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Guest Editors: Shé Mackenzie Hawke and Reingard Spannring

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EDITORS-IN-CHIEF

Martin Dodman, University of Valle d'Aosta, Italy
m.dodman@univda.it

Giuseppe Barbiero, University of Valle d'Aosta, Italy
g.barbiero@univda.it

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Guest Editors:
Shé Mackenzie Hawke and Reingard Spannring

Critical issues for water sustainability and climate change



(Photo credit: Reingard Spannring)



(Photo credit: Shé Mackenzie Hawke)

Guest Editors

Shé Hawke Mackenzie

Department of Gender and Cultural Studies, University of Sydney, Australia she.hawke@sydney.edu.au

Reingard Spannring

Institute for Educational Science, University of Innsbruck, Austria reingard.spannring@uibk.ac.at

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Critical inter-disciplinary and inter-species approaches to water sustainability and climate change issues

Shé Mackenzie Hawke, Reingard Spannring

This special issue represents critical intersections within and between different disciplinary fields, cultures and methodologies towards water sustainability praxis and understanding and climate change mitigation strategies. In recent years both an increasing volume of scientific research and successive international conferences on climate have made it very clear that the *linkage* between critical issues of sustainability (and indeed all the elements that comprise planet earth), continues to be under-considered. No element or cultural context is any less significant than another. At the same time, recent discussions on issues like equity in access to fresh water and many other aspects related to climate change are often overshadowed by the incessant emphasis placed on the global goal to reduce earth's atmospheric temperature by 1.5 degrees Celsius by actions such as reducing emissions or carbon capture. This is, of course, a critical issue, yet the quest for solutions requires understanding that all facets of life, weather and climate are inextricably interlinked, as strategies for resolving or mitigating must also be. Our search for “constructive alignment” (Biggs and Tang, 2015) between the ecological, socio-cultural, and economic concerns of sustainability involves making radical departures, some of which appear in each of the papers published in this Special Issue of *Visions for Sustainability*.

As editors of this issue, for us this follows on from our work in co-creating the AquaMOOC: Participatory Engagement with Water that emerged from our first research project¹ together on the Anthropocene. The AquaMOOC is a series of

¹ <https://imoox.at/course/AquaMOOC?lang=en>, “Surviving the Anthropocene” (2019-2022) funded by ARRS (J7-1824) and FWF (I-4342-G). MOOC means massive open online course.



online learning modules on climate change, water and the Anthropocene. It includes instructional films with footage of the Isar River on the border of Austria and Germany, and the Murrumbidgee River Corridor on First Nations Ngunnawal Country in Canberra, Australia. The online learning platform advances an inter-cultural, inter-disciplinary, and inter-species approach to water literacy that actively involves citizens - a concern that has led us to many fruitful collaborations including the edited volume *Pedagogy in the Anthropocene* (2022), and the contributions to this Special Issue.

The guiding questions for this issue involve a search for how science, governance, technology, and citizens can come together effectively and respectfully to drive genuine and inclusive stewardship and sustainability pathways. Our emphasis is on water and the need to understand that it continues to co-evolve with other elemental properties, human culture, and inter-species relationships. An ongoing challenge of these early decades of the twenty-first century is discovering ways in which different fields of science can listen actively and deeply to each other and move towards innovative, rigorous, transboundary, and achievable outcomes as partners for the planet and its sustainability patterns for the future, through mechanisms such as Ecosystem Based Approaches (EBAs), and Nature-Based Solutions (NBSs) that include nature as a (research) partner. Part of our intention has been to advance the thinking embedded in the work of the late Deborah Bird Rose. She advocated for a “border zone in which Indigenous ecological knowledge, Western scientific knowledge and Western philosophical and poetic inquiry converge” (2007, p. 9). This approach is both intelligent and imperative and is evident in some of the articles included here. In addition, we take our general cues from Anthropocene scholars including Steffen, Crutzen and McNeill (2007), Stoermer and Crutzen (2000), and Palsson (2013). They have provided detailed geological and biosocial data and accessible information about the impact of the human species on planetary life, weather changes, global warming, and climate change projections within the Anthropocene perspective.

More specifically and more recently, there has been a turn to the humanities and social sciences to explore other integrated possibilities that include interspecies relationships in a more equitable and sustainable way. This perspective on human-animal and human-nature relationships invites us to critically consider the impact of anthropocentrism and speciesism, as, for example, in the work of Martin Lee Müller on salmon in various cultural contexts. Müller questions the mindset underlying Western practices of fishing, fish farming and river damming, which annihilate fish as agents and protagonists of their own lives:

[...] the story of human domination has suffused the modern lifeworld in ways that are thorny, resilient, and ubiquitous, reaching into the legal, political, economic, and scientific imagination, propagating itself through technology as well as through social institutions, resounding even in grammar or particular speech habits, and subtly shaping even the ways in which we humans inhabit space and time (2020, p. 65.)

Similarly, while scrutinizing water practices, Janet Donohue, in line with Heidegger, argues that dwelling in a riverscape does not primarily involve “the application of technology to water, or the management of water. It is about the ability to care for water and to take care with regard to water.” (2020, p. 86)

One of the things we would like to affirm is the way we align our research ‘thinking’, and ‘doing’ to effectively bring differences together in a sustainable and potent alignment. Pedagogical expert Biggs (1996) explains constructive alignment as the flow from outcomes-based learning approaches or Intended Learning Outcomes (ILO). This aligns teaching and assessment methods to those outcomes through Teaching and Learning Activities and Assessment Tasks (ATs). This idea not only applies to classroom learning and teaching. We propose, along with some of the articles featured in this issue, that constructive alignment between research intention and thinking, practical learning activities and outcomes could also be better aligned to facilitate more meaningful and coherent climate change solution and mitigation research. As some of the articles show, citizen science and participatory engagement between hard science and everyday people affords many opportunities for projects to intentionally align what they hope to discover, with specifically designed activities and engagement that will lead to those discoveries and their elaboration.

We have intentionally invited papers from *across* fields, as well as papers that include inter-disciplinarity as a field in itself. We open with a contribution by Meulenbergh, Hawke, Cavaion, Kumer and Lenarcic “Understanding Interdisciplinarity through Adriatic Maricultures and Climate Change Adaptation”. The acceleration of climate change arising from the Anthropocene (Hawke and Palsson 2017; Steffen, Crutzen and McNeil 2007), and the associated effects on land and sea biodiversity necessitates a new way of doing research. Inter-disciplinary research serves to connect science, social sciences and humanities, technology and engineering, as well as welcoming citizen scientists into the research environment, working towards common goals. In this article, through the example of shellfish marine cultures they explain our view on inter-disciplinarity, particularly through marine biology, health and well-being, social

science and cultural geography. They all come together at the interface between nature, culture and climate change mitigation strategies.

Kimberly Noble and Elena Marie Enseñado present an empirical paper entitled “Analyzing Co-creation Levels of Urban Living Labs in Europe”. In their article, they introduce the concept of the Urban Living Lab (ULL), and its application as a framework for future climate change activities. They further ask which characteristic of ULLs that focus on urban sustainability, can most enhance its level of co-creation involving different stakeholders. They collected data in an online survey which involved 30 ULLs in Europe and established that the “aim” of ULLs is the most important characteristic that enhances co-creation. Their approach builds on the idea that optimization of characteristics of a successful ULL can positively affect co-creation levels, ultimately improving its outcomes and shared aims. These outcomes can position the ULL model as a methodological tool in climate change and water research for the future. The authors also draw attention to the difficulty of delivering co-creation outputs without organizational clarity and field specificity.

A more positional and provocative paper comes from Jan Jagodzinski, on “The E(thi)co-Political Aesthetics of ‘Designer Water’: ‘Becoming Water’ in the Anthropocene”. He affectively politicizes the global condition of water in the context of “designer capitalism” by analysing its commodification through a colonial discourse that romanticizes indigeneity to sell its “bottled purity”. The ethical concerns of “designer water” (bottled water) are raised within the broader agenda of ecosophy as inspired by Gilles Deleuze and Félix Guattari’s essay *The Three Ecologies* (2000). This develops an aesthetic trajectory sustained by “anti-globalization” forces of protest and an astonishing multiplicity of artists who are sensitizing us toward “becoming water”. In short, Jagodzinski juxtaposes capitalism’s “designer water” to performative artists working with ice and water who raise e(thi)co-political issues within the Anthropocene problematic.

In “Water Management: Pragmatic and ethical issues for species-inclusive and sustainable water policies”, Helen Kopnina and Veronica Strang draw on their earlier work that appeared as a blog called: “Re-imagining Water Management on World Water Day”. (Springer Nature: Sustainability Community)² and lead us towards understanding water respect both as an everyday necessity and as an inter-species concern. They apply E.O Wilson’s “Nature Needs Half” (NNH) as

² Kopnina, H. and Strang, V. (2020) Re-imagining Water on World water Day <https://sustainabilitycommunity.springernature.com/posts/63674-re-imagining-water-management-on-world-water-day>

a way of advancing equity and access not only for humans but also for all living things. For the authors, a major impediment to addressing water scarcity, climate change, biodiversity loss, and pollution is the dominance of anthropocentrism, which positions humankind as separate from and "above" a non-human world. The need for sharing the planet more equitably is readily visible in societies' engagements with water. Within the larger problem of anthropogenically-caused climate change, overusing freshwater and degrading waterways places the surrounding ecosystems under increasing strain, threatening water, food and energy security. Decisions about water management and use are often driven by short-term responses to these pressures that, as well as sacrificing the rights, needs, and interests of less powerful human communities, override those of non-human species and ecosystems.

A Bachelardian (Bachelard, 1999) poetics of both water and space for example, is evident in the eco-poetic paper "Life's Shared Dependence on Water: A potential wellspring of ecocentric concern and interspecies kinship" by Joe Gray. An ecocentric world view holds that non-human life has intrinsic value – a worth that is independent of any benefits that human beings may derive from such life. As an example of this, a salmon matters for reasons that are far greater than simply being potential calorific input into a human digestive system or a possible flavour on a human tongue. A parallel tenet of an ecocentric world view is that moral issues permeate beyond the merely human world and into wider nature. Furthermore, this world view foregrounds the unfolding mass extinction of life on Earth as the arch-crisis of our times. This, in turn, is being driven by an array of interconnected emergencies including rapid anthropogenic climate change and diminishing freshwater supplies. In the case of water, shifting rainfall patterns and increasing pressures on water extraction to support a growing human population are causing suffering and rendering landscapes unliveable, to humans and non-humans alike. All life is united in its dependence on water. This shared elemental need offers a potential touchpoint for citizens of all age groups to develop a sense of kinship with non-human others and to become more ecocentric in their value systems. Ultimately, a groundswell of ecocentric concern will help generate policies and foster practices that support broad socio-ecological justice in water usage and in other domains, of what the author describes as sharing lives with Earth-kin.

Michael Paulsen's eco-poetic paper, "Oceanic and Tethysian Being-in-the-world - An Essay on the Human Self and World Understanding in the Anthropocene", takes us on a journey through deep space and time from the Greek Deities of Oceanus and Tethys to artist installations in the twenty first century. A

constructive yet creative alignment of sorts is at play. He invites readers to approach the lifeworld as a Heideggerian *being-in-the-world* with awe and wonder through the uptake of the *berlberl* installation³ as an inter-elemental meeting place and reminds us that alignment doesn't always need to be scientific, pedagogical, or philosophical. It can be alignment of mind, body and spirit as the nature learner explores the environment as natural phenomena of learning about the lifeworld and our place in it, as well as through artistic and creative industry that represents the natural world.

As these articles demonstrate, we humans have become dangerously alienated from our source of life. The evidence is overwhelming that the predominant anthropocentric and Eurocentric angle of vision has been how to organise water for primarily human concerns; how to trap it, pipe it, store it and, equally important, how to over-use it to feed an eternally thirsty agrarian monoculture, and industrial military complex. We have not only come to think of regulated, dammed, and canalised rivers as the normal state of being for living waters. Indeed, their containment is also an apt metaphor for our thinking and existence: "living like a river in a concrete bed" (Hawke and Spanning, 2022). This has merely served to guide us along a narrow line of thinking and action in which water is dominated by the logic of capitalism and technology. In this Special Issue we have endeavoured to open up the space of a more intertwined river or waterscape, particularly to convey our propositions about interdisciplinarity, polyvalence and interspecies communities, in the attempt to avoid the metaphorical dammed river flooding our interspecies communities and lifeworld. "[...] The concept of living with water as a complex entity, inseparably connected with all three levels of existential complexity - individual, social, and ecological" (Simmons, Woog and Dimitrov 2007, p. 275), feeds directly into our intention to produce an equilibrium that is ecologically, economically, and socio-culturally productive and reflects the balance and alignment required for planetary sustainability of all life.

In such a water-centric world the challenge ahead is to transform our thinking and practice - to re-align it and re-wild it with intelligence and insight - given that climate change crises have become the urgent driver within whatever vision and action we can now imagine. To re-iterate what Donohoe says, "Our cultivation, ... is about the ability to care for water and to take care with regard to water. In doing so, we can find ourselves more attentive to water in its wateriness, thereby bringing our own placemaking in line with water in allowing it to reveal itself as

³ <https://berlberl.world/>

what it means that the place of water must be (no pun intended) fluid" (2020, 86). How we will do this is our urgent responsibility.

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Authors

Shé Hawke Mackenzie, Department of Gender and Cultural Studies, University of Sydney, Australia she.hawke@sydney.edu.au

Reingard Spannring, Institute for Educational Science, University of Innsbruck, Austria reingard.spannring@uibk.ac.at

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Understanding interdisciplinarity through Adriatic maricultures and climate change adaptation

Cécil J.W. Meulenber, Shé Mackenzie Hawke, Irina Cavaion, Peter Kumer, Blaž Lenarčič

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1. Introduction
2. Shellfish maricultures as an interdisciplinary case study
3. A methodology involving Citizen Science
4. An ecolinguistic, intercultural and ethnographic view of maricultures
5. Cultured shellfish as Mediterranean human food
6. The contribution of shellfish maricultures to biodiversity
7. Shellfish as environmental/ecosystem biomarkers
8. Ecosystem services of shellfish farming: understanding shared values for the future
9. Conclusions

Keywords: Interdisciplinarity; Maricultures; Eco-linguistics; Climate change; Citizen science; Ecosystem services.

Abstract. *The consequences of accelerating climate change for land and sea biodiversity require innovative approaches to research. Interdisciplinary research serves to connect natural science, social sciences and humanities, technology, and engineering, as well as welcoming citizen scientists into the research environment. Interdisciplinarity is part of a developing innovative*



approach to research that emphasizes co-evolution of traditional sciences, with citizen science and participatory engagement in the realisation of research goals and the promotion of climate change mitigation strategies. In this article, through the example of shellfish maricultures we illustrate interdisciplinarity, particularly demonstrating how marine biology, health and well-being, social science and cultural geography come together at the interface between nature, culture, and climate change mitigation strategies.

1. Introduction

The acceleration of climate change arising from the Anthropocene Epoch (Steffen, Crutzen and McNeil 2007; Hawke and Pálsson 2017) and the associated effects on land and sea biodiversity necessitate innovative ways of doing research. This paper's aim is to illustrate the importance of interdisciplinary research through the example of marine aquacultures, also known as maricultures, that produce shellfish (as opposed to freshwater aquacultures and fish maricultures). We seek to investigate the impact of maricultures on society and vice versa by describing different intersecting scientific sectors that can identify stakeholders who through citizen science can make a contribution to climate change mitigation, especially at the coastal land-water interface. For our purposes we apply the definition of interdisciplinarity from earlier research work (See Paulsen, Jagodzinski and Hawke 2022), but in specific reference to this paper, we refer to the work of Edwards (1998), who presented a framework comprised of diverse aspects of marine aquacultures, covering: production technology, socio-economic characteristics, and the environment as an ecosystem. Recently, this socio-ecological system framework was elaborated on by Johnson et al. (2019), to which we add cultural heritage and participatory engagement (Kumer and Urbanc 2020) from citizen science.

In this example, we emphasize the confluence between different fields of science that include, but are not limited to, engineering and technology, marine biology, kinesiology (the study of human movement embracing health sciences), social science, cultural geography and heritage studies, together with citizen science. These all play a pivotal part in understanding the interface between nature and culture. They are not the only possible intersections, but are chosen as those most relevant to this article on maricultures and coastal climate change issues. We will

also refer to the climate change innovation project Smart Control of the Climate Resilience in European Coastal Cities (SCORE)¹ as a living example of how to develop coastal resilience, in association with the ecosystem services partially provided by maricultures. Figure 1 presents a sample of intersecting areas of interdisciplinarity in relation to our field of inquiry.

