

**Never the same river:
An interdisciplinary exploration into the
confluence of nature, people and place
for river catchment stewardship with
citizen science**

by

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A thesis submitted in fulfilment of the requirements

for the degree of

Doctor of Philosophy (PhD)

in Mary Immaculate College and the

University of Limerick

Department of Geography

November 2023

Abstract

**Never the same river:
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Good freshwater quality is essential to supporting healthy people and ecosystems. Measures to reverse deteriorating water quality in surface waterbodies are set out in Ireland's River Basin Management Plans, under the EU's Water Framework Directive, using an integrated catchment management approach that promotes community stakeholder participation in water matters. Combining elements of environmental science, politics, psychology and sociology, this interdisciplinary research project highlights the complex dynamics of addressing poor water quality through environmental governance frameworks using an Irish case study. The study investigates the influence of nature experiences on identity, and how a sense of belonging or attachment to place, community or nature contributes to awareness, pro-environmental behaviours and volunteerism. A combination of theory and praxis uncovers motivations, barriers and intentions of environmental actions as a baseline to inform strategies for recruitment and retention of volunteers. The study analyses quantitative and qualitative data from questionnaire survey responses throughout Ireland, and focuses on the 'at risk' Mague River catchment in County Limerick. Qualitative data from key informant interviews and focus groups provides thematic analytical comparisons between new and established volunteers and stakeholders. Key findings reveal that 1) Experiences in nature are transformative and, for some, they inspire a lifetime commitment to environmental stewardship; 2) There is growing social acceptance and interest in environmentalism, however, misconceptions and conflicting priorities may stymie conservation efforts and the development of a social norm; 3) Nature-based citizen science, built into a progressive, diverse training programme that incorporates social learning, can invite casual or committed environmental volunteerism that mutually benefits the health and wellbeing of volunteers and the environment, and optimises volunteer programme success; 4) Awareness-building and volunteer recruitment campaigns should be tempered with messages of hope that it is possible to make a difference. Community-driven, collaborative initiatives are essential to help achieve effective catchment management. Nature-based citizen science and volunteerism provide a platform for public involvement that fosters connections to nature and a sense of ownership over local and community ecosystems that can ultimately benefit the health, wellbeing and resilience of people, communities and the environment.

Declaration

I hereby declare that this project is entirely my own work, other than the counsel of my supervisors. Any contributions made by other authors have been recognised appropriately. The work herein has not been submitted for any academic award or part thereof at this or any other establishment.

The thesis work was conducted from 2020 to 2023 under the supervision of Dr. Catherine Dalton and Dr. Julian Bloomer at Mary Immaculate College and the University of Limerick.

Signed:



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Candidate for PhD in Geography

Limerick, 2023

Acknowledgements

No collection of words can adequately express my gratitude for Catherine Dalton and her unwavering encouragement and guidance through the sometimes dark and obscure pathway of the PhD tunnel. Especially now, in hindsight, I understand how much she taught me about myself, and how she supported the development and refinement of my skills and capacities for all my future endeavours. Thank you, Catherine, for believing in me, and for sharing so generously of your knowledge, experience and kindness. My gratitude is unequivocal, boundless and eternal. You once told me that a PhD supervisor supervises the way they were supervised, so I am also thankful to your PhD supervisor.

I am also very grateful for the support and guidance of Julian Bloomer. Thank you, Julian, for casting your eagle eye over my verbose writings and for ensuring that I never overlooked the finer details and subtler nuances of language. Thank you also for stimulating my curiosity and opening my eyes to new thoughts in the human geography discipline.

Thank you to the MIC Geography Department, Des McCafferty, Liz Gabbett, Tom Harrington, Rhiannon Laubach, Gill Weyman, the MRT, Ruairí Ó Conchúir and LAWPRO for helping to make this PhD journey less daunting, and even enjoyable.

A big thank you to the participants of my study for their time and openness, and to all the dedicated volunteers everywhere who work to protect nature and aquatic habitats. Don't get discouraged - keep up the good fight!

Thank you to my family and friends for their encouragement, love and comfort. I am blessed to have you in my life. Thank you, Mom, for giving me joie de vivre, and Dad, for taking me on those early explorations of woodlands and streams that sparked my lifelong path towards protecting them. Mark, Vickie, Natalie, Boubick and Melissa - You know how I feel about you.

Of course, I am also very thankful for the funding provided by the Environmental Protection Agency (2019-W-PhD-15) and Mary Immaculate College that made this study possible.

Dedication

To nature and all that is wild,
and to those who sacrifice to protect it.

In wildness is the preservation of the world.

-Henry David Thoreau

*No man ever steps in the same river twice,
for it is not the same river and he is not the same man.*

-Heraclitus

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Weiner D., Bloomer, J., Ó Conchúir, R., and Dalton, D. 2022. "The Role of Volunteers and Citizen Scientists in Addressing Declining Water Quality in Irish River Catchments." *Citizen Science: Theory and Practice* 7 (1).

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Weiner, D., Dalton, C. (Co-authors TBC) (in draft 2023) "Profiling efforts to establish voluntary stewardship in a river catchment"

List of Abbreviations

| | | |
|-----|---|---------------------------------|
| EPA | = | Environmental Protection Agency |
| ICM | = | Integrated Catchment Management |
| MRT | = | Maigne Rivers Trust |
| RBD | = | River Basin District |
| SDG | = | Sustainable Development Goal |

Chapter 1 Introduction

1.1 Background and context

Water is a vital natural resource upon which all life depends, and Ireland's freshwater ecosystems are under pressure. Pollution, habitat degradation and altered hydrology pose imminent threats to the health and resilience of river catchment ecosystems (EPA 2019; 2020b). Despite strong European and national laws and interventions, surface water quality in Irish rivers, lakes and streams continues to decline. Anthropogenic activities are the cause of many of these pressures (EPA 2019; 2020b), and this study draws on the strengths of various academic disciplines to explore the potential of local community engagement and volunteer involvement in environmental stewardship as a bottom-up solution to more effective management of catchment water quality.

Citizen Science engages non-professional volunteers in collaborative scientific investigations to collect data that can be useful for catchment managers because local people have the access and ability to monitor conditions in local small streams and rivers at extensive spatial and temporal scales (Conrad and Hilchey 2011; Dickinson *et al.* 2012). At the outset of this study, citizen science in Ireland was underutilised and the potential was unrealised (Roche *et al.* 2021). Also lacking was local community involvement and cooperation in river and environmental protection matters, as well as the knowledge about the facets that contribute to or limit public participation, particularly in rural agricultural catchments (RBMP 2019). Citizen science volunteerism offers a platform that can advance scientific knowledge by filling data gaps about catchment water quality, and, as part of an environmental stewardship programme, it can simultaneously play a role in addressing environmental challenges by fostering community engagement in water matters (Devictor *et al.* 2010; Moolna *et al.* 2019).

Nature and society are never separate, and nothing links humans more to nature than our connection and dependence on the hydrological cycle. According to Swyngedouw (1999, p. 445), water, food, production, energy and technology are connected, and yet replete with "contradictions, tensions and conflicts." As a result, water is also the most contested resource on earth (Strang 2020). Common resources, such as the water and fish in a river,

are at risk due to pollution, overexploitation and unsustainable use. These risks can be minimised with local cooperation and community-approved systems based on local knowledge (Burger and Gochfeld 1998; Robbins 2020). A bottom-up, participatory and planning approach to communal river catchment management (Feeny *et al.* 1990) has the potential to reverse Hardin's 'Tragedy of the Commons' (1968). By understanding that ecologically damaging practices emerge from social organisations (such as community practices or traditional agricultural processes) (Loftus 2015), it makes sense to work with the social organisations to initiate change.

The confluence of the geographies of place, people and the environment merit explorations through the disciplines of natural resource management, sociology, political ecology and environmental psychology to enrich our understanding of the intricate relationships between stakeholders within river catchment communities (Acharya 2015; Walker-Springett *et al.* 2016; Fletcher 2017; Rolston *et al.* 2017). The interdisciplinary socio-ecological fields provide insight into human-induced environmental problems, with a focus on hydrology, water quality and aquatic ecosystems (Crutzen 2006; Steffen *et al.* 2007) and some of the conflicts and politics that arise based on human dependence on nature's resources (Bodanis 2006; Forsyth 2015). Other aspects include environmental conservation strategies and types of valuation of nature including ecosystem services, and the concept of integrated catchment management to account for a collaborative, public participatory process (Pahl-Wostl *et al.* 2007; Mostert *et al.* 2008).

The boundaries between human and nature systems are investigated by delving into the influence of nature experiences on self-identity, and how a sense of belonging, connection or attachment to place, community or nature contributes to awareness, pro-environmental behaviours and environmental volunteerism (Lewicka 2005; Hinds and Sparks 2008; Devine-Wright 2009; Gosling and Williams 2010; Beery and Wolf-Watz 2014; Clayton *et al.* 2017). These build the foundations for understanding the level of utilisation and current state of citizen science to monitor environmental and aquatic habitat quality (Conrad and Hilchey 2011; Dickinson *et al.* 2012; Walker *et al.* 2021) as well as the strengths and weaknesses of different types of programme designs. Also considered are the motivations, barriers and benefits to citizen science volunteers, as well as the roles that health and well-being and

connections to nature play in water stewardship matters (Bonney *et al.* 2009b; Devictor *et al.* 2010; Dickinson *et al.* 2010; Dickinson *et al.* 2012; De Moor *et al.* 2019). Citizen science is also given context into how it can meet legal obligations and policy development (Rolston *et al.* 2014; Buytaert *et al.* 2016; Fritz *et al.* 2019).

A combination of theory and praxis uncovers motivations, barriers and intentions of environmental actions as a baseline to inform strategies for recruitment and retention of volunteers. The study is guided by the framework of mixed methods interdisciplinary environmental, sociological research (Pellow and Nyseth Brehm 2013). A positivist paradigm is used for the quantitative portion in that it relies on statistical analysis between variables for objective, verifiable results. Thematic analysis is used as a tool to probe the boundaries between psychology, sociology and ecology, and the relationships and conflicts between humans and the environment, including elements of health and well-being, political ecology and environmental sociology (Braun and Clarke 2014). A social action theoretical framework explores the environmental volunteer's experiences, values, actions and behaviours, and how they are influenced by childhood experiences, family, community, intentions, social norms and affective responses. Drawn upon are other sociological frameworks such as symbolic interactionism in how society, community and personal experiences influence perceptions; constructivism, due to the link between cognition, nature experiences and the evolution of awareness-building via citizen science training and social learning; behaviourism, for the drivers of behavioural change; and labelling theory in that people's self-identities and beliefs about themselves influence their behaviours (e.g. as an environmentalist) (Mostert *et al.* 2007; Allen *et al.* 2011; Jordan *et al.* 2011; Bratman *et al.* 2015; Lacasse 2016). Also explored are transformative experiences, in the context of health and well-being as well as connections to nature, and how they can lead individuals to change behaviours and perspectives, and some, to lifelong environmental volunteerism and activism (Guiney and Oberhauser 2009; Oh *et al.* 2021; Keith *et al.* 2022). This is generally a theory-oriented framework that seeks causal connections between factors, and that explores the boundaries between eco-centric and anthropocentric perspectives within a human-environmental systems framework. However, there are also elements of being an action-oriented study in seeking effective programme designs for citizen science (Binder *et al.* 2013; Cumming 2014).

1.2 Rationale and trajectory

This study emerged from a PhD proposal entitled *Citizen Science Investigations: River Environmental Stewardship*, designed to explore the initiation, implementation and measurement of citizen science projects to monitor water quality. The role of the researcher was to work in partnership with a Local Authority Waters Programme (LAWPRO) community water officer and the Mague Rivers Trust (MRT), a catchment-based environmental non-government organisation. Both organisations have a remit to protect water quality in rivers, lakes and streams, and, the latter, specifically those within the mostly-agricultural, 'At-Risk' Mague River catchment in County Limerick (Weiner *et al.* (in draft 2023).

The majority of the nearly 1,300 kilometres of rivers and streams within the Mague River catchment flow within County Limerick, with less than 10% originating from Counties Tipperary and Cork to the East. The catchment is within the southern region of the Lower Shannon (Dalton and Walsh 2018). There are five additional subcatchments that contribute water to the Mague River channel, and major tributaries are the Barnkyle River, the Comoge (or Drumcomoge) River, the Clonshire Grenagh River, the Loobagh River and the Morningstar River (Figure 1.1) (Dalton and Walsh 2018). There are also smaller tributaries including the Gloshagh and the Glen River, and seven natural lakes within the catchment. The catchment comprises predominantly lowland regions below 75m above sea level, except for the Loobagh River which arises in the Ballyhoura Mountains and the Slieveveagh Hills, and the region's highest elevation is Seefin Mountain (528m) to the south of the catchment. Before the end of the 19th Century, the Mague had been well-known as a salmon angling river, but there were significant declines that led to Inland Fisheries Ireland closing the Mague system to salmon angling in 2006. A similar trend was seen throughout Ireland at this time, with over 75% of rivers suffering salmon declines (Harrington 2019).

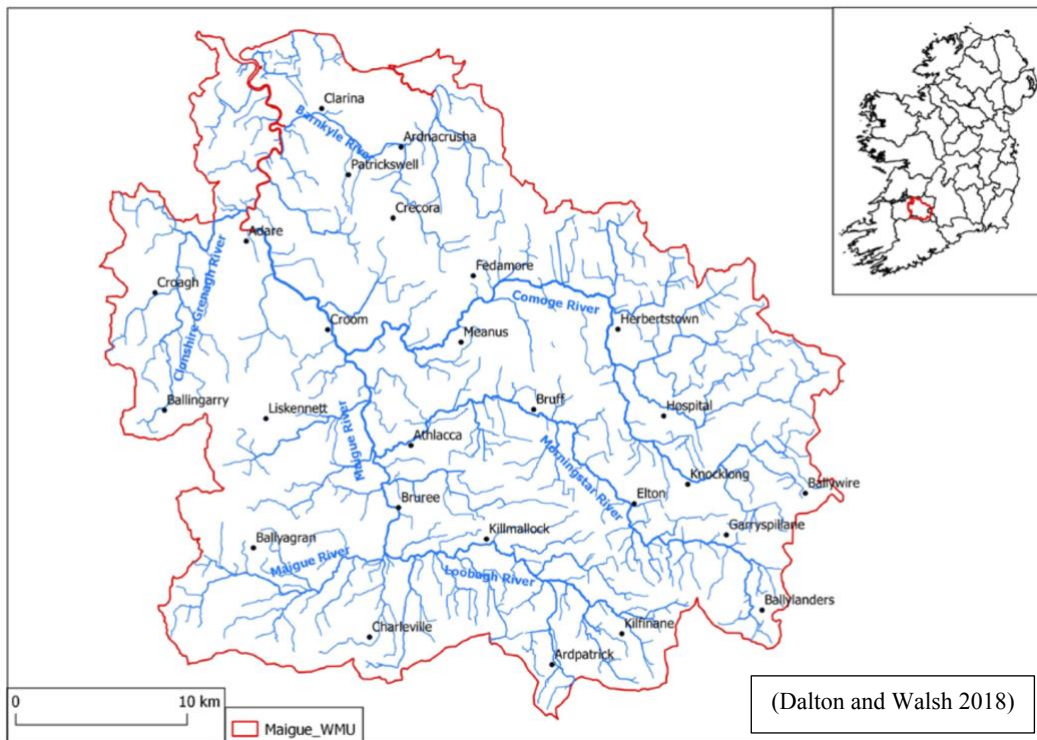


Figure 1.1 Map of the Maigue River catchment and subcatchments

Based on the EPA’s national water monitoring programme, which classifies water quality as either high, good, moderate, poor or bad, the Maigue River catchment has experienced the loss of its high value river systems, and declines in those classified as having good biological water quality since the 1970s (Figure 1.2). Pressures in the catchment likely began with arterial drainage taking place in the 1970s, and in 2023, the primary pressures to water quality throughout the river catchment are agriculture (diffuse and point source), domestic waste (septic tanks), hydromorphology (such as channelisation, embankments, dams, barriers, culverts, land drainage, overgrazing and bank erosion), and other anthropogenic pollutants (including nutrient, organic and sediment pollution as well as chemical and microbiological) (EPA Maps 2024; Harrington 2019).

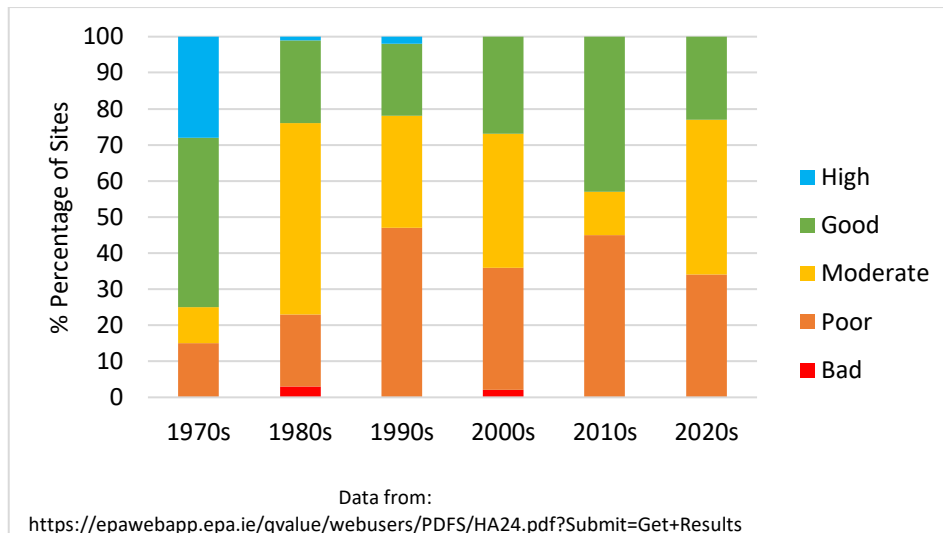


Figure 1.2 Changes in Water quality in Maigne River catchment, 1970s to 2023

The partnership with the MRT was to facilitate an academic-practitioner collaboration to initiate and mutually support a citizen science programme, and to measure its success and drawbacks. Two programmes to monitor water quality were trialled: the Freshwater Watch system to monitor nutrient levels, turbidity and physical parameters, and the Citizen Science Stream Index (CSSI), an amateur ‘traffic-light’ sampling system that measures the levels of six bioindicator aquatic macroinvertebrate species. These were intended to be precursors to a co-developed citizen science programme for the Maigne River catchment. These practical aspects of the study are included in a paper that is pending publication, entitled ‘Profiling efforts to establish voluntary stewardship in a river catchment’ (Weiner *et al.* (in draft 2023) Appendix 11).

Covid-19 and governmental restrictions altered the trajectory of the practical aspects of this research, and the research was adapted to place a stronger emphasis and focus on catchment resident and volunteer motivations, barriers, concerns, preferences and perspectives regarding citizen science, nature conservation and river ecosystem stewardship. The combined approach endeavours to gather insights to optimise volunteer programme designs to best harness the potential of citizen science as a vehicle for scientific data gathering, but also as a problem-solving and knowledge dissemination tool within the context of Irish river catchment stewardship.

1.3 Aims and objectives (and methods)

The ultimate aims of this project are to improve water quality in an at-risk river catchment through

1. understanding whether or not nature-based citizen science can be an effective, sustainable element of a bottom-up approach to integrated catchment management (ICM), and
2. informing the design of citizen science initiatives that attract and sustain local participation in environmental stewardship.

The overall study aim integrates both social and ecological dimensions by addressing the need for public involvement and cooperation in river catchment protection to instil a sense of ownership and responsibility amongst local communities. It was essential to assess the ecological monitoring parameters that would be most useful for catchment managers, but also most attractive to catchment residents to elicit and sustain volunteer engagement.

Mixed methods research was used to combine the rigor of quantitative analysis with the depth of qualitative inquiry, and this was determined to offer the most powerful toolset to meet the socio-ecological aims of this study. The study analyses quantitative and qualitative data from questionnaire survey responses (n=756) throughout Ireland, and focuses on the 'at risk' Maigne River catchment in County Limerick. The questionnaire survey's fixed queries explored current and past experiences in nature, values and concerns people have for the environment, their pro-environmental behaviours and knowledge about current environment issues, and their preferences, participation and activities as conservation volunteers. These were analysed with statistical testing to measure significance and the strength of the relationships between variables.

Research questions explored in the quantitative analysis relate to the influences or relationships between; a) demographics and the level of connectedness to nature, concerns, behaviours and conservation activities, particularly related to the Maigne River catchment residents in comparison with the rest of Ireland, b) positive childhood experiences in nature and feelings of connectedness to nature, c) connectedness to nature and the level of environmental concerns, behaviours and activities, and d) the ability to experience health

and wellbeing benefits from time in nature. Conservation actions were measured as well as perceptions, awareness, perspectives and motivations for involvement in nature-based citizen science and environmental stewardship.

The questionnaire survey also provided extensive qualitative data from the open-ended responses, and more substantive and in-depth insights were derived from focus group and key informant interviews that provided thematic analytical comparisons between new and established volunteers and community stakeholders. These are separately analysed using Braun and Clarke's (2012) six-phase thematic analysis approach that detected emergent themes using reflexive coding and categorisation processes. Five main interlinked themes emerged from the findings; a) Cognition and the influence of nature experiences on awareness, b) Identity and the influence of ideation, place and belonging, c) Emotions and their influence on concerns related to human and environmental health, d) Level of behaviours and actions for the environment, and e) Transformative value of experiences.

Ultimately, secondary data from the academic literature review is triangulated and synthesised with the primary data from the quantitative analysis results and the qualitative analysis findings to achieve robust and rigorous investigation and solutions relevant to the objectives of the study relating to the potential of nature-based citizen science as an environmental stewardship tool. The discussions focus on; a) Identity, ideations and an apparent value-action gap between pro-environmental aspirations and nature conservation action, b) Nature-based citizen science as an opportunity to promote health and wellness (including how Covid-19 influenced this), and c) Demographic variability related to age and residence in the Maigne River catchment.

1.4 Thesis structure

Chapter two sets out the literature reviewed that was relevant to the socio-ecological objectives of this study. These focus on the practical and theoretical elements associated with catchment-based management to remedy water quality issues. This includes some of the controversy and difficulties in implementing effective top-down, governmental programmes, and highlights the potential of bottom-up, community strategies to meet some of these challenges. The nexus between humans and nature are explored with a

combination of theory and praxis in terms of the values people place on nature, the mechanisms that lead to participation in environmental volunteerism and stewardship, and the strengths and distinctions between citizen science programme designs to monitor water quality and the level of citizen science volunteerism.

Chapter three details the methodology and process of primary and secondary data collection for the mixed method study as well as the research design and timelines. Following the literature review, there was a national questionnaire survey, focus groups and key informant interviews. Also covered are the methods used to recruit questionnaire respondents, citizen science volunteers and study participants, as well as issues related to conducting research in an ethical and trustworthy manner.

Chapter four sets out the results of the quantitative data analysis of the Likert scale, multiple choice, matrix and scaled queries on the questionnaire survey. Demographics, and descriptive and frequency analysis are followed by statistical analysis on the correlations and relationships between variables. Variables considered are age and gender, as well as the geographical region of residence, and these are explored against feelings of connectedness to nature, concerns for the environment, awareness of environmental issues, participation in outdoor and conservation activities and pro-environmental behaviours, values felt toward the environment, and appreciation of nature for the benefits of health and well-being.

Chapter five details the findings from Braun and Clark's (2014) six phase thematic analysis and includes sample quotations from the responses to the open-ended questionnaire survey queries and these are compared and evaluated against the responses from the focus group and key informant interviews. These provide evidence of the emergence of the themes, as well as insight, substance and depth into understanding the conceptualisations and ideations related to the environment, nature and the river, and whether or not personal experiences, characteristics, perspectives and emotions inform the level of involvement in environmental stewardship.

Chapter six discusses the triangulation and synthesis of the data from chapters two (literature review), four (quantitative analysis results) and five (qualitative thematic analysis findings). Three main discussion points arose: Firstly, the influence of identity and ideas on environmental change; secondly, nature and well-being: A case for 'soft' citizen science; and finally, demographic influences on actions for nature.

In summary, this thesis provides a comprehensive, interdisciplinary exploration of the factors that can influence public engagement in water quality matters in an Irish cultural context. The combination of theory and praxis investigates the potential role of nature-based citizen science as the bottom-up tool to help reverse the decline in river ecosystem quality, and also how participation can impact and improve the livelihoods and health of people and the environment, and secure a more resilient, sustainable future.

Chapter 2 Investigating theory and praxis of volunteer river stewardship

2.1 Introduction

This review of the literature synthesises the body of academic work that relates to the subjects and themes relevant to the management of a river catchment using citizen science initiatives that activate and train community volunteers to monitor water quality. The interdisciplinary nature of the study necessitated reviewing literature related to the science and politics of natural resource management, particularly freshwater ecosystems; and additionally, explored catchment management from the local, bottom-up levels, and the sociology and psychology of volunteerism, behavioural change, community environmental stewardship and the benefits of nature-based citizen science.

2.2 Integrated Catchment Management to manage natural resources

Good freshwater quality is essential for life and human health. Thus, European and Irish legislation prioritise implementation of effective management plans that maintain or improve water quality to at least good status. Top-down, fragmented approaches to freshwater management failed to achieve legislative objectives (Rolston *et al.* 2014), and surface water quality in Ireland, particularly in rivers, continued to decline (EPA 2019). The need for a different approach led to water programmes that unify the natural science considerations with the diverse socio-economic actors, stakeholders and institutional sectors involved in water matters (Giordano and Shah 2014).

Integrated Natural Resource Management focuses on water as a resource, while Integrated Catchment Management (ICM) takes a river basin scale approach. However, both seek holistic solutions to degradation in water quality that account for the complex hydrological, biophysical, chemical, environmental and ecological interactions with the political, socio-economic and cultural influences inherent and omnipresent within a river catchment (SurrIDGE *et al.* 2009; Giordano and Shah 2014). A collaborative, integrative approach can be successful if the programme is adequately supported and implemented, all stakeholder aims are identified, and it is flexible and tailored to the characteristics of the people and landscape of the catchment (Ballinger *et al.* 2016). It is integrating both the top-down and

bottom-up approaches that may foster a meeting in the middle that achieves the goals of ICM and water protection legislation by engaging a wide range of stakeholder participants for collaborative action and decision-making in freshwater quality issues (Giordano and Shah 2014).

2.2.1 Law, policy and planning considerations in water management

The EU Water Framework Directive (WFD) sets out the river basin approach to water management. Integrated Water Resource Management is a process of unifying all actions related to the handling and control of a water resource to fulfil an objective (Cardwell *et al.* 2006). Integrated catchment-based management focuses the scale to all the potential actions and ecological impacts within a river basin for the protection of water quality as well as political and socio-economic functions (Mostert 2006; Weber *et al.* 2009; Fenemor *et al.* 2011) to best cope with the unique complexity and vulnerability of river systems.

The catchment, river-basin or watershed scale, is delineated by the topography, biophysical geography and hydrological processes of the region. The catchment of a river includes any of the surrounding land area that contributes water to the river and its tributaries, connecting the river's headwater source to its floodplains, mouth and coast (EPA Catchments 2020). The catchment is the practical, governance scale and natural physical unit of a landscape because land use strongly influences the water quality and biodiversity of a river (Allan *et al.* 1997), and likewise, the quality of the river ecosystems indicates the health of the upland regions, the surrounding terrestrial ecosystems and the entire river catchment (UN Environment 2018). The concept of ICM is that patterns and the potential impacts to a river's ecosystem functions become more visible when looking at the whole picture (Geldof 2005; Daly *et al.* 2016a; Reis *et al.* 2019).

Application of the term 'integrated' in any water resource management system varies. It can mean the integration of land use and water, upstream to downstream, water policy and programmes, institutional sectors or the interests of all stakeholders (Biswas 2004). But for a holistic, sustainable, participatory approach, it is important to include all aspects because water issues are pervasive within a community, and objectives, interests and agendas are widely diverse (Warner 2006). The scale of ICM generally includes the interactions between

land, water, flora, fauna and human communities within the boundary of the physical watershed of the river, but there is added complexity as the temporal, spatial and institutional scales are diverse and dynamic (Lovell *et al.* 2002). ICM approaches also vary depending on whether the focus is based on water quality, water quantity or physical characteristics of the catchment waterbody. While floral and faunal biodiversity monitoring based on the WFD's targets for good ecological quality status will provide sufficient indication that a significant stress is present, a truly integrated ICM will consider the interactions between all actions and consequences (Logan 2001).

In Ireland, high pressures to riverine habitats and biodiversity from agriculture, alien invasive species, changes to hydrological processes, forestry, and wastewater compromise the economic and ecosystem service potential of riverine habitats (EPA 2019). To successfully manage a river habitat, it is essential to apply a multifunctional approach that integrates the concerns of all institutional, community and administrative users and stakeholders over the whole catchment, but it must also recognise that biodiversity is a key element (Schindler *et al.* 2016). ICM that equally prioritises all interests and issues within the catchment can offer multiple benefits to water quality, flood reduction, biodiversity and human health (Gilvear *et al.* 2012).

River Basin Management Plans (RBMP) aim to achieve results that benefit the environment and society equally, and the Dublin Statement's (1992) guiding principles recommend an integrated approach to freshwater resource management and planning that integrates environmental considerations with economic and social aspects for sustainable use. Policy objectives for the water sector are complex as there are often conflicting policy objectives for energy, land use, development and agriculture (DECLG 2015). For ICM to be sustainable, new policies and legislation must comply with those already existing, and both social and natural sciences should inform policy so that stakeholder needs are addressed as well as water quality objectives (Rolston *et al.* 2014). It is the complete range of policies and disciplines that influence, or are related to river water quality, that should be collaboratively planned and implemented (Macleod *et al.* 2007).

Integrated management approaches for water resources can be criticised for their vagueness, their overly-ambitious aims and for the difficulty in implementing plans that equally address all objectives and interests of stakeholders (Butterworth *et al.* 2010). Finding an acceptable compromise through negotiation between stakeholders while simultaneously protecting the environment is not straight-forward. Even within integrated water management systems, there are difficulties in coordinating plans because the problems are often unclear, human activities further complicate water systems, and new measures can create new problems (Geldof 2005).

Suggestions for planning a more sustainable ICM system include making integration a clear objective, reducing bureaucracy, having one portal for data, fostering grassroots community groups, supporting key individuals, establishing systems to test out new approaches and policies, and simplifying regulatory requirements to encourage voluntary participation and gain support from local community leaders (Southern *et al.* 2011).

Also suggested was a policy-supported national community engagement framework so that community-managed initiatives can build awareness and increase local involvement in water quality issues (Rolston *et al.* 2014). Integration and development of public policy for water governance that crosses governmental departments has its own challenges, but if integration and unification can be achieved then at least it removes contradictory instruments. To develop integrated policy such as that for ICM, flood control, climate action and adaptive management systems, there should be political leadership and a collaborative search for novel solutions in conditions that generate mutual trust, shared visions, agreement on joint responsibility and a sharing of resources, and participatory research as well as experimentation and development of guidance documents (Rouillard *et al.* 2013). Communication to understand the multidisciplinary catchment issues should be ongoing between global scientists and regional water managers, and this will encourage support and involvement amongst stakeholders which will help develop effective, strong ICM policy (Stevenson and Sabater 2010).

While there are many challenges and ambiguities to overcoming the complexities of ICM to achieve water quality objectives (Jeffrey and Gearey 2006), it is clear a fragmented

approach is ineffective as water quality objectives have not been met (EPA 2019). Thus, as long as genuine integration and co-learning are built into a water management system, and it is all-inclusive, effectively implemented, flexible and adaptable to environmental, cultural and social contexts (Hillman and Brierley 2005), then there is no better alternative for surface water protection than that offered by Integrated Catchment Management (Snellen and Schrevel 2004).

2.2.2 Public participation in Integrated Catchment Management (ICM)

Despite EU Directives, national laws and local nature conservation efforts, native biological diversity and the quality of the water in Irish rivers continues to decline (EPA 2019). Over-exploitation, pollution and improper management of natural resources all contribute to making Ireland's natural landscape inhospitable for native biodiversity (Fogarty 2017). Because human activity is the main source of pressure on riverine systems and natural habitats, a potential solution rests in increasing local community interest, involvement and cooperation in water and catchment management initiatives. The second cycle of the River Basin Management Plan, 2018-2021 recognises the importance of increasing public participation to better implement the WFD and improve ambient, surface water quality.

Implementation of the WFD with the top-down approach to ICM is not working (EPA 2019; 2020b), but neither are attempts to engage active, meaningful public participation in the Republic of Ireland (Irvine and O'Brien 2009). According to Irvine and O'Brien (2009), potential reasons for the low response rate to public consultation were that the public felt either detached from water issues or sceptical at the meaningfulness of the public consultation process. There may also be other reasons for non-participation in ICM consultation such as insufficient awareness and representation, allegiances and political considerations including not wanting to be identified as allying with a particular side (Warner 2006).

Government agendas are increasingly calling for public involvement in catchment management and decision-making (Department of Housing 2019), but top-down governmental communications may be perceived as authoritarian and thus met with resistance and scepticism. Hannigan (2014, p. 139) states that community collective action

will “percolate from the grassroots rather than pass from the top downwards,” and Bickerstaff and Walker (2005) conclude that bottom-up approaches to catchment management cannot be prescribed, and they will not be an improvement to former methods until all stakeholders are equally and fully informed and empowered.

For public participation to move from top-down approaches, there needs to be targeted effort to actively engage people; and for it to be meaningful involvement in ICM, then there needs to be involvement in earlier stages of management strategies to reach the realm of public empowerment, and that includes involvement during the planning and research phase (Parkes and Panelli 2001). When people are involved from the start in a collaborative project, there is personal ownership that leads to deeper commitment, better implementation and more effective catchment protection. The different levels of local involvement and the level of empowerment they offer are listed in Table 2.1 which summarises, adapts and synthesises data and tables from Parkes and Panelli (2001) and Pretty and Smith (2004).

Table 2.1 Levels of public participation and empowerment

| Participation Type | Degree of local involvement | Degree of local empowerment | Management Direction |
|------------------------------|---|--|----------------------|
| Passive | Token representation | No input, no empowerment | ↓ Top-down |
| Incentivised / bought | Incentivised tasks and directed priorities | No input, no empowerment | ↓ Top-down |
| Consultative / contributory | Local opinion considered. Design, analysis and decision-making by scientists. | Little input, no empowerment | ↓ Top-down |
| Cooperative / collaborative | Design initiated by scientists. Design is adapted, and priorities are decided together to meet objectives. Analysis, promotion and reporting by participants. | Input and empowerment, if priorities are implemented as agreed | ↓ and ↑ Equilibrium |
| Co-created / social learning | Shared knowledge between scientists and public develops understanding to inform action. Scientists facilitate only. | Input and empowerment | ↑ Bottom up |
| Collective Action | Local people initiate and mobilise action. No Scientists. | Input and empowerment | ↑ Bottom up |

Passive, incentivised and consultative approaches of participation do not work for nature conservation and biodiversity (Pretty and Smith 2004). Even environmental management that invites public participation but limits it to the consultation process of pre-drafted policy

and decision-making may be perceived as a placation of the public, and a tokenistic gesture to comply at a basic level with legislative requirements for public participation. It is challenging to move to a flexible, participatory system when the traditional top-down structure of governance has been so entrenched (Rollason *et al.* 2018), but genuine, effective ICM will only arise from a shared commitment to environmental management that balances social, environmental and economic elements where issues and solutions are jointly defined by public stakeholders as well as researchers and decision-makers (Cook *et al.* 2013). For example, the Stroud Rural Sustainable Drainage (RSuDS) Project in the UK, where the community Flood Action Groups, landowners and farmers sought to implement Natural Flood Management throughout the catchment with funding from and collaboration with Council and government agencies (Graham 2016).

A challenge in the participatory approach is the diversity of stakeholder interests, biases, goals and motivations. For example, it was important to understand the farmers, landowners and land stewards when developing agri-environmental schemes (Ahnström *et al.* 2009). Using FARMSCOPER, a decision support tool, divergent viewpoints became apparent when looking to agree on the action necessary to mitigate non-point source nutrient pollution into the oligotrophic Black River catchment in the west of Ireland (Micha *et al.* 2018). The farmers valued visible, multiple-benefit solutions at farm-level, whereas ecologists sought catchment scale, long-term, sustainable solutions (Micha *et al.* 2018). Participatory modelling technologies, such as FARMSCOPER, are software programmes that facilitate stakeholder collaboration. They can simplify the process by compiling the different viewpoints, and by creating a visual demonstration that can predict the potential consequences of management decisions while simultaneously building awareness (Voinov and Bousquet 2010).

According to Schusler, Decker and Pfeffer (2003), however, education and awareness building is not enough. The collaborative process needs proper support, inclusion, empowerment and building of capacity and confidence so the public co-produce, co-manage and co-learn in partnership. For ICM measures to work, the most basic level of the participatory scale needs to be at the cooperative level, but for a more sustainable, long-

term commitment to environmental stewardship, social learning with subsequent policy reform is key (Pretty and Smith 2004).

2.2.3 Collaborative Catchment Management and Social Learning

The second cycle of the RBMP's catchment-based approach has a focus on increasing communication, public participation and stakeholder engagement in water policy and decision-making. Community-based natural resource management is a bottom-up, participatory approach to ICM that fully involves local catchment community members and all stakeholders in water planning and implementation to achieve water quality restoration objectives (Dublin Statement 1992).

Public participation is not simply an additional element of the top-down approach, but a different method of governance that is potentially more effective because it is more overt, democratic and integrated. Social learning is a concept associated with collaborative management approaches that helps cope with some of the complexity of environmental programmes (Tippett *et al.* 2005). The crux of social learning is that there is a long-term working relationship between all stakeholders, where each shares his or her diverse and divergent knowledge, interests, experience or capability to the resolution of the matter at issue (Mostert *et al.* 2007). The learning process should be continuous, and skills, attitudes, trust and abilities are constantly developing (Mostert *et al.* 2008).

There are elements of peer-to-peer learning where people who share livelihoods can share their experiences of tested and proven land management strategies and measures, for example, in a network of practice, where farmers shared knowledge and challenges on implementing a new farming technology (Eastwood *et al.* 2012). Public participation can also build and enhance community communication. Genuine public partnership with social learning can lead to citizen empowerment and community building as well as increased awareness and better-informed, creative decision-making and policy development (Collins *et al.* 2009). These peer-sharing decisions better integrate social, economic and environmental interests and allow for broader consensus and acceptance of ICM measures that facilitated implementation (Mostert 2003). It can also lead to more sustainable ICM, because it can highlight previously overlooked issues, perspectives and aspects (Warner

2006), and build partnerships for the resolution of future problems (Voinov and Bousquet 2010).

There are generally four types of stakeholders involved in catchment management: professional organisations; regulators; local community groups; and individual members of the public (Orr *et al.* 2006). Amongst each of these are a diversity of participants, and full collaboration between them can be challenging with the differing personalities, interests, expectations, standards and interpretations of the issues. To overcome these, communication that builds trust and mutual respect, and provides clarity in roles and expectations (Kilvington and Allen 2007) becomes important. Also important are early engagement, transparency and active listening to understand the needs and interests of other stakeholders, and to give opportunity for meaningful, effective involvement in catchment issues (Orr *et al.* 2006).

In short, an essential component for successful ICM is that it is adaptive and collaborative (Rogers 2006), and that it involves each of those stakeholders with differing perspectives (Allen *et al.* 2011). What begins as interdisciplinary communication between scientists and water managers (Young 2009) to understand the movement, uses, pollution sources and remediation methods of the water in the catchment (Piégay *et al.* 2008), becomes an engagement and co-ownership with local communities and key stakeholders to collaboratively develop, adopt and apply water management measures (Daly *et al.* 2016b). These are tailored to the catchment's threats, and they incorporate expert and local knowledge to facilitate a participatory approach where all stakeholders share a common vision for the future of their catchment (EPA 2020a).

Many studies focus on co-learning, community participation, cooperatives and inclusion as the precursor to effecting change, and while many factors influence whether or not social learning will be effective, importantly there needs to be open communication and equal power between the stakeholders (Roux *et al.* 2006; Reed *et al.* 2008; Whatmore 2009; Demeritt 2015). There is unequal power as soon as one stakeholder uses law or policy to back their interests in the dialogue (Van Bommel *et al.* 2009), as this, in effect, turns the discussions into a top-down approach, leading to defensiveness and no resolution.

Additionally, politicising environmental issues can also cause psychological barriers, backlash and distrust in the scientific community (Gifford 2011; Scruggs and Benegal 2012).

For example, when a UK town refused, on aesthetic grounds, to allow government works to build hard embankments to minimise floods that were clearly in the interest of the community, a collaborative think tank of experts, residents and scientists met regularly, conducted site visits, researched, modelled and ultimately found a compromise that led to the implementation of natural flood management measures (Whatmore and Landström 2011; Braun 2015). The co-learning had helped them find the middle ground.

Natural resource management that involves communities in the entire research process, from design, concept and data collection to analysis and reporting, empowers and builds the capacity of the community participants. Participatory research means there is a reciprocity of knowledge production and transfer. The scientific researcher offers the expertise, but acts as a facilitator that engages the community participants across the different project programmes and encourages the application of local knowledge and input, and this generates outcome-driven action (Wulfhorst *et al.* 2012).

Rather than solely institutional or expert-led natural resource governance, collaborative ICM offers flexible, social learning that ultimately increases capacity for local people to participate in law and policy related to water matters (Pahl-Wostl *et al.* 2007). Strong scientific knowledge about the issues is still important, but the initiative should highlight common ground, values and shared benefits between stakeholders (Boulton *et al.* 2008; Weber *et al.* 2009). Effective integrative approaches are developed from mutual trust, and they are collaboratively built from the bottom-up and managed at the lowest appropriate level (UN 2012). This level of local community participation and capacity-building also ensures that the process will be resilient and sustainable for the future (Fenemor *et al.* 2011; Ananda *et al.* 2020).

2.2.4 Building awareness and trust to bridge connections for ICM

Socio-ecological systems are complex with the many dynamics, interests, exchanges and variables, and they require input from multiple parties and disciplines, and participatory

initiatives that bridge these interests can help with co-learning and trust-building. Learning comes from doing, from communicating and from sharing ideas in a knowledge partnership (Berkes 2009). The doing aspect is necessary, and public participation in project-based, experiential learning can influence sustainable changes in awareness, perceptions and behaviours (Ryan *et al.* 2001). A participatory approach to catchment management requires relationship-building that comes from a multi-directional flow of knowledge at all levels that evolves with new techniques and changing circumstances (Roux *et al.* 2006).

In raising awareness of environmental issues, there needs to be a basis of trust between all parties, such as water managers, scientists and the public. It is the relationship of trust and mutual respect between the actors that influences the understanding and acceptance of the information and message, and it is not about the concepts, policy, law or the data itself. Educational institutions can play a role (Roche *et al.* 2020), as can the social learning process by providing insight into the multi-faceted scope of catchment biophysical processes that can help people understand that sustainability and resilience comes from a catchment-scale perspective, that will ultimately benefit local farm issues, with a little patience and perseverance (Micha *et al.* 2018).

Trust is key when hoping to initiate behavioural change (Gifford 2011). Pro-environment agendas and measures need to be developed in context, sensitive to local ecology, history, culture and knowledge (Brennan *et al.* 2009; Mathevet *et al.* 2015; Wisner 2015). Trust reduces scepticism and increases uptake by the public on expert information when there is a reciprocity of respect, and especially when there is incorporation of local knowledge into the programme (Wynne 1992).

When community stakeholders are equally involved in the development of the ICM package, then the values and the priorities of the community are incorporated into the plan (Norton 2000). This raises the level of the community commitment to implement those measures with the backing of the community social capital and their assets of shared place attachment (Manzo and Perkins 2006), social networks, local knowledge and personal investment (Cooper 2016). Social bonds and groups of stakeholders are a resource, and as the networks grow, the value of the social capital increases (Dickinson *et al.* 2012). When

the knowledge and experience of the group help to develop catchment management and nature conservation measures, there is more long-term commitment of environmental stewardship.

Ultimately, the success of a community participation conservation initiative will depend on the relationships between the individuals (Muhar *et al.* 2018). Feeling connected to a community helps individuals feel that their efforts within the group are meaningful, and this can encourage further involvement and behavioural change that benefits the community (Cojuharenco *et al.* 2016). For a successful bottom-up approach, public participation in ICM needs to be true integration and a foundation of shared knowledge and social learning that leads to meaningful involvement, trust and a connected catchment community.

2.2.5 Pressures on freshwater ecosystems

Riverine environments are one of the most heterogeneous and species-rich on earth (Ward *et al.* 1999). They are the interface between land and water, the dynamic movement of nutrients and the priority of a number of stakeholders, and their good quality waters support numerous, biodiverse and vulnerable species. Freshwater ecosystems are diverse and complex, and many stressors can impact water quality. The inputs into a river system include precipitation, waste and run-off from land, and the amount, movement and flow of these sources can impact the levels of pollutants in the river. Anthropogenic activity that directly or indirectly inputs toxins (Bille *et al.* 2017), pollutants or nutrients into an aquatic ecosystem can cause dramatic, cascading and far-reaching changes that can lead to mass fish kills and toxic water conditions. The main factors that can impact the health and biodiversity in a river are habitat loss and degradation, alteration of physical and chemical properties, alien invasive species, overexploitation, secondary extinctions, wastewater discharge, organic and nutrient pollution, and climate change (Malmqvist and Rundle 2002). Global warming and changes in precipitation can also increase the range and severity of impacts, and when managing aquatic ecosystems, it is important to fully consider how control methods may impact native biodiversity and ecosystems (Walther *et al.* 2009). Climate change exacerbates habitat degradation in already-stressed ecosystems (Staudt *et al.* 2013), and freshwater systems are especially vulnerable because climate impacts water temperature and many sensitive freshwater species are intolerant to increased

temperatures (Woodward *et al.* 2010). Many of these are the species that are used as bioindicators to monitor and test water quality. Rivers, with their flow, volume and high permeability can offer some resilience to short term, acute deleterious events, but their ability to recover depends on the type, source and duration of the pressure (Allan and Flecker 1993). Poor water quality also increases the cost of water treatment for human supply and can lead to illness and disease in human and non-human populations (Arnell 2002).

2.2.6 Financial value of natural and aquatic ecosystems

Ecosystem functions that provide a benefit to human life are ecosystem services. Ecosystem services were popularised in the Millennium Ecosystem Assessment in 2005 as essential benefits that biodiversity and natural resources provide for human life and health, whether or not humans appreciate or are aware of them. There are direct, essential provisions, such as food, medicine, raw materials, freshwater and energy; and indirect, such as photosynthesis, pollination and nutrient cycling, and benefits to cultural and social wellbeing and health (Millennium Ecosystem Assessment 2005; Sandifer *et al.* 2015). Protecting biodiversity is essential for humanity because organisms, and species-rich communities, are essential for ecosystem services and productivity (Cardinale *et al.* 2006; 2012). Organisms are involved in ecosystem engineering and influencing the formation of habitats; they are essential components to the biogeochemical cycles, and they influence productivity by supporting their trophic layer in the food chain (Cardinale *et al.* 2012). Human disturbance of the biophysical, ecological, hydrological or chemical characteristics of river habitats limit ecosystem functions that carry out river processes and thus the value of the benefits an ecosystem can provide, and these are projected to increase over the next few decades (Millennium Ecosystem Assessment 2005).

There are criticisms about the concept because it is seen as anthropocentric and limiting in that it prioritises economic value and benefits to humanity over an intrinsic value to nature (Schröter *et al.* 2014). The seemingly priceless value of ecosystem services may seem an obvious justification to protect natural ecosystems in their own right, but there are complex political and social variables; and as agricultural, food and chemical production have become more industrialised, it is deemed necessary to place an economic value on

ecosystems to appeal to market forces and capitalism (Daily *et al.* 2000). However, policy on ecosystem valuation can never adequately reflect the social costs nor the complex dynamics, variability, interdependence and uncertainty of ecological processes (Daily *et al.* 2000), so, inevitably, there will always be controversy (Kull *et al.* 2015). To guarantee the sustainability and protection of a natural resource, it needs to be appreciated for its intrinsic value because that would transcend the need to impose a monetary value which will be lost once that natural resource is depleted. Additionally, the rarer a resource, the higher its value and the price it attracts, and this can further increase exploitation and competition. Is it wise to let economists decide the value of nature when, as Oscar Wilde wrote, it is possible “to know the price of everything and the value of nothing” (Wilde 1890, p. 46)?

If protected, what will not decrease is the aesthetic value of nature, and economists have incentives here too because homes near natural areas fetch higher property prices, and thus increase the economic value of neighbourhoods and private property. Waterfront properties have even higher economic value (Völker and Kistemann 2011), particularly those that have undergone environmental restoration projects (Wakefield 2007), and those with higher water quality status based on the standards of the Water Framework Directive (Artell 2014). Thus, aesthetic natural environments warrant both an intrinsic value and a monetary benefit, so the schism between economic and environmental objectives may be illusory, but if there is one, it is certainly not irreconcilable, it is simply about finding the balance that sustainably protects societal, economic and ecological interests (Pugh and Sarmiento 2004).

Another avenue to highlight the intrinsic value of nature and the connections between society and ecology is by linking natural heritage with cultural heritage. Cultural heritage developed in tandem with natural heritage from shared physical geography, borders, climate, weather, traditions, legends, symbols, history, seasons, ancestry and language, and in Ireland, agriculture and farming are deeply entrenched in cultural heritage. The connection between cultural and natural heritage ascribes a moral responsibility to protect what has been passed down to this generation and to ensure that there is an inheritance of natural resources and ecosystem services to bequeath to future generations (Howard and Papayannis 2013). Legislation protects select species and habitats, Natura 2000 sites and

water quality. However, the remaining 'non-protected' regions of catchments are also valuable and should be protected because of their connectivity with protected habitats, but also because they are part of the cultural and natural heritage (Catsadorakis 2007).

Agricultural heritage has high financial value, so it is readily protected and bequeathed. Resilience in an ecosystem matters to farmers, foresters and conservationists alike because it means the natural system can repair itself and continue to be productive (Norton 2000). Agricultural landscapes are also valued aesthetically, and attract tourism (Kelly 2016), particularly traditional farms or those with natural features such as waterways and trees, so aesthetic value also increases the economic value of cultural heritage (Daugstad *et al.* 2006). Natural heritage and biodiversity are co-dependent and inextricably linked to agriculture and rural cultural heritage, as areas completely untouched by humans are rare (Phillips 1998). Traditionally, barns, outbuildings, hedgerows, pastures and stone walls were extremely valuable for biodiversity straddling the interface between wild nature and human habitation (Bignal and McCracken 1996; FAO United Nations 2020). Resilience in an ecosystem for both agriculture and biodiversity are important for the sustainability of future generations (Erisman *et al.* 2016).

2.2.7 Managing the commons in the hydro-illogical Anthropocene

The European Convention on Human Rights protects landowners, giving them the right to peaceful enjoyment of their property unless it is against the public good. European laws also protect rivers and riparian habitats (Water Framework Directive and Habitats Directive). Rivers are natural markers, often chosen to delineate boundaries between privately-owned lands, and while the privately-owned river banks may grow, shift and shrink, the river remains common property (Blomley 2008). Pollution from the land that impacts water quality is against the public good, yet the dynamic nature of water and its complex range of scale, interested parties and sites make waterscapes one of the most challenging resources to manage, particularly when being sensitive to biodiversity, local cultural symbolism, private landownership, landscape and connectedness to water (Acharya 2015). The diverging priorities result in an illogical outcome, in that knowing of the human dependence on good quality freshwater, there are nevertheless limited collaborative efforts between public and private bodies to prioritise the protection of water quality. Catchment

restoration implies reinstating the whole of a riverine system to a former state of functioning, movement and interaction between its riparian zones, head waters, meanderings, the tributaries, floodplains, the riverbed substrate and the mouth; however, while the focus should account for the whole catchment, these plans are often too expensive and unrealistic as much of the land is privately owned.

As the global human population continues to expand, competition increases for natural resources. The diverging interests and conflicting priorities increase the complexity within these interactions, and the academic field of Political Ecology studies these human 'ecosystems' and how human politics influence protections and management of natural ecological systems (Forsyth 2015). In political ecology studies, there is a considerable body of work related to agricultural impacts and farmer attitudes, motivations and willingness to adopt, participate and comply with environmental protection measures (Wilson 1996; Armstrong and Stedman 2012; Greiner 2015). However, King *et al.* (2019) identify a need for more research that examines freshwater ecosystem environments, particularly for unprotected habitats subject to surface water pollution.

Understanding the perceptions and expectations, particularly related to government controls over regions neighbouring protected areas is important. In Ireland, the river water's 'commons' status combined with the State's goals to improve its quality (per the WFD and River Basin Management Plan) may, in effect, make it a protected habitat or appear as such because these commons areas border and are influenced by activities on those private lands. Restricting land use on private property, particularly for conservation purposes, causes conflict because of the prioritisation of nature over humans, livelihoods and culture (Fortmann 1990; McCarthy 2002; Robbins 2020).

A river catchment management programme should not appear to scrutinise the activities of landowners and farmers, as it needs to be sensitive in its approach. When environmental programmes are predicated on views that assert seemingly biased assumptions about environmental degradation caused by local traditional practices (Fairhead and Leach 1995), even legitimate, scientific programmes, (particularly if they interfere with livelihoods and traditional production methods or values) may cause uncertainty, scepticism and distrust

(Roche and Davis 2017). Even amongst farmers who join agri-environmental schemes, for example, the main motivations are often not environmental protection but financial awards and economic compensation (Barghusen *et al.* 2021).

Challenges to the acceptance of directives and regulations from the European Union habitats and water protection laws may stem from top-down political, regulatory and implementation frameworks (Roche and Davis 2017). Collaborative, community-based programmes can help to avoid some of the pitfalls of being perceived as a form of government agency or control. In furthering a state goal to preserve habitats, community, nature or sustainability, as is the case with the Water Framework Directive, it runs the risk of being politicised and associated with a government entity and thus deter buy-in, acceptance and efficacy of the water protection programme (Robbins 2020).

A public-centred approach envisions active revolutionaries who initiate environmental change by sharing this knowledge with students and encouraging public participation, engagement and activism (Loftus 2015; Wisner 2015; Osborne 2017). Once activated, global environmental grassroots efforts drive political change and legislation, and these stewards of planet Earth elicit change that can maximise ecosystem resilience to the influences of the Anthropocene (Chapin *et al.* 2011; Ogden *et al.* 2013). This suggests a cycle between the local bottom-up and governmental top-down approaches, where both have power as forms of governance (Mostert 2003; Macken-Walsh 2016). Other researchers, however, believe the opposite; that activism only exacerbates tensions, and that to promote pro-environment change there should be partnership building, dialogue, commonality and co-learning (Chatterton 2006).

Objections to pro-environment actions come in many forms depending on the context. For example, “amenity migration” which describes a pattern of human migration to rural areas to better access nature and outdoor recreation (Abrams *et al.* 2012). In California, traditional rural production and land use were deemed aesthetically and environmentally displeasing by wealthy in-migrants who had chosen the region for its natural beauty, culture and scenic landscape. Resentment grew when the newcomers entered local politics and initiated a government programme to preserve natural heritage, habitats and open spaces,

thereby limiting and interfering with the traditional rural culture and economy. In an effort to diffuse tensions, the programme was to be run by public participation, citizens and volunteer committees, however, these representatives were considered biased, and the differing views of 'landscape' were irreconcilable (Walker and Fortmann 2003). It is evident that context and dialogue are necessary to understand the differences between human nature and their differing perspectives on nature.

There are no easy answers to address the complexity, diversity and variability of long-term ecological degradation to water and natural resources (Robbins 2020) in this Anthropocene. When "flows of water...are simultaneously flows of power" (Loftus 2015, p. 182), it is challenging to find mutually acceptable compromises, and the round-table discussions on natural resource management should integrate the socio-environmental sciences with the practical sciences, to engineer contextually-overt, omni-perspective community solutions that are historically, locally and culturally sensitive and sustainable, and built upon the foundations of common ground.

2.3 The volunteer in nature

ICM works at the whole catchment scale, so issues dealing with community development and well-being, public health, water quality and environmental protection are linked. Catchment management goals will not be achieved if there is no consideration given to the relationships and values people feel towards nature and environmental protection, and the interdisciplinary field of environmental psychology can contribute to understanding stakeholder perspectives about river habitats and the surrounding landscapes (Walker-Springett *et al.* 2016). Yet, as important as it is for effective catchment management to unify the sociological disciplines with the natural sciences, Selinske *et al.* (2018) argues that there is little integration of human psychology with studies on biodiversity conservation and catchment management.

It is justifiable and necessary that scientific specialisations exist, and it would take a "Renaissance person" (Daily and Ehrlich 1999, p.279) to fully dissolve the boundaries that exist between disciplines, however non-integration runs the risk of incomplete knowledge with little ability to fix real-world problems (Brewer 1999). Although it is particularly

challenging, it is necessary, to integrate the psychological and sociological with ecological elements when the research aim is to understand the complex interactions and influences from human environments such as values and politics, behavioural psychology and economics and their impacts to natural environments (Schultz 2011; Pellow and Nyseth Brehm 2013; Moon and Blackman 2014; Moon *et al.* 2016).

2.3.1 Human health and nature

Human physical, mental and emotional health is strongly linked to the health of the ecosystem (Kellert 2009), and social scientists and psychiatrists could benefit from coordinating with public health practitioners and environmental scientists to develop policy and programmes that integrate human health with nature conservation activities (Sandifer *et al.* 2015; Williams *et al.* 2021).

Biological indicators highlight the health of the environment. Scientists can measure bioindicators in natural environments, and the level or absence of select species, such as bees and sensitive aquatic macroinvertebrates, can determine the health, balance and quality of natural ecosystems (Moolna *et al.* 2019). Scientists can also study human tissue to get an indication of the level, type and pathway (water, food, air or soil) of individual or community contamination by environmental pollutants (Cole *et al.* 1998). Thus, protecting natural environments is linked to and can help protect people from physical disease and ill-health. However, according to the World Health Organisation, “health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity” (WHO 1989, p. 1), and natural environments can also benefit the psychological and social factors of human well-being (Wade and Halligan 2004).

The physical health benefits of living near green space can include better respiratory, cardiovascular and intestinal health; reduced incidence of strokes, mortality, low birth weights, infectious diseases, obesity and high blood pressure; and increases in anti-cancer proteins and addiction recovery (Sandifer *et al.* 2015). These are at least partially attributed to better air quality and increased physical activity and exercise from time outdoors (De Vries *et al.* 2003; Barton *et al.* 2009; Lachowycz and Jones 2014). However, there are also studies linking access to green spaces and natural landscapes with numerous other benefits

(Kellert 2009; James *et al.* 2015; Sandifer *et al.* 2015; Hansen *et al.* 2017), including improved human psycho-physiological health and well-being (Velarde *et al.* 2007), better cognition (Wells 2000; Berman *et al.* 2008), and reduction in stress, mental fatigue and anxiety (Velarde *et al.* 2007; van den Berg *et al.* 2010; Groenewegen *et al.* 2012; Bratman *et al.* 2015; James *et al.* 2015). The healing properties of particular spaces are well-studied, and the therapeutic value of these landscapes can depend on the context and the various experiences of people. These can differ depending on the scale of the geography, as well as the individuals, cultures and populations experiencing them (Bell *et al.* 2018).

Although not receiving as much focused attention, there are studies that link the potential therapeutic benefits of blue space, i.e. aquatic environments, for improving health and well-being. These are more associated with emotional health benefits due to memories of contemplative, experiential activities rather than physical activity (Foley and Kistemann 2015; Völker and Kistemann 2011). Blue space with nature scenes improves mood and states of mind (Ulrich 1981), and even rivers and canals within built, urban environments offer restorative benefits (White *et al.* 2010; Smith *et al.* 2022). A natural environment with sounds of running streams reduces pain levels in hospital patients (Diette *et al.* 2003), a painting or a view of a nature scene can ease stress levels and improve focus (Tennessen and Cimprich 1995; Berto 2014), and a view of green space from a window showed reductions in depression and anxiety (Braçe, O. *et al.* 2020). Although actual nature shows highest improvement to mood levels (Browning *et al.* 2020), when a person is unable to access actual nature, virtual reality nature, especially with nature sounds (Annerstedt *et al.* 2013), showed stress reduction, and improved mental and physical well-being (White *et al.* 2018). According to these studies, as stress is a risk factor to human physical and mental health, a cost-effective and convenient way to improve physical health and mood, and to supplement medical and psychological therapies and treatments, is to spend time in nature.

Numerous studies measure the benefits of spending time in nature while conducting nature-based outdoor activities, and one study found that 75% of the participants believed it to be one of their most important experiences for their emotional, intellectual and personal development (Kellert 2009). Confidence, self-esteem and self-identity improved, and they felt positivity and overall well-being. Additionally, it helped them build a

connection to nature and other participants. People who feel an appreciation and connection with nature (Zhang *et al.* 2014a), and that nature is an important part of their identity, tend to feel more satisfaction, purpose and happiness in life (Nisbet *et al.* 2011). Additionally, green space enhances social and community connections, and these too are known factors that benefit health and well-being (Umberson and Karas Montez 2010). The connections that can promote mental wellbeing can also be related to a collective sharing of attachments, such as to place or community (Duff and Hill 2022). It may be challenging to prove the causal relationship between exposure to natural landscapes and improved human health, but this does not detract from the evidence that there is a correlation, just as there is also a negative effect on the health of those who do not experience time in nature (Grinde and Patil 2009). Therefore, access to blue space as a resource for promotion for health benefits has the potential to influence policy that can increase their protection (Foley and Kistemann 2015).

2.3.2 Human dependence on natural ecosystems

Humans are not separate from nature. From Anthropogenesis to the Anthropocene, human evolution, development and survival depended on natural resources. People build, innovate and engineer every item that we utilise in our daily existence from the products and resources of nature: Furniture, homes, buildings, cement, jewellery, books, clothing, food, water, medicine, plastic, and even electrical energy is from nature (Bodanis 2006).

All of life on earth is dependent on water and is intrinsically linked to the earth's hydrological cycle. Humans are made up of 60 percent water, with our brains, hearts and lungs being between 73 and 83 percent water. Humans can survive without drinking water for only three to four days. While 70 percent of the earth is covered in water, only 3.5 percent is fresh and 0.01 percent is available to humans in rivers, lakes and aquifers. Of that, much is washed away as flood water, and what remains of this most precious natural resource is subject to over-exploitation and pollution (Ball 2000).

Human foragers settled into permanent farms with the Agricultural Revolution (Harari 2014). A remnant of this foraging history, humans evolved with a primal preference for landscapes with natural resources that can support human life (Kahn 1999; Frumkin 2001).

The need for a regular supply of fresh water for drinking, bathing, crops and livestock meant early settlements and civilisations began within river catchments and flood plains (Postel and Carpenter 1997), and this continues with a greater global development by lower elevations and coastal regions for economic advantages and access to food, and by navigable rivers due to agriculturally-advantageous areas of nutrient-rich soils (Small and Cohen 2004).

Human civilisations developed around waterbodies such as rivers, lakes and floodplains because freshwater is an essential component for human life, and for the lives of plants and animals that humans rely upon, giving people a sense of security and well-being (Gullone 2000). Under the biophilia hypothesis, humans have an innate curiosity and affinity with living things and nature (Wilson 1984; Kellert 2002). Biophobia is a fear of threats, disease-carrying insects, allergies, predators and dangerous species that exist in natural spaces, and in terms of rivers, this includes a fear of floods, drowning, pollution and pathogens, but this depends on the individual (Ulrich 1993; Hartig *et al.* 2011) and their previous experiences. For example, some communities have to cope with worries related to frequent and/or severe river flooding, and people may associate rivers with death and drownings.

The recent panacea for preventing ecosystem degradation is by re-bridging the connection people have with nature. Ideas include increasing nature recreation or urban gardens (Kareiva 2008), or promoting public awareness and childhood outdoor experiences (Louv 2005). If biophilia derives from an evolutionary sense of security from having access to essential resources, and that innate connection to nature is weak, then perhaps the connection to nature can strengthen by knowing the economic, health and utilitarian provisions of ecosystem services (Norton 2000; Simaika and Samways 2010). The connection to nature can be reinforced in childhood (Kellert 2002; Kellert 2009), particularly if the family value nature (Oh *et al.* 2021), if they reside near a natural space, and if they have direct nature experiences where they learn about wildlife and environmental issues, and develop the capability and skills to improve them (Cheng and Monroe 2012; Keith *et al.* 2022), and this also includes in adulthood (Cleary *et al.* 2020). Thus, rural residents (Hinds and Sparks 2008), those that live nearer to waterbodies (Larson and Santelmann 2007), and people who have outdoor experiences in green and blue space tend to have a stronger

connection to nature, making it more likely that they will work to protect it and conduct more pro-environmental behaviours (Restall and Conrad 2015; Mackay and Schmitt 2019).

Experiences in nature, particularly direct experiences that are conducted with the intention of spending time in nature, can also influence environmental attitudes and pro-environmental behaviours, although transformations may be dependent on other factors such as the way nature is experienced and changes in societal perspectives (Clayton *et al.* 2017; Rosa and Collado 2019). Childhood nature experiences set a child's trajectory towards pro-environmental attitudes, and increase the level of contact in nature people have as adults, and this influences self-identity and the level of pro-environmental behaviours (Wells and Lekies 2006; Lacasse 2016; Prévot *et al.* 2018; Rosa *et al.* 2018). An absence of childhood experiences in nature is an 'Extinction of Experience' that leads to Richard Louv's (2005) 'Nature Deficit Disorder,' that should be prevented with policy and community projects if the aim is to increase the level of contact people have in nature (Pyle 1978; Soga *et al.* 2016). With populations growing in regions with less access to nature, and with people preferring to stay indoors, it can lead to a loss of access to the benefits and well-being that comes with a connection to nature (Soga and Gaston 2016). The loss of natural habitats, biodiversity and species can perpetuate this extinction of experience (Miller 2005). Colléony *et al.* (2017) suggest that childhood nature experiences in a diversity of spaces may increase the types of natural habitats that people will aim to protect; "*What I have not been used to seeing or hearing or in any way experiencing, I shall not miss*" (Vetlesen 2015, p. 209). Education activities in nature included within a school curriculum can enhance connections to nature and the proclivity for young people to become adults who protect nature (Schuttler *et al.* 2018), offering the potential to bequeath the value of nature and its conservation to future generations. The connection to nature, however, can vary depending on age, as can the emotional health benefits that nature can provide (Barton and Pretty 2010; Hughes *et al.* 2019). The connection to nature is ultimately a self-determined, subjective element of self-identity, and a person can feel so connected to nature that exposure to it brings them happiness, a sense of well-being and concern for the welfare of the natural environment, which can lead to pro-environmental behaviour (Mayer and Frantz 2004; Brügger *et al.* 2011; Zelenski and Nisbet 2014). On the other hand, that same concern may bring on anxiety, frustration and sadness about the decline of biodiversity and

destruction of natural habitats and landscapes (Capaldi *et al.* 2014; Cunsolo and Ellis 2018), particularly when it is combined with powerlessness to cease its evanescence. Solastalgia are the feelings of distress and nostalgia that come from powerlessness, and homesickness and loss due to environmental changes (Albrecht *et al.* 2007; Warsini *et al.* 2014; Galway *et al.* 2019), however, concerns may be offset with a programme that offers the opportunity and skills to make a difference, which can increase satisfaction and well-being of participants (Binder and Blankenberg 2016; 2017; Ágoston *et al.* 2022). A nature-based volunteer programme, however, cannot be so prescriptive that it does not accommodate the various ways people experience and benefit from time in nature (Bell *et al.* 2018).

2.3.3 Value of natural spaces as place

Nature also provides numerous other benefits to humans, and the valuation of the resources that nature provides is controversial (Vetlesen 2015). Although some strongly believe that nature has an objective, intrinsic value outside of human judgment, there is a wide spectrum of subjective human perspectives on the value of nature's assets, for example, life support, financial, political, moral, aesthetic, recreational, scientific, health, historical, endangered species, religious or spiritual, depending on the intended purpose and the valuer (Rolston 1988).

Cognition or cognitive process is "thinking, reasoning, perceiving, imagining, and remembering" in terms of concepts (Bayne *et al.* 2019, p. R608). Many studies to understand the human-nature relationship focus on the experiences individual people have in nature, that is, the type of exposure, and how the resulting values, attitudes, connections and concern about nature might motivate people to increase pro-environmental behaviour. However, as the concept of nature is vague and complex, and will differ between people based on their social conditioning and past experiences, perhaps it is associating nature to a particular place that can harness the sense of personal, ecological and community identity, ownership and place attachment that will ensure continuous, long-term commitment to nature conservation (Zavestoski 2003; Beery and Wolf-Watz 2014).

Place attachment describes the human emotion of feeling bonded to a particular place. It can be based on the feelings and connections towards a physical setting, dependence on

the resources derived from the place, and the emotional connections to a place from the history that is shared with family and friends (Muhar *et al.* 2018; Oh *et al.* 2021).

Psychological well-being associated with place attachment derives from a sense of bonding to family, culture, the past, traditions and community, which usually (but not always) leads to positive memories, a sense of belonging and feelings of relaxation, security and comfort, and a connection to nature (Scannell and Gifford 2017; Passmore *et al.* 2021). Connections to nature and awareness of current environmental issues can also be built by means of cultural heritage and the arts (Selman *et al.* 2010), and a sense of place and attachment to place can then be linked to the biodiversity of the region and increase public concerns and support to protect it (Gosling and Williams 2010; Hausmann *et al.* 2016).

The experiences and activities that people conduct within a physical environment provide a basis for how individuals and communities identify themselves, and also how they are identified by others (Graumann 1983), and these places can cue a sense of group identity (Devine-Wright and Lyons 1997). Collective identity develops when individuals feel an emotional, cognitive or moral connection with their community, originating from a shared interest, goal, heritage, history, tradition and bonds (Polletta and Jasper 2001). However, the framing and objectives of the group identity have to be desirable in order to attract new recruits and alliances, and the label needs to be found acceptable to attach it to their own personal identity (Oyserman 2001; Polletta and Jasper 2001).

Collective action is most often to voice discontent towards a state or corporate injustice or a visible environmental health infringement (Hannigan 2014), and protecting private property from threats to place and identity are common themes in NIMBY activism. Place attachment motivates landowners and farmers to protect their land from degradation (Walker and Ryan 2008). Thus, the 'Not in My Back Yard' concept tends to refer to familiar places, and the attachment, ownership and personal or community identity they inspire, rather than natural environments (Devine-Wright 2009). However, increasing childhood and adult outdoor experiences and nature activities can change perspectives and feelings of connectedness (Nisbet *et al.* 2008), occupying a larger space of positive feelings of nostalgia, culture, family, ecological identity and memories (Capaldi *et al.* 2014). Having an ecological self-identity will predispose a person to active pro-environmental behaviours (Van der Werff *et al.* 2013a;

Balundé *et al.* 2019). If this is coupled with awareness of catchment-based environmental threats and social norms, people can affix the same level of place attachment, ownership, protectiveness, concern and action for insidious environmental changes in their communities and larger catchment areas as they can for immediate threats in their own back yards (Schultz 2002).

2.3.4 Environmentalism

The concept of environmentalism may be undergoing a change (Besthorn 2002). Whereas an identity as an environmentalist was perceived as the purview of extremists and tree-huggers (Clayton and Opatow 2003), it has had a revival, perhaps with the influence of youth movements, such as that led by Greta Thunberg, it has become more popularised . Wright *et al.* (2012, p. 1451) find that climate change and the concept of sustainability has triggered the development of an identity as a “green change agent, ” being the “impetus for personal reinvention as a moral agent of change.” The Wright study (2012), however, was conducted in a corporate environment, and it is more the influence of the community and society that may help define if a person identifies themselves as an environmentalist. The Theory of Planned Behaviour presupposes that the likelihood of taking conservation action increases based on one’s intention to behave as an environmentalist to conduct that action (Lokhorst *et al.* 2014). This could be associated with identity for an environmentalist, but also with behavioural change for farmers when they have committed to an environmental programme. On the other hand, many are ‘inadvertent environmentalists’ who conduct actions that are beneficial for the environment, even though their intentions do not relate to values or concerns for the environmental, but for practical purposes such as to save money (Hitchings *et al.* 2015).

According to the distinctiveness hypothesis, what makes a person stand out from the group may be how they identify themselves. It may be that living in a primarily agricultural or urban region distinguishes those with pro-environmental behaviours and interests in nature conservation, and thus, what influences their identifying as an environmentalist (Owen *et al.* 2010; Balundé *et al.* 2019). Wade-Benzoni *et al.* (2007) claim that the differences in the level of pro-environmentalism lie in the manipulations of context. It is more likely that people will deny that they are causing the environment harm rather than admit to promoting its health,

in that pro-environmental behaviours that reduce a carbon footprint or prevent plastic pollution, by recycling properly, are distinguished from actively working towards nature conservation and protection (Richardson *et al.* 2020). A method of promoting pro-environmental behaviours was to convince people that they were good environmentalists already, i.e. positive reinforcement. What remains are those defining factors that make an environmentalist, whether they are in identity or action or how they want to appear (Milfont 2009; Kormos and Gifford 2014). Does it relate to different interpretations of the environment and how nature is perceived and conceptualised (Ducarme and Couvet 2020)? Is it personality, an emotional predisposition, a sense of compassion or an accumulation of positive experiences in nature (Zelenski and Desrochers 2021)? What is it that bridges the value-action gap between identifying as an environmentalist, valuing nature intrinsically, feeling at one with nature and taking action to protect it (Barr 2004; 2006; Kennedy *et al.* 2009; Van der Werff *et al.* 2013b)? Perhaps it can partially be determined by those who do not experience 'compassion fade' and still choose to volunteer despite the large scale of problems in the environment (Markowitz *et al.* 2013).