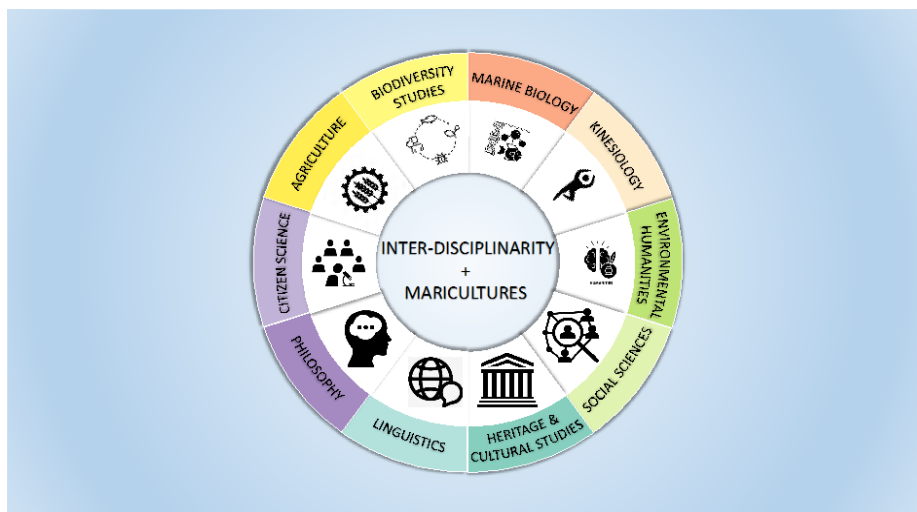


Figure 1. An example of Interdisciplinary Research Intersections through Maricultures

At times innovative and emergent research dialogue takes place between two fields and at other times involves many fields of scientific inquiry. Imbricated in this method of interdisciplinary research is the way in which connections evolve between theory and practice. How that interface is understood across different sectors (including business) influences rigorous and diverse research possibilities that lean towards climate change mitigation. Before we explore the world of maricultures, we present some key definitions and concepts that set the background for developments in the field of interdisciplinary studies as they relate to climate change mitigation research and practice.

¹ The authors of this paper are or were partners in the SCORE Consortium. We are in the process of analyzing the data sets gleaned from the first twelve months of this project. More empirical evidence will be available in work forthcoming.

2. Shellfish maricultures as an interdisciplinary case study

The probable effects of maricultures on health, environment and ecosystems, their products at the nature-culture interface, and the ecosystem services they provide, has attracted widescale research interest beyond marine biology (Johnson et al., 2019; Mascorda Cabre et al., 2021), as we will discuss below. Studying maricultures during the current period of climate change provides the opportunity for unique cross-disciplinary data about human impact and pollutants to be gathered and analysed.

The type of research necessary to discover the benefits and general effects of maricultures requires both biological and social science data, because each of these fields gathers and analyses data differently. Social science has a greater emphasis on both quantitative and qualitative data, as well as narrativization, while biological sciences approach nature more quantitatively. By merging the full spectrum of research results from each of these fields we can build a more comprehensive picture of what is happening within and through maricultures. Here the role of fishing community observances of changes in maricultures are vital and are also detected differently. Ethnography and auto-ethnography also come into play, in that they relate as much to heritage practices and lived experience as to specific biological science applied to aquaculture – marine biology. Mapping the cultural geography, habits, and practices of fishing communities, and partnering with them, thus forms a pivotal part of a broader and more robust research picture that is inherently interdisciplinary, rather than constrained by the specificity of one scientific approach.

The European Commission is embracing interdisciplinarity through its funding calls that expressly invite biological, social and citizen sciences to collaborate innovatively towards richer and more diverse research practice and outcomes. For example, it has implemented a strategy to ensure that safe human food products enter the markets of its member states (SFEP, 2015), mandating the implementation of the Directive on Maritime Spatial Planning by 2021. In addition, there are other initiatives such as The Marine Strategy Framework Directive; The Water Framework Directive; The Flood Directive, The Natura and Habitats Directives and the 2030 Biodiversity Strategy.

Other instruments that engage in research practice and knowledge sharing across fields include the Sustainable Development Goals (SDGs) adopted by the United Nations (UN, 2015). These goals identify areas in which it is argued that development can be promoted while ensuring protection of the planet by

adopting interwoven socio-cultural, environmental and geographical approaches. In relation to maricultures, goals no.3 – *Good Health and Well Being*, no.12 – *Responsible Consumption and Production* and no.14 – *Life Below Water* are particularly relevant. The motivation behind the adoption of the SDGs was to educate and to enact mitigation pathways in the face of climate change, and also explain how these effect people and species in different parts of the world, thereby combining cross-cultural and geo-political concerns with ecological concerns. By merging directives and instruments with the practices of daily life – in this instance citizen scientists in the mariculture communities of the Mediterranean area (in particular the Adriatic Sea) – further knowledge can be built by expert researchers and commissions that have already reported about mariculture products, its benefits and pitfalls (EUMOFA, 2017).

Continual building of research across fields, and indeed going beyond borders, towards the achievement of sustainable goals for maricultures and biodiversity, is crucial. Human cultures that do this as part of their cultural heritage while also being citizen scientists, demonstrate both the need for interdisciplinary research conversation and a better understanding of how interdisciplinarity can be applied to modern research (Johnson et al., 2019) and climate change challenges (Jones et al., 2022; Mascorda Cabre et al., 2021). Part of that research is developing methodological frameworks that attend to both ecosystem services and the socio-economic assessment of the sustainability of those services for local as well as market communities. By consolidating transboundary and interdisciplinary links, a more comprehensive research picture will emerge for maricultures, while still respecting the specificity of marine biology and its rich tradition.

3. A methodology involving Citizen Science

The Green Paper on Citizen Science (2013, p. 21) defines the participation and co-creation of lived experience science and research in terms of how “citizen science refers to the general public engagement in scientific research activities when citizens actively contribute to science either with their intellectual effort, or surrounding knowledge, or with their tools and resources.”

The term “citizen science” encompasses a wide range of activities and practices related to renewed collaborations between research and society (Haklay et al., 2021, p. 4). It includes the generation of scientific data, engages volunteers over a large area, and addresses a politically, economically, socially, or environmentally relevant issue. Without a precise definition and adoption by all fields of inquiry, citizen science and its associated participatory engagement gives rise to

discussion about what type of activities and practices should be included (Haklay et al., 2021) in its scope. But fundamentally it includes “public participation and knowledge production” in science and research activities (p. 2). Later in our article we look at fishing communities and their everyday science lived experience through the lens of citizen science, considering it as inherited knowledge enacted daily.

The growing need for solving complex research and environmental challenges demonstrates the inherently interdisciplinary aspect of citizen science research and approaches. Tipaldo and Allamano (2017) argue that interdisciplinary approaches focus on citizen science as well as on social mechanisms that push non-experts (i.e., citizens) to invest time and personal knowledge in collaborative initiatives for science. This is not to be confused with crowdsourcing, which is more of a funding drive that engages citizens to contribute to research costs.

As Heiss and Matthes (2017) observe, activities and projects following social sciences and humanities topics and approaches are less easily discernible in citizen science practice, although they may be fueled by genuine and challenging questions. This is supported by the data available from the EU open science monitor (European Commission, 2020) which shows that among the citizen science projects financed by the EC the great majority of projects in 2019 were in the field of ecology and environment (623), followed by nature and outdoors (618), biology (518) and animals (396). Hence, it is possible to justify the use of citizen science as a research method in climate change phenomena and research, as citizens are faced with elemental challenges emphasized by funding bodies. Conversely, according to Tauginienė et al. (2020), social sciences may apparently recruit fewer citizen scientists because of the stable, long-lasting relationships social science has developed with communities in general, through surveys and focus groups, but not necessarily defined as citizen science.

In relation to coastal cities, mapping hazards such as tidal surge, coastal flooding and the concomitant effects on infrastructure and tourism, as well as everyday life, a participatory approach with citizen scientists who live in the local area is both logical and desirable. Many citizens also have multi-generational links with an area, such as fishing communities, and know about more or different aspects of a geographical area and its weather changes through their lived experience than what is available through technological data collection. Fishing communities also take us into the field of history, heritage studies, eco-linguistics, ethnography, and cross-cultural engagement, as we show in this article.

In the Smart Control of the Climate Resilience in European Coastal Cities-project (SCORE), for example, nine European Union coastal cities and one from Turkey have been chosen to monitor, research and contribute to research data and output about climate change mitigation, and protection of resources such as fresh water and biodiversity. In this project, the concept of 'living labs' is applied as defined by the European Network of Living Labs (2022):

Living Labs are open (urban) innovation ecosystems in real-life environments based on a systematic user (stakeholders and citizen scientists) co-creation approach that integrates research and innovation activities in communities, actively involving stakeholders (including citizens) to co-create, implement, test, and evaluate innovations in real-life situations (Anton et al., 2022)².

This extends to coastal cities, creating the Coastal City Living Labs (CCLL) as a new and innovative approach that uses the people of the coastal city as a fundamental part of the research base, rather than confining research to a science laboratory. Through this method, stakeholders (citizens, businesses, academia, and governance) co-identify the primary coastal hazards of each of the ten coastal cities, along with their impacts, and co-address climate change adaptation and resilience issues. Already the CCLL of Piran has demonstrated extreme climate change hazards and impacts (Kumer et al., 2022), such as drinking water scarcity and coastal flooding. Furthermore, through advanced mapping information provided together with local environmental and civil protection agencies, it is possible to view both superficial and deep changes on the coastline that effect marine habitats and species such as maricultures. For example, the Slovenian Environmental Ministry (ARSO) and the Civil Protection and Disaster Relief Agency have collected data to represent the increase in intensity and timing of extreme events such as storm surges, landslides, sea floods and tidal erosion. The research team is currently developing and analysing the data gathered so far, but even at this early stage the project shows how the intensity and frequency of extreme

² Some of the early results and definitions of the SCORE project were reported by Anton et al at the EGU General Assembly 2022, Vienna, Austria and Online, 23–27 May 2022, EGU22 5469 and at the 2nd Consortium Meeting in Sligo, June 2022, and at the conference on Pedagogy and Climate Change in August 2022. <https://www.itsligo.ie/education-with-sustainability>. As the projects CCLL's mitigation strategies develop until 2024, more data will become available. Local projects such as Dobro za Morje (Rural development program of the Republic of Slovenia through the Ministry of Agriculture Forestry, and Food combined with the European Fishery Fund 2014-2020, <https://dobrozamorje.si>), have also yielded early information particularly in relation to Aquacultures. The definition of Living Labs applies to the projects methodology and is drawn from the Living Labs concepts. https://score-eu-project.eu/wp-content/uploads/2022/03/Introduction-to-the-SCORE-CCLL-framework-and-methodology_compressed.pdf

weather events are on the rise. We have been graphing data sets from 2005 to the current time, and coastal flooding is the most predominant risk factor, along with the coastal erosion it creates. This makes the coastal city of Piran and its maricultures very vulnerable. Recently Mascorda Cabre et al. (2021) mapped the influence of the presence of offshore maricultures on coastal and seabed erosion, as well as various weather events. The results suggest that not only do maricultures provide relevant ecosystem services, valorized food and well-being sources, they could provide shoreline protection and seabed stabilisation in the face of future extreme coastal weather events.

Kociper et al. (2019) outline an index of agricultural climate change vulnerability in terms of three factors: exposure, sensitivity, and adaptive capacity. Applying such an indexing approach to general information and vulnerabilities, coupled with specific data from Piran, the SCORE project and the mariculture communities, will enable more effective data generation and sharing for disaster planning and biodiversity and infrastructure protection.

Despite generous funding from organizations such as the European Commission, citizen science remains under-utilized and often misunderstood in many European settings. In Slovenia for example, the most notable citizen science input is with ecologically centered projects that relate to *Natura 2000* and the national monitoring of jellyfish, the four-lined snake³ and invasive species⁴. In the context of the SCORE project Slovenia is represented through the CCLL of Piran in Slovenian Istria near the Croatian border because it is the most vulnerable to climate change impacts such as coastal flooding and storm surges (together with water scarcity) affecting everyday life, infrastructure, tourism, and fishing, including maricultures. Slovenia has only 42 kilometers of coastline and Piran is one of four main cities, the others being Koper, Izola, and Ankaran near the border of Italy. In studies of mariculture, citizen science has already been utilized, especially with regards to gathering and delivering data and identifying precise aquaculture species (see Tiralongo et al., 2020), for broader scientific audiences and environmental agencies alike.

³ (<http://www.natura2000.si/novica/goz/>)

⁴ (<https://www.tujerodne-vrste.info/>)

4. An ecolinguistic, intercultural and ethnographic view of maricultures

Maricultures, like all human actions on the environment, perform a function related to survival, but do so in compliance with human laws and capital, in other words, economic and social needs. Maricultures are based on direct, physical, and immersive relationships between humans and nature. These relationships are established through actions, gestures, and words that come from the sea. The words arise from ancient actions and efforts aimed at caring for, preserving, indicating, explaining, and warning about natural phenomena and elements that are important to a more modern study of the nature-culture interface, and ongoing respect for “all planetary life” (Hawke and Spanning, 2022). This lexicon is often poetic as well as scientific and cultural. It could also be described as ethnographic, or auto-ethnographic (Spanning and Hawke 2022), whereby the researcher also becomes the object of study. This makes maricultures a fitting case study, as fishing communities are constantly analyzing and adapting their practices, making meaning of their own life and work.

The fishing communities in the northern Adriatic Italian-Slovenian Sea region are characterized by a common language that dates to the ancient Republic of Venice at the beginning of the XV century (Dudine, 2014; Rogelja and Janko Spreizer, 2017; Saracino, 2021). Despite the fall of the Venetian Serenissima Republic at the end of the eighteenth century, common, and arguably nature-based, language was developed and continues to be maintained to this day in the fishing communities, which all speak an Istrian-Venetian dialect (Dudine, 2014; Rogelja and Janko Spreizer, 2017; Saracino, 2021).

The craft of the sea was passed down among families, predominantly from parent to child and through the Istrian-Venetian language, which gave a name to tools, boats, fishing techniques, recipes, and weather conditions. In Istrian-Venetian fishing communities, knowledge was shared with all areas of life that included food preparation, usually the domain of the women, although women were also involved in the fishing. Recognizing the importance of this specific linguistic and semantic universe enriches the skills and the understanding of any researcher in the field of scientific, social, or humanistic studies who wishes to tackle the study of mariculture in the northern Adriatic Sea, and create genuine cross-cultural participatory engagement built on the way fishermen speak about their lifeworld to themselves, cultural neighbors, and researchers.

The Istrian-Venetian terms that refer to this ecolinguistic world include *musoli*, *musolere*, *musoler* (mussels); *trabacoli*, *bragozari*, *batei* (typical local boats); *mandracchio*,

squero (spaces for the repairs and maintenance of boats, places of encounters, of specialized professionals and sea lovers). These words cannot (do-not-need-to) be translated. They exist as referents to experiences difficult to tell and describe yet known because lived. They are words that transcend geographies and times, that survive republics, empires, nations, communities (both mainstream and marginalized) and perhaps even globalization. These are words that identify people, their actions, and choices, define communities and economies, words as semantics of place, of natural balances between human-territory intervention-tradition and which represent a body of information, to be listened to rather than merely assumed.

To study the biodiversity of a territory without immersing oneself through all the senses, and in the sound of languages that describe and interpret ancient wisdom natural phenomena and their nuances, including, warnings, advice, relationships, and traditions, is a sectoral scientific approach that can bring new insights, collaborative possibilities, and dialogue with other disciplines. However, in a truly interdisciplinary approach, maintaining a wholeness and solidity of perspective that avoids being overly influenced by specific fields of study and their methodologies is crucial. Studying the biodiversity of places without including and engaging minority autochthonous communities (often left aside from scientific research) is a missed opportunity. To act through an approach based on cultural empathy, understood as “the attempt to organize experience through a set of constructs that are more characteristic of another culture than of one’s own” or “the imaginative, intellectual and emotional participation in another’s person experience” (Bennett, 1993, p. 156), is necessary.

The study of communities, their history and their traditions tells us a lot about this territory, indirectly indicating the extent of the phenomena, the presence, absence or replacement of certain fishing varieties and mariculture practices. And while it may be challenging to merge modern science with ancient practices, interdisciplinarity opens some space for such possibilities.

Since the Middle Ages, fishermen on the Adriatic coast have been organized into brotherhoods which became over centuries until the twentieth century, cooperatives that developed canneries and fish processing factories. Before World War II, the cooperative united more than 300 fishermen in Piran alone, and after the war and the emigration of most of the population from the coastal towns, the first established post-war cooperative had about 90 members. In Piran, the first fishermen's cooperative was founded in the early years of the twentieth century under the Austro-Hungarian Empire and was dissolved in 1911. The second cooperative, *Cooperativa fra pescatori di Pirano*, was founded in 1925. Particularly

important was and still is the annual catch of mullet in the Bay of Piran in late autumn (Juri, 2019).

Acknowledging these fishermen and their linguistic environment is an important reference for interdisciplinary scientific investigation. This is because linguistics, according to Stibbe (2015):

“[...] provides tools for analyzing the texts that surround us in everyday life and shape the kind of society we belong to. These tools can help reveal the hidden stories that exist between the lines of the texts. Once revealed, the stories can be questioned from an ecological perspective: do they encourage people to destroy or protect the ecosystems that life depends on? If they are destructive then they need to be resisted, and if beneficial they need to be promoted” (p. 2).

Furthermore, historic knowledge and hidden stories may indeed re-surface and contribute to understanding coastal climate change issues and knowledge through fishing communities invited to take part in research as citizens scientists. We will now look more specifically at the biological, health sciences and natural science component of interdisciplinarity through a case study of Mediterranean maricultures.

5. Cultured shellfish as Mediterranean human food

Shellfish maricultures traditionally developed as a food source well before modern concerns over climate change and aquaculture food security. Compared to land-based agriculture, maricultures use less land, but more importantly, produce less greenhouse gases and their products contain more micronutrients per protein quantity (Parodi et al., 2018; Barange, 2020). We will now examine their contribution to both food sustainability and climate change mitigation.

In recent decades much attention has been given to the health benefits of the consumption of marine fish, especially in regard to providing bulk protein and high concentrations of essential fatty acids. The literature clearly demonstrates that health benefits are associated with consumption of omega-3 long-chain polyunsaturated fatty acids (PUFAs) abundantly present in mariculture food products (Parodi et al., 2018), including Adriatic shellfish (Bongiorno et al., 2015; Prato et al., 2019). A FAO/WHO report mentions that these associations are demonstrated in numerous studies across a wide range of populations and in differing but complementary fields of inquiry which go beyond health sciences, and reflect the sum of benefits and risks from all of the constituents

(FAO/WHO, 2011). However, fish was defined as finfish and shellfish, whether of marine or freshwater origin, farmed or wild. Thus, for the consideration of total omega-3 PUFAs intake, the majority of studies examined finfish consumption, rather than considering also shellfish. In other words, the health benefits induced by consumption of fish as opposed to shellfish (or even farmed versus wild), have not generally been investigated. This presents the fields of broader kinesiology (human movement, physical health and wellbeing) and social sciences with opportunities to further explore partnerships with citizens who are co-producing the products of the Mediterranean diet and to carry out research that might further valorize their food, cultural heritage and lifestyle, in the face of changing climatic conditions.

Shellfish have traditionally been cultured as food within the Mediterranean basin, as part of the *Mediterranean diet* that has been recognized as an 'intangible cultural heritage' (UNESCO, 2013). Hence, the Mediterranean diet can be interpreted as a *lifestyle* (Meulenberg, 2019a). Noting the lived experience of a group of people adds greater possibilities for heritage studies and social sciences to map the many features of the Mediterranean diet, as adherence to the lifestyle can provide sustainable wellbeing and longevity (Meulenberg, 2019b). Using narrative and oral history accounts and focus groups as a participatory method can yield a more personal understanding of the industry that further adds to the interdisciplinary nature of research into maricultures constituted also by heritage studies, ethnography and auto-ethnography as a practice of observing communities that takes us beyond ourselves to include fisherman within their own communities.

However, recent wild fish stock depletion (largely due to unsustainable over-fishing practices) makes it necessary to investigate separately the potential health benefits of farmed shellfish consumption, in relation to supply. Such research could provide kinesiological evidence to support the valorization of this type of food, as a proven ingredient for physical well-being, as well as demonstrating the ongoing relationship between people and the sea, through mariculture production and aquatic cultural heritage (Figure 2). The association of such benefits as resulting from the interdisciplinary mariculture sector would also support blue growth and provide sustainable food choices (Jones et al., 2022; Mascorda Cabre et al., 2021, Meulenberg, 2019b; Naylor et al., 2021).



Figure 2. Views from the vineyards of the Debeli Rtič landscape park: the lined-up floaters of the maricultures in the Slovenian waters with the Italian city of Trieste on the opposite coast (second picture). Photos by Cécil Meulenberg.

6. The contribution of shellfish maricultures to biodiversity

In this section we look at shellfish maricultures from the perspective of biodiversity and marine studies. In the Adriatic sea, which includes coastlines of Slovenia, Croatia and Italy, farms traditionally consist of vertical lines to which shellfish adhere directly and attach in socks.

The organisms do not need human-introduced biotic elements to feed on. The cultured shellfish species are filter-feeders, meaning they consume the microscopic plankton and floating sediment already in the sea waters. By filter feeding they diminish eutrophication, the natural process of water enrichment with nutrients and minerals especially nitrogen and phosphorus, and thus

improve water clarity and the quality of coastal-interface waters (e.g., Petersen et al. 2016). Hence, the circularity of this ecosystem – its circular economy – is guaranteed and is also free of introduced antibiotics and growth promoters (as compared to common agriculture activities).

The most common farmed species are endemic, such as the Mediterranean blue mussel (*kelapavica* – *Mytilus galloprovincialis*) and oysters (*ostriga* – *Ostrea edulis*) that need a substrate to attach to. Others like clams (*ladinke* – *Venus verrucosa*) do not require a substrate, but can be reared in cages. Spillover of de-attached/de-caged individual specimens into the sea waters is not regarded as a problem precisely because farmed species are endemic, although the fall-off shells can cause alterations in sediment biogeochemistry and can attract predatory species (Callier et al., 2018). The floaters and the vertical lines, with cages deeper down the line (close to the sea floor) will combine the farming of two or more species (known as integrated multi-trophic aquacultures), and as a whole might contribute to attracting both mobile and immobile species, like algae, crustaceans, and fish, provide shelter and act as nurseries similar to the diverse communities of natural reefs, as Callier et al., (2018), have noted. However, the water column and the husbandry activities might also repel certain species. In the Eastern Adriatic waters of Croatia, there have been reports of predation on farmed shellfish by sea bream (Tičina et al., 2020). Despite this predation, the introduced farms contribute to a novel foodweb structure, although it will be important for future research to also consider the effects of climate change events such as storm surges and coastal erosion to this unique foodweb structure. In the North Adriatic Sea, research regarding the effects of shellfish aquacultures on local marine biodiversity is still relatively new. Moreover, through inclusive partnerships with fishing communities, using applicable smart sensor technologies (for monitoring the growth in the mariculture or sea water properties) with inter-generational marine expertise (about species and the marine environment), the mariculture sector can be upgraded as a modern food supply system while incorporating essential local and historical knowledge. Such an interdisciplinary approach provides opportunities for both the maricultures and the people involved in the production of this food.

7. Shellfish as environmental/ecosystem biomarkers

Throughout the Adriatic waters, mussels in particular have been investigated as biomarkers for various environmental aspects, as outlined by Bajt et al. ,(2019). Shellfish occupy a basic position in the marine food chain, and due to their filter-

feeding tend to accumulate chemicals introduced through pollution (either natural or human). Contaminants of a human nature identified in shellfish range from heavy metals, polychlorinated biphenyls (PCBs) and organochlorine pesticides, to polycyclic aromatic hydrocarbons (see also Prato et al., 2019). From 2014 to 2017 a decline in visible collected macro litter, mainly consisting of plastics, was observed for Slovenian beaches (Schmid et al., 2021). On the other hand, human laundry activities that create microplastic fibres also enter marine ecosystems and damage the DNA, gill, and digestive gland tissues of *Mytilus galloprovincialis* (Alnajar et al., 2021). The consequences of such pollution are not completely understood, but emerging research suggests more marine species and their environments will be adversely affected. Furthermore, appropriate research can help to direct practical interventions, as well as support public and business education on the benefits of the industry.

For example, the growth cycles of shellfish are dependent on the availability of nutritious plankton, in combination with the properties of the sea water like temperature, salinity and acidification. When the marine environment changes – due to pollution or climate change effects such as ocean temperature rise – the plankton properties change. Subsequently the growth of shellfish adapts and their biochemical compositions and nutritional values change. The functionality of shellfish physiology, the biochemical composition of both the soft tissues and the shell, can indicate particular aspects of environmental and ecosystem health. Sea acidification, in combination with low oxygen levels (hypoxia), in warm waters might have a particularly negative impact on the shell size of crustaceans and molluscs and corresponding mechanical strength (Gazeau et al., 2013) and their nutritional values (Aneleto et al., 2014). This climate change phenomenon causes developmental harm and can give rise to smaller specimens more susceptible to disease and predation. Moreover, in recent years the Adriatic Sea has seen a partial decrease in nutrient (phosphate and nitrate) concentrations, very likely as a direct result of stricter waste water policies that have cleaned up rivers. On the other hand, it has been observed in the Mediterranean Sea that the irregular combination of low salinity, increased sea water temperatures and eutrophication driven by climate change lead to a greater occurrence of toxic tides (Zingone et al., 2021), and more frequent harmful algal blooms (HABs). Consequently, aquaculture production has at times been halted in the Adriatic Sea. Mapping trends specifically related to toxic algal species is a developing area of longitudinal research.

It has been speculated that maricultures control erosion along shorelines by stabilizing local sediments through increase of the sedimentation, and might

moderate the effects of extreme (weather) events (Alleway et al., 2019; Gentry et al., 2020). The SCORE project is currently investigating such impacts in coastal cities in Europe through various methodologies that focus on the sustainable protection of sea life broadly understood, as well as general erosion impacts⁵. Furthermore, the SCORE project and associated local environmental agencies provide coastal mapping data of off-shore environments (e.g., Espinosa and Portela, 2022; Toledo et al., 2022), also using sensor technology. This new data will certainly enhance coastal resilience strategies and assist in the reliability of predictive data to protect people and aquatic life alike.

It could therefore be affirmed that shellfish organisms as a whole, both wild and farmed, are important marine biomonitors concerning both pollution and climate change. Hence, seasonally monitoring the properties of shellfish both in and around the vicinity of the farms, as well as in the wider marine-land interfaces, will provide relevant information on the health of the marine ecosystems. Fishing communities, businesses and citizen scientists together form an integral and mutually constituted part of this research that simultaneously sheds light on the ecosystem services provided by the shellfish themselves.

8. Ecosystem Services of Shellfish Farming: Understanding Shared Values for the Future

Ecosystem services (ESSs) consist of many and varied benefits provided by the natural environment and healthy ecosystems for primarily human purposes. Often the categories of such ecosystem services are divided into categories (Haines-Young and Potschin, 2018), such as 1) *provisional services* in the form of provision of food, drinking water and raw materials; 2) *regulating and maintenance services* that provide support to habitat and ecosystems by moderating natural phenomena and processes; and 3) *cultural services* that cover non-material benefits, generally providing wellbeing to communities and contributing to the development and cultural advancement of people. Here again maricultures and shellfish farming prove to be a productive example of the relationships between

⁵ For example, at the recent »Education with Sustainability» Conference in Ireland August 15-17, (<https://www.itsligo.ie/education-with-sustainability/>), representatives from SCORE presented climate change issues through innovative methods and practices in pedagogy. Teaching climate change studies is a new area from which and through which future participatory resources will be developed. See for example Lucy and Freney (2022).

nature and humans and the shared understanding of what contains value for life in terms of the here and now, together with visions for the future (Figure 3).

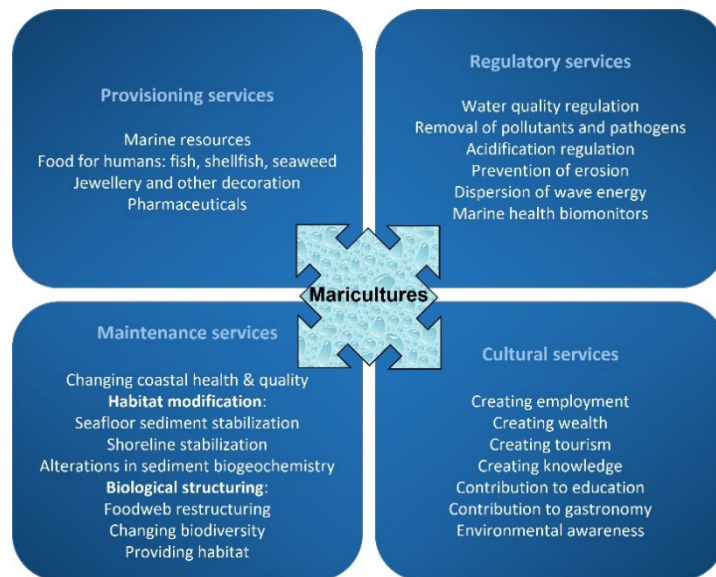


Figure 3. Ecosystem services of maricultures

Maricultures enable *provisional services* in the form of farmed food, and thus enable food security (Bush and Osterveer, 2019; Jones et al., 2022; Naylor et al., 2021), as well as contributing raw materials in the form of decorations (such as shells) and pharmaceuticals. The high quality and healthy foods provided by aquacultures are part of the rich Mediterranean gastronomy in the Adriatic. Additionally, the aquacultures contribute culinary aspects in the form of *cultural ecosystem services* that also cover the provision of wellbeing of rural and coastal communities of the Adriatic by generating wealth and employment, livelihood, tourism and education (Spanou et al., 2020; Weatherdon et al., 2016). Maricultures also maintain cultural heritage through natural and culinary lifestyle, and raise environmental awareness that can enhance broader marine conservation.

Marine aquacultures as an introduced technical ‘farm’ within the marine-land interface ecosystems, also provide *regulating - habitat and supporting - maintenance services* (Smaal et al., 2019; Rullens et al., 2019), and may positively affect marine

biodiversity. Shellfish maricultures in particular have a potential to contribute to *regulating services* such as habitat modification, water quality regulation, removal of nutrients, pollutants and pathogens, and stabilization of both sea floor sediment and shoreline (Alleway et al., 2019; Jones et al., 2022; Rullens et al., 2019). Ecosystem services provided by marine aquacultures can also include climate change mitigation strategies (Reid et al., 2019a,b; Rosa et al., 2014). The sector is certainly influenced by climate change drivers but might also provide potential solutions to these global threats, most importantly with possibilities and actual roles as ecosystem service providers. As part of the SCORE project, we have been mapping the alignment between ecosystem services and nature-based solutions as a means of augmenting resilience in vulnerable coastal cities. Weather sensing technology, for example, can enhance predictions of disruption to certain ecosystem services and communities in general, thereby enabling mitigation strategies for protection of coastal biodiversity to be planned for in advance. Preliminary evidence from SCORE suggests that smart technology to measure (the lack of) rainfall and predict droughts and its effects (Espinosa and Portela 2022), will become an essential feature of climate change mitigation practice from which future data can be analysed.

The ecosystem approach to aquaculture (Brugère et al., 2018) is a global strategy for the integration of aquaculture activities within the wider ecosystem such that it promotes a truly sustainable form of development, equity, and resilience of interlinked social-ecological systems. While the approach demonstrates mainstream integration into global and regional 'blue growth' programmes, recently, the Aquaculture Advisory Council (AAC, 2021) reported that:

“[...] well-managed finfish in ponds, lagoons and estuaries and bivalve aquaculture contribute significantly to the preservation and improvement of environment, maintain the biodiversity associated with aquatic ecosystems and generate ecosystem services to society that are not always recognized. The specifics of these aquacultures in terms of both ecosystem services and needs, should be better understood and acknowledged by policy makers and the public” (p.35).