2.3.5 Nature conservation volunteerism

Human behaviour, and the patterns of human behaviour in this Anthropocene era, need to change to reverse the trends of biodiversity loss, environmental pollution and unsustainable use of natural resources (Steg and Vlek 2009). To modify those aspects of human nature that cause environmental problems, it is important to fully integrate the social sciences with nature conservation science (Bennett *et al.* 2017) and to understand the human psychology in the human-nature interface (Howard 1997). Perceptions and motivations differ amongst the diversity of human actors. There are various ways to elicit pro-environmental behavioural change including building awareness in environmental matters, promoting more environmentally-friendly choices, highlighting the benefits of nature to human health and well-being (Clayton *et al.* 2016), removing the barriers that prevent the behaviour (McKenzie-Mohr 2000), and empowering people with the skills to make improvements in the environment (Pugh and Sarmiento 2004).

Under Lindenberg and Steg's (2007) Goal-Framing Theory, summarised in Table 2.2, certain goals also need to be met before a person will make the decision to engage in pro-

environmental behaviour. The hedonic goal is associated with feelings of pleasure, the gain goal provides the actor with a benefit, and the normative goal fulfils a perceived social duty.

Normally, all three goals are simultaneously and subconsciously active when a person is making a decision, and when the goals conflict, the decision turns in favour of that which is most dominant in that individual given the particular situation (Lindenberg and Steg 2007; Steg *et al.* 2014).

Table 2.2 The Goal-Framing Theory

| Goal | Description |
|----------------------|---|
| Hedonic goal | <ul style="list-style-type: none"> • Altruism • Doing the right thing • Nature improves state of mind • To attain a sense of pleasure and gratification |
| Gain goal | <ul style="list-style-type: none"> • Fun, interesting • Co-benefits of a communal past time • Co-benefit of exercise • Co-benefit of cognitive/mental well-being • Education and continuous development • Sense of community • Save money or effort • Gain social status • Increase resources • Preservation and protection for progeny • Environmental health link to human health • Our greening actions may influence corporations, having largest impacts |
| Moral/Normative Goal | <ul style="list-style-type: none"> • Social norms / morally accepted /socially desirable • Public trend • Duty and responsibility • Belief of societal expectations |

It is usually the moral goal that conflicts with the others, because the moral, social duty requires the most personal sacrifice. If there is any confusion in what a person believes is expected of them, they may resort to the hedonic or gain goals (Lindenberg and Steg 2007), and not conduct the socially-accepted pro-environmental behaviour. For example, when a person makes the pro-environmental effort to reuse the same plastic bottle numerous times, and then eventually disposes of the bottle responsibly in the appropriate recycling bin, they have achieved the benefits of all three goals: Gratification and happiness that they have done the right thing (hedonic) (Bissing-Olson *et al.* 2016), they saved money (gain) and

they are confident that they have behaved in an environmentally and socially appropriate manner (normative).

Numerous personal factors related to experiences, values, politics, personality traits, biases and attachments, as well as social factors such as community norms and religion can influence pro-environmental behaviours, and various combinations can determine who may change their behaviour (Gifford and Nilsson 2014). Generally, having an appreciation of the beauty of nature tends to make people more altruistic, prosocial, generous, trusting and positive (Zhang *et al.* 2014b). People who are more selfless and prosocial, that value nature and are concerned about the environment will more likely change their habits, particularly if the cost is not too high and if a feasible, convenient opportunity is available (Steg and Vlek 2009). For those without those traits, breaking the habits that lead to environmentally damaging behaviour requires strategies to alter motivations, perceptions, knowledge and values. A contextual change can force a break in a habit (Fujii *et al.* 2001), and, for example, Covid-19 has the potential to trigger this capability.

A challenge to changing behaviours on a catchment-wide scale are that humans can have a blindness to large-scale spatial and long-term temporal biogeographical and ecological processes (Saunders *et al.* 2006). Thus, environmentally-deleterious behaviour can often stem from a lack of awareness that seemingly innocuous actions can cause far-reaching negative consequences, and it is not that they set out to destroy nature (Howard 1997). However, there are other factors and priorities that may influence an individual's pro-environmental behaviour or a farmer's adoption of best management practices (Hyland *et al.* 2018; Liu *et al.* 2018; Moss 2019).

Education and building awareness of environmental issues, informing people about alternative actions, explaining negative and positive consequences of their actions, and then offering feedback and reward can bring about some changes (Steg and Vlek 2009). However, education on the benefits to the environment or themselves are not enough, and messages need to address long-term consequences and benefits, and these need frequent reminders in the form of notices, rewards, recognition, appreciation, prompts or feedback in order to maintain a behavioural change (Lehman and Geller 2004).

Denial of risk is another human tendency that needs to be overcome. When made aware of an environmental harm that their actions cause, even if it proves to the ultimate detriment of their own health, some people have almost a reflexive denial of risk. It explains why some people decide to start smoking cigarettes, even though they know it is a high risk behaviour. The perception of risk, particularly from environmental pollutants that are invisible, cumulative or long-term, is influenced by factors such as trust, values, past experience and one's world view (Clayton and Myers 2015). Long term scale or invisible pressures like climate change are also difficult to accept (Gifford 2011; Van der Linden *et al.* 2015).

Adults who are aware of environmental problems and have experienced the loss of natural habitats, if they feel they have a responsibility to protect the environment and the skills to do so, will have developed empathy with nature, and will be highly predisposed to pro-environmental behaviour and commitment to its protection (Monroe 2003). However, it is also important not to trigger Vasi and Macy's 'mobiliser dilemma,' (2003) whereby individuals are deterred from participating in pro-environmental collective action because they feel they are helpless to make a difference (the 'efficacy problem'), and also they may feel that their individual input is unnecessary because everyone else has it covered (the 'free-rider problem'). So it is important that the message calling people to action is not so negative and seemingly hopeless as to make people feel that all efforts are futile, such as in the tragedy of the commons (Hardin 1968), but also to demonstrate success stories so that people are empowered in the knowledge that their contribution can be meaningful and that it is necessary (Burger and Gochfeld 1998; Vasi and Macy 2003).

It is equally important to modify the behaviour of communities as it is the behaviour of individuals. Key factors to influence communal behavioural change are to a) target the priority, highest impact behaviours and b) ensure the desired change is realistic, and has high plasticity, based on how much of the population already engages in the behaviour, and if successful marketing has elicited the change in the past (Schultz 2011).

Due to complex elements of human psychology, when marketing to change behaviour or make more pro-environmental choices, it will be more effective to promote the connection

to nature and the resulting benefits to health and well-being rather than the negative, fear-based messages of needing to reverse the trend of environmental collapse (Mayer *et al.* 2009). The more goals that can increase the motivations, the more likelihood that people will change behaviours and even volunteer.

2.3.6 Covid-19 implications for volunteerism

Covid-19 increased the potential of mental health issues with the increased concerns and worries over contracting the disease (Lauri Korajlija and Jokic-Begic 2020). Social isolation, financial worry and concern over the uncertainties due to Covid-19 lockdown restrictions have impacted human mental health with increased stress-levels, anxiety and depression (Sibley *et al.* 2020). However, Covid-19 also created opportunities for engagement with nature (Soga *et al.* 2021). Thus, there were also benefits to mental and emotional health from an increase of time in nature as a positive consequence of lockdown restrictions, as well as a new appreciation of having proximity and access to nature sites (Guzman *et al.* 2020; Rousseau and Deschacht 2020; Foley *et al.* 2022). Moreover, the shared threat has strengthened community connections, social belonging, patriotism and place attachment (Sibley *et al.* 2020). Potentially, therefore, people may be more willing to participate in community-based outdoor activities and volunteerism than they would have pre-Covid-19 as they are now habituated to feeling safer in outdoor gatherings, but also for the well-being benefits. This is supported by the GreenCOVID survey that found that the increased engagement during Covid-19 led to greater appreciation for nearby nature and also promoted pro-environmental sentiments and caring for place (Foley *et al.* 2022). This also included an awareness that the improved quality of the natural environment, due to reduced air and noise pollution from lower levels of vehicular traffic, led to the perception that people were healthier due to reduced exposure to these pollutants while increasing their levels of time in nature (Carrido-Cumbrera *et al.* 2021).

Individuals with health problems such as type 2 diabetes, cancer, obesity, respiratory and cardiovascular disease are at higher risk if they contract Covid-19. Outdoor activities are known to improve physical fitness and overall health and well-being (McCurdy *et al.* 2010; Mutz and Müller 2016). Post-Covid-19 behavioural change creates opportunities to increase public participation in nature-based community volunteer initiatives. Additionally, there is

growing science, dialogue and awareness of the links between a decline in environmental health to an increased risk of pandemics and disease (Madhav *et al.* 2018), and growing knowledge that not only are the vaccines and cures for pandemics in nature and biodiversity, so are the preventions (Alves and Rosa 2007; Sharma 2012). Lockdown increased the appreciation of nature and interest in spending time in nature, but it also highlighted inequalities in the ability to access and reap the benefits that nature provides (Rousseau and Deschacht 2020; Spotswood *et al.* 2021). Public health and development groups may be more motivated to develop multidisciplinary partnerships and increase investment into accessing green space, and Covid-19 is an opportunity to reconnect the human-nature relationship (Soga *et al.* 2021). The ultimate decrease in cost of psychiatric and medical treatments combined with the benefits to the environment and society will facilitate true integration of economic, social and ecological priorities.

Another change to arise from Covid-19 is a higher level of confidence and trust in government bodies and scientific authorities (Sibley *et al.* 2020). This contrasts with governments being perceived as authoritarian and programmes run by scientists being met with resistance, scepticism (Hannigan 2014) and distrust due to being prescribed by law, policy or governing bodies (Fairbrother 2017). This bodes well to further the aims of ICM and water quality objectives of the WFD and the RBMP.

2.4 Citizen science for environmental data collection

Citizen Science is a valuable form of public participation that engages non-scientist volunteers in collaborative scientific investigations, thereby providing professional researchers with access to localised data at extensive spatial and temporal scales that would otherwise be impossible or prohibitively expensive to obtain (Conrad and Hilchey 2011; Dickinson *et al.* 2012). For example, researchers can learn of the presence of rare or invasive species, gaps, patterns, relationships and trends in climate, habitats or ecosystems (Bonney *et al.* 2009a; Donnelly *et al.* 2014; Williamson *et al.* 2016), and are also combining datasets for information (Dickinson *et al.* 2010). Data from citizen scientists has advanced scientific knowledge for hundreds of years, particularly for nature observation (Miller-Rushing *et al.* 2012). For example, historical records provide 1200 years of dates of Kyoto, Japan's cherry blossom festivals and 640 years of French grape harvests, providing temporal information

indicating climatic trends (Chuine *et al.* 2004). Climate change is seen where earlier bird egg-laying was shown to coincide with earlier plant growing seasons, based on data from over one million records covering 60 years, contributed by 1,000 volunteers (Crick *et al.* 1997; Silvertown 2009; Cooper 2016).

More recently, citizen science projects are designed and developed with a targeted aim. Citizen science projects use games to attract technophiles (Iacovides *et al.* 2013), and there are purely online citizen science formats (Raddick *et al.* 2009) such as Zooniverse (www.zooniverse.org) that offers a choice of 98 citizen science projects on a range of subjects for their 1.6 million registered volunteers. Like CitSci.org, there is also a facility for researchers to build customised online citizen science research projects that can collect, analyse and provide feedback on data and project participants. Online citizen science obviously needs to align with emerging technologies such as smartphone applications, online tools and wireless sensors to streamline processes, lower costs, and ease data collection and management, as well as engage more participants (Dickinson *et al.* 2012; Newman *et al.* 2012).

2.4.1 Citizen science for water quality monitoring

Citizen science programmes can be designed to monitor and discover a wide range of parameters about aquatic environments. Various methods and systems have been developed to best answer the questions scientists are looking for volunteers to help answer, and Appendix 1 provides an article that includes, in its supplementary files, tables of international and Irish citizen science water-related projects indicating the parameters measured (for example, biological, chemical or physical) and the level of skill required for the volunteers. Targeted citizen science programmes vary in parameters from characterisation of ecosystems, biochemistry or specific taxa, such as macroinvertebrates, and in others, contributors can choose to input data on whatever species interest them. For example, in China, to determine the sources of the nutrients causing eutrophication (a problem caused by excessive nutrient pollution) in a river catchment, 400 citizen scientist volunteers were trained to monitor, record and submit data on environmental conditions and water quality parameters once a month for three years (Zhang *et al.* 2017). Parameters included the surrounding land use, the bank and aquatic flora and fauna, estimates of water

level and flow, water surface characteristics and water quality indicators such as conductivity, phosphate and nitrate levels, and water colour. The data gathered was overlaid with Geographic Information System (GIS) satellite imagery to compare with the catchment's land use and cover for a comprehensive spatial and temporal understanding of the catchment influences on the river water quality and the sources of the pollution (Zhang *et al.* 2017).

For 18 years, French citizen scientists collected weekly data on seasonal nutrient concentration levels, determining the effectiveness of land management improvements such as removal of point source pollutants (for example, from effluent discharge pipes) but were also able to determine their ineffectiveness in reducing impacts from non-point source pollutants, such as from agriculture (Abbott *et al.* 2018). Clearly, citizen science initiatives are diverse and adaptable enough to meet various programme objectives in different disciplines, scales and formats, and can also be tailored to target specific environmental problems and volunteer participants. In terms of scale, these can vary depending on those that are broadscale and purely computer-based versus those that require some outdoor activity, such as sampling and identifying aquatic macroinvertebrates. This will also depend on the goal of the project, and on the gap in the data that scientists wish to fill, whether it is catchment-based, national, global or related to a particular community or river, for example to find the cause of a mass fish kill (Brooks *et al.* 2002; Moolna *et al.* 2019). This is where citizen science data over a long temporal period can be valuable for scientists and catchment management programmes (Kuussaari *et al.* 2009), particularly when considering the extinction debt which is the period of time between a pollution event and the local extinction of a species (Hanski and Ovaskainen 2002).

In Ireland, there are annual weekend Waterblitz events and regular, monthly citizen science monitoring using Earthwatch's Freshwater Watch field testing kits to monitor nutrients and turbidity (Hegarty *et al.* 2020; 2021). Additionally, the StreamScapes catchment-scale education programme builds environmental awareness and encourages public participation in aquatic biodiversity and ecosystems with field-based activities and education offered to diverse stakeholders such as corporations, schools and community groups, partnerships with rivers trusts, social and natural scientists, eNGOs and government (Boyden 2015). The

Small Streams Risk Score (SSRS) system helps detect significant sources of diffuse waterbody pollutants by measuring the abundance of sensitive taxa of aquatic macroinvertebrates to determine the water quality in river tributaries (McGarrigle 2014). Volunteers that are trained to collect data using approved, standardised methods are providing researchers with necessary data to target remediation works for WFD compliance, and also undertaking an experiential learning process that can encourage active public participation in catchment management issues by increasing understanding of the health of the environment. Active engagement can ultimately further the public participation aims of WFD, RBMP and conservation legislation, and it can enhance conservation and protections for biodiversity within communities (Cooper *et al.* 2007; Devictor *et al.* 2010) and connect the bottom-up and the top-down approaches of ICM (Moolna *et al.* 2019).

A citizen science initiative to monitor water quality can help improve river catchment health by actively involving the public in ICM, and it offers the potential to help contribute to legislative and policy goals to protect humans and the environment (Van Brussel and Huyse 2019), and fulfil policy and legal objectives in increasing bottom-up engagement (RBMP 2019). The scientific knowledge that can be obtained about water quality over the scale of a river catchment can inform policy, conservation and land management (Geoghegan *et al.* 2016). It is also useful to build public awareness of scientific methodology in how and why water quality is monitored and managed because understanding why environmental health and water quality is important can lead to increased civic participation (Turrini *et al.* 2018).

Citizen science for the protection of ambient waterbodies can bridge the social sciences with natural science to achieve ICM aims by contributing to the body of knowledge seeking to understand how participation in a nature-based citizen science project changes public attitudes and behaviours (Crain *et al.* 2014). However, it is essential to be aware that there can also be negative consequences from citizen science programmes, such as being too burdensome for the volunteer, not protecting the privacy of participants, or creating conflicts and tensions between local people or water managers (Walker 2021). Flint, Michigan offers a cautionary tale, whereby government authorities and managers failed to adequately protect public water supplies, and a breakdown in governance, with a lack of accountability led to tragic outcomes for local people, thus cementing a distrust and

scepticism in the assurances of government scientists. Eventually, public action was taken under the guise of citizen science making false assertions in an attempt to strengthen lawsuit claims and increase media support. The misconduct and fearmongering demonstrates that bottom-up mechanisms may also result in an abuse of power that muddies waters and increases distrust between local people and state authorities (Roy and Edwards 2019). This coincides with those researchers who believe that activism only exacerbates tensions, and that essential elements to any programme are partnership building, dialogue, commonality and co-learning (Chatterton 2006).

Sociology might focus on problems of inequality, education, powerlessness, barriers and emotional health, and a citizen science initiative to protect the health of natural environments for the benefit of society as well as biodiversity, also offers a public health service (Hannigan 2014). It is a bonus that the act of participating in a nature-based activity also offers numerous mental, emotional and physical health benefits to its participants and society (Pocock *et al.* 2023).

2.4.2 Nature-based citizen science for the citizen scientist

The benefits of a nature-based citizen science programme are numerous, and they can result in transformative learning outcomes for both researchers and participants (FitzPatrick *et al.* 2015; Bela *et al.* 2016; Peter *et al.* 2019). Citizen science can build public awareness and trust in scientific methodology (Devictor *et al.* 2010; Crall *et al.* 2013), increase scientific knowledge of the catchment health and community to help inform management decisions (Bela *et al.* 2016), and also increase meaningful public participation to help inform policy and decision-making (Nerbonne and Vondracek 2003) by building public confidence and capacity (Richter *et al.* 2018), and providing the skills on how to improve conditions (Evans *et al.* 2005; Moolna *et al.* 2019). However, awareness-building campaigns alone are insufficient to effect behavioural change (Osawe *et al.* 2023) that increases environmental conservationism and volunteerism.

Citizen science also bridges connections between people and natural habitats (Schuttler *et al.* 2018) that can inspire pro-environment behavioural and attitude change (Crall *et al.* 2013). The nature-based citizen science experience can help remind people that they were

never really disconnected from nature, and thereby rebuild and re-bridge their connection to nature (Fletcher 2017) and increase the desire to protect it. Feelings of connections to nature, due to its influence on levels of concerns, can increase the tendency to perform more pro-environmental behaviours and more nature conservation actions. Spending time experiencing nature in simple engagement activities can increase connections as well as pro-environmental behaviours and conservation actions (Richardson *et al.* 2020).

Water monitoring by citizen scientists led to increased scientific literacy, raising awareness of poor water quality or the danger of high groundwater levels being contaminated by wastewater or weakening house foundations. These studies demonstrated a link to citizen science leading to behavioural change (Jørgensen and Jørgensen 2021; Walker *et al.* 2021). There were also behavioural changes reported from an increase in awareness and knowledge, and a most common change is wanting to make a difference (Jordan *et al.* 2011), but Toomey and Domroese (2013) are uncertain if it is citizen science that leads to a change in attitude and behaviour.

Nature-based citizen science can be designed to satisfy all goals of the Goal-Framing Theory (Table 2.2). If the burdens are removed, the personal benefits are promoted, and the opportunity is easily accessible, then the gain goals are clear: There is no cost, but numerous personal benefits of improvement to mental, emotional and physical health, and it is a fun, engaging, educational, social event in a natural landscape. Thus, an overall enjoyable experience (gain) that also appeals to the sense of pleasure derived from altruistic, community-based, volunteer activity (hedonic) involving the socially-acceptable, increasingly trendy (normative) improvement of the health of the environment (Lindenberg and Steg 2007).

2.4.3 Challenges and disadvantages for citizen science managers

There are also disadvantages and challenges to overcome with citizen science programmes. Data validation is often a problem for scientists, and this may be due to volunteer biases and errors as well as inconsistencies and variability in volunteer-derived data (Dickinson *et al.* 2012). For example, common participant biases that can impact the quality of the analysis are not reporting the absence or abundance of a species, or over and/or under

reporting based on interest (Dickinson *et al.* 2010). Other biases and errors may result from non-standardised, non-randomised data collection practices, mistakes in identification of similar species, and also variability in the volunteer demographics, ability, experience and commitment that can impact the quality of the data (Kosmala *et al.* 2016).

In a water quality monitoring study (temperature, electrical conductivity and pH), many parameters were comparable in results between scientists and volunteers while bias was evident in some parameters (Storey *et al.* 2016). To correct bias, an understanding of the tendency and type of error as well as the level of inaccuracy is necessary to enable calculation of a correction factor to achieve reliable measurements (Loperfido *et al.* 2010). After all, even amongst professional scientists, data is subject to variability and bias (Storey *et al.* 2016). The data quality issues related to volunteer collection more often occur either in the field, using incorrect procedures, where they may exclude, misinterpret or note down incorrect data, or at home when data is entered into the database. Common errors are in GPS data, and contact information (Hunter *et al.* 2013), or technological issues such as faulty equipment, mobile device unreliability, the inability to work offline in the field and application accessibility (Kosmala *et al.* 2016).

To reduce bias and data validity issues, citizen science can apply a two or three-tiered system so that in the first tier, there are uncomplicated, easy sampling methods that require minimal equipment and training (Moolna *et al.* 2019), the next being a flexible system where all volunteers are trained to conduct activities, monitoring and collect of data on the taxonomic groups that are easy to identify and differentiate, and in the next tiers, the more experienced, committed volunteers are trained in the more exacting methodology to collect data on the challenging taxa (Nerbonne and Vondracek 2003; Dickinson *et al.* 2010). In macroinvertebrate monitoring, stream-specific keys can be distributed as well as identification images and keys (Nerbonne and Vondracek 2003), or a user-friendly computer or smartphone applications with controlled drop-down menus that automatically apply validation methods (Hunter *et al.* 2013). Personalised, rather than online, training using consistent, standardised procedures (Dickinson *et al.* 2010; Tweddle *et al.* 2012) can also be helpful, and for any suspect, inconsistent or obvious outlier data within the dataset, the researchers can request confirmation and proof of the results before including them into

reports. Individual citizen scientist volunteers can be rated by reliability (using a system similar to e-commerce ratings) based on quality, frequency, qualifications and duration of past contributions (Hunter *et al.* 2013), and eliminate any data from, for example, first year volunteers, short-term, ad hoc dabblers, or volunteers with known errors (Dickinson *et al.* 2010). Overall, measures that lower expectations of the type of data required may mitigate some of the potential disadvantages and weaknesses of citizen science initiatives and increase the reliability of the data (Penrose and Call 1995).

Recruiting and maintaining citizen science volunteers can also be challenging and time-consuming (Silvertown *et al.* 2013). Recruitment is usually through free advertising via websites, posters, television, radio, or social media, but it is also important to target interest groups, community organisations, conservation groups, hobbyists, active retirement groups and scouts or after school groups (Cooper *et al.* 2007). The diverse levels of experience and interests of potential volunteers make it challenging to target the promotion and programme (Tweddle *et al.* 2012). It is also important to address the challenges in recruiting, motivating and retaining long-term volunteers (Silvertown *et al.* 2013). The programme design, marketing and delivery need to take human psychology into account (McKenzie-Mohr 2000), and to sustain interest and involvement in the initiative there needs to be regular acknowledgement, communication and feedback (Geoghegan *et al.* 2016), which requires time and commitment from the organiser (De Moor *et al.* 2019). This requires having the technological capabilities to manage the data so it can be analysed and synthesised to present results and feedback to the researchers, volunteers and water resource managers. The system needs to be innovatively designed and flexible to meet the citizen science project objectives as well as manageable for the project facilitators (Newman *et al.* 2011).

It is also advisable to run a trial at a school or with a community group as this will provide a good indication of how a larger scale project will fare (Tweddle *et al.* 2012). The pilot citizen science training programme should be measurable and assessed based on the level of accuracy of the data, and not based on self-reporting (McKenzie-Mohr 2000). Training processes need to account for the Hawthorne Effect, wherein knowing they are being observed, participants will be altering their behaviours, but the same level of care is not

guaranteed when they are conducting measurements on their own. One method to ameliorate the Hawthorne Effect is to generate an atmosphere that is unthreatening, friendly, trusting and relaxed (Oswald *et al.* 2014). However, the Hawthorne Effect needs to especially be considered when training volunteers in biosecurity protocols, such as when asked to collect data from rivers where there is a risk of spreading invasive species. Even in hospital environments, staff were found to more consistently comply with hand sanitising rules in the Intensive Care Unit when they knew they were being observed (Eckmanns *et al.* 2006). Citizen science project designs can be streamlined during implementation stages, and success of conservation projects can ultimately be measured by the level of improvement in water quality and biodiversity in the catchment (Margoluis *et al.* 2009), but also based on the level of community involvement, and the level of satisfaction and commitment in the volunteers (Wright *et al.* 2015).

Continuous evaluation of the project design, materials, processes, instruction, data reporting, volunteer capabilities and expectations will help tailor to the needs and objectives of both volunteers and the citizen science project (Dickinson *et al.* 2012). With proper optimisation, standardisation, and validation techniques, there need not be any sacrifice to the quality of the citizen science data (Kosmala *et al.* 2016). A user-friendly, trialled programme that is evaluated for its effectiveness (Bela *et al.* 2016), and takes into account human error and bias, can lead to multiple long-term benefits for the natural environment, the citizen scientist volunteers and society (Turrini *et al.* 2018).

2.4.4 Volunteer motivations and nature-based citizen science

Much of the understanding about volunteerism in general applies to volunteering for citizen science projects. Understanding people's values, motivations, and their connection to nature is beneficial to the aims of any programme. Well-designed nature-based, water protection citizen science programmes benefit science and water management, but importantly, it can also transform volunteers so that they make more pro-environmental decisions in the future outside of the citizen science experience. More importantly, with social diffusion, they may influence their friends, families and social networks (McKenzie-Mohr *et al.* 1995; Church *et al.* 2019; Grilli and Curtis 2021) and create a social norm. This can make the programme and any pro-environmental behaviours that have been

emphasised, such as responsible waste management, more widely accepted and more visible in the community (Brick *et al.* 2017), which may increase participation in the programme and the potential for community-wide behavioural change. The terminology used for recruitment needs to be mindful of the potential of exclusivity and preconceived associations that may attract or preclude involvement (Eitzel *et al.* 2017).

Satisfying the goals and expectations that motivate people to make decisions, and particularly the decision to volunteer, can inform the development of a nature-based citizen science programme (Silvertown *et al.* 2013; Geoghegan *et al.* 2016), and understanding volunteer diverse motivations can help match the promotional strategy and marketing to attract participation and encourage people to make the decision to volunteer (Clary and Snyder 1999). A study of nature conservation volunteer programme found that the main motivators for involvement were to have fun, meet like-minded people, learn about environmental restoration and get access to restricted nature spots, and also because of a place attachment and the desire to care for the environment and other people (Caissie and Halpenny 2003).

According to de León and Fuertes (2007) the answers to three questions can help to understand the people who may voluntarily participate in citizen science programmes, and what may motivate them to continue to volunteer in the long term. First, why does a person decide to volunteer; second, why actually make the effort to volunteer; and third, why continue to volunteer. As Table 2.3 summarises, there are diverse, variable needs, core beliefs and traits that may drive a person to take the first steps into volunteering. Feeling personal satisfaction that the volunteer experience meets their expectations (Davis *et al.* 2003) and fulfils their initial personal goals will motivate them to persist (Clary and Snyder 1999; Finkelstein *et al.* 2005).

However, motivations differ widely between volunteer demographics and cultures, and they change throughout a person's lifetime based on their age and circumstances (Silvertown *et al.* 2013). Just as assigning tasks that volunteers enjoy will help to satisfy their personal motivation (Finkelstein *et al.* 2005), a citizen science programme that incorporates various elements for different interest-groups and motivations will assist in retention. For example,

if the programme has tasks that involve activities volunteers would be doing anyway, such as a recreational activity or a science hobby (Jones *et al.* 2018), then there will be more buy-in, higher quality results and longer-term commitment (Goffredo *et al.* 2010). Some environmental volunteers are only motivated because they want to help a particular site, and each volunteer will have differing expertise, interests, commitment-levels, circumstances and skills (West and Pateman 2016). While some may be content to conduct clean-ups and support work, others will want more meaningful involvement and training in intensive environmental restoration work or scientific procedure and analysis (Silvertown *et al.* 2013) to stay interested.

Table 2.3 Why volunteer and why for citizen science?

| | |
|--|--|
| Why decide to volunteer? | <ul style="list-style-type: none"> • opportunity to express altruism and prosociality • learn new skills or have a new experience • meet and spend time with like-minded people • CV enhancement and up-skill to advance career • protect self and alleviate negative emotions • positive feelings, improved self-esteem • other determinants - personality, fun, opinion about volunteering, age, demographics |
| Why make the initial effort to volunteer? | <p>As above</p> <ul style="list-style-type: none"> • beliefs are aligned with those of the organisation |
| Why continue to volunteer? | <p>As above. Also:</p> <ul style="list-style-type: none"> • personal commitment to the organisation • role identity • personal satisfaction and enjoyment • intention to continue • perception that others expect them to continue • meets their original expectations and goals |
| Why citizen science specifically, and why nature-based citizen science? | <ul style="list-style-type: none"> • data collected will be put to good use by researchers and agencies • data collected identifies and addresses environmental problems • data collected contributes meaningfully to scientific knowledge • learn about the natural environment, and how to help protect it |

Adults interested in volunteering for field-based nature conservation projects are mostly motivated by the desire to help and learn about natural environments (Ryan *et al.* 2001), and gain new skills in scientific methodology, so the project design should offer group training and instruction by enthusiastic expert scientists or nature interpreters (Bell *et al.* 2008). It is almost a give and take, as conservation volunteers might be more willing to donate their time to catchment management programmes in exchange for knowledge on ecosystems and ecology (Van Den Berg *et al.* 2009). Additionally, training in scientific

procedure, methodology and analysis (Trumbull *et al.* 2000; Evans *et al.* 2005) needs to be explicit and properly elucidated (Brossard *et al.* 2005) to ensure volunteers fully appreciate the scientific process.

2.4.5 Volunteer dabbler versus long term

Attracting large numbers of citizen scientists to a project is a rewarding goal, but efforts also need to be made to retain long-term volunteers. As with all big data, the more volunteers, and the larger the data bank, the more correlation and comparison between data sets, the more validity, and visibility of obvious data outliers to be investigated or disregarded. However, it was found that with online citizen science projects, larger groups of volunteers contributed less than smaller groups of long-term volunteers, and the contributions from the sustained participants was more accurate and useful because the data quality improved over time (De Moor *et al.* 2019). Long-term volunteers are more valuable because experienced, committed volunteers would have invested more time into learning and developing their skills, and in building relationships with the organisers, making their data more credible. Additionally, recruiting and training new volunteers is challenging, time-consuming and expensive (Silvertown *et al.* 2013; Alender 2016). This suggests that it may be better to invest more effort into retaining long-term volunteers than in recruiting large groups of new participants. However, few citizen science programmes manage to retain volunteers long-term (Rotman *et al.* 2014).

A citizen science programme that is easy, fun and social, where benefits are clear and coincide with the motivations of volunteers will attract volunteers (Dickinson *et al.* 2012). The more goals and motivations that are met the more likely to recruit long-term volunteers (Silvertown *et al.* 2013). For example, nature-based citizen science volunteers want to feel close to nature by being outdoors, and want to give back to nature by having a positive impact on the natural environment (Guiney and Oberhauser 2009). A primary motivation particular to citizen science volunteers is that their contributions, skills and knowledge are utilised, and that they are as valuable and meaningful as that of the experts (Bell *et al.* 2008). Environmental citizen science programmes will not be effective if the target data is not used to inform scientific knowledge, conservation action and management decisions (Nichols and Williams 2006), and the participants will lose motivation if they do not receive

feedback and progress reports on the usefulness of their contributions because making a difference is an important motivation (Jordan *et al.* 2011). Positive feedback particularly increases motivation to continued participation (Tiago *et al.* 2017), including updates and stories of successes and achievements, and before and after photographs that demonstrate effectiveness of volunteer efforts (Ryan *et al.* 2001).

A unified, multi-tiered, varied citizen science learning system, where the level of difficulty progresses over time with the confidence of the participants, can improve volunteer retention because it will satisfy volunteers learning motivations (Tweddle *et al.* 2012), and the programme could capture volunteers with a wide range of experiences, interests and capabilities. Additionally, provision of progress 'passports' can be a useful tool to "endorse, make visible and celebrate" achievements (MacBeath 2012, p. 3). The passport documents completed training levels, volunteer achievements, and the further training available. This tool offers an incentive and commitment to continue, and can inform the next level or type of training. The progressive training levels may also give the citizen science volunteers the confidence to become trainers themselves (Jones *et al.* 2018). However, all volunteers will have different motivations for participating, and some may not wish to progress, so flexibility in training, supports should be built into the programme (West and Pateman 2016; Roche *et al.* 2020).

More successful citizen science projects have regular real-time communication between researchers and the citizen scientists, and regular feedback, press releases, social network updates, and acknowledgement and appreciation of contributions will satisfy those motivated by the social contact (Dickinson *et al.* 2012; Silvertown *et al.* 2013; Geoghegan *et al.* 2016). However, while email and internet discussions suffice, face to face is preferable because the contact improves volunteer commitment, development and learning (Evans *et al.* 2005).

Many volunteer because it is a social opportunity to meet new people and spend time with those who share an interest (Bell *et al.* 2008). This helps to build close relationships within a community, and long term social interactions that can build trust and friendships are even more important for effective collaboration in a multidisciplinary environment (Daily and

Ehrlich 1999). Also, volunteering in older age, and feeling appreciated for it, was found to provide physical and psychosocial benefits by improving levels of happiness, self-esteem, independence and life satisfaction, and it increases social circles which leads to higher levels of social support and overall wellness (Anderson *et al.* 2014).

Some of the main reasons for long-term volunteerism are personal commitment to the ethos of the organisation, and that they achieve satisfaction and enjoyment from contributing (de León and Fuertes 2007). After achieving a stable, reliable group of long-term volunteers, the main issue becomes sustaining the programme itself in relation to funding and ensuring its continued running, commitment and regular communications with the participants.

A nature-based citizen science programme that succeeds in fulfilling the goals and motivations of the volunteer, and removing any barriers, while increasing awareness, skills and a sense of place can also lead to continued environmental volunteerism (Gooch 2003; Evans *et al.* 2005). The longer a person volunteers for a nature protection initiative, the greater the likelihood they will participate in environmental advocacy (Ryan *et al.* 2001) because the experience changes their values and perspectives (Lawrence 2006). It can also lead to joining, voting or contributing to an activist group, purchasing more responsibly i.e. organic, sustainable or energy saving products, and to ecosystem restoration activities such as planting for wildlife, bee B&Bs, bird feeders, and participation in environmental citizen science (Monroe 2003).

2.4.6 Overcoming volunteer barriers

McKenzie-Mohr (2000) suggests the necessary strategy to promoting desired behaviours and community behavioural change is by incorporating scientific knowledge and psychology into the design and delivery of environmental programmes. If the desired behaviour is to increase pro-environmental behaviour following participation in a nature-based citizen science programme, then it is necessary to identify the internal and external barriers to engagement that need to be overcome. The difficulty is in reaching those who choose not to participate and discovering why. Some barriers to participation may be socio-economic, or due to a lack of awareness of the volunteer opportunity, or not having free time, or access

or means to access the training or a monitoring site (Hobbs and White 2012). Not all barriers are easy to overcome, but when recruiting volunteers, it is important to be mindful of these factors.

Incorporating psychological understanding into the design of the citizen science programme, publicity and delivery, to include piloting, assessment for efficacy and fine-tuning will address the multitude of motivations, barriers and decision-making processes of the volunteer citizen scientist (McKenzie-Mohr 2000). Training with targeted, clear, consistent practical skills and know-how from credible sources about how actions can mitigate environmental harms is more useful than generalised information on environmental processes (Ryan *et al.* 2001). Also helpful are regular progress reports and news of additional participant enrolment as well as providing continuous training and development (Monroe 2003). It is also important to build partnerships, and ideally with people for whom the action is consistent with their personal identity. If the action is affirmed as a social norm, in that it is a socially and community-accepted practice (Goldstein *et al.* 2008), then it will help to remove barriers to commitment. For example, claiming to be pro-environmental in behaviour demonstrates an awareness of a developing social norm (Félonneau and Becker 2008).

There are many reasons for people to avoid participating in a citizen science programme. For example, levels of IT and computer skills amongst volunteers can vary, and some participants might struggle to make online submissions, but this can be resolved with proper training, a variety of submission formats, and by making the software application or online form as easy to use as possible (Williamson *et al.* 2016). Volunteers may also be reluctant to submit data, and this element of trust takes on many forms for the volunteer (Wilson 2010). For example, volunteers may feel protective and may not want the presence or location of a protected or rare species publicised. Volunteers may also feel underconfident at the accuracy of their data, and so hesitate to submit to a national repository (Williamson *et al.* 2016), or they can feel that they have no skills of value to contribute to the programme (Hobbs and White 2012). However, with proper promotion, training, support and building of capacity, relationships and confidence of the citizen scientist volunteer, these barriers can be overcome (Ryan *et al.* 2001).

2.4.7 Programme designs for public engagement in catchment care

There are generally three types of citizen science programme designs that are developed with differing levels of collaboration and ownership. Contributory projects are top-down in that they are designed by scientists and volunteers are trained in how to collect data as prescribed. This method is more based on the aims of the researchers than the volunteers (Tweddle *et al.* 2012). In collaborative projects, design development and data analysis are conducted by scientists with the help of volunteers. In co-created projects, also termed Extreme citizen science (Haklay 2015), volunteers are involved in most or all of the steps of the programme development (Bonney *et al.* 2009a), and the local knowledge, interests and social networks of the volunteers are incorporated into the project design and goals (Wildschut 2017). After selecting the type of citizen science project, or a combination of them, that will best meet the objectives, the team of all interested parties, with their diversity of skills, goals and experiences, open communication to share ideas on how best to reach the project aims. Dialogue highlights and clarifies the interests, motivations, skills and training requirement of the potential volunteers.

Although the cost will be higher in terms of establishing the programme and recruiting volunteers, a co-created, social learning citizen science for ICM programme has the best potential to increase participant empowerment, awareness and capacity; lead to the best management of the catchment resources; and build communication, collective identity and trust within the community (Shirk *et al.* 2012).

There are also distinct advantages to citizen science over professional monitoring, and a combination of the two is what can lead to the meeting in the middle of top-down and bottom-up governance. Danielsen *et al.* (2010) found that there is more rapid decision-making, implementation and impact when monitoring is conducted by local people compared to scientists. Where scientific monitoring can lead to eventual large scale policy changes, it is local participatory monitoring that enables local immediate action and behavioural change (Cooper 2016). When a local problem is identified, local people can increase discussions and act sooner to resolve the issues (Danielsen *et al.* 2010). With the

rapid decline of biodiversity, it is important to activate immediate on-the-ground efforts to restore or protect habitats while the broader, yet slow, policy changes are in development.

When water quality, biodiversity and environmental problems are seen in one's own backyard (Devine-Wright 2009) it may inspire people to take action (Dickinson *et al.* 2013). Appealing to place attachment can foster a community identity that appreciates the diverse stakeholders' interests, knowledge and perspectives, and the dynamics of relationships, values and motivations to activate public participation in the collaborative process of ICM (Lewicka 2005; Saunders *et al.* 2006; Devine-Wright 2009). A positive community identity, or even a citizen science project identity, made up of people who share interests and mutual trust (Manzo and Perkins 2006) and are empowered with the skills to make a difference (Vasi and Macy 2003), may be the potential emergent norm of collective action in ICM that can lead to novel, effective catchment management policy, solutions and resolutions (Collins and Ison 2010).

2.4.8 Citizen Science for global, European and national law and policy

The EU Water Framework Directive (2000) sets out requirements to achieve at least 'good' status water quality in all ground and surface waterbodies, and the Wildlife Acts and European Communities (Birds and Natural Habitats) Regulations 2011-2015 and the River Basin Management Plans promulgate the EU Directives, and provide a strong legislative backing for nature conservation. There are also other protections for biodiversity and habitats such as the United Nations Convention on Biological Diversity (1992), that requires signatories to protect biodiversity; The Bern Convention on the Conservation of European Wildlife and Natural Habitats (1979) that requires signatories to protect species of wild flora and fauna, and their habitats; The EU Habitats Directive (1992) that requires the designation of Natura 2000 sites to protect habitats of native rare or threatened flora and fauna; and the EU Birds Directive (1979/1992) that aims to protect vulnerable migratory and wild bird species and their habitats. The EU's Biodiversity Strategy for 2030 will also be furthered because increasing native biodiversity and reversing the decline in aquatic ecosystems are priorities that are shared with the goals of citizen science for water programmes, and citizen science can contribute to monitoring, records and assessment of trends and distribution of national and even global biodiversity (Chandler *et al.* 2017).

The United Nation's 2030 Agenda for Sustainable Development has adopted 17 Sustainable Development Goals (SDGs) for its global partners to prioritise in relation to human life, livelihoods and the environment (UN General Assembly 2015). The SDGs are diverse and interdisciplinary, but they are also interrelated, and citizen science for ICM and environmental protection has the potential to connect and support a number of the SDGs. Additionally, citizen science is an effective tool to measure the progress of the SDGs, offering those same benefits of monitoring at large spatial and temporal scales for a wide range of thematic disciplines, and then collecting the data that managers will analyse and process, and this can serve the dual purpose of collecting data and reporting for the citizen science project goals and EU WFD objectives, as well as for SDGs (Fritz *et al.* 2019) (Table 2.4).

There is a vital need for immediate action to conserve and protect biodiversity and the natural habitats upon which they depend, and legislation has been enacted with this objective. However, top-down governance and management efforts are often met with resistance, and in the context of developing an Integrated Catchment Management programme, it is useful to bear this in mind. A citizen science programme for ICM that captures large-scale involvement in monitoring and data-collection has the potential to inform hydrological and catchment policy and management (Buytaert *et al.* 2016), leading to more effective, creative solutions that are bottom-up and community-initiated, and this will aid in furtherance of the legislative and policy objectives. Citizen science can also be used as a method to build climate change resilience in an ecosystem by using experimentation and monitoring to test implemented remediation measures for a more flexible, fully integrative approach to nature conservation (Hansen and Hoffman 2011).

Table 2.4 SDGs implementation using nature-based citizen science (UNGA 2015)

| Sustainable Development Goal | Description of coverage |
|--|---|
| SDG3 Promoting health and well-being | Citizen science for river protection will help improve air and water quality, and there are physical, mental and emotional health benefits from involvement in activities in and around natural landscapes. |
| SDG4 Ensures education and lifelong learning | Citizen science programmes aim to upskill and educate. When citizen scientist volunteers are being trained in scientific methodology, biodiversity monitoring, data collection and reporting, the training opportunity is offered to everyone. It is also education on why it is important to protect water quality and environmental health. |
| SDG5 and SDG11 To achieve gender equality and empower women and girls, and to make cities and human settlements safe, resilient and inclusive. | Citizen science welcomes adults of all ages and genders, and families, giving equal, inclusive opportunity to access green spaces and to learn. |
| SDG6 Ensure availability and sustainable management of water and sanitation. | Citizen science programme that activates communities to monitor water quality in their rivers to improve conditions. |
| | (Indicator 6.3.2) Activates communities to monitor water quality and ensures sustainable management of water resources, with its focus on monitoring ambient water quality, particularly for the orthophosphate, nitrate and electrical conductivity parameters (Quinlivan <i>et al.</i> 2020). |
| | (Indicator 6.5.1) Citizen science helps implementation of integrated water resource management. |
| | (Indicator 6.6.1) Citizen science monitoring of changes in inland aquatic ecosystems. |
| (Indicator 6.b.1) Citizen science encourages local community participation in water management. | |
| SDG8 Promotes economic growth, productive employment and decent work. | A programme that recognises and advances volunteers to becoming trainers themselves, can provide skills that may influence their own career paths and futures. |
| SDG14 Conservation of oceans, seas and marine resources – “to prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities and nutrient pollution.”(UNSD, 2016) | (Indicator 14.1) Rivers are conduits for estuarine and marine pollution, and successful catchment-based programmes will improve the water quality in its river’s outflow and the health of catchment ecosystems. |
| SDG15 Citizen science aims to protect and restore biodiversity and to promote the health of natural ecosystems. | Using the ICM approach will look to ameliorate impacts from land use and river catchment activities that degrade natural habitats. |
| SDG16 Promoting peaceful and inclusive societies and building effective, accountable and inclusive institutions. | By building knowledge, a citizen science programme can also build capacity and confidence to increase involvement in policy decision-making, as well as strengthen effectiveness of existing legal and policy instruments. |

2.5 Conclusion and chapter summary

This literature review investigates the research related to water resource management and considerations into some of the conflicts involved in managing at the catchment-scale.

These also offer theoretical insights into the use of volunteer citizen scientists as a public engagement tool for monitoring aquatic ecosystems as well as the optimal development, design, publicity and implementation of a nature-based citizen science initiative for river environmental stewardship. The benefits include being the bridge that spans the interdisciplinarity of the human-environment divide, or at least reminds people that this schism is illusory. This research aims to measure the evolution of citizen science to monitor freshwater water quality in Ireland using an at-risk catchment in County Limerick as the study site.

In summary, nature-based solutions with a citizen science programme that enables community transformations that improve the ecosystem resilience of a catchment, water quality and the lives of the people helps meet multiple environmental and catchment policy and legislative aims. There is also potential for concomitant, supplemental benefits in addition to those set out in the literature regarding nature-based citizen science. These can benefit scientific knowledge and the environment as well as health and society, and the economy, and some of these are set out in Figure 2.1 (Crall *et al.* 2013; DeVictor *et al.* 2010; Fritz *et al.* 2019; Moolna *et al.* 2019; Shuttler *et al.* 2018; Wiederhold 2011).



Figure 2.1 Potential environmental, societal and economic benefits to citizen science

Chapter 3 Merging streams of inquiry for a panoptic approach

3.1 Introduction and overview

This research methodology section provides a comprehensive, sequential description of this study's research design, data collection and data analysis processes, and explains why the components, and their combination, were selected as the best methods and how they contribute to form a cohesive, logical study. Additionally, the background and potential biases of the researcher are declared, as well as the efforts made to minimise any influence or prejudice in order to best increase validity and credibility. Multiple disciplines are relevant to this socio-ecological study including the natural sciences, aquatic ecology and hydrological monitoring; catchment and natural resource management; governance; psychology and sociology, and how these relate to the drivers and barriers of nature-based volunteerism. A mixed-methods approach was selected to complement the interdisciplinary socio-ecological nature of this study, entailing both quantitative and qualitative data collection and analysis. Data collection began with a review of academic documentation and a literature review to refine and direct the study design. Primary data was collected using a questionnaire survey that obtained both quantitative and qualitative data, and additional qualitative data was collected from two semi-structured focus groups and individual interviews with two key informants. The study used verified and verifiable methods to explore the themes relevant to this PhD study's research questions.

3.2 Aims and objectives

The ultimate aim of this project is to assess the potential of nature-based citizen science as an effective, sustainable bottom-up approach to integrated catchment management, and to investigate the elements of citizen science initiatives that can attract and maintain local participation in environmental stewardship. Working in collaboration with the Mague Rivers Trust (MRT), the study site was in the Mague River catchment. The MRT offered a local community hub from which events could be organised; citizen science programmes and activities could be introduced, monitored and piloted; and participant volunteers could be recruited, trained and observed.

Covid-19 and governmental restrictions constrained practical piloting and implementation of citizen science. Nevertheless, a limited range of MRT public events were co-delivered in the communities of the catchment over the duration of the research to promote river engagement, for training and citizen science recruitment, and to measure the interest, uptake and potential long-term engagement in the citizen science projects. These included fun activities such as a kayaking event in Lough Gur and a family fun day in Croom, as well as citizen science demonstrations during Science Week in Croom, a river ecology field trip to the Comoge River, and also training events of river chemistry and macroinvertebrate sampling methods in Kilmallock, Kilfinane and online. A full report on these efforts is included in the paper 'Profiling efforts to establish voluntary stewardship in a river catchment' (Weiner *et al.* (in draft 2023)) (see Appendix 11). There were also events to thank and provide feedback to citizen science participants.

Consequently, the research pivoted to a focus on volunteer motivation, barriers, concerns, and perspectives on citizen science and river ecosystem stewardship. The research project can be summarised in three key phases: Phase 1 of the study sought to explore the concerns local people have and how they feel about their local natural environments in a questionnaire survey. Phase 2 collected qualitative data in the interviews and focus groups that would explore further the perspectives, beliefs and feelings of participants for more depth and insight. Phase 3 consisted of an exploration for statistically significant relationships in the quantitative data as well as descriptive analysis that sets out some of the main preferences, benefits and barriers to participation in environmental stewardship and volunteerism, and nature conservation activism. This is followed by an in-depth thematic data analysis that focused on the research questions related to (a) the effectiveness of citizen science and (b) sustainable stewardship.

3.3 Research design

3.3.1 Interdisciplinary nature of the study

Just as Integrated Catchment Management considers Earth's physical, chemical and biological processes and their interconnectedness with human psychology and sociology, this study delved into the natural sciences and the social sciences to collect, analyse and synthesise data in an integrated way. The unique complexity of the issues, and the

interdisciplinary, socio-ecological characteristics of this study requires this integration and synthesis of disciplines to be comprehensive and panoptic to adequately respond to the research questions. River catchment management is highly complex with numerous hydrological, political, social, economic and cultural factors to consider.

3.3.2 Research approach

The aim of this study is to understand how and why people volunteer, and to explore the most effective way to involve local people in citizen science to gather data about their local environment in order to help scientists monitor and protect that natural environment, and so this study is problem-centred, and the knowledge sought is for pragmatic purposes (Creswell and Creswell 2017). Thus, this study utilises a fully mixed methods research approach to explore and test the theories deductively using quantitative, statistical analysis as well as inductively by identifying themes from human experience (Creswell and Creswell 2017). While mixed methods can be a challenging research design, it offers the flexibility and potential to yield a comprehensive understanding for the multidisciplinary facets of this study (Leech and Onwuegbuzie 2009; Molina-Azorín and López-Gamero 2016).

Quantitative and qualitative research methods are each powerful research tools, and mixed methods combines the benefits of both (Johnson and Onwuegbuzie 2004). Quantitative research provides a generalised, broad view from a larger sample size with analysis that is an unbiased, objective, empirical exploration of the study hypotheses where context and emotion are removed. Qualitative research is used to obtain a subjective, detailed study that is rich in context and human values and emotion, and provides a more in-depth understanding of the perspectives, backgrounds and personal experiences of individuals (Johnson and Onwuegbuzie 2004). The stories of lived personal experiences from a smaller sample of individuals was necessary to elicit information about concerns and awareness of matters related to their local river and landscape without the limitations of a questionnaire survey. Mixed methods provides corroboration, complementarity and a more complete picture than solely quantitative or qualitative research for understanding social phenomena (Tashakkori and Teddlie 2008), and it also offers more potential to facilitate social change (Fielding 2012).

The mixed methods research design was based on a parallel, or simultaneous, study method in that the quantitative and qualitative data collection and analysis were conducted simultaneously (Johnson and Onwuegbuzie 2004). Both methods of data analysis were given equal weight, and used a combination of deductive, objective analysis of the quantitative data triangulated with the inductive, interpretive analysis of the qualitative data in that the researcher brought some themes and ideas into the coding process (Bryman 2016, p.34). Triangulation Design was chosen for the study analysis as it is “the most common and well-known approach” for mixed methods research (Creswell and Plano Clark 2011, p.62). Triangulation helps to corroborate the findings and offsets any weaknesses of using a single method of data collection and analysis. Triangulation strengthens the validity of the qualitative findings and explores more deeply the meanings within the quantitative data (Bryman 2016, p.641). The most common design for MMR is to use quantitative data from a survey combined with the qualitative data from interviews, and the second most common is combining the responses for open and fixed questions on a survey (Fielding 2012). This study uses both (Figure 3.1).



Figure 3.1 Mixed Methods Research Design

The qualitative data analysis uses Braun and Clarke's (2012) six-phase approach to thematic analysis. Braun and Clarke's (2012) thematic analysis approach was applied to the qualitative data collected from the interviews, focus groups and open-ended survey questions. Thematic analysis is an effective approach and useful when there are factors that will be applied outside of academia, such as into policy and into practice, as in applied research. This would apply here, as the findings can be used to improve the design and effectiveness of citizen science projects, as well as the levels of recruitment and maintaining volunteers (Braun and Clarke 2014).

This combination of qualitative and quantitative data collection and analysis helps to better understand the connection between people and their local, natural environments and rivers, and their current behaviours and beliefs about environmental stewardship. As there is a deeply ingrained connection between people, communities and their local rivers, it was essential to understand the people, and in this case, in the context of their residence in the catchment, or river basin, of Limerick County's Mague River.

3.4 Methods and procedures of data collection

The research study gathered primary and secondary data. First, secondary data was gathered and collated in the form of a literature review and synthesis of global and national projects that relate to water-based citizen science, and second, primary data in the form of a questionnaire, focus groups, interviews, events and observations were assembled. The combination of these data collection methods were chosen because they were deemed as the most appropriate to reach the aims of this study.

Quantitative data was gathered with the questionnaire to measure and verify the theories and relationships that were anticipated with this study. Qualitative data was collected from open-ended questions on the questionnaire, from two focus groups, and from two one-on-one semi-structured interviews. Qualitative data was to more fully explore and discover the themes, experiences and phenomena of participants.

3.4.1 Timeline

The chronological timeline for the data collection is set out in Table 3.1.

Table 3.1 Timeline of data collection

| Dates | Data Collected |
|----------------|--|
| Jan-June 2020 | Literature review: Model and first draft developed. |
| Feb-Dec 2020 | Meta-data search for Irish and global water-based citizen science projects. |
| May-Oct 2020 | Questionnaire developed, piloted and reviewed. |
| September 2020 | Research Ethics Committee (MIREC) application was approved. |
| Jan-Nov 2021 | Questionnaire released, distributed and publicised. |
| Jan-July 2021 | Questionnaire face to face interviews conducted at MRT events and at public parks. |
| June 2021 | Focus Group 1 |
| July 2021 | Interview 1 |
| August 2021 | Interview 2 |
| February 2022 | Focus Group 2 |
| March 2022 | Open-ended questionnaire at Lough Gur citizen science event. |

3.4.2 Secondary data

Secondary data was collected via a literature review and the building of two metadata listings of citizen science projects for water quality monitoring and Irish water-related groups and organisations.

3.4.2.1 Literature review

The data collection for this interdisciplinary study began with a model to plan out the path of the research, and continued with a review of the literature that related to political ecology, freshwater ecology, natural resource and catchment management, water quality monitoring, citizen science, environmental health, benefits of spending time in nature and the psychology and sociology of behavioural change, community engagement, volunteerism and pro-environmentalism.

Using Google Scholar, ResearchGate, and Web of Science with *Ex Libris's* Summon, peer-reviewed scholarly articles published by academic journals relevant to the study were researched, collected, organised, synthesised, analysed and interpreted so to highlight themes, pitfalls, conclusions and recommendations. The broad search of keywords uncovered numerous academic articles and books that focused on various themes relevant to this study. Searches for relevant books from the library were also conducted. Appendix 2 is included as a sample of the keyword searches and their variations and combinations.

Citation chaining, also known as reference mining, enabled discovery of further relevant articles and themes (Hellqvist 2010).

Keyword searches, and their variations include “natural resource management,” “river basin management” and “catchment management,” or “citizen science,” as well as “participatory action research,” “environmental stewardship” and “community-based monitoring,” followed by systematic Boolean search combinations with terms such as “water quality,” “river,” “surface water,” or “catchment” to narrow down responses. Other combinations include the terms “citizen science” or “volunteer” with the words “barrier,” “benefit,” “health,” “confidence,” “education,” “policy,” “effective,” “satisfaction,” and “long-term.” While the dates of publication were not restricted, only those published between the years 2000 and 2021 were incorporated into any papers sent out for publication.

Online searches found numerous academic articles, of which the abstracts were read, and if it was determined to be relevant, the article was read in full and categorised into folders. Within the main literature review folder, there are circa 1,600 relevant articles, and they are categorised by theme into circa eight separate folders such as: Health and wellbeing, ecosystem services, ICM and natural resource management, political ecology, aquatic ecology, biological monitoring, social behavioural change, values and citizen science. There are also sub-folders such as within the citizen science folder, for example: Connection to nature, integration and transdisciplinary, citizen science issues and improvements, citizen science advantages, maximising citizen science, citizen science motivation.

3.4.2.2 Citizen science projects

In developing the list for the Irish and global water-related citizen science projects, the researcher used meta-analysis online searches, and incorporated into a spreadsheet were key characteristics of the citizen science project, such as programme focus, level of activity and target audience.

Once the literature was collected, each study or review was further examined along with meta-analysis online searches to elucidate examples of aquatic or riparian-based citizen science projects to develop a spreadsheet list of Irish and global projects. These projects were

collated in a metadatabase. The Excel file was populated with a non-exhaustive list of 157 global English-language, water-related citizen science projects to aggregate examples from the individual studies. Variables recorded include programme focus, region, type of survey and target audience. The projects were classified according to their programme focus, whether habitat monitoring (water chemistry, nutrient levels, pollution or other abiotic conditions), taxonomy (specific taxa), both habitat and taxonomy, biodiversity (non-specified flora and fauna), and invasive alien species. The type of survey was classed as either broadscale internet-based or focused activity-based. Projects were then subdivided by target audience for data provided by either skilled volunteers who are trained to sample and/or identify biodiversity to species level, or members of the public reporting on casual sightings of specific taxa, invasive species or non-specified biodiversity. It must be noted that there was a deliberate bias in the metadata searches towards citizen science projects in Ireland. The comprehensive list of Irish water-related citizen science projects was then compared with the wider list for the comparative ratio of project types, activities and level of skill required.

Collection and synthesis of 157 citizen science projects related to water quality monitoring helped to inform the future development of a citizen science project to monitor water quality in Ireland, and to identify potential gaps. Additionally, research was conducted on the different methods of developing a citizen science programme, and which methods would be most appropriate and effective at increasing engagement for the short and long term. These lists are incorporated into a review article that was published for this study in a citizen-science peer-reviewed journal (Weiner *et al.* 2022). This article is included as Appendix 1.

3.4.3 Primary data

Primary data was collected using a questionnaire survey, two focus groups, two semi-structured interviews, and participant observations. These methods were chosen because the accepted application of the scientific method is when “researchers develop research questions or hypotheses and collect data on events, objects, or people that is measurable, observable, and replicable. The ultimate goal in conducting primary research is to learn about something new that can be confirmed by others and to eliminate our own biases in the process” (Driscoll 2011, p. 154).

3.4.3.1 Questionnaire survey

Standardised questionnaires are used in research to collect information on the behaviours, preferences, attitudes and perceptions of a sample of a population (McLafferty 2003), and this study administered a research questionnaire entitled “Connections, concerns and caring for your local river” (Appendix 5) using Qualtrics. The questionnaire was designed to explore how people spend time in their local natural environments and near their rivers, and their experiences, values and connections related to nature. Additionally, the questionnaire sought to understand the concerns people have in relation to their local rivers and if these concerns and connections influence their pro-environmental behaviours, awareness or engagement with outdoor community groups. Finally, the questionnaire sought to understand the motivations or barriers that might influence their participation in local volunteer and citizen science initiatives.

The questionnaire contained a mix of Likert, multiple choice and scaled questions to obtain quantitative data, and there were also five open-ended questions offering some qualitative data at the preliminary stage of the data collection (Krosnick 2018). There were a total of 12 substantive questions, some with multiple parts, and five demographic questions. Of the two Likert psychometric scale questions, the first was a six-point scale (Strongly agree, Agree, Neutral, Disagree, Strongly disagree and I don’t know) and the second was a four-point scale (Very motivating, Somewhat motivating, Not at all motivating and I am not sure).

3.4.3.1.1 Recruitment for the questionnaire survey

An Irish context is important to give meaning to the findings of this study, and as the study site is the catchment of the Maigue River, the residents of the communities within the catchment were the target population. While the questionnaire survey gathered data predominantly from a sample of the Maigue River catchment population, there were also unintentional respondents from the rest of Ireland, as survey recipients shared it within their peer groups. This study used convenience sampling methods, or accidental sampling (Etikan *et al.* 2016), in that it sought responses from residents of the study site (within the Maigue River catchment) who were willing to participate. The intention was to obtain a

broad representative sample of stakeholders with a diversity of backgrounds, beliefs and interests. To ensure a random representation and to reduce bias so that not all responses to the questionnaire were from nature-oriented and conservation groups, the heading on the invitations to participate in the survey was “Do you care about your local river?”.

The questionnaire was available online via Qualtrics, and a QR code and Bit.ly link were generated for convenience. Invitations to complete the online version of the questionnaire were sent via email and Facebook to the contacts of the Mague Rivers Trust, Limerick City and County Council and Ballyhoura Development (a development company local to the Limerick County area that works with communities and businesses) as well as to numerous Limerick-based interest groups such as Tidy Towns, community groups and hobby groups (e.g. anglers, ‘things-to-do,’ kayaking); recreation facilities, hotels and the tourism industry, GAA clubs, garden centres, schools and parish church newsletters, the contact details of which were located online (see Appendix 6); and each email included requests to please forward to their contacts and staff. All Facebook community-interest groups within the Mague River Catchment region received at least one reminder.

The QR code was shared online at a talk on rivers, the survey questionnaire was conducted face-to-face in December 2020 and June 2021 in parks within the catchment and at Lough Gur, and hard copies were distributed at in-person events and at outdoor cafes. The advantage of handing out surveys and meeting people in public was that a number of the people claimed they would never have accessed an online survey.

3.4.3.1.2 Sample size for the questionnaire survey

Obtaining survey responses from all members of a population is unrealistic, so the questionnaire sought responses from a random sampling intended to represent the whole of the population. To strengthen the validity of the statistical analysis, we determined the appropriate sample size based on various margins of error and confidence levels (Singh and Masuku 2014). Using an online Sample Size Calculator (<https://www.qualtrics.com/uk/experience-management/research/determine-sample-size/>), we provide in Table 3.2 the appropriate sample size and compare it with the actual

response rate for the populations of All-Ireland, Limerick County and City, Limerick County only and the Maigue River Catchment. The Confidence Levels and Margins of Error are adjusted to demonstrate the minimum levels to achieve the appropriate response rates.

Populations were derived from the Central Statistics Office for the all-Ireland population (CSO, 2022) and the City and County of Limerick Census that recorded the total population to be 194,899 in 2016 (Limerick 2021). According to Limerick City and County Council, the total population of Limerick County alone is 89,849 (Limerick City & County Council 2021). The Maigue Catchment is estimated to cover about 1/3 of Limerick County, and so the population can also be estimated to be c.29,950. Sample sizes achieved represent between 5% and 7% of the population groups with confidence levels between 94% and 99%.

Table 3.2 Sample size for questionnaire survey

| | All-Ireland | Limerick County and City | All Limerick County (Excluding City): | Confirmed Maigue River Catchment |
|---------------------------|--------------|--------------------------|---------------------------------------|----------------------------------|
| Population size | c. 5,123,536 | c. 194,899 | c. 89,849 | c. 29,950 |
| Confidence Level | 99% | 95% | 95% | 94% |
| Margin of Error | 5% | 5% | 6% | 7% |
| Ideal Sample Size | 663 | 384 | 266 | 180 |
| Actual Sample Size | 744 | 377 | 315 | 186 |

The preamble and the final page of the questionnaire invited people to get involved in further stages of this study, such as participating in citizen science, an interview or a focus group. Three people got in touch and claimed interest in getting involved in either focus groups, an interview or citizen science, although none accepted any future personal invitations.

3.4.3.2 Focus Groups and interviews

Focus groups were used in the data collection plan to elucidate the views, beliefs, perceptions and values of different levels of environmental volunteers in an efficient manner (Onwuegbuzie *et al.* 2009). Focus groups are group interviews where an interviewer directs a number of people through open-ended, exploratory questions focused on key elements relevant to the study (Patton 1990). There are numerous purposes to use focus

groups in sociological research, and they vary in flexibility, but in the context of this study, the data was categorised, analysed, triangulated and compared with the other data gathered (Fontana and Frey 2000). Focus group discussions offer the potential to learn from the collective testimonies, ideas and attitudes of people from the same locality. The use of pre-existing groups helped to facilitate the interaction between participants and provided an opportunity for the group to build on each other's comments and also acted as an awareness-building process that could help build connections within the community (Mishra 2016). The focus groups were to further the aims of this study in that the researcher was able to explore and brainstorm the barriers, needs, preferences, priorities or problems with undertaking nature-based citizen science, and to potentially reveal novel and multiple data at one time, including complex concepts and ideas (Cyr 2016).

Two focus groups were recruited of four individuals each. Sampling for the focus groups was based on two cohorts. The first cohort was current, active, committed, long-term river-based volunteers from a Rivers Trust in the Inishowen catchment, County Donegal who were trained in and used multiple types of citizen science techniques to monitor water quality. The objective was to explore what led them to decide to volunteer, what they enjoy most and least about their participation, and why they continue to volunteer. Recruitment for the first focus group was conducted by contacting the project officer of the Rivers Trust with an active group of River Guardian volunteers who regularly attend and participate in the group's meetings, training, citizen science and river restoration events. The researcher attended one of their regular online meetings, and invited their participation. Three people agreed immediately, and a fourth person contacted me a few days later and asked to be included.

The second focus group cohort was made up of citizen science volunteers who were newly recruited and active with the Mague Rivers Trust's citizen science programmes for just over one year. They had been trained in specific citizen science initiatives to monitor water quality (Freshwater Watch and a macroinvertebrate system) in the rivers of the Mague catchment in County Limerick. The objective was to ascertain their opinion, understanding and experience of learning the techniques, and what factors encouraged their initial and continued volunteerism.

Purposive, homogeneous sampling (Etikan *et al.* 2016) was used to recruit for the focus groups as the participants were composed of people with similar experiences at generally the same stages of citizen science and involvement with a particular river conservation group, either beginners or advanced. Having two diverse focus groups provided a comparison between different levels of volunteerism as well as different geographical localities.

By allowing for part observation and part interview, the researcher has the added advantage of gaining insights from the relationships and interactions between participants. Additionally, the group dynamic allows for the generation of new ideas or aid recall, and the data gained may confirm, elaborate or fill gaps from the desk research and questionnaire regarding motivations, barriers and other factors related to volunteerism and nature-based citizen science. Table 3.3 sets out the considerations for the focus groups, and the full question plans for the focus groups are included in Appendix 8. Participant information letters and informed consent forms were emailed to participants with an explanation of what to expect at the focus group. Once all the consent forms were electronically signed and returned, virtual Zoom focus group meetings were scheduled.

Individual online semi-structured interviews were conducted with two key informants, selected based on their local knowledge about their communities. One key informant resided in Inishowen, Donegal and was a farmer and an experienced River Guardian volunteer, and the other resided in the Mague River catchment, Limerick and was a farmer involved in an environmental scheme who was interested in rivers and considering undertaking citizen science to monitor water quality. These individualised interviews allowed for lengthier conversations and more in-depth understanding about their experiences and perspectives related to the objectives of this study, particularly the motivations, barriers and preferences related to environmental volunteerism.

The researcher used snowball sampling (Bryman 2016, p. 188) as the second key informant was recruited from referrals. Another purposive sampling approach used was criterion sampling (Bryman 2016, p. 409) because participants of the second focus group and

interview were selected based on their meeting the specific criteria of residing in the Mague River catchment, which is the study site.

Table 3.3 Considerations for focus groups (Fontana and Frey 2000; Nyumba *et al.* 2018; Mishra 2016)

| | |
|--|---|
| Preparation | <ul style="list-style-type: none"> • Identify, recruit and invite participants, confirm access capabilities and obtain informed consent via participant info letter and demographics • E-mail regular reminders prior to the interview • Offer early test sessions to troubleshoot anticipated technology issues • Explain procedure for any Wi-Fi issues • Borrow MRT’s Zoom account to avoid 40 minute limit |
| Facilitator facets | <ul style="list-style-type: none"> • Objective, impartial, flexible, empathic, persuasive, good listener • Get responses from entire group for fullest coverage • No interruption, ask for clarification if needed • ‘Encourage, Engage and Elicit’ |
| Format | <ul style="list-style-type: none"> • Welcome, introduction and summary of what to expect • Thank participants, and let them know that feedback is welcome • Confirm all have researcher’s details in case of future questions • Explain how the results will be handled and the ground rules (below) • Participants take turns answering questions, one at a time • After each has answered, all have an opportunity to add to their answer • Acknowledge participants to conclude and ask for permission to follow-up |
| Ground rules | <ul style="list-style-type: none"> • Participation in the focus group is voluntary • Privacy and confidentiality is guaranteed • Can disengage any time with no consequences and with no explanation • Can abstain from answering any questions, and speak as openly as prefer • Respect the opinions of others even if you don’t agree • Stay on topic; we may need to interrupt so we can cover all material • Please don’t reveal detailed information about your personal health • Please protect others’ privacy- don’t discuss details outside the group • Participants say their names, they agree to participate and to recording • Feel free to use chat, turn off video, and stay muted while other speak |
| Potential limitations and challenges to focus group | <ul style="list-style-type: none"> • Recruiting participants in a Covid-19 restricted world • Online delivery excludes if no computer access, and limits visual cues • Authenticity and Hawthorne Effect. However, focus groups increase interactions between participants and decrease those with the researcher and so limits her influence and increases potential authenticity • Biases: “dominance effect (a dominant individual shapes the discussion), halo effect (the perceived status of a group member influences the discussion), groupthink (the members in a group tend to think similarly to maintain group cohesion)” (Fontana and Frey 2000; Nyumba <i>et al.</i> 2018) |
| Advantages of online format | <ul style="list-style-type: none"> • Reduced travel burden – cost and time of transport • Includes hard to reach people • Can record easily • Can take turns easily- muting themselves when not their turn |
| Results | <ul style="list-style-type: none"> • Transcribe discussions, destroy recording and anonymise the participants, store in password-protected document • Search, categorise, code and analyse common ideas, patterns and themes • Acknowledge that results are just a small representative sample |

For each interview, the researcher prepared an interview guide (Appendix 8) containing sets of questions that were customised to the interviewee’s level of expertise and their position within their communities. The interview guide questions were organised by key topics for this study to ensure the researcher adhered to a systematic and comprehensive data collection process. A well-developed interview guide for semi-structured interviews is an important factor to improve research rigour and trustworthiness, and it sets out the main topics to be covered, but as is the nature with semi-structured interviews, is not strictly followed and only serves as a guide for the participants in their discussions (Jamshed 2014; Kallio *et al.* 2016). As these were semi-structured interviews, the interviews were conducted in a conversational manner, and there was a natural flow where the interviewee was given prompts on occasion but was encouraged to speak about what most interested them as it related to the question and the key topics of the study. Table 3.4 provides details on the dates and duration for the interviews.

Table 3.4 Interview and focus group details

| | Focus Group 1 | Interview 1 | Interview 2 | Focus Group 2 |
|-------------------------------|----------------------|--------------------|--------------------|----------------------|
| Date | 24 June 2021 | 29 July 2021 | 12 August 2021 | 16 February 2022 |
| Duration | 2hrs 05mins | 1hr 44mins | 2hrs 30mins | 1hr 15mins |
| Number of participants | 4 | 1 | 1 | 4 |

Each interview and focus group was recorded on Zoom and was transcribed verbatim. The transcript and the video or audio recording were stored safely on a password-protected device and prepared for analysis. Fusch and Ness (2015) proposed that ten participants were deemed sufficient to achieve data saturation because the data was of sufficient quality and quantity for the study to be replicated, and triangulation with the quantitative data from the questionnaire will further enhance saturation.

3.5 Methods for data analysis and synthesis / data processing

Integrating the data from both quantitative and qualitative research methods is an essential component to mixed methods research analysis. To adequately evaluate the data, the analysis was designed for the purposes of triangulation (where one set of results corroborates the other), complementarity (where one set of results enriches and elaborates

on another), development (where one set of results informs the other), initiation (where one set of results will contradict the other) and expansion of factors (where one set of results expands on the depth and breadth of the other) (Greene *et al.* 1989; Johnson and Onwuegbuzie 2004). The analytical approach, based on Braun and Clarke's (2012) thematic analysis, does more than simply identify and describe themes, but the data is also challenged, connected and contextualised, and the findings aim to be coherent, complete, clear and robust (Bazeley 2009).

Variants of the triangulation design were primarily utilised for data analysis. Firstly, the traditional convergence model, or the convergent parallel design, where data from both the quantitative and qualitative studies is collected and analysed separately, but concurrently, and then merged so to best compare, contrast and validate (Creswell and Plano Clark 2011; Creswell and Clark 2017). Secondly, the validating quantitative data model where the questionnaire asked five open-ended questions to supplement the quantitative survey, and these enabled validation and comparison with both the quantitative elements in the survey and the qualitative data gathered from the interviews and focus group (Creswell and Plano Clark 2011). Additionally, some elements of the transformative model were utilised as the qualitative data was coded and transformed into quantitative data to enable for word counts and ratings based on predominance and recurrence of themes (Creswell and Plano Clark 2011).

3.5.1 Quantitative data analysis

Data was analysed from the responses to fixed questions of the questionnaire for descriptive statistics as well as crosstabulation for deeper analysis and correlation between variables to assess the relationships as well as the levels and strengths of the associations. The Chi-square test (represented by 'P-value' or 'P') for independence was the measurement and reliability test used to determine whether the relationship between variables were as expected and to determine the probability of there being statistically significant associations between variables (Franke *et al.* 2012). With a confidence level of 95%, a statistically significant association is revealed by a P-value below 0.05 after cross-tabulation of relevant categorical variables. The results of the Chi-square test that deviate from the assumption of independence are presented. To measure the strength of

statistically significant associations between variables with two or more categories, Cramer’s V Correlation (represented by ‘ ϕ_c ’) was used as the measure to determine the strength of the associations between categorical variables. A value between 0.10 and 0.15 demonstrates a weak to moderately strong association between variables, a value between 0.15 and 0.25 shows a moderate to strong relationship, and a value above 0.25 shows a strong to very strong association between variables (Akoglu 2018). IBM’s SPSS software and Microsoft Excel were used for assistance in quantitative analysis.