It is possible to assess general environmental impacts associated with all the stages of a commercial product through the Life Cycle Assessment (LCA), where every step of a production cycle is evaluated in carbon-footprint and monetary terms. Hence, such LCAs show that the lowest greenhouse gases production per unit of protein is from molluscs and salmon aquaculture, as well as small pelagic, large pelagic and demersal fish fisheries. Catfish, invertebrate and shrimp aquaculture production are the largest emitting sectors, with greenhouse gases

production per unit of protein comparable to land-based beef production (Barange, 2020). This LCA knowledge can affect consumers' willingness to pay, enable sustainable food choices and support the marine aquaculture sector. In short, this can contribute to the ecosystem awareness that the ACC is promoting. Both an ecosystem services analysis and an LCA analysis of the mariculture sector will contribute to understanding its sustainability for all stakeholders. The involved economic costs, carbon footprints, and emissions do also depend on geography, and for Slovenia and the Adriatic region, no assessments of this kind have yet been performed. Thus, while better mapping of ecosystem services linked to maricultures be of interest to (local) authorities and producers, knowledge about such services and how climate change affects marine ecosystems and marine aquacultures may help further empower citizens in their contribution to science and enhance environmental awareness.

9. Conclusions

What we have tried to present in this paper through both interdisciplinarity and cross-cultural engagement is how the mariculture sector can profit both ecologically and economically from well-planned interdisciplinary research involving both academia and knowledgeable citizen science. Maricultures provide an alternative to our dependence on land-based farming and on wild-caught fish stocks for food and fishmeal (Barange et al., 2014). Combined with technological developments in production design, and weather forecasting and sensing, maricultures could significantly contribute to global food security with climate change, while limiting greenhouse gas production. The mariculture interdisciplinary approach is a unique example of how people, governments and researchers can come together to develop, sustain and share best care and sustainability practices in the face of climate change for vulnerable coastal land-marine interfaces.

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Authors

Cécil J.W. Meulenberg Institute for Kinesiology Research and Mediterranean Institute for Environmental Studies, Science and Research Centre, Koper (ZRS). cecil.meulenberg@zrs-kp.si. *Corresponding author*.

Shé Mackenzie Hawke, Mediterranean Institute for Environmental Studies, ZRS.

Irina Cavaion, Institute for Linguistic Studies Science, ZRS.

Peter Kumer, Mediterranean Institute for Environmental Studies, ZRS.

Blaž Lenarčič, Institute for Social Sciences, ZRS.

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Analyzing co-creation levels of urban living labs in Europe

Kimberly Noble, Elena Marie Enseñado

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1. Water issues, living labs and co-creation
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Keywords: living labs; co-creation; urban sustainability.

Abstract. *Which characteristic of urban living labs (ULL) that focus on urban sustainability, including climate change and water issues, can enhance its level of co-creation? The main question raised for this research paper builds on the idea that optimization of characteristics can positively affect co-creation levels, ultimately improving the outcome of the urban living lab. Through data collected from an online survey participated in by 29 urban living labs in Europe which focused on varying issues, such as water and climate change, it became clear that the most important characteristic to enhance co-creation*

levels was to establish very clear ULL aims in the first instance. Without a purposive aim, the successful delivery of co-creation outputs proves difficult.

1. Water issues, living labs and co-creation

Water is a key planetary resource and keeping oceans and seas healthy is crucial. However, many factors are increasingly impacting negatively on their health. According to Herbert-Read et al. (2022):

Currently recognized drivers of declines in marine and coastal ecosystems include overexploitation of resources (for example, fishes, oil and gas), expansion of anthropogenic activities leading to cumulative impacts on the marine and coastal environment (for example, habitat loss, introduction of contaminants and pollution) and effects of climate change (for example, ocean warming, freshening and acidification) (p.1).

At the same time, planetary freshwater is subject to the same negative factors. Only 3% of planetary water is freshwater and only one third of this is accessible for use in human settlements and agriculture. Water-intensive human activities are leading to increasing depletion of global freshwater resources and numerous cities are subject to growing water stress (Spannring and Hawke, 2021).

In this paper we illustrate the aims and roles of Urban living labs (ULLs) in sustainability practice and propose ULLs as a way of addressing many critical climate change issues as well as the wide range of water issues that have been identified. According to the European Network of Living Labs ENoLL (2018):

Living Labs (LLs) are open innovation ecosystems in real-life environments using iterative feedback processes throughout a lifecycle approach of an innovation to create sustainable impact. [...] They focus on co-creation, rapid prototyping & testing and scaling-up innovations & businesses, providing (different types of) joint-value to the involved stakeholders. [...] In this context, living labs operate as intermediaries/orchestrators among citizens, research organizations, companies and government agencies/levels. [...] Within a wide variety of living labs, they all have common characteristics, but multiple different implementations (para. 2).

ULLs are based on independent rules, norms, procedures, and principles, and have transformed conceptualizations of governance for sustainable urban management and development (ENoLL 2018), including addressing water issues. ULLs serve as an instrument utilized by various actors to guide transformation efforts by directly intervening and altering traditional systems through real-world testing, co-production of knowledge, and co-creation induced innovations (Rosado et al., 2015; Bulkeley et al., 2016).

ULLs are used interchangeably with ‘living labbing’, ‘living laboratories’, ‘transition labs’, ‘social innovation labs’, “testing grounds”, ‘hubs’, and ‘field labs’ (McCormick and Kiss, 2015; Steen and van Bueren, 2017). There is no shared definition, having been defined as a site, methodology, system, an organization, arena, and innovation approach (Følstad, 2008; Bergvall-Kåreborn et al., 2009; McCormick and Hartmann, 2017). However, ENoLL has defined urban labs as ‘real-life’ research environments utilized to confront innovation challenges in various fields (Feurstein et al., 2008; Den Ouden, 2016). They describe the main activities of urban labs to be co-creation, exploration, experimentation, and evaluation.

Co-creation is an activity in which actors work together to create benefits (Nesti, 2018). Co-creation is generally defined as the action of making value with two or more actors. The literature recognizes co-creation as a process that stimulates mutual value creation and enables creativity and innovative solutions by linking multiple streams of knowledge through partnership interactions (Tanev et al., 2011; Veeckman et al., 2013; Puerari et al., 2018). Haukipuro et al. (2018) further elaborate on the concept of co-creation, stating that this process is where the creativity of citizens and that of interdisciplinary experts are conjoined to realize effective and meaningful change processes, such as in addressing climate change and water issues.

Co-creation contributes to the maintenance of reflexivity and can render opportunities for participants, through ongoing interactions, iterative cycles of implementation, testing, development, and research (Keyson et al., 2016). A study conducted by Puerari et al. (2018) provides a clear overview, derived from a comprehensive literature review, of the five most common elements of co-creation fostered in urban labs: purpose of co-creation, degree of informality, ownership of co-creation process, motivations and incentives for co-creation, and places and spaces for co-creation.

European cities have rapidly taken up urban labs as new collaborative sites to challenge conventional unsustainable trajectories and contribute to urban

sustainability through their outputs derived from co-creation activities. Trencher et al. (2013) present an overview of initiatives that have successfully utilized co-creation for sustainability throughout Europe which have aimed to mobilize and disperse knowledge, transform, and restore natural and built environments, and develop new socio-technical configurations through innovation and multi-actor learning, involving stakeholders from a wide range of areas, including business, academia, government and citizen scientists, as in the Quadruple Helix model proposed by ENoLL (2018).

These urban labs have been employed to inspire the testing, development, and implementation of innovative urban sustainability solutions through the creation of new knowledge, technologies, services and infrastructures. However, there is increased difficulty in determining a full comprehensive understanding of urban lab success factors that could potentially be up scaled or used in different contexts.

This situation necessitates more research regarding co-creation to fulfill desired sustainable outcomes and to bring urban lab initiators in structured knowledge creation as well as build awareness of crucial lessons and issues experienced for the success of each urban lab (Lucassen et al., 2014). Without further research into the conditions necessary for harnessing high co-creation levels, management and performance of urban labs will be averted from their full potential to make significant impacts.

If the characteristics that best optimize conditions for co-creative outputs can be identified, urban labs can foster high co-creation levels to be utilized as an effective and efficient mechanism for sustainable change in urban areas. Hence, assessments must be made on the performance of their characteristics. The influence of these characteristics on cocreation levels must be analyzed to indicate the most important aspect for co-creation optimization to further the understanding of knowledge generation, co-creation outcomes, and the improvement of current and future urban labs for urban sustainability.

This paper presents the results of a survey in which we examined 29 ULLs in Europe that focus on varying issues, including climate change and water issues. These ULLS represent 13 countries, namely Switzerland, Spain, Italy, Sweden, the Netherlands, United Kingdom, Belgium, Turkey, Greece, France, Austria, Slovenia, and Denmark. The main research aim was to explain which characteristics of ULLs can enhance co-creation levels. Specifically, we aimed to answer the following questions: Do self-proclaimed ULLs in Europe have co-creation activities? Do these ULLs have high, medium (upper), medium (lower), or low

co-creation levels? Which characteristics of ULLs can explain the co-creation level?

2. Understanding living lab co-creation activities

All 29 ULLs (100%), who served as respondent in our survey, were found to engage their participants in at least one co-creation activity. These activities consisted of future workshops, prototyping, surveys, testing, evaluation, image boarding, interviews, and brainstorm meetings. Other activities identified were symposia, social safaris, focus groups, and placemaking. Of the 29 ULLs, almost half (44%) utilized an average of four to five co-creation activities. There is no ideal number of co-creation activities for ULLs to utilize, although it is mentioned from literature that high frequency collaboration could contribute to the success of co-creation outcomes.

The most frequently used co-creation activities were those which the literature depicted to have the highest success for co-creation and knowledge generation, such as future workshops, prototyping, brainstorming meetings, interviews, and testing (Eriksson and Svensson, 2009). These are the activities that not only serve as a foundation for the generation of valuable ideas but also make them tangible, leading to new innovative solutions designed to be iterative (Veeckman et al., 2013). Thus, lack of activities can be problematic for innovation and the impact of ULLs on urban sustainability.

The purpose of co-creation plays a role in the determination of methods and techniques used in the urban lab. Different methods such as prototyping, surveys, future workshops, evaluation, and tests combined with a variety of techniques such as scenarios, interviews, and mock-up serve as a foundation for the generation of ideas and render them tangible in a 'real life' context through usage (Eriksson and Svensson, 2009). Eriksson and Svensson (2009) found that the purpose of co-creation can also be determined by participation, specifically, the degree of user involvement, whether it is decision, information, or creation.

The decision degree of user involvement is easiest to apply to methods and techniques, such as surveys or evaluations, that are less resource dependent, straight forward, and ask questions regarding preferences of designs or use behavior. The information degree requires a higher number of resources, and generates a rich set of data through diaries, observations, and interviews. These two degrees correlate with the intentions to generate knowledge and learn through cocreation processes. The creation degree correlates with the purpose of making something through co-creation processes. It is challenging to incorporate in technique and

methods and usually require resources for prototyping methods or future workshops.

3. Level of co-creation in living labs

Co-creation is the key element of the urban lab process, the development of new products, services, systems, and processes within urban labs are utilized to employ people as cocreators to examine, explore, test, and evaluate novel ideas, systems, scenarios, services, and creative solutions in complex ‘real life’ contexts. The employment of co-creation in urban labs broadens engagement, empowerment, and collaboration of citizens. Co-creation is significant for the alignment of ideas and definitions, and to facilitate discussions about possible actions in decision making processes.

For our study, co-creation level is high when user feedback is captured iteratively. Users are part of the innovation process and can make changes in the innovation themselves. In terms of medium (upper) co-creation levels, user feedback is also captured iteratively. However, this may lead to some modifications/alterations of the innovations. In medium (lower) co-creation levels, user feedback is captured, but users have no decision-making power in the innovation process. Co-creation level is low when there is rare to no interaction with users.

ULL initiators rated the co-creation level as their perspective would present a most accurate depiction between the target of co-creation focus and the actual reach. Initiators and facilitators were chosen to be surveyed to identify the state of co-creation levels in their urban labs because they constitute the ‘core group’ of urban labs.

Of the 29 ULLs, 18 (62,1%) reported medium (upper) co-creation levels. Only 7 (24.1%) of the ULLs have reported high co-creation levels. Meanwhile, 3 (10.3%) reported having medium (lower) co-creation levels, while 1 (3.4%) reported low co-creation levels. Projects of the labs ranged from various sustainability initiatives and sectors that involve co-creation activities, such as transitioning towards a circular economy, greening of an urban space, taking up sustainable governance and development, or addressing climate change and water issues¹.

¹ In relation to water issues and climate change the SCORE project has developed a unique system of Coastal City Living Labs (CCLLs) as is also covered in this issue by members of the Piran Coastal City Living Lab (Meulenberg et al., 2022).

4. Influential characteristics of living labs

ULLs have different characteristics. For this study, we grouped these characteristics according to “aims”, “activities”, “participants”, and “context”. In order to analyze which characteristics of urban living labs influence co-creation levels, we examined these against two sets of ULLs: (1) the top three ULLs with the highest co-creation levels, and (2) the bottom three ULLs with the lowest co-creation levels. Using ordinal logistic regression analysis, we examined the significance of these characteristics to the level of co-creation. It has been revealed that “aims”, followed by “participation”, and “context” can influence co-creation level.

4.1 Aims

The ultimate aim of urban labs is to learn, experiment, and innovate for the purpose of increasing urban sustainability. Urban labs can have distinct goals, such as to collectively work towards an innovation output e.g., service, product and to build knowledge, learn, and create networks through collaboration. Determining the aim of the lab sets important conditions for pathways that ensure ambitious innovative solutions developed through co-creation (Steen and van Bueren, 2017).

Also, the processes of learning and innovation derived from experimentation are fundamental to the function of ULLs. Innovation in ULLs refers to the discovery of new solutions for existing problems and the development of new products, such as a service, object, application, technology, or system. Successful learning processes between participants can form a pivotal yield for innovation, but it can be difficult to establish, even in the facilitating conditions of the ULL setting, due to the many conflicts or unmet expectations that can arise from diverging interests (Naumann et al., 2018). These learning processes contribute to the emergent experimental process of responding to sustainability issues and can be realized through forms of ongoing participant engagement and consultation or through data control and management systems and 'smart' applications.

Under “aims”, based on the survey among the ULLs, the three most significant characteristics are focus, clarity of goal, and goal completion. When goals are clear to all participants, and the goal is to both learn and co-create knowledge and physically make something, it creates conditions that significantly effects co-creation levels. This finding is supported by Veeckman et al. (2013) and Puerari et al. (2018). Interestingly, specific factors, such as lab lifespan, usage context research, frequency of events, and resource availability, did not have a direct correlation to co-creation level variation.

The literature implies that a longer time period will enable participants to interact and generate additional knowledge, expand audience reach, increase networks, trust and develop relationships that will lead to enhanced co-creation levels (Tanev et al., 2011; Luederitz et al., 2017; McCormick and Hartmann 2017). Usage context research before the development of the urban lab process, expressed to be an important factor to influence knowledge production and innovative co-creation outcomes (Veeckman et al., 2013), did not seem to influence co-creation. This claim is underpinned by the depiction of urban labs as specific to each site and heterogeneous, easily altered by particular time and location, contributing to the variations of urban lab co-creation experiences and outputs (Jordan and Lenschow, 2009; Mulder, 2012; Evans and Karvonen 2014).

4.2 Participants

Three specific factors under “participants” were found to have an influence on co-creation levels. These are balanced partnership, power struggles, and predetermined structure. Based on the results, neither the urban labs with the highest or lowest co-creation levels had completely exclusive partnerships. This finding was in accordance with existing literature (McCormick and Hartmann, 2017; Puerari et al., 2018), regarding the value of obtaining a careful balance. As suggested in the literature (Tanev et al., 2011; Veeckman et al., 2013; Puerari et al., 2018), it is also recommended to avoid fully exclusive partnerships, although this will not guarantee high cocreation levels. A lack of completely exclusive partnerships can benefit the co-creation outcomes of urban labs but may not be sufficient to fully impact the outcome of co-creation level.

Further supporting previous studies that emphasize the importance of balance and flexibility in the ownership of urban labs, the findings on power struggles presents a minor correlation between this factor and co-creation level variation. It was determined that poor performance of this indicator can have great influence on co-creation levels due to the higher degree of power struggles with little to no interference from initiators. Thus, it is recommended that there be enough supervision over co-creation activities to ensure there are no power struggles occurring within the urban lab that can hinder co-creation outcomes such as knowledge co-production, learning processes, or innovation ideas.