Additionally, the data from the Maigne River catchment respondents was compared to the data from residents outside of the catchment to gauge the level of representative sample of the Maigne River catchment population, and to learn if there is a demonstrable difference between their behaviours, values and concerns.

Table 3.5 lists some of the dependent and independent variables that were explored in the questionnaire survey. Motivations and barriers to involvement were also queried.

Table 3.5 Variables explored in the questionnaire survey

| Independent variables | Dependent variables |
|--|---|
| Age | Pro-environmental behaviours |
| Gender | Involvement in nature conservation groups |
| Locality of residence (e.g. rural or urban) | Involvement in outdoor activities |
| Feelings of connectedness to nature | Awareness of issues related to the river |
| Positivity of childhood experience in nature | Concern for the environment |

3.5.2 Qualitative data analysis

Analysis of qualitative data from the focus groups, interviews, and open-ended questionnaire questions was undertaken using NVivo for coding (Braun and Clarke 2012). Zoom was used to perform and record the online focus groups and interviews into mp4 formats. As some participants had poor Wi-Fi, some interviews were conducted by telephone on speaker, and the audio of these were recorded using Zoom. Microsoft Word was used for the transcription of the interviews.

3.5.3 Thematic analysis

Generally, qualitative analyses processes include constant comparison analysis, word counts, thematic content analysis, grouping and ranking of themes (Leech and Onwuegbuzie 2011). Braun and Clarke's (2012) method of thematic analysis was used to categorise and analyse the qualitative data. The methods used for the six phases of the thematic analysis are Phase one) Familiarisation with and immersion within the data, Phase two) Breaking down the data with systematic data coding (open coding), Phase 3) Categorising and generating initial themes from coded and collated data (developing categories), Phase four) Developing and reviewing themes (in-depth examination), Phase five) Refining, defining and naming themes (developing thematic framework), Phase six) Creating the report (Nowell et al. 2017). The coding of the data was conducted reflexively and without preconceptions, in that the researcher subjectively used her own prior experiences and beliefs to contemplate and explore the data to identify the emergent themes and the linkages and connectivity between them, and to apply them to address the research questions of this study (Braun and Clarke 2019).

Codes were developed after familiarisation with the data (phase one) to systematically organise and analyse the data descriptively and interpretively (Clarke and Lane 2013; Braun and Clarke 2012). There were 52 main codes generated initially from the questionnaire responses, focus groups and interviews (phase two), and these were then grouped into categories (phase three) that identified common factors and connections between the codes (Braun and Clarke 2012), resulting in 13 main categories with 82 sub-codes. Phase four was the review, refinement and quality check of the codes themselves, and this is an important stage for this study due to its large dataset (Braun and Clarke 2012), and these were refined into 12 main categories with 80 sub-codes (Appendix 9). An inductive approach was used to seek recurrent patterns and categories within the data itself, as was a deductive approach from which some concepts and ideas of the researcher were incorporated into the coding and interpretation (Braun and Clarke 2012; Maguire and Delahunt 2017).

In phase five, a thematic framework was developed where five main themes emerged by collapsing and refining the 12 main phase four categories, and the themes and sub-codes

were clearly and singularly defined and labelled. All the sub-codes were cross-checked to ensure they still worked, and those that did not were either discarded or moved to a more appropriate theme. Themes were then reviewed and categories were compared or differentiated, patterns within the data were made evident, and this was followed by interpretation of the data, and the themes were then assessed to ensure they represented the data set and related to the research questions. Phase six's reporting of thematic findings are set out within Chapter 5. Key quotes are extracted to represent the theme and are presented in narrative form with explanations of how they are connected and interesting in relation to the research questions (Braun and Clarke 2012). Appendices 10 and 11 set out the full codebook and further sample quotes from the questionnaire survey and interviews that represent the themes. Overall, the connections and relationships are explorations into the meanings of concepts from the perspective and words of the participants in the open-ended questionnaire responses, interviews, and focus groups to reveal new understandings and knowledge (Patton 1990). Chapter 6 is a synthesis and discussion that triangulates and ties together the findings from the qualitative thematic analysis, the quantitative analysis and the academic literature, where themes were compared with the results of other similar studies, concepts and themes in the relevant fields.

3.6 Practical application of study results

There is also the potential of pragmatic and practical application from the analytical conclusions related to the questions to this research. Action research is “a practical approach to a problem in practice aimed at generating knowledge to support a meaningful and sustainable positive change” (Ivankova and Wingo 2018, p. 993). Action research and mixed methods research share similar methodologies, and by applying the findings of this study for both theoretical and pragmatic application, the results of this study can extend to providing a solution into the best means of developing a programme for effective water monitoring and protection with citizen science (Ivankova and Wingo 2018). This study incorporated the quantification and objectivity associated with quantitative research as well as a systematic and transparent process of qualitative data collection and analysis with explorations into phenomenology, or the experiences, emotions and perceptions of participants (Guest *et al.* 2011). This study also used observations, and monitored the uptake and interest in the citizen science pilot programmes. Additionally, collaboration with

the Maigne Rivers Trust in delivering these programmes led to the development of a citizen science programme with effective, sustainable monitoring of water quality in the catchment. In summary, with mixed methods action research there is potential to incorporate the findings of this study beyond academia and theory to its practical applications (Ivankova and Wingo 2018), and these findings have the potential to be applied in an action research setting in that application of the theories explored can influence the development, recruitment and implementation of a citizen science programme to monitor river water quality over an at-risk catchment.

3.7 Ethical considerations

Ethical research clearance was obtained, and consent and security measures were adhered to as per the Mary Immaculate College Research Ethics Committee (MIREC) which provided clearance and approval for the research study under Application **Reference Number A20-044** on 2nd September 2020 (Appendix 3).

Focus group and interview participants were informed of the true role of the researcher and the purpose of participation was always made clear (Felzmann 2013). Each participant received a Participant Information Letter and an Informed Consent Form a week or two prior to their interview, and was asked to return the Informed Consent Form signed either digitally and returned by email or in hard copy prior to the scheduled interview or focus group. Each participant returned an electronically signed Consent Form by email. A sample of these are included as Appendix 4. Reminders of confidentiality and anonymity, and the recording of the interactions were confirmed verbally and by the Informed Consent Sheets before commencement of any questioning or recording.

All MIREC guideline requirements on confidentiality, anonymity and voluntary participation were strictly adhered to, as were the data management guidelines. All names and contact details of participants were kept separate from the data and were stored on a password-protected device. All responses on transcripts were anonymised using codes that replaced names, and for data security, there was no sharing of the videos nor the transcripts (Felzmann 2013). Only the principal researcher had or will have access to the data, files, contact details, transcripts or recordings, they will only be kept as long as necessary, and the

transcripts and all other data will be deleted before three years after the completion of this study, per the MIREC requirements.

Child protection laws were safeguarded as no children under the age of 18 years were involved in any portion of this study (Felzmann 2013). The online questionnaire package, Qualtrics, was set to automatically exclude any survey responses that were returned from those who ticked the option “17 or younger “ in the ‘Age Range’ category of the questionnaire’s demographics section. For the face-to-face questionnaire, and for all other involvement in this study, all potential participants were confirmed to be 18 years old or older before questioning commenced. If anyone was under 18, they were not interviewed.

3.8 Research validity and researcher objectivity

Efforts were made to ensure that the methods for collecting data were trustworthy and credible. The descriptions of methods and data analyses are as detailed and transparent as possible so that the findings are auditable and transferable to alternative and similar contexts. The study maintained a systematic approach, and the combination of analytical processes reduce the uncertainties inherent in inferential findings, and increase the reproducibility and probability that the responses from this study’s sampling is representative of the larger population of Ireland (Amrhein *et al.* 2019). Additionally, by offering hybrid (online and paper/in-person) completion of the questionnaire, nonresponse bias is also minimised (Sax *et al.* 2003).

3.8.1 Trustworthiness, dependability and transferability

Quantitative data and qualitative data were analysed using accepted and approved analysis software and methods using a systematic approach. For the quantitative data, a combination of SPSS and Microsoft Excel were utilised. For the qualitative thematic analysis, to ensure an audit trail, as well as trustworthiness, confirmability, rigour and a methodological process to the qualitative research, the decisions and thought processes of the researcher were coded, organised, recorded, analysed and presented using NVivo (John and Johnson 2000; Nowell *et al.* 2017). These allowed for stronger validity and auditability (Mertens 2010), and statistics and conclusions were reviewed and approved. The researcher adhered to the rules for conducting robust and thorough research for both the quantitative

and qualitative portions of the study (Golafshani 2003; Bazeley 2009), and made efforts to integrate them to obtain the benefit of both (Onwuegbuzie and Johnson 2006).

Despite the subjective elements of qualitative data, the researcher attempted to keep an open-mind and, as best as possible, presented all the data that was deemed relevant. Triangulation of the quantitative and qualitative data, and comparisons between differing data sources were also conducted to help reveal context and address the questions relevant to this study. This also serves to strengthen and corroborate data to increase the validity of findings and conclusions (Bazeley 2006; Creswell and Plano Clark 2011; Creswell and Creswell 2017).

3.8.2 Researcher's background, beliefs and biases

This study is transdisciplinary as it relates to more than one branch of knowledge, and the doctoral research's academic background and experience coincide well to that of this study, and demonstrate competence to conduct the research (Choi and Pak 2007). The researcher has been involved in citizen science as a volunteer and also as a trainer, leading students and volunteers in environmental, aquatic ecology and outdoor activities and walks. Her academic background is in natural sciences, with specialisations in ecology, environmental science and aquatic ecosystems, as well as law, with a strong interest in human psychology and behaviour. To limit biases, in the analysis and the conclusions, the quantitative data was wholly objective and reproducible. With the qualitative data, which is inherently subjective, the researcher provides an audit trail and codebook to detail the thought processes and why various decisions were taken.

Chapter 4 Statistical insights into the perspectives of people in nature

4.1 Introduction

Results from the analysis of the quantitative data collected from the questionnaire survey are presented in this chapter. Set out initially are the demographics of the sampled respondents as well as the frequency and univariate results for the responses to the multiple choice, rating scale, matrix and Likert scale questions. These are followed by bivariate cross-tabulation between independent and dependent variables to statistically test the correlations between them.

4.2 The questionnaire survey objectives

The questionnaire survey set out to gather data on the connections people felt towards rivers and their potential as environmental stewards. The questionnaire was also designed to measure and stimulate interest and participation in environmental volunteerism and citizen science. Also explored were the demographics of the respondents, such as age, gender, locality and duration of their current residence, the distance they reside from a river and whether or not they resided within the Maigne River catchment. The questionnaire survey also sought data on the types of pro-environmental behaviours respondents participate in, their level of spiritual or emotional connection to nature, the level of positivity of their early childhood experiences in nature, their perceptions, concerns and awareness of issues related to their local rivers, how they spend their time outdoors, their level of involvement in community or conservation groups, and their preferences or dislikes about types of project designs.

The questionnaire survey objectives were to explore the following research questions:

- A) Do **demographic** factors influence people's levels of connectedness and activities related to nature and the **Maigne River catchment**?
- B) Is there a **relationship** between positive early childhood experiences in nature and an emotional connection to nature in adulthood?
- C) Does an emotional connection to nature **influence** the level of concern, care, behaviours and activities related to nature?
- D) What is the relationship between feelings of connectedness to nature and mental, physical and emotional health benefits (**well-being**)?

4.3 Descriptive analysis of the quantitative data

A total of 756 people responded to the questionnaire survey. The respondent demographics are outlined, and descriptive analysis is provided in this section with the frequency of responses to the Likert-scale, matrix and multiple choice queries.

4.3.1 Demographics of the survey respondents

Demographics of the respondents to the questionnaire survey illustrate the sample breakdown. While the Maigue River catchment residents were targeted in the survey, only 25% of the survey group identified as catchment residents completed the survey, although 65% were from Limerick. 36% of the respondents were from the wider Shannon River Basin District and 38% were from the rest of Ireland (Figure 4.1).

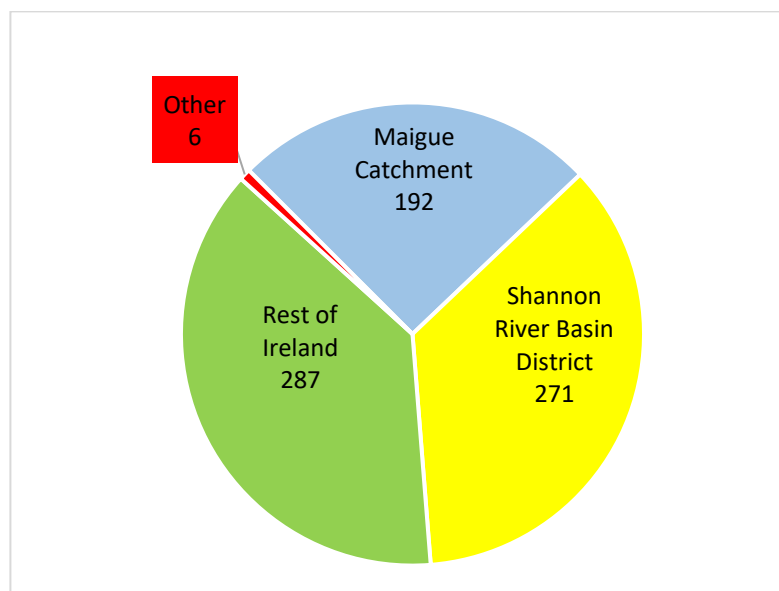


Figure 4.1 Questionnaire survey respondent region of residence

The 14 counties from which there were five or more responses to the questionnaire survey are listed in Table 4.1 according to number, with the majority of respondents being from Limerick County. Counties with less than five responses are Cavan, Laois, Leitrim, Louth, Mayo, Meath, Monaghan, Roscommon, Sligo and Wexford, and there were six 'other' international respondents.

Table 4.1 County breakdown of responses to questionnaire survey

| County | Number | Percentage |
|-----------|--------|------------|
| Limerick | 430 | 57% |
| Cork | 136 | 18% |
| Clare | 47 | 6% |
| Tipperary | 26 | 3% |
| Dublin | 11 | 1% |
| Kerry | 10 | 1% |
| Kildare | 10 | 1% |

| County | Number | Percentage |
|-----------|--------|------------|
| Carlow | 5 | 1% |
| Donegal | 5 | 1% |
| Galway | 5 | 1% |
| Kilkenny | 5 | 1% |
| Offaly | 5 | 1% |
| Waterford | 5 | 1% |
| Wicklow | 5 | 1% |

More females (62%) than males completed the questionnaire survey, and most of the respondents are aged between 30 and 65 years old (81%). The largest proportion of respondents resided in a rural location (43%) within 30 minutes from a river (76%) for over 20 years (51%), and most are working for payment or profit (69%) (Table 4.2). A substantial 14% of respondents did not know the name of their local river.

Table 4.2 Gender, age, residence, employment status characteristics of respondents

| Gender Profile | |
|-------------------------|-----|
| Female | 62% |
| Male | 38% |
| Age Profile | |
| 18-29 | 9% |
| 30-49 | 40% |
| 50-65 | 41% |
| >65 | 10% |
| Rural and urban profile | |
| Rural | 43% |
| Village | 18% |
| County town | 15% |
| City | 23% |

| Time at current residence | |
|-------------------------------------|-----|
| Over 20 years | 51% |
| 11-20 years | 23% |
| 2-10 years | 14% |
| Under 2 years | 4% |
| Other | 7% |
| Distance from river | |
| Under 30 mins | 76% |
| Need to drive | 16% |
| Other | 7% |
| Do you know the name of your river? | |
| Yes | 86% |

| Employment Status | |
|--|-----|
| Working for payment or profit | 69% |
| Retired from employment | 11% |
| Other | 6% |
| Student or pupil | 6% |
| Looking after home/family | 5% |
| Unemployed | 1% |
| Unable to work due to permanent sickness or disability | 1% |
| Looking for first regular job | 0% |

4.3.2 Frequency analysis for survey queries

The frequency of the responses to the survey queries are set out in this section. These are arranged by Likert-scale queries relating to perceptions, awareness and beliefs, and also to motivations for volunteerism. There are also multiple choice queries relating to pro-environmental behaviours and actions, concerns about the river, and involvement in community, outdoor and conservation groups. These analyses represent the responses for all of the respondents of the survey. Responses from the Maigne River Catchment residents are analysed separately and comparatively in Section 4.4.1.2.

4.3.2.1 Perceptions and concerns

Sixteen 6-point Likert-scale questions explored the respondents' perceptions and concerns related to nature and the river by asking their level of agreement with a statement. The responses by percentage are listed in Table 4.3. Most respondents 'strongly agree' that 'Nature is valuable and deserves to be protected' (94%), that 'It is important to preserve Ireland's natural heritage for future generations' (83%), and that spending time in nature helps them to de-stress and feel better (74%). Respondents also strongly agreed that 'Covid-19 demonstrates why it is so important to protect the natural environment' (58%), that they would feel proud if their town or area won a Tidy Towns or biodiversity award (60%), that 'the government should do more to protect river water quality' (61%), and that 'to help wildlife, there should be more native trees and plants near the river' (57%). Many respondents strongly disagreed that 'Water pollution in the river does not affect my life' (54%), while just under half of the respondents (49%) strongly disagreed that 'There are more important things to worry about than water pollution or nature.'

Table 4.3 Responses to Likert questions relating to perceptions and concerns

(>50% respondents are in bold)

| Likert questions: Do you Agree? | Strongly agree | Agree | Neutral | Disagree | Strongly disagree | I don't know |
|---|----------------|-------|---------|----------|-------------------|--------------|
| Nature is valuable and deserves to be protected. | 94% | 6% | | | | |
| The economic value of the land should take priority over nature conservation. | 4% | 4% | 14% | 35% | 41% | 1% |
| It is important to preserve Ireland's natural heritage for future generations. | 83% | 15% | 2% | | | |
| Covid-19 demonstrates why it is so important to protect the natural environment. | 58% | 24% | 12% | 3% | 1% | 2% |
| Water pollution in the river does not affect my life. | 2% | 4% | 8% | 31% | 54% | 2% |
| I would feel proud if my town/area won a Tidy Towns or biodiversity award. | 60% | 30% | 8% | 1% | 1% | |
| I try to help people and my local community when I can. | 36% | 44% | 17% | 2% | 1% | 1% |
| People cannot make a difference to help improve river water quality - it is too big a problem. | 3% | 5% | 7% | 39% | 45% | 1% |
| The government should do more to protect river water quality. | 61% | 30% | 6% | 1% | 1% | 2% |
| There are more important things to worry about than water pollution or nature. | 2% | 5% | 11% | 32% | 49% | 2% |
| I do not feel safe when I am alone in a public open space. | 4% | 11% | 18% | 35% | 31% | 2% |
| Spending time in nature helps me de-stress and feel better. | 74% | 23% | 2% | | | |
| There is increasing public concern in my community about protecting our native plants, animals and natural resources. | 13% | 39% | 26% | 12% | 2% | 9% |
| Any man-made barriers that restrict fish passage should be removed or adapted. | 44% | 35% | 12% | 2% | | 6% |
| To help wildlife, there should be more native trees and plants near the river. | 57% | 32% | 8% | | | 2% |
| Natural landscapes should be kept neat, tidy and free of weeds. | 12% | 9% | 11% | 34% | 33% | 2% |

4.3.2.2 Motivations

Practical application of these study results include design considerations for a citizen science programme that accounts for the main drivers, motivations, benefits and barriers to local community participation in volunteerism. Eighteen 4-point Likert-scale questions related to programme design factors that are preferred and more motivating were offered (Table 4.4). The programme design factors that were found to be most motivating are that 'Participants

learn about the plants and animals living near the local river’ (64%), that ‘It will benefit the environment and water quality in the river’ (75%), that ‘It is an opportunity to make a difference and give something back’ (64%), that ‘It is good for physical and mental health’ (69%), that ‘It is all outdoors, and an opportunity to spend time in nature’ (73%), that ‘It is family-friendly, and people of all ages can get involved’ (54%), and that ‘No prior experience is needed. Participants are taught everything they need to know’ (59%). The factor that was least motivating was that the experience would enhance their CV (57%). Some design factors, when ‘Very motivating’ and ‘Somewhat motivating’ were combined, totalled over 90%, for example: ‘It keeps people active in their communities’ (95%), ‘It is enjoyable, fun and easy’ (92%), ‘It is social, and participants will meet new people’ (92%), and ‘Participants learn new skills on how to monitor water quality’ (90%).

**Table 4.4 Responses to Likert queries on motivations for volunteering
(>50% respondents are in bold)**

| Likert questions: How motivated would you be if...? | Very motivated | Somewhat motivated | Not at all motivated | I am not sure |
|--|----------------|--------------------|----------------------|---------------|
| It is enjoyable, fun and easy. | 49% | 43% | 3% | 5% |
| It is social, and participants will meet new people. | 45% | 47% | 6% | 2% |
| Participants learn new skills on how to monitor water quality. | 46% | 44% | 6% | 4% |
| Participants learn about the plants and animals living near the local river. | 64% | 32% | 3% | 1% |
| It will benefit the environment and water quality in the river. | 75% | 24% | 1% | 1% |
| Local initiatives can link to regional, national and international initiatives. | 43% | 45% | 6% | 6% |
| It is an opportunity to make a difference and give something back. | 64% | 33% | 2% | 1% |
| It may improve a Tidy Towns assessment score. | 28% | 48% | 19% | 5% |
| It keeps people active in their communities. | 50% | 45% | 4% | 2% |
| The experience will enhance my CV. | 11% | 25% | 57% | 8% |
| It is good for physical and mental health. | 69% | 28% | 2% | 1% |
| It is all outdoors, and an opportunity to spend time in nature. | 73% | 24% | 2% | 2% |
| Participants will be knee-deep in the river, in wellies or waders. | 22% | 41% | 26% | 11% |
| It is family-friendly, and people of all ages can get involved. | 54% | 40% | 4% | 2% |
| It requires no long-term commitment. | 41% | 44% | 9% | 6% |
| No prior experience is needed. Participants are taught everything they need to know. | 59% | 35% | 3% | 4% |
| Participant safety is a priority, and social distancing will be adhered to at all times. | 47% | 39% | 10% | 5% |
| There is a mobile phone application to help with inputting the collected data. | 34% | 43% | 14% | 9% |

4.3.2.3 Pro-environmental behaviours

Participants of the questionnaire survey were asked which pro-environmental behaviours and actions they participated in, and they could select as many as applicable. The self-reported results are provided in Figure 4.2, and the most commonly selected behaviour was recycling, reusing, reducing and repairing (89%). Also commonly selected (72%) was the conservation of water and energy at home as well as composting food and garden waste (71%). Over 50% of the respondents avoid single use plastic (55%), limit their use of fertilisers and biocides (65%), and manage their farms or gardens for bees and other wildlife (60%). Only 1% of respondents did not conduct any of these actions. For the option 'I am happy to do any pro-environmental action if it saves me money,' 22% of respondents selected this.

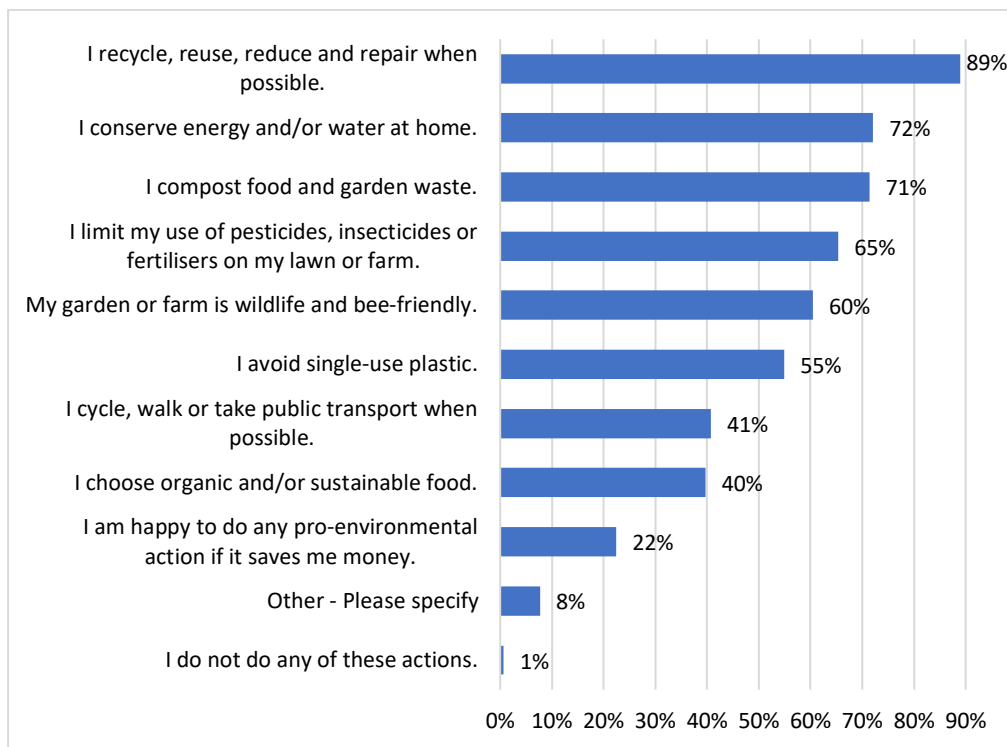


Figure 4.2 Self-reported pro-environmental behaviours (n = 756)

4.3.2.4 Concerns about the river

Participants of the questionnaire survey were given a list of concerns relating to the river, and they could select as many as applicable. Figure 4.3 lists the options provided, and the percentage of the selections. The most frequently selected concerns were pollution, plastic

and other waste (84%), the decline in wildlife, including fish (65%) and the quality of drinking water (49%), while 8% say their river is fine.

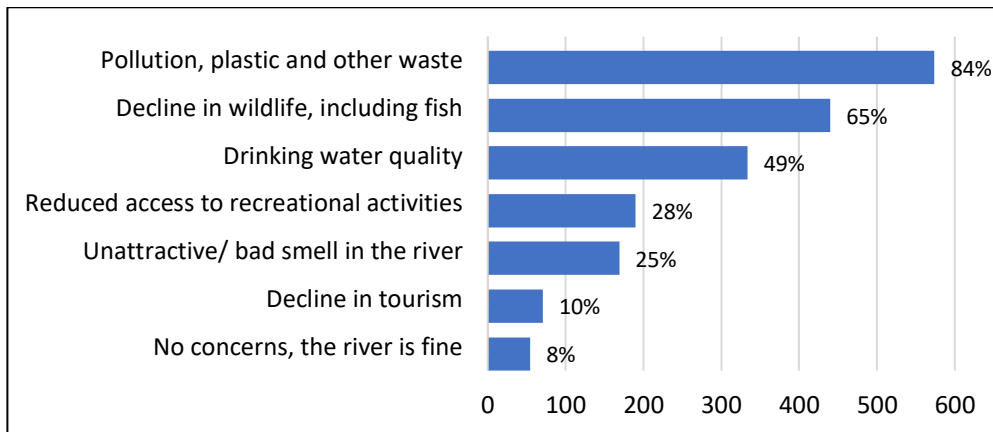


Figure 4.3 Concerns about the river (n = 753)

4.3.2.5 Participations in groups and volunteerism

The survey asked about past or current involvement in community, outdoor or environmental conservation groups (Figure 4.4), and respondents could select as many as applicable. Of those who participate, the most frequently selected was Tidy Towns (29%) and involvement in citizen science (20%). The least selected was involvement in an angling club (6%). There were 234 people (31%) who have never participated in any conservation group. The most common combinations of group involvement were Tidy Towns and kayaking or boating club (14 people), Tidy Towns and beach clean-up (11 people) and nature conservation group and Citizen Science (11 people).

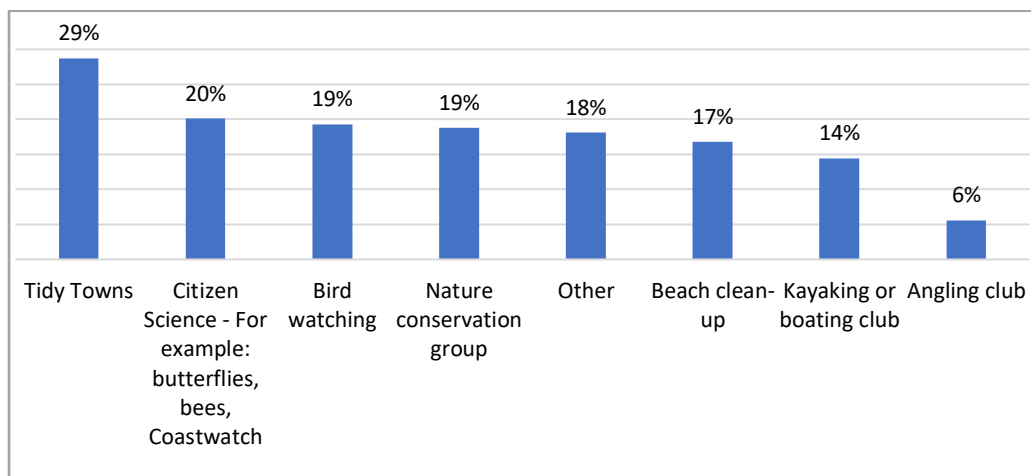


Figure 4.4 Participation in community or conservation group (n = 756)

4.3.2.6 Time and activity spent in nature

Participants of the questionnaire survey were provided with a matrix query exploring the amount of time they spent in nature, with the five options being 'daily,' 'weekly,' 'almost monthly,' 'one or two times a year,' or 'never.' They were provided with eight activities or reasons why they spend time in nature: 'For recreation,' 'To relax and de-stress,' 'For exercise or sports,' 'For the scenery and wildlife,' 'To meet with friends,' 'To walk the dog,' 'For work' or 'Fishing or angling.' Example response profiles are provided in Figure 4.5. People spend time in nature daily most frequently for recreation (387), to relax and de-stress (350), for exercise or sport (308) or for the scenery and wildlife (295). People were least likely to spend time in nature, and selected 'never,' either fishing or angling (437), working (358) or walking the dog (251). Likewise, people selected 'never' the least for spending time in nature for the scenery or wildlife (9), recreation (11) or to relax and de-stress (14).

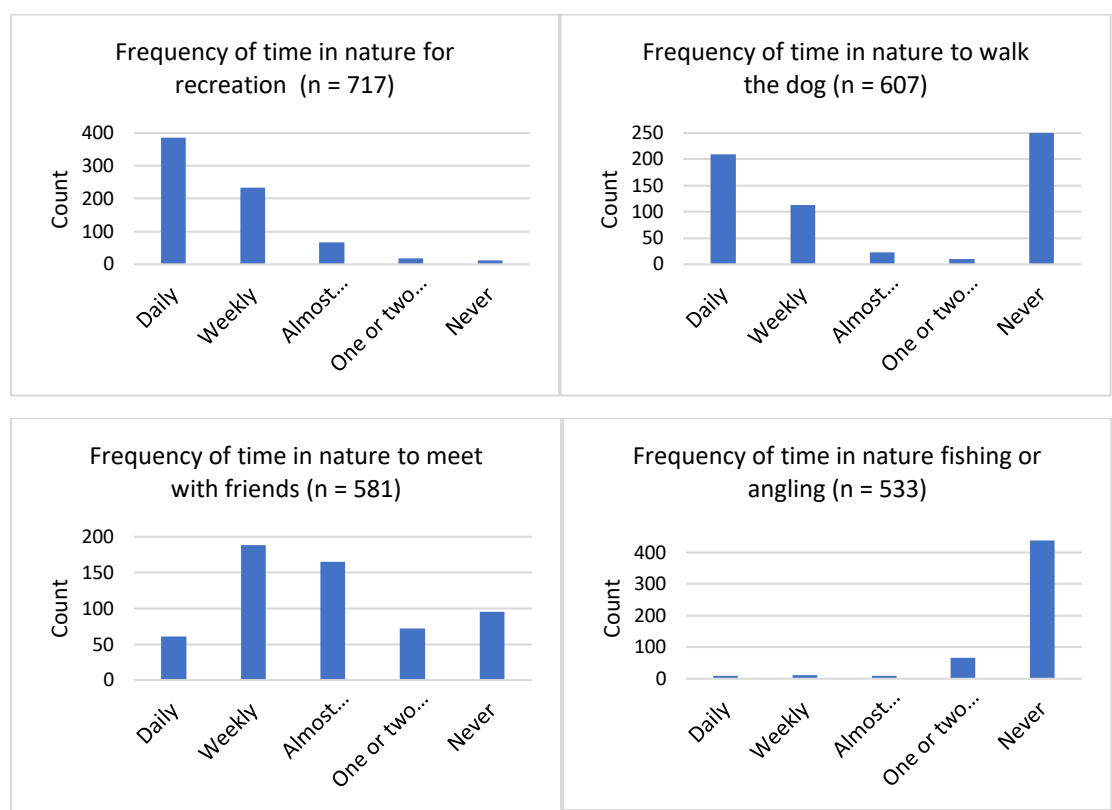


Figure 4.5 Series of graphs for the purpose and frequency of time spent in nature

4.4 Correlations between variables

Quantitative data analysis was carried out to explore the five research questions and the associated null hypotheses, and to measure the level of association of the nominal, or categorical, data obtained from the responses to Likert, multiple choice, scale and matrix queries of the questionnaire survey. Results of the Chi-square test are represented by ‘P-value’ or ‘P,’ where a statistically significant association is revealed by a P-value below 0.05. The strength of the associations are measured using Cramer’s V and are represented by ‘ ϕ_c .’ The statistical tests of association conducted to delve into the four main questionnaire survey objectives are summarised in Table 4.5.

Table 4.5 Summary of research question statistical tests

| Research question Abbreviated | Statistical Tests of Association |
|--|--|
| A: Demographic influences on actions for nature and the Maigue River catchment | A1: The age of participants does not influence their feelings of a spiritual or emotional connection to nature. |
| | A2: The age of participants does not influence the levels of concern for the river, pro-environmental behaviours and environment group involvement. |
| | A3: The gender of participants does not influence the levels of concern or care for nature and the environment, pro-environmental behaviours or the number of environmental group involvement. |
| | A4: The Maigue River catchment residents will not differ from the rest of Ireland in their feelings of a connection to nature, their awareness and concern for environmental issues nor in their level of participation in pro-environmental behaviours and environmental groups. |
| B: Relationship of a connection to nature and childhood experiences | B1: Extremely positive early childhood experiences in nature do not influence the level of feelings of a spiritual or emotional connection to nature as adults. |
| C: Influence of a connection to nature on caring and concerns | C1: Deep feelings of a spiritual or emotional connection to nature do not influence the level of involvement in nature conservation groups and volunteerism. |
| | C2: Deep feelings of a spiritual or emotional connection to nature do not influence the number of pro-environmental behaviours a person conducts. |
| | C3: Deep feelings of a spiritual or emotional connection to nature do not influence the number of concerns a person has about the river. |
| | C4: Deep feelings of a spiritual or emotional connection to nature do not influence the level of awareness of current issues with the environment or the river. |
| D: Connection to nature impacts on human health and well-being | D1: Deep feelings of a spiritual or emotional connection to nature does not influence a person’s ability to derive the health benefits that nature provides. |

4.4.1 Query A: Demographic influences on actions for nature

Analysis was conducted to explore whether or not demographic factors influence people’s feelings of connectedness to nature, and the levels of concern, care, behaviours, awareness and activities related to the river and the environment. The demographic variables analysed

are age and gender, and also the location of residence based on geography and description, where the responses of the Maigue River catchment residents are compared with the rest of Ireland. To properly explore the relationship between variables, this section is explored at greater length than queries B through D. The Maigue River catchment responses were correlated against every variable and query in the survey, and compared to the responses with the rest of Ireland and the Shannon River Basin District. The data analyses presented here is that which demonstrated a statistically significant relationship.

4.4.1.1 Age range and gender

Firstly, an exploration into the correlations between independent variables and age and gender and feelings of an emotional connection to nature was conducted. The age range of the participants was found to influence the level of connection respondents felt towards nature (Figure 4.6). Cramer’s V demonstrates that there was a relatively strong relationship between the two variables ($P < 0.001$, $\phi_c = 0.18$), with those aged 30 or above feeling the most deeply connected towards nature. In terms of their proportionate response to the survey, 31% of those aged between 50 and 65, and 44% of those aged over 65 selected a level of 10 on the emotional or spiritual connection to nature scale, as opposed to only 23% of those aged between 30 and 49.

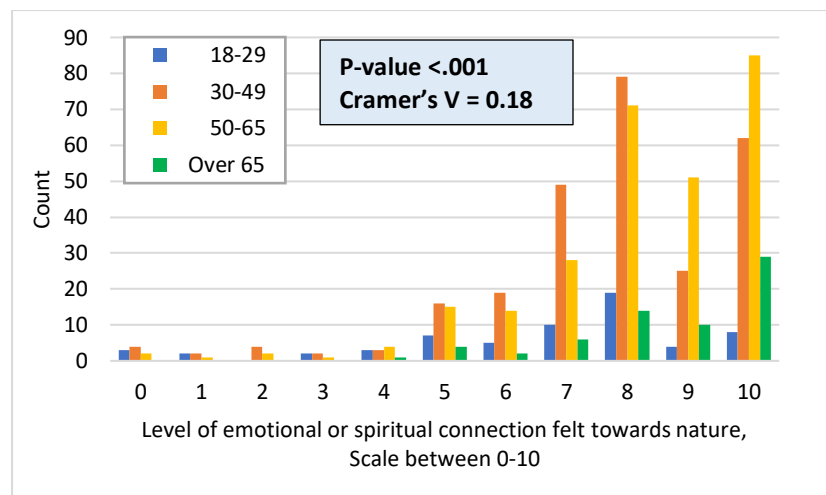


Figure 4.6 Correlation between age range and the level of spiritual or emotional connection felt towards nature (n = 668)

The age range of the participants was correlated with, firstly, the sum of the self-reported pro-environmental behaviours chosen (Figure 4.2) (totalling 10) (P -value = 0.25), secondly,

the sum of the concerns related to the river (totalling 7) (P-value = 0.16), and, finally, the sum of the community groups chosen (totalling 7) (P-value = 0.09). None of these revealed any statistically significant associations. However, when explored based on proportionate response, there was a small inclination of those aged over 30 to conduct more pro-environmental behaviours (Figure 4.7), as four environmental behaviours were selected by the largest number (21%) of those aged 18-29, while seven environmental behaviours were selected by the largest percentage (20%) of those aged 30-65. Only five people (1%) do not perform any of these actions, and of the 51 people (7%) who selected 'no concern, the river is fine,' seven were aged between 18-29, nineteen were aged between 30-49, seventeen were aged between 50-65 and eight were over 65 years old.

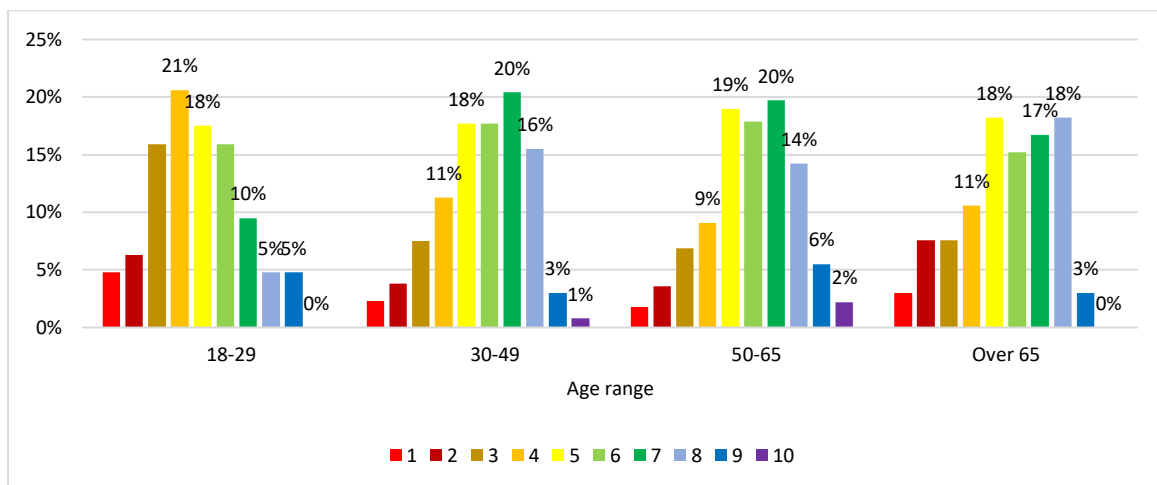


Figure 4.7 Proportion of age range to number of environmental behaviours (n = 686)

The gender of the participants was similarly cross-tabulated, and there was no statistically significant association between the gender of respondents and their feelings of a spiritual or emotional connection to nature. However, there was a statistically significant relationship between the gender and the level of positivity of their early childhood experiences in nature, as the female respondents were more likely to have had 'Extremely positive' experiences (n = 667, $P < .001$, $\phi_c = 0.19$). There was also a statistically significant association found between gender and the sum of the self-reported pro-environmental behaviours chosen (Figure 4.8). However, this association is not strong. There was no significant association between gender and the level of concerns for the environment nor the number of environmental groups involved in.

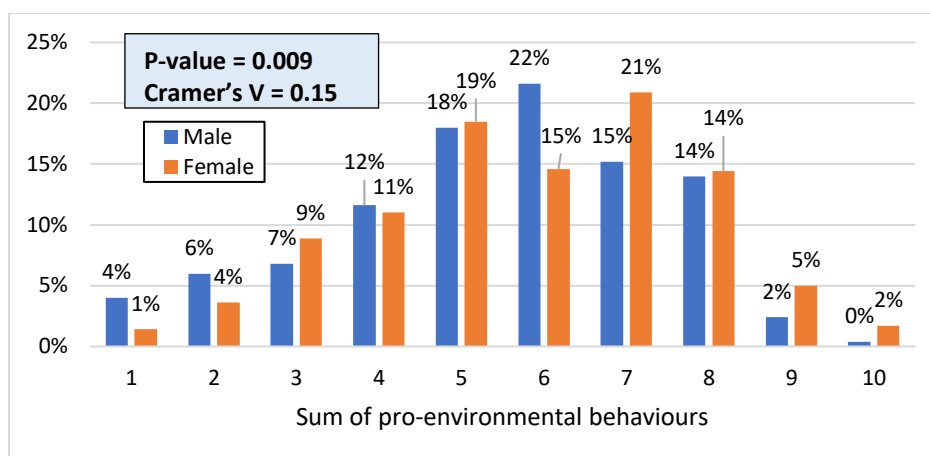


Figure 4.8 Gender and total number of pro-environmental behaviours (n = 673)

The relationship between gender and age range, and motivations for involvement in a volunteer programme was examined. Table 4.6 summarises the responses related to motivations and correlates them to the independent variables related to demographics.

Table 4.6 Motivations and preferences significantly correlated to demographics

| Likert questions: How motivated would you be if...? | Statistically significant correlation to gender | Statistically significant correlation to age range |
|--|---|--|
| It is enjoyable, fun and easy. | n = 654, P <.001, ϕ_c = 0.13 | |
| It is social, and participants will meet new people. | n = 656, P = .011, ϕ_c = 0.25 | |
| Participants learn new skills on how to monitor water quality. | n = 653, P <.001, ϕ_c = 0.10 | |
| Participants learn about the plants and animals living near the local river. | n = 651, P <.001, ϕ_c = 0.16 | n = 646, P = .041, ϕ_c = 0.10 |
| It will benefit the environment and water quality in the river. | n = 646, P <.001, ϕ_c = 0.23 | |
| Local initiatives can link to regional, national and international initiatives. | n = 650, P <.001, ϕ_c = 0.13 | n = 645, P <.001, ϕ_c = 0.14 |
| It is an opportunity to make a difference and give something back. | n = 648, P <.001, ϕ_c = 0.17 | |
| It may improve a Tidy Towns assessment score. | | |
| It keeps people active in their communities. | n = 645, P <.001, ϕ_c = 0.14 | |
| The experience will enhance my CV. | | n = 641, P <.001, ϕ_c = 0.23 |
| It is good for physical and mental health. | n = 647, P <.001, ϕ_c = 0.20 | |
| It is all outdoors, and an opportunity to spend time in nature. | n = 650, P <.001, ϕ_c = 0.19 | |
| Participants will be knee-deep in the river, in wellies or waders. | | |
| It is family-friendly, and people of all ages can get involved. | n = 649, P <.001, ϕ_c = 0.14 | |
| It requires no long-term commitment. | n = 645, P = .047, ϕ_c = 0.09 | |
| No prior experience is needed. Participants are taught everything they need to know. | n = 649, P <.001, ϕ_c = 0.17 | n = 644, P = .027, ϕ_c = 0.10 |
| Participant safety is a priority, and social distancing will be adhered to at all times. | n = 642, P <.001, ϕ_c = 0.19 | |
| There is a mobile phone application to help with inputting the collected data. | n = 654, P = .009, ϕ_c = 0.11 | |

Gender is more of a determinant to particular motivations, and there were strong relationships with programmes that are social where participants will meet new people, where participants will learn about the plants and animals living near the river (although age also showed a weak statistical association), and that are beneficial for physical and mental health. There was a strong correlation to age range with the motivations that it will enhance their CV, where this was ‘Not at all motivating’ to the majority of those aged 30 and over, and ‘Very motivating’ or ‘Motivating’ to those aged between 18 and 29 (80%). Whereas an initiative that links to regional, national and international initiatives was ‘Very motivating’ and more frequently selected by those aged between 50-65 (48%) or over 65 (60%).

In terms of demographics influencing awareness of current environmental issues, Table 4.7 provides a summary, although all associations are weak. In relation to the removal of fish barriers, those aged over 30 were more likely to strongly agree, and in terms of gender, most respondents agreed or strongly agreed, but females were slightly more likely to answer ‘I don’t know.’ In relation to keeping landscapes free of weeds, those aged between 30 and 65 were more likely to disagree or strongly disagree.

Table 4.7 Significant correlations between demographics and level of awareness

| Likert question: Do you agree? | Correlated to gender | Correlated to age range |
|--|------------------------------------|------------------------------------|
| Any man-made barriers that restrict fish passage should be removed or adapted. | n = 665, P = .016, $\phi_c = 0.12$ | n = 660, P = .024, $\phi_c = 0.12$ |
| To help wildlife, there should be more native trees and plants near the river. | | |
| Natural landscapes should be kept neat, tidy and free of weeds. | | n = 661, P < .001, $\phi_c = 0.16$ |

4.4.1.2 Maigne River catchment versus Ireland

The study site for this PhD study was the Maigne River catchment, and so the residents of that catchment were targeted for responses to the survey as well as to provide stimulus for potential river stewardship and citizen science participation. In the analysis, the responses related to the feelings, perceptions, behaviours and concerns of the residents of that catchment were separated from the responses of the Shannon River Basin district and the rest of Ireland to offer a comparison. Maigne catchment residents constituted 192 of the responses (25%) to the questionnaire. A further 34 individuals (5%) are potentially residents

of the Maigue catchment although they are categorised as residents of contiguous catchments and the Shannon River Basin district (36%). This is because they reside in Limerick County, but they responded that they did not know the name of their local river. In this section, we compare if the responses of the confirmed Maigue River catchment residents differ significantly from those of the Shannon River Basin District (Shannon RBD) and of the rest Ireland (38%) in terms of their behaviours, values and concerns.

While 76% of the respondents to the 6-point Likert scale question 'The economic value of the land should take priority over nature conservation' responded either 'Disagree' or 'Strongly disagree,' when the responses from the Maigue River catchment residents were compared with those of the Shannon RBD and the rest of Ireland, there were some marked differences ($n = 687$, $P < .001$, $\phi_c = 0.15$). For example, 52% of respondents from the rest of Ireland selected 'Strongly disagree,' as opposed to 40% of those from the Shannon RBD and 29% from the Maigue River catchment respondents. Twenty-five percent (25%) of those from the Maigue River catchment responded 'Neutral' to that question, whereas 10% and 12% chose 'Neutral' from the rest of Ireland and the Shannon RBD, respectively (Figure 4.9).

This cross-tabulation was further filtered for the responses depending on the description of the locality of their residence (e.g. city, large or small town, village or rural), and there was also a statistical significance in their responses to this query, albeit a weak association ($P = .027$, $\phi_c = 0.11$). Fifty percent (50%) who 'Agreed' that the economic value should take priority over nature and 29% who 'Strongly agreed' reside in rural areas, although 46% of those who 'Strongly agreed' reside in cities. This was particularly evident from those residing in rural areas and villages in the Maigue River catchment and Shannon RBD compared with the rest of Ireland. In response to the queries regarding their concerns about the river, of the 51 people (7%) who selected 'no concern, the river is fine,' the majority (45%) reside in rural areas.

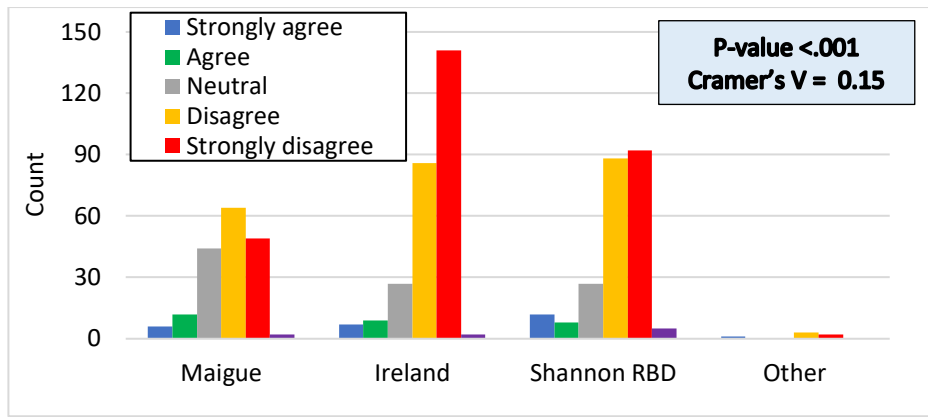


Figure 4.9 Maigue River catchment comparison for question 'The economic value of the land should take priority over nature' (n = 650)

There was no statistically significant difference between the Maigue River catchment and the rest of Ireland nor the Shannon RBD in terms of feelings of connectedness to nature, nor in levels of positivity of childhood experience in nature. In terms of the sum of their environmental behaviours, Figure 4.10 demonstrates that there was a statistically significant relationship in that the rest of Ireland revealed they were more likely to conduct seven, eight or nine of the pro-environmental behaviours listed in Figure 4.2, whereas the Maigue residents peaked at five behaviours. The Maigue residents were also less likely than the rest of Ireland to have been involved in more than five nature conservation groups (n = 521, P = .015, $\phi_c = 0.15$). Of the 51 people (7%) who selected 'no concern, the river is fine,' 21 (38%) were from the Maigue.

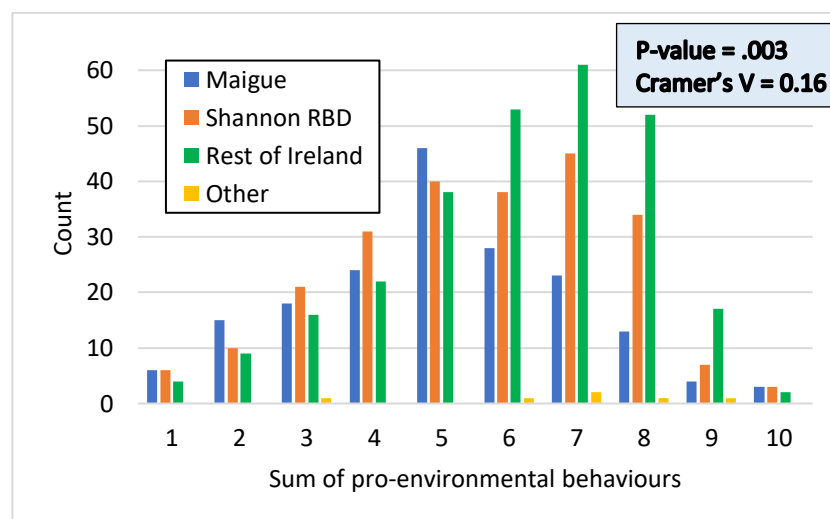


Figure 4.10 Maigue River catchment, Shannon RBD and the rest of Ireland compared in the number of pro-environmental behaviours chosen (n = 695)

Responses to the questionnaire query ‘Do you agree? Natural landscapes should be kept neat, tidy and free of weeds’ also demonstrated a statistically significant relationship when comparing the responses from the Maigue River catchment, the Shannon RBD and the rest of Ireland (n = 687, P <.001, ϕ_c = 0.22) (Figure 4.11). Eighteen percent (18%) of the Maigue River catchment ‘Strongly agree’ and 15% ‘Agree,’ as opposed to the rest of Ireland, where only 7% ‘Strongly agree’ and 5% ‘Agree.’ Disagreeing with the statement indicates a higher level of awareness of environmental issues, and in the Maigue River catchment, only 15% ‘Strongly disagree’ and 38% ‘Disagree,’ as opposed to the rest of Ireland, of whom 52% ‘Strongly disagree’ and 27% ‘Disagree.’ Also in the Shannon RBD, a total of 61% of respondents either strongly disagreed or disagreed, and a total of 23% either agreed or strongly agreed.

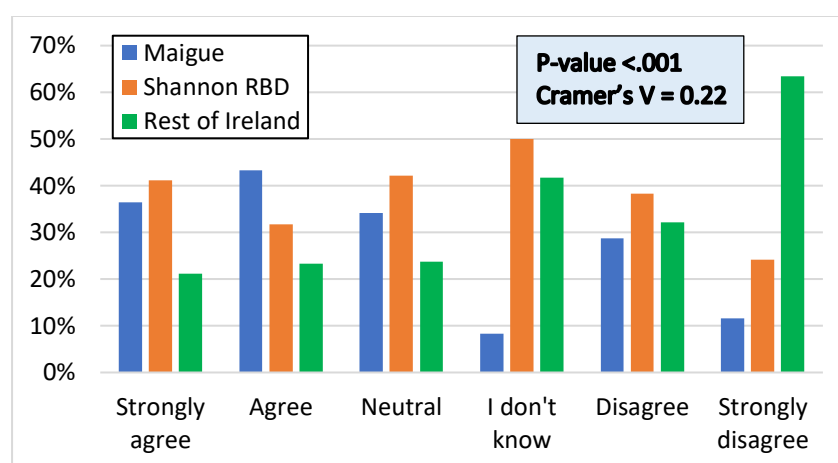


Figure 4.11 Maigue River catchment, Shannon RBD and the rest of Ireland in response to query: ‘Do you agree? Natural landscapes should be kept neat, tidy and free of weeds’ (n = 687)

A strong association was revealed from the responses to the query ‘Do you agree? It is important to preserve Ireland’s natural heritage for future generations’ (n = 684, P <.001, ϕ_c = 0.25). A large majority of the total respondents selected ‘Strongly Agree,’ that is, 87% of the Shannon RBD, 85% of the rest of the Ireland and 78% of the Maigue River catchment respondents. However, 20% of the Maigue River catchment residents chose simply ‘Agree.’ There was a similar subtle difference in response to the query ‘Do you agree? Nature is valuable and deserves to be protected’ (n = 693, P <.001, ϕ_c = 0.25). Where 89% of the

Maigue River respondents ‘Strongly agree,’ 95% of the Shannon RBC and 96% of the rest of Ireland ‘Strongly Agree.’ The reverse is true in the query ‘Do you agree? I would feel proud if my town/area won a Tidy Towns or biodiversity award’ where slightly more Maigue River residents selected ‘Strongly Agree’ (that is 67% as opposed to 56% of the Shannon RBD and 60% of the rest of Ireland).

The responses to the query ‘Do you agree? To help wildlife, there should be more native trees and plants near the river’ (n = 683, P = .005, $\phi_c = 0.13$) revealed similarly subtle and weak associations, as seen in Table 4.8, with the notable 13% of responses being ‘Neutral’ and a lower percentage strongly agreeing. There was no statistically significant correlation in the responses related to the removal of man-made barriers to allow fish passage.

Table 4.8 Breakdown by location of residence to percentage of responses to statement ‘To help wildlife, there should be more native trees and plants near the river’ (n = 683)

| Responses by location to: Do you Agree? To help wildlife, there should be more native trees and plants near the river. | Strongly agree | Agree | Neutral | I don't know | Disagree | Strongly disagree |
|--|----------------|-------|---------|--------------|----------|-------------------|
| Maigue Catchment residents | 46% | 39% | 13% | 2% | 1% | 0% |
| Shannon RBD | 54% | 34% | 7% | 4% | 1% | 0% |
| The rest of Ireland | 66% | 27% | 4% | 2% | 0% | 1% |

There were also statistically significant differences between the Maigue River catchment residents and the rest of Ireland in terms of the activities and frequency of the time spent in nature. For recreation, the Maigue River catchment residents were just as likely to participate in daily recreation whether they felt a deep connection (8-10) to nature or a passive connection (4-7) (n = 177, P <.001, $\phi_c = 0.31$), where in the rest of Ireland and the Shannon RBD, the majority of those who daily spend time conducting recreational activities in nature are deeply connected. Additionally, spending time in nature daily for the scenery and wildlife also showed a statistically significant difference between the Maigue River catchment residents (n = 163, P =.002, $\phi_c = 0.27$) and the rest of Ireland (n = 251, P <.001, $\phi_c = 0.36$) and Shannon RBD (n = 217, P <.001, $\phi_c = 0.34$). While a statistically significant association was shared between all residents in that a deep connection to nature increased the likelihood of daily spending time in nature for scenery and wildlife (n = 637, P <.001, ϕ_c

= 0.29) (Figure 4.12), only in the Maigue River catchment did some respondents (3%) who are deeply connected to nature select 'never.' In terms of spending time in nature to relax and de-stress, while all show a strong statistically significant association between feelings of a deep connection to nature ($P < .001$), the strongest association is in the rest of Ireland ($\phi_c = 0.34$) as opposed to the Maigue River catchment ($\phi_c = 0.28$) and the Shannon RBD ($\phi_c = 0.24$).

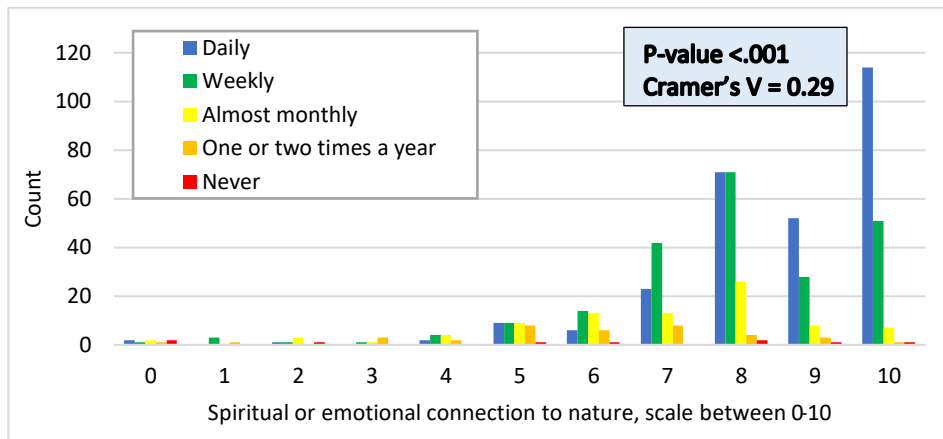


Figure 4.12 Connection to nature correlated to the amount of time spent in nature for the scenery and wildlife (n = 637)

In summary, for statistical test A1, there was a statistically significant correlation between the age range of the survey participants and their feelings of a spiritual or emotional connection to nature, with older age tending to indicate stronger connections. However, there was no statistically significant correlation between the age range of the survey participants and the levels of concern for the river, pro-environmental behaviours and environment groups participated in (Statistical test A2). Nor was there a statistically significant correlation between the gender of the survey participants and the levels of concern for the river, nor the number of environment groups they participated in. However, there is a statistically significant, moderately strong relationship between the gender of the survey participants and the number of self-reported pro-environmental behaviours (Statistical test A3) with females selecting more. Statistical test A4 found that there were statistically significant differences between some responses from the Maigue River catchment residents and the rest of Ireland, with the rest of Ireland having higher levels of awareness and concerns regarding nature and the river.

4.4.2 Query B: Relationship childhood experiences to a connection to nature

This research question explores the relationship between the perceived positivity of early childhood experiences in nature, and feelings of a spiritual or emotional connection to nature and the river in adulthood. Participants were offered a 5-point scale ranging from 'Extremely Positive' to 'Negative' and were asked if their earliest childhood memory of spending time by a river was a positive or a negative experience? 68% of the 745 respondents professed to have had an 'Extremely positive' experience, 25% had 'Positive' experiences (Figure 4.13). Very few people had negative experiences (2%).

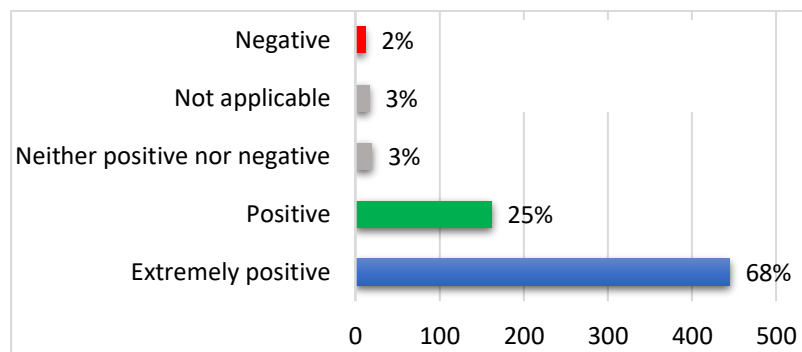


Figure 4.13 The early childhood experience query: Was your earliest childhood memory in nature a positive or negative experience? (n = 745)

The feelings of a connection to nature query explored how spiritually or emotionally connected participants felt to nature. Respondents were offered a scale ranging from zero to ten, zero demonstrating no feelings of a spiritual or emotional connection to nature, and ten revealing a very deeply-felt connection to nature. 67% selected eight or above on the scale (Figure 4.14).

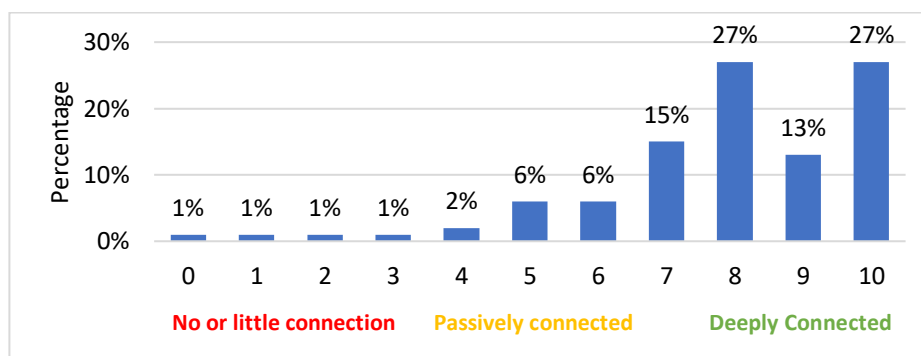


Figure 4.14 The feelings of connectedness to nature query: On a scale from 0-10, how spiritually or emotionally connected do you feel to nature? (n = 716)

The responses to the feelings of emotional or spiritual connection to nature scale (0-10) were cross-tabulated against the level of positivity of early childhood experiences (Figure

4.15), and revealed a statistically significant relationship ($P < .001$, $\phi_c = 0.22$). The inference is that very positive early childhood experiences in nature have an influence on the level of spiritual or emotional connection people feel towards nature as adults.

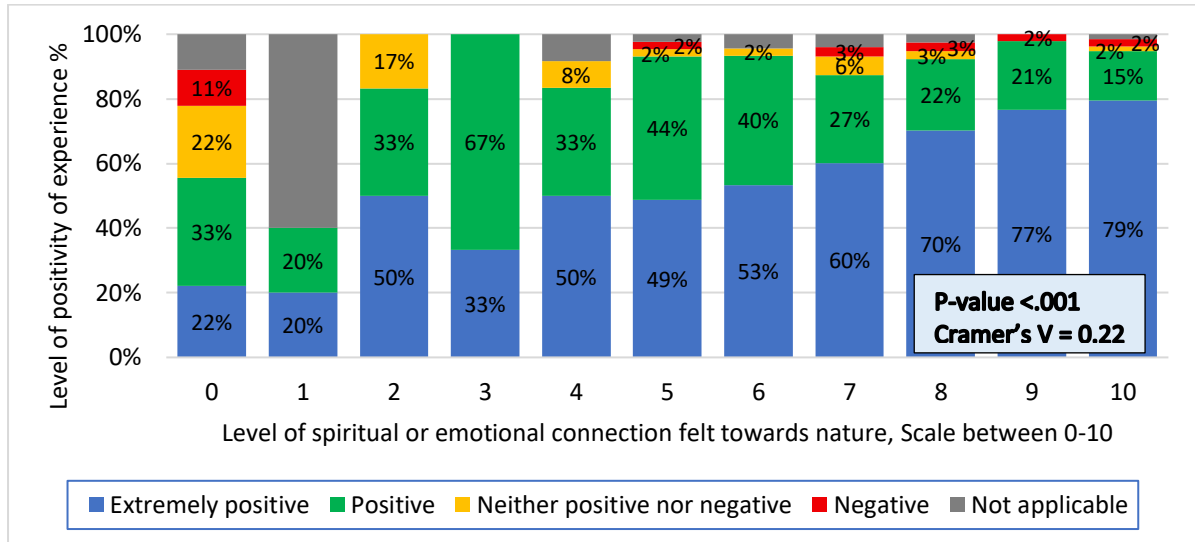


Figure 4.15 Correlation between feelings of connectedness to nature and positivity of early childhood experience (n = 707)

Respondents were also asked if they believed this childhood experience influenced how they felt about spending time outdoors in nature today. When the level of their connection was compared with their answer (yes, no or maybe), a correlation was revealed between those that answered yes, and those that felt deeply connected ($P < .001$), and it was a relatively strong level of association ($\phi_c = 0.24$) (Figure 4.16).

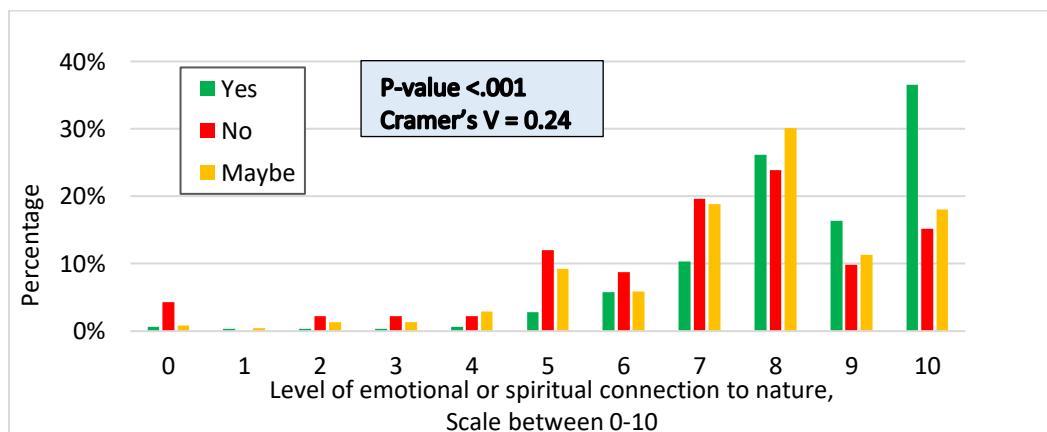


Figure 4.16 Correlation between feelings of connectedness to nature and the query 'Did your early childhood experience influence how you feel about spending time outdoors in nature today?' (n = 690)

Likewise, when the level of positivity of their early childhood experience in nature was cross-tabulated to the responses as to whether or not their experience influenced their current feelings about spending time in nature (yes, no or maybe), there was an even stronger association ($\phi_c = 0.30$) (Figure 4.17).

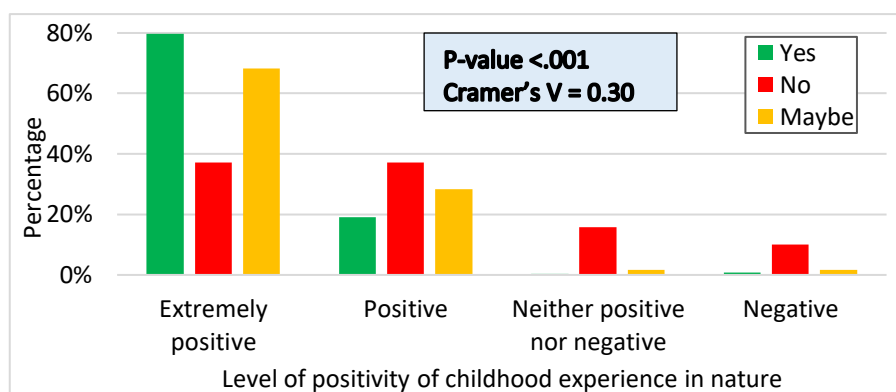


Figure 4.17 Correlation between positivity of early childhood experience and the query 'Did your early childhood experience influence how you feel about spending time outdoors in nature today?' (n = 686)

In summary, for statistical test B1, there is a statistically significant relationship between extremely positive early childhood experiences in nature and the level of feelings of a spiritual or emotional connection to nature as adults. Additionally, those with extremely positive early childhood experiences in nature believed that these experiences influenced the depth of feeling of their connectedness to nature as adults.

4.4.3 Query C: Influence of a connection to nature on caring and concerns

Analysis was conducted to explore whether or not feeling a deep spiritual or emotional connection to nature influences the levels of concern, care, behaviours, awareness and activities people have related to the river and the natural environment.

4.4.3.1 Behaviours, concerns and care

The sum totals of pro-environmental behaviours (Figure 4.2), concerns about the river (Figure 4.3) and the number of community or conservation groups (Figure 4.4) were totalled so they could be correlated against the level of spiritual or emotional connection to nature scale (0-10) chosen by the respondents to explore if there was an association between the number of behaviours, concerns and groups chosen and their level of connection to nature.

There was a statistically significant association between deep feelings of a connection to nature and the total number of pro-environmental behaviours selected ($n = 695$, $P < .001$, $\phi_c = 0.16$). There was also a statistically significant association, albeit weak, between the level of connection felt towards nature and the number of community and conservation groups selected ($n = 521$, $P = .034$, $\phi_c = 0.16$) and only those deeply connected to nature selected that they were involved in more than five groups, and only one person who selected between zero and four on the nature connection scale selected more than two groups. Of the 16 people involved in more than five groups, 14 of them selected either nine or ten on the connection to nature scale. There was no statistically significant association between feelings of a connection to nature and the sum of their concerns related to the river ($n = 657$, $P = .20$, $\phi_c = 0.13$), however, none of the respondents who selected between zero and four on the connection to nature scale selected more than five concerns.

4.4.3.2 Awareness of issues

Three of the Likert scale queries listed in Table 4.3 were included in the questionnaire survey as a measure of the awareness of current environmental issues. The issues related to barriers along the river that prevent fish migration, the loss of riparian zone vegetation and the perception that weeds are harmful rather than beneficial. The responses to the awareness queries correlated against feelings of a spiritual or emotional connection to nature and to the sum totals of the respondents' pro-environmental behaviours (Figure 4.2) and the number of community and conservation group involvement (Figure 4.4) are listed in Table 4.9.

Table 4.9 Connection to nature with significant relationship against awareness

| Likert question: Do you agree? | Correlated to feelings of connectedness to nature (scale 0-10) | Correlated to the sum of pro-environment behaviours conducted | Correlated to the sum of community and conservation group involvement |
|--|--|---|---|
| Any man-made barriers that restrict fish passage should be removed or adapted. | $n = 686$, $P < .001$, $\phi_c = 0.18$ | | |
| To help wildlife, there should be more native trees and plants near the river. | $n = 683$, $P < .001$, $\phi_c = 0.18$ | $n = 683$, $P < .001$, $\phi_c = 0.17$ | |
| Natural landscapes should be kept neat, tidy and free of weeds. | $n = 687$, $P < .001$, $\phi_c = 0.18$ | $n = 687$, $P < .001$, $\phi_c = 0.20$ | $n = 515$, $P < .001$, $\phi_c = 0.16$ |

The below is a sample of graphs (Figure 4.18) summarising the level of spiritual or emotional connection to nature of those who conduct the nature-based or conservation activity (Figure 4.4). Tidy Towns and citizen science are the more popular activities, and angling club (not depicted) was only selected by 42 individuals. Tidy Towns demonstrates the widest range of levels of connection, while kayaking or boating club demonstrates that the lowest level of connection is four (i.e. passively connected).

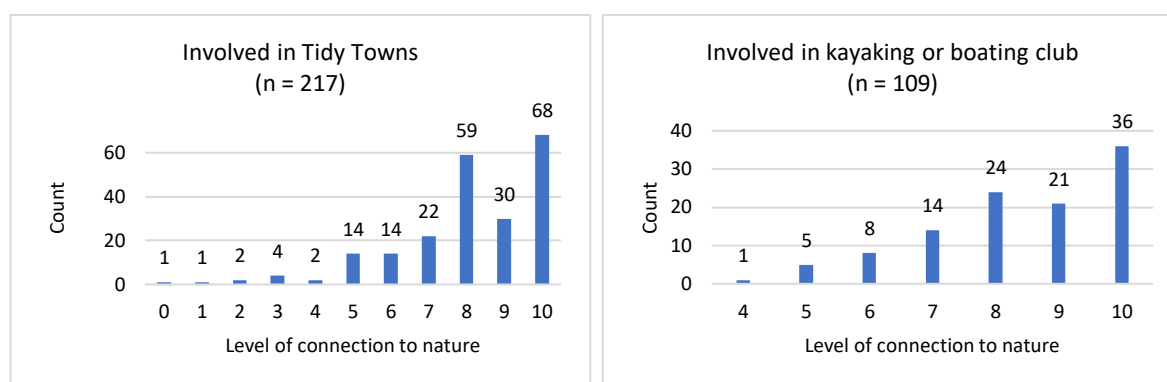


Figure 4.18 Sample of graphs showing connection to nature and involvement in nature-based activity or conservation group

The responses to feelings of connectedness query, on the scale between 0-10, were cross-tabulated to the responses on the preferences and motivations for volunteering Likert-scale queries (Table 4.4). These results are provided in Table 4.10. The strongest relationships were shown for the programmes that were enjoyable, fun and easy, and those that were an opportunity to make a difference and give something back. For most of the crosstabulations that showed an association, the majority of those who selected 'Extremely motivated' were also those who selected either eight, nine or ten on the feelings of connectedness scale, except for the statement 'Participants will be knee-deep in the river, in wellies or waders' where the largest proportion chose 'somewhat motivated,' and by those people who selected eight on the connection to nature scale.

Table 4.10 Motivations and preferences significantly correlated to nature connectedness

| Likert questions: How motivated would you be if...? | Correlated to feelings of connectedness to nature (scale 0-10) |
|--|--|
| It is enjoyable, fun and easy. | n = 654, P <.001, $\phi_c = 0.25$ |
| It is social, and participants will meet new people. | n = 656, P = .034, $\phi_c = 0.15$ |
| Participants learn new skills on how to monitor water quality. | n = 653, P <.001, $\phi_c = 0.19$ |
| Participants learn about the plants and animals living near the local river. | n = 651, P <.001, $\phi_c = 0.21$ |
| It will benefit the environment and water quality in the river. | n = 646, P <.001, $\phi_c = 0.21$ |
| Local initiatives can link to regional, national and international initiatives. | n = 650, P <.001, $\phi_c = 0.22$ |
| It is an opportunity to make a difference and give something back. | n = 648, P <.001, $\phi_c = 0.25$ |
| It may improve a Tidy Towns assessment score. | |
| It keeps people active in their communities. | |
| The experience will enhance my CV. | |
| It is good for physical and mental health. | |
| It is all outdoors, and an opportunity to spend time in nature. | n = 650, P <.001, $\phi_c = 0.18$ |
| Participants will be knee-deep in the river, in wellies or waders. | n = 647, P <.001, $\phi_c = 0.18$ |
| It is family-friendly, and people of all ages can get involved. | |
| It requires no long-term commitment. | |
| No prior experience is needed. Participants are taught everything they need to know. | |
| Participant safety is a priority, and social distancing will be adhered to at all times. | |
| There is a mobile phone application to help with inputting the collected data. | |

In summary, statistical tests C1, C2 and C4 showed statistically significant associations between deep feelings of a spiritual or emotional connection to nature and C1) the level of involvement in nature conservation groups and volunteerism, and only those with feelings of a deep connection to nature were involved in more than five conservation groups, C2) the number of self-reported pro-environmental behaviours and actions a person conducts, and C4) the level of awareness of current issues and problems in the environment and by the river. However, these feelings did not influence the number of concerns a person has about the river (statistical test C3).

4.4.4 Query D: Connection to nature impacts on human health and well-being

This research question explores the relationship between feelings of spiritual or emotional connectedness to nature and the ability to benefit from the mental, physical and emotional health provisions of spending time in nature. This was measured with survey questions relating to spending time in nature for the purposes of exercise, health and well-being.

The responses to the connectedness to nature scale (between 0 and 10) were cross-tabulated with a 9-item question that measured how frequently and for what reasons respondents spent time in natural environments. The options for the activity in nature were for recreation, for exercise/sports, for fishing/angling, for work, for the scenery and wildlife, to relax and de-stress, to walk the dog, and to meet with friends.

Early childhood experiences and/or feelings of connectedness to nature were cross-tabulated to questions on the survey that asked about the amount of time people spend conducting activities outdoors and in nature, and also what the activities were. The strongest associations were from those with a deep connection and who spend time in nature daily to relax and de-stress ($p < .001$, $\phi_c = 0.26$) (Figure 4.19) and also for recreation ($n = 679$, $p < .001$, $\phi_c = 0.25$).

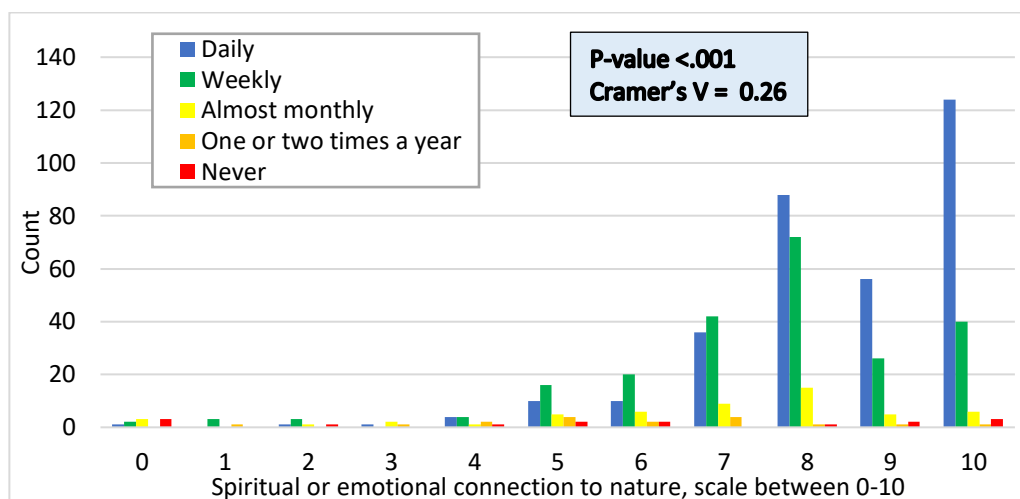


Figure 4.19 Connection to nature correlated to the amount of time spent in nature to relax and de-stress (n = 644)

The spiritual or emotional connection to nature scale query was also correlated against the Likert query *Do you agree? Spending time in nature helps me de-stress and feel better*. Figure 4.20 reveals that those who feel deeply connected are more likely to Strongly agree, and there was a statistically significant correlation ($P < .001$, $\phi_c = 0.22$). Additionally, there was a strong correlation between those who agree and strongly agree that spending time in nature helps them to de-stress and feel better and those who spend time in nature daily (86%) or weekly (70%) ($n = 622$, $P < .001$, $\phi_c = 0.25$). This also influenced the 150 people who

conduct citizen science activities because 80% of them strongly agree that spending time in nature helps them to de-stress and feel better.

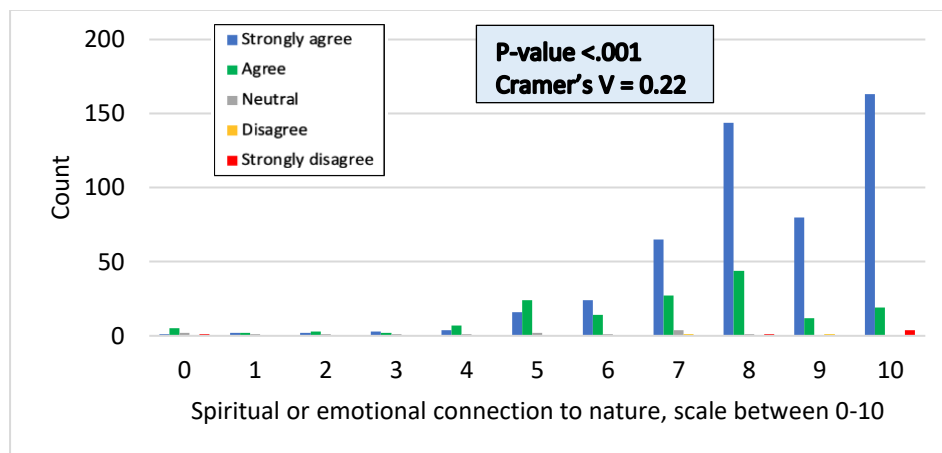


Figure 4.20 Connection to nature correlated to response to query ‘Do you agree? Spending time in nature helps me de-stress and feel better’ (n = 686)

The majority of respondents (59%) responded that Covid-19 changed the amount of time they spend in nature, and while the association between this query and feelings of a deep connection to nature were statistically significant, it was a weak association (n = 708, P = .009, $\phi_c = 0.10$). The responses to the open-ended question ‘If yes, how did Covid-19 change the amount of time you spend in nature’ are analysed in the qualitative analysis section of this chapter.

In summary, there is a statistically significant correlation between feelings of a spiritual or emotional connection to nature and the ability of a person to avail of the health benefits that nature provides (Statistical test D1).

4.5 Conclusion

The statistical tests revealed that there were patterns within the responses based on demographics and also in terms of the perspectives of people in nature, such as their connections and values about nature, the most determinant variables being age and the region of residence. Additionally, having positive nature experiences in childhood was found to influence the level of feelings of an emotional or spiritual connection to nature in adulthood, and that this connection was statistically connected to the level of pro-environmental behaviours, volunteerism and participation in community groups, and

awareness about problems in the environment. There were also relationships between feelings of connectedness to nature and benefitting from feelings of relaxation and well-being from spending time in nature. Some differences between the Maigue River catchment residents and the rest of Ireland are that fewer Maigue respondents felt strongly that the economic value of the land should not take priority over nature, and that they were less likely than the rest of Ireland to have ever participated in more than five nature conservation activities.

Chapter 5 The meandering pathways to river environmental stewardship

5.1 Introduction

Presented in this chapter are the findings from the thematic analysis, organised by the themes that emerged from the combined coding of all the qualitative data that includes the key informant interviews, focus groups and open-ended questionnaire responses. Provided here are sample quotations from the responses to the open-ended questions of the questionnaire survey with narrative on how they represent the themes and categories, as well as representative samples from the discourse that took place during the focus groups and interviews. The foundation of the findings of this chapter was formed from carrying out the six phases of Braun and Clark's (2012) thematic analyses (i.e. familiarisation with the data, reflexive coding, the generation, review and defining of themes, and reporting), and they constitute the qualitative analysis portion of this mixed methods study.

5.2 Data overview

The nine open-ended questions on the questionnaire survey (Appendix 7) resulted in responses totalling 35,941 words (this includes the 3,373 words used to respond to the 'other' options in the multiple choice questions). This is compared to 48,016 words generated in the combined responses from the focus groups and interviews. The volume can be attributed to the timing of the survey in that it was released during the first Covid-19 lockdown. The interview guides are detailed in Appendix 8 and they set out the question plans for the semi-structured key informant interviews and focus groups. As is the case with semi-structured interviews, the questions were not followed exactly because the direction of each conversation depended on the flow and the topics that arose. The interview guides and the conversations themselves centred around three main focus areas (cognitive, emotive and behavioural factors) that coincided with and delved deeper into the questionnaire queries and responses, and these categories are summarised in Table 5.1.

Table 5.1 Main focus of open-ended questionnaire queries and interview guides

| Open-ended questionnaire survey queries | Focus group/interview guide categories and excerpts |
|---|--|
| <p><u>Cognitive</u></p> <ul style="list-style-type: none"> • What is your earliest childhood memory of spending time by a river? • What ‘other’ ways do you spend time in nature? • What positive or negative changes have you noticed to your local river in your lifetime? • Has Covid-19 changed the amount of time you spend outdoors in nature? If yes, please explain how Covid-19 has changed how you experience nature or the amount of time you spend in nature. • What projects would you like to see in your community? | <p><u>Cognitive</u></p> <ul style="list-style-type: none"> • Childhood nature experiences • How they spend their time outdoors or in their communities as adults (whether voluntary or otherwise). • Why they conduct these activities. • Their observations of any changes over time in their local rivers and natural environments. • What other types of programmes or activities they thought might help or protect the water quality in their local river. |
| <p><u>Emotive/Affective</u></p> <ul style="list-style-type: none"> • What ‘other’ concerns do you have about the river? • Did your early childhood experience influence how you feel about spending time outdoors in nature today? If yes, please explain how. | <p><u>Emotive/Affective/Self-identity</u></p> <ul style="list-style-type: none"> • Feelings and values towards nature • Level of feelings of connectedness to nature or their communities • Concerns about the river • Feelings about their current volunteer activities, if relevant • Identity as an environmentalist |
| <p><u>Behavioural</u></p> <ul style="list-style-type: none"> • What ‘other’ pro-environmental behaviours do you conduct? • What ‘other’ conservation or community groups are you involved in? | <p><u>Behavioural</u></p> <ul style="list-style-type: none"> • Opinions about other people’s perspectives towards environmental volunteerism • Has volunteerism led to action or including other people such as family members in their activities, if relevant • What types of citizen science project designs would be most interesting to participate in to monitor water quality in the future? |

The thematic analysis was based on the responses from the 756 respondents to the open-ended queries on the questionnaire, eight focus group participants over two focus groups and two interviews with key informants (Table 5.2). Focus group 1 are River Guardians who are dedicated, long-term volunteers residing in the Inishowen catchment, and focus group 2 are new volunteers from the Mague River catchment, recruited to conduct water quality nutrient monitoring using test strips for a specific catchment-based citizen science project. Quotes provided are followed by the participant reference, and where no reference is provided, this indicates that the statement is made by a questionnaire respondent. Names of the leaders of the volunteer groups referenced have been replaced with [Leader].

Table 5.2 Qualitative data contributors

| Data set | Referenced as: | Age range | Gender |
|---|---------------------|-----------|--------|
| Questionnaire Survey: 756 respondents | None | N/A | N/A |
| Focus Group 1: River Guardians, Inishowen, Donegal | Participant 1 (PT1) | 30-49 | Male |
| | Participant 2 (PT2) | 30-49 | Male |
| | Participant 3 (PT3) | 50-65 | Female |
| | Participant 4 (PT4) | 50-65 | Male |
| Focus Group 2: Maigue Volunteers, Limerick | Participant 5 (PT5) | Over 65 | Male |
| | Participant 6 (PT6) | 30-49 | Female |
| | Participant 7 (PT7) | Over 65 | Male |
| | Participant 8 (PT8) | 30-49 | Male |
| Interview 1: Donegal | Key Informant 1 | 50-65 | Male |
| Interview 1: Limerick | Key Informant 2 | 50-65 | Male |

The thematic analysis from the combined participant qualitative responses uncovered five main themes: Cognition, Identity, Emotion, Behaviour and Transformative Experiences, depicted in the thematic structural map, Figure 5.1. Introductions to each theme, sub-categories and codes are outlined at the start of each thematic section. Each of the five themes includes two to three categories, and the number of subcodes ranges from one to sixteen. The full list of subcodes, categories and themes of the qualitative analysis are provided in Appendix 9, and a table that includes further examples of codes and participant quotes, organised by theme and category, is available in Appendix 10. The transformative experiences theme stands alone as a key theme of this analysis, but as it is the thread that ties all the themes together, the representative subcodes are included and referenced throughout the narrative of the remaining four themes.

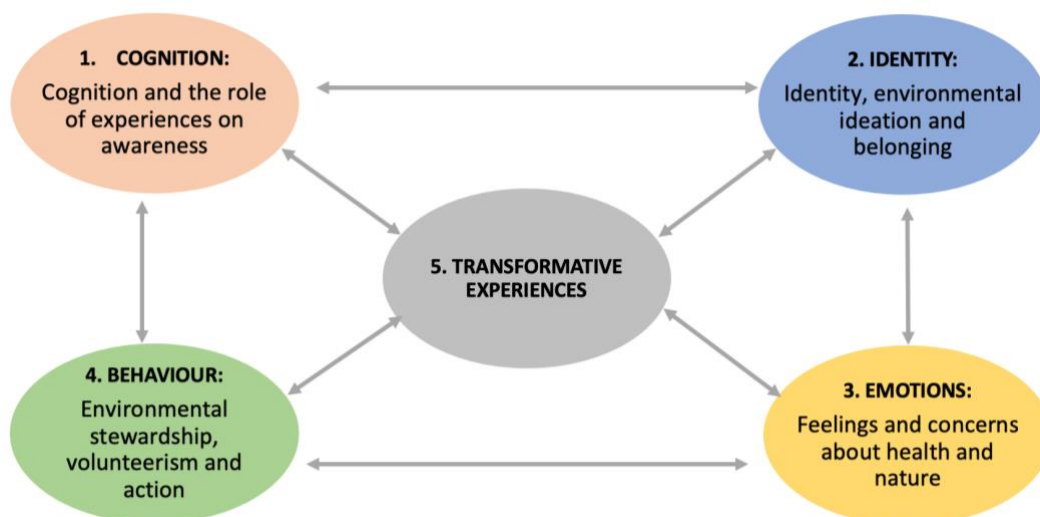


Figure 5.1 Thematic map of qualitative analysis

5.3 Theme 1. Cognition and the role of experience on awareness (Cognition)

Nature experiences, be they in the past, the present or planned for the future, as expressed by the questionnaire respondents, are informative in their descriptions as well as instrumental in their influence. Theme one (Cognition) is described in Table 5.3, and the categories and subcodes are depicted in Figure 5.2. Theme one focuses on cognition, and the transformative role that life experiences can play in increasing awareness, knowledge, curiosity about learning and the desire to continue to learn.

Table 5.3 Theme 1: Cognition and the role of experiences on awareness

| Theme | Description |
|--|--|
| Theme 1: Cognition and the role of experiences on awareness (Cognition) | This theme explores the relationship between past and present experiences in nature and respondents' interests, observations, knowledge, awareness and learning (Cognition). |

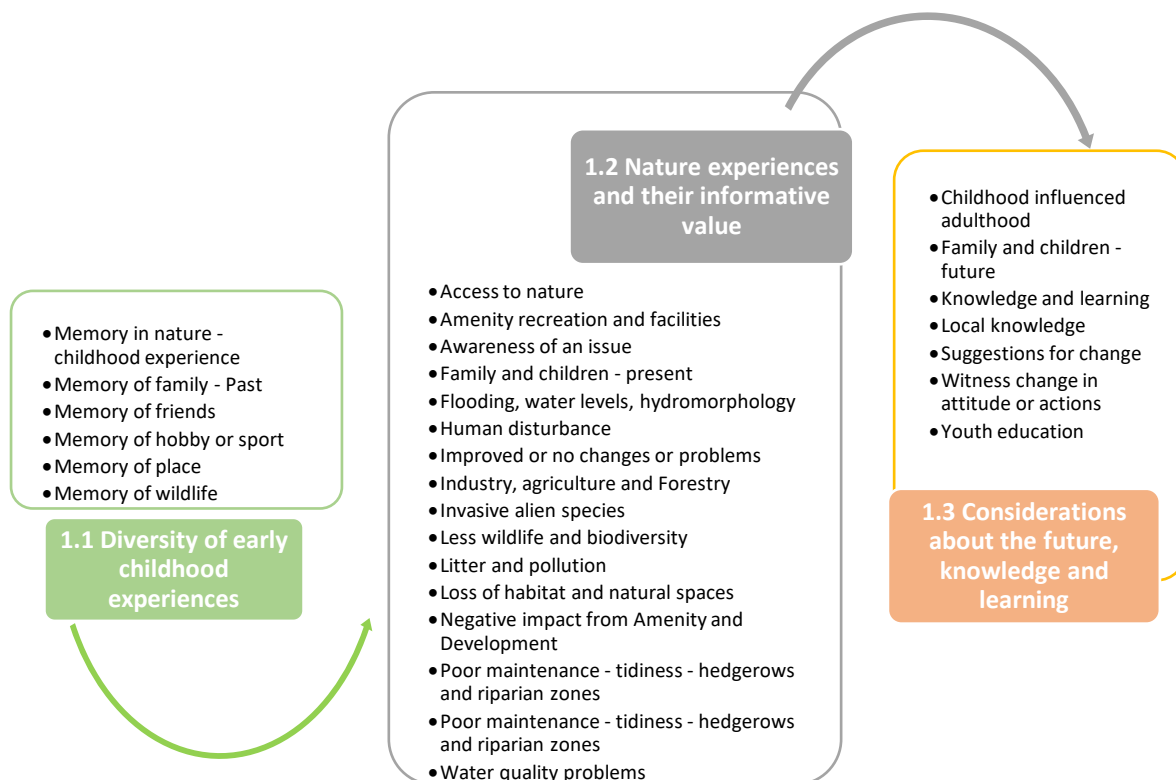


Figure 5.2 Theme 1: Cognition, thematic categories and subcodes

For example, one questionnaire respondent clarified the concept when he expressed how early nature experience *“Gave me a deeper understanding and relevance of both the birds animals and plants associated with the river, my father was an angler so being taught the life cycle of the fish and flylife at an early age I think gives you a lens to view it differently.”*

This statement demonstrates not only that his past nature experience was connected to memories of his father, the river, angling and wildlife, but also that he was influenced by the values and teachings of his father related to the river, that the experience altered his understanding and awareness about lifecycles and ecosystems, and also that it changed his perspective about life. In his reminiscence, by looking back, he considered how those experiences had influenced his future views as an adult.

5.3.1 Diversity of early childhood experiences

Early nature experiences, as expressed in the questionnaire survey responses, are so varied that they begin to differentiate the interests, influences and personalities of the respondents. The responses to the open-ended question: 'What is your earliest childhood memory of spending time by a river?' differed in the activities and the foci of their memories, demonstrating what is prominent and meaningful to the respondents, as well as highlighting the friends and family who influenced these experiences.

The focus of many of the memories related to activities, recreation or sport by the river, with frequent references to *swimming, paddling, angling, rowing, fishing, picnics or throwing stones*. There were also more specific activities referenced such as; *"walking along the river bank," "flyfishing every chance we got when we were kids," "wading in freezing water in summer," "playing along the river,"* and *"building dams."* Some respondents remember being in or on the water while others remember spending time along the banks of the river. Some remember the thoughts and emotions they felt; *"being able to walk to a little island on the river when the tide was out. Felt like an adventure"* and *"Peaceful with a jam jar with my brother collecting tiny fish and eels spent hours happily there."*

For others, their memories were of more sensory, contemplative, spectatorial experiences;

listening to the sound of water

water flowing

sitting by the river with my dog

seeing people swimming in it during summer

watching the millenium [sic] celebration and fireworks reflecting over the river at night.

Crossing the iron bridge to go to school every morning and looking into the river below

There are frequent references to catching fish, twelve of which specified “*in a jar,*” such as minnows or ‘*pinkeens*’ (local name for minnows), trout, stickleback, ‘*brickeens*’ (local name for trout or stickleback), ‘*collies*’, perch, ‘*tiddlers*’ (stickleback or any small fish), tadpoles and lampreys (nicknames used were pinkeens (9 times), collies (7 times), brickeens (4 times) and tiddlers (3 times). There are also many references to other wildlife, such as feeding ducks and swans, but also: “*Snorkelling in a stream, tickling fish, catching crayfish,*” and “*throwing dried rabbit droppings in a [sic] and watching fish come up for them,*” and “*Hiking along streams and rivers and catching newts.*”

A vast majority of the memories are reminiscent of idyllic childhoods spent enjoying and playing in or by the river, but there were also negative experiences; “*I lived right beside the river when growing up but my earliest memories were quite negative as my parents were very nervous about a large water body and lots of young children,*” and “*Being told to stay away from it in case I fell in. Neither of my parents could swim.*”

Evidently, parents and caregivers play a large role in these memories of negative experiences, either as being their saviours from drowning, but also from the adult’s nervousness about nearing the river. However, it is much more likely that family provided positive childhood experiences in nature. For many respondents, other people featured strongly in their memories. Some shared time in nature with friends conducting activities such as building rafts, exploring, swimming, picnics, playing, or sitting beside the river, but for many others, family members were predominant in their memories;

Although it is probably my parents' values which both brought me out as a child and gave me a similar value system for my work in childcare and with my own children today

Swimming in the river near my grandmothers farm in summer either after saving the hay or just on a hot day.

My Dad was teaching myself and my sister how to skim stones across the surface. I threw a stone and hit my sister on the head!

I come from a family of fishermen - fond memories of seeing lots of fishermen on the Shannon in Limerick city.

Rivers didn't really feature regularly in my childhood, except for going to the river near my gran with my parents. On the other hand, being on my grans farm and learning where the snowdrops, the primroses, the daffodils, the wild strawberries grew that had a huge positive effect on me.

A deep appreciation for all of nature was passed down to me from my dad who lived in a town but loved having walks in nearby countryside and spending time in his beloved garden.

My mother loved the outdoors and swimming.

It was part of a childhood of interest in nature cultivated by my father.

Playing dams catching collies with jam jar, fishing for eels with uncle who knew about all the insects and poems about the river.

I grew up near a river.earliest [sic] one was my brother teaching me to fish (i didnt like it).

The diverse foci of interests, as well as the mention of relatives and friends were also strongly supported in the interviews with key informants and in the focus groups. For example, Participants 1 and 4 both grew up as anglers with “a lot of angler friends,” whereas Participant 3, was “from a family of fisherfolk” who “all read the sea,” and she was very influenced by their values. As an adult, she became an avid white water kayaker, and was involved in a local water protection organisation which later became a rivers trust. She recalls of her childhood experiences that she always volunteered;

I started doing recording and surveys when I was 7 and that was through the young ornithologists club and then through the British Botanical Society. And so you know most weekends and then time after school we'd go off and do recording and also bat monitoring as well. So that was all through my childhood I was doing that. And then the rivers were strictly for paddling on. (PT3)

She attributes her lifelong environmental stewardship and interest to her father's values and influence; “I was completely immersed in nature growing up [...] that's down to my Dad, [...] he was a marine biologist and a wildlife enthusiast [...] and he brought us up like that.” (PT3). This family influence was consistently strong amongst the focus group and interview participants: “My grandfather would have been the person who imparted nature onto me,

[...] he took me to the river to teach me how to fish when I was 7.” (PT1); “I always loved the river... I was born and reared beside it and all the things that could be done in a river, this was back in the 50s and early 60s and I loved the river from the first time we ever saw it. It was quite near us at home.” (PT5); and “It was actually an uncle who introduced me, and bought me my first fishing rod, so my father had no interest at all, so I must have picked up a gene from a previous generation.” (Key informant 1)

Participant 6 had a negative childhood experience by the river, and her family restricted her play;

“Unfortunately, I don’t have any lovely childhood memories that I can draw on of playing. Now we had a stream in the garden, but apparently we used to play in the river Slaney when I was little until one day when I was about four my mother saw my head bobbing off towards Enniscorthy and I had to be rescued, so that was the end of us playing in the river.” (PT6)

However, her family’s interest in community projects and other habitats also influenced her, and she volunteers for Tidy Towns. Participant 6 is only now starting to have positive experiences by the river, but she is not confident volunteering alone, so she has teamed up with Participant 5 to conduct citizen science at the river.

In summary, early childhood experiences play a role in cognition and awareness about environmental conditions, because their memories as adults set the basis upon which they observe change, and also the interest, focus and priorities of their curiosity.

5.3.2 Nature experiences and their informative value

The open-ended query “What positive or negative changes have you noticed to your local river in your lifetime?” received a wide range of varied responses, often contradictory. This is expected as the previous section demonstrated the diverse experiences, foci and interests of respondents, and contradictory observations (and opinions as to whether a change is positive or negative) will result from differing priorities, localities and levels of awareness and knowledge. For example, in relation to changes associated with climate change, flooding and water levels, the following statements were made;

It is quite small and close to the source but has been diverted and piped upstream and dries up for longer periods during summer months.

*More canalization, banks pushed up higher.
More litter*

The water level over the last 15 yrs at Bruree has dropped dramatically.

The water table is higher and it is fuller than it used to be and more prone to flooding

Less fish but town (Croom) doesn't flood any more

river prone to flooding

a degree of change in flow channel. more incidences of flooding due to more severe/extreme rainfall events. occasionally (usually Sunday/weekends) water discoloured and foul smelling- obviously something being discharged at out of office times

It's still the same, but due to climate change it floods into the fields at times after heavy rain fall.

Residential areas have expanded in the vicinity of the lake. However, the biggest change seems to be that due to the warm winters, the lake has not been able to freeze every year, which affects many things.

my local river (Fergus estuary) regularly floods and i sometimes think that the flooding will reach my home in my lifetime.

More flood events, more sediment and damage completed when draining.

Awareness and concern is evident so it is not surprising that people keep abreast and current on efforts to manage flooding problems in their localities: *“Highly concerned about OPW walls scheme and general unpreparedness for climate change impacts”, “Flood prevention measures installed upriver from my area. One weir in particular has changed in dynamic.”*

The word cloud (Figure 5.3) summarises the most commonly used words describing changes, and are a mix of positives and negatives. The most frequently occurring term is pollution (143 times), followed by fishing (96 times) and people (90 times). Variants of physical pollutions are also mentioned, such as litter (69 times), rubbish (64 times), dumping (28 times) and plastic (27 times). More informative is one respondent's summary that encompasses the majority of responses;

“Negative:- Rubbish left behind on banks and thrown into rivers, spraying of (weeds) wild flowers on walks or trails. More invasive alien species signs in certain areas and evidence of these plants in particular. more coarse fish and less natural trout and salmon. I remember seeing a fresh water crayfish when young that I have not seen for a long long time. Some flood relief projects that interfere with the river and destroy natural habitat and cause flooding further down the river. Positive:- More awareness in the community

local areas, as well as opinions about the effectiveness or destructiveness of same. However, by far, the most frequently mentioned negative observations about their local rivers were litter and rubbish.. This makes sense as they are very visible forms of pollution. Typically, some respondents did not consider litter a problem, and some were aware that no visible rubbish did not necessarily mean it was unpolluted; *“Positive: less polluted or at least less obvious pollution. When I was a child, I would occasionally see dead animals in the river. This would never happen now,”* and *“All the usual concerns re environment. Climate, Biodiversity, Pollution (including endocrine disruption). Declining amounts of wild spaces.”* A better indication of learning and awareness, then, is the framing of observations as a comparison from an earlier time because they are comparing their current observations to their recollections of conditions during past experiences;

I would never swim in the river maigue now.. my childhood memory is clean crisp water.. now it just looks polluted all the time

There is more litter and pollution in general affecting rivers now

water is not as clean as when I was small. When I am by the river I can usually see some type of rubbish in the water.

water quality has improved but plastics and rubbish has increased

Obviously pollution. Har [sic] to walk the river or its man made canals (Ardnacrusha/Pardeen) without encountering plastic pollution and more recently, discarded masks. etc.

water quality and drop in insect numbers would be biggest negative, taking in most rivers in my wider area and its obvious affect [sic] on the recruitment of juvenile fish, having spent a huge amount of time in or around most of the Rivers in my area over the last 40 years I would notice a decline of juvenile fish numbers just by there [sic] absence in the evenings were [sic] previously they could be seen feeding in large amounts say on pool tails or glides

There are other observations regarding the river, and again these can vary in focus and be contradictory, but many speak of change in comparison to the past; *“No one seems to swim in the river anymore, where as I would have spent every fine day of the summer swimming in our local river”, “pollution, less fish, mussels gone, dippers gone, otter very rare, brown with run off or slurry after heavy rain, floods more often due to drainage upstream, no more mayflies,”* and in contrast *“In general there is more interest, rivers are cleaner,” “In recent years i am noticing more fish in the river, though small, this is a positive sign. The return of more kingfishers, heron, otter and of course the dreaded but lovely mink tells me that too.”*

An indication that respondents are environmentally-aware and gave the subject thought and consideration is when the reference is to less evident pollutants or to the source of the pollutant, such as; *“Water levels affected by silt and mud levels. Water quality diminished due to pollution by farm animals and people,” “farming practices are very close to the banks of the river, such as weedkiller spreading.”*

Many statements are not directly about water quality problems, but they refer to the biological indicators of poor river water quality, for example;

Decrease in salmon and brown trout, decrease in flylife, numbers and diversity, less dragonfly and mayfly, less noise of grasshoppers. Greater eutrophication. Less use of local weirs and rivers by local people for summer recreation and when it is used it's used for rowdy drinking behaviour rather than by families and kids. Local Angling community less focused on working on and caring for river, more interested in fishing competitions and qualifiers (just in the location I grew up in).

In the past 20 years, I have noticed increased amount of furry green/brown coverage on teh [sic] stones on the river bed. Also I see less fish and over the past two years have seen a few dead fish floating, both large and small fish. The banks are getting more polluted with plastic bale wrap too. Some local farmers are taking water from local streams to feed their herds leading to a criss cross of black pipes going along rivers, streams and banks. One farmer i know has no drinking troughs for his cattle and they drink from the river and so polluting it more.

A small number of respondents (20) noticed no changes in their local rivers. Of the many observations of positive changes, many were due to an increase in amenity use and facilities, but also due to a change in either community attitudes, improved maintenance and practices by state bodies or environmental activism. Similar to the flood management and other works, it is notable that many of the waterways are referred to by name; *“The River Lee almost 40 years ago was a different river - it smelt and looked dirty. I no longer have that feeling about it”, “Well, as the Barnakyle is a small river, we don't take too much notice, really. I'd say it's actually less polluted than 30 years ago.....”, “amenities around river locations have really been enhanced and developed over the years to ensure a very positive enjoyable experience when visiting.”*

Litter and pollution are the most frequently mentioned negative changes (393 times), followed by decreases in wildlife and biodiversity (198 times), a loss of natural habitats (119 times), and an increase in invasive species (53 times). The most reported positive change

(223 times) is an increase in facilities and amenities such as walkways that allow for more access to the river, followed by noticing a change in public attitude, interest or activities related to the river (48 times). However, there are also many respondents who believe there is reduced access to the river as a result of flooding, fencing or private property; *“Where I live there is no decent walkway by the river - I mostly go through fields No one swims in the rivers anymore Banks of rivers are unkept - Sally’s growing that block views”, “Land owners preventing access where traditional access was available”, “Historical development pressures have altered the riparian zones, removing much of the vegetation. Artificial embankments have altered the ecosystems and act as barriers that reduce access to the stream for recreational/educational purposes.”*

Many respondents consider an increase in amenity to be a negative change. For example, it can lead to crowds, antisocial activity, dog faeces and litter, and other reasons that increase concerns, such as; *“More people using means increased litter and disruption of nature,” or “That the special protected area status may be disrespected by putting a man made boardwalk into it. Disturbing the wildlife that live there” or “Crowds deter the use by locals and have no consideration for local residents.”* Thus, the most frequently mentioned positive change is linked to increasing the most negative change, and this limits the amenity value of the river (Figure 5.4).

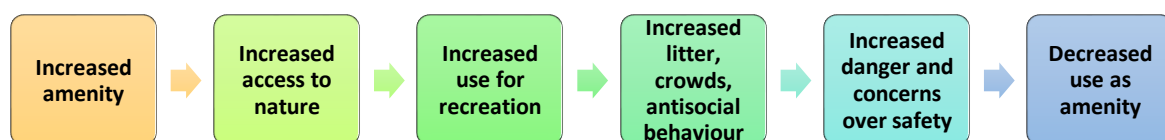


Figure 5.4 Link between positives and negatives on increases in amenity

For many of the participants of the focus groups and interviews, they became involved with volunteering because they noticed differences in the river;

I think one of the biggest things that led me toward the trust was the Breda River where I used to do a bit of work around it on my own just years and years ago, maybe 20 years ago and I could see the degradation in it [...] taking my kids were small at the time, and mind I hadn’t been there for like 10 years, and I took them down for a walk one evening and expecting it to be pretty much how it used to be. Where when we were young in the evenings, we would have had thousands of small trout, raising like it would have been like rain in the water, you know, and larger fish than salmon and we walked down that evening and the river was just covered in rubbish from a recent

flood and I think we seen one fish, one small little fish on the way back, and I just thought that was depressing. (PT4)

I wasn't always interested in the Morningstar river, I was born and reared further up river, in Bruff, where we live now and um I always liked the river from my very younger days. We had swimming, temporary swimming pools and we used to do fishing which the modern fisher people mightn't like the way we were doing it and all that. And um I also noticed down through the years it was that the the gradual degradation and the cleanliness of the river. like in my time you could swim in that river and you were quite safe. I wouldn't like to swim in it now at certain times of the year. (PT5)

Fishing may well have alerted me in that I saw great decline in the numbers of well migratory sea trout and salmon over my lifetime, but I saw that the problem wasn't going away, it was getting worse, so maybe that's what alerted me, but I also noticed things about rivers there. Just the quality of the water, the siltation and things, I would have been noticing and thinking this is not what it used to be. So yeah, it wasn't the RT that alerted me you know, to the need, it was the rivers themselves. (Key Informant 1)

However, similar to the questionnaire responses, not all the observations about changes in the river were negative. Participant 7 had the opposite motivation of getting involved as he had “*given up on the river maybe ten years ago,*” but when he noticed recent improvements he got involved in volunteerism;

About 20 years ago, I did Aquanets... It was how to do kick samples and understand the river with flyfishing term, so that's ... I'm still at it like, I'm still interested in the river, so this is just a natural part for me, so I'm quite happy at, when I met you at first we were by the river and I couldn't get over how good the quality water was...we saw a lot of fish. Because I had given up on the river maybe ten years ago [...] but it has improved an awful lot since then. (PT7)

5.3.3 Considerations about the future, knowledge and learning

When asked what projects respondents would like to see in their local communities, unsurprisingly, many suggested clean-up and litter pick campaigns or more bins. However, there were also suggestions for projects that focused on biodiversity and pollinators; “*Biodiversity based projects aimed at restoring ecological corridors*”, “*I'd love to see neighborhoods use some of the green space for wildflowers and teach the kids about nature.*”

Numerous suggestions focused on education and knowledge (147 times), access to data and increasing public engagement for children and adults, including citizen science. These

indicate a desire for learning as well as increasing public awareness; *“Each river...could have its own conservation group made up of locals with specific focus on the river and riverbank environment”, “More information for the public... leaflets, posters, talks, walks! I am involved in both the All-Ireland Pollinator Plan and the Ellen Hutchins Festival, and have seen firsthand how successful this approach can be.”*

Interestingly, some respondents credit their enjoyment of early nature experiences to the educational value and because it piqued their curiosity and the desire to learn more;

It increased my curiosity and interest in the natural world

Associated with fun and always something new to behold

I associate being near a river with fun, holidays, exploration

I know more about Ireland than the Irish and I go to many many nature places now in Ireland

Yes, but it was one of many experiences in various habitats where I explored, listened and learned either on my own or with a mentor/adult. Experiences are complex and for me, it is not down to one moment or event.

The river is not accessible to the public to explore its full natural beauty and to teach our future generations an understanding of our environment.

Perhaps this desire to learn caused by experiences in nature is an element that explains or influences the heavy focus on access to education and information. There were also a number of respondents who demonstrated good knowledge of environment problems and who made suggestions for creative, practical solutions (also demonstrating that they had devoted time to thinking of these solutions). Some provided the reasons why they thought education and building awareness were so important;

“Reforestation projects- large and small. Would like to see replanting of native woodland particularly in upland areas to increase biodiversity, reduce the need to use fertilisers, stabilise the soil, improve water quality and prevent downstream flooding. I would like to see “mini-forests” being planted in the city to increase biodiversity and educate children. I'd also like to see more education and understand about river quality, removal of dams and barriers to migrating fish. I would like to see a restoration of destroyed riverbanks and more planting of trees along rivers. I would really like to see a bottle & can refund/return scheme as I

think this would stop an awful lot of waste ending up in the river and would encourage children to act in an environmentally responsible way by earning money.” (Survey respondent)

One respondent suggests “*Biodiversity and conservation education - i think that teaching people to identify species of wildlife etc will make people feel more connected to wildlife and more protective of it.*” This belief ties into the concept of awareness and knowledge leading to a change of perspective which might lead to pro-environmental behavioural change and also activism.

Awareness sharing is evident in the statement “*I know the fishermen in Limerick complain that the fish numbers are decreasing,*” suggesting a proclivity to openly communicate about environmental issues. Although one respondent felt; “*plastic bottles / rubbish dumped by the river - this country has a terrible attitude and behaviour towards littering in general,*” many others believe that there is an increase in awareness and value placed on nature and rivers, and that this will lead to improvements;

Greater use of the river as an amenity and a greater appreciation of it in the last decade. When I was a child I don't think that we consciously [sic] thought about our rivers and protecting them. I think people are more aware of their value now. Negatively, [sic] the water quality has decreased. But this is changing as people become more conscious [sic]

And I've been in Limerick for 20 years and I have noticed an increasing awareness of and use of the Shannon. My wife swims in it ever [sic] day. We walk the three bridges frequently. The river is moving from the periphery to the heart of the city.

A local stream, the nearest to me, has been 'tidied up' by a beautiful architect designed and landscaped house in the last 10 years. All the wild banks and plants have been removed. It has been bulldozed, levelled banks, cutified by a little bridge and cut stone decoration but I wonder about the natural habitat. It's a very manicured and landscaped stream at the point nearest to my house now. Not the broad, meandering, tangle of plants and lazy stream bed that it once was.

I've seen pollution, but more recently I have seen fish and wildlife return as people are more aware of how important it is to keep the river in a great condition. I have also noticed a lot more water sports and more people enjoying the river

I also notice in Lough Gur awful weed going crazy in the lake. I go kayaking there and it's really noticeable. I hear that is from effluent and I don't know but the water is thick with algae bloom. I like the Shannon however, and I like the way that people are conscious [sic] of preserving the integrity of waterways. I know people who fish who throw fish back in because they don't want to deplete the population of fish. People are talking about water quality and are conscious of it.

In the focus groups and interviews, increasing awareness was also evident; “*The crux of the matter is outreach to the youth and education from a young age and the importance of our environment as a biosphere that we have to exist within.*” (PT1) but they repeatedly mentioned a curiosity and desire for knowledge about nature and their locality. Free

training courses were a main draw and benefit of volunteering, and learning about hydromorphology was especially popular amongst the River Guardians (Focus Group 1 participants) because it was enlightening and full of new information; *“...they were able to answer so many of those questions for me ... the more they answered the more I wanted to know. I constantly want to understand and to learn and to better myself but to use it for what I love and for the things around me.”* (PT1)

Lochs Agency had provided a course, for I think they called it entomology for anglers, so it was basically pretty much the same thing as the riverfly monitoring thing, you know identifying your species or the families of insects and invertebrates all living in the rivers ... you can never learn too much. (Key Informant 1)

I've had opportunity of free training and ... lots of the courses that are put on would cost individuals significant money out of their own pocket...Personal benefits, you know to be able to avail of training in things that I've been interested in. (Key Informant 1)

Social learning, however, was just as important because they valued learning from the other people in their River Guardian group. They are all nature lovers, but with diverse experience, interests and expertise and for a few, they most enjoy learning and spending time with other participants.

I'm having a good time and all these people... are valuable teachers to me...that time to me is very valuable... they have such interesting backgrounds and such commitment and passion for the environment. What they've got to say is interesting so when they go to say it, I want to be present. (PT1)

The personal benefit of it has just spoken. Because it was getting to know PT5. Because we're working together as a team, it's been fantastic. I don't know the area as well as PT5, and PT5 has taught me so much about the river and there's always this chat, and a bit of a story about the river and the local knowledge. It's been a very enjoyable experience, yeah, I haven't regretted it for a minute. (PT6)

In summary, early childhood and current experiences in nature, and knowledge accumulation and learning can be a motivator for future volunteerism, and help build awareness of environmental issues (Figure 5.5). These cognitive experiences may begin in childhood, or one can argue that the reverse is also possible, and begin through learning via others.

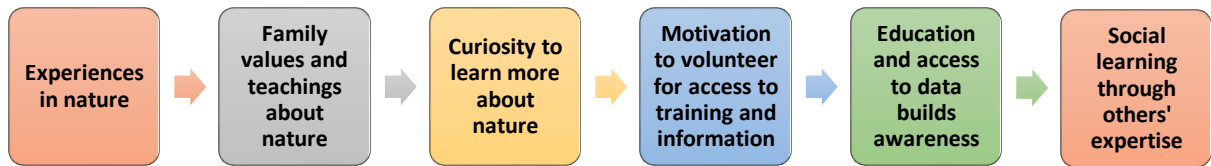


Figure 5.5 Early experiences link cognition, awareness and social learning

5.4 Theme 2. Identity, environmental ideation and belonging (Identity)

Identity and a sense of belonging can be associated with a particular place, type of locality or community, and they can also be demonstrated by involvement in interest groups and hobbies. Theme 2 (Identity) is described in Table 5.4, and the categories and subcodes are depicted in Figure 5.6. The way a person experiences nature can define an identity. Explored here are some concepts that distinguish these interest-based identities from those that define an ‘environmentalist’, and also how some identifying characteristics may change over a person’s lifetime. These concepts are important for the research questions of this study because they relate to personal identity and place attachment, and whether or not demographics play a role in the concept of environmentalism and volunteerism.

Table 5.4 Theme 2: Identity, environmental ideation and belonging

| Theme | Description |
|--|--|
| Theme 2: Identity, environmental ideation and belonging (Identity) | This theme relates to the interests people have in terms of hobbies and community, but also explores people’s ideals, their sense of belonging and place attachment, the influence of demographics and how they identify or understand the term environmentalist (Identity). |

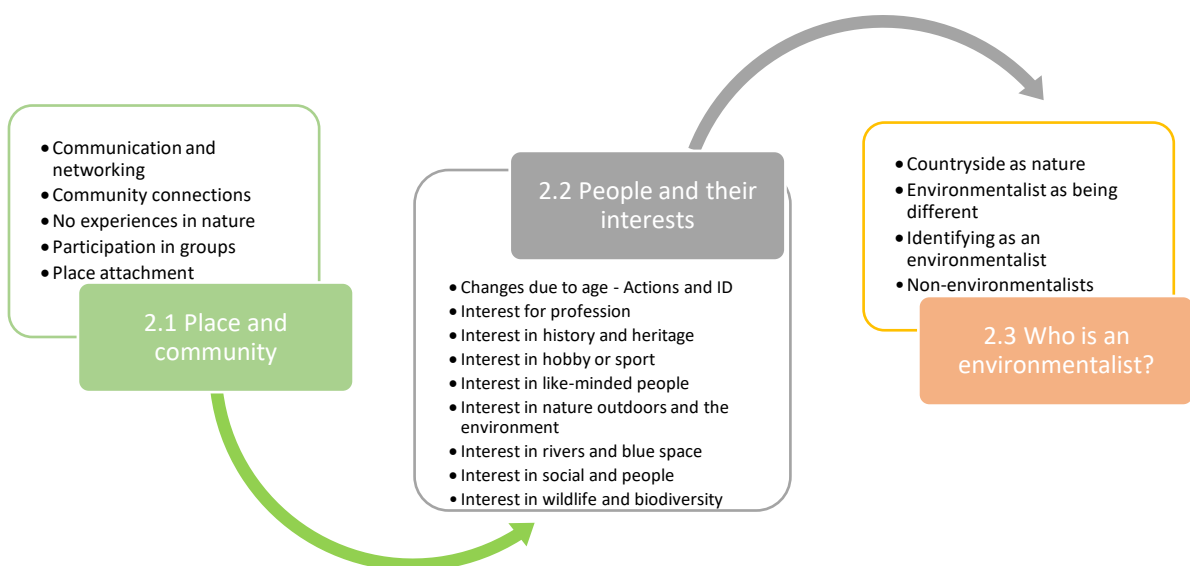


Figure 5.6 Theme 2: Identity, thematic categories and subcodes

5.4.1 Place and community

The attachment to place or community provides a sense of identity or belonging, and the childhood memories of many respondents were associated with a particular place. While they sometimes gave descriptions of the locations such as “*playing beside and in the river in the field behind my house where we walked the dogs*” or “*swimming in the river near my grandmothers farm,*” they also referred to the particular place or river by name, suggesting that the particular place held importance for them, and perhaps an attachment. For example;

learning to swim in Nenagh River at a place called "Murty's Hole"!

Watching fish jump in Tallow Co. Waterford where I lived as a child

I grew up by the Shannon estuary, I lived by the river garnet in clare I used to find fossils there and go beachcombing for lamprey etc

My earliest member [sic] of spending time by a river would be my family occasionally spending time walking on a nature trail near our home (&[sic] 5 miles, we'd drive). There was a stream there which led to the Boyne just a twenty metres from the trail car park. During my teen years we would swim in the river around the same place almost daily

I come from Adare and there was a small stream by my house that all the local children used to play by, it had wonderful limestone steps down into it, it fed into the Maigue.

River Maigue down the end of my cul de sac in Croom, used [sic] visit 3-4 times a week and listen to the water and swim in summer.

It was at the bottom of our field and we used to walk along it & in under the bridge which crossed the main road at Banogue. Sometimes it used to flood onto our field, so we used an old tin bath and a plastic baby bath & tried to paddle around

Throwing sticks for my dog in the Blackwater river behind my house.

the mouth of the Burne, Scotland, paddling in shingle, peering into the water, Stepping stones following the river upstream, reflections depths, wildlife, bridges,

Some respondents described rural upbringings with references to the countryside and farming activities: “*bringing cows for a drink many years ago*”, “*Washing my feet to cool down while making hay in the fields*”, “*Brought up on market farm, outdoors in nature was our free time*”.

Interestingly, a number of the respondents simply responded that they were from a farming background or grew up in the countryside, such as “*I am a farmer,*” or “*I love nature, I grew*

up on a farm,” with the implication that their childhoods were predominantly spent outdoors and in nature. This suggests a sense of belonging to rural regions and the countryside, but also a particular type of nature experience. This distinction between different types of nature experiences could have implications for the concept of what is ‘nature’;

Outdoors was our playground on the farm. Cats and dogs and cows etc. Cycle of nature was part of our cycle of play.

I grew up on a farm. Being outdoors in nature is a very natural thing to me.

I grew up on a farm in rural Ireland. Many positive experiences of being outdoors [sic]

I grew up in the countryside on a farm and the wildlife was plentyfull [sic]

I think any positive, enjoyable experiences that occur during childhood would likely result in a positive appreciation & interest in adulthood. I grew up with a rural farming background.

rivers didn't really feature regularly in my childhood, except [sic] for going to the river near my gran with my parents. On the other hand, being on my grans farm and learning where the snowdrops, the primroses, the daffodils, the wild strawberries grew that had a huge positive effect on me.

The description of the region of respondents’ residence was not only noted in relation to their belonging or identity, but also in terms of how it influenced them. For example, being raised on a farm or in the countryside versus in the city;

“I grew up in a countryside with animals and a big vegetable garden, which gave me an awareness and certain understanding of [sic] the natural environment, natural cycles, interdependencies in ecosystems and our (human's) dependency on nature as back then my family was 'fed' by the nature in a more direct way and we had to look after our animals and plants in order to get our nutrition. This is not the case for me now (living in a city) but this knowledge and appreciation will definitely stay with me for life.”

Two respondents claimed to have had no experiences in nature due to where they lived, but this lack of childhood nature experience was very influential, particularly when they learned what they had been missing; *“Where I grew up, no outdoors, but now in Ireland the outdoors very much influences me”, “I grew up in the suburbs so getting out in nature was a rare treat. As an adult, I've made it a priority.”*

In response to projects they would like to see, a number of respondents focused on local community-based projects, including natural and cultural heritage. This demonstrates an

interest in increasing community activism or bringing improvements to their locality, and thus a form of place attachment;

I would like our community to support the local river and the native broadleaf woodland we have. As well as the history on our river

I would like to see the community care for the historic monuments on their doorstep. This village has extensive poetic history and it is unrecognised

Planting trees, community garden allotment

Paid nature conservation corps, community farm, community garden, community woodland

community orchards

Community centre needed and community led activity

programme of community education and awareness on ecology and environment [sic] based in local park

A community Garden/Wildlife Area. Display Boards showing features in the parish e.g Hills, Rivers, Heritage areas, Woods. Another Board detailing wildlife local to area

There were also respondents with interests in preserving history and heritage sites (e.g. historic monuments, poetic history, reflections on generations past and how they used/viewed the river). This still relates to place, but place in a different time.

Similarly, in the focus groups, the geographic locality in which they were raised influenced childhood experiences, and were credited with being a motivation for environmental activism;

“Everything, from where I’m growing up and all of us growing up in suburban and rural communities, like the great outdoors were free, so my passion is just to try and save that.” (PT1)

There was also a focus on community activism and social connections in the focus groups, but only for Participant 6. She was very involved in volunteerism, but community involvement was particularly important as it was a value her father had imparted to her;

...community involvement. My dad more than my mom, he’d be out at meeting every night of the week with every single different community organisation and you know that rubs off ... I certainly modelled myself on him. (PT6)

Key Informant 1 was influenced by his family, but for him, it was a particular place and location that was the stronger influence;

My uncle, I suppose, fished more in the sea. He wasn't that interested in fishing rivers, but because I lived here on the farm anyway and the countryside and there was little river stream thing, small little, well we call it the river, but it's about two to three metres wide, and there was lots of brown trout in it, and I ... couldn't keep away from it. (Key Informant 1)

The specific locality was important generally, but for most of the River Guardians (focus group 1), they volunteered because of their strong interest in and attachment to rivers, nature and the environment in general and not because of a particular place. The impression is that they would seek out opportunities to volunteer for environmental causes wherever they lived. *"I lived between my two local rivers so I I [sic] kinda was never away from them."* (PT1) and *"I grew up along the River Severn in the UK, which is like a massive massive river, so it's always been an important part of my life."* (PT3)

Three participants of the Maigne Volunteers (focus group 2) were Tidy Towns volunteers. While they wanted to participate in a volunteer project that would help their local rivers, Participants 5 and 6 volunteered with the citizen science project because;

Tidy Towns now put a lot of emphasis on the Sustainable Development Goals, one of which is life below water and ... I got interested in it from that point of view... when I heard of this information evening and it was on down in Kilmallock, I said, there's something, there's a box I can tick under the life under the water Sustainable Development Goal. (PT6)

Volunteering for Participant 6 was what made her feel connected to her new locality, but her greatest motivation was the social, community connection; *"it's been great hearing all the stories about the river, learning about the river, and beginning to feel a bit connected to my locality which as a blow-in has been great."* (PT6)

Key Informant 2, a keen farmer, relays; *"I feel a huge attachment to my own place because I was brought up there, so I know every blade of grass in the place."* It is the familiarity and his childhood experiences, and that the land had been owned by his family for generations that makes him feel attached to place. *"I'm a farmer myself and I'm a farmer's son ... and I'm a farmer's grandson and a farmer's great great grandson ... and our land has been in the*

family for forever ... I can go back to the 1840s so we have a history of farming on the land."

Farming and being his own boss and owning the land gave him a sense of freedom, and being outdoors was a part of farming.

When he describes other landowners, he felt the attachment to place is also partly due to Irish history,

there's a huge attachment to land in Ireland ... because we didn't own our own land ... going back to the 19th century and 18th century and 17th when there was landlords and now we own our own and it's a huge thing in Ireland about owning land ...so people are very very close to passing it down to generation. (Key Informant 2)

One farmer on the questionnaire survey added a comment, "*From a farmer's perspective nature is important but land is priceless!*" Whereas respondents implied that nature and a farming background were the same, this farmer does not seem to recognise a connection between agricultural land and nature.

As well as farming, Key Informant 2 is also keenly interested in history and preserving heritage, and he feels strongly about instilling traditional values on his son,

I love that ... to see history and the people ... that walked the land ... tilled it ... my son when he was six or seven he was in the car with me one day and ...we passed a guy on the road another farmer who ... was going to the shop with a horse and a cart ... I said look at that ... remember that now ... he was the last of that...I have that in him that sense that ... we're all just passing through so you just have to try to pass it on as best as you can and look after it. (Key Informant 2)

He summarised his interests as, "*Fields and the river and names it's a huge...interest I have.*" He enjoys his time in nature and is passionate about his land, but for its economic value and that it is entrenched in family history. He is aware that the land provides ecosystem services and benefits for his cattle, and he wants to be a "custodian" who preserves the health of the land and the river for the future without impacting it negatively, but he identifies himself as a lifelong farmer from a long line of farmers, and distances himself from being identified as an environmentalist. What is clear is that his mind-set does not prioritise environmental protection, but protection of the land and parts of the river that he privately owns.

5.4.2 People and the interests that distinguish them

Hobbies and interests help inform the self-identity of a person. This can also relate to place because outdoor sports and recreational activities depend upon a particular type of habitat to conduct the activity. A hobbyist may also join a local interest group because it is convenient, and then the attachment can relate to the community within that locality as well. This thematic analysis attempts to distinguish and separate themes into categories, however, place and hobbies and natural environments are intertwined and connected. In this section, the diverse and varied interests as adults are explored.

When asked how they currently spent time in nature, for those who chose 'other' than the options in the quantitative portion (i.e. fishing/angling, exercise/sport, recreation, work, scenery and wildlife, relax and de-stress, walk the dog or meet with friends), there were activities such as kayaking, dragonboating, cold water swimming, camping, fishing, photograph, golf, shooting, sailing, swimming, archery, rowing club, painting, hiking, mountain biking, exercising, game hunting, and gardening. These activities, and joining in hobby groups could help form an identity.

Identity is more evident when responses to the query "How did early childhood experiences influence time in nature today" include identifying characteristics, such as "*lifelong angler.*" The phrasing indicates that this respondent identifies as an 'angler' rather than referring to the activity of 'angling.' Other responses that may demonstrate identity are those that mention lifelong interests based on the influence of their early childhood experiences;

Always loved the water, especially the sea, but coming back more and more [sic] to rivers as I grow older. I love getting off my bike and looking over bridges or walking beside them on tow paths

This exploration into the streams and its surrounds started a lifelong love, am still walking by waterways, poking about in canals and watching river ecosystems four decades later

It started a life long relationship with angling which grew into a wider interest in nature and ecosystems

Developed a love of outdoors which I still have, it is an ingrained love

Profession is an identity, and some people spend time in nature due to their jobs; *“Coillte forester,” “For travel to work,” “Work research,” “tour guide” or “I now spend much more time conducting field research than desk-based work.”* While others indicate that they choose to work in a particular field due to their interest in nature and the environment; *“I’m practicing as a nature-based landscape architect and we also give a fair bit of the land here over as nature reserves, fencing off and planting trees + low intensity farming,”* and *“The boy became a man and rivers and fly-fishing became both a past-time and a job.”* One person singles out the river as the motivation to work outdoors *“I wouldn’t be working in the environmental education industry if it weren’t for the river.”* This also follows with focus group members; *“I work in nature and I have a great interest in nature and I’m interested in doing things that are positive for the environment to offset some of the damage caused by humans.”* (PT2) *“I like being outdoors yeah. All my life I worked outside. I like the outdoors. Things like rivers, streams, mountainous areas, wooded areas, it would appeal to me.”* (PT5)

Demographics such as age also informs identity, but it is not fixed and changes over time. There are recurrent references to people, either themselves or others, changing behaviour, feelings or perspective over time; *“It made me appreciate how much more relaxed I felt in natural environment, particularly [sic] as I got older,”* And *“I am a farmers daughter and spent alot [sic] of time working on the farm as a child, during my late teens and in my 20’s I spent little to no time outdoors. Now I have come full circle and crave the outdoors and the emotional connection and sensory attachemnt [sic].”*

Also observed are references to a change in the times that influence actions and perspectives; *“No young anglers, and though most modern fishermen practice catch and release it’s essential we have guardians who will report pollution, dumping and illegal fishing.”* This respondent recognised different methods of angling from the past, and this is potentially due to regulatory and policy changes.

Times being different from the past also refer to different parenting methods, and this is part of what impacts childhood experiences and thus the future impacts and influences of these experiences *“Being a child in the 1970s involved spending vast amounts of time outdoors esp in summer. I lived near the Shannon, with nearby woodland also, and me and*

my friends would regularly visit those areas for recreation (climbing trees etc.)” and “Making rafts from barrels and planks (most activities in water as a child not allowed now! Mostly due to helicopter parenting, reduced freedom for children and health and safety concerns).”

Participant 1 in the River Guardian focus group noticed that his perspective changed in adulthood. He suspected that there were negative changes in environmental condition, but he was not confident that his memories from childhood were reliable so he disregarded them until he began volunteering when it was confirmed for him that he had been accurate;

I’m looking at it now from a different perspective, I’m grown up, I’m an adult now and that’s how things look from an adult’s perspective ... when you meet like-minded people and when you get involved in these projects, you realise now your eyes and mind are telling you the truth, that things aren’t the way they were. (PT1)

Key Informant 1 recognised changes in perspective from when he was young. He mentions the desire for knowledge based on nature piquing his curiosity. Initially, he was focused only on fish, but the desire to learn about ecosystems and the entire aquatic environment grew along with his knowledge.

I have developed a lot of my knowledge ... when I was a child you just maybe see, perhaps I just saw the fish, they were sort of an enigma you know there at the bottom of the stream and how would I catch them, and so it was a bit of a narrow focus maybe in the beginning, but now as my life went on I started to get much more of the wider picture of nature and had learned a lot about it you know from being in the natural environment and well, it’s just, it’s natural to me. (Key Informant 1)

But ageing has also influenced his activism, and he indicates a belief that activism is for young people.

I must be getting too old ... I don’t seem to have the time for more activism. ... I lost a bit of the fight. The fight is going out of me I think in many regards. So I just want to get through my day’s work and not too much hassle outside of that, unfortunately, you know I’d like to be more energised and yeah kind of out there campaigning, and but I don’t think it’s for me now. You know, I think you’d have to get younger recruits.... I’m not as patient ... getting a bit grumpier in my old age. (Key Informant 1)

Key Informant 2 felt that modern farmers are under more pressure than they were in the past, “*much more stressful and people are very stressed now ... okay, you get paid, but they want a lot more from you.*” He also believed this was related to age and the demands of family life;

The younger people are more driven, they are more target-orientated and they are more focused ... they want to drive production. ... I suppose they're also paying off loans ... trying to put kids through college or ... kids through school ... or build a house. ... You have to make money like – the difference is when you get to the other end you're – you're not old, but when you're not under as much pressure you can just ... relax and enjoy life ... cuz you only live once. (Key Informant 2)

Key Informant 2 also noticed a difference in terms of changing times. His father had been an avid fisherman and he felt;

“fishing is kind of dying - younger people don't fish ... most of the fishing people here are all the older people ... they grew up fishing ... in Ireland in the 1940s there was nothing to do really only fish and hunt ... if you have a play station and all this kind of stuff ... it's a different world really.” (Key Informant 2)

In summary, time, ageing and changes over time are recurrent concepts that relate to identity. Changes in priorities, perceptions and behaviours influenced by family, and time spent in nature ultimately become a means of identifying oneself.

5.4.3 Who is an environmentalist?

Self-identity as an environmentalist was determined by various factors, such as, respondents using terms describing nature and the environment as an essential part of their lives and daily existence. For example, instead of responding how their early experiences in nature influenced their feelings about nature as adults, they used terminology suggesting that being outdoors and within nature was an integral part of their identities; *“Its who I am,”* or *“Always. Being outdoors and loving it made me who I am now,”* or *“Established a way of life in terms of appreciating nature.”*

However, there were many references that were more vague, and so difficult to categorise. For example, *“I am a real outdoor person,”* could relate to hobbies such as farming, hunting and fishing, so not necessarily an ‘environmentalist.’ Also, *“It was a part of life. Rafts and catching wildlife,”* while he describes nature experiences as integral to his life, it is in the past tense. While focus group and interview participants made similar comments, such as *“It just kinda encapsulated the kind of person I am”* (PT1) and *“I’ve always had an environmental background,”* (PT3) there was more depth and elucidation provided to the views surrounding the concept of being an environmentalist.

If environmental action is what defines an environmentalist, many questionnaire respondents discuss their current volunteer activities, mostly local clean-ups and litter picking, some with an organised group and others on their own or with family. The next most popular volunteer activities are Tidy Towns and biodiversity recording with citizen science projects. Citizen science could demonstrate concerns for nature and biodiversity, but Tidy Towns and local communities clean-ups might more be based on attachment and interest in place and community. One respondent appears to be a serious environmentalist based on her actions;

I used to belong to Earthwatch in the 1980s. I coordinate Green Schools in the school where I teach. We partake in Team Limerick Clean up at school and at home in the community. I am a member of BSBI Botany society of Britain and Ireland.

Most participants of the focus groups had lifelong inclinations towards nature and the environment, and for some, their identity as an environmentalist made them 'different' or even outcasts; *"I think the term when I was growing up, was 'weirdo' because I was the one that wouldn't understand and break things or you know fascinated with frogs and things ... there was a difference in me, there was a thing with me that always needed to be around nature and around rivers."* (PT1) and *"Some people it's ok, some are indifferent and some are derogatory, you know if you're an environmentalist it's like having an illness of some kind."* (Key Informant 1). He continues;

I would be probably considered by the entire family and relations and probably a lot of people ... to be some kind of environmentalist... You can make different interpretations of what they mean ... I think I'm known slightly fairly widely among the people that know me that I lean towards the greener side of life ... I'm not sure how I got that reputation, I must have obviously spread and given vibes off in enough places for that to happen for me to earn that. (Key Informant 1)

He recognises that the term 'environmentalist' is vague and indefinable, but he accepts that he must be one because other people recognise something in him and label him as such.

Participant 7 also mentions other people's judgment setting him apart;

I'm always associated with nature. And when I was young... I wanted to see this rabbit, where this rabbit goes, where this rabbit lives, so ... from very early days I was ... mad for nature. Nature is unbelievable because you just can't beat it. There's a quarry about the mountain beside me and it was a quarry 20 years ago and now it is back again as a woodland. It's after growing itself back. Nature can heal itself. (PT7)

He is very aware of nature and environmental changes around him, and admires nature's power and tenacity. Participant 1 defines the other volunteers by their dedication to environmental protection, *"They have such interesting backgrounds, and such commitment and passion for the environment."*

It was also clear the term 'environmentalist' was perceived differently for different people. Participant 7 interprets being an environmentalist as awareness and thinking about nature;

I have no qualifications whatsoever... so I don't know whether environmentalists like to eat their own food but that's me... environmental issues ... go hand in hand with nature. So if you're into nature, you're into the environment. You can't separate them... I would say that I'm aware of the environment and nature, and yeah, it's a big part of my thinking. (PT7)

Participant 6 also mentioned qualifications, but she's less confident about whether she earned the label;

I'd love to ... I don't have any qualifications that would qualify me to be an environmentalist, I'm a health care worker, but yeah, I would love to think that I am working for the environment. Doing bits anyway, I suppose that's what an environmentalist is. (PT6)

PT6's hesitation may also be in part because her priority is community involvement, and she differs from all the other focus group participants; *"I enjoy being outdoors more than indoors but I'm not a huge outdoors person either."* Participant 5 believes;

I would be an environmentalist, but an environmentalist from the point of view that I would worry about nature itself. I wouldn't be worried about the political side of it, I'd let that for somebody else. (PT5)

These references about academic qualifications or political involvement being a part of an environmentalist identity highlights potential misconceptions, but ultimately each decided that an environmentalist is someone who worries or thinks about the natural world and works to protect it.

However, one could not infer an identity as an environmentalist simply because someone works to preserve a natural habitat where they regularly conduct a hobby. The motive behind the desire to protect seems to be the distinguishing characteristic. There are people who perceive nature as a resource (e.g., boating, fishing or hunting), and they want to

protect it so that they can ensure continued access to their preferred activity. Whereas an environmentalist might be more appreciative of nature for its intrinsic value, and even if they are lifelong anglers, they might sacrifice the ability to do so if they believed it would protect the river; *“I gave up angling. I just dedicate myself now to 100% conservation...I started my own conservation group this year.”* (PT1)

Key Informant 2, is a keen farmer first, and while he is aware of environmental issues; *“I’ve always been interested in the environment ... you try to work with nature ... You know you wanna make a living and you want a good standard of living ... you have to make money like but at the same time it needn’t cost the world,”* he would not identify as an environmentalist. When asked if he would speak out about changing practices to be more environmentally-friendly to his farmers association group, he said *“It is becoming a lot more fashionable to actually speak on behalf of the environment [and] it’s easier to talk about it, not to feel you’re being ridiculed.”* (Key informant 2) This is an indication that even in farming communities, times are changing in how environmentalism is perceived.

The interpretation of what is ‘nature’ may differ between those who identify as environmentalists versus those who love the outdoors. For example, Key Informant 2 relays how he feels about his own land compared to spending time in a public park;

There’s always issues, but I think it can give you a good quality of life to live in the countryside and you can, you have a lot of freedom. I know you don’t have stuff like that’s at your door, but there’s a lot to be said for living in the countryside and living by the river... it’s like your own part if you know what I mean. Like you know people go to work. I mean, ... we go places with our friends and they want to go see a park right and I’m kind of walking around this park and I’m going, yeah, right, because you see for them, they work in a hospital, in a lab and the one who works in revenue for the government like for them walking around the park is special but for me it’s like work really. (Key Informant 2)

His love of being outdoors and in nature goes back to place attachment and owning the land. He is not interested in the park, although the preservation of natural heritage is also important to him, and while he may not identify himself as an ‘environmentalist,’ if the definition entails acting towards the preservation and protection of the natural environment, then this may only be a matter of semantics. Of course, if an identity is

dependent on the prioritising of nature and the environment in thought and actions, then again, this is vague because it depends on the motivation. Changing times and changing attitudes may perhaps bring changes in how 'environmentalism' is defined. This farmer felt very emotionally connected to his animals, the countryside and his land, and he also felt strongly that while he wanted to make a good living as a farmer, he was only a "custodian" and that the land needed to be left the same as how he'd found it. He understands that he wants to "make a living and at the same time ... preserve the river and preserve the land ... because if you ... foot to the floor ... okay, you will make money now but there's no future like you'll have nothing it'll just wipe it out." This belief caused him to make efforts to adapt his ploughing practices to protect ground-nesting birds and a tree that had managed to grow in the middle of his field, believed to have been sprouted from a seed dropped by a bird. He also had strong superstitions that he called *Pishog* about protecting the land. He felt that something bad might happen if this tree or the ringfort that was on his land was ever removed, so he stressed to his son, who has no inclination towards the outdoors and was to inherit the land, that it was important that these always be protected. If the son obeys his father, can these bequeathed family values and influences to protect nature, in whatever their form, origins or intentions, make an environmentalist?

The concept of an environmentalist is a self-identifying term, and implies actions to preserve nature. When asked of the River Guardians in focus group 1 what differentiated them from a regular volunteer;

the River Guardians is specifically volunteers who are trained. So the River Guardians is a training programme for the volunteers... we use social media ... we attend an awful lot of conferences, so word goes around that way, and then we actually specifically invite people...so we will approach and ask people, 'we're doing this in 3 weeks, do you want to come and help us?' (PT3)

With their strong desire to learn about the environment, the appeal of the River Guardian training programme is evident, but the River Guardian programme also gives the long term, trained volunteers a sense of confidence, belonging and identity. Armed with the knowledge they acquired from the training, and having earned the title of River Guardian, they place themselves in the role of building awareness at conferences and trying to recruit

new volunteers to join them. When asked if they felt being labelled a River Guardian made a difference, PT1 answered;

It's in the name guardian, guard, a duty, associated with a duty, I'll stand on my post now but whenever it's time, I'll pass that on and it's somebody else's turn to guard it then. So I think there's a niceness to that... passing it on in better shape that I've got it. (PT1)

There was also a strong sense of belonging, whether it was due to a shared interest, identity or concept of environmentalism (Figure 5.7). When the River Guardians (focus group 1) were asked if they felt a part of team, they were all nodding while Participant 1 responded;

A community more than a team. I feel part of a community, and what I mean by that we all come from different backgrounds, we all come from ... geographically different areas ... but we all have ... the same end goal or passion, which is to protect and sustain and have a better understanding of our environment and to help other people understand the benefits of looking after your environment. (PT1)



Figure 5.7 The concept and self-identity of being an environmentalist

Focus group 1 labelled themselves and each other as environmentalists, bound in a River Guardian group they considered a “community” due to their high levels of “commitment and passion for the environment” (PT1). This sense of belonging came from their shared values and commitment to act. They were also proud to participate in the focus group and get to know their fellow River Guardians on a different level and to share about the progress they made;

It's actually been very inspiring just to hear from everybody and a bit more about their background and the whys and the wherefores and what they're gaining from it all too, and it's been nice to have this meeting just to kinda learn more about everybody. (PT2)

Although a long-term volunteer ‘community,’ who had attended parties and river events together, they had never communicated about nor shared how much they valued working

together and how impressed they were with each other's achievements. An excerpt at the close of the interview is transcribed in full here:

PT4 *I just want to say, PT3, you were chatting about costs earlier and the costings for projects, and are they worth it – and I think the work you're doing around [W...]'s, the fact that you had a successful farmer in his bare feet walking about the soil, saying, "Oh my God this is so soft, this is so soft," that's priceless.*

PT1 *The rain dance.*

PT4 *There will be reverberations I think through the community. Somewhere you know.*

PT3 *I was pretty gobsmacked, to be fair, I was like, oh my God, [W...]'s taken his socks and shoes off, so yeah, and he couldn't get over – like, he's been a farmer all his life and he was going, "PT3, the soil is so soft," and I was like, "What did you think it was going to be?" Like I plant wildflowers with my bare feet all the time so I wasn't expecting him to come out with that, but at least he did it.*

PT4 *Yeah.*

RESEARCHER *Those are massive feats, feet and feats, to get a farmer to literally connect with the earth*

PT3 *Yeah to literally connect with the soil that he's been. . . so that was great.*

That this community of River Guardians were able to influence change in the perspective and behaviour of a lifelong farmer is an achievement. Participant 4 believed this would cause "reverberations" in the farming community as well; that a new perspective, from working with these staunch environmentalists, would influence change.

What is also telling is that the River Guardians were very excited and stimulated that they had caused this change. Participant 3 ended the conversation by saying that she was going to visit the farmer's farm again and see if the project they had been working on was successful, despite earlier saying that she had very limited time, and that she participated in volunteerism because of the social interactions with like-minded people.

In summary, whatever interest drove them to become environmental volunteers, for example, botany, boating, wildlife, forestry or fishing, or even an interest in community, place and commemorating the past, ultimately, nature has become their hobby and passion (Figure 5.7). Ultimately taking action and making sacrifices to the betterment of the environment makes environmentalists, whether they identify as such or not.