The results derived from the analysis of the predetermination of urban lab structure also reinforced the consensus in the literature that there is a delicate balance between flexibility and structure that would best enable an urban lab to foster high levels of cocreation (Eriksson and Svensson, 2009; Mattelmäki and Visser, 2011; McCormick and Hartmann, 2017). Participant inclusion was not a

determining indicator for the explanation of co-creation level variation, an important indicator for the enhancement of cocreation levels as suggested by the existing literature (Feurstein et al., 2008; Veeckman et al., 2013; Puerari et al., 2018). Whether collaboration was arranged sporadically or continuously was concluded to not have a direct influence on cocreation level variation. Unlike in Puerari et al. (2018), the coupling of sporadic participant inclusion with short term goals will not have a negative impact on co-creation levels and urban lab success. The finding derived from the analysis of involved sectors infers that the diversity of sectors involved will not ensure high co-creation levels for the urban labs, opposing remarks from the literature declaring sectoral diversity is crucial for co-creation outputs supporting urban sustainability (Tanev et al., 2011; Westley et al. 2011).

All urban labs included at least three sectors throughout the co-creation process, however, no direct correlations were made between the initiating sector, diversity of sectors involved and the variation of co-creation levels. Thus, while diversity of sectors can provide expertise knowledge to forge innovative solutions, it is not a determinant of co-creation level variation. Exposure of intellectual property rights was also not found to directly affect co-creation outcomes that contribute to sustainability (also see research of Veeckman et al., 2013; Luederitz et al., 2017). Counter to Vivek et al. (2012), the study found that co-creation level variation will not necessarily be limited due to the lack or presence of participant motivation.

4.3 Context

ULLs are commonly bound to specific geographical areas, situated in a “real-life” use context, reducing limitations such as space or time, where co-creation, development, experimentation, and evaluation occurs outside of a laboratory setting (Mulder 2012, Veeckman et al. 2013, Steen and van Bueren 2017). Geographic configurations able to host ULLs consist of either a region, agglomeration, city, district, neighborhood, road, corridor, or building (Voytenko et al., 2016).

The geographic aspect is important for the empowerment of discrete actors to challenge sustainability issues and monitor outcomes and effects of the experimental lab. Local scales, at which ULLs proliferate, territorialize urban innovation at a manageable scale and enhance accountability and trust between participants. Projects, constituting the core of ULLs, are context specific and enable stakeholders to develop local solutions.

The consideration of context research before the development of the ULL can influence its purpose due to the importance of contextual understanding, of the environmental setting, for deep comprehension of the subject to be focused on (Veeckman et al., 2013). Contextual framework factors in a particular location and time contribute to the variations in ULL design, knowledge production, and innovation outcomes (Jordan and Lenschow, 2009; Mulder, 2012; Evans and Karvonen, 2014).

Of the context indicators, visibility was determined to be a significant determinant of cocreation level variation. To optimize co-creation processes and overall co-creation level, the existing literature suggests visibility can attract activities, intensify links and connections, and create support beyond the vision and purpose of the urban lab, catalyzing the uptake of innovative sustainable solutions amongst users (Veeckman et al., 2013; Luederitz et al., 2017; McCormick and Hartmann, 2017). Substantiating the literature on urban lab visibility, this finding revealed that the better the performance score on visibility, the higher the cocreation level fostered by the urban lab. Conversely, the urban labs with poor performance on visibility occupied the lowest co-creation levels. Thus, it is recommended that urban labs focus extra refinement or improvement efforts on urban lab visibility.

High visibility through physical artifacts produced by co-creation activities can help overcome barriers, such as context dependency, to upscale and diffuse co-creation outputs, thereby delivering a well-known symbol of sustainability within the surrounding community to inspire and serve as a demonstration site for initiating further co-creation activities. All urban labs in the study sustained a sense of community ranging from active to passive. While high co-creation levels were not directly correlated with an active sense of community, urban labs that maintained a passive sense of community were associated with low co-creation levels. Although high cocreation levels will not be guaranteed from the successful performance of this one indicator alone, it is recommended to establish an active sense of community, through alignment of shared motivations for collaboration and increased engagement to sustain motivation and encourage valuable interactions, as a foundation to support the performances of the indicators capable of delivering high co-creation levels, such as goal clarity (Veeckman et al., 2013).

One of the most prominent features of urban labs is the “real-world” context in which they emerge. Therefore, it was interesting to find that the results of this indicator contradicted studies that communicated high importance of this indicator for generating the necessary urban lab conditions for co-creation success (Veeckman et al., 2013; Steen and van Bueren, 2017). While there may be a need

or desire of participants to experience the “real-world” environment, there is no correlation found between the performance of this indicator and the level of co-creation variation. Possible explanation for this occurrence could be that the “real-world” environment contains many complexities and uncontrolled conditions, not necessarily facilitating the co-creation process, but provides a suitable environment for experiments to take place and valuable knowledge to be generated (Evans and Karvonen, 2014). Valuable knowledge related to water and climate change issues include knowledge on solutions and technologies that are being piloted, tested, and evaluated in living labs². Thus, it can be speculated that real world context does not provide a significant explanation for variation co-creation levels. Indicators that do not significantly influence co-creation levels should not be discredited, as these indicators could play a significant role in the underpinning of impactful indicators.

5. Conclusions

With the European urban population expected to rise to 80% by 2020 (Voytenko et al., 2016), it is imperative that cities take collaborative action to subdue current sustainability challenges and prevent their exacerbation. Co-creation is a key component to the transformative changes that are necessary to sustain technological and societal transformations for urban sustainability. Collaborative planning initiatives that form enabling conditions and incentives, developed by formal and informal actors, stimulate co-creation processes that reconnect society to the biosphere.

Often framed differently, urban labs generate a range of sustainability solutions through participation, experimentation, collaboration, and learning-by-doing in a ‘real-life’ context (Höflechner et al., 2016). This approach holds great potential for catalyzing sustainable transitions by fostering co-creation dynamics that contribute to the continuous evaluation for the improvement and refinement of an initiative (Mulder, 2012). The development of a meta-analysis of urban labs across Europe can enable more in-depth comparative studies to refine and realize any generalizations or improvements that can be applicable to any urban lab context.

Underpinned by theoretical knowledge of co-creation dynamics and their inter-relationships to urban lab characteristics, the primary objective of this study was to gain new insights on the most valuable urban lab characteristics in forging high

² For additional reference, see Atlas of the EU Water Oriented Living Labs which identified 105 living labs in Europe.

levels of co-creation. Overall, the findings suggest that the predominant characteristic of the “aims” of ULLs is to promote co-creation level enhancement. Important specific factors encompassed within this characteristic are lab focus, goal clarity, and goal completion. Hence, a distinct focus on the shaping and planning of the “aims” aspect in urban lab processes can provide benefits that will enhance co-creation experiences, outputs, and overall levels.

This analysis verifies the research by Voytenko et al. (2015), where the capacity of co-created sustainable contribution by urban labs largely depends on practice design and execution. “Aims” is the characteristic in which participants learn to interact with others in collaborative processes and understand how to cater to the concerns of others (Mudler, 2012; Hakkarainen and Hyysalo 2013). It can determine the extent of learning, success of learning processes that form a pivotal yield for co-creation outcomes (Naumann et al., 2018). The processes of learning and innovation derived from experimentation are fundamental to the function of urban labs.

Therefore, the urban lab planning process should assess the quality of the “aims” aspect when creating or optimizing urban lab processes, paying considerable attention to its goals and briefing all participants on the focus of the urban lab. Through the organizational planning of the lab, the “aims” characteristic sets the stage for the structure of the urban lab, determining the lab focus, goals, frequency of open events, methods, techniques, and infrastructure (Eriksson and Svensson, 2009; Juujärvi and Pessa, 2013; Den Ouden et al., 2016, Steen and van Bueren, 2017). Without organizational clarity, the successful delivery of co-creation outputs will prove to be difficult.

Linked to other transdisciplinary knowledge, the empirical data deduced from this research can potentially provide enhancement in co-creation levels of urban labs in various contexts, along with an overview of necessary improvements for a successful urban lab initiative, and the critical issues that can influence success outcomes. A greater capacity to foster co-creation can facilitate discussions and the alignment of actions in decision making processes through strengthening engagement, collaboration, and empowerment of participants. It can yield information to enhance the relationship between institutions that produce knowledge and users of that knowledge, facilitating urban lab objectives carried out through the stimulation of cross-disciplinary research. Therefore, co-creation enhancement can further support the desired sustainability transitions and projects of urban labs (Puerari et al., 2018).

Apart from contributing to the literature and knowledge on co-creation in urban labs in Europe, this study also provides a new analytical framework for the evaluation of characteristic performance. This strategy can be used to evaluate and measure the levels of co-creation within labs, contributing to refinement and improvement of urban lab processes. However, due to a small sample size and diverse context of urban labs, these demographic observations cannot be confirmed as the general averages of all urban labs throughout Europe.

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Authors

Kimberly Noble, Institute for Housing and Urban Development Studies, Erasmus University Rotterdam, the Netherlands. knoble140@gmail.com

Elena Marie Enseñado, Institute for Housing and Urban Development Studies, Erasmus University Rotterdam, the Netherlands. ensenado@ihs.nl *Corresponding author*

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The e(thi)co-political aesthetics of 'designer water': 'becoming water' in the Anthropocene

jan jagodzinski

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1. Introduction
2. Global Politics of Water: Assemblages of the Environmental Material Plateau
3. The Social Relations Plateau of Water Assemblages
4. Mental Ecological Plateau; *Multiple Water Ontologies*
5. Becoming Water?

Keywords: Designer water, designer capitalism, Modern Water, Deleuze and Guattari, multiple ontologies, indigeneity

Abstract. *This essay attempts to affectively politicize the global condition of water in the context of 'designer capitalism' by calling on its commodification through a colonial discourse that romanticizes Nature to sell its 'bottled purity.' The ethical concerns of 'designer water' (bottled water) are raised within the broader agenda of ecosophy as inspired by Félix Guattari's last essay, The Three Ecologies. Designer water is explored in relation to Global and Modern Water proceeding to raise the question of 'multiple water ontologies' where indigenous water ontologies present further ethical and political issues within the Anthropocene era. I end with a section called 'becoming water' with an*



attempt to provide a pedagogical way to face the crisis of water in the Anthropocene based on the journey taken through this problematic.

1. Introduction

When it comes to the Anthropocene, Félix Guattari's (2000) three ecologies - environmental, social and mental - which form an 'assemblage' (*agencement*); that is, a heterogeneous complex of interlocking, conjugated and transdisciplinary flows held together by desire through habituated patterns, currently dominated by what he called Integrated World Capitalism (IWC), or *Empire* by Michael Hardt and Tony Negri (2000). Throughout my own work and in this essay, what I am calling *designer capitalism* (i.e., jagodzinski, 2010). The environment cannot be thought outside these three-overlapping mental, social, and natural registers since the contemporary turn to natureculture was already in place with Guattari's ecological writings. The assemblage of such an eco-logic presents an opportunity to grasp and participate in what Guattari developed throughout his oeuvre as 'transversality,' the possibility of a dissensual culture for an imaginary other than the hegemonic market driven consensual techno-scientific postmodernism of designer commodities. As Guattari put it, 'Rather than looking for a stupefying and infantizing consensus, it will be a question in the future of cultivating a *dissensus* and the singular production of existence' (p.50, original emphasis). Such a 'deteritorialized aesthetic direction' (as alter-imaginaries) formed by ecological acts of micropolitical and microsocial dissent would cut across entire fields, bringing disciplines together in a new way, recreating them as some 'thing' else, so as not to give designer capitalism our unconscious consent. It is 'aesthetic' in the sense that the assemblages we are caught by are foremost affective forces that draw us in by the lifestyles offered that surround the 'agency' of the thing - the designer bottled beverage. 'We have to learn to make our thought traverse the interrelations and mutual influences between empty systems, the material world, social and individual relations' (Guattari 2000, p. 35). Water is the test case in this essay for such an approach; water as the *empty* signifier that holds the global eco-system in place - transparent, a source of renewal and rebirth, a blessing, a gift, and a human right - seemingly ubiquitous and abundant to those who have no need to be concerned about it, but progressively more and more under the control of globalized capital. Guattari's three ecological planes - the environment, social, and mental - form the remaining structure of this essay. I end with some projected conclusions where I attempt to project an assemblage of 'becoming water'

that riffs on Deleuze and Guattar's (1987) 'becoming-molecular,' which marks the conditions for the affirmation of a new subject position in relation to water and lays down a possible foundation for a different future regarding its value as a precious resource.

2. Global Politics of Water: Assemblages of the *Environmental Material Plateau*

Many analyses of the state of the global hydrocommons are sensitive to its decolonization via indigenous interventions. In this section, the shift is simply to a broad outline of what the Canadian geologist Jamie Linton (2010) charted as the 'modernization 'of water (or Modern water) to eventually achieve its current state where PET bottled designer water became the apotheosis of such a hegemonic ontology. This is to say, designer capitalism's ability to bestow an exclusivity on a certain brand of water that is differentiated from 'tap' water, as well as from rivers, lakes, streams that are utilitarian, pedestrian and possibly polluted. As Linton makes clear Modern Water was 'worlded' or enacted as a process by Lavoisier in his Paris laboratory as that abstract, measurable and knowable chemical compound that has been deterritorialized, universalized and uniformed to morph into Global Water as an abstraction that is to be (im)possibly managed as it now becomes a commodified and quantified resource part of the world's total hydrological stocks and flows. Modern water has now morphed into 'Anthropocene water' (Neimanis 2017). It is now projected as a way for 'global water governance,' marking the Third Water Age (Gleick, 2010), which follows the Second Water Age characterized by massive physical interventions in the natural hydrolytic cycles (The First Water age was simply when water was stored and taken when needed and available). The intensified engineering of water aptly describing the impact this has had on the globe, confirming the anthropogenic impact on the earth's hydro-cycles that jumps us into this Third Age. The Global Water Systems Project, a promotion video for a conference called, Water in the Anthropocene held in Bonn, Germany in 2013, (<https://www.youtube.com/watch?v=0-TduHRocw8>) provides the startling statistics for such dramatic changes: 800 million people live without safe drinking water, 2.4 billion lack adequate sanitation, and a further 1.7 billion live in areas where groundwater extraction is happening faster than the rate of replenishment. 48,000 large dams have been constructed worldwide that move more sediment than natural erosion and rivers. Two-thirds of all major river deltas are sinking while half of all wetlands in the world have been drained by human activity. Anthropocene water is not planetary NASA water. The frozen liquid on Mars presents yet another ontology, another imaginary

as to its futuristic properties, a cosmological engagement quite apart from what Lavoisier had started with the recognition that water was not its own element but composed of two hydrogen and one oxygen atom.

The four best-known major corporate players (Nestlé, Danone, PepsiCo, Coca-Cola) have global water control over the most precious of the four classical Greek elements: water, air, earth, fire. All have been commodified and controlled, if only by illusionary means. Earth, as territorialized land has been aestheticized and made open for sale as capitalist private property, designer soils proliferate for home gardening and agriculture, clay bodies for ceramics are in constant development; fire has been commodified through various technologies - from matches, BIC disposable lighters, to technologies of pyrolysis); air too has been packaged and compressed, its value as a resource magnified in India with the Covid-19 pandemic when no bottled oxygen was available to meet the need of their medical emergency. All this seems to take a backseat when it comes to water as global warming, where the continual rise of CO₂ levels has increased droughts, flooded, and dried up rivers, increased the rate of glacial melt, shrank wet-lands, and polluted water basins and lakes with trace pesticides, herbicides, heavy metals and plastics. The commodification of all these basic 'free' elements is inter- and intra-connected. Big agribusinesses (corporate farming) guzzle up most of the water through irrigation schemes that dam(n) up and drain river systems; raising cattle follows when it comes to inefficient land use and dung pollution in rivers and lakes. The San Joaquin Valley in California would return to desert conditions if it wasn't for irrigation schemes. Its vineyards and orchards would disappear. Add to this the burning of the Amazon rain forests that releases more carbon dioxide into the atmosphere by the mismanaged neoliberal economic policies of Brazil's Jair Bolsonaro. The Amazon Rainforest is now losing resilience as a sink for carbon storage (Boulton et al., 2022). The hydrologic rain cycle continues to degrade creating extreme flooding, not only in monsoon countries. All four life-sustaining elements are imploding, raising the earth's temperature. The global picture projected for 2050 is dire. Reassessing the United Nations World Water Development Report of 2018, Alberto Boretti and Lorenzo Rosa (2019) report shocking projected statistics that will see 6 billion peoples suffer from clean water scarcity. Their assessment of other ecological changes, especially to soils, grasslands and wetland areas is equally dire. This is to say nothing as yet of the oceans (acidity, plasticity and desalination).