5.5 Theme 3. Feelings and concerns about health and nature (Emotions)

Respondents frequently make unprompted references to emotions when discussing their time in nature, most being positive. Explored here are how nature experiences inspire feelings of well-being and emotional or spiritual connections to nature. There are also negative associations with nature, such as concerns for human physical health, safety, the future and climate change, as well as grief, despair and hopelessness at the deterioration of environmental conditions. Theme 3 (Emotions) and its categories and codes are included in Table 5.5, and the categories and subcodes are depicted in Figure 5.8.

Table 5.5 Theme 3: Feelings and concerns about health and nature

| Theme | Description |
|--|---|
| Theme 3: Feelings and concerns about health and nature (Emotions) | This theme centres around emotions and feelings, be they positive feelings of connectedness to nature, well-being and happiness from time in nature, or negative feelings with concerns about safety, or hopelessness and despair about the future or the state of natural environments (Emotions). |

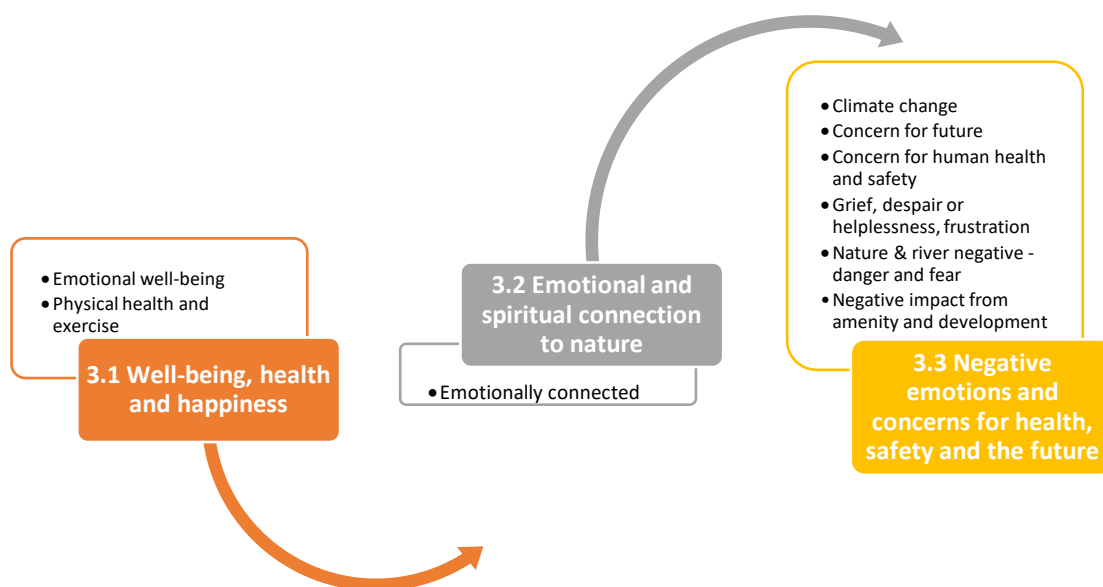


Figure 5.8 Theme 3: Emotion, thematic categories and subcodes

5.5.1 Well-being, health and happiness

The word 'happy' was used 184 times in the questionnaire responses, and also other words such as beauty (24), peace (17), relax (12), calm (5) and joy (4) were considered determinants of positive emotions from spending time in nature. What makes people happy is illustrated in statements: *"Enjoyment. Fresh Air. Scenery. My Kids, my wife and I watched*

an otter last year in the Shannon near our home,” and “Time in nature is central to my happiness and always has been - nature is restorative,” and “I am happiest when in nature and there is lots of wildlife. I now only admire what I see.” Additionally, many respondents explicitly mention well-being and wellness associated with time in nature, be they past or present; *“Living in the country, with a river running through our farm, time spent outdoors feels essential to my well-being.”*

A number of respondents, refer to nature as a tool to relieve negative feelings; *“still live on home farm and outdoors is destressor,” and “i would get depressed if i couldn't.”*

The river was singled out as particularly restorative and beneficial for positive sensory experiences; *“I love being near water, and the sound of flowing water,” and “Running water always fascinates me and is good for the soul.”*

For many people their positive childhood experiences in nature influence their current activities and perspectives in nature because they feel the same positive feelings in their adulthood that they remember from their childhood; *“I am very positive about spending time outside as a result of the very positive childhood experiences I had”, “It made me appreciate how much more relaxed I felt in natural environment, particularly [sic] as I got older.”*

While others focus on other people, either by recognising a shift in perspective or having the desire to share the experiences and benefits with other people; *“I try to educate people on the mental health benefits of nature,” and “Love of nature continues into adulthood and want to foster that love and respect in my own children.”*

These positive emotions and feelings of wellness of being in nature are very much supported amongst the focus group and interview participants;

I don't know whatever it was, birds, sound of running water, I always think that if no matter what mental stresses you have in the day or how bad things are, if you just sit beside running water or a river for five minutes just close your eyes and just listen to that water, there's nothing will soothe you quicker than any box of pills ... the connection between us and the earth and the rivers, and you know I feel that very strong, the feeling that I felt when I was seven I still feel today – I get it every time I go to the river. (PT1)

The focus groups and interviews had similar desires about providing future generations with the same positive emotions they experienced from time in nature;

things aren't the way they were and all I want, the only thing, is to try and stop, restore so that I can pass it on to my own son and my nieces and my nephews. I wouldn't like to think that I kinda went through life and just turned a blind eye and then not affording that next generation the joy that I got out of it. (PT1)

For Participant 1, there is a strong element of time in nature helping him cope better through challenging times; *"I just need to get out to the river or out to the shore or out to the woods,"* and *"being out doing the rivers has helped me be [...] a better father. [...] I try to look at his condition as being as wild as the rivers and as wild as nature. (PT1)*

Participant 2 benefitted from the sensory experiences, and the sense of calm and wellbeing from time in outdoors. This was regardless of what the interpretation of nature might be, either wild or cultivated;

I just I like the idea of just being out and about and your day is your own and you decide what you do when you do it and how you do it. That's kind of why and I like working with animals anyway and in nature anyway... being by the river and when I get my cows at 5:15 in the morning and you're by the river and you'll say June July and it's just getting light. It's really nice, because you can hear the river and you can hear the cows breathing and you know, it's just it's kind of it's hard to explain ... you're on your own really. Everybody's asleep and you're there and if the cows are in the field near the river ... I'll go down and I look at the river and look in, whatever it is about water, you just look at it for some reason... and you'll hear just the silence (Key Informant 2)

5.5.2 Emotional and spiritual connection to nature

Many respondents express feelings and emotions when relaying their experiences in nature, and the word 'love' was used 107 times in their descriptions, demonstrating positive emotions; *"It gave me a love for watersports sports [sic],"* and *"I developed a love of nature as a very young child and from an early age it was a source of recreation."*

Unprompted, respondents also describe feeling an emotional or spiritual connection to nature; *"Peaceful feelings; oneness with nature,"* and *"It's 'me time' connecting spiritually through nature."*

When asked how childhood nature experience influenced how they spend time in nature as adults, some respondents felt that their childhood experiences directly influenced their connection to nature as adults, *“That period engendered in me a connection which has persisted.”* Childhood experiences influence not only a love of nature, but also the desire to continue to have experiences in nature; *“It lays down how you will be as an adult,”* and *“It creates habits.”* Sharing the same enjoyment and emotional connection with their children;

A drive to or a walk in nature, usually by a river or lake was something that happened pretty much every weekend with my parents. These walks and talks instilled a love and respect for nature in me and have continued to be a routine for me as an adult with my own family.

Another respondent had concerns about her local river, but her phrasing demonstrates troubled, yet hopeful emotions about the power of nature to reclaim itself. She seems to recognise nature as a living organism and demonstrates feelings related to her observations;

The river I grew up beside was in my native suburb in Germany. I now live in Limerick near the Groody River. On exploring it with my children recently I noticed that the land around it seems very hurt. I [sic] has been dug up and dragged open by big machinery it seems. The land is not natural looking in the sense that the hills seem to be made by diggers and parts are very straight and flat as if dug up. A lot of trees are knocked over in a careless way. But still the relatively new mounds have been converted into fox hollows, new growth is covering many areas. The land looks like it is ready to be loved and cared for and could be a wonderful, charming place. Most of the time it is too wet to enter (or so I always thought), but a few lockdowns and a good set of boots have taught us differently. Unfortunately there is rubbish in many places and there are areas with stagnant, sickly looking water. Over the past 15 years willows have begun to reclaim the land and converted parts of it to a fairy forest with moss growing on stems and rustling leaves overhead. There is great potential here for some community efforts. Otherwise, time will do its best to heal and rewild the area.

A connection to nature was unequivocal and evident amongst the River Guardians (focus group 1); *“the connection between us and the earth and the rivers ... I feel that very strong.”* (PT1); and

with feelings towards nature and trying to protect it...and the value of it... and then there’s another level, of maybe it’s just where you get to in life where you realise that we’re all connected we’re all a part of it, so what happens to the rivers or environments within yourselves, so it’s a deeper level. (PT4)

Some respondents blame modern technology for the decrease in nature experiences, and they imply that this is one cause for the disconnect to nature: *“Increased pollution and*

absolute disconnection from people and community. Societal rise in addition [sic] to screens and devices leading to less time out doors for adults and children.” Participant 1 describes how nature shouldn't be “*a kind of an inconvenience that we see as we drive about in our cars and look out the window...people are so removed from nature,*” and feels that early education and awareness building will help build connections to nature.

It seems there are those who feel a connection and are compelled to seek out nature experiences, such as the two respondents mentioned earlier, who were devoid of early nature experiences, and so prioritise the outdoors as adults, while there are some people who are not at all predisposed to do so. For example, Key Informant 1 feels that a connection to nature was instinctive to him, and, as opposed to his father and his son, he sees himself and the rest of his family as completely connected to and a part of nature;

The whole environment, yes wildlife, what we call nature, but we are nature too, so, the water, it all comes together to make a beautiful picture ... my father had no interest at all, so I must have picked up a gene from a previous generation ... I've got a sister and husband in Switzerland and we keep ... exchanging pictures and things about nature ... our little group that's called 'Nature Watch,' and um my wife, and myself and them, and my daughter will be nature focused you know and my son is completely disconnected probably – (laughs) - and can't do anything about it ... Our son ... he's our technical genius ... While he's got no connection much with nature, he certainly has a very useful side to him. (Key Informant 1)

While Key Informant 2 seems to have perceived the concept of 'nature' differently from environmentalists, with the river that runs through his land, his emotional connection appears to be very strong, and he discusses early childhood experiences and the values his father placed on it;

The river's on our land ... I grew up on the farm and I'm farming it now ... so the river has always been obviously part of the farm. When we were younger, we used to swim in the river during the summer and the cattle drank from the river... my father was a fisherman, he was a member of the local angling club for, I think it was treasurer for 40 years or something so. So the river has been a big part. My father was really loved fishing he fished all his life for trout um fresh trout freshwater trout and uh the river for me now is part of my farm um it's different now in the sense that cattle don't drink from it anymore ... I was in an environmental scheme and the environmental scheme wanted you ...to keep cattle out of the river because they were damaging the bank of the river and they were also obviously polluting the river so the cattle don't actually go into the river any more ... it's different because you know water and water pumps and wells are so much scarier so it's a different world to when I grew up like, so the river now probably has grown more wilder more because it's fenced off now and it's not..

it's there's no cattle walking up and down the banks and knocking the banks of the river (Key Informant 2)

5.5.3 Negative emotions and concerns for health, safety and the future

Not all respondents had positive early experiences in nature, and as highlighted in Theme 1, this could influence perspectives as adults about the river; *“nearly drowned a few times so led to fear of being in the water and reluctance to swim.”* There are also people who, while they may not indicate causal connections, associate rivers with danger, death, fear and suicide; *“Sadly, much of the news regarding the river over the last decade has been associated with suicide attempts and a need to patrol to prevent this.”*

Some of the concerns about safety relate to poor water quality and pollution, including concerns about infectious diseases from spending time in the river or drinking water (Covid-19 is handled in Section 5.8); *“I question has the water quality at ringmoylan pier been evaluated recently. Large amounts are now swimming at the pier and sometimes swimmers have a brown sediment marking on thir [sic] faces. This washes off but leaves me wondering if the water quality is safe.”*

For some, the increase in signage alerting people about water safety or poor water quality was an indication that swimming was unsafe; *“We all swam in the river as children... As adult I saw notices say water polluted and not to swim. Now I swim with caution. I have no faith in water quality monitoring and would like reassurance re same. Also no eels anymore and little fish in comparison to past. Also feel annoyed at treatment of migratory salmon.”* One respondent commented; *“Cattle effluent now more of an issue than 30 years ago. A lot more signs and safety concerns in the modern world so you dont [sic] see kids swimming in rivers due to farmer fears of being sued”* highlighting agricultural pollution.

Negative aspects of nature, such as litter and pollution, were discussed in Theme 2 (Identity), and many of these were emotional, but in terms of concerns over danger, human disturbance is also a cause of concern for some respondents; *“The river bank often has sulky racers and quad bikes which make it dangerous. It is not suitable for such activities because it is narrow”, “The biggest negative is the dog dirt, The walk is FILTHY, Last night there were 27 different piles, it is making the walk unusable. I have had poo bedded in my buggy*

wheels, thus in my car boot etc. Recently I helped a lady who slipped on the walk on dog excrement. It is now dangerous.”

Deep emotional connections to nature can also cause negative emotions, such as sadness, despair and hopelessness. These often include concerns about future generations being able to have positive nature experiences. While not all statements include words expressing emotion, they are easily inferred;

There are far less of everything, trout, salmon, fresh water clams, dragon flies, insects, bees which makes me sad and fearful for my kids.

Would like to see local flower beds planted with [sic] biannuals, breaks my heart seeing the council workers pulling out those flowers and planting new ones few times/year.

Pollution from increasing dairy [sic] industrial farming. Rivers only seen as a way of moving on pollution.

In the streams feeding into the river reduced wildlife due to farming practices. In the local turloughs removal of all vegetation which supports invertebrates and no safe hatching for water hens and ducks The ducks were shot as it was believed they might carry bird flu.

Wildlife along the river is not as plentiful and the volume of dog poo, where a large number of the community use the riverbank walks, turns my stomach.

One thing I really hate to see is plastic stuck in overhanging branches and broken river features like weirs or banks washed away, it is as if the river has been wounded.

Despair and hopelessness were felt by those who identify as environmentalists in the focus groups; “massive grief around what’s happening with the biodiversity and the climate” (PT3) or “I think we seen one fish, one small little fish on the way back, and I just thought that was depressing...I’m sure well most days, we’ve gone through despair and maybe anger at times, hopelessness when you see everything being damaged and destroyed the way it is,” (PT4) and “as bad as things are at the moment I think it can be better. It can slow down and possibly a reverse in time, but I am sceptical enough about that where we’re going unfortunately - I hate to say that now to younger folks.. It’s just another page, another chapter in this history of one thing after another being destroyed.” (PT5) These negative emotions are expanded on in the next theme in that they are a main motivator for environmental volunteerism.

In summary, emotions (theme 3) play a key role in environmental volunteerism. Feelings of wellness from time in nature build emotional connections, and the loss of nature can cause the despair and grief that can spurs people to taking environmental action.

5.6 Theme 4. Environmental stewardship, volunteerism and action (Behaviour)

This theme deals with the act and experience of volunteerism, group leadership and some of the motivations, challenges and barriers to volunteerism. Also explored is if volunteerism inspires any transformations in perspective or behaviour. The focus here is mainly on the key informant interviews and focus groups responses. Theme 4 (Behaviour) is outlined in Table 5.6, and the categories and subcodes are depicted in Figure 5.9.

Table 5.6 Theme 4: Environmental stewardship, volunteerism and action

| Theme | Description |
|---|--|
| Theme 4: Environmental stewardship, volunteerism and action (Behaviour) | This theme explores actions and volunteerism, pro-environmental behaviours and environmental stewardship, and it highlights the barriers, motivations and opportunities that may influence these behaviours (Behaviour). |

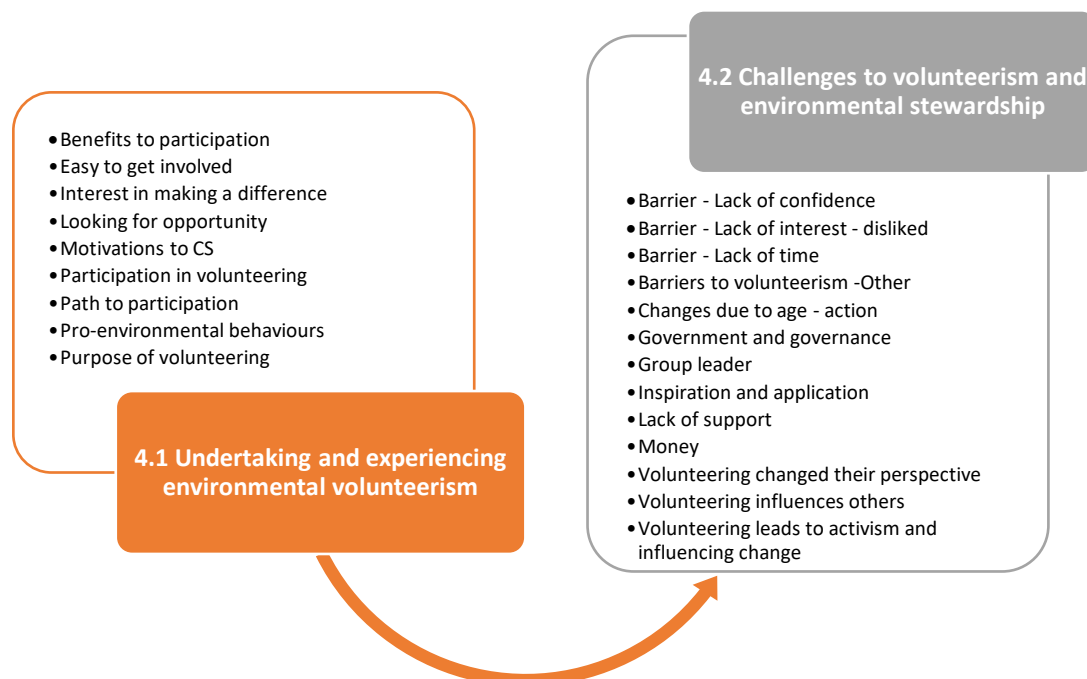


Figure 5.9 Theme 4: Behaviour, thematic categories and subcodes

5.6.1 Undertaking and experiencing environmental volunteerism

Some motivations for volunteerism are covered in earlier themes, such as cognition and the desire to learn, but what also motivates volunteers is the desire to teach and spread awareness. There are also motivations that connect to earlier themes, such as identity and the protection of attachments for now and for the future, and with emotions, it is continuing to experience positive feelings and those of connectedness to nature, as well as alleviating any negative feelings of loss of healthy natural habitats.

The benefits of nature-based volunteerism have been referenced throughout this thematic analysis, such as the enjoyment of spending time in nature or feelings of well-being, free training, or socialising with like-minded people. Explored here are some of the other aspects that drive and motivate volunteers, and what may differentiate short term volunteers and dedicated, long term River Guardians.

The benefits for the River Guardian volunteers are encapsulated by this statement;

the craic's in our team, we have the best time, everybody gets on brilliantly, there's no difficulties at all ... you're learning, you're having a good time, you're doing something positive, and yeah it may be a whole load of work for just a tiny little 100 yards ... so what? ... I think sometimes our modern evaluation methods miss the ethics of the spiritual side of it and I think that needs to play a much more prominent part. To hell with the money, to hell with the tick boxes to hell with all of that. Like, we have just done this amazing bit of work on this tiny bit of river and the benefits to that little bit of river are massive and so let's just keep going... so I think it helps mitigate grief for me and it gets me out doing something. (PT3)

PT3 has shared that her experience of volunteering is fun and enjoyable because she is spending time outdoors with like-minded people, she is learning and she is making genuine, immediate on-the-ground improvements. The river has an intrinsic value to her, and she feels frustration when bureaucracy and funding needs prevent or delay action. Volunteering helps to alleviate some of the despair, grief and helplessness that she feels from witnessing the steady degradation of natural habitats. The benefits outweigh the disadvantages of it being a 'whole load of work' for such a 'tiny bit of river.'

The training provided by the volunteer organisation is a strong motivation, as discussed in Theme 2, but it is not only curiosity, it is about using the knowledge to make a difference, "I find the training absolutely fantastic. I don't find any of it challenging, well, to a point I

suppose, but it's all valuable, all the training. I'll try to make use of it as much as I can in the future." (PT4) Participant 2 uses the knowledge in his profession to perform responsible, nature-friendly forestry, but also to expand his work to nature conservation;

it's helped me expand some of the stuff I do for clients in terms of protecting waterways and improving biodiversity on projects and all kinds of stuff ... and it's been great in that regard. So it's also opened up other professional opportunities as well ... I'm the principal contractor for the nature-based flood management project, so I'm in charge of all the ground works associated with ... implementing leaky dams, stone dams, and bunds, etc. (PT2)

Making a difference also means improving or preserving these sites for future generations, but also that these future generations know that efforts were made. The desire for other people to get enjoyment from nature implies building awareness about the joy that can be gained from spending time in nature, but it also implies the desire that other people could appreciate nature more, and that might ensure that more people and future generations continue the fight to protect it. Their concerns over the future are a major driver for involvement as is the desire to share the love and enjoyment of nature and spread the desire to preserve it;

it happened on what I class as on my watch, like in my generation that something needs to be done about this. And then seeing that most rivers have gone in the same way in a pretty short space of time, like, talking 20 years maybe. So to find that the RT was there and the work they're doing and all the different groups, I just thought, yeah, that's worth, that's worth getting involved in. (PT4)

I wouldn't like to see it being degraded like it has been for a few years and I'm very pleased to see all the different groups around the river doing something in a small way maybe in each area to tidy it up, and I hope that that kind of progress with continue. We mind the river even for future people to enjoy it. (PT5)

I'd say that as time goes on, that if it continues the way it's going, there'll be less time for people along rivers because the quality won't be good. And I think that kind of inspires me a bit as well that you know that you can have more of an awareness of what's happening with agriculture and what's going on with treatment plants and ... the river seems to be a real dumping ground ... more aware of that. I'd stop and might read something about it now... and for my lads I suppose, to enjoy the river as well because it is very, it is really, it's the perfect country for it. (PT8)

These statements highlight efforts to alleviate negative emotions, and are often followed by references to the motivation of getting involved in volunteerism;

it's always been an important part of my life in that way, so it was an opportunity to actually do some of the practical work rather than just giving out about all the things that are wrong ... the personal benefit of the trust the activities that we do and the actions that we take help to offset some of the massive grief around what's happening with the biodiversity and the climate ... There's a lot of powerlessness in that situation ... and the Trust gives the massive opportunity for actually doing something rather than just sitting feeling miserable about it. You know it offers solutions and it offers doing rather than just sitting around saying oh the government should do this the government should do that. (PT3)

5.6.2 Challenges to volunteerism and environmental stewardship

There are many challenges and barriers to taking action for the environment which can range from finding opportunities, recruitment, lack of time and confidence. However, volunteering changes perspectives, influences others, and can lead to change.

One challenge for respondents was difficulty in finding available opportunities. A number of questionnaire respondents, when asked about their involvement in projects, or those they would like to see, answered; *"It's difficult to get involved when you don't know what programmes are out there and what they do", "Lack of awareness of groups involved."*

Focus group participants comment; *"there was never an organisation like that when I was in my younger years. If there had have been I would have been along with that organisation then."* (PT1) Participant 4 believes; *"it's the sort of thing I would have always wanted to be involved in. Personally, I think there's a lot more people out there ... That aren't aware that it's available."* (PT4).

A major challenge for community groups is recruiting volunteers. As mentioned in theme 2, free training about the environment is a motivation to volunteerism, so the River Guardian training programme should be attractive to those looking for an opportunity to get involved. Those who are interested in making a difference, will seek opportunities to get involved in local environmental projects. There are efforts to recruit; *"[Leader] is always pushing, 'we need more people!'"* (PT4), and the River Guardians can direct their energy to projects they enjoy.

That has been a challenge for us ... we've had to discuss about how do we retain volunteers. But you know for five years, it was slog. You know it was 'just keep going' and [group leader] did all the funding applications, and she's very very good at it, and I think once you've got somebody in who's really good at getting the money and

putting the proposal together and then you win those, and then you gather people in from the community to come and help you and then you build on that. You know, we got a good reputation by starting off slowly and just working really, really hard at building that community. But it's not actually been that easy. There have been times in the past few years, where it's been like 'god what are we doing this for?' (PT3)

Lifelong environmentalists might seek opportunities or jump at them when they are discovered, and they are driven to remain by the push and the passion of their group leader. The leader or river champion is an essential component for maintaining and motivating volunteers;

[Leader] is such a driving force. She's very very very dedicated, like to the point of mania... her passion is very contagious as well and she takes people with her and she's a great diplomat ... We're minor components compared to [Leader] ... she's just so focused in making stuff happen. (PT2)

This was also evident with Participant 6 who contacted the researcher following the focus group as she wished to add;

I was regretting afterwards that I didn't mention [Leader] ... really went above and beyond for us on the first day that we did a test. At a few hours notice she came out to us and did the test with us. So supportive. Great comfort to have her there on our first day. (PT6)

But for those who are not as committed or long-term, it might be lack of pressure and commitment that they prefer;

...there was no pressure put on that three monthly or monthly. But I think we kind of felt especially because there were two of us that we could probably manage the monthly, so we just decided that night that we would give it a try, but there was never any pressure to do it...I think the fact that this is local is, it's just so friendly, and oh, I suppose no stress or pressure, so I just think you're running it really well and it will be a great thing to get more people involved because it's such a positive experience. (PT6)

that kind of set up was very good and there's no pressure on anybody to just walk along and have a look, and I just assumed that would be a big draw for people to come in and get involved like. (PT8)

Community groups get support and funding upon which they rely, but their success depends heavily on the continued dedication of their group leader. With the level of work necessary, in management of volunteers and projects, this may not be sustainable, *"this project and this project and this project, and we were like, what the bloody hell are we talking about now, and now I have it all up on my office wall ... so that I can keep tabs on it... [we] started*

to drop a few balls because it's just too much, and [we're] completely overwhelmed." (PT3)

The River Guardian's group leader had been a volunteer before she received funding. Very few people would have the ability, skills and personal dedication to this personal sacrifice, and this would certainly be a challenge to sustain.

The main barrier to joining or staying as a volunteer was a lack of free time. Some respondents to the questionnaire explained; *"No I do not have the time,"* or *"No, busy job and young family mean I have little free time, but would love to participate in some of these groups when my children are a little older."* This latter suggests a desire to participate, but at a later time.

Stage of life references were also made in the focus groups. Participant 5 became an avid volunteer after his retirement, and he lacked time to take on more because he already felt overextended with volunteer activities; *"When I retired, I was always interested in all of these things ... have I time to take on anything else? I'd have to tell you, I'm already in Tidy Towns, I'm involved with the Rivers Trust now as well, and we have some planning going on over the next ten years ... I'm also involved in the local men's shed now."* (PT5)

Participant 3, of the River Guardian focus group, was also overextended with other environmental volunteerism, especially when her children were young, however she did always maintain some form of contact and attended the social activities until she was able to devote time to volunteering as a River Guardian.

Despite lack of time being an issue for other River Guardians in focus group 1, Participant 2 was still committed to making the effort to volunteer. For him, volunteering had added benefits, he wants to make a difference, the training was enjoyable and it was useful for his profession. Perhaps this is why he makes time to volunteer despite; *"I'm so busy with life - I've got three wee kids, I run my own business, I help my Dad on the farm -he had a stroke last year, and I manage my own woodland here, so trying to find time to do stuff is so hard in general. But it would be ideal to take some of the kids along and get them in on it too cuz they absolutely love looking at insects."* (PT2)

Participant 4, on the other hand took a break from his lifelong angling hobby while his family were young, but he had always intended to return once his children were more independent; *“... when I got married, I didn’t angle very much at the start, I was very busy, had to go to work 9 to 5 didn’t have time.”* (PT4) It was seeing the loss of wildlife and changes in river water quality when he returned decades later that motivated him to volunteer for conservation work. He felt especially regretful and depressed that it had happened *“on my watch,”* suggesting that had he known the river was undergoing such a drastic deterioration that he might have become involved in volunteerism sooner.

For some questionnaire respondents, it is working in a group that they dislike; *“No, never participade [sic] in those organised groups, probably lack of time but did many of those activities on my own/with friends or family”* and *“Like to do my own thing.”* One respondent specifies that she had been involved but was put off by the other volunteers; *“Tidy towns wasn’t for me to [sic] clanish and bitchy sorry.”* The motivation to socialise with other people, like-minded or otherwise, is in the majority, and for the two female focus group participants (PT3 and PT6), it is unlikely they would conduct citizen science monitoring or solitary projects because a main part of the enjoyment and appeal for them is the social element. Participant 3 is a dedicated, lifelong environmental activist, yet, *“I can’t actually do the practical stuff unless there is the social involved as well. It has to be a merging of the two for me.”* (PT3)

Other barriers could be overcome, but only if the benefit was worthwhile. Enjoyable time by the river was a massive benefit for the River Guardians, but some work duties and the time needed to conduct undesirable tasks could be challenging. For example, attending long meetings indoors, *“I’m involved in a number of committees ... it just kills me to sit through two hour meetings every week and everybody’s talking about their different points of view and everybody’s different but I just can’t handle it, I just want to get out and here’s a project, here’s what we want to do, let’s do it, bang”* (PT2) or *“I have a really low tolerance for bureaucracy ...I struggle with that side of things”* (PT3). Key Informant 1 also finds the level of time commitment challenging *“an element of dread always sets in, you know ‘Oh my god no do we have to?’ I know it’s going to involve considerable time and maybe frustration trying to get a suitable group together ... If it was my job, you know, I probably wouldn’t*

dread it. That's always been the snag. I've already got a job." Despite this, Key Informant 1 is undertaking approaching his neighbours to try to implement reparations to a section of his river. He is willing to sacrifice valuable time and conduct a role he is very uncomfortable with, because it might make a difference;

It probably should be a worthy scheme if we can pull it off. It's on a bigger scale so far with farmers. If you have a group of a dozen or whatever in the one stretch, and neighbouring farms, then you would actually really probably make a difference to part of the river. And the influence to other farmers would probably be much bigger you know if they see this taking place on a significant scale to their colleagues you know upstream or whatever. But I'm dreading at the same time what's involved.

(Key Informant 1)

There are also suggestions that environmental volunteers are challenged in how they are perceived by others in their communities. Working for the environment, either as an individual, with a community group or with a state agency seems to become more about the people and their different identities than actual environmental stewardship. For Key Informant 1, being outside of an organised group was an important factor in dealing with barriers; he approached his neighbouring riverside landowners as an individual, an angler and a neighbour, and also one-on-one because he felt that efforts with individuals are more effective to elicit cooperation and change;

We called individually with each landowner along the way and someone advised me about that ... you get a big room full of farmers and put in an idea, you'll always get one that is negative and it can infect the whole gathering. If there is any sort of suspicion you know in people's minds about your project or reservations, they're very easily swayed if you have a negative person there to spread through the whole group. It's much easier one to one in their own environment in their own yard or their own kitchen or wherever to talk to them; and when we went out and did that, we got the best of cooperation from them. (Key Informant 1)

During his efforts to include all his neighbour farmers and landowners to participate in a fish protection project along a shared stretch of river, he will likely identify himself as a neighbouring farmer and angler, and not an environmentalist. This suggests an awkwardness and distrust between farmers and community groups or state agencies looking to protect rivers, which is an additional challenge that needs to be overcome. He needs to approach neighbouring farmers as an individual who is concerned about his own land and section of the river, and at the same time he is promoting social learning with his expertise as an angler, and with the knowledge he gained from the River Guardian training.

This is how river water quality in a catchment can improve, because while he approaches with the language of self-interest and place attachment, in actuality, he is creating a group identity, with his real goal being to improve as much of the river as possible for the sake of the river health; *“If you have a group of a dozen or whatever in the one stretch, and neighbouring farms, then you would ... make a difference to part of the river.”* If he was only protecting his interest, he would have only approached his neighbours upstream of his home, but his efforts included the downstream neighbours as well. His ultimate goal is to influence the community as a whole, and the farming community especially *“the influence to other farmers would probably be much bigger ... if they see this taking place on a significant scale to their colleagues ... upstream.”* Key Informant 1 is willing to make these added efforts as an individual, because the barriers are outweighed by the possibility that his project can cause far-reaching improvements in river conditions.

Participant 7 would agree that the snowball effect, that is, the spreading of interest and awareness, needs to come from a local, as when he was conducting water quality monitoring, a number of passers-by asked what he was doing; *it's better to have someone from that locality doing the test because they will straight away draw the attention ... if I was inside with a county council jacket on me and they didn't know me, they might just pass by.”* (PT7)

Participant 5 had a similar experience, but it was mixed with the distrust in authority, and some passers-by were concerned that data would be reported;

We had a big crowd and it was a nice calm evening and we were out doing the test there and ... a lot of people seemed to be right worried, they thought that we were taking samples and that we were going to report it somewhere but like, it would be kind of emphasised that we don't have any statutory powers ... that it was purely scientific ... maybe an hour or so beforehand and a couple of guys who just happened to be down the river walk ... they were 'what are you doing, what are you doing with that, and where is that going, and who else sees this?'... so I had to spend a bit of time and explain to them that we were ... just surveying and we were just gathering information on how trends might be going and whether they were improving. (PT5)

He continues that it would be helpful to get more public interest by sharing monitoring results periodically, and to make information more publicly available. Participant 5 noticed

that people were curious, but also that some were suspicious and distrustful until he explained that he was not a state authority and that the data would not be sent to one.

At the opposite end of the spectrum, Participant 1 feels frustration over the inaction of state bodies in protecting the environment and distrust of “*those who are supposed to be responsible,*” because he wants them to do more;

the next generation if they're armed with all the information that we have now, they're going to be some hell of a force to be dealt with by the people who are supposed to be responsible, the departments and governments looking after this...when someone's trying to tell you what you should and shouldn't do for your environment, that's ok, but they've a big fat salary at the end of it, so how much of that what they're telling you is true and honest and how much of that is not just based on their wanting to get a paycheck at the end of the month. So I would take these guy's advice and words over the top of anybody no matter how many letters they have behind their name. (PT1)

Clearly, Participant 1 is averse to participation in state-run projects. While most River Guardians dislike the bureaucracy, planning, lengthy telephone calls and indoor meetings; “*I remember going to a few meetings...it was all heavy...I have a really low tolerance for bureaucracy,*” (PT3) they were still willing to participate knowing that they were necessary stages to prepare for the next river-based outdoor event. Even those who enjoy the planning, it is the implementation that is key;

I love being involved in projects and planning them and implementing them and seeing them work. That's what it's all about for me. So like I hope we're getting to the stage now where we've had quite a lot of training and starting to win projects ... but I think we'll gauge our success by having lots of successful projects under our belt. (PT2)

Participant 1 learned from these planning meetings as well as from the River Guardian technical training, and he applied the skills to his local river;

I started my own conservation group this year ... and I would be committee officer on my local angling club ... I started up a spearheading group within the club which looks at enhancement and development and maximising the good areas in the river ... I delivered two salmon spawning development projects last year... and they've been 100% successful. (PT1)

Despite just wanting to spend time by the river, he is organising meetings, planning projects and dealing with bureaucracy. Clearly, barriers are overcome when the benefits to the environment outweigh them.

Citizen science can cause barriers because of a lack of confidence and a lack of interest. The new volunteers in Limerick conducted water monitoring because they knew the data would be useful to the organisation and they wanted to get involved. Participant 6 feels confident because she conducts the water monitoring with Participant 5. She appreciates the simpler systems of citizen science, and it seems she would not conduct projects in which she lacks confidence;

that it's doing something positive for biodiversity is a big thing for me. I'm also doing the bumblebee monitoring in Bruff which is ... much more challenging. It's difficult. I'm on less sure ground. Identifying the bees is so tricky and I'm sometimes not sure if I'm identifying them correctly and all. Whereas I find that the water testing, it's very clear it's explained very well. We know we're doing it right and there's great satisfaction in that. But it is great being outside and ... yeah, it's great doing something for the community. (PT6)

Testing with aquatic macroinvertebrates can cause a struggle with confidence;

I do a lot of recording... for the actual river stuff, no ... I stopped doing anything to do with the invertebrates, because I just didn't have the confidence...if it's totally new to you, you have to go out and practice ... and I didn't feel confident ... I mean I was so ignorant about the wildlife under the water...I could tell you endless things about beavers and otters and aquatic plants and riparian plants and trees, endless stuff, but I had zero knowledge. So I think when you're starting from that level, it's fascinating but you actually just need to practice regularly to get it ... that was definitely a challenging part. (PT3)

When asked if he enjoyed learning about the different macroinvertebrates; *"I didn't because I was overwhelmed by the amount of different ones...if you have to be looking at magnifying glasses and things like that... so no, I can identify that's a caddis fly, that's a mayfly, that's it. I'll leave it at that. I won't be trying to diagnose which mayfly that is or what family that mayfly belongs to."* (PT7) Similarly; *"I did one this last weekend past which was advanced riverfly...I did come home thinking, maybe this is a step further that I want to go."* (Key Informant 1) The latter two were anglers, and they were clearly not likely to conduct the macroinvertebrate testing on their own.

As expected, what is considered a barrier will differ depending on the personality, preferences and interests of the volunteers. For example, Participant 8 tried to recruit his

brother to accompany him to collect water samples for citizen science monitoring. He relays;

...we spent a good two hours trying to get through bog trying to get down there, and I brought him with me and he was so sick of it at that stage. But we found a place ... about a mile down the road, there's just a bridge between two houses and you can access the Mondelihy very easily. And he went down with me then after that a couple of times. Now he likes it, but it just it's not his bag, it's not for him. (PT8)

Participant 8 continued to be a regular, committed volunteer, while for his brother, the actual activity was an insurmountable barrier to his participation, despite enjoying the time in nature with his brother. Even for the River Guardians, some activities would have deterred them from participating; *"I did the electrofishing, which was challenging in a really emotional way."* (PT3)

For the River Guardian, Participant 1, however, citizen science is a self-learning tool to monitor the water quality in all the rivers in his catchment and he was grateful for the training;

from a macroinvertebrate, it gives you that initial [...] look in - there's something wrong here or something's got better here, so it allows you to build that picture in the catchment....what I've taken from it, to be a better person... and have a bit of confidence in myself and you know that's what I owe the Trust, so I'm just paying it back with my time. (PT1)

He has also found a way of spurring the local authority to act;

if there's an issue with my own river, normally what I do, I record it, photograph it, take GPS coordinates, then, I mean if I have a test strip, I can normally take a sample and a photograph of test strips, and I used to send that stuff to the local authority, but I realise now that the LA [Local Authority] rings me back quicker if I just send it to everybody cuz everybody seems to ring the LA and give out, and they, the LA, will ring me and give out, but I still get somewhere with it. (PT1)

He used citizen science to detect a problem, and he forwarded the data to local anglers and other stakeholders because there was a better response than just contacting the local authority directly. In one example, he explains that he regularly monitored water quality in a part of the river where Participant 4 regularly fished;

PT4 and I were talking about an issue on that river...I got an acknowledgement and an admittance that they [the Local Authority] are causing the impact in the area and they gave it to me in writing the other day so that's the biggest step forward ... in dealing

with this problem that's been happening for 21 years. But again it all came about from a citizen science approach. (PT1)

In summary, theme 4 (behaviour) illustrates barriers to volunteerism, and obstacles to environmental stewardship. For many of the volunteers, the fit needs to be right; attitudes, level of time commitment, the amount of pressure placed upon them, and the type of activities expected of them. Volunteerism can be a springboard to activism, and with that the high level of potential impact, influence and change.

5.7 Theme 5. Transformative experiences

Transition is the common thread that ties all the themes (Cognition, Identity, Emotions, Behaviour) together, and the influence of early experiences in nature is the catalyst that springboards change. Past experiences in nature form foundations for the future, and explored here is how past, and more recent nature experiences such as Covid-19, are the drivers of transition and transformation (transformative experiences theme). These experientially-driven shifts may be in thought, awareness and perception (cognition theme); interests and a sense of self, place or community (identity theme); feelings, moods, emotions, attitudes or concerns (emotion theme); or in decision-making about participating in pro-environmental behaviours, actions and volunteerism (behaviour theme). Early childhood experiences in nature can increase awareness, alter perspectives, engender identities, generate emotions, and influence concerns, actions, behaviours and the decision to get involved in environmental stewardship. Although early childhood experiences may not directly cause each of these shifts, they are the common thread that links and connects the themes of this study, and they are the transformative experiences that are the impetus for change. This synthesis theme explores how these experiences influence cognition and awareness, personal identities, and feelings and emotions related to nature, and if these inspire pro-environmental behaviours and activism. Early childhood memories in nature provide substance and background to the quantitative responses on the positivity of their childhood experiences, while Covid-19 offers a microcosmic perspective on the transitions between the themes of this study. Theme 5 (Transformative Experiences) and its categories and codes are outlined in Table 5.7. The categories and subcodes are depicted in Figure 5.10.

Table 5.7 Theme 5: Transformative experiences

| Theme | Description |
|-------------------------------------|---|
| Theme 5: Transformative Experiences | This theme is central to all the other themes as it centres around the drivers of change and the linkages that power transformations between all the themes. This begins with early childhood experiences in nature and how they generate interests and past influences, and then explores if these trigger or alter awareness, learning, understanding, perspectives, feelings, concerns, attitudes or perceptions, and if there is a relationship between them and decision-making about their environmental behaviours, activism or volunteerism. Covid-19 is also explored as an experience that caused change. (Transformative Experiences). |

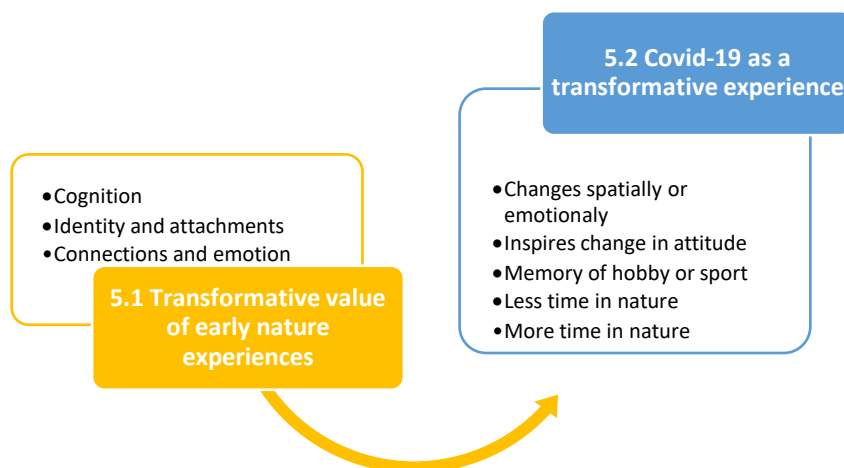


Figure 5.10 Theme 5: Transformative Experiences, thematic categories and subcodes

5.7.1 Transformative value of early nature experiences

Theme one demonstrates that early childhood experiences spur awareness and influence cognition. This can be due to various reasons including the type of activity spent in a particular habitat or with a particular guardian or family member. Awareness and cognition are also influenced when observations of the state of current environment conditions are compared with memories from earlier experiences. These demonstrate that past experiences combined with current experiences affect knowledge, awareness and cognition. Running across the complete gamut of the themes, it emerged that experiences transform awareness and cognition (theme one), and most notably transformative is when repeated experiences, observations and awareness lead to attachments and connections that

influence the development of an environmental identity (theme two). A combination of awareness and environmental identity have been shown to increase concerns (theme three). Nature experiences in nature are restorative as well as transformative, in that they increase feelings of well-being and enjoyment from the time spent outdoors doing nature-based activities, and these can be strong drivers to environmental volunteerism (theme four). However, in terms of inspiring action, both positive and negative emotions can motivate people to take action for the environment. Many concerns or worries are linked to the loss of place or the loss of an experience that has been valued over their lifetimes (these losses being ascertained by their observations and comparisons over time). Early experiences in nature had provided positive sensations and emotions, but now it is causing grief, hopelessness, despair and frustration (theme three). To help alleviate these is to feel like they are making a difference, and if there is a solution that they can get involved in, then they may be more inclined to act (theme four). There is the added benefit that the time in nature still provides that positive emotion of wellbeing, but now it is heightened by being shared with a group of like-minded people with a common aim and environmental identity (theme two). Further transitions and experiential transformations that were highlighted in this analysis are broken down in Table 5.8. Ultimately, they all relate to the transformative value of past experiences in how they influence current experiences and actions as well as how they inspire plans and decisions towards future experiences and actions, for themselves and for future generations.

Table 5.8 Summary of examples of experiential transformations

| Example of transitions | Thematic movement |
|---|---|
| 1) Hobbies and recreational activities help generate an identity based on place, community, and the particular landscape, as well as potential active environmentalists. | Experiences to identity to activism |
| 2) Early childhood experiences, current actions influence peoples' awareness and knowledge about problems in their local environment and a desire to build awareness in others. | Experiences and interests lead to identity to cognition to activism |
| 3) Experiences and happy memories as children can influence provision for their own children and inspire action to preserve these places. | Experiences and wellness to concerns to activism |
| 4) Early childhood experiences can influence awareness of changes, good or bad. Meaningful and accessible opportunities influence involvement in volunteerism. | Experiences to cognition to action for more experience |
| 5) Identities can also inspire action. The desire to be with like-minded people, or to protect the place to which they are attached or to preserve a lifelong hobby (for example, fishing), may increase the inclination to act or volunteer. | Identity and place attachment to action |

The paths to environmental volunteerism will differ depending on the individual, but for many environmentalists, the path begins with positive early experiences that generate a lifelong identity that inspires curiosity and gives them enjoyment, comfort and a sense of connection and belonging, the loss of which causes despair or grief. Activism, despite barriers, alleviates some of this negative emotion. Figure 5.11 depicts a typical path through the themes of this analysis that begins with positive childhood nature experiences and leads to environmental stewardship behaviours taken by the River Guardian volunteers.

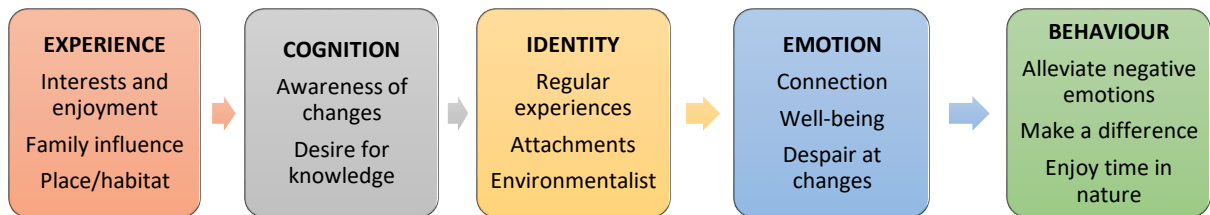


Figure 5.11 Typical environmentalist path to action for nature

5.7.2 Covid-19 as a transformative experience

Covid-19 offers a microcosmic perspective on the transitions between the themes of this study. Similar to the influence of early childhood experiences, Covid-19 either reignited or altered nature-related behaviours, attachments to place, awareness, attitudes and connections. The added element of immediate danger associated with a global pandemic seemed to trigger accelerated experiential transformations.

Covid-19 had a major impact on the amount of time people spent in nature and the way they experienced nature (i.e. transformative experiences theme). Most respondents had more free time because there were no commutes and less work obligations, and the scaling back of social activities due to restrictions on clubs and public gatherings meant spending more solitary time running, swimming, walking and exploring in their local natural environments. Thus, many people spent more time outdoors and made new observations (i.e. cognitive theme);

I've been taking a lot more walks - usually by the river, particularly during the first lockdown when the weather was fine. Being in one place all the time also led me to notice the local birds a lot more.

I have also noticed things that I would never have noticed without being forced to slow down during lockdown. I have learnt about more flora and fauna right on my doorstep, while becoming fascinated by the birdlife that my garden attracts

I value my time spent out doors even more, I spend more time in outdoor areas near where I live and I am more aware of the positive effect it has on my wellbeing and that of my family. My son who is 2 is so engaged ...He notices so many amazing things and has taught me to appreciate more too.

Covid has opened my ears to the beautiful bird songs, it has made me open my eyes to the nature around me. I see and notice nature more now

...during lockdown teenagers went back to swimming in rivers, building rafts like we did when that age.

A number of people spent less time in nature because they felt unsafe leaving their homes; *"Have to stay at home for health and safety reasons"* and *"I want to avoid people and the river is a busy spot for walkers,"* or they had more family obligations; *"Less free time with children home more"* or because *"would have to travel outside 5 klms [sic.]"* and *"Because I'd be afraid of being told it was not essential, and would be out of my 5k."* This limitation, that the localities where they reside prevented nature experience, might have impacted on their feelings of attachment to place. Instead of a positive attachment, there are elements of frustration (i.e. emotive theme). For example, more populated locations would have attracted more crowds, deterring some from areas they may have frequented before Covid-19; *"Spend less time as my usual routes now have too many people using them and it is impossible to social distance at an adequate level",* and *"I want to avoid people and the river is a busy spot for walkers"* and the five kilometre distance restrictions essentially trapped people within their localities, preventing them from accessing preferred nature spots to which they may have felt attached. The places they enjoyed were either overrun by threats to their health, or they were out of reach, but the forced geographical disconnection did not break the emotional attachment, and instead seemed to reinforce the sense of loss (i.e. place/identity and belonging theme); *"I long for it more. I wish I could get out to places beyond my 5km. I appreciate nature more.*

Others took it as an opportunity to spend more time in their own gardens, exploring their local communities or discovering new local nature spots. This might have increased their

appreciation and attachments to their local regions and communities (i.e. place/identity and belonging theme); *“I always prefer to be outside, but now meeting anyone else also has to be outside, so I meet them for walks etc. I think more people are coming to value our beautiful countryside and are treasuring some of their local spots they never knew or bothered about. I have also biked and walked up tiny lanes and roads, I would have passed by before. So that element of discovery in your very local areas is a great thing and is teaching us all the value of the local green spots.”*

One respondent thought that the popular tourist nature spots might benefit from the absence of crowds and human disturbance; *“I was very interested in seeing the effects on nature e.g. in Venice of a slowing down in human activity, thus giving nature a chance to rejuvenate.”*

There are also frequent references to mental health being the reason why people increased their time in nature, such as to de-stress and get fresh air, or for a change of scenery and to *“escape from being stuck in one location”* or get a break *“from the family antics.”* For a number of people, Covid-19 has given a new appreciation for nature, and it was used as a tool to cope with the negative mental and emotional impacts of Covid-19 (i.e. emotive theme); *“Although it was vital for me to spend [sic] outdoors prior to covid, from a mental health point of view, I cannot go a day without getting outside”, “I now walk or run every day simply for mental health and Covid restrictions limits other activities.”*

There were also those that were determined to ensure their quality of life and adapted their behaviours, and experience nature in a new way; *“I started a community garden in my estate. I have often done clean ups - just myself as well as group efforts”, “made a large pond on my property and now take great interest in identifying wild plants.”*

For the dedicated volunteers of the focus groups, they were also determined to conduct their environmental stewardship and volunteerism, despite the barriers imposed by Covid-19 (i.e. behaviour theme); *“it has been on off on off on off on account of the Covid situation,”* (PT5) and Participant 1, the River Guardian spoke of his intense connection and need to get out to the river;

...one of the things I struggled with very hard this year with the Covid would be that not being out on the ground as much as I'd like to be due to travel restrictions, I know [Leader] got me sorted out with paperwork then that allowed me to travel about and do me monitoring. (PT1)

Covid-19 greatly influenced the themes of this study in terms of experiences transforming levels of awareness, appreciation and connections to nature. While many hobbies and activities were paused, interest-based identities were less likely to be affected, but perhaps with the reminder of the benefits that nature experiences offer, there were people whose emotional connections to nature deepened and thus a potential interest in environmental volunteerism. While the influence of Covid-19 may be temporary, Participant 1 is hopeful;

there is people out there, and the message is just getting out there now, it's all relatively new too...there is an awakening in people now ... maybe that's something to do with Covid, I don't know I can't answer that. But I do know ... now a lot of people that I know are ...more environmentally conscious. I think the tide is turning. (PT1)

In summary, the transformations theme incorporated the four main themes (cognition, identity, emotions and behaviours) and uncovered the way respondents experienced nature, and how this influenced their interests, values, awareness and desire for knowledge related to the environment. Childhood nature experiences, reinforced by Covid-19 experiences, led to feelings of well-being and an emotional connection to nature.

Chapter 6 Discussion and synthesis: The nature of connections with nature

6.1 Introduction

This chapter synthesises the quantitative and qualitative findings from the broadscale questionnaire survey and volunteer focus groups and interviews with the relevant academic literature to strengthen the validity and robustness of the interpretations. It triangulates and explores the differences and similarities, and how they pertain to understanding the research problem of this study, that is, the factors that influence environmental stewardship and volunteerism to address poor river water quality in an at-risk catchment. The research questions addressed here are 1) How identity and ideation about environmentalism influence environmental stewardship, and the factors that may explain the value-action gap, 2) How emotional responses to attachments and connections to place influence environmental stewardship, including concerns related to human health and well-being during Covid-19, 3) How respondent demographics in a catchment influence perspectives, concerns and actions, particularly related to residing in the Mague River Catchment.

6.2 The influence of identity and ideas on environmental change

The factors that lead to environmentalism and taking environmental action vary depending on an individual's experiences, values, perspectives and personality. The indeterminate nature of the concepts associated with environmentalism, however, may preclude, limit or challenge the ability for public engagement to reverse the trend in degradation of the quality of catchment habitats and rivers.

6.2.1 Environmental ideation: Preconceptions, misconceptions and misgivings

Self-identification as an environmentalist is a factor that can increase pro-environmental behaviours and activism (Wade-Benzoni *et al.* 2007). However, the concepts associated with identity and self-identity, particularly as an environmentalist (Clayton and Opatow 2003) are vague and they vary between the participants in this study. Some individuals felt environmentalism meant active protests against government action or inaction, while others felt it was keeping abreast of current news and conducting regular pro-environmental behaviours. The River Guardians took pride in identifying as environmentalists due to their lifelong passion for experiencing time in nature and seeking

out opportunities to learn about and act to improve environmental conditions. Each valued nature and the “joy” that nature had provided for them throughout their lives, making personal sacrifices to take action beyond what is requested of them as volunteers due to a sense of moral obligation (Grilli and Curtis 2021). Maigne Volunteers, however, were not as confident, with some believing that a qualification is necessary to warrant the label, even though they would “love to think” they were “working for the environment” because it is a “big part” of their thinking. This implies a preconception about the definition of ‘environmentalist’ and what environmentalism entails that may influence the level of commitment to take action for the environment.

Values about nature combined with a reinforcement that they are pro-environmental can lead to a stronger sense of environmental identity, and so past action can be a determinant of future environmental action (Van der Werff *et al.* 2013b). This may provide insight into the Maigne group’s lesser level of commitment, as they were taking the first steps from volunteerism for the community to that for the non-human environment. One aim of the questionnaire survey was to stimulate interest in getting involved, so the highly positive pro-environmental responses may have been stimulated and reinforced by being reminded of the value they felt for nature. It remains unclear, however, if many of them will cross the line that leads to actual volunteerism, such as the Maigne group, and even more so to the level of commitment of the River Guardian volunteers (Barr 2004; 2006; Kennedy *et al.* 2009).

Indeterminate ideations on the concepts of environmentalism and nature (Wade-Benzoni *et al.* 2007; Owen *et al.* 2010), and the feelings, actions and perspectives that constitute an environmentalist (Barr 2004; Hitchings *et al.* 2015) matter in this study. Data are based on generalisations and an assumption that people agreed on the terminology in queries such as ‘nature is valuable and deserves to be protected’ and ‘spending time in nature helps me destress and feel better.’ What is considered a nature experience will differ depending on an individual’s concept and definition of nature, and there were diverse interpretations of what constitutes natural space (Beery and Wolf-Watz 2014; Ducarme and Couvet 2020). For example, many survey respondents consider amenity infrastructure in a park to be nature while others associated nature with wildlife and wildness, and a lack of man-made

influence. Many respondents claimed growing up on a farm was experiencing nature, whereas agriculture, cultivated fields and cultural landscapes may not be 'nature' to an environmentalist (Phillips 1998). These conflicting conceptualisations would explain the survey's contrasting preferences between highly maintained landscapes that provide human amenity-value and access, and those that allowed nature sites to grow without human interventions to provide safer habitats for wildlife. A more specific question on the meaning of nature to individuals may have solicited a more comprehensive representation of people's perspectives (Forsyth 2015; Ducarme and Couvet 2020).

6.2.2 Identity and intentions on acting for the environment

The motivations, interests, actions and experiences people have as individuals, in groups or with family help form a self-identity (Graumann 1983; Oyserman 2001). When relaying their experiences related to nature, the questionnaire survey respondents highlighted priorities that served to demonstrate whether or not the label of environmentalist was warranted. For example, "*a lifelong love*" for nature can predispose people to developing an environmental mind-set (Wells and Lekies 2006), and self-identification as an environmentalist (Balundé *et al.* 2019).

Many survey respondents focus their interests on particular outdoor activities while others focus on people or specific geographical locations and communities. For a larger number of people, however, the interest or memories focused more on a type of natural habitat, such as rivers, wildlife or nature in general. This suggests that efforts to protect the latter are more associated with having an ecological identity (Gooch 2003), or being an environmentalist, such as for this respondent; "*a life long [sic] relationship with angling ... grew into a wider interest in nature and ecosystems.*" However, ecological identities are inextricably linked to society and community (Zavestoski 2003).

There is also a link between place attachment and identity (Lewicka 2005), and this has ramifications in terms of protective actions for the environment even though the intention is more related to NIMBYism (Not in My Back Yard) (Devine-Wright 2009). The level of personal commitment to the environment, and certainly the intentions behind actions differ depending on how a person self-identifies (Van der Werff *et al.* 2013a; Balundé *et al.* 2019).

For example, the lifelong farmer from a long line of farmers distances himself from identifying as an environmentalist, even though he participates in an environmental scheme, he is aware that biodiversity and nature provide ecosystem services and benefits for his livestock, and he has a strong desire to preserve the future health of his land and the river that runs through it. His protective actions apply to the lands he privately owns, and they do not extend beyond the boundaries of his farm. His priorities are based on his attachment to place, and actions conducted as part of the environmental scheme did not alter his sense of self. Lokhorst et al. (2014) found that farmers who do not self-identify as conservationists nor feel that environmental behaviours were typical for them would be less likely to engage in conservation activities. This dichotomy is an important consideration in catchment-based conservation efforts, particularly in rural and agricultural catchments (Walker and Ryan 2008).

That being the case, how one identifies or compares themselves to others in a community becomes important, and potentially disadvantageous to effecting change. Based on this study, in Ireland, promoting environmentalism may be less effective because of the many preconceptions and misconceptions surrounding nature and environmentalism. For example, one River Guardian has multiple identities (River Guardian, angler, farmer and landowner). He approaches neighbouring farmers individually, identifying himself as a neighbouring landowner with an interest in the fish in his river to surmount implicit awkwardness, misgivings and distrust between farmers and environmental groups or state agencies (Hannigan 2014; Fairbrother 2017). He is using the attachment to place and community rather than his interest in protecting the river and environment as a whole to increase engagement and buy-in from his neighbour (Lewicka 2005). The identity he uses is of self-interest, but he is actually acting in the interest of the entire river habitat. This is evident because if he was only interested in improving the section of river by his own property, then he would only have approached his upstream neighbours.

His ultimate goal is to influence the community as a whole, and the farming community especially, using networking and the influencing processes of social diffusion so that more significant scales can be reached (Brick *et al.* 2017; Church *et al.* 2019); *“the influence to other farmers would probably be much bigger ... if they see this taking place on a significant*

scale to their colleagues ... upstream." This community and place identity opens a channel of communication where he can impart his personal knowledge of changes in the river (Devine-Wright 2009), and this can promote social learning and influence his neighbours' actions (Micha *et al.* 2018). Instead of a river-based tragedy of the commons, the sharing of space became an opportunity for integration (Hardin 1968; Burger and Gochfeld 1998). Rivers traverse across the privately owned lands, and, in essence, knit together a community composed of neighbours with a common identity and attachment to place. Survey respondents who focused their interests on their localities and community-based projects would also be swayed by the community's acceptance of a river restoration project (Owen *et al.* 2010). Farmers' efforts in an agri-environmental scheme, as much as the incentive may be financial and based on place attachment, are still demonstrating a commitment to conservation, and this can be linked to a change in self-identity and how they see themselves, and thus pro-environmental behavioural change (Lokhorst *et al.* 2014; Barghusen *et al.* 2021).

The community within which one belongs strongly influences the ability to be pro-environment in identity and in behaviour (Owen *et al.* 2010). The River Guardians are a community of environmentalists, in part due to the distinctiveness hypothesis (Owen *et al.* 2010) because some felt different from other people growing up, but within the River Guardian group, they were bonded by being committed to protecting nature, and this behaviour was accepted and encouraged. They never needed the tide of societal change to ride the environmentalist wave, as they seemed already predisposed towards nature, and joining a group of like-minded people created a sense of belonging and a collective identity (Polletta and Jasper 2001). This gave them the confidence and desire to recruit more volunteers to join them, from their social networks and neighbourhoods. From this small community of environmentalists within a larger geographic community, there is evidence of the inception of social diffusion influencing the social norm (McKenzie-Mohr 2000).

Social diffusion, via community networks, can influence a socially acceptable behaviour or perspective to eventually become a social norm (McKenzie-Mohr *et al.* 1995; McKenzie-Mohr 2000). For behavioural change, it is not just about changing the behaviours of individuals, but it is about change in the community (Schultz 2011). The more visible and the

more widely accepted environmentalism is in the community, the more potential for environmental action, even if not to the level of identity (Brick *et al.* 2017; Church *et al.* 2019). The data suggests that it may be more *'fashionable'* to speak on behalf of the environment in farming communities and amongst those completing the study's online survey, but it is not yet a social norm to prioritise the environment and river water quality. This is evident because river water quality continues to steadily decline, in part, due to diffuse catchment-wide pollution (EPA 2020a) in an 86% - agricultural catchment (Dalton and Walsh 2018). Many of the river quality problems are due to agricultural practices causing nutrient and sediments entering rivers (EPA 2020b). For many of these farmers who work the land, and, collectively, also own the majority of the land area, the economic value is a main priority; *'Nature is important but land is priceless!'*, even amongst those who join environmental schemes (Ahnström *et al.* 2009; Barghusen *et al.* 2021). Also, there are still considerable misgivings, mistrust and scepticism in state bodies and community groups looking to temper or change behaviours and practices to better protect rivers and the environment (Forsyth 2015).

The data also suggests that both non-environmentalists and environmentalists distrust the authorities and state agencies responsible for water protection. The former because they resent action, interference, investigation or prosecution into the sources of pollution, and the latter because they resent inaction and a lack of interference, investigation or prosecution to remedy pollution or punish polluters. The River Guardian who started his own conservation group also uses community and place attachment to further his environmental aims. If he detects a pollution problem, he rallies his local anglers, friends and social media followers to put pressure on state agencies to implement solutions to resolve the issue. He too diffuses and suffuses environmental stewardship in a community bound by neighbourly ties (Lewicka 2005), by sharing his knowledge and furthering social learning with skills he learned from the volunteer group (Vasi and Macy 2003), and he has initiated collective action that can influence catchment management policy (Collins and Ison 2010). If state remediation impacts the practices of a farmer, and it is linked back to conservation groups, then distrust and a breakdown in communication can resurface (Hannigan 2014; Fairbrother 2017). Catchment management practices that respect local knowledge, shared social bonds, culture, priorities and attachment may lead to a better

result (Norton 2000; Manzo and Perkins 2006; Brennan *et al.* 2009). Whatever the identity and perspective, all people prioritise the ability to leave a legacy for future generations, whether it is a productive farm or a healthy natural environment (Figure 6.1). This suggests that the terminology used for programme designs would include words like inheritance, legacy and heritage, rather than environmental buzz-words such as sustainability, pollution and climate-action, to best limit preconceived associations and garner more inclusion, interest and involvement (Daugstad *et al.* 2006; Ahnström *et al.* 2009; Gifford 2011; Eitzel *et al.* 2017).

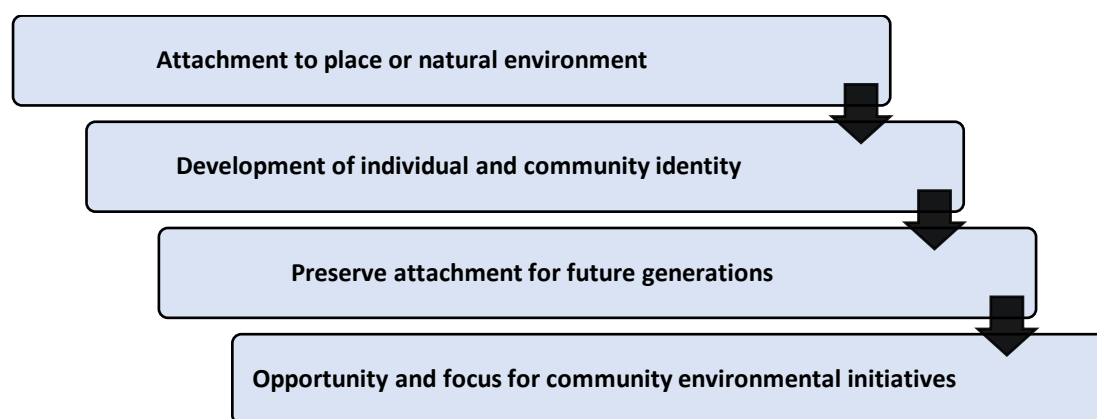


Figure 6.1 Link between place attachment and the desire to preserve it for the future

Local and personal initiatives can offer more potential for positive catchment change than any state-led or even community-led environmental conservation project (Feeny *et al.* 1990; Robbins 2020). As much as an environmentalist, or a conservation group, aims to improve the quality of water and habitats over entire river catchments, there is more social diffusion and acceptance when speaking in terms of a sense of place and to specific geographic locations and communities (Gooch 2003). These private lands or cultural and community identities are more salient to those not predisposed towards environmentalism, and because theirs are the behaviours most targeted for change, therein lies the common ground to ensure the future, and from where moral responsibility and social norms more readily proliferate (Howard and Papayannis 2013).

6.2.3 Environmental stewardship: Aspirations, practicalities and a value-action gap

Having an environmental identity is linked to valuing nature and feeling emotionally connected to nature (Van der Werff *et al.* 2013b). There are various statistical measurements of connectedness, such as enjoying time in nature, appreciating nature or feeling emotionally attached to nature versus the way people conceptualise their existence as part of who they are as well as the predisposition to act for the environment (Van der Werff *et al.* 2013b; Balundè *et al.* 2019). Mayer and Frantz's (2004) scale of Connectedness to Nature measured the connection people felt to each other as well as to nature, and interpreted this as a determinant of identity as an environmentalist, and thus a predictor for environmental stewardship. Sixty-seven percent (67%) of respondents selected eight or above on the connection to nature scale, 94% of the respondents strongly agreed that "*Nature is valuable and deserves to be protected,*" 83% felt "*It is important to preserve Ireland's natural heritage for future generations,*" and 85% agreed that pollution in the river affected their lives (Table 4.3). Identity and connection to nature influence pro-environmental behaviours (Brügger *et al.* 2011; Mackay and Schmitt 2019), and the quantitative results of this study found that feeling deep connections to nature (having selected ten on the scale) increased the number of pro-environmental behaviours, and the likelihood of participating in more conservation groups and activities such as citizen science, tidy towns, birdwatching and beach clean-ups.

These high percentages demonstrate that respondents feel deeply connected to nature and that nature has a high intrinsic value, yet there are disproportionately few who actually volunteer and participate in measures designed to protect the environment, and thus revealing a large value-action gap (Kennedy *et al.* 2009). The highest level of volunteerism in conservation groups was 29% having participated in Tidy Towns, and the next highest were 20%, 19% and 19%, having participated in some form of citizen science, bird watching or nature conservation group, respectively. Additionally, due to the survey being released during Covid-19, the question was framed as "*Have you ever participated with a community or conservation group?*" thus providing no timeframe. Survey results are clearly influenced by the phrasing of questions asked and potentially even fewer respondents were regular or recent participants of conservation activities, and there is no way to know if they would resume post-Covid-19.

There also cannot be any assumptions based on the high levels of self-reported pro-environmental behaviours reported. Eighty-nine percent (89%) of this study's respondents "recycle, reuse, reduce and repair when possible," but recycling and waste facilities are made available by the local councils, they are convenient, and save people money, so recycling and reusing require little sacrifice. Seventy-two percent (72%) of respondents "conserve energy and/or water at home" and 71% compost, but these actions also help save money (Figure 4.2). These may be more inadvertent environmentalists who do not connect their actions to the value they have for nature (Hitchings *et al.* 2015). Additionally, it must be taken into consideration that self-reporting on pro-environmental behaviours may lessen the reliability that these are all accurate and true representations (Kormos and Gifford 2014).

This self-reporting value-action gap is typical and can illustrate the bias in the data (Kennedy *et al.* 2009). As one of the aims of the questionnaire survey was to stimulate interest in nature-based volunteering, and because reinforcing the belief that people are good environmentalists has been shown to increase pro-environmental behaviours (Wade-Benzoni *et al.* 2007), there was potential to fuel action. Additionally, while it may not be measurable statistically, it does demonstrate that pro-environment values are becoming more socially desirable and acceptable (Milfont 2009; Brick *et al.* 2017). The positive bias may also be attributed to the title of the survey "*Connections, concerns and caring for your local river,*" which may have discouraged those with no interest in rivers, and elicited more responses from people predisposed to appreciating nature. Additionally, while one at-risk region (Maigne River catchment) was heavily targeted to stimulate engagement, their response rate was relatively small. In contrast, copious responses to the survey were received from throughout Ireland, suggesting an increase in concerns and awareness of current environmental issues and the policies to address them. Albeit, not yet at the stage of a social norm that leads to active community environmental stewardship (Clayton *et al.* 2017).

Growing awareness and acceptance in community stewardship was influenced by visibility, but not necessarily related to environmental concerns (Brick *et al.* 2017). The main concern

for respondents related to levels of litter, and the most common volunteerism was litter clean-ups most often conducted in their local communities. While the survey queries were posed as pro-environmental behaviours, perhaps the advantage to the environment is coincidental, in that the priority was more about the community. Concerns for the environment are linked to having a connection to nature (Richardson *et al.* 2020; Schultz 2002), but it is uncertain if the pro-environmental behaviours selected demonstrated connections to nature or to place, or simply conducted because they are convenient.

Most people find the more invisible, cumulative or long-term problems (such as deteriorating river water quality) harder to understand and accept (Gifford 2011; Van der Linden *et al.* 2015), so it makes sense that focus on the visible and noticeable forms of pollution predominates. Literally, as they can see the litter, dog faeces and fly-tipping in their towns, amenity sites and parks, and they are reminded of its presence every time they spend time outdoors. Also visible, however, based on publicity, news stories and social media, are current environmental global issues such as climate change and biodiversity loss. These are especially visible when they become local issues with the potential to impact livelihoods, such as flooding and droughts. The Maigne Volunteers mentioned being involved in community-based climate change and sustainability action, and of course, river water problems are also a symptom of these issues. On the other hand, the main concerns for the River Guardians were the more invisible issues of deteriorating water quality and the loss of biodiversity and habitats in general. Three levels of awareness and concerns about environmental issues can be summarised in this study from the physically visible to the publicised to the invisible, and demonstrated is how these coincide with the level of learning and the type of action taken (Figure 6.2). This suggests that learning and awareness campaigns help make the invisible visible and, at least for some of the survey respondents with aspirations to get more involved, this may increase their level of concerns and environmental volunteerism beyond their own localities.

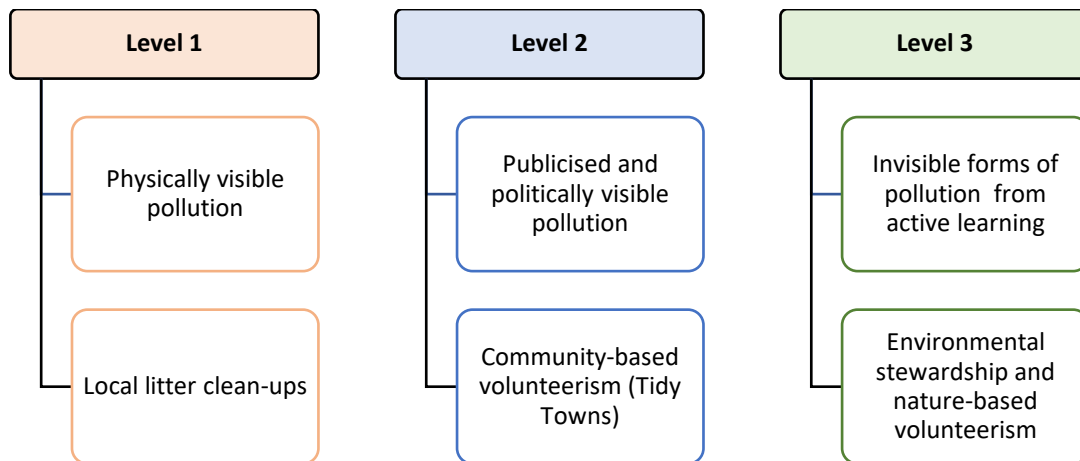


Figure 6.2 Levels of environmental awareness to environmental action

Volunteer actions, whatever their intention, should not be disparaged as they can shift perspectives that non-environmentalists have for the environment, and start to build connections that can bridge the value-action gap (Hitchings *et al.* 2015). Farmers may join environmental schemes because they receive financial incentives from the government, and they may protect habitats such as ring forts due to fear of superstitious reprisals, and although they depend on the next generation's propensity and perhaps sentimentality to maintain the same practices, they have been beneficial for the environment in this generation, and perhaps an influence on socially acceptable, desirable behaviour (Félonneau and Becker 2008). The Maigne Volunteers may have been motivated by Tidy Town assessment scores, but this led to their building awareness of the more invisible forms of river water pollutants. These are all valuable social learning experiences in that information and awareness is shared with others, and they have the power to promote the visibility of the less obvious environmental problems and influence social norms (Goldstein *et al.* 2008; Grilli and Curtis 2021).

The transformative value of past experiences is evident in how cognition and learning led to different ways of thinking about the environment, and also the level of environmental stewardship and behavioural changes they inspired. This coincides with the thematic analysis as it supports the linkages between past experiences and their influence on behaviour, awareness, identity and actions for the environment. Especially for the River Guardian volunteers, they empirically observed nature and witnessed the changes in the

level of wildlife and pollution when comparing conditions from their memories of past experiences. These past nature experiences are especially transformative for those who developed identities from them, and for whom a lifelong emotional connection to nature became a driving force for their actions.

6.2.4 Opportunities and preaching to the converted

The River Guardian programme was successful due to its team of established, dedicated volunteers, one of whom was their team leader. They could be described as ideal volunteers because they were 'converted,' lifelong environmentalists, who seek out opportunities to get involved, learn and make a difference. The River Guardians claim they differ from other volunteers because of their level of training, but this study finds they are more differentiated by their strong desire, curiosity and passion for learning about nature, and their level of commitment to being trained on what they can do to protect the environment. The accumulation of skills and knowledge was not their final goal, but simply a tool to springboard their personal efforts to apply their training (Toomey and Domroese 2013).

Training for River Guardians was diverse enough to sustain their interest because these lifelong nature enthusiasts all arrived with prior levels of expertise in their own fields (e.g., botany, wildlife, angling and river fly and fish lifecycles, and woodland management), and they were curious to learn about aspects of the environment that supplemented their previous knowledge (such as hydromorphology). The River Guardian programme trained the volunteers in multiple forms of citizen science for water quality monitoring, and they expressed distinct preferences (for example, basic or advanced identification of macroinvertebrates, or chemical and nutrient testing that did not require in-stream access). Additionally, the volunteer programme offered progressive levels of training that led to practical, hands-on remediation works. These group projects satisfied their need to make a difference as well as provided social learning opportunities.

Experienced River Guardian-level volunteers are exemplars for catchment-based projects because they are more likely to get involved in decision-making and activism, as encouraged by the RBMP. These are the committed individuals who are motivated to learn, and will maximise the training and knowledge they gain and apply it at home, potentially influencing

their neighbours and their communities (Evans *et al.* 2005; Peter *et al.* 2019). The River Guardian, who started as a hobbyist angler, was empowered by his use of citizen science to detect problematic areas and rally his social media followers to rectify them with his own conservation group, clearly indicating how citizen science led to behavioural change (Toomey and Domroese 2013; Wright *et al.* 2015; Walker *et al.* 2021). Thus, providing lifelong environmentalists with training opportunities in how they can engender environmental change creates environmental ambassadors that can change behaviours and influence community and social norms.

However, these programmes appeal to those already dedicated to the environment. If the goal is to recruit new volunteers to build awareness and activism on a larger scale, then a volunteer programme needs to appeal to those who are not yet involved nor as dedicated (Tiago *et al.* 2017). This is where citizen science can play a potential role (Jordan *et al.* 2011; Jørgensen and Jørgensen 2021).

It would be unfair to compare the budding Maigne group programme to the more established River Guardians because the Maigne's citizen science pilot project was prescriptive, for recruitment purposes, and the training was limited to two types of citizen science monitoring (i.e. Freshwater Watch and basic macroinvertebrate identification) (Weiner *et al.* (in draft 2023) (Appendix 11). Additionally, most of the Maigne volunteers were recruited to participate in the citizen science project from Tidy Towns, in that they were already committed volunteers, but with a focus on communities. Nevertheless, they were happy to collect and submit data once per quarter, this being the minimum that was requested of them, and they appreciated that there was "*no pressure*," and the requirements were not too complicated. There was, however, already an element of social learning in that participants were pairing up and expressing an interest in spending time together to learn from each other's past experiences.

Only one Maigne volunteer submitted records monthly, and he was the sole participant who was not recruited, but sought out the volunteer opportunity. He was also the only individual who expressed a strong curiosity to learn about more advanced citizen science river monitoring techniques. This suggests that if a volunteer programme similar to the River

Guardian's was set up in the Maigne, he would have participated, but also that the basic level of the Maigne group's citizen science would not have sustained his interest for long (Ryan *et al.* 2001). It also seems likely that even if the River Guardians had been just starting out, then that basic level would not have sustained their interest either (Caissie and Halpenny 2003; Finkelstein *et al.* 2005; Silvertown *et al.* 2013; Geoghegan *et al.* 2016).

This suggests that volunteer training opportunities that are multi-tiered with training in basic to advanced citizen science techniques as well as different hands-on projects are preferable (Finkelstein *et al.* 2005; Goffredo *et al.* 2010; West and Pateman 2016). All volunteer programmes start with awareness-building on the importance of the project, and for this reason, they all share the same capacity and potential of social diffusion (Mostert *et al.* 2007; Mostert *et al.* 2008; Collins *et al.* 2009). When a volunteer is noticed by local passers-by while conducting their work, this opens communications so that they too become ambassadors who discuss what they are doing and why it is important. Volunteers working in the river have multiple social learning and social diffusion possibilities, because rivers traverse physical, geographic boundaries as well as administrative, social and property boundaries (Mostert *et al.* 2008). If a programme like the River Guardian's was as visible as some Tidy Towns groups, curious passers-by could also be invited to participate, offering further opportunities to recruit volunteers and influence the social norm (McKenzie-Mohr 2000; Owen *et al.* 2010; Grilli and Curtis 2021). Some of these new volunteers will be lifelong environmentalists similar to the River Guardians, who actively seek opportunities to make a difference.

6.3 Nature and well-being: A case for 'soft' citizen science

Nature experiences are beneficial and transformative as have been illustrated in this study. This section explores the role of emotions and well-being on environmental stewardship and the health benefits of time in nature as a motivator to involvement in nature-based citizen science.

6.3.1 Well-being from time in nature

Positive early childhood experiences in nature lead to feeling connected to nature, the desire to spend more time in nature and a desire to protect it (Wells and Lekies 2006; Rosa

et al. 2018). Humans are biophilic, and they have an innate sense of security and appreciation for living organisms (Wilson 1984; Gullone 2000). As a result, spending time in nature also has numerous benefits for mental (Berman *et al.* 2008; Barton and Pretty 2010) and emotional health and well-being (James *et al.* 2015). Many survey respondents appreciate and avail of this health benefit, as they, directly or indirectly, used words associated with wellness, “*relaxing*,” “*restorative*,” or “*for my mental health*,” 178 times in the open-ended responses to the questionnaire, and 46% of the respondents spent time daily by the river and in nature to de-stress and relax. There were also statistically significant associations found between deep feelings of connection to nature and those who spend time in nature daily to relax and de-stress, as well as those who spend time in nature daily for the scenery and wildlife, demonstrating that those who value nature and feel connected to nature are more able to access the feelings of wellness that nature provides (Nisbet *et al.* 2011; Zelenski and Nisbet 2014).

Positive, active, early childhood experiences in nature, that foster learning are linked to increased feelings of a connection to nature, especially experiences that are long-term and repeated (Schultz 2007), and a self-identity as an environmentalist in adulthood (Prévot *et al.* 2018; Keith *et al.* 2022). As discussed earlier, increased concerns can increase volunteerism and actions for the environment (Richardson *et al.* 2020), which in turn increases satisfaction, health and well-being (Binder and Blankenberg 2016; 2017). The benefit of mental wellbeing from the shared attachment to place and caring for their local green and blue spaces is amplified, such as with the River Guardians, so much so that it creates a community between them (Duff and Hill 2022; Umberson and Karas Montez 2010). These are supported by the data analysis of this study, as in that the positive, happy feelings from childhood influence the desire to spend time in nature as adults and share the experience with their children. Positive childhood experiences in green and blues spaces, then, can lead to healthier outcomes for humans as well as the environment (Binder and Blankenberg 2016; Foley and Kistemann 2015).

However, there is also an extinction of experiences in nature (Louv 2005) as most people now live in urban areas and spend a majority of their time indoors (Soga and Gaston 2016; Schuttler *et al.* 2018). This coincides with a loss of natural habitats and biodiversity, and

access to nature spaces, so it can also be construed that extinction of species and habitats is contributing to this loss of experience (Miller 2005). Additionally, with safety risks and the sensitisation of outside dangers (allergies, stings, toxic plants, pathogens), described as ‘*helicopter parenting*,’ (Prévot *et al.* 2018) parents can prevent children from spending time in nature, or sanitising it enough so that there are none of these potential dangers. With this comes loss of access to the health benefits of nature over a lifetime, but also loss of the connection to nature that can fuel an environmental identity and nature-protective activism and stewardship (Restall and Conrad 2015).

This perpetuates the cycle of less natural habitats and biodiversity, less connections to nature, less concerns for biodiversity, less actions to protect the environment, more extinction of species, less nature experiences, less health benefits (Figure 6.3). Nature-based citizen science can potentially reverse this trend (Schuttler *et al.* 2018; Williams *et al.* 2021).

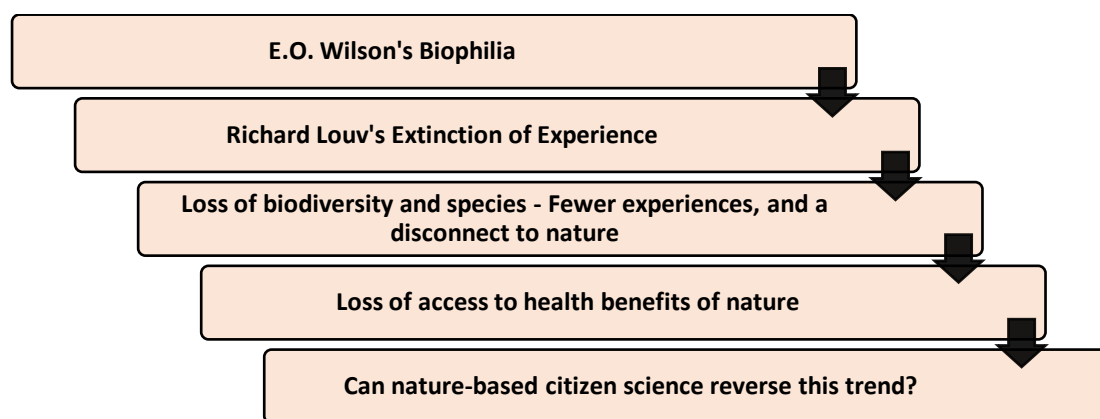


Figure 6.3 Extinction of experience and species, and loss of connection

6.3.2 Concerns and negative emotions

Early childhood experiences that lead to a connection to nature can also lead to negative emotions, so there is also a disadvantage to having a higher level of connection, compassion, empathy and appreciation of the beauty of nature (Monroe 2003; Steg and Vlek 2009; Zhang *et al.* 2014b; Zelenski and Desrochers 2021). *Ecological grief* can occur due to chronic environmental change “*associated with the physical disappearance, degradation and/or death of species, ecosystems and landscapes*” (Cunsolo and Ellis 2018, p. 276). Our deep connections to nature can fuel these intense emotions and pain at witnessing its loss.

For the lifelong environmentalists, such as the River Guardians, they are pained by the decline in the quality of nature when compared to their earlier memories. They feel “*massive grief,*” “*despair and maybe anger at times, hopelessness.*” Not only the sense of loss of place and belonging, but also shame and guilt that it happened on their “*watch,*” and they are unable to provide the same “*joy*” and benefits to their children and next generations. The River Guardian-level emotions demonstrate a deeper level of responsibility and emotional investment in the survival of nature, and this coincides with feelings of ecological grief or solastalgia (Albrecht *et al.* 2007) for a large number of questionnaire respondents. In these situations, biophilia, that innate connection to living organisms, can turn into biophobia (Ulrich 1993).

River Guardians feel a strong sense of guilt and responsibility, and they share the same motivation to reduce feelings of solastalgia (Albrecht *et al.* 2007). They feel gratitude for the training and get-togethers that the volunteer organisation gave them but also for the joy and wonder nature gave them throughout their lives. Nature-based volunteering gives them the opportunity to alleviate the hopelessness, so they ultimately still benefit from feelings of well-being by spending time in nature, but also by the satisfaction that they are taking practical action to apply solutions to the problems (Binder and Blankenberg 2016), and this alleviates some of the guilt and negative sensations (Ágoston *et al.* 2022) (Figure 6.4).

Eight percent (8%) of survey respondents felt that river pollution is too big a problem to remedy, and this is likely due to an overload of negative messages regarding the deterioration of environmental quality, the acceleration and accumulation of which seems impossible to overcome (Hardin 1968; Vasi and Macy 2003). While these people may be unlikely to volunteer, they can be turned around as seen with the Mague Volunteer who only got involved when he saw other people making an effort and noticed that they were making improvements. While some studies say we are incapable of noticing change on such a large scale (Gifford 2011; Van der Linden *et al.* 2015), those who observe and recall differences in a particular site from their childhoods, and those who feel deeply connected, such as the River Guardians, will notice. Additionally, those who identify as environmentalists will not be as easily deterred from involvement by the overwhelming

number and complexity of problems (Markowitz *et al.* 2013). An environmentalist is losing a part of themselves when they witness the loss of natural habitats, so they are willing to make an effort if they see that there may be solutions, even if they require considerable sacrifice.

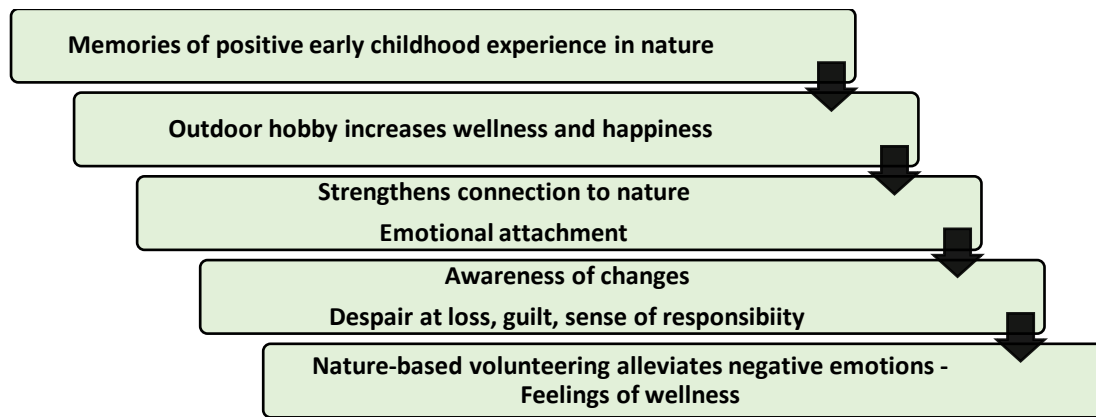


Figure 6.4 Link between childhood experience, emotions and volunteerism

6.3.3 Covid-19 and behavioural change

Covid-19 changed the relationship people had with nature (Soga *et al.* 2021). Worries and concerns over contracting Covid-19 increased, particularly for parents and for people with chronic illnesses, and this resulted in an increase in anxiety and mental health concerns (Lauri Korajlija and Jokic-Begic 2020). Additionally, many people expressed the need to ‘escape’ or get a ‘break’ from the stress of family obligations and remote working. For many people, these impacts on well-being were mitigated by spending time in nature, and Covid-19 changed the amount of time 59% of respondents spent in nature. There was also a sense that Covid-19 increased people’s appreciation for nature, as 58% felt that Covid-19 demonstrated how important it was to protect nature, and for many it became vital to their mental health that they spend time in nature daily.

In contrast, some people became distressed by the increased crowds in nature spots that they had frequented pre-Covid-19 due to the increase in litter and worry that they could not maintain a safe distance from others. These emotions resemble solastalgia, due to the loss of the ability to experience time in nature in the same way they had pre-Covid-19 (Albrecht *et al.* 2007; Galway *et al.* 2019).

Rousseau and Deschacht (2020) believe that the shift in perspective and appreciation of nature due to Covid-19 has the potential to increase public support for protecting the environment, but that this is likely temporary, as people will revert back to their habitual behaviours. In which case, even if Covid-19 helped people appreciate and value nature more (Soga *et al.* 2021), and even if this led to an increase in well-being, it does not necessarily lead to an environmentalist identity and activism. However, the coordinated response to the global problem of Covid-19 demonstrated that, with minor adjustments to behaviour, people can have a positive impact on large-scale problems that seem too big (Rousseau and Deschacht 2020). It is this positivity that led the focus group participants to volunteer, in that there was hope that by taking action, they could make a difference. This highlights the value of sending positive messages and stories of successful campaigns to improve conditions on both local scale problems, such as streams and rivers, as well as those of catchment, national and global significance (Dickinson *et al.* 2013).

Although surveys may be positively biased in general, in that people are not as enthusiastic about taking action as they may indicate, Covid-19 may have also biased the results of this study. The questionnaire survey was released during the height of Covid-19 when Government restrictions limited the number of events and the levels of attendance permitted, as well as practical volunteer opportunities (albeit outdoors and socially distanced). The aim of promoting the citizen science programme, which is bringing communities together for group volunteerism and participatory environmental stewardship, was in direct contrast to mind-sets of early Covid-19. On the other hand, this did create space and time which enabled respondents to contribute vast amounts of qualitative survey data. Also, Covid-19 may have been the contextual shift that changed perspectives in relation to trusting the scientific community and also increased interest in environmental protection (Fujii *et al.* 2001). Future research that compares the results of the questionnaire survey with a similar survey post-Covid-19 would be valuable to learn if the changes in behaviours, perspectives and connections towards nature were permanent or temporary, and if there were any additional undiscovered changes due to Covid-19.

6.3.4 Citizen Science for the unconverted

High percentages of survey respondents are very motivated to participate in opportunities (64%) that are '*outdoors in nature*' (73%), good for their health (69%) and of benefit to the environment and water quality (75%). This suggests that while most survey respondents do not volunteer (64%), they are looking for opportunities to learn about nature and make a difference. These respondents are the unconverted, that this section explores. The focus group participants are already converted volunteers, but can citizen science offer the opportunity to bridge the value-action gap (Barr 2006), with the ultimate goal being volunteers who pro-actively contribute to protecting river water quality and environmental health?

Many of the survey respondents do not know that river and environmental conditions are deteriorating, and that this can impact their lives. Table 4.9 demonstrates that those with the most awareness of current, more '*invisible,*' learning-based environmental problems are those with deep connections to nature. Most do not have lifelong experiences in nature nor an identity as an environmentalist, such as the River Guardians who were already investigating and '*giving out*' about the environment with their families and social networks before they started volunteering. This was the knowledge that inspired them to volunteer in the first place. Thus, if citizen science is to be a tool to increase public engagement in ICM, per the RBMP (Department of Housing 2019), then part of the project design and dissemination needs to be an attractive, easy opportunity that allows the '*unconverted*' to realise their ideals to take action, but that also builds awareness. Because community-based awareness-building campaigns alone are not sufficient to effect behavioural change in individuals nor in communities (Osawe *et al.* 2023), the unconverted can benefit from additional structures, such as citizen science, upon which to take first steps of practical action that leads to public engagement and volunteerism (Crall *et al.* 2013). Even farmers in an agri-environmental scheme are influenced by their commitment and intentions towards nature conservation and deepening connections to nature (Lokhorst *et al.* 2014; Barghusen *et al.* 2021).

This means that as well as citizen science being about gathering data for scientists, another end goal would be providing training and awareness-building, about the scientific process,

and to build trust in the community as well as a social norm (Devictor *et al.* 2010; Crall *et al.* 2013). The many challenges associated with programme administration and maintenance justify these additional gains and aims (Conrad and Hilchey 2011; Donnelly *et al.* 2014; Buytaert *et al.* 2016). This was demonstrated with the Maigne Volunteers, who had the initial drive to volunteer, but not necessarily for the environment, and citizen science was the tool that engaged them in water quality monitoring measures as well as increased their awareness and engagement in catchment management matters (Moolna *et al.* 2019). These potential benefits to the environment and water quality in river catchments, which is the ultimate goal for environmental protection laws and RBMPs, is another layer for which to measure programme success (Margoluis *et al.* 2009).

The health benefits of spending time in nature are a very popular motivation, particularly following the public health scare of Covid-19 (Rousseau and Deschacht 2020). This suggests that nature-based citizen science offers an opportunity for health, learning and making a difference, and also that this can benefit science as well as the volunteer participants (Church *et al.* 2019; Williams *et al.* 2021). Nature-based citizen science was shown to build nature connectedness, and programmes with nature-noticing activities scored even higher at feelings of well-being and joyfulness (Pocock *et al.* 2023). Human health will benefit from the time outdoors, but so will the environment with growing awareness of problems that need to be addressed. Some water quality monitoring citizen science programmes are based on capturing river quality conditions over a particular period of time, providing snapshots in terms of data, such as the Dublin City University and Freshwater Watch WaterBlitz (Hegarty *et al.* 2020; Weiner *et al.* 2022). These are popular and successful partially because they require little long-term commitment, and so are able to recruit large numbers of unconverted volunteers. However, amongst these there will be those who seek long-term volunteer opportunities (9% of the survey respondents); *“Citizen science, These are run periodically but would be great to have them every wk yr [sic] round,”* and *“Each river...could have its own conservation group made up of locals with specific focus on the river and riverbank environment.”* Many motivations lead to environmental volunteerism (Caissie and Halpenny 2003) and involvement to convert the unconverted can exist with convenient, visible opportunities that provide nature experiences to make a difference in the community and the environment (Figure 6.5) (Jordan *et al.* 2011). Volunteer opportunities

such as those with nature-based citizen science approaches, go beyond education and awareness-building by offering opportunities to spend time in nature, and this increases the connection people feel towards nature, and breaks the cycle of extinction of experience (Lokhorst *et al.* 2014; Schuttler *et al.* 2018).

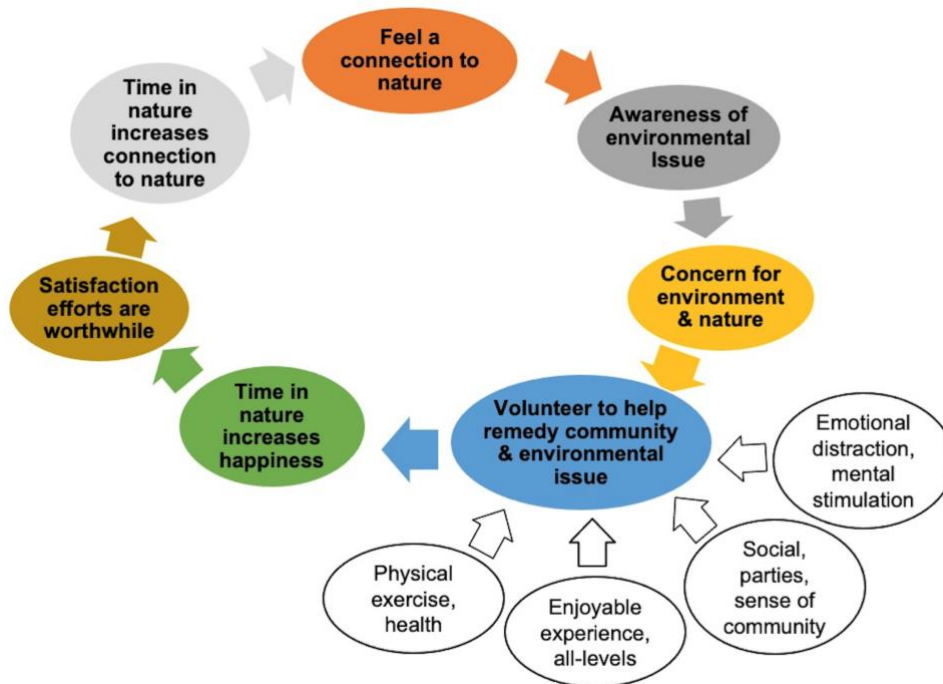


Figure 6.5 Positive feedback loop of nature experiences

Similar to the opportunities for the converted, if there are multi-tiered citizen science monitoring projects with different levels of commitment, difficulty and sampling techniques that are built into a catchment-based training programme, then there is potential of offering a first step into building those nature connections and bridging the value-action gap, because there is the added level of satisfaction by making a difference (Pocock *et al.* 2023). This flexible system accommodates the various ways people experience and can benefit from time in nature (Bell *et al.* 2018). Even if most volunteers are only casual and occasional, there will be a select few who may persevere, and, regardless, all levels of awareness-building have the potential to lead to social diffusion outcomes (Evans *et al.* 2005; Church *et al.* 2019).

6.4 Demographic influences on actions for nature

This section explores the influences of age profile and residence in the Mague River catchment to actions taken to protect the environment.

6.4.1 The variability of age

The study found that childhood nature experiences influence our perspectives and connections to nature as adults, and also that feelings of connections to nature increased with age. Those aged 30 or above felt stronger connections to nature than those aged under 30, those aged between 50 and 65 felt stronger connections than those aged under 50, and more of those aged 65 and over felt strong connections to nature than those younger. The study also found that those aged over 30 conducted more pro-environment actions, and that the older the age range, the more that respondents wanted local initiatives to link to those with regional, national and international scopes, suggesting that their interests and concerns related to the environment are broadening beyond their own localities. This coincides with the academic literature that feelings of a connection to nature vary over a lifetime (Hughes *et al.* 2019). Extinction of experience of the younger age ranges may also play a part in this age variability (Soga and Gaston 2016), in which case family-friendly citizen science would be a logical goal, particularly with family values being another strong influence on environmental perspectives and nature connectedness into adulthood (Oh *et al.* 2021; Passmore *et al.* 2021).

Young children have an affinity to nature (Wilson 1984), then it declines during one's teenaged years and starts to steadily rise again from one's 20s (Hughes *et al.* 2019). Positive childhood experiences in nature increase the connection to nature as adults and the value they place on nature, as influenced by their families, and this increases the sense of responsibility of caring for nature and thus, the levels of pro-environmental behaviours (Kellert 2002; Cheng and Monroe 2012; Oh *et al.* 2021). To increase the potential of environmental volunteerism, Hughes *et al.* (2019) found that the age to target is in older teenagerhood, especially as people aged between 16 and 24 are the most likely to volunteer (Kellert 2002). Although not explored in this study, this is also the age that would derive the most benefit from improved self-esteem from time in nature (Barton and Pretty 2010), and

training in a citizen science programme that can be included on a CV will also appeal to the 18 to 29 age range.

This suggests that volunteer programmes should be designed to accommodate different age groups. However, time of life might be a more important factor as this determines our priorities and the free time available to volunteer (Silvertown *et al.* 2013). Even with the dedication of the River Guardian group, time of life was a strong determinant of volunteerism. Focus group participants were either committed to other volunteer projects, or busy with career or family obligations, and it was not until they were more available that they were able to join. Thus in an ideal world, it may be more important to have an established volunteer programme that is an available opportunity for when it is more convenient.

These age-related disparities could also be due to a bias in the data due to the typical demographic of the social media platforms upon which the survey was advertised, as in Facebook, Twitter and e-mails, and this may have inadvertently excluded some age groups. Additionally, some respondents may not have been reached as not everyone has access to Wi-Fi or the internet.

6.4.2 The Maigue River catchment and place

A key focus of this work was to ascertain if living in the 'at risk' Maigue River catchment influenced the environmental concerns and actions of residents, and interestingly the Maigue River catchment respondents demonstrated that they were less concerned and less aware of environmental problems than those in the rest of Ireland. For example, more people in the Maigue River catchment agreed or were neutral that '*The economic value of the land should take priority over nature conservation,*' and this was particularly true for those residing in rural areas and villages of the Maigue River catchment, such as the 17 (81%) of the people of the Maigue River catchment who selected 'no concern, the river is fine.' This demonstrates that education and awareness-building are even more vital in regions such as the Maigue River catchment, given its 'at risk' status, and citizen science programmes offer rural community groups, such as with the Maigue volunteers, and

educational institutions the first steps to building awareness of the more invisible pollutants and their impacts (Roche *et al.* 2020).

When the relationship between connection to nature and the reasons why people conducted outdoor activities were compared, the residents of Ireland who daily spend time in nature for recreational purposes were found to feel very deeply connected to nature, except for in the Mague River catchment, where a large percentage only felt a passive connection to nature (4 to 7 on the scale). Also, while respondents who spent time in nature daily for the scenery and wildlife felt deep connections to nature, there was a weaker level of significance for those residing in the Mague River catchment, and in the reverse, only in the Mague River catchment were there people who never spent time outdoors for the scenery and wildlife (3%), even though they felt deeply connected (Figure 4.12).

This difference may be due to the primarily agricultural demographics of the Mague River catchment (86%) (Dalton and Walsh 2018), as the qualitative data suggests that being a farmer or coming from the countryside represents a different perspective and definition about the concept of nature (Phillips 1998; Ahnström *et al.* 2009). Owen *et al.* (2010) found that the characteristics of a community plays a large part in how individuals identify, and that this impacts their actions, so it makes sense that the social norms associated with living in an agricultural catchment would influence the perspectives of the residents.

These differences could also be attributed to the way residence in the Mague River catchment was determined from the survey results. This was a) by answering 'Yes,' they knew the name of their local river and b) naming that river or tributary. This means that they were excluded from the Mague River catchment cohort if they did not know the name of their local river. Additionally, there is the possibility that people were mistaken when they named their local river, particularly as many believe the Shannon to be the name of their river, and as the Mague Catchment is technically in the Lower Shannon estuary area, this confusion is understandable.

The bias could also be because efforts to obtain responses to the survey were targeted at the Mague residents, so the responses were more balanced between those who were and

were not predisposed towards the environment, making this a more genuine and accurate representation of the views of the people of Ireland, and thus a smaller gap between value and action. For example, the email headings sent to the various stakeholders (churches, hotels, businesses, schools, etc) within the Maigue River catchment was 'Maigue River Survey.' For the church newsletters, the title was 'Do you care about your local river?' There were also a few iterations of the survey title itself. For example, the initial working title was 'Values and Connection to Local River Catchment,' and this was changed to 'Connection, concerns and caring for your local river.' These titles, albeit descriptive of the goal of the survey, may have elicited responses predominantly from those with an interest in caring for their local river.

This meant that the survey might not have reached catchment stakeholders who were not necessarily interested in the local river environment. Efforts were made to minimise this bias by conducting face-to-face surveys of random people at outdoor events and cafes in the Maigue River catchment. However, for these 53 in-person surveys, the people approached were all outdoors, and most were spending time in parks in nature spots by waterways, so this bias would only have been minimally reduced. There is also the potential that many stakeholders within the catchment, particularly landowners and farmers, are frustrated at past and current levels of government or community group intervention, interference and attempts to activate community engagement related to environmental protection (Macken-Walsh 2016; Fairbrother 2017). For example, the politicising of climate change and environmental protection putting pressure on farmers, and this may have deterred some survey respondents (Hannigan 2014).

Although attempts to minimise the limitations were made, there were difficulties in reaching people who were not online and who did not access social media; reaching Maigue River catchment residents who were not aware that their local tributary was within the catchment; and overcoming the survey fatigue at the time, as there were numerous questionnaire surveys from a multitude of sources related to water, the environment and nature during the time period that this survey was active.

Chapter 7 Conclusion

The Anthropocene period is used to describe the period of marked impact that we humans and our technology, industry and consumption have made on planet Earth. Human ingenuity has extracted opportunity and utility from all of Earth's natural resources, and our dependence on them has resulted in the degradation of these natural resources with accumulations of pollutants, chemicals, nutrients and waste entering into our hydrologic, atmospheric and geological systems. There is no place on our planet that has not been impacted by humans, and despite the inability of people, animals and plants to survive without it, freshwater, such as that in rivers and streams, is no exception. This study explored the conditions that lead people to realise the value of nature and freshwater systems, and the influences that drive the attitudes and efforts to protect them.

Nature and society are never separate, yet views, values and perspectives of nature, landscape and conservation differ between parties and are always changing. Context and dialogue are necessary to understand the differences between human character and their disparate perspectives on nature. There is a considerable body of work related to farmer attitudes, motivations and willingness to adopt, participate and comply with environmental protection measures, and this doctoral study has endeavored to fill a gap in knowledge by examining the attitudes and motivations of local community residents to adopt and engage in local river stewardship particularly for habitats unprotected by European Union legislation (Weiner et al. (in draft 2023)). The study focused on the Maigue River catchment, a primarily agricultural catchment that was at-risk of failing to meet its WFD obligations due to declining water quality in its rivers and streams.

Citizen science, to monitor the quality in surface waterbodies (such as Freshwater Watch), can provide valuable data on local small stream and river water conditions (Weiner et al. (in draft 2023)). It can also help bridge social and natural sciences to achieve ICM aims because it explores water quality conditions while increasing public engagement in water quality matters. For researchers, it also provides a measure into how participation in a nature-based citizen science project can lead to changes in public attitudes and behaviours. Additionally, sociology focuses on problems of inequality, access to education, powerlessness and health, and a nature-based citizen science initiative that aims to improve

the quality of natural environments also contributes those benefits to society, local communities and the individuals who participate (Hannigan 2014). Participating in nature-based activities requires spending time in the therapeutic landscapes of green and blue spaces and offers mental, emotional and physical health benefits. Citizen science projects are available to all members of the public and they all begin by training and educating volunteers in the required protocol. This increases awareness and knowledge about changes in environmental conditions and problems associated with water pollution. These potential sociological benefits to individuals and communities also highlight the strength of the connections between environmental health and human health, and these may offer a motivation for local people and policy-makers to increase protections for natural habitats, as well as increasing access to them.

The multiple, conflicting demands on freshwater systems and the multi-faceted complexity of river catchment dynamics and water management demonstrates the importance of finding a balance between the needs of human health and wellbeing, the natural environment and its economic value as a natural resource. ICM, with inclusive stakeholder and community participation, requires a balanced, panoptic approach so that natural environments are also protected and given priority. This study explored whether or not nature-based citizen science was an effective, sustainable element of a community bottom-up approach to ICM, and to inform design of citizen science initiatives that attract and sustain local participation in environmental stewardship.

Connections to nature and attachment to place were heavily influenced by childhood experiences and family values, demonstrating their importance for future environmental stewardship. The pathways taken to reach active environmental volunteerism are varied and meandering, but often associated with past nature experiences that instil positive associations and feelings of attachments. These connections can evolve and deepen with age, and vary over a lifetime. Awareness-building for those without long-term nature experiences was demonstrated through learning of publicised pressures on natural environments but also by witnessing community efforts and the availability of opportunities offered to remedy them. Nature-based citizen science offers an opportunity to bridge connections to nature and the value-action gap for those looking to dip their toes into

water-based volunteerism and community engagement. These are only effective, however, if they are thoughtfully planned, managed and implemented, as well as flexible to accommodate the diversity of the volunteers' interests. The value of free training about environmental processes, pressures and the methods used to monitor and remediate problems is immeasurable, for those volunteers who dip in and out, and for those whose time of life leads them to seek long-term opportunities that make a difference. The activity in nature, combined with awareness-building, can lead to social learning and a social community of like-minded people that support and encourage pro-environmental behaviours and norms. By respecting that the shared main goal of all community stakeholders is ensuring a viable future, for health and for the next generations, there is a commonality that can be capitalised upon. Whatever the perspective, if it is based on place attachment, connection to nature or identity, a main motivation that spurs concerns and environmental action is the loss of something that people want for the future.

Long-term volunteers (such as the Inishowen River Guardians) offer the best value for quality citizen science data as well as environmental activism, and they also have high potential to inspire community social diffusion that can change minds, perspectives and behaviours. They can be the agents of change who can bring the knowledge back to their geographic neighbours, communities and local tidy towns groups, and it is these small social learning and social diffusion efforts that may break down the barriers of cultural and political misconceptions and preconceptions about environmentalism while at the same time spreading the word that there is hope to make a difference.

There are multiple citizen science programme design considerations that can be applied based on the findings of this study (Table 7.1). Where the goal of a conservation-based organisation is to find a core of volunteers that have the potential to be river stewards or champions that are self-sustaining as a social group, then the training opportunities should be diverse, but also offered regularly. Much of what can create a loyal community of volunteers is the shared experiences of time in nature, but also the shared learning, and that includes co-learning from each other's prior expertise and experiences. The group, as well as the training, has to also be long-term and consistently available so that new members may join when life and family obligations allow them to dedicate time to

volunteering. This means the opportunity has to be available at all times, and it should be unified and multi-tiered, so that new volunteers can commence with basic training, or refresher courses, and work their way towards advanced levels if they are interested. Also necessary is a consistent, passionate and long-term leader to facilitate and welcome new volunteers, as well as ensure the longevity of the group, or community, dynamic.

A nature-based citizen science programme that is designed to collect data on water quality conditions as well as attract river champions should also lead to river stewardship projects that rehabilitate sections of a waterway. Funding opportunities need to be available long term to account for the level of research and planning that predicated the implementation of a remediation project, but they also need to be independent enough from the authority of government bodies to ensure buy-in from catchment landowners. If local authorities, in their efforts to support the RBMP, wish to engage bottom-up action and empower local people, then policy needs to support partnership building between landowners, neighbours and community catchment stewardship group stakeholders independent of local authority interference.

Table 7.1 Citizen science programme design considerations based on study findings

| Programme and policy considerations for nature-based citizen science |
|---|
| <ul style="list-style-type: none"> • Identify a core of volunteers that are self-sustaining. • Offer diverse training opportunities regularly. • Provide unified and multi-tiered training (basic, refresher, advanced) to encourage long-term volunteer engagement. • Facilitate volunteer involvement with a consistent, long-term leader. • Provide opportunities for shared learning and experiences in nature. • Provide social and family-friendly events for early nature experiences. • Utilise the data so that programmes lead to water rehabilitation projects. • Build programme partnerships with health service executives. • Build farmer and community group partnerships independent of government bodies. • Recruit citizen scientists from outdoor hobbyists and community-based volunteers. |

Legislative priorities differ amongst farmers, landowners and environmental groups. The Sustainable Development Goals and policy seek to find the balance that equally prioritises the economy, society and the environment (UNGA 2015). Ultimately, this balance is challenging to achieve because those stakeholders who find their economic or societal priorities compromised can be the most vocal, and there is legislation that supports their

own interests, even if these are in detriment to the environment. If, on the other hand, the environment was actually prioritised, then this would add value to the economy and society, in terms of health, wellbeing, property value and ecosystem services, as well as climate change mitigation, albeit in the long term. Nevertheless, short term solutions are those more frequently pandered to, and this is part of the contradiction, complexity and tragedy of human dependence on nature's bounty.

There are numerous areas in which policy can be developed from the study findings. It is important to link the importance of caring for the quality of our local places and natural environments to the health and wellbeing of those who wish to experience green and blue nature spaces. Collaboration between health service executives and local catchment management can highlight the link between poor river water quality and human health because of inadequate drinking water treatment will have more of a policy impact. Additionally, nature-based citizen science can be a tool and a first step to experiencing therapeutic landscapes in tandem with traditional therapies. This will increase the level of investment into providing access to nature sites, as well as ensuring their protection and enhancement in quality for the long term. The benefit of time in therapeutic landscapes, particularly blue space, can result in positive nature experiences for current and future generations and ultimately connections with nature and, for some people, deep enough emotional connections that they are driven to protect it. If the influence of early childhood nature experiences are to be captured, then there is potential to incorporate this into school curriculums as well. This direct connection to improvements in lifetime health due to time outdoors can also deepen the broken connections with nature that can lead to improved environmental stewardship and natural resource management.

Future studies on the practical application of a unified, national, tiered citizen science training are recommended. This would involve offering different levels of protocol for different types of community groups and schools to select what they might prefer and what might be relevant for them. For example, training for beginners where there is no need to access the river, to intermediate levels where the level of identification of bioindicator species is basic and easy, to advanced levels of macroinvertebrate species identification that is mostly suitable for very dedicated volunteers (these are also the most useful for

scientists, in terms of determining water quality but also in terms of reliability of the data). This long-term, multi-tiered nature-based citizen science pilot programme would also have a single online digital hub for which data can be incorporated. This would be similar to Ireland's National Biodiversity Data Centre or Coastwatch, but allowing for the incorporation of the basic levels of citizen science data, and also specifically for freshwater systems. This would also enable statistics on the most popular activities and successful levels of recruitment from different stakeholder groups. For example, would fishing clubs, kayaking groups, wild swimmers, colleges, primary schools or other eNGOs offer the best potential for long term citizen science data and volunteerism?

Covid-19 changed the behaviours and appreciation for time in nature for most people on our survey. Future studies that explore the longevity of these changes, or if people reverted to how they behaved before Covid-19, are recommended. If the changes are permanent, did they lead to an increase in environmental stewardship actions or volunteerism? If so, how? If they reverted back, was it involuntarily due to work and family responsibilities? If involuntary, do they feel a loss and any negativity from the decreased amount of time in nature? While their actions may have reverted, did their levels of appreciation and the "need" to get out into nature and reconnect to nature abate? Also, it would be useful to compare the influence of early childhood experience versus an involuntary pandemic-related experience, i.e. is there any difference between the positivity of early childhood experiences causing changed perspective and behaviour, and the negative, health-scare anxiety that brought on the Covid-19 experience? It would also be interesting to explore the experiences of children and determine if and how their Covid-19-related nature experiences may or may not have influenced their behaviours, perspectives and feelings about spending time in nature.

Additionally, due to agriculture being a major pressure on water quality, future research that focuses on farmers and the drivers of change in behaviours and perspectives related to the environment and water quality in rivers would be useful. It would be an opportunity for social learning, but also to understand the specific barriers that might prevent them from adapting practices that are detrimental to water quality. It would also be useful to explore farmer perspectives about any pressures they feel have been put on them by state agencies

and community groups, and if these act as a deterrent. Also, if climate change has had an impact, if they anticipate an impact, or if they are concerned about impacts, and if so, which impacts? If they did have any concerns, about, for example, the water availability and a sustainable, reliable supply, would they be willing to contribute data to a citizen science project that aims to explore solutions? If not, would they be more amenable to contributing data to their farmer organisation?

In conclusion, this interdisciplinary study into the confluence of nature, people and place has examined the influence of nature (and water) experiences on identity, sense of belonging, attachment to place and influence on environmental behaviours. Community-driven, collaborative initiatives are essential to help achieve effective catchment and river management. Nature-based citizen science and volunteerism provide a platform for public involvement that fosters connections to nature and a sense of ownership over local and community ecosystems that can ultimately benefit the health, wellbeing and resilience of people, communities and the environment.

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Appendix

Appendix 1

Article including table of International and Irish CS water-related projects:
Weiner D., Bloomer, J., Ó Conchúir, R., and Dalton, D. 2022. "The Role of Volunteers and Citizen Scientists in Addressing Declining Water Quality in Irish River Catchments." *Citizen Science: Theory and Practice* 7 (1).

Appendix 2

Sample of the keyword searches and combinations for relevant literature review articles related to citizen science and volunteerism.

Appendix 3

The Mary Immaculate College Research Ethics Committee (MIREC) clearance and approval to conduct the study.

Appendix 4

Focus group and interview Information Letter and Consent Form samples.

Appendix 5

The questionnaire survey entitled "Connections, concerns and caring for your local river."

Appendix 6

List of Maigue River Catchments contacts who received the questionnaire survey.

Appendix 7

List of open-ended questions of the questionnaire survey.

Appendix 8

Interview Guides for the focus groups and interviews.

Appendix 9

Codebook for qualitative thematic analysis

Appendix 10

Examples of quotations based on thematic analysis

Appendix 11

Article of efforts to profile and recruit citizen science volunteers:
Weiner, D., Dalton, C. (Co-authors TBC) (in draft 2023) "Profiling efforts to establish voluntary stewardship in a river catchment"

Appendix 1

Article on the role of citizen science to monitor water quality:

Weiner, D., Bloomer, J., Ó Conchúir, R. and Dalton, C., 2022. The Role of Volunteers and Citizen Scientists in Addressing Declining Water Quality in Irish River Catchments. *Citizen Science: Theory and Practice*, 7(1), p.13. DOI: <http://doi.org/10.5334/cstp.447>



The Role of Volunteers and Citizen Scientists in Addressing Declining Water Quality in Irish River Catchments

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REVIEW AND
SYNTHESIS PAPER

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ABSTRACT

Integrated Catchment Management (ICM) frames water management in Ireland to account for the complex hydrological, biophysical, and environmental interactions along with the political, socio-economic and cultural influences inherent in the management of river catchments. Despite a range of European Union (EU) Directives, national laws, policies, and incentives, the quality of water and biological diversity in Irish rivers is declining. In response, there has been an increased effort to involve local communities in ICM through a bottom-up, nature-based citizen science approach to activate local cooperation and environmental stewardship. This paper assembles 157 examples of citizen science water-based projects (48 in Ireland as of 2021) to appraise the position of community-led water monitoring in ICM. Notable differences found between the Irish and international programmes found a greater emphasis on habitat internationally, while a taxonomy focus was evident in Ireland despite a lower number of skilled volunteer activity-based citizen science projects. The continuing decline in water quality in Ireland, even with appropriate regulations, commendable governance changes, and expansion of citizen science, suggests more work is necessary before there will be successful ICM and improvements to river water quality.

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KEYWORDS:

integrated catchment management; citizen science; water quality; environmental stewardship; volunteer; stakeholder involvement

TO CITE THIS ARTICLE:

Weiner, D, Bloomer, J, Ó Conchúir, R and Dalton, C. 2022. The Role of Volunteers and Citizen Scientists in Addressing Declining Water Quality in Irish River Catchments. *Citizen Science: Theory and Practice*, 7(1): 13, pp. 1–12. DOI: <https://doi.org/10.5334/cstp.447>

INTRODUCTION

Nothing links humans more to the natural world than our connection to and dependence on fresh water. Good-quality water that is not polluted is essential for life and human health, yet globally, nationally, and locally in Ireland, river water quality is in decline (Malmqvist and Rundle 2002; Dodds, Perkin, and Gerken 2013; EPA 2019). To support a rapidly growing global human population, there is a corresponding growth in urbanisation, industrial activity, energy consumption, and intensification of agricultural activity, and these are major contributors to the current state of environmental degradation in this Anthropocene era (Crutzen 2006). Increased concentrations and cumulative loads of environmental pollutants, unsustainable use of natural resources, and loss of natural habitats and biodiversity impact water quality and impair freshwater ecosystem services, and this is against the public good (Dodds, Perkin, and Gerken 2013). Ecosystem services include direct provisions, such as food, medicine, raw materials, freshwater supply and energy; and indirect supports, such as photosynthesis, flood control, pollination and nutrient cycling (Sandifer, Sutton-Grier, and Ward 2015).

European Union Habitat, Nitrates and Water Framework (WFD) Directives provide strong statutory frameworks for managing river basins to ensure that water quality is maintained or improved to achieve at least good ecological status. Progress was made in the first cycle of River Basin Management Plans 2009–2014 under the WFD on the scientific aspects of catchment management in the Republic of Ireland, such as in catchment delineation, catchment characterisation, and increased monitoring, as well as baseline and applied research (EPA 2019, 2020). However, these regulatory or top-down successes in freshwater management in Ireland failed to achieve legislative objectives, and surface water quality, particularly in rivers, has continued to decline (EPA 2019). Regulations, incentives, implementation frameworks, and European, national, and community schemes to protect natural habitats and water quality may have even contributed to challenges of their acceptance, and thus their ineffectiveness, because they did not allow for meaningful participation and social learning with local stakeholders (Boyden 2015; Daly, Archbold, and Deakin 2016). Pressures from human activity are causing the deterioration in Ireland's river water quality, so an acknowledged causative factor in the continued decline is a lack of local community engagement in state-led water protection systems (Rolston, Jennings, and Linnane 2014; EPA 2019).

Integrated Catchment Management (ICM) is endorsed nationally and internationally as essential to successful

water management. ICM is the approach prescribed by the River Basin Management Plan (RBMP) from 2018 to 2021, as part of the second RBMP cycle to best implement the WFD objectives by stressing the importance of increasing public participation and stakeholder engagement in decision-making. It is being implemented by the newly created Local Authority Waters Programme (LAWPRO) in conjunction with Ireland's Environmental Protection Agency (EPA), working with local authorities and multiple other stakeholders. ICM is about bringing water issues, organisations, and people together, at the right scale, to deliver effective solutions that offer multiple benefits. ICM fosters the integration of both the top-down and bottom-up approaches that may foster a meeting in the middle that achieves water protection through collaborative action (Rollason et al. 2018).

Community engagement in water protection issues include volunteer participation in decision-making, active on-the-ground engagement, and more recently, citizen science initiatives. These models can foster environmental stewardship, caring for nature and water, increased scientific literacy, and good community citizenship (Bonney et al. 2009; Conrad and Hilchey 2011). Citizen science is a valuable form of public participation that involves non-professional scientist volunteers in collaborative scientific investigations, providing professional researchers with access to localised data at extensive spatial and temporal scales that would otherwise be impossible or prohibitively expensive to obtain (Dickinson et al. 2012).

Some citizen science project models are broadscale and internet-based, and they utilise multiple participants to collect data on large geographical scales, while others are more focused and activity-based, and organise targeted groups of volunteers to tackle local-scale issues (Conrad and Hilchey 2011). Owing to technological advancements, more citizen science projects are using Information and Communication Technology (ICT) mobile applications and websites to record data and promote projects, and this can increase uptake in projects related to biodiversity and the environment (Kobori et al. 2016; Bautista-Puig et al. 2019). Not only has data gathered by citizen scientists informed researchers of environmental conditions, but citizen science activities also help to build local community awareness of those environmental conditions. This can increase ecological identity and a sense of place that can motivate and empower individuals to take action or to become involved in volunteering and in policy and decision-making to remedy environmental issues within their local communities (Gooch 2003; McKinley et al. 2017). Citizen science, both broadscale and focused, is increasingly being promoted and actioned as a mainstream exercise to bridge the gap between top-down environmental regulation and bottom-up individual behaviour (Bautista-Puig et al. 2019).

The aim of this review paper is to examine community-led water quality monitoring in ICM, and to evaluate the role of citizen science. A range of international biodiversity and in-stream citizen science projects are collated and analysed. A summary of water governance, and comparisons with recent citizen science developments in Ireland helps identify gaps and acts as a first step for future plans to co-develop holistic community-based initiatives. The research is based on the concept that citizen science efforts in Ireland lag behind other countries owing to a predominantly top-down approach that lacked opportunities for public participation.

METHODOLOGY

This article uses review and synthesis methods, including a scoping review and meta-analysis. Firstly, the key components of water governance in Ireland and particular characteristics (governance, organisations, and projects) were assembled from primary published studies and authors' professional experiences to provide stakeholder context. Secondly, key characteristics of community-led citizen science projects, including programme focus and target audience, were evaluated to help identify potential gaps and inform future plans for community engagement.

Key review themes related to freshwater environments, catchment management, community engagement and volunteerism, and citizen science models were reviewed by summarising material from primary published studies between the years 2000 and 2021. Using Google Scholar and Web of Science (with Ex Libris's Summon), keyword searches were conducted with variations in terminology such as "natural resource management," "river basin management," and "catchment management," or "citizen science," as well as "participatory action research," "environmental stewardship," and "community-based monitoring," followed by systematic Boolean search combinations with terms such as "water quality," "river," "surface water," or "catchment" to narrow responses. Other combinations include the terms "citizen science" or "volunteer" with the words "barrier," "benefit," "health," "confidence," "education," "policy," "effective," "satisfaction," and "long-term."

Once the literature was collected, each study or review was further examined along with internet searches to elucidate examples of aquatic or riparian-based citizen science projects. These projects were collated in a metadatabase. The Excel file was populated with a non-exhaustive list of 157 global English-language, water-related citizen science projects to aggregate examples from the individual studies. Variables recorded include programme focus, region,

type of survey, and target audience. The projects were classified according to their programme focus, whether habitat monitoring (water chemistry, nutrient levels, pollution, or other abiotic conditions), taxonomy (specific taxa), both habitat and taxonomy, biodiversity (non-specified flora and fauna), and invasive alien species. The type of survey was classed as either broadscale internet-based or focused activity-based. Projects were then subdivided by target audience for data provided by either skilled volunteers who are trained to sample and/or identify biodiversity to species level, or members of the public reporting on casual sightings of specific taxa, invasive species, or non-specified biodiversity. It must be noted that there was a deliberate bias in the metadata searches towards citizen science projects in Ireland. The comprehensive list of Irish water-related citizen science projects was then compared with the wider list for the comparative ratio of project types, activities and level of skill required.

RESULTS

WATER GOVERNANCE IN IRELAND

In response to criticisms of a top-down approach in the first cycle of the RBMP, the second RBMP cycle focused on increasing communication, stakeholder engagement, and public participation (Rollason et al. 2018). Key players in water governance in Ireland are included in Supplemental **Table 1**. In 2015, a new three-tier governance framework was established: (1) A water policy advisory committee; (2) the EPA, who are responsible for coordination and technical implementation; and (3) the Local Authority Water and Communities Office (LAWPRO), who are tasked with coordinating public participation at the regional and local levels (O Cinnéide, O'Riordan, and Boyle 2021). Additionally, An Fórum Uisce (The Water Forum) was established as a statutory body in 2018 to strengthen democratic inputs and facilitate stakeholder engagement in water governance and decision-making.

Catchment management associations, Rivers Trusts, nongovernmental organisations (NGOs), community groups, and European Innovation Partnership (EIP) projects now also populate the landscape of community engagement with water in Ireland. However, community-led initiatives can struggle to access sufficient funding and technical expertise to implement their catchment plans. Some NGOs have secured European Union (EU) funding for example, through the LIFE programme (CINEA 2022) and INTERREG (2022), but they still require technical support, particularly when undertaking management actions in Special Areas of Conservation (SACs) or Special Protection Areas (SPAs). Recent efforts to address this have resulted in the pilot Resilience Project which provided partial funding

to employ project officers for two rivers trusts (Inishowen and Maigue) to drive forward the goals of the rivers trusts and LAWPRO.

CITIZEN SCIENCE NATURE-WATER PROJECTS

A literature and internet review of citizen science nature-water projects was conducted to examine key characteristics (programme focus, region, type of survey, and target audience) and to help inform future plans for community engagement. This resulted in the collation of 157 water-focused citizen science projects in a metadatabase. A recent review by Capdevila et al. (2020) assembled 34% of these (published) projects in an examination of characteristics for success. Citizen science water-related projects (both published and

ongoing) focus on habitat monitoring (45%) for data on water chemistry, nutrient levels, pollution or other abiotic conditions, taxonomy (22%), both habitat and taxonomy (16%), biodiversity (10%), and invasive alien species (6%) (Figure 1). There were more programmes focused on activity-based local scale projects than there were broad geographical scale ICT-based projects in which volunteers submit data on chance sightings (Table 1).

A wide range of data was sought, varying from reports provided by skilled volunteers who are trained to sample and/or identify biodiversity to species level through to members of the public reporting on casual sightings of specific taxa, invasive species, or non-specified biodiversity. ICT or gamified (task, game, activity) projects attract

| TYPE OF PROGRAMME | ACTIVITY-BASED | ICT BASED | ICT AND ACTIVITY- BASED | TOTAL |
|----------------------------------|----------------|-----------|-------------------------|------------|
| Alien invasive species | 3 | 6 | 0 | 9 |
| Alien invasive species & Habitat | 0 | 1 | 1 | 2 |
| Biodiversity | 3 | 12 | 1 | 16 |
| Habitat | 41 | 26 | 3 | 70 |
| Habitat & Taxonomy | 25 | 0 | 1 | 26 |
| Taxonomy | 14 | 20 | 0 | 34 |
| Total | 86 | 65 | 6 | 157 |

Table 1 Summary of activity-based (focused) and Information Communication Technology (ICT) (broadscale) aquatic citizen science programmes (n = 157).

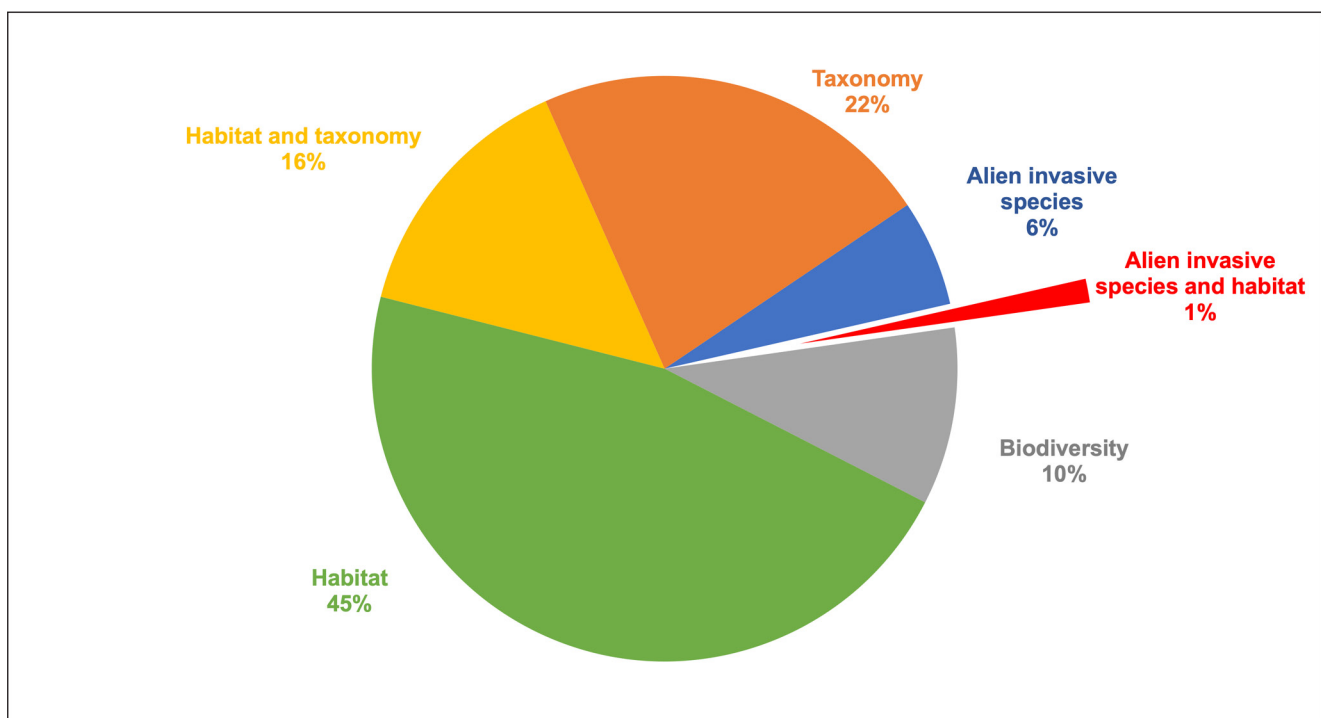


Figure 1 Summary of aquatic citizen science projects and their programme focus (n = 157).

technophiles (Curtis 2015), and there are purely online formats, such as Zooniverse (2022), which offers a choice of 87 projects on a range of subjects for their 1.6 million registered volunteers, and *CitSci.org* (2022), which has a facility for researchers to build customised online research projects that can collect, analyse, and provide feedback on data and project participants.

Activity-based projects focus on more intense modes of participation and maximise the role of the individual participant through professional training opportunities, specialised equipment, and rewards (Crall et al. 2011; Catlin-Groves 2012). Citizen science initiatives to monitor local river issues are a source of community action and a way for people to come together with the aim of addressing collective and individual concerns (Haklay 2013). For example, researchers can learn of the presence of rare or invasive species, gaps, patterns, relationships, and trends in climate, in habitats, or in ecosystems (Bonney et al. 2009), and scientists are also combining and comparing historical and current datasets from different citizen science programmes to glean information (Dickinson, Zuckerberg, and Bonter 2010). Some international environmental protection agencies use volunteer water quality data to target streams and rivers for protection (McGoff et al. 2017), and community-based rainfall, river levels, and flood observations, alongside traditional sources of hydrological information, support characterisation of catchment response more accurately (Starkey et al. 2017). Monitoring

physical habitat mosaics and human pressures (MoRPh) within short river reaches was the focus of a project by Shuker et al. (2017), while smaller waterbodies were examined in McGoff et al. (2017), filling a gap in statutory water quality monitoring programmes (Shuker et al. 2017).

The review revealed 157 global projects as of 2021 that could be categorised as citizen science for water stewardship. The projects were separated by region, resulting in 109 non-Ireland, international projects, which are included in Supplemental Table 2, and 48 Irish-based projects, which are included in Supplemental Table 3. The 48 Irish projects represent an increase compared with previous reviews of citizen science projects in Ireland (Donnelly et al. 2014; Roche et al. 2021). Just four of the water quality projects in Ireland have been published as of 2021: The CITCLOPS project/Forel-Ule Colour Index System (Garaba et al. 2015), the Citizen Science project for Sustainable Development Goal 6 (Garaba et al. 2015; Quinlivan, Chapman, and Sullivan 2020), the Backdrop project (Hegarty et al. 2020; Hegarty et al. 2021), and a biosecurity mobile application to report on alien invasive species (Melly and Hanrahan 2018). The projects in Ireland are equally split between coastal/marine and freshwater environments, whereas of the 109 international projects, 82% focus solely on freshwater and 10% on marine. In Ireland, more than 28% of projects are habitat focused, while 36% target taxonomy and 19% target biodiversity (Figure 2). In contrast, 51% of the non-Irish projects target

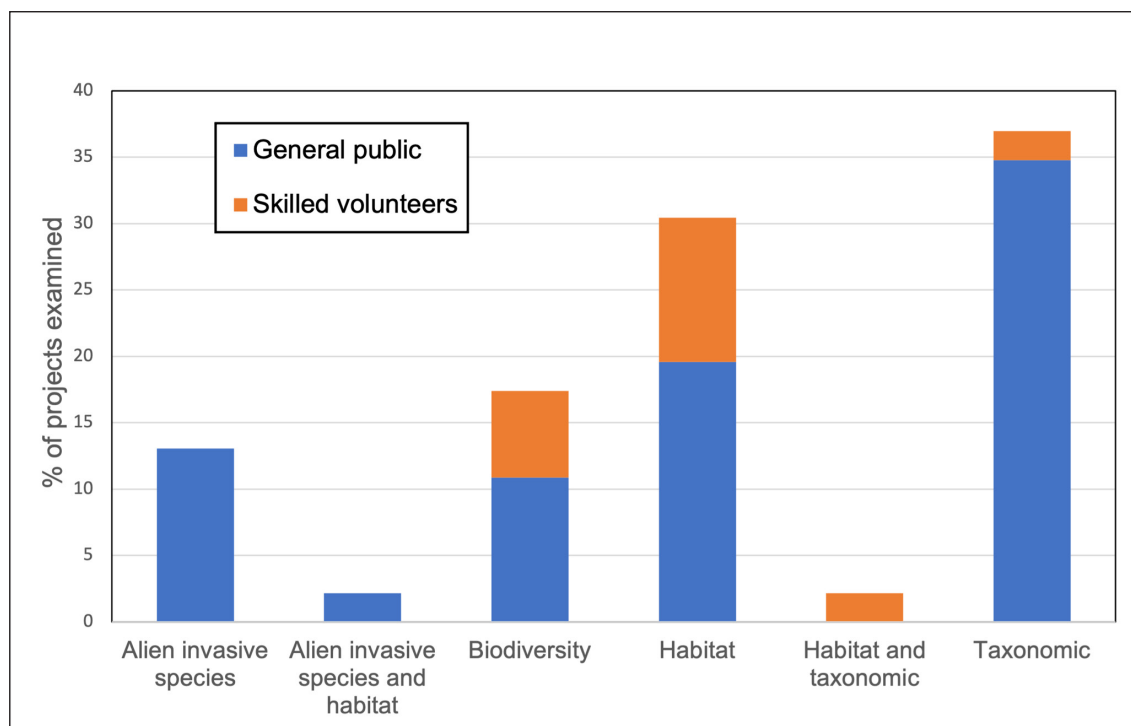


Figure 2 Summary of Irish marine and freshwater citizen science programmes and level of skill required (n = 48).

habitat, 16% target solely taxonomy, and 23% target both habitat and taxonomy. In Ireland, the majority (79%) of projects target members of the general public, while 21% focus on more skilled volunteers, whereas with the non-Irish projects, the majority (67%) target skilled volunteers and 27% the general public (*Figure 3*).

This notable difference between the Irish and international programmes suggest that activity-based citizen science projects targeting skilled volunteers to monitor freshwater habitats could be further developed in Ireland.

DISCUSSION

FRESHWATER ENVIRONMENTS

This review of water-focused citizen science projects has revealed a diversity of project types across regions, types of water, and geographical scale. The dynamic nature of water and its complex range of scale, interested parties, and interacting sites make waterscapes one of the most challenging natural resource environments to manage, particularly when being sensitive to local cultural symbolism, landscape, and connectedness to water (Acharya 2015). The water in rivers constitute common resources along with their plants, invertebrates, and wild fish, and thus are freely available for all to use. This also brings threats of overuse, damage, and degradation. Adding to the complexity, rivers are natural geographical

markers, often chosen to delineate boundaries between political, administrative, and privately-owned lands, and while the variously-owned and managed river banks may grow, shift, and shrink, the water in the rivers remains common property (Blomley 2008).

In contrast, the catchment can be an ambiguous geographical entity for many people to contemplate and a challenge when developing citizen science initiatives. In terms of scale, it is more difficult for people to appreciate large-scale spatial and long-term temporal biogeographical and ecological processes (Saunders, Brook, and Myers Jr. 2006), which are often the subject of ICT-focused citizen science projects. Thus, environmentally damaging behaviour can stem from a lack of awareness that local actions can cause far-reaching negative consequences. While small-scale river restoration initiatives may be more successful in activating local engagement, it is management at the wider catchment scale that offers the greatest potential. Thus local activity-based projects need to be properly rooted in catchment management plans. Rivers constantly interact with the surrounding landscape as they collect water along with any pollutants, chemicals, and nutrients as they flow downstream from their sources and headwaters to their flood plains and outlets. Successful management initiatives require building awareness of these intricate interactions, in collaboration with local communities, whilst drawing attention to protection on a catchment scale (Kerr 2007; Surridge, Holt, and Harris 2009).

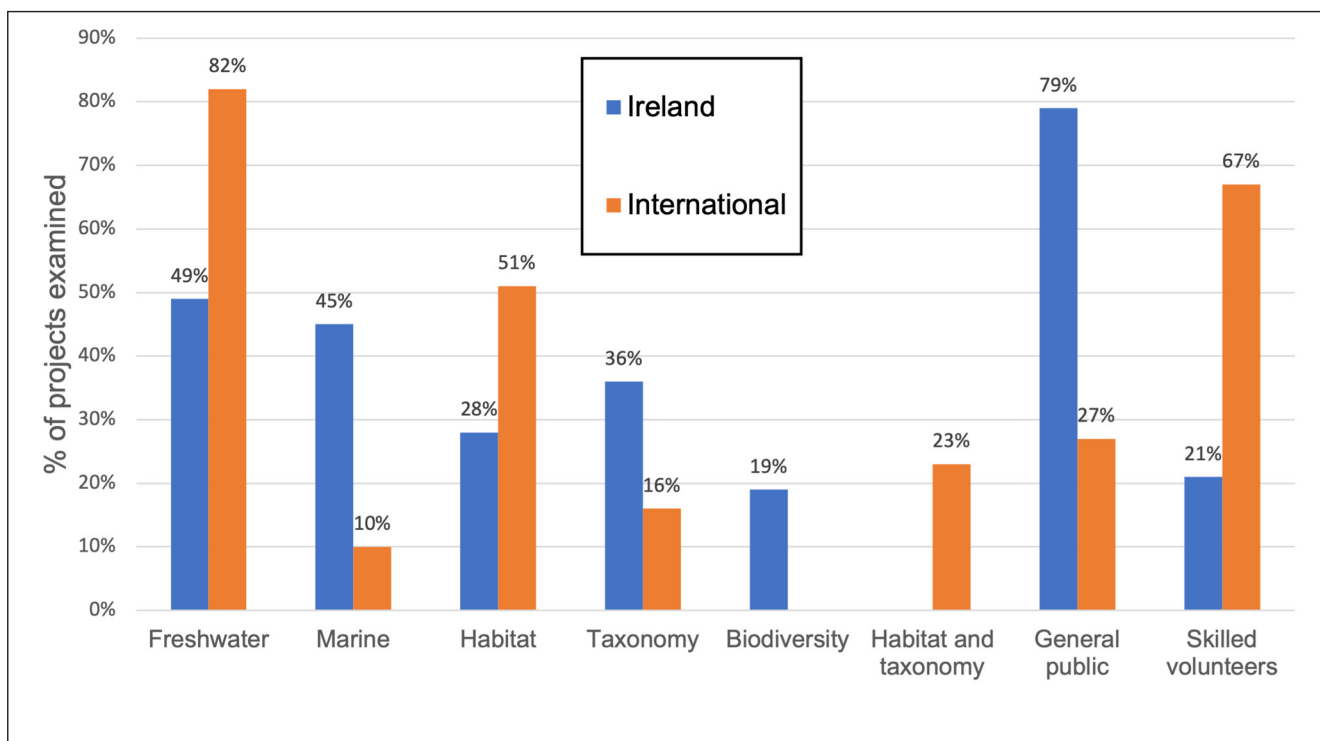


Figure 3 Comparison between Irish (n = 48) and international (n = 109) water-related citizen science projects and project focus.

CATCHMENT MANAGEMENT

ICM is based on the concept that catchments are distinct, unique biophysical units on the scale of an entire river drainage basin. Included in each unit are all the influencing political, socio-economic, and cultural factors inherent and omnipresent within a river catchment (SurrIDGE, Holt, and Harris 2009). ICM focuses the scale to all the potential influences and impacts within a river basin for the protection of ecology, water quality, and socio-economic functions (Rollason et al. 2018), and it also ensures water quality can be monitored, that there are appropriate policy objectives and organisational structures, and that there is integration of scientific and local community involvement. The recent governance changes and emergence of a new landscape of community engagement with water in Ireland has the potential to fulfil ICM more effectively.

A collaborative, integrative approach is fundamental to successful ICM if the programme is adequately supported and implemented, all stakeholder aims are identified, and it is flexible and tailored to the characteristics of the people and landscape of the catchment (Ballinger et al. 2016). Community-based natural resource management is a bottom-up, participatory approach to ICM that fully involves all stakeholders in water planning and implementation to achieve water quality restoration objectives (Dublin Statement 1992). This collaborative, social learning process can give insight to the multi-faceted scope of catchment biophysical processes that can help multiple stakeholders understand that resilience and sustainable solutions come from a catchment-scale perspective (Micha et al. 2018). Challenges in terms of governance, supports, and funding have constrained community-led programmes in Ireland to-date. Moreover, integrated management approaches for water resources have also been criticised for their vagueness, for their overly-ambitious aims, and for the difficulty in implementing plans that adequately address all interests of stakeholders without creating new problems (Butterworth et al. 2010).

CITIZEN SCIENCE FOR RIVER STEWARDSHIP

Surface water or blue spaces, such as lakes, rivers, and coasts, are globally recognised as physical, ecological, economic, and cultural assets and attractions in the landscape (White et al. 2010). In contrast, water quality is a less tangible entity and has been described as invisible (Capdevila et al. 2020). Thus, the challenge in citizen science for river stewardship is how best to motivate and sustain stakeholder involvement to fulfil the fundamental participatory component of ICM.

The tendency of a person towards pro-environmental behaviour increases if that person feels a connection to nature (Mackay and Schmitt 2019). If their identity is intertwined with their emotional attachment to a particular place, for

example a river, then they may be more predisposed to protecting it (Lokhorst et al. 2014), particularly if it is at risk of pollution or deterioration (Stedman 2002). Positive nature experiences can increase feelings of connectedness to nature (Mayer et al. 2009; Lokhorst et al. 2014) that can lead to further pro-environmental behaviour and, thus, improved or maintained environmental conditions (Toomey and Domroese 2013). A complex combination of personal (age, gender, education, personality), social (urban/rural, class, geographical proximity, childhood experience) and cultural (religion, values, politics) traits can influence the propensity towards pro-environmental behaviour (Gifford and Nilsson 2014). An examination of the profile of Irish citizen scientists will be an important component in the next research stage.

Citizen science provides numerous benefits to science, research, and volunteers, can complement top-down environmental regulation, and can facilitate a meeting in the middle for stronger, more effective water quality protection. Citizen science initiatives must further scientific knowledge to achieve genuine outcomes (ECSA 2019), and not simply be infotainment and a greenwashing exercise. Additionally, there are criticisms of citizen science data due to potential biases, errors, and variability (Dickinson, Zuckerberg, and Bonter 2010; Dickinson et al. 2012). Methods to improve data validity may include researcher-prepared reference data, increasing supervision and training, and recruitment of long-term volunteers or those with an economic, health, or personal stake in the outcome of the research (Aceves-Bueno et al. 2017). All of these are challenges for the development of citizen science in Ireland, particularly in terms of being an opportunity for meaningful engagement, use and management of the data, and longer-term project implementation. Thus, the design of the initiative is important for its effectiveness as well as its ability to attract volunteer participation and maintain long-term engagement.

FUTURES FOR COMMUNITY ENGAGEMENT WITH WATER IN IRELAND

Water governance reform at national, regional, and local levels represents a welcome advancement in the water sector in Ireland. The developments aimed at coordinating public participation at the regional and local level are very positive and are providing stronger leadership and opportunities for local communities (Hegarty et al. 2020). The proliferation of water quality-related citizen science projects across nations, and the expansion of community players and projects in the Irish landscape suggest a brighter future for community engagement with water in Ireland but also present challenges. Despite laudable citizen science provision and expansion as well as new governance structures, water quality in Ireland has continued to decline.