In 1995, Ismail Serageldin the World Bank's President for Environmentally Sustainable Development said that "the wars of the next century would be over

water, not oil" (<http://www.serageldin.com/Water.htm>). UN Secretary General Kofi Annan, six years later, stated in a press release to the Association of American Geographers that "fierce competition over freshwater may become a source of conflict and wars in the future." Ban Ki-Moon, his successor, in a *Washington Post* editorial, wrote: "Darfur is an environmental crisis a conflict that grew at least in part from desertification, ecological degradation and a scarcity of resources, foremost among them water." The *Dune* scenario, directed in 1984 by David Lynch based on Frank Herbert's 1965 sci-fi novel, is already with us as protests and skirmishes to make water an environmental human rights are in full force extended to rivers. The paradigm case, often cited, is New Zealand granting the legal status of personhood to the Whanganui River, a recognition of the Māori social relations to it as a living 'being,' as well as "recognition of its elemental and cultural value" (Hawke 2022, p. 6). This is (arguably) an example of how "decentering the role of humans in water governance involves acknowledging the rights of water itself" (Wilson and Inkster, 2018, p.531). Such a relational ethics of the Ngai Tahu's (a Māori *inwi* tribe) engagement with the Hurunui River in Aotearoa, New Zealand has been articulated by Amanda Thomas (2015, 2017), and is taken up in the next to last section of this essay. In the Canadian context, Green leaders such as Maude Barlow (2005) helped found the Blue Planet Project (<https://www.blueplanetproject.net/>) (BPP), an initiative by the Council of Canadians. It is an organization committed to supporting global grassroots struggles for the right to water under the slogan "water is life." BPP is part of the 2022 Alternative World Water Forum to globally seek for water justice. The Canadians Maude Barlow and Tony Clarke (2002) were involved in the Blue Gold initiative that raised awareness of the corporate theft of the world's water by the 'big four' companies. Clarke (2007) went on to write the first comprehensive attempt to critically analysis the social, political, and environmental impact of the bottled water industry in Canada and the United States (*Inside the Bottle*). He became the founder and director of the Polaris Institute, organizing conferences and meetings to draw public awareness through articles and public speaking as to what is happening to water rights globally. Fortunately, there are legitimate organizations like the Earth System Science Partnership (ESSP) (<https://www.essp.org/>) who have a comprehensive reach with other organizations for a future earth, projects that include water issues (Global Water System Project - GWSP) and Monsoon Asia Integrated Study (MAIRS) as well as projects regarding carbon, food and health.

Such committed leaders are invaluable, but it was a 'lowly' Bolivian machinist-turned-union activist, Oscar Olivera, who, in protest at water privatization in his country ("Cochabamba Water Wars") organized La Coordinadora de Defensa de! Agua y de la Vida' and started the *first* water war in the year 2000 against the World Bank and Betchel, a giant San Francisco engineering company (Olivera and Lewis, 2004). Latin America has been the site of the most intense struggles against the privatization of water since the so-called "Washington Consensus" model of development that advocated the wholesale adoption of deregulations, privatization and unregulated free trade (Barlow and Clarke, 2002). In the 1980s, the World Bank targeted the developing countries of Latin America to adopt these neoliberalist policies in exchange for debt relief. Foremost, in Argentina under the public privatization policies of President Carlos Menem, and then in Bolivia, Brazil, and Uruguay, the privatization of water has caused nothing but grief. In the Peruvian Andean Highlands similar clashes between differing water ontologies take place: Andean societies 'hydrocosmological cycle' is at odds with the governmentality that is being imposed on them (Boelens, 2014). Climate change has further intensified such ontological disjunctions in the Peruvian Andes (Stensrud, 2016). We now weep for the devastation of Amazon rain forests and the indigenous peoples whose cultures are being obliterated.

Perhaps a paradigm example of water justice is the case of India. A five-year protest and struggle by the community of Plachimada in Kerala against Coca-Cola, who set up a bottling plant in the year 2000 sets the scene (Berglund and Helandser, 2015). Within a year, the groundwater started to decline and the wells became polluted. Despite the protests and the support of the local government, which denied the renewal of the plant's license, Coca-Cola was able to have this decision overruled in 2005 by two judges of the same court who then enabled Coca-Cola to have use of the water over the local government's right to regulate it. The state government took its appeal to the Supreme Court. Finally, on August 9, 2006, the Supreme Court of India ruled in their favor. The government of Kerala was able to ban the production of Coca-Cola and Pepsi in the state as it was also found that the bottled soft drinks contained pesticide residues 24 times higher than the European Union standards and those proposed by India's own Bureau of Indian Standard (BIS). Many states across India followed suit. In 2017, over a million traders in India boycotted 'fizzy drinks' including Coca-Cola and Pepsi for exploiting the country's water resources to manufacture their bottled drinks. However, that is perhaps only the start of the story, since Coca-Cola rallied as mentioned earlier, with their campaign of 'giving every drop back' (<https://www.coca-colacompany.com/sustainability/water-stewardship>)

although, by all accounts, this is a myth, as Arjen Hoekstra, the creator of the water footprint, showed before his sudden death (MacDonald, 2018).

South Africa is one more continent to end this section on Guattari's global environmental plateau where the abstraction of Global Water is in play. Since apartheid ended in 1994, it has also become a hotbed of civil unrest, especially in Soweto in 2000, as the poor were unable to pay for the water at prepaid water dispensers. Every Afrikaner household in Johannesburg was then allowed 6000 liters of 'free' water per month. After that they had to pay for it. Even if people couldn't pay, the constitution guaranteed them a minimum of water to sustain life. The Suez water company met this obligation by installing water pipes known as '*tricklers*,' a suitable name for taps that drip water a drop at a time 24/7 to fulfill this mandated law of survival, frustrating the collecting of water (Docherty, 2006). Patrick Bond (2020), for example, examines the sanitation rules and regulations that emerged due to drought conditions, focusing on Durham as a paradigm example to find the 'perfect toilet.' The situation worsened in 2018 when South Africa was hit with a terrible drought. Three years of drought left Cape Town on the verge of an unimaginable abyss. In March of 2018, Cape Town was going to be the first city to run out of drinking water: 'Day Zero,' as it was called, the point where the municipal water supply was to be cut off. Its citizenry was asked to cut half of their already reduced water consumption from 50 liters per day to 25. The good fortune of rain and citizenry efforts to institute water saving measures staved off the day's coming by consciously changing habits of water use. Water saving initiatives meant 2 min. showers, flushing toilets only when necessary, reducing the city's water pressure, recycling water, redirecting farming water into the city, and no more swimming pools! As a result of this near disaster, the Institute of Water Modelling (IWM) now tries to establish a universal set of ethical principles making water subject to 'common' ownership and not the marketplace. IWM became committed to the equal distribution and conservation of water since it is no longer a renewable resource, a global institution which wants to maintain water quality and democratize it in the hands of communities and not governments nor corporations.

3. The *Social Relations* Plateau of Water Assemblages

The theme 'water is life' appears to be an all-pervasive catch phrase when it comes to Global Water. This becomes a 'contested zone' to forward an ecological economic message to secure the support of NGOs as well as 'ethically branded water' companies so that consumers can donate as well as 'drink' with a good

moral conscience, knowing that part of the company's profits will be directed toward water-related charitable causes. These marketing strategies, referred to as cause-related marketing (CRM) are an old ploy to offset intense negative publicity that the industry has had with its PET bottle pollution. Like Coca-Cola's 'give back every drop' campaign, Buying Thirst Aid Water means knowing that a percentage of their profits are directed to clean water projects in Africa or Asia. Bottled water as a political object in this assemblage is complex since this niche sector of designer water is small in comparison to the big four companies mentioned above. 'Ethical water' is usually started by people who have a clear moral agenda and passion to make a difference. Peter Gleik (2010, p.163ff.), for example, provides the background that drove Peter Thum to start Ethos Water and Kori Chilibeck to found the Canadian company called Earth Water. Chilibeck introduced a corn-based biodegradable bottle in 2007, claiming to donate 100 percent of its net profits to developing countries. Charting a CEO's personal narrative becomes part of the brand itself, as does disseminating statistical data, images of impoverished African villages, celebrity endorsements as ambassadors, business sponsors and NGOs. Gleik provides a list of 'ethical bottled water' along with a summation of their charitable contributions, websites, activities and the countries of origin: the three being UK, US, and Canada. Examples include: Frank Water, One Water and Global Ethics, Belu Spring Water, Aquaid Ltd., Ethos Water, Earth Water International, Thirsty Planet, Athena Bottled Water and Nika Bottled Water). Gay Hawking et al. (2015, p.193) discusses corporations who engage with Cause-Related Marketing (CRM), such as the Australian company Mount Franklin and Coca-Cola Amatil (CCA). These two-business models intentionally make themselves ethically visible to show off their 'good work,' biopolitically and socially when it comes to global water issues. Such a strategy of green capitalist practice of 'social responsibility' mimics Coca-Cola's 'drop' campaign style.

In relation to Guattari's ecological call for a dissensus, the attempt here is to refigure political action by explicitly providing the consumer with a moral choice rather than simply refusing wholesale to drink designer water or to position choice as a purely individual calculation. Consumption becomes a virtue, of generosity, and the concern for the Other. One Water has the slogan: "When you drink One, the world dinks too." Duncan Goose, its CEO states: "People have recognized that water is water; why wouldn't you opt to buy a brand that changes people's lives? [...] These ethical brands enable consumers to make political gesture without effort *and* without explicitly identifying with an activist counterpublic; these gestures also offer translocal connections and scale shifting: choosing here reverberates there" (Hawkins et al., 2015, p. 191).

There is a downside to this. In Astrida Neimanis' (2017, 178-179) view, charitable organizations like WATERisLIFE (<https://www.waterislife.com/>), whose mission is to provide clean water, sanitation and hygiene programs focused in Africa, end up repeating racist discourses of white saviourism of gendered brown bodies. While the UN Conference on Sustainable Development campaign: 'The Future We Want: Drop by Drop' does much the same through its call for Drop by Drop Image contest. The winner's (!) copy reads, 'Wasting water will kill the future/Change begins at home.' The image "featured a hand (the body out of view) holding a blue (water?) gun, pointed at the head of a white, cherubic baby [an image] drenched in heteronormativity and family values, saturated by straight time and a progress narrative of messianic future orientation" (Neimanis, 2017, p.181). The issues with the bottled ethical water are more subtle as they coverup or 'erase' the consumption of a 'demonized product' by empowering the consumer to make a 'choice' which is 'no choice.' Which is to say, the informed consumer citizen is said to make the 'better' choice rather than not choosing designer water at all to feel that something worthwhile is accomplished. The obvious 'truth' is that it seems ridiculous to pay for designer water when you can get it 'free' from the tap, *but*, then you are not given an opportunity to help solve the World Water Crisis. You are not part of the 'solution.' If you *are* going to drink bottled water, then make a *difference*. In this way the unsustainable market-based practice of designer water remains intact.

A variant of ethically bottled designer water, often mentioned for its usual affective impact, also performs a dissensus but one, like the above examples, 'claws' back its effects and offsets the often contingent and situational anti-bottle activism. It specifically targets the single-serve PET 'bottle' as the source of plastic environmental devastation. Anti-bottle campaigns problematize any clear distinction between consumers and publics as they appeal to both at once. Gay Hawkins et al. (2015, 149ff) reviews the anti-bottle activism of the Polaris Institute, mentioned earlier, a Canadian NGO (<https://www.polarisinstitute.org/>) whose campaign slogan, 'Inside the Bottle' has proven to be resilient and effective. Do Something, an Australian-based organization (also known as the Bottled Water Alliance) ran a campaign centered on bringing back water fountains into vogue at pedestrian malls. The new assemblage around state-of-the-art water fountain technology that facilitated easy refilling of pedestrians' own bottles enabled a public 'commons' to be established, a new habit of sharing a resource that reevaluated public drinking water and drastically reduced the buying of bottled water as the act of drinking from the same 'well' established a new ethical public space.

In terms of dissensus on the social scale, it is Brita's 2008 Filter For Good Campaign (<https://www.brita.com/intl/>), which has drawn the most attention, and is often cited in the literature for its impact. It alone has been able to change dramatically the perception of the materiality of the PET bottle, its material contents transformed in its campaign to promote and sell water filters. Its advertisement campaign can be seen as an *assemblage breaker*, an ontological disturbance (or n-1), as it generates an affect which metamorphizes the PET bottle onto an object of affect. The image is that of an ambiguously young man wearing a white-T shirt or an ambiguously young girl wearing a White-T string top drinking oil, which is flowing from their mouths on and down their T-shirts as if they were vomiting it. The text is blunt and matter-of-fact as it states statistically the amount of oil used to make the plastic water bottle. The consumer is asked to make a virtuous choice between filter use or, again, a single-use bottle. When viewers were directed to the Brita water filter company site the information reiterated the anti-bottle activism as to plastic hazards. The invitation was to 'take the pledge' to use filtered water rather than PET bottles as the more sustainable drinking choice. Bottled 'pure' organic water was transubstantiated into oil, collapsing the imaginary life-worlds as constructed by the industry. Oil becomes 'magically' the abjected substance that was disguised as plastic. It has been unveiled for what it is (Hawkins, 2009).

The ambiguity between the politics of consumption and the politics of public 'good' appear as this human-nonhuman assemblage presented the 'matter' of plastic in another unexpected associative form that carried its effect as a pollutant. It all weighs down on the Anthropocene, quite distinct from the critical campaigns of the Polaris Institute, which relies on statistics, experts, scholarly articles, and conferences for its informational appeal to empower an issues public. As Hawkins (2011) maintains, Brita's campaign is a paradigm example of a 'hybrid-market' forum that mobilizes the affective modulation of vital materialism (cf. Bennett, 2009; Connolly, 2017) creating in the process an 'infrapublic'. Like the ethical bottle business model, Brita's advocacy for the use of water filters is able to get a market share into the industry and gain superiority by amplifying the uncertainty about the quality of tap water, in many situations, not an unreasonable justification when it comes to excessive amounts of iron and calcium. A Take Back the Filter campaign (<http://www.takebackthefilter.org/>) was launched against Brita in Canada, which ended up Brita recycling its filters by teaming up with Preserve Company that recycled plastic products. As such, it restructured its campaign by pulling the ads and generating a number of videos to promote its anti-bottled water pledge.

4. Mental Ecological Plateau; *Multiple Water Ontologies*

In his chapter on 'hydrolectics,' Linton (2010) outlines the practice of social hydrology that "conceives of a water process out of which particular instances of water get fixed or instantiated in social relations" (p.223.) Hydrolectics is a recognition of how a particular assemblage is formed around an imaginary that shapes a particular ontology as to what water 'is.' In other words, water as an empty signifier is imbued with particular values and qualities. Elsewhere Linton (2019) writes: "Publicly-owned and managed water system is constitutionally different from the commercial water distributed and sold in individual bottles" (p.54). In one sense he is right, and in another sense, he is mistaken. If there are 'multiple ontologies of water' (Yates et al., 2017) with multiple assemblages that are formed through the desire that holds a particular ontology or 'worlding' together then the complexity of the hydrocommons has increased. Throughout this long exposé on designer water and its affective force in relation to the larger Global Water crisis the political and ethical issues are always in play in the assemblages of 'water worlds' that are formed (Barnes and Alatout, 2012; Hastrup and Hastrup, 2016). In this section the difficult question concerning the indigenous relationship to water needs to be raised as issues of postcolonialism imbued throughout the Anthropocene are vividly exposed (Sundberg, 2014). This comes towards the end of this paper as it directly confronts the difficulties of 'multiple ontologies of water' (often referred to as the 'anthropological turn') that are on display throughout the journey I have taken. The clash between indigenous 'being-with-water' as opposed to Modern Water (Hawke and Spanning, 2022; Linton, 2010) as a natural source to be managed or commodified is not about to go away, and it forms a global struggle for water governance by indigenous peoples with the grounding of UN Declaration on the Rights of Indigenous Peoples (tellingly and shamefully abstained by Australia, New Zealand, Canada and the US at the time, 2007). Marlowe Sam and Jeannette Armstrong (2013) provide a succinct overview of its grounding and the global struggles over water rights and governance that have taken place since, which is constantly evolving.