Further collaboration and partnership between agencies and all catchment communities is necessary to reach scientific outcomes and potential solutions. Additional vertical and horizontal learning opportunities are needed to build capacity to address environmental challenges at local scale. Successful, well-implemented nature-based volunteer and citizen science initiatives have the potential to offer numerous benefits to the environment, society, and the economy including improvements in biodiversity, active community engagement, and enhanced ecosystem services (*Figure 4*). However, without adequate supports, funding, and structured data repositories, bottom-up, community-led programmes will have limited scientific value (Ballinger et al. 2016).

The contrasts highlighted between the international projects and the Irish projects demonstrate that there is room in Ireland to develop projects that train volunteers to conduct skilled monitoring of freshwater habitats. This would be particularly useful to science if volunteers were trained to monitor the water quality in the rivers

and streams adjacent to their private lands where state agencies or scientists have no access. To optimise the potential of success, this gap could also be filled with citizen science programmes that are co-designed by community members using the principles of social learning, which might help identify problems and encourage stakeholder agreement on remediation measures. A nationally coordinated water-focused programme developed in this manner with standardised protocols and adequate supervision and training may simplify the complex citizen science landscape of multiple short-term ad-hoc projects and data collection initiatives. For example, tiered levels of data collection starting from (1) submissions on chance species sightings, to (2) regularly scheduled site surveys for specific and invasive species, to (3) water-based chemical and nutrient testing, and (4) beginner macroinvertebrate sampling up to (5) advanced levels of macroinvertebrate identification. This would offer volunteers a wider range of opportunities to suit their differing interests, motivations,



Figure 4 Benefits of nature-based citizen science.

skills, and commitment, as well as offer progression and upskilling to help sustain longer-term volunteerism, which would also help improve problems of data validity (Aceves-Bueno et al. 2017). LAWPRO launched a catchment-based training programme in 2021 to be delivered to community groups that focuses on healthy waters, sustainable activities, citizen science, catchment management, and local biodiversity planning and restoration works (LAWPRO 2021). The recruitment, engagement, and confidence-building that citizen science provides may ultimately lead some volunteers to progress to the more informed volunteer and advanced scientific data collection (Donnelly et al. 2014), and others to become more active in policy consultation and decision-making.

Capdevila et al. (2020) identified three key contributory factors that ensure success in citizen science projects in water quality monitoring: (1) individual attributes of participants, (2) organisation characteristics, and (3) supporting structures. In Ireland, much of the decline in water quality is associated with agricultural activities (EPA 2019). Community-led citizen science may offer farmers the social norm that can initiate behavioural change (Goldstein, Cialdini, and Griskevicius 2008), and because citizen science is voluntary, it may increase potential for greater uptake in the farming community compared with compulsory regulations (Barnes, Willock, and Hall 2013). Farmers have an intimate knowledge of the land and the ability to observe changes in biodiversity over time, and with the proper design and support, citizen science may provide the tool for farmers to autonomously monitor impacts of their farming practices on water quality, and also the means to communicate that knowledge and data. More work needs to be done to reach rural communities and to increase awareness of the wide range of opportunities to get involved, either as individuals, as families, or with a community group. With the recent upsurge in the number of new water-related citizen science projects, it could be a matter of publicising the available citizen science opportunities, and also allowing for some time for public participation to build. A centralised system would help in assessing project success in terms of levels of engagement and sustained engagement and upskilling, and it would help support community groups with project implementation by providing a means from which they can easily report on data and provide participants with regular feedback, which would help them to maintain volunteer engagement for the long term (Haklay 2015). With increased uptake, Ireland's citizen science landscape may still foster the sharing of information and social learning that is necessary for bottom-up engagement, successful ICM, and, ultimately, improvements in water quality.

CONCLUSION

Shared common resources within a catchment, such as rivers, lakes, coastal waters, and fish, risk pollution, overexploitation, and unsustainable use unless there are locally-designed and community-led systems based on local knowledge to protect those resources. Despite its limitations, citizen science can be a multi-beneficial bottom-up approach to water quality monitoring that can complement top-down catchment management and governance in Ireland. With proper design, promotion, implementation, and training, nature-based citizen science can meet the goals of both scientists and volunteers.

SUPPLEMENTARY FILE

The Supplementary File for this article can be found as follows:

- **Supplemental Tables.** Tables 1 to 3. DOI: <https://doi.org/10.5334/cstp.447.s1>

ACKNOWLEDGEMENTS

The assistance provided by Liz Gabbett and the Maigne Rivers Trust is greatly appreciated.

FUNDING INFORMATION

The funding supplied by the Environmental Protection Agency (EPA) Research Programme (2019-W-PhD-15) and Mary Immaculate College - University of Limerick is greatly appreciated.


COMPETING INTERESTS


The authors have no competing interests to declare.


AUTHOR CONTRIBUTIONS


Each author approved the final manuscript, agreed to be named on the author list, approved the full author list, and significantly contributed to the conception and design, drafting, reviewing, and/or revising the article.

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TO CITE THIS ARTICLE:

Weiner, D, Bloomer, J, Ó Conchúir, R and Dalton, C. 2022. The Role of Volunteers and Citizen Scientists in Addressing Declining Water Quality in Irish River Catchments. *Citizen Science: Theory and Practice*, 7(1): 13, pp. 1–12. DOI: <https://doi.org/10.5334/cstp.447>

Submitted: 14 June 2021 Accepted: 08 April 2022 Published: 06 May 2022

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Citizen Science: Theory and Practice is a peer-reviewed open access journal published by Ubiquity Press.

Appendix 2

Example keyword searches for citizen science portion of literature review methodology

| From years 2000-2021 | Combined with : | | | | Number of documents |
|----------------------------|-----------------------------|---------------|---------------|----------------------|---------------------|
| Keywords | Combination 1 | Combination 2 | Combination 3 | Combination 4 | Google Scholar |
| Citizen science | project | | | | 27,300 |
| Citizen science | project | water | | | 17,200 |
| Citizen science | project | water | river | | 16,400 |
| Citizen science | project | water | river | catchment | 3,990 |
| Citizen science | project | water | river | catchment management | 589 |
| Citizen science | project | water quality | | | 17,300 |
| Citizen science | project | water quality | river | | 15,200 |
| Citizen science | project | water quality | river | community engagement | 1,840 |
| Citizen science | water | | | | 19,100 |
| Citizen science | water | river | | | 16,800 |
| Citizen science | water | river | catchment | | 4,390 |
| Citizen science | water | river | watershed | | 10,500 |
| Citizen science | water quality | | | | 10,600 |
| Citizen science | water quality | river | | | 7,470 |
| Citizen science | water quality | river | project | | 6,890 |
| Citizen science | water quality | river | monitor* | | 6,950 |
| Citizen science | water quality | river | monitor* | volunteers | 3,500 |
| Citizen science | natural resource management | | | | 4,910 |
| Citizen science | natural resource management | river | | | 2,820 |
| Citizen science | natural resource management | river | water quality | | 1,440 |
| Citizen science | benefits | | | | 17,300 |
| Citizen science | motivation | | | | 17,500 |
| Citizen science | motivation | nature-based | | | 1,390 |
| Citizen science | motivation | nature-based | water | | 1,160 |
| Citizen science | limitations | | | | 17,000 |
| Citizen science | education | | | | 19,300 |
| Citizen science | learning | | | | 17,200 |
| Citizen science | confidence | | | | 17,700 |
| Citizen science | barriers | | | | 17,500 |
| Citizen science | policy | | | | 24,000 |
| Citizen science | effective* | | | | 17,900 |
| Citizen science | effective* | water quality | | | 9,040 |
| citizen science | river monitoring | | | | 213 |
| citizen science | river monitoring | volunteers | | | 153 |
| Community-based monitoring | water quality | | | | 2,220 |
| Community-based monitoring | water quality | river | | | 1,740 |
| Community-based monitoring | water quality | river | volunteers | | 812 |

| Keywords (continued) | Combination 1 | Combination 2 | Combination 3 | Combination 4 | Google Scholar |
|-------------------------------|---------------------------------|---------------|---------------|---------------|----------------|
| Community-based monitoring | water quality | surface water | | | 625 |
| Community-based monitoring | water quality | surface water | catchment | | 286 |
| Community-based monitoring | water quality | ambient water | | | 60 |
| Community-based monitoring | water quality | ambient water | catchment | | 35 |
| Community-based monitoring | integrated catchment management | | | | 67 |
| Community-based monitoring | river | | | | 3,760 |
| Community-based monitoring | conservation | river | | | 3,220 |
| Environmental stewardship | | | | | 29,800 |
| Environmental stewardship | volunteers | | | | 15,400 |
| Environmental stewardship | catchment | | | | 5,550 |
| Environmental stewardship | catchment | water quality | | | 3,560 |
| Environmental stewardship | catchment | water quality | surface water | | 1,560 |
| Participatory Action Research | water | | | catchment | 2,490 |
| Participatory Action Research | watershed | | | | 8,470 |
| Participatory Action Research | water | River | Catchment | | 2,070 |
| Participatory Action Research | water | Watershed | | | 7,080 |
| Participatory Action Research | water | River | Catchment | River | 13,300 |
| Participatory Action Research | water quality | | | | 3,980 |
| Participatory Action Research | water quality | watershed | | | 2,160 |
| Participatory Action Research | water quality | catchment | | | 1,110 |
| Participatory Action Research | water quality | catchment | river | | 971 |
| health | nature | | | | 841,000 |
| health benefit | nature | | | | 28,800 |
| health benefit | time in nature | | | | 130 |

| Keywords (continued) | Combination 1 | Combination 2 | Combination 3 | Combination 4 | Google Scholar |
|---------------------------------|-------------------------|---------------------------|---------------|---------------|-----------------------------------|
| health benefit | green space | | | | 1260 |
| health benefit | blue space | | | | 112 |
| natural resource management | water quality | river | | | 45,000 |
| integrated catchment management | | | | | 7,910 |
| integrated catchment management | community engagement | | | | 678 |
| integrated catchment management | public participation | | | | 1,470 |
| integrated catchment management | engagement | | | | 4,220 |
| integrated catchment management | community engagement | citizen science | | | 157 |
| catchment management | political ecology | water quality | | | 454 |
| Political ecology | water quality | commons | | | 9,440 |
| Political ecology | water quality | commons | river | | 7,590 |
| Social learning | | | | | |
| Volunteer | nature conservation | | | | 24,900 |
| Volunteer | nature conservation | barrier | | | 71,900 |
| Volunteer | nature conservation | commitment | | | 102,000 |
| Volunteer | motivation | | | | 726,000 |
| Volunteer | satisfaction | | | | 619,000 |
| Volunteer | barriers | | | | 459,000 |
| Volunteer | barriers | nature conservation | water quality | | 28,700 |
| Volunteer | benefits | nature | | | 709,000 |
| Volunteer | benefits | nature | river | | 123,000 |
| long term volunteer | environmental | benefits | | | 553,000 |
| long term volunteer | environmental | benefits | water quality | | 202,000 |
| long term volunteer | environmental | benefits | water quality | river | 85,900 |
| | | | | | |
| Using Summon | | | | | Summon number of documents |
| Citizen science | water quality | | | | 32,625 |
| Citizen science | water quality | monitoring | | | 16,131 |
| environmental stewardship | benefits | | | | 247,000 |
| water resource management | OR catchment management | OR river basin management | water quality | integrated | 17,200 |
| Participatory Action Research | water | | | catchment | 277,024 |

Appendix 3

The Mary Immaculate College Research Ethics Committee (MIREC) clearance and approval to conduct the study.



Mary Immaculate College Research Ethics Committee

MIREC-4: MIREC Chair Decision Form

APPLICATION NO.

A20-044

1. PROJECT TITLE

Citizen Science Investigations: River Environmental Stewardship

2. APPLICANT

| | |
|------------------------------|-------------------------|
| Name: | Donna Weiner |
| Department / Centre / Other: | Geography |
| Position: | Postgraduate Researcher |

3. DECISION OF MIREC CHAIR

| | |
|-------------------------------------|--|
| <input type="checkbox"/> | Ethical clearance through MIREC is required. |
| <input type="checkbox"/> | Ethical clearance through MIREC is not required and therefore the researcher need take no further action in this regard. |
| <input checked="" type="checkbox"/> | Ethical clearance is required and granted. Referral to MIREC is not necessary. |
| <input type="checkbox"/> | Ethical clearance is required but the full MIREC process is not. Ethical clearance is therefore granted if required for external funding applications and the researcher need take no further action in this regard. |
| <input type="checkbox"/> | Insufficient information provided by applicant / Amendments required. |

4. REASON(S) FOR DECISION

I have reviewed this application and I believe it satisfies MIREC requirements. It is, therefore, approved.

5. DECLARATION (On behalf of MIREC CHAIR)

| | |
|---------------|--------------------------------|
| Name (Print): | Professor Michael Healy |
| Signature: | |
| Date: | 2 nd September 2020 |

Appendix 4

Focus group and interview Information Letter and Consent Form samples.



Citizen Science Investigations: River Environmental Stewardship

Participant Information Letter

Thank you for participating in the study.

In this interview / focus group phase, you will be asked open-ended questions to explore your feelings, memories, experiences, values and attitude about your local river and the catchment landscape. Questions will also relate to your interest, motivations and barriers to participation in a nature-based initiative to protect river water quality.

Your participation is voluntary. ***You may withdraw from participation at any time without giving a reason and without any consequence.***

- All information gathered will remain ***confidential*** and will not be released to any third party.
- All data is collected ***anonymously*** – you are only required to give your name for consent.
- Any **recordings will be encrypted**, and they will be stored securely and anonymously. They will be deleted as soon as the data is transcribed.

In accordance with MIC Records Retention Policy, anonymised data may be retained indefinitely as required by the researcher. This research complies with the Mary Immaculate Research Ethics Committee and the ethical guidelines of the Psychology Society of Ireland.

If at any time you have **any queries / issues** regarding this study, my contact details are:
Donna Weiner, e-mail : donna.weiner@mic.ul.ie
Contact telephone: 089 460 6490

Supervisor contact details:

Dr Catherine Dalton, e-mail: catherine.dalton@mic.ul.ie

Dr Julian Bloomer, e-mail: julian.bloomer@mic.ul.ie

If you have concerns about this study and wish to contact someone independent, you may contact:

MIREC Administrator, Research and Graduate School, Mary Immaculate College, South Circular Road, Limerick. Telephone: 061-204980 / E-mail: mirec@mic.ul.ie



Citizen Science Investigations: River Environmental Stewardship

Informed Consent Form

Please read the following statements before signing this Informed Consent Form. Only sign this form if you are happy to proceed with the interview.

As outlined in the Participant Information Letter, this study aims to:

- understand your perspectives, values and attitude about your local river catchment and nature,
 - learn the type of citizen science initiative you would participate in to protect your river water quality, if any, and
 - understand your interests, motivations and barriers to participation,
 - learn why and what you get out of participation, if you currently participate in a citizen science initiative.
-
- I confirm that I consent to this interview, and I agree to comply completely with all public health guidelines in relation to COVID-19.
 - I have read and understood the Participant Information Letter.
 - I understand what the project is about and what the results will be used for.
 - I know that my participation is voluntary.
 - I know I can withdraw from the interview at any stage without giving any reason and without consequence.
 - I know that my anonymity is assured.
 - I consent to the recording of the interview.
 - I am aware that my results will be kept confidential.
 - I have read this form completely, I am 18 years of age or older and I am happy to take part in the study on citizen science and river water quality.

Name
(PRINTED): _____

Name
(Signature): _____

Appendix 5

The questionnaire survey entitled “Connections, concerns and caring for your local river” and the Invitation/Recruitment e-mail.



Citizen Science Investigations: River Environmental Stewardship

Connections, concerns and caring for your local river Questionnaire Survey

Freshwater is essential for human life, and nature helps us protect the water quality in our river catchments. Please help us understand what is important to you about water quality by answering this questionnaire survey which focuses on your connection and concerns for your local natural environment and river catchment.

This survey is part of a larger study (CSI-Rivers) which aims to enable and empower individuals and communities to improve the health of their local waterbodies through environmental stewardship by engagement in water and nature-focused initiatives (citizen science) that will benefit individuals, communities, our rivers and the natural environment.

Citizen science is where members of the public undertake scientific research by helping scientists collect data. Our citizen scientists will explore their local river catchments and collect data about the plants, animals and environmental conditions while boating, wading or simply walking alongside a river.

Because local people know their natural environments best, by working together, community volunteers and scientists can make a real difference to improving water quality. All waterbodies are connected in their catchment, so when the survey asks about a river, please feel free to share your experiences about streams, lakes and other waterbodies.

The survey has three key sections (A - Connections, B - Concerns, C - Care) and a total of 17 questions, some with multiple parts. It will take you about 10-12 minutes to complete.

Important - Please Note: Participation in this survey is **entirely voluntary** and you **may withdraw at any time** you wish, with no consequence. All data will be kept **entirely confidential and anonymous** per MIREC ethical clearance requirements (Application Approval A20-044). To learn more about this project or to participate further, please contact me on donna.weiner@mic.ul.ie.

B. Environmental concern and behaviour

8. Do you have any concerns about the following in your local catchment? Please select all that apply.

- Drinking water quality
- Pollution, plastic and other waste
- Reduced access to recreational activities
- Decline in tourism related to the river
- Decline in wildlife, including fish
- Unattractive/ bad smell in the river
- No concerns, the river is fine
- Other - Please specify _____

9. Do you take any of the following steps to protect the natural environment? Please select all that apply.

- I cycle, walk or take public transport when possible.
- I recycle, reuse, reduce and repair when possible.
- I compost food and garden waste.
- I conserve energy and/or water at home.
- I choose organic and/or sustainable food.
- I avoid single-use plastic.
- I limit my use of pesticides, insecticides or fertilisers on my lawn or farm.
- My garden or farm is wildlife and bee-friendly.
- I do not do any of these actions.
- I am happy to do any pro-environmental action if it saves me money.
- Other - Please specify _____

10. Have you ever participated with a community or conservation group? Please select all that apply.

- Tidy Towns
- Nature conservation group
- Beach clean-up
- Kayaking or boating club
- Angling club
- Bird watching
- Citizen Science – for example, butterflies, bees, coast
- Other (Please specify _____)

10 a. What projects would you like to see in your community?

11. How much do you agree with the following statements?

| | Strongly agree | Agree | Neutral | Disagree | Strongly disagree | I don't know |
|--|----------------|-------|---------|----------|-------------------|--------------|
| a. Nature is valuable and deserves to be protected. | | | | | | |
| b. The economic value of the land should take priority over nature conservation. | | | | | | |
| c. It is important to preserve Ireland's natural heritage for future generations. | | | | | | |
| d. Covid-19 demonstrates why it is so important to protect the natural environment. | | | | | | |
| e. Water pollution in the river does not affect my life. | | | | | | |
| f. I would feel proud if my town/area won a Tidy Towns or biodiversity award. | | | | | | |
| g. I try to help people and my local community when I can. | | | | | | |
| h. People cannot make a difference to help improve river water quality - it is too big a problem. | | | | | | |
| i. The government should do more to protect river water quality. | | | | | | |
| j. Any barriers that restrict fish passage should be removed or adapted. | | | | | | |
| k. There are more important things to worry about than water pollution or nature. | | | | | | |
| l. To help wildlife, there should be more native trees and plants near the river. | | | | | | |
| m. Natural landscapes should be kept neat, tidy and free of weeds. | | | | | | |
| n. I do not feel safe when I am alone in a public open space. | | | | | | |
| o. Spending time in nature helps me de-stress and feel better. | | | | | | |
| p. There is increasing public concern in my community about protecting our native plants, animals and natural resources. | | | | | | |

C. Caring for your river

12. Listed below are possible reasons that might motivate someone to become active in (citizen science) initiatives to care for their local river. Please indicate how motivating you personally find each reason.

| | Very motivating | Somewhat motivating | Not at all motivating | I am not sure |
|---|-----------------|---------------------|-----------------------|---------------|
| a. It is enjoyable, fun and easy. | | | | |
| b. It is social, and participants will meet new people. | | | | |
| c. Participants learn new skills on how to monitor water quality. | | | | |
| d. Participants learn about the plants and animals living near the local river. | | | | |
| e. It will benefit the environment and water quality in the river. | | | | |
| f. Local initiatives can link to regional, national and international initiatives. | | | | |
| g. It is an opportunity to make a difference and give something back. | | | | |
| h. It may improve a Tidy Towns assessment score. | | | | |
| i. It keeps people active in their communities. | | | | |
| j. The experience will enhance my CV. | | | | |
| k. It is good for physical and mental health. | | | | |
| l. It is all outdoors, and an opportunity to spend time in nature. | | | | |
| m. Participants will be knee-deep in the river, in wellies or waders. | | | | |
| n. It is family-friendly, and people of all ages can get involved. | | | | |
| o. It requires no long-term commitment. | | | | |
| p. No prior experience is needed. Participants are taught everything they need to know. | | | | |
| q. Participant safety is a priority, and social distancing will be adhered to at all times. | | | | |
| r. There is a mobile phone application to help input the collected data. | | | | |
| s. Other - Please specify | | | | |

D. General Information:

13. Gender: Female
 Male
 Other
 Prefer not to say

14. Age Range: 17 or younger
 18-29
 30-49
 50-65
 Over 65

15. Employment Status:
 Working for payment or profit.
 Looking for first regular job
 Unemployed
 Student or pupil
 Looking after home/ family
 Retired from employment
 Unable to work due to permanent sickness or disability
 Other - Please specify _____

If working, do you work in an environmental field?

- Yes
 No

16. Please select a description of the area where you live:
 Rural Village Small town Large town City
 Other - Please specify _____

In which county do you live? _____

17. How long have you lived in the area?
 Under 2 years
 2-10 years
 11-20 years
 Over 20 years
 Other _____ Please specify

Please keep
this page for
your
reference.



Thank you!

Thank you very much for participating in this survey. I hope you enjoyed it. Your data will be kept **confidential and anonymous**.

To **learn more** about this project, please follow our progress on the Mague Rivers Trust website (www.maugueriverstrust.ie), [Twitter](#) and [Facebook](#) page, or on the CSI-Rivers [Twitter](#) page.

To **participate in a (citizen science) initiative** to help improve and protect the Mague River Catchment water quality and biodiversity, please e-mail me at donna.weiner@mic.ul.ie.

If you are 18 years old or older, and you would like to be a part of the **focus group or interview** stage of this study, please email me at donna.weiner@mic.ul.ie.

Links to Survey:



<https://bit.ly/3nT6uQF>



Citizen Science Investigations: River Environmental Stewardship

Recruitment / Invitation e-mail for Questionnaire Survey

My name is Donna Weiner, and I am a first year PhD research student at Mary Immaculate College / University of Limerick in Limerick conducting a study co-funded by the Environmental Protection Agency and Mary Immaculate College / University of Limerick.

I am conducting this study to understand the spectrum of connections, perspectives and values the residents of the Maigue River Catchment feel and ascribe towards nature and their local river.

The study also aims to measure the interest in participating in a voluntary field-based citizen science initiative that will help water scientists collect data about the water quality in the river.

Target Audience: Adult residents of the Maigue River catchment.

Confidentiality: Participation in the survey is entirely voluntary and you may withdraw at any time you wish, without consequence. All data is entirely confidential and anonymous.

The survey contains 30 questions, some with multiple parts, and will take approximately 12-15 minutes to complete.

Appendix 6

List of Maigue River Catchments contacts who received the questionnaire survey.

| CSI-Rivers Survey Distribution Plan | |
|--|--|
| Distribution | Date requested/conducted between 2020 and 2021 |
| Ballyhoura Development (BH Dev) mailing list (ML) and social media | 25 th January 2021 |
| Duhallow IRD ML | |
| MRT Facebook page, social media and website | 21 st January 2021 |
| Tidy Towns MLs | 25 th January 2021 (by BH Dev) |
| LAWPRO Regional MLs | 25 th January 2021 ? – requested |
| Cork Nature Network ML | February 2021 |
| Put link onto MRT, BH Dev, (LAWPRO and catchments.ie??) | |
| Face to face surveys (when safe to do so) | Lough Gur – 12 th December 2020 Kilfinane River Walk – 5 th June 2021 Croom Family Fun Day – 19 th June 2021 BH Dev Tidy Towns meeting – 8 th July 2021 |
| Continue face to face | |
| Contact Fiona Doyle (Canovee school contact) Grew up along Camoge stream (straveen?) and knows Steven, farmer from Camoge and Mary, farmer from the Maigue for contact details | 22 nd February 2021 |
| Groups in bordering catchments of MRC: Suir, Blackwater, Tralee Bay-Feale, Duhallow | N/A |
| UL and Mary Immaculate College Staff and Postgraduates MLs | 800 Staff requested by Des by email on 12 th February Sent request to MIC Student union president, Aisling 22 nd Feb – Not permitted. |
| Schools in MRC - reception and teachers | |
| Facebook Forums | Limerick Forum – 37 followers (2009 last post) Lim Co and City Forum – 119 (2019 last post) Lim/Clare Do you know – 148 Limerick's Social Diary! – 2,800? (Sent email to Joanne Moloney 14th July) |

| Distribution (continued) | Date requested/conducted |
|---|---|
| <p>I love Limerick – 5,000 Requested from John MacNamara 12th Feb . Also sent email to I Love Limerick FB page to ask same thing as no response. 14th Feb. NO - They don't share surveys.</p> <p>Limerick – 675 Requested from Peter O'Malley 14th February</p> <p>SW Croom/Adare 121 Requested from Emer McCarthy 15th Feb. From Marion Ryan, requested on 14th July.</p> <p>Adare Tidy Towns – 1,814 Requested 16th Feb via Messenger</p> <p>Glenbrohane TT – 246 Requested from John Fenton by email Feb 16th</p> | <p>Communities Alliance Limerick - 217 members (Pat Foley Administrator) - Approved posted Feb 4th and he will share my link and gave me Pat Lysaght's name and contact details - Friended him. - 431 members as of July 14th and re-sent invitation.</p> <p>Croom Past and Present - 2,071 members (Maresa Kaerney McNamara, Admin) - Approved and posted 4th February 2021 (Resent Reminder 14 June)</p> <p>Celebrating Greater Kilmallock -Culture-Community-EnterPrise-creativity (Bruree, Athlacca, Bruff, Hospital, Knocklong, Garryspillane, Kilfinane, Ardpatrick, Effin & Kilmallock) - 465 members (Danny Moloney, Admin) Approved and posted 5th Feb. Resent Reminder 14th June)</p> <p>Limerick Environmental Network - 217 members (Anneke Vrieling) - Approved and posted 4th February. Resent FB Reminder 14th June)</p> <p>Kilfinane photographs and daily news 2,910 Requested from Hugh Murph by email 15th February. Approved and Posted 16th Feb (Resend reminder 14th June)</p> <p>Ardpatrick Community – 1746 Requested via FB Feb 16th. (DW put up public post 12/3) (Resent reminder 14th June)</p> <p>Things to do with kids in and around Limerick – 2,800 Requested from Anne Hadnett Feb 15th (DW put up public post 12/3) Resent reminder 14th June.</p> <p>Love Kilmallock – 830. Requested messenger (no name) 15th Feb. (DW put up public post 12/3)(Resent reminder 14th June)</p> <p>Ballinagarry Community Park Group – 561 - Requested Sarah Lynch 12th February. (DW put up public post 12/3) Resent reminder 14th June)</p> <p>Anglesboro TT – 255 Send to Facebook public page on 5th April (send reminder 14th July)</p> <p>Bruff Community Page – 2,687 Requested on FB 16th Feb. (DW put up public post 12/3) (Resent reminder 14th June)</p> <p>Rockhill/Bruree Tidy Towns – 535 Requested by email Tracey D Feb 16th. Posted on FB public 5th Apr (Resent 14th July)</p> <p>Bruree/Rockhill Community games 484– Sent FB reminder 14th June)</p> <p>Happy Thoughts Limerick - 1455 requested from Jade Hayes Quinn 14th Feb (public post on Apr 10) Resent reminder 14th June)</p> <p>Glenbrohane Community Association: 788 people requested April 10th by messenger (sent on FB with permission April 11th) (Resent reminder 14th June)</p> <p>Croom Tidy Towns website – sent request by http://cromadh.com/tidy-towns/ enquiry 9th May</p> <p>Civic Centre in Croom sent email 9th May - civiccentrecroom@gmail.com</p> <p>Kilteely Tidy Towns - Sent e-mail 9th May - kilteelytidytowns@gmail.com</p> <p>Croom CDA – Croom.ie 2,453 members. Sent request 14th July</p> |

| Distribution (continued) | Date requested/conducted |
|--|--|
| <p>Maigue Trust Directors</p> | <p>Sent 1 Feb 2021. By myself and Liz Gabbett.</p> <p>Asked Directors to forward to their contacts at MRT meeting 15th Feb.</p> <p>Asked Directors to send reminder to contacts 13th July 2021.</p> <p><maiguetrustdirectors@maigueriverstrust.ie>, anne.goggin@limerick.ie, "veronica.santorum@gmail.com" <veronica.santorum@gmail.com>, "Mary Fitzgerald (Woodlands Hotel)" <MFitzgerald@woodlands-hotel.ie>, sinead.mcdonnell@limerick.ie</p> |
| <p>Schools 78 in total sent email on 19th May 2021</p> <p>Sent to 24 GAA secretaries 11th June</p> | <p>info@villers-school.com, stmunchins@eircom.net, admin@stclements.ie, mungretcc@lcteb.ie, office@limericketss.ie, reception@laurelhillfcj.ie, reception@laurelhillcolaistefcj.ie, info@gcldrive.com, info@crescentsj.com, office@cnnlimerick.ie, asroffice@ardscoil.com, info@thomondcc.ie, ardpattickns@gmail.com, athlaccans@gmail.com, info@ballyagrannationalschool.com, ballylandersns@live.ie, banoguenationalschool@gmail.com, bulgadennationalschool@gmail.com, office@caherellyns.com, caherlinenationalschool@gmail.com, carnanens@gmail.com, ballingarryns@yahoo.ie, secretaryrecorans@gmail.com, croaghns@outlook.com, donoughmorenslimk@gmail.com, gaelscoilanraithin@gmail.com, garrydoolisns@gmail.com, glenbrohaneschool@eircom.net, office@granaghns.ie, herbertstownns@gmail.com, info@kildimons.ie, kilfinnyns@gmail.com, kilteelyns@outlook.com, info@knockaineyns.ie, office@knockeans.ie, knsparents@outlook.ie, letsnationalschool@gmail.com, lcsmungret@gmail.com, office@lsp.ie, info@loughgur.com, martinstownns@gmail.com, ourladyoflourdesrb@gmail.com, office@olqp.ie, ourladyabbeyadare@eircom.net, info@patrickswellns.com, info@preslimerick.ie, donatleahy@sprox.ie, principal@sjtbb.ie, secretary@ballybrownns.ie, office@saintmarys.ie, info@smnslimerick.ie, office@stnessans.ie, sannioclas.ns@hotmail.com, stpaulsdooradoyle@gmail.com, stpetersgns@gmail.com, scoildeancussen@gmail.com, kilfinanens@gmail.com, principal@hospitalns.net, principal@scoilmhathairde.ie, info@kns.ie, info@scoilnaomhiosafadare.com, shountradens@gmail.com, info@modelschool.ie, whitethornsmontessori@hotmail.com, naionracnoctheas@gmail.com, niamha.cusack@gmail.com, manister.ns@hotmail.com, eleanormontessori@gmail.com, playgroupleaderkilfinaneps@gmail.com, marianagisb@hotmail.com, ballypreschool@gmail.com, hcpp2010@yahoo.ie, info@thomondcc.ie, lsominfo@lcteb.ie, info@gcldrive.com, hazelc@hazelc.ie, info@pallaskenry.com, bruffcommunitypreschlted@yahoo.ie</p> |
| ESAI | N/A – academic and national |
| CSI TWITTER | N/A - international |
| <p>Garden Centres / machinery in MRC (22)</p> <p>Sent June 22nd</p> | <p>Info@ahernnurseryseries.ie, info@cuanmhuiregardencentre.com, hennessynurseryseries@eircom.net, info@dandmgardencentre.ie, news@limerickleader.ie, info@curraghchasegardencentre.ie, RockbartonFarm@gmail.com, alan.kentuckygold@gmail.com, info@libertylandscaping.ie, terranovabookings@gmail.com, sales@youngnurseryseries.com, hello@allaboutplants.ie, info@hanlysgardenmachinery.ie, info@dalylandscaping.ie, liston.fiona@gmail.com, david.hurley@limerickleader.ie, skulefedamore@yahoo.ie, info@shannonvalelandscaping.com, info@stoneage.ie, info@stjosephsfoundation.ie, andrew@hourigans.ie, oconnormaurice@gmail.com</p> |
| Libraries (10) Sent 22 nd June | <p>kilmallocklibrary@limerick.ie, adarelibrary@limerick.ie, rathkealelibrary@limerick.ie, kilfinanelibrary@limerick.ie, askeatonlibrary@gmail.com, glinlibrary@limerick.ie, dromcollogherlibrary@limerick.ie, foyneslibrary@limerick.ie, galballylibrary@limerick.ie, roxborolibrary@limerick.ie</p> |

| Distribution (continued) | Date requested/conducted |
|--|---|
| <p>Church/parish Newsletters – Sent by email 19th Feb 2021</p> <p>parishseacruff@hotmail.com, - email didn't work</p> | <p>office@adareparish.ie (Rita Hickey confirmed 22/2 will go on church noticeboard and on their Adareparish.ie website)</p> <p>revlizadare@gmail.com (Liz Beasley Confirmed 19/2 to be in next e-mailed newsletter),</p> <p>senanclon@gmail.com,</p> <p>pwbbparishoffice@gmail.com,</p> <p>croomchurch@eircom.net,</p> <p>croaghkilfinny@eircom.net,</p> <p>balgranparish@gmail.com (Marian confirmed 20/2 no newsletter, suggested I send request to 'contact us' on granagh.com website), (Sent Request to Granagh website 24/2)</p> <p>4dlord@gmail.com,</p> <p>conorrh@eircom.net,</p> <p>charlevilleparishoffice@gmail.com, mairimcmahon@gmail.com,</p> <p>michelle.cagneymccarthy@kerry.ie (Michelle Cagney McCarthy Confirmed 20/2 will go to Whatsapp group, The local newspaper, the Vale Star, and the next weekend newsletter), kilmallockparish@gmail.com,</p> <p>whennesy@eircom.net,</p> <p>mbktp2@gmail.com,</p> <p>thomasbreen47@gmail.com,</p> <p>parishoffice@mcrparish.com</p> |

Appendix 7

List of open-ended questions of the questionnaire survey.

1. How frequently, and for what reasons, do you spend time in natural environments? Please select all that apply. – If other, please specify.
2. What is your earliest childhood memory of spending time by a river?
3. Did this childhood experience influence how you feel about spending time outdoors in nature today? If yes, - Please explain how - Text
4. Please explain how Covid-19 has changed how you experience nature or the amount of time you spend in nature.
5. What positive or negative changes have you noticed to your local river in your lifetime?
6. Do you have any concerns about the following in your local water catchment area? Please select all that apply. If other, Please specify.
7. Do you take any of the following steps to protect the natural environment? Please select all that apply. If other, Please specify.
8. Have you ever participated with a community or conservation group? Please select all that apply. If other, Please specify.
9. Please specify here any projects that you like to see in your community.

Appendix 8

Interview Guides for Focus Groups and Key Informant Interviews

Focus Group 1 Interview Guide Questions (River Guardians)

Experience/Behaviour/Activities Questions

- How long have you been involved in the volunteer work?
- What led you to start participating?
- Would you be as engaged if it was not a nature-based/outdoor project?
- How do you think your early childhood experiences influence your feelings about nature?
- Please describe the training undertaken to learn about the CS protocol (Cognitive).
 - Are there aspects you find too challenging or uninteresting?
 - Are you confident?
 - What are your favourites?
- What activities do you currently enjoy doing in nature? Is the CS part of your hobby at home?
- What other volunteer, conservation or pro-environment activities do you conduct?
- Has being involved changed your behaviour at home in any way?
- What would I observe if I was there on a typical day?
- What and/or who do you think might have influenced you to participate in nature and river conservation (spouse, parents, grandparents, children, etc.)?
- Please describe all the activities that you do or have done as part of this project (Behavioural).

Feelings/values

- What were you hoping to get out of it? (Motivation).
- What do you see are the personal benefits of being involved?
- What did you expect the experience of participating to be like?
- Did anything about your involvement change you or your views or surprise you?
- Do you feel connected to the people and a part of the team/organisation that runs it?
- What do you enjoy most?
- What do you dislike most – are there aspects you do not get involved in?
- What sustains your interest in being involved?
- How do you feel at the end of an active Inishowen RT day?
- Has your interest changed from when you first began? How?
- What makes you say that? (Social).
- What has involvement meant to you since you started? (Affective).
- Any concerns about your involvement in terms of the river?
- Do you feel connected to nature or a particular type of natural space?
- What are the strengths and weaknesses of the programme?

Opinion/Future

- Any advice on a budding RT to attract and maintain active volunteers?
- What do you think prevents other people who care about their river from participating, i.e. what are their main barriers?
- Has your involvement increased your capacity/ability/interest in increasing activism in policy and decision-making?
- If you were in charge, how would you improve it?
- What other type of community CS programme or activities do you think could help improve or protect the water quality and natural environment of the river?
- Do you include your family in some of the CS work?
- Do you think local community interest in the environment has increased from the past? How can you tell? Any other thoughts you'd like to share? Anything that might be interesting or useful to my aims?

Focus Group 2 Interview Guide – Weds Feb 16th 7:15pm (New MRT CS Volunteers)

| | |
|---|--|
| Motivations benefits and feelings (Experience/ Behaviour/ Activity) | <ul style="list-style-type: none"> • Why did you decide to participate in FWW with MRT? • Any personal benefits you were hoping to get out of participating? • How do you feel after you've done a FWW monitoring session? • Has your interest changed from when you first began? If so, how? • Would you be as engaged if it was not an outdoor nature-based project? • Some of you chose to test monthly, when asked only quarterly, why? |
| The experience (Experience/ Behaviour/ Activity) | <ul style="list-style-type: none"> • Was FWW what you expected from the description and training? • What part of FWW do you most enjoy? Why? • What part of FWW least interests you? Why? • Are there any disadvantages from participating? • Have you ever volunteered with another group? If yes, how did it compare? If no, why did you stop? • How can we attract others to participate? • What keeps other people who care about the river from participating? • Did you find the FWW form or App easy to use? • Do you feel that other people might enjoy CS? Why or why not? • Any concerns about your involvement in terms of the river? |
| Changes (Feelings/ Values) | <ul style="list-style-type: none"> • Has FWW changed how you feel about the river? • Do you see things differently in general about the environment? • Did anything about your involvement change you or your views, or surprise you? • Is there anything you do differently at home due to what you learned from FWW? |
| Connection (Feelings/ Values) | <ul style="list-style-type: none"> • Do you feel connected to or a part of the natural world? Ever felt any different? • Do you consider yourself an environmentalist? Do other people see you as one? • Did you spend a lot of your youth in nature and outdoors? • Do you feel a connection to any particular place in your community? • Do you benefit from the social interactions from the group? E.g. make any friendships or community connections? |
| Co-Design (Opinion/ Future) | <ul style="list-style-type: none"> • If you saw a demo of the macroinvert sampling - What do you think about it? • How would you compare it with your interest in FWW? • Any thoughts you'd like to share? • Are there any ways in which it could be improved for you? • What other type of community CS programme or activities do you feel could help improve or protect the water quality and biodiversity of the river? • Are there any environmental problems you'd like to tackle in your community? • Any ideas on how we can incorporate river protection into outdoor hobbies? |
| Future plans (Opinion/ Future) | <ul style="list-style-type: none"> • How would you feel about being prompted to record monthly? • How about pre and post a forecast storm? • How about when there is good weather forecast? • Do you want further training in different programmes? |
| Other business: | <ul style="list-style-type: none"> • Sending "I consent" return email from their email account • The picnic – 26/27th • FWW email: Change usernames (eg from their real names), til until Feb 28th. • Accuracy of results – data points are not absolute. Multiple data points, and continuous monitoring are the key to ID trends and ensuring confidence and validity of data. • Soil type (local) and time of year – plant growth and rain levels impacts results. This is a piece of the jigsaw. |

Key Informant 1 Interview Guide Questions

Experience/Behaviour/Activities Questions

- How long have you been involved in the IRT/CS work?
- What led you to start participating?
- Would you be as engaged if it was not a nature-based/outdoor project?
- How do you think your early childhood experiences influenced your feelings about nature? Who or what might have influenced you?
- Please describe the training undertaken to learn about the CS protocol (Cognitive).
 - Are there aspects you find too challenging or uninteresting?
 - Are you confident?
 - What are your favourites?
- What activities do you currently enjoy doing in nature? Is the CS part of your hobby at home?
- What other volunteer, conservation or pro-environment activities do you conduct?
- Has being involved changed your behaviour at home in any way?
- What would I observe if I was there on a typical day?
- What and/or who do you think might have influenced you to participate in nature and river conservation (spouse, parents, grandparents, children, etc.)?
- Please describe all the activities that you do or have done as part of this project (Behavioural).

Feelings/values

- What were you hoping to get out of it? (Motivation).
- What do you see are the personal benefits of being involved?
- What did you expect the experience of participating to be like?
- Did anything about your involvement change you or your views or surprise you?
- Do you feel connected to the people and a part of the team/organisation that runs the CS project?
- What do you enjoy most?
- What do you dislike most – are there aspects you do not get involved in?
- What sustains your interest in being involved?
- How do you feel at the end of an active Inishowen RT day?
- Has your interest changed from when you first began? How?
- What makes you say that? (Social).
- What has involvement with the CS project meant to you since you started? (Affective).
- Any concerns about your involvement in terms of the river?
- Do you feel connected to nature or a particular type of natural space?
- What are the strengths of the programme?
- What are the weaknesses of the programme?

Opinion/Future

- Any advice on a budding RT to attract and maintain active volunteers?
- What do you think prevents other people who care about their river from participating, i.e. what are their main barriers?
- Has your involvement increased your capacity/ability/interest in increasing activism in policy and decision-making?
- If you were in charge, how would you improve it?
- What other type of community CS programme or activities do you think could help improve or protect the water quality and natural environment of the river?
- Do you include your family in some of the CS work?
- Do you think local community interest in the environment has increased from the past? How can you tell?
- Any other thoughts you'd like to share? Anything that might be interesting or useful to my aims?

Key Informant 2 Interview Guide Questions

Experience/Behaviour/Activities Questions

- What childhood experiences do you have related to the river or nature?
- Did these influence how you feel about nature and the river?
- Did any of your family members have a close relationship to the river? E.g. angling, boating? Family members that have no interest?
- Have you noticed any changes to the river or the natural landscape in your lifetime?
- Do you spend time by the river and in nature? If so, for what reason? E.g. recreational activities?
- At home, what energy/water conservation or waste/pollution prevention measures?
- Have you ever volunteered with a conservation programme or community?
- What type of activities did it involve? How did it benefit the environment?
- What did/do you like about the experience?
- Do you still do this?
- If no, How long did you stay - Why did you stop?
- Do you ever photograph landscapes, animals or plants? Do you or any family members ever share them on social media?

Feelings/values

- How much do you feel that you are connected to and a part of the natural world?
- Have you ever felt any different?
- Is there a particular place or environment you feel most connected to?
- Has there ever been any environmental/river protection guidelines or laws that impacted you or your business?
- any examples ?
- How did it make you feel?
- How could it have been done differently or better for you?

Opinion/Future

- Do you have any concerns of environmental problems in your community/the river/natural landscape?
- What should the priorities be regarding natural heritage?
- Do you think people in your community/village care about the river?
- Compare and differ: How do your feelings and concerns about the river and nature compare to other farmers/landowners in your community?
- Do you think children and grandchildren should be encouraged to get involved in river protection or nature conservation activities?
- Would you be interested in monitoring the water quality in your river if there was an easy tool?
- What type of conservation activity/programme would most interest you? Indoor, outdoor, group, family, heritage-focused?
- What would prevent you or family members from participating in CS for rivers?
- What do you think might prevent other people from participating?
- Could CS be popular in your community?
- Do you think covid might have changed people's the priorities for the river and nature?
- Any additional thoughts you'd like to share you feel might be relevant to me and this study?

Appendix 9

Codebook for qualitative thematic analysis

| Name | Description | Files | References |
|--|--|-------|------------|
| 1. Nature experience and awareness (Cognitive) | | 6 | 2514 |
| 1.1 Diversity of early childhood experiences | | 0 | 0 |
| Memory in nature - childhood experience | Participants discuss their own childhood experiences in nature | 5 | 234 |
| Memory of family - Past | Participants discuss a childhood memory of experience with a family member | 5 | 167 |
| Memory of friends | Participants discuss nature memories with friends | 1 | 17 |
| Memory of hobby or sport | Participants refer to a sport, hobby or activity as part of their earliest childhood memory in nature or by a waterbody. | 1 | 305 |
| Memory of place | Participants reminisce about their memories in nature, related to a particular place | 3 | 166 |
| Memory of wildlife | Participants mention spending time in nature in childhood and appreciating or noticing wildlife | 3 | 159 |
| 1.2 Present nature experiences and their informative value | | 5 | 2054 |
| Access to nature | Participants are concerned with or aware of limited access to nature. | 2 | 92 |
| Amenity recreation and facilities | Participants discuss an increase in or not enough amenity, parking and pathways as well as toilets and other facilities. Also discussed is an increase or decrease in use of the river for recreation as amenity. Amity is discussed, whether it is positive or negative. The next subcategory separates into those who see negative impacts from amity. | 3 | 262 |
| Awareness of an issue | Participants demonstrate awareness of issues relating to environmental and river pollution | 2 | 15 |
| Family and children - present | Respondents mention family-friendly events and experiences, ie spending time with family members. | 4 | 59 |

| Name | Description | Files | References |
|--|---|-------|------------|
| Flooding, water levels, hydromorphology | Participants are aware of or concerned with the problem of flooding or the management of flooding defences. Also includes lowering of water levels. Also changes to hydro morphology of river and poor management practices | 1 | 127 |
| Human disturbance | Participants discuss people, and other nature visitor causing disturbance, pollution or problems. | 2 | 57 |
| Improved or no changes or problems | Participants express their belief that environmental conditions are improved or the same as in the past, or that there are no issues or problems with declining water quality in rivers. No changes are noticed. | 3 | 162 |
| Industry agriculture and Forestry | Participants are aware of or concerned with the actions of industry such as agriculture and forestry causing problems and pollution within the environment. Also includes developments | 4 | 153 |
| Invasive alien species | Participants are aware of or concerned with the problem of IAS in the environment | 2 | 53 |
| Less wildlife and biodiversity | Participants discuss that they notice decreased numbers of wildlife or biodiversity | 5 | 198 |
| Litter and pollution | Participants are aware of or concerned with the problem of litter or they mention pollution generally within the environment | 2 | 393 |
| Loss of habitat and natural spaces | Participants are aware of or concerned with the loss of natural habitats and riparian zones in the environment | 3 | 119 |
| Negative impact from Amenity and Development | Participants speak about amenities, the development of amenities and the increase in amenity recreation and facilities in negative terms. e.g. there are too many, it is destroying the natural habitat and attracting too many people and pollution. | 1 | 37 |
| Poor maintenance - tidiness - hedgerows and riparian zones | Participants believe a problem with the river is that the riparian zone is overgrown. Or that the river has been neglected and improperly maintained. Also included is poor management of hedgerows and riparian zones. | 2 | 86 |
| Water quality problems | Participants are aware of or concerned with the problem of decreased water quality or an increase in algae in the river | 4 | 179 |
| Witness change in attitude or actions | Participants express that they are seeing more interest, laws and actions to protect the environment or water, or a change in attitude. These actions can be from individuals or | 5 | 62 |

| Name | Description | Files | References |
|---|---|-------|------------|
| | governments. | | |
| 1.3 Considerations about the future, knowledge and learning | | 6 | 460 |
| Childhood influenced adulthood | Participants make reference to their childhood experiences influencing their actions, feelings or attitudes as adults | 5 | 85 |
| Family and children - future | Participants demonstrate a concern for the future in relation to their children and and/or families | 4 | 62 |
| Knowledge and learning | Participants choose words such as explore, curious, desire to learn | 5 | 147 |
| Local knowledge | Participants demonstrate or discuss their previous knowledge based on their hobbies and personal interests | 5 | 40 |
| Suggestions for change | Participants make suggestions on improvements to management practices or mention changes and practices that they would like to see done | 3 | 39 |
| Witness change in attitude or actions | Participants express that they are seeing more interest, laws and actions to protect the environment or water, or a change in attitude. These actions can be from individuals or governments. | 5 | 61 |
| Youth education | Participants desire that there be more education and awareness about nature, wildlife and the environment that targets youth. | 1 | 26 |
| 2. Identity, environmental ideation and belonging (Sense of self) | | 5 | 1205 |
| 2.1 Place and community | | 5 | 258 |
| Communication and networking | Participants discuss communication and networking and connecting with people | 5 | 45 |
| Community connections | Participants demonstrate feeling connected to their local community | 5 | 60 |
| No experiences in nature | Participants express that they lacked or had very few outdoor or nature experiences or had very limited access | 2 | 4 |
| Participation in groups | Participants demonstrate current involvement in volunteerism - be it community, hobbyist or environmental group | 5 | 98 |

| Name | Description | Files | References |
|---|--|-------|------------|
| Place attachment | Participants discuss connections to place and locale | 4 | 51 |
| 2.2 People and the interests that distinguish | | 5 | 872 |
| Changes due to age - Actions and ID | Participants discuss changing or differing attitudes over time due to ageing and perspectives changing | 4 | 29 |
| Interest for profession | Participants discuss how volunteerism benefits their professions and working skills and knowledge. | 2 | 16 |
| Interest in history and heritage | Participants discuss an interest in history, cultural heritage. | 2 | 15 |
| Interest in hobby or sport | Participants describe how they spend time in nature conducting a hobby or a sport such as angling or boating. Also includes childhood memory/experience. | 4 | 94 |
| Interest in like-minded people | Participants describe that they enjoy and are interested in spending time with people who are like-minded. | 3 | 22 |
| Interest in nature outdoors and the environment | Participants describe their interests in and appreciation of the natural environment and being outdoors | 5 | 265 |
| Interest in rivers and blue space | Participants describe particularly their interest in water-based nature such as rivers and streams | 5 | 158 |
| Interest in social and people | Participants describe their interest and motivation to spend time with people and in social situations. The code entitled 'Time in nature for social reasons' was merged into this code and removed. | 5 | 45 |
| Interest in wildlife and biodiversity | Participants demonstrate interest, interest in learning about or concern for wildlife and biodiversity | 5 | 228 |
| 2.3 Who is an environmentalist | | 5 | 75 |
| Countryside as nature | Respondents associate living in the countryside or in a particular with experiencing time in nature. i.e. easy access to the outdoors as in being a farmer or living near rivers. | 4 | 43 |
| Environmentalist as being different | Participants describe being different from others because of their interest in nature and the environment. | 3 | 12 |

| Name | Description | Files | References |
|--|---|-------|------------|
| Identifying as an environmentalist | Participants express their feelings about environmentalists and whether or not they identify themselves as such. | 4 | 16 |
| Non-environmentalists | Participants share their beliefs about non-environmentalists | 1 | 3 |
| 3. Feelings and concerns about health and nature (Emotive) | | 5 | 596 |
| 3.1 Well-being, health and happiness | | 5 | 199 |
| Emotional well-being | Participants discuss the emotional health benefits of time in nature | 5 | 183 |
| Physical health and exercise | Participants talk about the physical exercise benefits of time outdoors | 1 | 16 |
| 3.2 Emotional and spiritual connection to nature | | 5 | 182 |
| Emotionally connected | Participants demonstrate an emotional connection to nature | 5 | 181 |
| 3.3 Negative emotions and concerns for health, safety and the future | | 5 | 215 |
| Climate change | Participants mention climate change or attribute impacts to climate change | 2 | 7 |
| Concern for future | Participants demonstrate a concern for the future | 4 | 19 |
| Concern for human health and safety | Participants demonstrate a concern for human health and safety related to environmental pollution or maintenance issues or access | 3 | 56 |
| Grief, despair or helplessness, frustration | Participants discuss despair, grief or helplessness at the current state of the environment. | 5 | 39 |
| Nature & river negative - danger and fear | Participants discuss associating rivers or nature with danger, fear or negative emotions. | 2 | 56 |
| Negative impact from Amenity and Development | Participants speak about amenities, the development of amenities and the increase in amenity recreation and facilities in negative terms. e.g. there are too many, it is destroying the natural habitat and attracting too many people and pollution. | 1 | 37 |
| 4. Environmental stewardship, volunteerism and action (Behavioural) | | 6 | 660 |

| Name | Description | Files | References |
|--|--|-------|------------|
| 4.1 Undertaking and experiencing environmental volunteerism | | 6 | 372 |
| Benefits to participation | Participants discuss the benefits they perceive from participation in CS and time in nature | 4 | 36 |
| Easy to get involved | Participants demonstrate it is convenient and easy to get involved initially and to continue to be involved. | 3 | 16 |
| Interest in making a difference | Participants discuss their interest in protecting, improving and restoring the environment | 4 | 35 |
| Looking for opportunity | Participants demonstrate a desire to get involved - are seeking an opportunity. | 5 | 27 |
| Motivations to CS | Participants discuss their preferences in relation to CS | 5 | 11 |
| Participation in volunteering | Participants discuss their participation in CS and volunteerism | 4 | 144 |
| Path to participation | Participants discuss what led them to start participating in CS | 3 | 22 |
| Pro-environmental behaviours | Participants demonstrate conducting pro-environmental behaviours | 3 | 64 |
| Purpose of volunteering | Participants discuss what they want to get out of participating | 4 | 17 |
| 4.2 Challenges to volunteerism and environmental stewardship | | 6 | 288 |
| Barrier - Lack of confidence | Participants lack confidence in some CS | 2 | 14 |
| Barrier - Lack of interest - disliked | Participants discuss a lack of interest in some aspects of CS. e.g. disliking aspects | 3 | 11 |
| Barrier - Lack of time | Participants don't have time | 5 | 18 |
| Barriers to volunteerism -Other | Participants discuss why they don't participate in volunteerism and CS, and these are the barriers that exclude lack of time, lack of interest and lack of confidence. e.g. don't like group activities, they would but don't, they don't like reporting or they don't have wifi in the field, weather, etc. | 6 | 26 |
| Changes due to age - action | Participants discuss changing or differing attitudes over time due to ageing and perspectives changing based on their actions | 4 | 23 |
| Government and governance | Participants opine about their experiences with government intervention as well as governance issues and legal recourse | 5 | 84 |

| Name | Description | Files | References |
|---|--|-------|------------|
| Group leader | Participants discuss a group leader in terms of motivation and part of their experience with a community group | 4 | 17 |
| Inspiration and application | Participants discuss how their involvement in CS and volunteerism led them to progress on their own and to apply their training | 2 | 26 |
| Lack of Support | Volunteerism and environmental projects need more support. | 3 | 7 |
| Money | There is a risk of loss of money | 4 | 21 |
| Volunteering changed their perspective | Participants explain how volunteering and learning from volunteering has changed how they see things and understand processes. | 3 | 10 |
| Volunteering influences others | Participants discuss the impact and influence their volunteering has had on others | 3 | 14 |
| Volunteering leads to activism and influencing change | Methods and means that participants felt made a difference or influenced change | 3 | 17 |
| 5. Transformative Experiences | This theme explores the origins of change and transformations, i.e. early childhood experiences in nature and the diverse influences. | 3 | 507 |
| 5.1 Transformative value of early nature experiences | | 0 | 0 |
| 5.2 Covid-19 as a transformative experience | This serves as a case study that demonstrates the movements and transitions that experiences can cause. | 3 | 507 |
| Covid - Changes spatially or emotionally | Covid changed their feelings or the quality of their experience in nature. | 2 | 79 |
| Covid - Inspires change in attitude | Covid inspired a change in attitude and perception in relation to pro-environmental behaviour, appreciation of nature, etc. Also a change in lifestyle | 2 | 70 |
| Covid - Less time in nature | Participants mention that they spend less time in nature due to covid. | 2 | 95 |
| Covid - More time in nature | Participants affected by covid in that they are able to spend more time in nature. | 2 | 263 |
| ZZ Memorable quotes | | 5 | 55 |

Appendix 10

Examples of quotations based on thematic analysis

| Theme 1: Cognition and the role of experience on awareness (Cognition) | |
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| Differing priorities, localities and levels of awareness and knowledge. For example, in relation to climate change, flooding and water levels; | <ul style="list-style-type: none"> • <i>Water levels have dropped dramatically over the years</i> • <i>More dry spots in the river.</i> • <i>Water levels lowering</i> • <i>The water level over the last 15 yrs at Bruree has dropped dramatically.</i> • <i>Less fish but town(Croom) doesn't flood any more</i> • <i>It is quite small and close to the source but has been diverted and piped upstream and dries up for longer periods during summer months.</i> • <i>Higher levels of water, ,more localised flooding</i> • <i>More canalization, banks pushed up higher. More litter.</i> • <i>The water table is higher and it is fuller than it used to be and more prone to flooding</i> • <i>river prone to flooding ...</i> • <i>periodical flooding events</i> • <i>A lot more flooding in the area</i> • <i>a degree of change in flow channel. more incidences of flooding due to more severe/extreme rainfall events. occasionally (usually Sunday/weekends) water discoloured and foul smelling- obviously something being discharged at out of office times</i> • <i>More flood events, more sediment and damage completed when draining.</i> • <i>It's still the same, but due to climate change it floods into the fields at times after heavy rain fall.</i> • <i>Residential areas have expanded in the vicinity of the lake. However, the biggest change seems to be that due to the warm winters, the lake has not been able to freeze every year, which affects many things.</i> • <i>my local river (Fergus estuary) regularly floods and i sometimes think that the flooding will reach my home in my lifetime.</i> |
| Concerns of local people and knowledge of current issues and management measures; | <ul style="list-style-type: none"> • <i>Highly concerned about OPW walls scheme and general unpreparedness for climate change impacts</i> • <i>The river flooded badly in 2008, so the river bed was cleared, bridges repaired and a warning system installed to prevent another flood.</i> • <i>Our local river ran through our school grounds so we were very aware of it's changes from season to season. Over the years efforts have been made to improve and develop it as an amenity and deal with flooding issues</i> • <i>Flood prevention measures installed upriver from my area One weir in particular has changed in dynamic</i> • <i>More litter both in and on the river banks. Also when the river is higher due to rain it seems to drop of extremely quickly compared to years ago as if it is being pumped away</i> |
| Differing priorities, localities and levels of awareness and knowledge; | <ul style="list-style-type: none"> • <i>Water levels have dropped dramatically over the years</i> • <i>More dry spots in the river.</i> • <i>Water levels lowering</i> • <i>The water level over the last 15 yrs at Bruree has dropped dramatically.</i> • <i>Less fish but town(Croom) doesn't flood any more</i> • <i>It is quite small and close to the source but has been diverted and piped upstream and dries up for longer periods during summer months.</i> • <i>Higher levels of water, ,more localised flooding</i> • <i>More canalization, banks pushed up higher. More litter.</i> • <i>The water table is higher and it is fuller than it used to be and more prone to flooding</i> • <i>river prone to flooding ...</i> |

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| <p>Differing priorities, localities and levels of awareness and knowledge; (continued)</p> | <ul style="list-style-type: none"> • <i>periodical flooding events</i> • <i>A lot more flooding in the area</i> • <i>a degree of change in flow channel. more incidences of flooding due to more severe/extreme rainfall events. occasionally (usually Sunday/weekends) water discoloured and foul smelling- obviously something being discharged at out of office times</i> • <i>More flood events, more sediment and damage completed when draining.</i> • <i>It's still the same, but due to climate change it floods into the fields at times after heavy rain fall.</i> • <i>Residential areas have expanded in the vicinity of the lake. However, the biggest change seems to be that due to the warm winters, the lake has not been able to freeze every year, which affects many things.</i> • <i>my local river (Fergus estuary) regularly floods and i sometimes think that the flooding will reach my home in my lifetime.</i> |
| <p>Belief the management practices around and in rivers and floodplains are problematic;</p> | <ul style="list-style-type: none"> • <i>Flood defences insisting that culverting of streams is only practical option. Meretricious [sic] but lazy approach.</i> • <i>To my local river today (stream) - there have been continuous efforts to engineer a solution to flooding, particularly within a golf course. They seem to be upset that this stream floods.</i> • <i>Pollution, littering, manmade flooding caused by development on flood plains and river realignment.</i> • <i>Our local stream is maintained by the OPW and I have concerns as to how they "destroy t" [sic] the river bank my experience in Croom and the Maigue (work) is all positive</i> • <i>more polluted, culverted, used as a drain and waste disposal point. lack of care and attention to needs of fauna and flora and respect for water itself</i> • <i>More litter and more pollution from diggers working on river banks, building more adjacent housing, and exaggerated run-off from hard landscaping, more re-shaping of rivers for development purposes and consequent loss of long term biodiversity, less insect life</i> • <i>Pollution; building on the floodplain; poor management; flooding; artificial levees turned into a river walk but subsidence makes it dangerous at times</i> • <i>Historical development pressures have altered the riparian zones, removing much of the vegetation. Artificial embankments have altered the ecosystems and act as barriers that reduce access to the stream for recreational/educational purposes.</i> • <i>loss of kingfishers. river getting wider.</i> • <i>Flooding because LCC gave planning permission to repeatedly build on long established floodplain.</i> • <i>Not as many people use the river now.. The currents are stronger and the flow of water in Limerick city faster since they changed the flow by putting in the dam in the city. Very few rowing clubs using it as a consequence.</i> • <i>Hmm. So in the Dooglasha some of the recent high volume water flow seems to have washed away the gravel beds. Thus no small trout visible in our section last year.</i> |
| <p>Comparing their current observations to their recollections of conditions during past experiences;</p> | <ul style="list-style-type: none"> • <i>I would never swim in the river maigue now.. my childhood memory is clean crisp water.. now it just looks polluted all the time..</i> • <i>"Pollution on the rivers is terrible compared to before"</i> • <i>"I have noticed more pollution in the last decade."</i> • <i>"lot more rubbish in the rivers now"</i> • <i>"Pollution has altered our rivers in recent years"</i> • <i>"Obviously pollution. Har [sic] to walk the river or its man made canals (Ardnacrusha/Parteen) without encountering plastic pollution and more recently, discarded masks etc"</i> |

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| <p>Comparing their current observations to their recollections of conditions during past experiences; (continued)</p> | <ul style="list-style-type: none"> • <i>“water is not as clean as when I was small. When I am by the river I can usually see some type of rubbish in the water.”</i> • <i>“There is more litter and pollution in general affecting rivers now.”</i> • <i>“water quality has improved but plastics and rubbish has increased”</i> • <i>I would say water quality and drop in insect numbers would be biggest negative, taking in most rivers in my wider area and its obvious affect on the recruitment of juvenile fish, having spent a huge amount of time in or around most of the Rivers in my area over the last 40 years I would notice a decline of juvenile fish numbers just by there absence in the evenings were previously they could be seen feeding in large amounts say on pool tails or glides. Positive would be the projects that have come about that have built or given access to Riverside walks and local awareness incentives</i> |
| <p>Change in the river observed in comparison to the past;</p> | <ul style="list-style-type: none"> • <i>More people using it for sports, recreation and walking.</i> • <i>No one seems to swim in the river anymore, where as I would have spent every fine day of the summer swimming in our local river</i> • <i>Less children playing by the river or exploring. Fewer people swimming and fewer people fishing. [sic]</i> • <i>An increase in water sports ...</i> • <i>In general there is more interest, rivers are cleaner</i> • <i>There can be an unpleasant smell occasionally from our river downstream that no one can identify a source for, and there has been an issue with the Reservoir in the past</i> • <i>It's not used in the same way as kids we learnt how to swim in it fished for minnows</i> • <i>... more dangerous for kids</i> • <i>... looks less clear could definitely see fish in the water from bridges previously, banks overgrown, seem abandoned.</i> • <i>Drainage Pollution Lack of angling Overgrown</i> • <i>Less fishing happening on it. More awareness of the river and its wildlife with local people. I feel the river banks are very bare, lots of trees were cut off the banks. Also I notice a lot of invasive plants like himalayan balsam and winter heliotrope</i> • <i>pollution, less fish, mussels gone, dippers gone, otter very rare, brown with run off or slurry after heavy rain, floods more often due to drainage upstream, no more mayflies.</i> • <i>In recent years i am noticing more fish in the river, though small, this is a positive sign. The return of more kingfishers, heron, otter and of course the dreaded but lovely mink tells me that too</i> |
| <p>Knowledge of the source of pollution or type of pollution that is less evident;</p> | <ul style="list-style-type: none"> • <i>“pollution increase in the last 5 or so years (particularly dumping from car windows at bridge)”</i> • <i>“It has become more polluted with farm runoff.”</i> • <i>“Litter and pollution from agri and garden Spray”</i> • <i>“Water levels affected by silt and mud levels. Water quality diminished due to pollution by farm animals and people”</i> • <i>“farming practices are very close to the banks of the river, such as weedkiller spreading.”</i> |
| <p>Reference to the biological indicators of poor river water quality;</p> | <ul style="list-style-type: none"> • <i>“The river was poisoned by effluent in 1981 and it hasn't recovered yet we had trout in abundance but we would hardly catch one now”</i> • <i>“I remember salmon jumping in the Shannon - I swam in it. I haven't seen salmon jump for decades and am not sure it is fit to swim in now.”</i> • <i>Decrease in salmon and brown trout, decrease in flylife, numbers and diversity, less dragonfly and mayfly, less noise of grasshoppers. Greater eutrophication.</i> |

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| <p>Reference to the biological indicators of poor river water quality; (continued)</p> | <p><i>Less use of local weirs and rivers by local people for summer recreation and when it is used it's used for rowdy drinking behaviour rather than by families and kids. Local Angling community less focused on working on and caring for river, more interested in fishing competitions and qualifiers (just in the location I grew up in)</i></p> <ul style="list-style-type: none"> • <i>Negative-more eutrophication, less aquatic invertebrates. More invasive species</i> • <i>On Newport river Increased pollution as a result of litter. Physical change due to dredging and banking by opw. Colonisation by alien invasive plant species. On Shannon, increased pollution from litter but decreased pollution from sewage, also alien invasive plants, fish, zebra mussel & freshwater jellyfish, decreased numbers of salmon.</i> • <i>In the past 20 years, I have noticed increased amount of furry green/brown coverage on teh [sic] stones on the river bed. Also I see less fish and over the past two years have seen a few dead fish floating, both large and small fish. The banks are getting more polluted with plastic bale wrap too. Some local farmers are taking water from local streams to feed their herds leading to a criss cross of black pipes going along rivers, streams and banks. One farmer i know has no drinking troughs for his cattle and they drink from the river and so polluting it more.</i> • <i>I would say water quality and drop in insect numbers would be biggest negative, taking in most rivers in my wider area and its obvious affect [sic] on the recruitment of juvenile fish, having spent a huge amount of time in or around most of the Rivers in my area over the last 40 years I would notice a decline of juvenile fish numbers just by there [sic] absence in the evenings were previously they could be seen feeding in large amounts say on pool tails or glides. Positive would be the projects that have come about that have built or given access to Riverside walks and local awareness incentives</i> • <i>The Lee has the Inniscarra dam and is v [sic] controlled- no salmon beyond the dam its depressing</i> • <i>Fish appear to be more scarce</i> • <i>... deterioration of the banks, but water quality appears to have improved. More people fishing - good or bad not sure. Bird life decreased, so suspect the amount of fish and insects etc in the foodchain have also decreased.</i> • <i>The maigue was very prone to flooding when I grew up in the late sixties and seventies. It was also though a very good salmon river. That all changes, when it was drained and the banks were raised. I do remember the local shops and lanes being flooded. We took little notice of standing on a floating plank inside a shop while waiting for a wafer ice cream. The drainage wiped out the fishing holes and spawning areas. I m sure it has gradually improved over the intervening decades. The development of the park in croom has turned the spotlight on the loveliness of the river, which is a great thing.</i> |
| <p>Observations of positive changes, including attitudes;</p> | <ul style="list-style-type: none"> • <i>Less raw sewage getting into the river</i> • <i>Cleaner. Now more of an attractive aspect of Limerick city</i> • <i>Rivers are cleaned and there's no rubbish around,</i> • <i>I think it is cleaner now than it ever was. Less efflient [sic] from farms</i> • <i>The decrease of rubbish in the river.</i> • <i>The River Lee almost 40 years ago was a different river - it smelt and looked dirty. I no longer have that feeling about it.</i> • <i>Well, as the Barnakyle is a small river, we don't take too much notice, really. I'd say it's actually less polluted than 30 years ago.....</i> • <i>It appears visibly cleaner - little rubbish and no dead animals floating down it. Slipways for water-based activities</i> • <i>Sewage treatment plan has improved the quality of the water in Cork inner harbour</i> • <i>More people make use of the outdoors and water. The water is much cleaner in the Lee.</i> • <i>Positive increase in numbers using the river</i> |

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| <p>Observations of positive changes, including attitudes; (continued)</p> | <ul style="list-style-type: none"> • <i>It's clearer - more accessible-Swans are regular visitors</i> • <i>Positive. Banks maintained. New walkway</i> • <i>Nice walk ways along the river bank. .More sporting activities carried out . Encouraging private , pleasure boats to dock on the River.</i> • <i>New pathway/lights</i> • <i>Killeedy Ecopark has been a huge addition to our locality - especially during lockdown - it is a haven for wildlife [sic] and biodiversity</i> • <i>Glenroe community is already addressing a lot of biodiversity issues</i> • <i>Over the last number of years they have cleaned up, the Limerick Main Drainage was of huge benefit to Limerick City.</i> • <i>Removal of the treatment plant at Shannon Banks is positive, along with the implementation of the Limerick Main Drainage Project.</i> • <i>Our local stream is maintained by the OPW and I have concerns as to how they "destroy t"[sic] the river bank my experience in Croom and the Maigue (work) is all positive</i> • <i>More work being done to ensure it is a valued feature of the community.</i> • <i>I notice more rubbish on the riverbanks, but I also note that there is a campaign at the moment to lower the weir at Annacotty to allow fish migrate easily which is great</i> • <i>amenities around river locations have really been enhanced and developed over the years to ensure a very positive enjoyable experience when visiting.</i> • <i>In recent years the councils have invested a lot of money and cleaned up the riverbanks and built new footpaths and cycle paths.</i> • <i>Less algae and cleaner water than when I was growing up, but also no trout, I never see anyone fishing anymore.</i> • <i>"Negative 1) Increase in pollution 2) Decrease in fish numbers 3) Access from Private landowners occasionally can effect going to rivers Positive 1) Local Authorities are trying to monitor water quality to the best of their capabilities 2) Increase in signage around water/ rivers 3) Lifeguard support from LA"</i> |
| <p>Belief there is reduced access to the river;</p> | <ul style="list-style-type: none"> • <i>Access has gotten worse and flooding is a bigger issue...</i> • <i>Where I live there is no decent walkway by the river - I mostly go through fields No one swims in the rivers anymore Banks of rivers are unkept - Sally's growing that block views</i> • <i>less access as all fenced off</i> • <i>Land owners preventing access where traditional access was available</i> • <i>The river walks have been developed more and are certainly safer, but in a way, the river is less accessible now.</i> • <i>I've seen the Canal being dragged and we were promised swimming and angling areas. Instead, the walls collapsed and the water stopped flowing. It's such a pity that we are not treating our waters properly!</i> • <i>Local river these days is river Barrow Co Kildare, paths get flooded and it's difficult to cycle on overgrown paths, it's not user friendly to spend time by the river especially with kids (not buggy friendly or toddler bike friendly)</i> • <i>Unfortunately, our local river which is at the bottom of our field is very unaccessible [sic] with fencing and barbed wire. It is such a shame that nature is fenced off like that. Also the times we have managed to get to the river, there are no fish, and the river is littered with farming waste eg old fencing!</i> • <i>On the positive side, the paths by the river have been upgraded. On the negative side, a neighbouring woodland has gone into private ownership and access to that area has been restricted.</i> • <i>Historical development pressures have altered the riparian zones, removing much of the vegetation. Artificial embankments have altered the ecosystems and act as barriers that reduce access to the stream for recreational/educational purposes.</i> |

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| <p>Suggestions for projects that focused on biodiversity and pollinators;</p> | <ul style="list-style-type: none"> • <i>Biodiversity based projects aimed at restoring ecological corridors</i> • <i>I'd love to see neighborhoods use some of the green space for wildflowers and teach the kids about nature.</i> • <i>Ban on idling cars everywhere esp outside schools and shops. 2. Biodiversity projects. 3. Wildlife walks , bird, bats tree and plant id walks. 4. Regular clean ups of public areas. 5. Installation of swift nesting boxes at any appropriate site. 6. Removal of invasive plants.</i> • <i>More emphasis on pollinator friendly grass verges on roadsides and in public spaces. Elimination of weedkiller to control 'weeds' in public spaces. Restriction on use of weedkiller in private gardens. More tree planting. More green spaces for recreational use.</i> |
| <p>Indications of a desire to learn or increase public awareness;</p> | <ul style="list-style-type: none"> • <i>no opportunity to clear fallen trees and query over discharges to the river.</i> • <i>How to access information on water quality checks</i> • <i>Youth awareness and education</i> • <i>Citizen science, These are run periodically but would be great to have them every wk yr [sic] round</i> • <i>Each river...could have its own conservation group made up of locals with specific focus on the river and riverbank environment</i> • <i>Nature awareness, youth and community environmental activation</i> • <i>Growing wildflowers, tree planting, support for biodiversity, awareness raising events, citizen science engagement, engaging younger generation in projects</i> • <i>It's difficult to get involved when you don't know what programmes are out there and what they do</i> • <i>Citizen science, bird watching</i> • <i>Clean ups, wildlife walks/projects for adults as well as youths</i> • <i>Education and awareness-building</i> • <i>Small educational talks by experts highlighting the flora/fauna of area</i> • <i>As a walks leader for groups who like to know the flora and fauna of an area.</i> • <i>More signage in the community to illustrate wildlife etc.</i> • <i>Biodiversity and its importance. This course should be run for the farming community.</i> • <i>Activities to encourage children to engage. with water, they will then carry love of water through life. Especially water safety & swimming classes.</i> • <i>Clean ups, education on what shouldn't be fed to wild birds!</i> • <i>nature awareness, youth and community environmental activation.</i> • <i>Clean ups, guided walks to introduce children and adults to local biodiversity and species. Tackling invasive species. Hen Harrier project</i> • <i>Education for everyone, names of birds/ flowers. Learn about your local area and the importance of protecting the nature we have and improving the lives of the wildlife that we share this world with</i> • <i>I'd love to see some semblance of a riverwalk in my community with signs explaining about the wildlife the river sustains.</i> • <i>Education of us all re the importance of our world.</i> • <i>River and riparian zone restoration, footpaths for recreational/educational purposes.</i> • <i>How to access information on water quality checks.</i> • <i>More education in schools about the environment.</i> • <i>Very polluted, not enough people see the river as valuable, an nature interpretation center is badly needed in Limerick</i> • <i>I'd like to see children active in picking up litter. A lot of adults in the community do it, but this behavior should be taught from a young age.</i> • <i>Changing the people attitudes [sic] of both young and old about our environment and how to protect it.</i> |