The recognition of a 'multiple ontologies' position confronts any possibility that there is one overarching ontology that would make manageable the global crisis of water. Julian Yates et al. (2017) outline this difficulty by referring to ontological processes that shape the hydro-ontological contestation of water governance within the province of British Columbia, Canada, opening up ontological conjunctures and disjunctures between provincial (settler-colonial) regulations and indigenous 'water-as-lifeflood,' described by a place-based, rights-producing ontology. Aboriginal elders describe water as 'earth veins.' It is a 'living being,' a

more-than-human entity with its own agential character. “The Elders believe water is alive or biotic. It has a living spirit [...]. Water still has [...] a special fundamental place in the First Nations’ ecosystem—it is at its heart, since it provides the “blood of life”” (Blackstock, 2001, p. 12). Such an ontology enhances rather than undermines drinking water requirements. It prioritizes source-water protection against its pollution and mistreatments. In this view, there is no ‘distance’ to be had cognitively and spatially as to its source, completely opposed to the Modern Water notion of ‘end-of-the-pipe’ treatment. Nicole Wilson and Jody Inkster (2018), in a further study, provide a ‘political ontology’ of four Yukon First Nations in the Canadian North to ‘decolonize water.’ Through interviews with no less than 27 elders, they elaborate how the term ‘respect’, along with responsibility, reciprocity and relationality define the values that govern their being-with-water, and the ceremonies which reiterate such a relationship confirming that water is ‘more-than-human person’ (p.517). This ontological turn has generally ignored intracommunity, and, in particular, intergenerational differences, as it is most often elders who possess traditional knowledge. There are several attempts to specify women’s roles as Elders in water ontologies (Anderson et al., 2013; Blackstock, 2001), something which raises unexplored questions as presented below.

The literature is extensive and far reaching when it comes to the tensions between indigeneity and settler ontologies. What is striking is how to approach the complex diversity of multiple indigenous ontologies without overly generalizing. This suggests that the ‘singularity’ of a “kincentric’ ecological assemblage (Salmón, 2000) provides perhaps the ‘safest’ response to grasp the changing forces and relationships in play. Often such specificity of situatedness that avoids any overreach quickly extends to the necessity of nothing less than the recognition of equal nationhoods, furthering any easy resolutions as there are none to be readily had. The tendency of scholars who do not identify themselves as First Nations (a term used in the Canadian context which includes Métis and Inuit (oddly the Dene Nation is rarely mentioned), Aboriginal, or Indigenous (as used by the UN charter) tend to be upfront in their disclaimers as the identity politics are difficult to negotiate. They proceed cautiously, navigating their positions of reconciliation. Those scholars who belong to the *minoritarian position*, in Deleuze and Guattari’s (1987) terms, which is not attributed to numbers but to resistance and struggle, qualify representational specificity of their identity by land, treaty, tribe, and clan as a point of pride and honour in relation to their ancestral heritage. It is in the ‘messy’ space of in-between these ontologies where gains and losses over water rights are made. In the literature of reconciliation around water there are attempts made to see where the mutual conjunctions between ontologies can take place

so that a mutual respect can take place. Co-management is the usual solution, which requires mutual co-learning. The interconnections of ontology happen where water-as lifeblood overlaps water governance approaches that are based on watershed and source protection rather than the end-of-pipe technologies. This solution to achieve sustainability of drinking water and does not disturb the question whether water is an 'animate being.'

We now arrive at the more moot questions regarding these multiple ontologies. The 'new animism' (e.g., Abram, 1996; Harvey, 2005) 'rights of nature' that has emerged is criticized by many indigenous-Métis scholars who accuse this development as a form of appropriation (Todd, 2016), but there are attempts at reconciliation (Rosiek, et al., 2020). Further, the vitalism that is pervasive throughout the posthumanities, so-called 'new materialisms,' has been (as shown) cleverly appropriated as the 'vitalism' of life itself - for health - as peddled by designer water. *This is not a question of kind but degree and is consonant with 'water-as-lifeblood'.* Fundamentally, multiple water ontologies present ethico-political choices with water's 'agential' force changing in each assemblage chosen. The water rights activist, Josephine Mandamin, an Anishinaabe elder, celebrated as the "Grandmother Water Walker" for her hydrosocial practice around Lake Superior as the gesture of 'responsibility' to Mother Earth as a giver of life, had a very specific order of ritual daily enactments. In water management laboratories around the world who carry out experimentation with Modern Water, a specific order of ritual enactments is carried out as well, especially when it comes to experimental nanotechnologies for drinking water. To extend this to designer water, there are also laboratory protocols for developing better disposable plastic bottles, or reusable ones which use less plastic (e.g., Vittel® GO system). The point being that ontological difference in thought and belief is not intrinsic to the person or the 'thing' itself. The relations and *performative* practices of the assemblage (the apparatuses included as in the protocols of ritual be it in the laboratory, a NASA experiment in search of water in space, or a lake 'walk' where a specific copper pail is used, tobacco ritually offered, and an eagle staff daily cleaned) is what 'matters.' Epistemologies (traditional 'knowledge', scientific 'knowledge') pervade these ecologies, as do both an ethics and an aesthetics. The assemblage 'creates' the 'thing' (water), in each differently. Yet neither indigenous peoples nor scientists know entirely just what water 'is.' There is only the belief in its impact on health and survival as performed in the embraced assemblage. That said, the *materiality* of water (as Nature) cannot simply be dismissed: it 'is' after all an 'entity' of some sort, which cannot be grasped or fully known. To dismiss this claim leaves us with 'floating' (groundless) simulacra: be it Jean Baudrillard's (1975) variety or Karen Barad's (2007) 'agential realism,' or as 'powers of the false' as

Deleuze (1989) would say. So, we are indeed 'left' with a cosmological question pervasive throughout the Anthropocene: How are we to live on this planet in relation to 'entangled' Nature? An ethical and politically contested question that will not go away since it is fundamental to the problematic of this era.

5. Becoming Water?

As an educator for art and media pedagogy, I am compelled to end this essay in a hopeful direction rather than leaving the reader on the cliff of the closing sentence of the last paragraph. Pedagogically the task is to compel a change in the visual imagination and symbiotic attachment to water. In other words, to intervene in the established assemblages in such a way so that a wider attunement is possible to other assemblages which open up and provide new qualities and characteristics of water in new contexts. This is not to say any one of us are able to 'escape' from the assemblages that already define us. "Becoming indigenous" has raised the ire of First Nations as yet other forms of appropriation (Chandler and Reid, 2019). Rather, a *positionality* is required where learning happens from the 'outside' by attuning to ontological differences that affect us so as to be able to go 'outside' ourselves. This is to follow Deleuze's (1997) Nietzschean materialism; 'to be done with judgment.' It becomes a question of feel and aesthetics to sustain conflicting views of water ontologies.

Such a position of attunement to the assemblages that one is embedded in and to other assembles of possibility are what I would call 'becoming water' (following Deleuze and Guattari's 'becoming animal, 1987). But there is a danger here. 'Ecology,' Guattari wrote, 'must stop being associated with the image of a small nature-loving minority or with qualified specialists' (2000, p. 52). Mystical nature, as a re-enchantment of the earth, can be marshaled as a 'countering discourse' (see Cohen, 1994; Conley, 1997) to the Romanticization of Nature as mobilized by the designer companies, but to what degree? The new 'science' of animism makes evident that water in trees contracts and responds to lunar cycles. Its crystal make-up will change according to different kinds of music that are played. Angry talk at water engenders a different crystal formation, while plant life and its colors change according to the molecular crystal formation of the water that they drink. Such anthropomorphic thinking enables one to imagine what is going on when coral reefs become bleached and lose color as instances of environmental 'suffering.' Such 'mystical' findings require us to pause in the way natureculture are intimately woven in the strange way deep ecology and indigenous people's intuitive understandings meet in the recesses of unknowable Nature.

'Becoming water' allows the human to imagine life from an inhuman perspective as 'impersonal matter,' physiologically changing our bodily feeling towards how the 'outside' affects us. To 'see' in Deleuze's Nietzschean sense is to experience the moment of learning as an attunement to the disruption taking place to one's material entanglement; it means to suspend judgment of those instincts and aims before acting on them. This requires experiencing the 'impersonality' of ourselves rather than simply affirming who we already believe ourselves to be (see Orlic, 2010). The Swedish eco artist Henrik Hakansson (Andrews, 2004), influenced by Deleuze and Guattarian theory, attempts to decenter human perception through installations like Sweet Leaf (2000) where alliances with the non-human (in this case birds and insects) are formed. By calling on a wide range of eco-artists who are generating enormous amounts of exemplary performances and installations to help sensitize the public specifically to the water "issue."

The greenmuseum's website (greenmuseum.org) yields an astonishing array of practicing artists from all over the world whose multiplicity in their singularities form a 'becoming water' sensibility. Many specifically work with water - be it with oceans, beaches and fishes, bacteria, stream systems, ponds, river systems, wetlands, and deserts where water is lacking. This host of artists offers many ideas for site-specific installations, agit-prop performances and ritual approaches to water as stepping-stones for opening the environmental imagination to the 'multiple water ontologies' that are in circulation within multiple assemblages. Educators can utilize this 'multitude of visions and approaches' to further students' sensibilities to dissolve the natureculture divide in the search for a more symbiotic, gentle and complex vision for the Anthropocene. This has already been the initiative by early childhood educators who now use the moniker 'childhood-nature' to forward their pedagogical initiatives (Cutter-Mackenzie-Knowles et al., 2020). Such an array of artists also counters romanticized nature and introduces new imaginings and new fantasies as to surrounding an ethical and political relationship with the earth's ecospheres, counteracting the new exotic fantasies to market water that are equally available. Richard Wilk (2006), for example, had 25 marketing professionals at a major U.S. business school generate brilliant new exploitative possibilities for designer water within the brief time of fifteen minutes! This *studium* approach (I am using the German word to suggest that the studio must be contextualized to social issues and concerns outside the confined space of the artist's work-place and the school room) is one part of a necessary two-part approach to 'ruin' the representation of water developed by designer capitalism.

While this pedagogical turn establishes counter-possibilities as to our relationship with water, it is necessary that a further pedagogical strategy be developed alongside it so as to directly attack the symbolic system, to empty it of desire and further ruin representation. This second pedagogical tactic is the obvious semiological deconstruction of idealized Nature (the patter) as represented by the design of the labels, on designer water Internet sites, the pseudo-science that surrounds the processes, and so on. But more specifically, it must combat the *technological imagination* (more pointedly the *technocratic imagination* and the symbolic capital it offers) that has been set up as a solution to global warming and Global Water management. It seems that such a task has only just started.

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Author

jan jagodzinski, Emeritus, University of Alberta, Canada. jj3@ualberta.ca

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Water management: pragmatic and ethical issues for species-inclusive and sustainable water policies

Helen Kopnina, Veronica Strang

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1. Introduction: ‘nature needs half’ movement and water
2. Nature needs half
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6. Conclusion

Keywords: biodiversity; Half-Earth vision; marine and freshwater conservation; “nature needs half” (NNH); non-governmental organizations (NGOs); re-imagined communities; species-inclusive; water management.

Abstract. *The Leaders’ Pledge for Nature highlights the fact that since ecosystems underpin human well-being, we need to “recognize that the business case for biodiversity is compelling”. In this article we argue that, in all areas of water management, there is an urgent need for a paradigmatic and practical shift to species-inclusive and sustainable water policies and practices. We believe that policies prioritizing human interests inevitably promote unsustainable forms of water management and use. This article outlines an alternative vision based on the “Half-Earth” (Wilson 2016) perspective,*

emerging from the “nature needs half” or NNH movement. NNH researchers state that to maintain viable long-term populations of most of the Earth's remaining species, approximately 50% of landscapes and seascapes need to be protected from intensive human economic use. However, while terrestrial conservation measures are prominent in the literature, a Half-Earth, of fresh and sea waterscapes is rarely discussed. Our article addresses this omission. We ask what species-inclusive policies and practices in marine and freshwater conservation would look like? If government policy-makers direct spending towards sustainable fishing, for example, how can this align with a focus on marine biodiversity? How can an ecocentric view tackle the illicit finance involved in illegal fishing? How do we marry up existing conservation policy, which is people-centric, with ecocentric 'nature positivity'? We reflect on possible implications for ecocentric water management and sustainable water policies and practices from examples of non-governmental organizations (NGOs) Sea Shepherd and Greenpeace. We also note the potential for Strang's proposed 're-imagined communities' approach to be applied to river catchment and marine management, providing a conceptual model for rebalancing wider decision-making processes to include non-human needs and interests.

1. Introduction: 'nature needs half' movement and water

The International Union for Conservation of Nature (IUCN, 2022) and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES, 2019) have made it clear that, with increasing anthropogenic pressures on the environment, biodiversity loss, both on land and in aquatic ecosystems, has been accelerating rapidly. On 28 September 2020, a *Leaders' Pledge for Nature* was issued. Representing 64 countries from all the world's regions and the European Union, the heads of state promised to “step up global ambition for biodiversity and to commit to matching our collective ambition for nature, climate and people with the scale of the crisis at hand” (<https://www.leaderspledgefornature.org>). The pledge also highlighted the key drivers of the environmental crisis and the interdependence between ecological degradation and a decline in social and economic wellbeing.

We are in a state of planetary emergency: the interdependent crises of biodiversity loss and ecosystem degradation and climate change - driven in large part by unsustainable production and consumption - require urgent and immediate global action. Science clearly shows that biodiversity loss, land and ocean degradation, pollution, resource depletion, and climate change are accelerating at an unprecedented rate. This acceleration is causing irreversible harm to our life support systems and aggravating poverty and inequalities as well as hunger and malnutrition. Unless halted and reversed with immediate effect, it will cause significant damage to global economic, social and political resilience and stability and will render achieving the Sustainable Development Goals impossible.¹

Further, the *Leaders' Pledge for Nature* highlights the fact that since “nature fundamentally underpins human health, wellbeing, and prosperity”, we need to “recognize that the business case for biodiversity is compelling”. Put in monetary terms, the “benefits of restoring natural resources outweigh the costs ten-fold, and the cost of inaction is even higher”.² This collective pledge demonstrates that governments and non-governmental organizations (NGOs) are trying to develop a vision of what “nature positive” conservation would look like. But it remains wedded to the assumptions about sustainability articulated in the Brundtland Report (1987) and more recently in the United Nations’ Sustainable Development Goals (SDGs).³

The concept of sustainable development is also fundamental to the UK Government’s recent Foreign, Commonwealth and Development Office report (FCDO, 2022), stating that the primary purpose of preserving or restoring the environment is for people’s welfare and poverty alleviation. On a similar note, in relation to water, Palma (2017) emphasizes that marine biodiversity “is a critical aspect of all three pillars of sustainable development - economic, social and environmental - supporting the healthy functioning of the planet and providing services that underpin the health, well-being and prosperity of humanity” (p. 001)⁴.

In practice, however, the focus on human economic development and economic growth, which is central to the SDGs, has often meant increased production and

¹ <https://www.leaderspledgefornature.org>

² <https://www.leaderspledgefornature.org>

³ <https://sdgs.un.org/goals>

⁴ Meulenbergh et al. (2022) also address these three factors through the lens of interdisciplinarity in this special issue (*Visions for Sustainability*, 18, pp. 11-36).

consumption of natural resources (Kopnina, 2020). Over an additional billion people have been born between the nineteen eighties and the time of writing this article. Yet sustainable development policies have been woefully and consistently inadequate in addressing biodiversity loss and habitat destruction (IPBES, 2019; Ceballos, Ehrlich and Raven, 2020; IUCN, 2022).

Biodiversity loss in marine environments has often been framed in anthropocentric terms, for example highlighting the coral reefs' demise and its impact on the tourist industry, or declining fishing stocks, with marine high temperature extremes amplifying the impacts of climate change on fisheries (Cheung et al., 2021). An even greater problem has been the loss of marine species that were not economically valued, but merely sacrificed as bycatch.⁵

This is not merely a matter of economic loss: it raises a question as to whether multi-species flourishing is even possible in the context of human development. Marine biologists studying changes in aquatic environments have long noted that in order to reverse ocean acidification, degradation of coral reefs, water pollution, or loss of fish populations the driving anthropogenic causes of decline need to be addressed (e.g., Doney et al., 2009; Good et al., 2020). To achieve multi-species flourishing in the context of water habitats it is necessary to redirect biodiversity conservation spending to support “nature positive” approaches (FCDO, 2022). This means, according to The Global Goal for Nature (naturepositive.org), reversing the current declines in biodiversity so that species and ecosystems can begin to recover. As social scientists have observed, these require changes in values and behaviour (e.g., Stern and Dietz 1994; Dunlap and York 2003). In line with this emerging scholarship, we argue that to address biodiversity loss it is necessary to shift away from a focus on economic benefits towards more nature-inclusive non-anthropocentric approaches (Washington, 2018; Taylor et al., 2020; Piccolo et al., 2022).