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| (continued) | <ul style="list-style-type: none"> • <i>More information for the public... leaflets, posters, talks, walks! I am involved in both the All-Ireland Pollinator Plan and the Ellen Hutchins Festival, and have seen firsthand how successful this approach can be</i> |
| <p>Enjoyment of early nature experiences led to desire to learn more;</p> | <ul style="list-style-type: none"> • <i>“adventure and curiosity reigns outdoors”</i> • <i>It increased my curiosity and interest in the natural world</i> • <i>Associated with fun and always something new to behold</i> • <i>I associate being near a river with fun, holidays, exploration</i> • <i>I know more about Ireland than the Irish and I go to many many nature places now in Ireland</i> • <i>Yes, but it was one of many experiences in various habitats where I explored, listened and learned either on my own or with a mentor/adult. Experiences are complex and for me, it is not down to one moment or event.</i> • <i>The river is not accessible to the public to explore its full natural beauty and to teach our future generations an understanding of our environment.</i> • <i>a place to wander at and ask ?? what's life about?</i> |
| <p>Belief there is an increase in awareness and value placed on nature and rivers, and that this will lead to improvement;</p> | <ul style="list-style-type: none"> • <i>Greater use of the river as an amenity and a greater appreciation of it in the last decade. When I was a child I don't think that we consciously [sic] thought about our rivers and protecting them. I think people are more aware of their value now. Negatively, [sic] the water quality has decreased. But this is changing as people become more conscious [sic]</i> • <i>I've seen pollution, but more recently I have seen fish and wildlife return as people are more aware of how important it is to keep the river in a great condition. I have also noticed a lot more water sports and more people enjoying the river</i> • <i>A local stream, the nearest to me, has been 'tidied up' by a beautiful architect designed and landscaped house in the last 10 years. All the wild banks and plants have been removed. It has been bulldozed, levelled banks, cutified by a little bridge and cut stone decoration but I wonder about the natural habitat. It's a very manicured and landscaped stream at the point nearest to my house now. Not the broad, meandering, tangle of plants and lazy stream bed that it once was. I also notice in Lough Gur awful weed going crazy in the lake. I go kayaking there and it's really noticeable. I hear that is from effluent and I don't know but the water is thick with algae bloom. I like the Shannon however, and I like the way that people are conscious [sic] of preserving the integrity of waterways. I know people who fish who throw fish back in because they don't want to deplete the population of fish. People are talking about water quality and are conscious of it.</i> • <i>And I've been in Limerick for 20 years and I have noticed an increasing awareness of and use of the Shannon. My wife swims in it ever [sic] day. We walk the three bridges frequently. The river is moving from the periphery to the heart of the city.</i> |
| <p>Learning and free training a main benefit of volunteering;</p> | <ul style="list-style-type: none"> • <i>...they were able to answer so many of those questions for me ... the more they answered the more I wanted to know. I constantly want to understand and to learn and to better myself but to use it for what I love and for the things around me. (PT1)</i> • <i>I have learned to adapt and understand nature and being outside and being outdoors learning training knowing these people it's helped me be a better communicator. (PT1)</i> • <i>benefits to me are an expansion of education and it's in something I'm interested in, which is nature. (PT2)</i> • <i>it was just an opportunity to learn and to do something positive with other like-minded people and it's been a great experience and I've learned a lot of stuff. I do a lot to protect water in my work, in general and to learn a lot more about the whys and the wherefores and to integrate that it's just been very positive and it's just expanded what I do as well professionally. (PT2)</i> |

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| <p>Learning and free training a main benefit of volunteering; (continued)</p> | <ul style="list-style-type: none"> • <i>the Trust were going to be doing restoration work and that there were training things coming up, that kind of grabbed me. (PT3)</i> • <i>I suppose becoming more educated, that there are solutions out there (PT4)</i> • <i>awareness programmes ... to get more information about what's going on and how we're doing ... it would be nice to know if the people understood and appreciated what was going on and maybe inquired (PT5)</i> • <i>it is important that you try and involve the community in nature and your best way to do that is to show them things and tell them things and take them on walks (PT7)</i> • <i>Lochs Agency had provided a course, for I think they called it entomology for anglers, so it was basically pretty much the same thing as the riverfly monitoring thing, you know identifying your species or the families of insects and invertebrates all living in the rivers so I had already got that under my belt so it made the RT training a bit easier for me and but nevertheless, you can never learn too much. (Key Informant 1)</i> • <i>I've had opportunity of free training and ... lots of the courses that are put on would cost individuals significant money out of their own pocket...Personal benefits, you know to be able to avail of training in things that I've been interested in. (Key Informant 1)</i> |
| <p>Social learning from other volunteers also valuable;</p> | <ul style="list-style-type: none"> • <i>I'm having a good time and all these people... are valuable teachers to me...that time to me is very valuable... they have such interesting backgrounds and such commitment and passion for the environment. What they've got to say is interesting so when they go to say it, I want to be present. (PT1)</i> • <i>The personal benefit of it has just spoken. Because it was getting to know PT5. Because we're working together as a team, it's been fantastic. I don't know the area as well as PT5, and PT5 has taught me so much about the river and there's always this chat, and a bit of a story about the river and the local knowledge. It's been a very enjoyable experience, yeah, I haven't regretted it for a minute. (PT6)</i> |
| <p>Theme 2: Identity, environmental ideation and belonging (Identity)</p> | |
| <p>Place attachment is indicated;</p> | <ul style="list-style-type: none"> • <i>"learning to swim in Nenagh River at a place called "Murty's Hole"!",</i> • <i>"Watching fish jump in Tallow Co. Waterford where I lived as a child,</i> • <i>"I grew up by the Shannon estuary, I lived by the river garnet in clare I used to find fossils there and go beachcombing for lamprey etc"</i> • <i>"the mouth of the Burne, Scotland, paddling in shingle, peering into the water, Stepping stones following the river upstream, reflections depths, wildlife, bridges,</i> • <i>"Throwing sticks for my dog in the Blackwater river behind my house.</i> • <i>"It was at the bottom of our field and we used to walk along it & in under the bridge which crossed the main road at Banogue. Sometimes it used to flood onto our field, so we used an old tin bath and a plastic baby bath & tried to paddle around .</i> • <i>"River Maigue down the end of my cul de sac in Croom, used [sic] visit 3-4 times a week and listen to the water and swim in summer.</i> • <i>"I come from Adare and there was a small stream by my house that all the local children used to play by, it had wonderful limestone steps down into it, it fed into the Maigue.</i> • <i>"My earliest member [sic] of spending time by a river would be my family occasionally spending time walking on a nature trail near our home (&lt; [sic] 5 miles, we'd drive). There was a stream there which led to the Boyne just a twenty metres from the trail car park. During my teen years we would swim in the river around the same place almost daily."</i> |
| <p>Farming background as the childhood experience in nature;</p> | <ul style="list-style-type: none"> • <i>"bringing cows for a drink many years ago"</i> • <i>"Washing my feet to cool down while making hay in the fields"</i> • <i>"Brought up on market farm, outdoors in nature was our free time"</i> • <i>Outdoors was our playground on the farm. Cats and dogs and cows etc. Cycle of nature was part of our cycle of play.</i> |

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| <p>Farming background as the childhood experience in nature; (continued)</p> | <ul style="list-style-type: none"> • <i>I grew up on a farm in rural Ireland. Many positive experiences of being outdoors [sic]</i> • <i>Live in the countryside</i> • <i>I grew up on a farm. Being outdoors in nature is a very natural thing to me.</i> • <i>I love nature, I grew up on a farm</i> • <i>Wading up the stream nearest my parents farm. It runs through a little woodland and has steps to make tiny waterfalls</i> • <i>growing up on a farm</i> • <i>I am a farmer</i> • <i>I grew up in the countryside on a farm and the wildlife was plentyfull [sic]</i> • <i>I think any positive, enjoyable experiences that occur during childhood would likely result in a positive appreciation & interest in adulthood. I grew up with a rural farming background.</i> • <i>rivers didn't really feature regularly in my childhood,except [sic] for going to the river near my gran with my parents. On the other hand, being on my grans farm and learning where the snowdrops, the primroses, the daffodils, the wild strawberries grew that had a huge positive effect on me.</i> • <i>"I grew up in a countryside with animals and a big vegetable garden, which gave me an awareness and certain understanding og [sic] the natural environment, natural cycles, interdependencies in ecosystems and our (human's) dependency on nature as back then my family was 'fed' by the nature in a more direct way and we had to look after our animals and plants in order to get our nutrition. This is not the case for me now (living in a city) but this knowledge and appreciation will definitely stay with me for life."</i> |
| <p>lack of childhood nature experience led to appreciation of nature;</p> | <ul style="list-style-type: none"> • <i>"Where I grew up, no outdoors, but now in Ireland the outdoors very much influences me."</i> • <i>"I grew up in the suburbs so getting out in nature was a rare treat. As an adult, I've made it a priority.</i> |
| <p>Focus on a desire for community-based projects;</p> | <ul style="list-style-type: none"> • <i>I would like our community to support the local river and the native broadleaf woodland we have. As well as the history on our river.</i> • <i>Planting trees, community garden allotment</i> • <i>I would like to see the community care for the historic monuments on their doorstep. This village has extensive poetic history and it is unrecognised</i> • <i>Paid nature conservation corps, community farm, community garden, community woodland,</i> • <i>Community centre needed and community led activity</i> • <i>community orchards.</i> • <i>programme of community education and awareness on ecology and envrionment [sic] based in local park</i> • <i>A community Garden/Wildlife Area. Display Boards showing features in the parish e.g Hills, Rivers, Heritage areas, Woods. Another Board detailing wildlife local to area.</i> |
| <p>Interests in preserving history and heritage sites;</p> | <ul style="list-style-type: none"> • <i>To explore Nature, heritage and history</i> • <i>Restoration/maintenance [sic] of iron bridge (local name for old train bridge which is now part of public walkway)</i> • <i>I would like our community to support the local river and the native broadleaf woodland we have. As well as the history on our river.</i> |

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| <p>Interests in preserving history and heritage sites; (continued)</p> | <ul style="list-style-type: none"> • <i>I would like to see the community care for the historic monuments on their doorstep. This village has extensive poetic history and it is unrecognised</i> • <i>Informal group who meet monthly to clean park centred on our local river, Glen River Park in Cork city. Involved in a number of historical societies that undertake small scale conservation work.</i> • <i>A community Garden/Wildlife Area. Display Boards showing features in the parish e.g Hills, Rivers, Heritage areas, Woods. Another Board detailing wildlife local to area.</i> • <i>To reflect on generations past and how the used/viewed the river</i> |
| <p>lifelong interests influenced by early childhood experiences;</p> | <ul style="list-style-type: none"> • <i>I have always had a keen interest in the outdoors, flora and fauna and exercising out in the open</i> • <i>Like to watch nature and still swim</i> • <i>It's started my love of nature and fishing as a past time</i> • <i>I fish ever since</i> • <i>I walk with friends more in the woods.</i> • <i>Yes, I ve [sic] always loved the water, especially the sea, but coming back more and bore [sic] to rivers as I grow older. I love getting off my bike and looking over bridges or walking beside them on tow paths etc.</i> • <i>It started a life long relationship with angling which grew into a wider interest in nature and ecosystems</i> • <i>This exploration into the streams and its surrounds started a lifelong love, am still walking by waterways, poking about in canals and watching river ecosystems four decades later</i> • <i>while fishing you get into all different types of nature</i> • <i>My parents loved walking and would take us for walks all the time - long walks. They lived very healthy and long which I believe to be apart from their gene pools it was to do with their continuous healthy lifestyle. It has influencd [sic] all my sibilings, I am the worst for not walking and rather cycling by the river bank.</i> • <i>Always wanted to be outside walking, climbing, exploring and finding animals</i> • <i>Recreation, spent time outdoors exploring nature with neighbours</i> |
| <p>References to people changing behaviour, feelings or perspective over time;</p> | <ul style="list-style-type: none"> • <i>It made me appreciate how much more relaxed I felt in natural environment, particularyl [sic] as I got older.</i> • <i>"I am a farmers daughter and spent alot [sic] of time working on the farm as a child, during my late teens and in my 20's I spent little to no time outdoors. Now I have come full circle and crave the outdoors and the emotional connection and sensory attachemnt [sic]."</i> • <i>It got me hooked on fishing and as I got older conservation</i> • <i>Yes, I ve [sic] always loved the water, especially the sea, but coming back more and bore to rivers as I grow older. I love getting off my bike and looking over bridges or walking beside them on tow paths etc.</i> • <i>I see a lot of rubbish on the tide marks upon the levees. As I've gotten older, I spend more time around the river but I think a negative aspect is that the levees block the river and for most people it ends up as wholly 'out of sight - out of mind' with regards to consciousness about the river network - this has not improved. Traditional local interaction is sparse.</i> • <i>beauty of nature more apparent as I have gotten older</i> • <i>Walking routes established along it now which is great. You would hope less pollution but I'm not sure about that. It seems to flood more but maybe that was something I didn't notice as a younger person compared to now.</i> |

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| Reference to current parenting methods impacting childhood nature experiences; | <ul style="list-style-type: none"> • <i>Making rafts from barrels and planks (most activities in water as a child not allowed now! Mostly due to helicopter parenting, reduced freedom for children and health and safety concerns)</i> • <i>Being a child in the 1970s involved spending vast amounts of time outdoors esp in summer. I lived near the Shannon, with nearby woodland also, and me and my friends would regularly visit those areas for recreation (climbing trees etc.)</i> |
| Self-identity as environmentalists or nature-lovers; | <ul style="list-style-type: none"> • <i>Its who I am</i> • <i>Yes, always. Being outdoors and loving it made me who I am now</i> • <i>Established a way of life in terms of appreciating nature</i> |
| identity as an environmentalist made them different | <ul style="list-style-type: none"> • <i>I think the term when I was growing up, was 'weirdo' because I was the one that wouldn't understand and break things or you know fascinated with frogs and things ... there was a difference in me, there was a thing with me that always needed to be around nature and around rivers. (PT1)</i> • <i>people don't even realise what's missing [...] when I was 18 and chained myself to a fence ... I was a big part of Greenpeace for years you know on actions. (PT3)</i> • <i>Some people it's ok, some are indifferent and some are derogatory, you know if you're an environmentalist it's like having an illness of some kind. (Key Informant 1)</i> |
| Theme 3: Feelings and concerns about health and nature (Emotions) | |
| References to how people get enjoyment from nature; | <ul style="list-style-type: none"> • <i>Gives joy</i> • <i>Getting joy and peace associated with childhood adventures.</i> • <i>The springtime flowers and the birdsong give me peace and joy.</i> • <i>Always a happy experience and always felt great</i> • <i>Quite peaceful seeing the flora and fauna</i> • <i>Enjoyment. Fresh Air. Scenery. My Kids, my wife and I watched an otter last year in the Shannon near our home.</i> • <i>Time in nature is central to my happiness and always has been - nature is restorative</i> • <i>I am happiest when in nature and there is lots of wildlife. I now only admire what I see.</i> |
| Explicit mention of well-being and wellness associated with time in nature; | <ul style="list-style-type: none"> • <i>Sheer joy of paddling and having minnows nibbling your toes. Mill stream</i> • <i>Fishing to relax</i> • <i>Living in the country, with a river running through our farm, time spent outdoors feels essential to my well-being.</i> • <i>For mental health reasons, fresh air is beneficial</i> • <i>just fun to get outside and clear the head. Also watching the scenery is nice. Makes you appreciate what is around us.</i> • <i>Very drawn to the countryside and water always - very peaceful</i> • <i>Nature's natural sounds, beauty, Wild life, God talks to us through nature, there is always something great to take home irrelevant of weather conditions</i> • <i>it generates positive feelings</i> • <i>good for physical and mental wellbeing</i> • <i>Meditation</i> • <i>Positive and calming experience</i> • <i>A positive experience with no fear of danger</i> • <i>Sense of beauty, happiness and well-being</i> • <i>I suppose I was unknowingly turning into my parasympathetic nervous system.</i> |

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| Nature relieves negative feelings; | <ul style="list-style-type: none"> • still live on home farm and outdoors is destressor • i would get depressed if i couldn't • Freedom, stress relief • I need to be outdoors everyday |
| Nature as restorative and beneficial for positive sensory experiences; | <ul style="list-style-type: none"> • I loved the sound and feel of the water • I love being near water, and the sound of flowing water • Love the sound and spending time by the river • I appreciate the beauty and special time by the river or lake • The positive feeling I got when I was near the river or playing in it • Running water always fascinates me and is good for the soul • The sound of the river is absolutely enegaging [sic] |
| childhood experiences in nature influence their current activities; | <ul style="list-style-type: none"> • I am very positive about spending time outside as a result of the very positive childhood experiences I had • It made me appreciate how much more relaxed I felt in natural environment, particularyl [sic] as I got older. • Exposure to nature as a child took me away from my worries and I have continued to spend as much time in nature as possible as an adult. • As I child I always went outdoors as much as possible and lv carried it with me all these years, I use it to distress to exercise and even just to enjoy myself • It's a positive memory from a very early stsage [sic] of my life that feeds into my sense of well-being when out in nature. |
| Indicate the desire to share nature experiences and benefits with others; | <ul style="list-style-type: none"> • I try to educate people on the mental health benefits of nature. • Love of nature continues into adulthood and want to foster that love and respect in my own children. • passing on the love to my kid • people now regard being near a river (running water) as a positive experience. • We had stream near house and we're in n [sic] it every day. I now have a stream at my house and take the grandkids into it as often as possible whether gardening or just playing pirate ship 🏴‍☠️. |
| Emotions and an emotional connection to nature; | <ul style="list-style-type: none"> • It gave me a love for watersports sports [sic] • Always loved river, took up canoeing, outdoor sports • I developed a love of nature as a very young child and from an early age it was a source of recreation • Peaceful feelings; oneness with nature. • It's 'me time' connecting spiritually through nature. • I loved the water and being close to nature • Developed a love of outdoors which I still have, it is an ingrained love • always connected strongly with nature as a family • I feel very closely connected to Nature and am very interested in wildlife, plants birds, trees, weather, geography and all Environmental issues. • the connection between us and the earth and the rivers, and you know I feel that very strong. (PT1) • with feelings towards nature and trying to protect it...and the value of it... and then there's another level, of maybe it's just where you get to in life where you realise that we're all connected we're all a part of it, so what happens to the rivers or environments within yourselves, so it's a deeper level (PT4) |
| Feelings that childhood experiences | <ul style="list-style-type: none"> • "Only by experiencing nature can you begin to appreciate it." |

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| directly influenced connection to nature as adults; | <ul style="list-style-type: none"> • <i>“This exploration into the streams and its surrounds started a lifelong love, am still walking by waterways, poking about in canals and watching river ecosystems four decades later.”</i> • <i>“That period engendered in me a connection which has persisted.”</i> • <i>I got a love for fishing at a very young age and I am still fishing today in my 70s wmy [sic] local</i> |
| Childhood experiences lead to the desire for more experiences in nature; | <ul style="list-style-type: none"> • <i>It lays down how you will be as an adult</i> • <i>Yes it was the catalyst that drove me to the love of water and nature</i> • <i>It creates habits</i> |
| References to the desire to share the same enjoyment and emotional connection with their children; | <ul style="list-style-type: none"> • <i>“Time spent by the sea/rivers swimming definitely gave me a love of the water and I ensured that my own children learned to swim from a young age - we also spent time kayaking, searching rock pools, and so on by the coast”</i> • <i>“A drive to or a walk in nature, usually by a river or lake was something that happened pretty much every weekend with my parents. These walks and talks instilled a love and respect for nature in me and have continued to be a routine for me as an adult with my own family.”</i> • <i>“Yes, I want my children to have the same connection to nature that I enjoyed as a child so I bring them outdoors every day.”</i> |
| Rivers are associated with danger, death, fear and suicide; | <ul style="list-style-type: none"> • <i>“Dangerous currents”</i> • <i>“Unfortunately, the river Shannon is now associated with death/suicide.”</i> • <i>“Tragic drowning”</i> • <i>“Refuse unfortunately been dumped in the river. Also unfortunately there have been a lot of suicides in the local river.”</i> • <i>“Sadly, much of the news regarding the river over the last decade has been associated with suicide attempts and a need to patrol to prevent this.</i> • <i>“My mother telling me not to swim in it (the Danube) as people regularly drowned in its dangerous whirls; I was nonetheless fascinated by the beauty of the river and spent many hours on its banks, especially as a teenager.”</i> • <i>“There was often drowning deaths and in more recent years suicides.”</i> |
| Health and Safety concerns about safety related to poor water quality; | <ul style="list-style-type: none"> • <i>Got a rash recently from swimming – different experiences from when young.</i> • <i>Pollution has made it unsafe for swimming.</i> • <i>People stopped swimming because of outbreaks of scabies.</i> • <i>I question has the water quality at ringmoylan pier been evaluated recently. Large amounts are now swimming at the pier and sometimes swimmers have a brown sediment marking on thir [sic] faces. This washes off but leaves me wondering if the water quality is safe</i> • <i>we don't drink tap water - e-coli and chlorine</i> |
| Increase in signage alerting people about water safety; | <ul style="list-style-type: none"> • <i>“We all swam in the river as children... As adult I saw notices say water polluted and not to swim. Now I swim with caution. I have no faith in water quality monitoring and would like reassurance re same. Also no eels anymore and little fish in comparison to past. Also feel annoyed at treatment of migratory salmon”</i> • <i>“Negative changes have become evident such as the use of the river, be it for fishing or for pleasure and in my opinion that is down to water safety being so prominent, which is great as it is important, but has almost made people fearful of the water and rivers.”</i> |

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| <p>Human disturbance as a concern;</p> | <ul style="list-style-type: none"> • <i>“The river bank often has sulky racers and quad bikes which make it dangerous. It is not suitable for such activities because it is narrow.”</i> • <i>“The biggest negative is the dog dirt, The walk is FILTHY, Last night there were 27 different piles, it is making the walk unusable. I have had poo bedded in my buggy wheels, thus in my car boot etc. Recently I helped a lady who slipped on the walk on dog excrement. It is now dangerous.”</i> • <i>Trolleys and other stuff in the river really annoys me. This part of education has to be brought into the school curriculum. Environment shall not be pushed into the massive bracket of Science - it has to be an entirely own subject!</i> |
| <p>Emotional connections lead to concerns and negative feelings;</p> | <ul style="list-style-type: none"> • <i>Increased pollution no proper sewerage system reduced wildlife in the Deel river and no longer a safe swimming amenity In the streams feeding into the river reduced wildlife due to farming practices. In the local turloughs removal of all vegetation which supports invertebrates and no safe hatching for water hens and ducks The ducks were shot as it was believed they might carry bird flu or a Covid type disease to affect livestock! Local boggy areas have been reclaimed to create more farmland removing flora and fauna and altering habitats.</i> • <i>Less use of pesticides and other harmful substances on campuses, public spaces. Would like to see local flower beds planted wit [sic] biannuals, breaks my heart seeing the council workers pulling out those flowers and planting new ones few times/year.</i> • <i>volume of litter and plastic, bad smell when water level is low, lack of bugs etc in the water and overgrown banks with thickets of brambles. One thing I really hate to see is plastic stuck in overhanging branches and broken river features like weirs or banks washed away, it is as if the river has been wounded. Wildlife along the river is not as plentiful and the volume of dog pooh, where a large number of the community use the riverbank walks, turns my stomach. I would be reluctant to bring my grandchildren in their buggy to walk there.</i> • <i>There are far less of everything, trout, salmon, fresh water clams, dragon flies, insects, bees which makes me sad and fearful for my kids and the future generations</i> • <i>It's constantly dirty. Our kids don't see it the way we did.</i> • <i>Only negative Sadly. No sticklebacks in small streams. Pollution from increasing diary [sic] industrial farming. Rivers only seen as a way of moving on pollution. My children will probably never be able to catch a salmon or sea trout due to pollution, overfishing, lost [sic] of spawning beds. Erosion of banks of my local river due to cattle access to river. Lack of fly life in rivers. No more hatches of Olives in the evening and no trout rising to them.</i> |
| <p>Theme 4: Environmental stewardship, volunteerism and action (Behaviour)</p> | |
| <p>Concerns over the future as a major driver for environmental stewardship;</p> | <ul style="list-style-type: none"> • <i>it happened on what I class as on my watch, like in my generation that something needs to be done about this. And then seeing that most rivers have gone in the same way in a pretty short space of time, like, talking 20 years maybe. So to find that the RT was there and the work they're doing and all the different groups, I just thought, yeah, that's worth, that's worth getting involved in. (PT4)</i> • <i>I wouldn't like to see it being degraded like it has been for a few years and I'm very pleased to see all the different groups around the river doing something in a small way maybe in each area to tidy it up, and I hope that that kind of progress with continue. We mind the river even for future people to enjoy it. (PT5)</i> • <i>I would like too to pass onto the next generation that I leave it with this, we did try to do something, or try to make people aware of what was going on and try to help maybe or set the framework for future help. That would be my kind of motivation (PT5)</i> |

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| <p>Concerns over the future as a major driver for environmental stewardship; (continued)</p> | <ul style="list-style-type: none"> • <i>I'm very interested in sustainability, biodiversity, climate change, all those green things. They are important to me, And a big motivation these days is my kids, I want um, to be able to turn around in my old age to my kids who are struggling with the effects of, the environmental effects, of what previous generations have left them. And turn around and say well, I did something. I didn't stand by and do nothing. Um, I didn't do much, but I did little bits and I certainly didn't make things worse. (PT6)</i> • <i>I'd say that as time goes on, that if it continues the way it's going, there'll be less time for people along rivers because the quality won't be good. And I think that kind of inspires me a bit as well that you know that you can have more of an awareness of what's happening with agriculture and what's going on with treatment plants and ... the river seems to be a real dumping ground ... more aware of that. I'd stop and might read something about it now... and for my lads I suppose, to enjoy the river as well because it is very, it is really, it's the perfect country for it (PT8)</i> |
| <p>Volunteering alleviates negative emotions;</p> | <ul style="list-style-type: none"> • <i>it's always been an important part of my life in that way, so it was an opportunity to actually do some of the practical work rather than just giving out about all the things that are wrong ... the personal benefit of the trust the activities that we do and the actions that we take help to offset some of the massive grief around what's happening with the biodiversity and the climate ... There's a lot of powerlessness in that situation ... and the Trust gives the massive opportunity for actually doing something rather than just sitting feeling miserable about it. You know it offers solutions and it offers doing rather than just sitting around saying oh the government should do this the government should do that." (PT3)</i> • <i>... we've gone through despair and maybe anger at times, hopelessness when you see everything being damaged and destroyed the way it is. But then when you find out that there is solutions, real solutions that can work... becoming more educated that there are solutions out there. (PT4)</i> |
| <p>Lack of opportunity and a desire to increase public participation;</p> | <ul style="list-style-type: none"> • <i>It's difficult to get involved when you don't know what programmes are out there and what they do,</i> • <i>Lack of awareness of groups involved</i> • <i>Citizen science, These are run periodically but would be great to have them every wk yr [sic] round,</i> • <i>Clean ups, wildlife walks/projects for adults as well as youths</i> • <i>Each river...could have its own conservation group made up of locals with specific focus on the river and riverbank environment.</i> • <i>I know how important these groups are and now I hope to get more involved</i> • <i>Not knowing which groups to join</i> • <i>More citizen science relating to water quality and kick sampling from a bio-diversity standpoint</i> • <i>i would like to be able to test water and keep track of pollution events</i> |
| <p>Dislike of pressure to participate;</p> | <ul style="list-style-type: none"> • <i>...there was no pressure put on that three monthly or monthly. But I think we kind of felt especially because there were two of us that we could probably manage the monthly, so we just decided that night that we would give it a try, but there was never any pressure to do it...I think the fact that this is local is, it's just so friendly, and oh, I suppose no stress or pressure, so I just think you're running it really well and it will be a great thing to get more people involved because it's such a positive experience. (PT6)</i> • <i>that kind of set up was very good and there's no pressure on anybody to just walk along and have a look, and I just assumed that would be a big draw for people to come in and get involved like. (PT8)</i> |

| Theme 5: Transformative experiences | |
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| Activities, recreation or sport by the river as well as swimming, paddling, angling, rowing, fishing, picnics or throwing stones. | <ul style="list-style-type: none"> • <i>“walking along the river bank,”</i> • <i>“flyfishing every chance we got when we were kids,”</i> • <i>“wading in freezing water in summer,”</i> • <i>“playing along the river,”</i> • <i>“building dams,”</i> |
| Thoughts and emotions felt; | <ul style="list-style-type: none"> • <i>“being able to walk to a little island on the river when the tide was out. Felt like an adventure,”</i> • <i>“Learning to hunt & fish and enjoy nature,”</i> • <i>“watching the floods, very exciting,”</i> • <i>Peaceful with a jam jar with my brother collecting tiny fish and eels spent hours happily there</i> |
| Memories of sensory, contemplative, spectatorial experiences; | <ul style="list-style-type: none"> • <i>listening to the sound of water,”</i> • <i>“water flowing,”</i> • <i>“sitting by the river with my dog,”</i> • <i>“seeing people swimming in it during summer,”</i> • <i>“watching the millenium [sic] celebration and fireworks reflecting over the river at night.”</i> • <i>“Crossing the iron bridge to go to school every morning and looking into the river below.”</i> |
| References to wildlife, such as feeding ducks and swans; | <ul style="list-style-type: none"> • <i>Snorkelling in a stream, tickling fish, catching crayfish</i> • <i>Building rafts and paddling on home farm river (gully) and catching tadpoles and 'pinkeens'.</i> • <i>throwing dried rabbit droppings in a [sic] and watching fish come up for them</i> • <i>Building dams in a stream and watching caddis larvae and shrimps</i> • <i>It was a part of life. Rafts and catching wildlife</i> • <i>Hiking along streams and rivers and catching newts</i> • <i>I was crossing over every day on my way to school. I loved being in a boat, swimming, studying water creatures...</i> |
| Negative experiences; | <ul style="list-style-type: none"> • <i>Trying to get the dog out of the water to go home!</i> • <i>I lived right beside the river when growing up but my earliest memories were quite negative as my parents were very nervous about a large water body and lots of young children.</i> • <i>Being told not to fall in.</i> • <i>Being told to stay away from it in case I fell in. Neither of my parents could swim.</i> • <i>Built love of being by the water as was in it every day, walking along the river, building forts but also nearly drowned a few times so led to fear of being in the water and reluctance to swim.</i> • <i>Water was freezing. Take great care jumping into rivers.</i> • <i>Fell in and was pulled out.</i> • <i>Falling into it in a local park!!</i> • <i>A birthday party at a friends house that had a small river at the bottom of the garden. Dire warnings not to go into the river if the football went in there by accident!</i> |

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| <p>Family members in their memories;</p> | <ul style="list-style-type: none"> • <i>Going with my parents & sisters for picnics by the lake.</i> • <i>Although it is probably my parents' values which both brought me out as a child and gave me a similar value system for my work in childcare and with my own children today</i> • <i>Making dams in a small stream with my siblings.</i> • <i>Being on a boat every week with my father.</i> • <i>Swimming in the river near my grandmothers farm in summer either after saving the hay or just on a hot day.</i> • <i>My Dad was teaching myself and my sister how to skim stones across the surface. I threw a stone and hit my sister on the head!</i> • <i>I come from a family of fishermen - fond memories of seeing lots of fishermen on the Shannon in Limerick city.</i> • <i>Rivers didn't really feature regularly in my childhood, except for going to the river near my gran with my parents. On the other hand, being on my grans farm and learning where the snowdrops, the primroses, the daffodils, the wild strawberries grew that had a huge positive effect on me.</i> • <i>Watering cattle on grandfather farm.</i> • <i>Parents encouraged us.</i> • <i>A deep appreciation for all of nature was passed down to me from my dad who lived in a town but loved having walks in nearby countryside and spending time in his beloved garden.</i> • <i>My earliest memory is watching my grandmother and aunts washing clothes.</i> • <i>Feeding the ducks with my parents.</i> • <i>I grew up near a river.earliest [sic] one was my brother teaching me to fish (i didnt like [sic] it).</i> • <i>My mother loved the outdoors and swimming.</i> • <i>Playing dams catching collies with jam jar, fishing for eels with uncle who knew about all the insects and poems about the river.</i> • <i>It was part of a childhood of interest in nature cultivated by my father.</i> • <i>The little stream where my aunt and uncle got water for their domestic use.</i> • <i>Always connected strongly with nature as a family.</i> • <i>My grandfather would have been the person who imparted nature onto me, [...] he took me to the river to teach me how to fish when I was 7." (PT1)</i> • <i>"I always loved the river... I was born and reared beside it and all the things that could be done in a river, this was back in the 50s and early 60s and I loved the river from the first time we ever saw it. It was quite near us at home." (PT5)</i> • <i>"It was actually an uncle who introduced me, and bought me my first fishing rod, so my father had no interest at all, so I must have picked up a gene from a previous generation." (Key informant 1)</i> |
| <p>Covid-19 influenced time in nature;</p> | <ul style="list-style-type: none"> • <i>I've been taking a lot more walks - usually by the river, particularly during the first lockdown when the weather was fine. Being in one place all the time also led me to notice the local birds a lot more.</i> • <i>I have also noticed things that I would never have noticed without being forced to slow down during lockdown. I have learnt about more flora and fauna right on my doorstep, while becoming fascinated by the birdlife that my garden attracts</i> • <i>I value my time spent out doors even more, I spend more time in outdoor areas near where I live and I am more aware of the positive effect it has on my wellbeing and that of my family. My son who is 2 is so engaged and independent when in nature exploring. He notices so many amazing things and has taught me to appreciate more too.</i> • <i>Covid has opened my ears to the beautiful bird songs, it has made me open my eyes to the nature around me. I see and notice nature more now</i> |

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| <p>Covid-19 influenced time in nature; (continued)</p> | <ul style="list-style-type: none"> • <i>...during lockdown teenagers went back to swimming in rivers, building rafts like we did when that age.</i> • <i>a new awareness of the river, its power as a tidal body of water, its Ice swimmers who inspire (especially during Covid), the Gandelow rowers, the accessibility to the boatclubs, the boatbuilders, those who have kept the memory and knowledge visible ... and the many walks that allow for public access.</i> |
| <p>Crowds deterred people from nature due to Covid-19;</p> | <ul style="list-style-type: none"> • <i>Spend less time as my usual routes now have too many people using them and it is impossible to social distance at an adequate level</i> • <i>Afraid to be outside and meeting people</i> • <i>I want to avoid people and the river is a busy spot for walkers</i> |
| <p>Covid-19 reinforce the sense of loss;</p> | <ul style="list-style-type: none"> • <i>lockdowns and restrictions on travel have reduced the opportunities to travel and visit forests, rivers, lakes beaches etc. We live in a suburban environment, so walks are now limited to local parks/pitches and along suburban roads</i> • <i>I long for it more. I wish I could get out to places beyond my 5km. I appreciate nature more.</i> • <i>Less opportunity to be on the river or in woods (due to covid) but still take walks to river edge</i> • <i>I cannot meet with friends to do so, and the current 5km restriction has meant I cannot get to any of the woods near me.</i> • <i>Unable to travel to the beach</i> • <i>I am restricted to stay within 5km, if I could travel I would organise day trips to Ballyhoura, Fota ect</i> • <i>we can't go to the sea or to the mountains to spend whole days outside.</i> • <i>I spend probably equal time outdoors as I did before, but less time in nature as I now live in Dublin City centre and don't get to go hiking or waking [sic] at home in Limerick or further afield with lockdowns</i> • <i>I normally spend my free time hillwalking, sea swimming or foraging for wild foods. The restrictions have forced me to re explore my local area and find wild places in a city</i> |
| <p>Covid-19 increased appreciation of local communities;</p> | <ul style="list-style-type: none"> • <i>I am now going for more walks than before, and appreciate being outside in fresh air more. We have some excellent walks here in my town. I have also foraged for elderflower, gorse and clover flowers to make cordial :)</i> • <i>I have always loved the land and riverscape and gardening. Now I have derived more consolation from it. Also , I see that fellow citizens enjoy the riverscape. The river and city are rendered more and serene and healthy by walkers. There is less traffic noise and more conversation about the locality. D [sic]</i> • <i>We are lucky to have a garden and rural lands nearby, but we are still spending less time out because it's the middle of winter and there's a 5km limit</i> • <i>We would sometimes travel as a family to parks, the seaside, or forests walks. We cannot now (though we are very fortunate to have a large garden, and can spend time there when the weather permits).</i> • <i>I always spent a lot of time outdoors, but I now work from home in the countryside so my outdoor environment is of a higher quality.</i> • <i>I have explored environs closer to home. Am walking more instead of driving to far flung places. I can safely greet people in the distance outdoors, which makes up for social isolation.</i> • <i>It's made me go out go out for a walk every single day. I can't always get to wild places but it has made me appreciate everything even in the built up area i live.</i> • <i>I always prefer to be outside, but now meeting anyone else also has to be outside , so I meet them for walks etc. I think more people are coming to value our beautiful countryside and are treasuring some of their local spots they never knew or bothered about. I have also biked and walked up tiny lanes and roads, I would have passed by before. So that element of discovery in your very local areas is a great thing and is teaching us all the value of the local green spots.</i> |

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| <p>Nature was a tool to cope with the negative mental and emotional impacts of Covid-19;</p> | <ul style="list-style-type: none"> • <i>realised it's the most important thing we need to protect</i> • <i>I've found time to stop and enjoy the little things in life like nature and the outdoors are so much more appreciated.</i> • <i>During the second lock down with my young family, we spent a huge amount of time at the beach! Endless hours of fun. We felt reenergised, happy and fulfilled! Nature offers so much for the soul!</i> • <i>Having spent more time in nature, I now feel something important is missing if I don't get out into nature on a daily basis.</i> • <i>Conscious effort to destress and "let loose" from working and schooling from haome [sic]</i> • <i>Although it was vital for me to spend outdoors prior to covid, from a mental health point of view, I cannot go a day without getting outside.</i> • <i>I now walk or run every day simply for mental health and Covid restrictions limits other activities</i> • <i>Nature has benefits psychologically and physically, covid hasnt [sic] changed my opinion on that. However, being more home based with Covid, and with restricted travel, more shorter trips to nature result, rather than longer less frequent trips</i> • <i>Not like others covid has had a positive impact on me when it comes to the river, I have been a lot more active in trying to get a swim in daily to help with my mental health</i> • <i>Being stuck inside all day everyday has been particularly hard for me. So I try to get out as much as possible for my mental health.</i> • <i>I now only get to walk in nature once a month, this includes the river walk. I am limited to what is within walking distance. Usually I would get to travel to places such as woods regularly, but it has not happened for nearly a year, This greatly impacts my mental health.</i> • <i>It's important that you get out and spend some time in the fresh air, it has great benefits for your mental health.</i> • <i>Greater need for activities to help mental health</i> • <i>Have more time to spend within nature & notice how it slows my body & mind down which enables more creative thinking</i> • <i>It has given me a new appreciation for nature. Without nature we don't have human life. Nature is also very important for our mental wellbeing.</i> |
| <p>Covid-19 caused people to experience nature in a new way;</p> | <ul style="list-style-type: none"> • <i>this is Covid, so to make do, rather than meeting his friends in in a restaurant or in a bar or somewhere he was just in the middle of a forest in the middle of nowhere basically in November... it was cold and they were all with woolly hats and anoraks, yeah and they were all sitting around, but do you know, it was human interaction."</i> (Key Informant 2) • <i>I walk daily and because of the 5k my only safe walk is the river which I walk at night to avoid the crowds by day.</i> • <i>Enjoying local areas and my back yard more. Because im wotking [sic] from home i was able to get some free range hens.</i> • <i>Daily walks. More appreciation of our local area. Desire to improve local environment.</i> • <i>I started a community garden in my estate. I have often done clean ups - just myself as well as group efforts</i> • <i>made a large pond on my property and now take great interest in identifying wild plants</i> |

Appendix 11

Weiner, D., (Co-authors TBC) Dalton C. (Pending) “Profiling efforts to establish voluntary stewardship in a river catchment”

Profiling efforts to establish voluntary stewardship in a river catchment

Donna Weiner, (Co-authors to be confirmed), Catherine Dalton

Abstract

River water quality in Ireland is in decline. The Maigue River in County Limerick exemplifies this decline with degrading chemical and ecological water quality. The most significant pressures are agriculture, and to a lesser extent, hydromorphology, urban and domestic wastewater systems. Because human activity is a main source of pressure on riverine systems and natural habitats, part of the solution rests in increasing local community interest, involvement, and cooperation in water and catchment management initiatives. This study profiles efforts made to foster engagement with residents of the Maigue River catchment. A devastating pollution event precipitated the formation of a community water group that provided initiatives to increase public involvement in events and projects focusing on river water quality and biodiversity. Most of the initiatives would not have been possible without the individual attributes of local participants, an organisational structure (Maigue Rivers Trust), and champion (Project Officer), and supporting funds, training, and resources. These bottom-up efforts demonstrate that voluntary engagement supported by core funding helped further the public participation aims of conservation legislation (Water Framework Directive and River Basin Management Plans) and expanded catchment stewardship. However, future sustainability, with meaningful improvements in water quality, requires time, a functioning structure, and adequate resources, as part of a coherent integrated catchment management approach, if trusting relationships with local communities are to be developed and maintained.

Keywords

Water quality, community engagement, citizen science, catchment management, Rivers Trust

Introduction

Rivers are natural resources that are at risk of pollution, overexploitation, and unsustainable use. Good quality fresh water that is not polluted is essential for life and human health, yet nationally, and locally in Ireland, river water quality is in decline (EPA 2022).

Integrated catchment management (ICM) is the approach prescribed nationally and internationally to best achieve good water quality and the Water Framework Directive (WFD) objectives (Daly, Archbold and Deakin, 2016). ICM focuses on a river basin scale to include the complex hydrological and ecological interactions as well as the political, socio-economic, and cultural influences that impact on water quality. Water management, with stakeholder and community engagement is compromised in Ireland as there is no coherent national water/ICM-focused community engagement framework or policy (Rolston et al. 2016; O’Cinnéide et al. 2021).

There are generally four groups involved in catchment management: stakeholder regulators; professional stakeholder organisations; local stakeholder organisations; and members of the public (Orr et al. 2006). The former take a ‘top-down’ approach in implementing frameworks, directives and regulations from the European Union habitat and water protection laws, whereas the latter take a ‘bottom-up’ community-based approach to natural resource management (Dublin Statement, 1992). Strictly top-down approaches often lead to poor outcomes in terms of water resource management, and only a genuine integration of both the top-down and bottom-up approaches has the potential to achieve the goals of ICM and the objectives of the WFD (Giordano and Shah, 2014; Ballinger et al., 2016). Advocates of social learning or ‘learning together to manage together’ emphasises collaboration between the different stakeholders, starting at the earliest possible moment in the process (Mostert et al. 2007).

Implementation of the WFD has proved challenging in the Republic of Ireland in terms of engaging active, meaningful public participation and has been questioned particularly in relation to inclusiveness and representativeness (Antwi et al. 2021)(Irvine and O'Brien, 2009). There was a low response rate to public consultations in the first River Basin

Management Plans (RBMP) cycle, and according to Irvine and O'Brien (2009), potential reasons included inadequate mechanisms and resources for the process, and ultimately scepticism at the value and authenticity of the exercise.

The second RBMP cycle saw the emergence of a new governance structures (policy, technical and participatory) focusing on increased communication, stakeholder engagement and public participation (Rolston et al. 2016; Antwi et al. 2021). As part of this new structure, the Local Authority Waters Programme (LAWPRO) was established in 2016, tasked with coordinating public participation at regional and local levels (O'Cinnéide et al. 2021). A second element of LAWPRO, the Catchment Assessment Team, focuses on measures to improve water quality in 189 priority areas (LAWPRO, 2021). Additionally, the establishment of a Community Water Development Fund (CWDF) has provided important financial support for communities to become active in water quality protection (Osawe et al. 2023). A number of Rivers Trusts, a UK model, also emerged during the second RBMP cycle, with 10 community groups established as of 2019 (EPA Catchments, 2019). A partnership agreement was signed between the Rivers Trust and LAWPRO, and an All-Ireland Rivers Trust Director was appointed (O'Cinnéide et al. 2021).

A wide range of people and entities now populate the landscape of community engagement with water in Ireland including LAWPRO community water officers, catchment management associations, Rivers Trusts, community groups, non-governmental organisations (NGOs) and European Innovation Partnership (EIP) projects (Weiner et al. 2022). Additional supports are available to volunteer groups via local development companies, the Sustainable Water Network (SWAN), the I-Catch training network and the Rivers Trust Network Support Service, thus making for an increasingly busy landscape of local water governance and engagement.

Maximising the potential of local knowledge and data collection with citizen science is an increasingly popular tool for capacity-building, increasing public engagement, and bridging society, science and policy efforts (Richter *et al.*, 2018; Haklay, 2015). Citizen science is a form of public participation that engages non-scientist volunteers in collaborative scientific investigations, thereby providing professional researchers with access to

localised data at extensive spatial and temporal scales that would otherwise be impossible or prohibitively expensive to obtain (Dickinson *et al.*, 2012). For example, researchers can learn of the presence of rare or invasive species, gaps, patterns, relationships, and trends in climate, habitats, or ecosystems (Bonney *et al.*, 2009; Williamson *et al.*, 2016). There are generally three citizen science models: those designed by scientists where trained volunteers collect data, collaborative projects that are designed and refined by volunteers, and co-created projects that involve volunteers at all stages (Bonney *et al.*, 2009); (Tweddle *et al.*, 2012). In terms of geographic scale, these can vary depending on whether they are broadscale and purely computer-based versus those that require active data collection at local or community scale, such as sampling and identifying aquatic macroinvertebrates or collecting water samples for laboratory analysis. This will also depend on the goal of the project and on the data gap that needs to be filled, whether it is catchment-based, national, global, or related to a particular community or river. A range of citizen science initiatives for water are summarised in Weiner *et al.* (2022) and Kelly-Quinn *et al.* (2022), spanning from gamified digital data collection to person-led field-based efforts.

This paper profiles the efforts made to establish a river community group and foster public engagement with a river catchment at risk of further degradation. Consideration was given to legislative recommendations, as well as the aspirations of the local community in the context of ICM, and evaluates if this engagement has furthered the public participation aims of the WFD, the RBMP and conservation legislation. Key questions asked are: 1. Where do community-level aspirations fit within an ICM model? 2. Can citizen science data collection fulfil community-based ICM aspirations? and 3. Who provides expert guidance to communities?

METHODS

The Maigue Catchment

The Maigue River catchment has a land area of 1122km² and encompasses 1296.7km of river channel with six main sub-catchments including the Loobagh, Morningstar, Drumcomogue/Camogue, Clonshire/Grenagh, and Barnkyle as well as the Maigue itself

(Figure 1). The third cycle of the WFD characterised the catchment waterbody (45 rivers) status as follows: 34% poor, 43% moderate, 23% good, and 0% high (epawebapp.epa.ie/qvalue). Degraded water quality is primarily associated with nutrient overload caused by agricultural pollution and, to a lesser extent, channel modifications, urban wastewater and poorly-maintained rural septic tanks.

Community Engagement

A pollution event occurred in the Mague catchment in 2014 when 70,000 gallons of slurry leaked into a headwater river and resulted in an extensive fish kill over several kilometres. This catastrophic event was the catalyst for the establishment of a community water group. The Mague Rivers Trust (MRT) includes a range of voluntary directors representing education, community, finance, amenity, business, research, farming, angling, and conservation. Since its launch in 2016, the MRT has endeavoured to foster and increase community interest and engagement with the catchment rivers and streams. The range of MRT activities and events were collated according to the date of occurrence, and the number of attendees, and were classified according to the type of engagement (participation, communication, consultation, and research) (Table 1).

A project officer was appointed in 2019 through funding from the Department for Housing, Planning and Local Government. The appointment was part of a 3-year pilot project (Resilience Pilot Project) to support the establishment phase of two Rivers Trusts in Ireland (Inishowen, Donegal and Mague, Limerick). The intention of the initiative was to support active community-based groups to achieve sustainability as water quality actors and inform future community engagement initiatives.

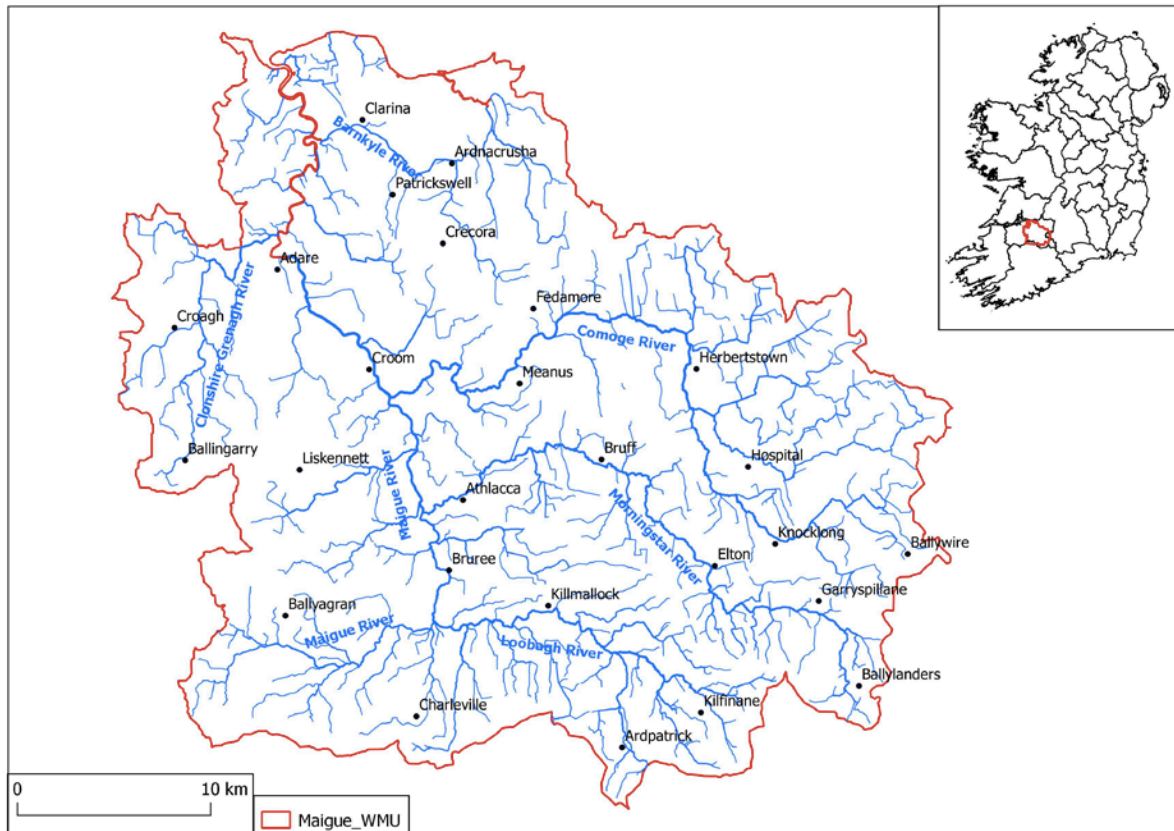


Figure 1: Location of Maigne catchment with river network and towns.

A range of river trust public membership models were examined by the MRT. First a network model was explored for sectoral interests (e.g., education, farming, recreation) with consideration of member group nomination and rotation procedures. Membership models with various categories (e.g., community groups, businesses, individual supporters, volunteers) were also examined for a range of UK rivers trusts (West Country, Wye and Usk). Benefits of the membership model included educational and training opportunities, insurance cover during organised events, and voting rights with nominal membership fees for full and associate members. In the end, a simple expression of interest section was added to the MRT website page, while the appointment of a project officer subsequently afforded opportunities for individual engagement and recruitment.

Volunteers and Citizen Science

When reviewing Rivers Trust membership models, it was noticeable that citizen science initiatives featured prominently. Citizen science was subsequently adopted to stimulate connections and interest in the river and potential volunteers and members of the MRT. A

collaboration between the MRT and an EPA and Mary Immaculate College funded postgraduate project explored the potential of utilising citizen science in the Maigne river catchment. The project, entitled Citizen Science Investigations – River Environmental Stewardship (CSI-Rivers), included a catchment-wide social survey that was intended to collect data on the concerns, perceptions and opinions of the catchment residents, as well as to stimulate potential interest in river observation and monitoring (Weiner, in progress).

Table 1: Public participation, communication, and consultation categories

| Participation | Communication | Consultation | Research |
|----------------------|----------------------|----------------------|--------------------|
| Fun Activity | Public talks | Public Consultation | Field surveys |
| Citizen Science | Newsletters | Collaboration | Research Reports |
| Field Sampling | Promotion | Funding Applications | Placement Students |
| Training | Material | Individual/landowner | Works |
| Demonstrations | Education | meetings | |
| | Material | | |
| | Social Media | | |
| | Public Meetings | | |

A range of citizen science initiatives for water were trialled in the Maigne River catchment: Small Streams Risk Score (SSRS), Small Stream Impact Score (SSIS), and Citizen Science Stream Index (CSSI), focusing on river biology, and Freshwater Watch (FWW), which focused on chemistry and physical parameters. The SSRS was developed in 2006 by the Environmental Protection Agency (EPA) and the Western River Basin District (WRBD). The system helps detect significant sources of diffuse waterbody pollutants by measuring the abundance of sensitive taxa of aquatic macroinvertebrates to determine the water quality in river tributaries (McGarrigle, 2014). Volunteers are trained to collect specialist data using approved, standardised methods. The SSIS was developed in 2020 by University College Dublin in collaboration with the EPA and LAWPRO and is also an approved method of measuring water quality using macroinvertebrates in small streams (Kelly-Quinn et al. 2020). The CSSI, also known as the traffic light system, developed by

practitioners and LAWPRO, and supported by the EPA (<https://lawaters.ie/citizen-science/>) is suitable for beginners. This CSSI simplifies macroinvertebrate identification to recording the absence or presence of six key macroinvertebrate taxa (flat mayfly nymph, stonefly nymph, green caddisfly larvae, leeches, snails, and blood worms). FWW, developed by Earthwatch Europe (www.freshwaterwatch.org), includes a monitoring kit supported by a web portal and mobile phone application to record and analyse water quality data (e.g., nitrates, phosphates, turbidity, and colour) from lakes, rivers, and streams.

RESULTS

Communication and Participation

Most of the Mague Rivers Trust activities since 2016 have centred around creating opportunities for public participation and communicating the role and work of the Mague Rivers Trust. These initiatives have included in-person and online meetings, public talks, demonstrations, training, kayaking events, workshops, festivals, and media and social media campaigns (Figure 2). The predominant activities included funding applications, landowner/ interested individual meetings, and public talks to a range of community groups (e.g., IFA, ICMSA, Tidy Towns, angling clubs). Research reports and annual newsletters were produced, and 37 applications for funding were submitted with a 60% success rate.

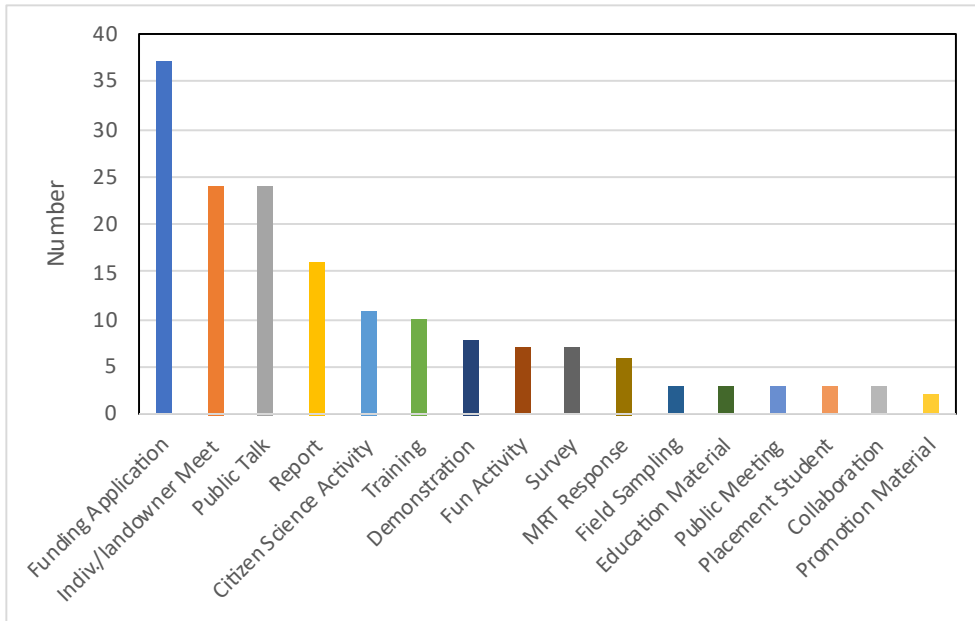


Figure 2: Events and activities conducted by the Mague Rivers Trust between 2016 and 2022.

The number of Mague Rivers Trust events and activities increased every year between 2016 and 2022 (Figure 3), except during 2020 due to the impact of COVID-19. The number of activities tripled following the appointment of a project officer in 2019.

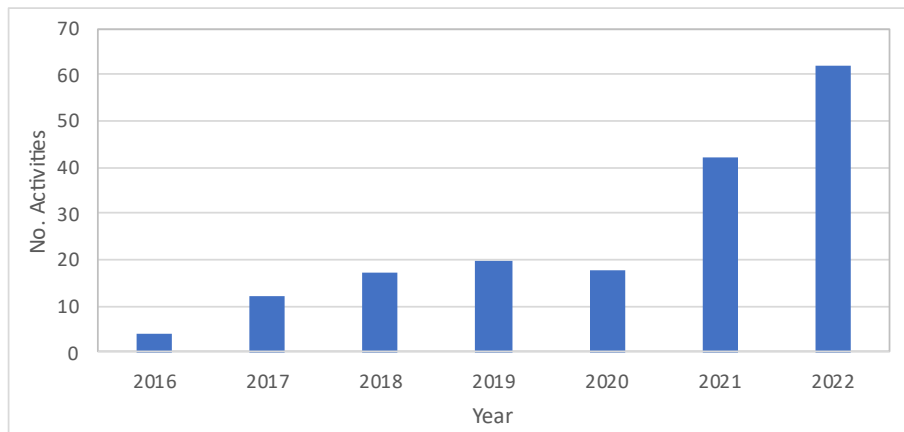


Figure 3: Number of Mague Rivers Trust events and activities between 2016 and 2022.

A range of efforts to identify and recruit potential catchment volunteers included social media campaigns, website appeals and enlistment of individuals at public events and activities. Efforts were made to interest individuals in the health of rivers as well as river and riparian zone biodiversity at public talks, demonstrations, fun activities, and public

meetings. The demonstration events were organised across the catchment from 2019 and reached approximately 1,800 people. With all events and activities, public safety and strict biosecurity measures were put in place to prevent the spread of alien invasive species such as the crayfish plague (*Aphanomyces astaci*), and talks included discussions about avoiding contact with hazardous alien invasive species such as Giant Hogweed (*Heracleum mantegazzianum*).

Citizen Science

Training in the Small Streams Risk Score (SSRS) was organised for groups of eight and ten anglers in 2017 and 2018. Five people attended the SSIS 'Train the Trainer' training in 2020. In 2021 training for the Citizen Science Stream Index (CSSI) was put in place in 2021 with just six individuals participating. Multiple invertebrate demonstrations took place across the catchment generating enormous interest on the day, but rarely resulting in expressions of interest for longer term volunteering. Just three individuals provided kick sample results by measuring macroinvertebrates using the CSSI (Citizen Science Stream Index).

The citizen science project, Freshwater Watch (FWW) measuring nitrate and phosphate levels, was introduced into the Mague River Catchment in 2021 and proved to be the most accessible and popular with volunteer engagement. A joint event with a Tidy Towns group was organised to recruit citizen scientists to monitor freshwater sites regularly within the catchment. Word of mouth and social media led to individuals and a youth group approaching the MRT to get involved, and a few individuals signed up at organised events. Expressions of interest were received from approximately 36 individuals. As a first step (in May 2021) online training was provided with 11 individuals participating.

The volunteers were asked to commit to taking water quality readings either monthly, quarterly, or intermittently. The MRT was particularly interested in obtaining samples from some of the smaller streams for which the EPA had not assigned a status. The MRT was mindful that obtaining a wide spatial coverage was important, but it was also beneficial to recruit volunteers with differing levels of time commitment within the same regions. Intermittent records helped provide baseline values while monthly readings

would help determine trends over time, if that level of volunteer commitment was possible. The volunteers were also encouraged to take readings based on events, such as before and after rainstorms, clean-ups, or flood works.

Volunteer scientists were predominantly male (70%) and almost half are associated with rural farms. Volunteers submitted data monthly (13%), quarterly (26%), or intermittently (26%) over the two years. Some citizen scientists (39%) maintained continuous sampling, and regularly took monthly, quarterly or seasonal readings at the same river or stream location. Other citizen scientists sampled randomly throughout the catchment. The river and stream locations sampled between 2021 and 2022 in the Maigue catchment included the Maigue itself and the key tributaries, the Morningstar, Loobagh, Grennagh/Clonshire, Camoge, and the Barnakyle (Figure 1). Additional samples were collected in the Ruppulagh catchment to the west, a tributary of the Deel River.

A total of 70 volunteer samples and 206 measurements (for nitrates and phosphates) were recorded for the Maigue between 2021 and 2022. An increase in the number of sites achieving low nitrate readings (<0.5), and a reduction of sites with higher nitrate levels was evident between 2021 and 2022, however seven sites were found to be polluted (2-5 mg/l) in 2022. There was an increase in the number of low phosphate measurements (<0.02 mg/l) between 2021 and 2022, and a concomitant decline in higher levels (0.02-0.2 mg/l) recorded, however high phosphate levels (<0.1 mg/l) were also recorded at seven sites in 2022.

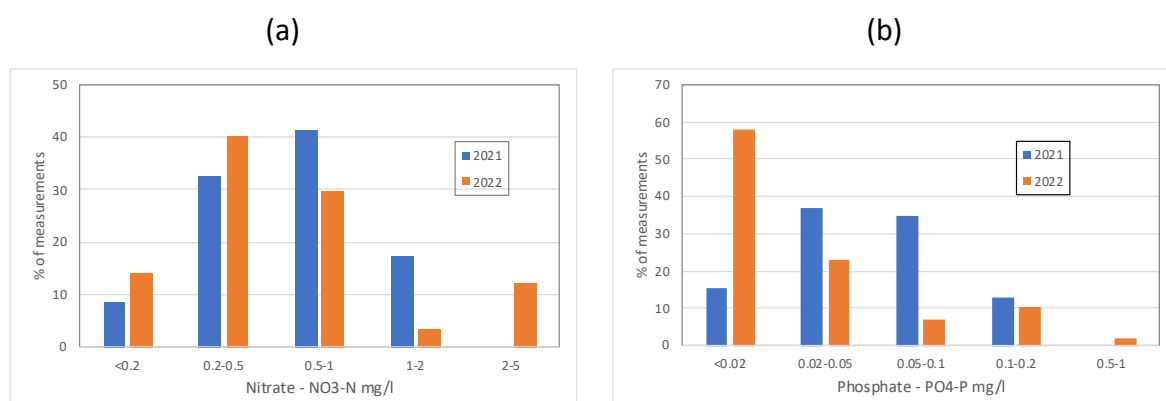


Figure 4. FWW Nitrate (a) and Phosphate (b) levels in the Mague River Catchment 2021 and 2022

While the citizen science nutrient testing kits were valuable in terms of the level of interest generated among volunteers, the value of the results can be questioned. The level of accuracy for low nitrate readings is weak. Nearly a quarter of the volunteers had difficulties at some point using the Freshwater Watch App, and some preferred not to use the App so they submitted their records to the MRT project officer on paper.

Discussion

Community level aspirations and the ICM model

The rationale for the establishment of the MRT was to provide a structure to involve local communities in meaningful participation in stewardship and management of the Mague river (maigueriverstrust.ie). This effort complies with the principles of ICM, the WFD and social learning (Mostert et al. 2007; Daly et al. 2014; Rolston et al. 2016), incorporating what legislation requires (i.e., from the top-down) with the aspirations of the community (i.e., from the bottom-up), with co-development, cooperation, pooling of resources and expertise and, importantly, building trust.

The MRT was established to conserve, protect, and rehabilitate the rivers, streams, and watercourses, of the Mague catchment, and the group evolved contemporaneously with LAWPRO and Rivers Trust in Ireland. MRT developed in three phases from an informal group responding to a pollution incident, to the formation of an initial core volunteer group aided by Limerick City and County Council staff, and ultimately, to a formal charity, with a dedicated project officer. The visibility of the Mague Rivers Trust has expanded locally and nationally each year since its official launch in 2016, and huge gains were achieved across the catchment in terms of river-focused events and activities. The project officer position facilitated professionalisation of a voluntary group through formulation of governance and finance structures, and adherence to charities and health and safety legislation, enabling an exponential increase in the visibility, depth, and breadth of public contact.

MRT successes could be described as greater vertical integration with river basin initiatives and greater horizontal integration with agencies operating at catchment scale (Mostert et al. 2008). However, MRT has yet to establish a membership model and collaborative catchment groups who would help define the aspirations for ICM, like those in the River Allow (Ballinger et al. 2016). At most, the MRT took the first steps towards a collaborative process (Orr et al. 2006), with an increase in public participation and awareness, but due to limited, and constrained funding opportunities, is only at the early stages of gathering viewpoints, representing interests, and mobilising and developing know-how (AEIDL 1997).

Most of the catchment and water stewardship initiatives would not have been possible without the individual attributes of participants, an organisational structure (Maigne Rivers Trust) and champion (Project Officer) and supporting structures (core funding and funding awards for training and resources). Resilience Pilot Project core funding on a sliding-scale enabled a comprehensive expansion of activities and facilitated an escalation in meaningful public engagement and reach across catchment communities. Additionally, CWDF funding seeded many beneficial awareness-raising projects in the Maigne catchment. However, the long-term nature of practical interventions and the short-term award cycle as well as partial funding awards limits the target outcome potential (Osawe et al. 2023).

It was envisaged that corporate funding streams and membership fees could have provided additional funding. To this end MRT directors undertook business and strategic plan mentoring. Unfortunately, the plan produced was deemed insufficient and the trust were advised to either develop fee paying services or secure core government funding. The lack of a membership model was an additional gap. Corporate Social Responsibility (CSR) funding for non-governmental organisations and charities has never been so relevant, and businesses are increasingly being required, encouraged, lobbied, or are genuinely interested in supporting sustainable practices and initiatives (Burke 2015). Charitable organisations are encouraged to develop business plans that help attract sponsorship. This can be a very challenging exercise for voluntary groups with limited or

no core funding, particularly in the current landscape of competing social interests. An effective mechanism is required to help bridge the gap between the need for green funding and CSR. Another potential solution is to scale-up the CWDF to provide core funding, a commitment made by the Programme for Government in 2019 (O Cinnéide et al. 2021; Osawe et al. 2023). This would bring elements of sustainability and continuity for community water groups.

Citizen science and community-based ICM aspirations

Policies mandating citizen participation in planning and decision-making for water are now widespread (e.g., Rural Development, WFD, National Biodiversity Action Plans) and there has been a rapid growth in citizen science initiatives internationally and nationally (Weiner et al. 2022; Kelly-Quinn et al. 2022).

The Mague Rivers Trust made substantial efforts to foster public engagement and citizen science in the Mague catchment. It was envisaged that citizen science would provide a meaningful activity to examine water quality and increase stewardship across the catchment (Haklay, 2015). A secondary aim was to fill gaps in EPA monitoring data and determine local pollution sources and pathways, however these aims have had limited success.

There were many challenges associated with attracting and maintaining volunteer engagement in all the water quality monitoring systems introduced by the Mague River Trust. Demonstration events attracted hundreds of people and were very well received, but only resulted in a handful of volunteer participants. Each expression of interest was followed up by the project officer, promoted and encouraged, but did not always result in an active participant, reflecting the challenges of transforming interest into activism (Clayton *et al.*, 2017).

Trials of citizen science initiatives for water focused on river biology and water chemistry with the latter proving most popular. Overall, the Freshwater Watch kits helped build connections and increase awareness, and they offered the local residents an opportunity to get involved meaningfully in caring for their river environments. Volunteer-collected

data, however, can include volunteer biases, errors, and data variability associated with demographics, ability, experience and commitment (Kosmala *et al.*, 2016). After two years of operation in the Maigue catchment a relatively modest number of volunteers (23) were recruited. 86.6% of the recipients utilised the kits and submitted data, a further 13.3% were interested enough to take kits and learn how to use them, however they did not operationalise them and submit data. Additional challenges were experienced with technological capabilities, data analysis to provide meaningful results, and feedback to the researchers, volunteers and water resource managers (Newman *et al.*, 2011). These challenges were surmountable only with the support of a project officer, who was necessary to help motivate and maintain volunteer interest, and remind them to take readings (Haklay, 2015).

The main value in the Freshwater Watch records was the establishment of a core group of intermittent and systematic environmental stewards, and an expansion of the range of monitoring points across the catchment. However, citizen sciences efforts to-date could be critiqued as they are not integrated with any strategic catchment management plan, and thus does not comply with ICM aspirations (Giordano and Shah 2014). A key question centres on how the output from volunteer monitoring can be employed to effect real change and how these efforts can be sustained. To generate resilience and future sustainability, for meaningful improvements to water quality, upscaling, and replication of initiatives across the catchment and longer-term progress tracking is necessary (Osawe *et al.* 2023). Thus, any significant water quality project is a long-term engagement and needs the support of a dedicated champion. To cope with the potential disadvantages and weaknesses of citizen science initiatives and to increase the reliability of the data, scientists and managers may need to lower the expectations for the type of data they require (Penrose and Call, 1995). The alternative is to simply accept that its main use is as a tool to increase public engagement in river stewardship.

Guidance for communities/Oversight

The WFD advocates for information supply, consultation, and active involvement. New governance structures for water management in Ireland have been a welcomed development to help further the overarching aim of the WFD and ICM, especially through

addressing gaps in public participation (Daly et al. 2016). However, with these new structures, the landscape of water-players has become somewhat complex, especially for community-led bottom-up efforts. Numerous entities and varying degrees of responsibility can create fragmented and siloed groups (Rollanson et al. 2018; Antwi et al. 2021).

The experiences (successes and failures) of the MRT have occurred within contexts of dominant vertical regulatory drivers, and more recent horizontal collaborative efforts (Daly et al. 2016; Rollanson et al. 2018). To fulfil the aims of ICM, communities need to collaborate effectively with a range of stakeholders at the local catchment level (e.g., IFI, OPW, NPWS, EPA, Local Authorities). While the MRT has developed such collaborations, the continued top-down regulatory imperative restricts integration between agencies and catchment communities. Local community participation is often limited to consultation and representation in catchment interventions (e.g., priority areas for action), with broadscale objectives and tight funding supports (O Cinnéide et al. 2021).

Expert guidance can help communities to participate in the development and implementation of an agreed vision of sustainable land and water use for their catchment (Ballinger et al 2014). But who will provide this guidance or oversight – An Fóram Uisce, LAWPRO, Rivers Trusts or Local Authorities? While there have been clear efforts to bridge society and science through policy and governance structures, the complex landscape and multiple players contributes to the continued top-down/bottom-up challenges. The traditional view that top-down management see public participation as a barrier to the delivery of management objectives is still evident (Rollanson et al. 2018), and this results in practices that exclude communities and participatory involvement at local level.

LAWPRO's dual scientific and community roles appear to be very compatible and synergistic. However, Community Water Officers (CWO) are responsible for impossibly large regions. This highlights the necessity for local community champions to fill geographical gaps and provide much-needed people-level interactions, to effectively overlap with the role of CWOs. There is room for community engagement expansion and

appetite for more consistent and sustainable contributions to the river basin management planning process (Antwi et al. 2021; O Cinnéide et al. 2021).

In conclusion, bottom-up voluntary efforts supported by core funding has contributed to enormous gains in terms of visibility, trust, recognition, and community education and engagement, but modest gains in terms of volunteer water quality monitoring in the Maigne catchment. The work of the MRT has furthered the public participation aims of conservation legislation, the WFD, and River Basin Management Plans. Positive factors have included the creation of a robust charitable framework with the potential for capacity building. However, meaningful and effective participation within ICM requires time and a functioning and resourced structure to develop trusting relationships with local communities if the aim of sustainable public participation in water quality improvements is to be achieved. While the mechanisms and resources for public participation has greatly improved, there are clearly synergies and further supports necessary to extend the effectiveness of the process and achieve sustainability for community groups as water quality actors.

Acknowledgements

The authors are grateful to the funding provided by Environmental Protection Agency and Mary Immaculate College that made this research possible, as well as the funding that made the Maigne Rivers Trust events possible.

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