2. Nature needs half

Conservation biologists, as well as other scientists, including social scientists, have maintained that to sustain viable populations of most of Earth's remaining species we need to protect approximately 50% of all lands and waterscapes from intensive human economic use (Noss & Cooperrider, 1994; Locke, 2014; Kopnina, 2016b; Cafaro et al., 2017; Crist et al., 2021; Kopnina, Mahammad and Olareru, 2022). Popularised by the late biologist Edward O. Wilson (2016), the

⁵ <https://www.worldwildlife.org/threats/bycatch>

“nature needs half” (NNH) movement is committed to ecocentric ethics (Taylor et al., 2020; Crist et al., 2021; Piccolo et al., 2022), new interspecies relational arrangements that reject anthropocentrism (Strang, 2017, 2021, Wallach et al., 2020), and better resolutions of anticipated conflicts between human and non-human needs and interests (Crist et al., 2021).

NNH is grounded in basic principles: that all living beings have intrinsic value; and that all species have a right to continued existence, free from anthropogenic pressures; and that there is a need to recognize that habitat destruction is the leading cause of biodiversity loss (Noss & Cooperrider, 1994; Locke, 2014; Kopnina, 2016b; Cafaro et al., 2017; Crist et al., 2021). NNH expresses three main tenets: (1) habitat loss and degradation are the leading causes of biodiversity loss, (2) current protected areas are not extensive enough to stem further loss of biodiversity, and (3) it is morally wrong for our species to drive other species to extinction (Wilson, 2016). These principles generate an urgent imperative to set aside much more habitat to preserve other species, and conservation biologists agree that a majority of Earth's existing species will not survive unless we do so. NNH scholars argue that intraspecies justice should not come at the expense of interspecies justice (Cafaro et al., 2017; Kopnina et al., 2018; Crist et al., 2021). This applies to all species whether they depend upon terrestrial or water habitats, but this article particularly focuses on water, as water is as essential for terrestrial species as it is for life in marine and freshwater environments.

If we move towards approaches that “explicitly include ecocentric values and peoples' moral obligations to nature” (Piccolo et al., 2022), it is necessary to reflect on how to square this commitment to uphold non-human interests with a still urgent need to address human poverty and deprivation. For instance, if government policy-makers direct spending towards sustainable fishing, how does that align with a focus on marine biodiversity? How can an ecocentric view tackle the illicit finance involved in illegal fishing? How do we marry existing conservation policy, which is people-centric, with ecocentric “nature positivity”?

This raises an important point: that even a shift across to ‘ecocentric’ thinking fails to challenge the intrinsically dualistic assumptions that human and non-human kinds inhabit separate domains which are fundamentally alienated from and in competition with each other. Basically, anything that divides ‘eco’ and ‘anthro’ can be problematic, and that ‘ecocentric’ implies a swing of the pendulum to the other ‘side’ even if its proponents do appreciate that there are no ‘sides’. But it is perennially difficult to get away from a separate “human” category of human. Economic development and nature conservation are often presented as a trade-off, or at best as complementary. It is this alienation, this

vision of separation, that permits the “externalization” of the costs of human activities to the non-human domain, and it is compounded by the unequal assessment of the value of the latter and the dominance of anthropocentrism, which positions humankind as not only separate from but also “above” a non-human world (Wallach et al., 2020; Piccolo et al., 2022).

So, while there is a strong case for a compensatory ecocentric bias to restore the well-being of non-human species in terms of policy and practice, we need, ultimately, to gain mainstream acceptance of conceptual models that acknowledge that human and non-human kinds inhabit and co-create a single, shared world that is materially and conceptually indivisible. In this sense, although dividing the world into a ‘human half’ and ‘half for nature’ is a useful heuristic device for underlining the need to protect habitats sufficiently to support biodiversity, it carries some risk of affirming the nature-culture dualism that undermines these goals. It is therefore important to stress that the NNH movement is not aiming to divide the world into human and non-human reserve areas, but with creating a balance that protects sufficient – i.e., half the world’s – living space and resources for non-human species to be sustained within a whole, interdependent world. This is particularly important in the case of water management. In writing this article, we consider the concept of “management” that mimics the preferred language of the United Nations and the *Leader’s Pledge for Nature*, to refer to pragmatic and practical implications of what ecocentric water sharing would look like.

3. Water management: examples from NGOs and lessons for NNH

Since the *Leaders’ Pledge for Nature* highlights the “business case” (as they phrase it) for biodiversity conservation, the question of management comes to the fore. While NNH has ambitious plans, it still needs to develop the agenda for biodiversity in both terrestrial and marine as well as fresh water. How it might do so can be illustrated here by the case of water management by environmental non-government organizations (ENGOS) Sea Shepherd, and Greenpeace, who deal directly or indirectly with marine or freshwater biodiversity protection. Sea Shepherd and Greenpeace fit within the larger ENGO movement, including the World-Wide Fund for Nature (WWF), and Friends of the Earth, who have long focused on increasing awareness and encouraging individuals to take consumer responsibility for their choices in terms of consumption.

In business terms, marketing is often attached to the idea of selling a product or service to people: it is therefore not just anthropocentric, but economy centered.

However, as non-profit organizations, NGOs emphasize a different type of management practice, acting as advocates for certain causes and neglected populations. Rather than selling a product or a service that the buyer will use, they allow citizens to invest in issues that are important to them (Andreasen and Kotler, 2008, p.6). For years it was seen as inappropriate for non-governmental organizations to act as managers:

Twenty years ago, management was a dirty word for those involved in nonprofit organizations. It meant business, and nonprofits prided themselves on being free of the taint of commercialism and above such sordid considerations as the bottom line. Now most of them have learned that nonprofits need management even more than business does, precisely because they are the discipline of the bottom line. The nonprofits are, of course, still dedicated to 'doing good'. But they also realize that good intentions are no substitute for organization and leadership, for accountability, performance, and results. Those require management and that, in turn, begins with the organization's mission (Drucker 1989, p. 91).

The necessity to compete for the loyalty of donors and to negotiate with much more powerful corporate entities means, however, that management and marketing have become an important aspect of running NGOs (Andreasen and Kotler, 2008, p. 11).

The Sea Shepherd Conservation Society is a non-profit environmental organization promoting marine conservation. The Sea Shepherd needs the support of donors and volunteers to protect endangered or illegally fished or hunted marine species, and it seeks this support not by conventional marketing but via the media. For example, brand awareness is generated through the television program *Animal Planet*, and through *Whale Wars*, which follows the activities of Sea Shepherd against predominantly Japanese whalers. In confronting commercial whalers, the program has generated considerable controversy, but it has also helped to open up a discussion about the treatment of non-human animals and the notion that water management may include literally patrolling the sea.

Some interrelated issues come into focus: the involvement in commercial activities (lotteries and merchandise) on the one hand, and the issue of Native People's rights in relation to fishing. These highlight some of the ethical but also pragmatic dilemmas in "ecocentric water management", as explained below. Within the Netherlands, such blending is exemplified by the sources of funding an NGO might receive. For example, Sea Shepherd became a beneficiary of the

Nationale Postcode Loterij, which not only provides a profit to its lottery winners but also donates much of the proceeds to non-profit organizations and helps to generate free publicity for them (Boutesteijn, 2012). As a beneficiary, Sea Shepherd has developed several volunteer-led programs to address larger issues associated not just with water but also seeking to protect water's non-human inhabitants (Boutesteijn, 2012). Sea Shepherd also generates profit by selling products, from T-shirts to backpacks⁶ (<https://shop.seashepherd.org/>). This commercial activity, which will be further addressed in the Discussion section below, highlights one of the ironies of 'management' by non-profit organizations. Some controversies can ensue. Holmes Rolston, a well-known environmental philosopher, describes the following situation:

Several indigenous groups in the United States, especially Alaska, maintain their right to cultural whaling. The Makah tribe in Washington state has reinstated their right to whaling, going back to the Treaty of Nakah Bay (1855) in which they ceded to the United States over half of their ancestral land to ensure their right to continue hunting whales. They may be traditional people, but they know how to enlist excellent lawyers... From the 1920's until the 1980s, the tribe ceased hunting, concerned about whale survival. After the gray whale was removed from the Endangered Species list in 1994, they decided to hunt again, revitalizing their ancient tradition. They harpoon the whale from a cedar canoe manned by eight men, trained for the hunt both physically and spiritually. They claim great respect for the whales they kill. They now shoot the whale with a rifle after it is harpooned, so that it dies with less pain. A number of Makah tribal members opposed resuming the hunt.

In 1999, the United States government allowed the Makah to take five whales a year for their ancestral hunt. They killed their first whale on May 17, 1999, with TV cameras in helicopters overhead, and with the threat of harassment by protestors' boats. Environmentalists are concerned about viable whale populations, especially if other native peoples make similar claims. There is a quota of 124 whales for native groups in the Northwest. Many also hold that eating whales, like eating chimpanzees, is immoral. Several hundred environmentalist and animal rights groups from over two dozen countries opposed the hunt, though Greenpeace and the Sierra Club did not.

⁶ <https://shop.seashepherd.org/>

Their permission to hunt was reversed in 2001. The issue has remained contorted by differing decisions, often involving environmental impact. Some of the 1999 Makah hunters, though now unauthorized, killed a whale in September 2007, the whale was immediately seized by the U.S. Coast Guard and sank unharvested (this is the word used by the Makah). The question posed for environmental anthropologists is what insights they can offer for enriching, or resolving, this issue, especially those relative to the ethical issues: the rights of the Makah, the 'rights' of the whales, and their conservation (2016, p. 22).

This certainly brings forth some ethical issues involved in not just “managing” territorial waters but thornier questions about ecological justice and non-human rights that NNH needs to consider further. One such issue is illegal fishing in Africa, with Sea Shepherd “working with local authorities and regional partners to combat one of the biggest threats to marine wildlife today: illegal, unreported, and unregulated (IUU) fishing”.⁷ But illegal fishing is often carried out by communities struggling with poverty, raising tensions between human or indigenous rights advocates, and those concerned about sustainability and animal welfare. This case therefore illustrates some of the complex ethical dilemmas involved in decision-making when multiple species are concerned.

A different type of water management is attempted by another ENGO, Greenpeace, which has historically been concerned with water pollution but has also recently developed regional focal points. Greenpeace’s European division stated that “the European Union and governments must protect our water from the pollution that kills wildlife and harms our health”⁸. It has concentrated on issues such as single plastics, harmful industrial processes such as chemical dumping, and wider issues caused by the poor management of plastic and toxic waste.

The United Kingdom division of Greenpeace has focused on creating “ocean sanctuaries” as well as “sustainable fishing”⁹. The latter issue is framed as such: “Many species which were once common-place are now threatened, dwindling to the point where there aren’t enough to catch and make a profit”¹⁰. However, it is worth noting that the emphasis remains on issues of social justice in the distribution of profit, poor working conditions and disadvantages to local

⁷ <https://www.seashepherdglobal.org/our-campaigns/iuu-fishing/>

⁸ <https://www.greenpeace.org/eu-unit/tag/waterpollution/>

⁹ <https://www.greenpeace.org.uk/challenges/ocean-sanctuaries/>

¹⁰ <https://www.greenpeace.org.uk/challenges/sustainable-fishing/>

economies, rather than aiming to manage the overall problem of overfishing and the damage that it causes to marine ecosystems. As Greenpeace puts it (our emphasis):

Just five families control nearly a third of UK fishing quotas and more than two-thirds of fishing quota is controlled by just 25 companies. Compared to smaller fishing operations, these big companies *employ fewer people*, use less sustainable fishing methods and *less money makes its way into local economies*.

Our government already has the power to change the way it distributes quotas. Greenpeace is campaigning for a *fairer allocation system* that favors local, sustainable fishing *which will help create jobs* and allow fish stocks to recover.

We're also taking on the corporate giants plundering our oceans. Thai Union, the biggest tuna company in the world and owner of John West, was turning a blind eye to *appalling conditions for workers* and destructive fishing practices.

It is not clear from the above why local fishing will be more sustainable (other than, perhaps, being smaller in scale), or how employing more people, creating more jobs, and stimulating local economies will help to address the issue of overfishing. The Australian division of Greenpeace has a more ecocentric framing, highlighting the cause of a problem:

A healthy ocean has diverse ecosystems and robust habitats. But a myriad of human pressures – from overfishing to climate change – are causing ecosystems to collapse, the extinction of many marine species, and the destruction of ocean habitats. Our own Pacific Ocean, one of the last relatively healthy ocean ecosystems, is being plundered at an alarming rate.¹¹

This suggests some variations in regional perspectives and approaches. When mentioning illegal fishing, as Sea Shepherd does, the Australian division points out that “In the Pacific, 46% of all fish caught may be illegal, unreported and unregulated”. The UK division, on the other hand, seems to suggest that local/community fishing in developing countries is something that might be supported, if sufficient “regulation” or “management” can be agreed. These variations in regional priorities help to make visible the tensions inherent in a

¹¹ <https://www.greenpeace.org.au/what-we-do/protecting-oceans/oceans-in-crisis/>

managerial vision founded on notions of trade-offs and competition between human and non-human interests.

4. Discussion

Ethically, a major impediment to addressing water scarcity, climate change, biodiversity loss, and pollution is the dominance of anthropocentrism, which positions humankind as separate from and “above” a non-human world (Wallach et al., 2020; Piccolo et al., 2022). Ironically, some of the more altruistic motives embodied by non-profit organizations such as Greenpeace and Sea Shepherds also show that professionalization and scaling up of efforts tends to encourage actions more reflective of capitalist ideologies or (as socialist/communist countries do not necessarily have a better track record of environmental protection) at least the anthropocentric norms common in industrialized societies (Kopnina, 2016a). While the need for sharing the planet more equitably is readily visible in NGO's engagements with water, they similarly reflect corporate terminology and practice. Management and marketing have become an important aspect of operating NGOs due to the aim for long-term financial stability, increased understanding of the value of techniques in marketing, and pressure from the public and government to conform to institutional conventions (Andreasen and Kotler, 2008; Andreasen, Goodstein, and Wilson, 2005, p.10). However, there are significant differences in the marketing strategies of commercial organizations and non-profit organisations. Although minor economic gains, such as tax breaks or gifts, can be acquired, marketing for non-governmental organizations is primarily concerned with promoting social transactions. Donating generates emotional satisfaction, self-esteem (Arnett, German and Hunt, 2003), and what has often been described as social capital.

The danger of being seen as neo-corporate entities, however, may overshadow some of the strategies that NGOs could successfully employ in securing multi-species flourishing and sustainable water management. While Sea Shepherd and Greenpeace criticise large-scale commercial fishing and industrial-scale production of 'sea products', their own *modi operandi*, from selling T-shirts to the professionalization of their organizations, seems to be at odds with these critiques. There is also the matter of ecotourism, wildlife tourist attractions and ethically complex “protected area” nature-based tourism, which many NGOs do not oppose. Thomsen (2022) concludes that at least in the case of terrestrial conservation in the American national parks, non-captive environments are optimal for supporting multispecies co-existence. Wildlife ecotourism in marine

environments, from whale watching to “swimming with the sharks” initiatives, illustrate how biodiversity can be wedded to both “business case”, generation of money for local communities, and protection. However, ecotourism activities can disadvantage marine wildlife, for example, because increasing numbers of ‘ecotourists’ on boat tours affect the stress levels of whales and dolphins and can even kill them (Cressey, 2014). There remains a need for a broader posthumanist wildlife-human coexistence framework that can be applied through “policy, discourse, and governance” (Thomsen, 2022).

A further irony is that while some NGOs, such as Sea Shepherd and the Australian division of Greenpeace, may be prioritizing the total human responsibility for overfishing, their inclusion of disadvantaged fishers involved in illegal fishing may be in tension with their own aims to address social justice and alleviate poverty. A short-term aim to achieve social justice can elide a longer-term perspective which recognizes that overfishing leads to an “empty sea” – similar to the overhunting and “empty forest” syndrome – which is likely to affect disadvantaged populations the most. The NNH idea of “sharing” space may involve natural predation or fishing; what is significant is that it aims for the human extraction of so-called “resources” from the sea to be balanced in terms of other species’ needs for fish and other marine “resources” as well.

It would be overly reductive to describe all humans as equally responsible for environmental degradation, which is unmistakably entangled with late-stage global capitalism and dominated by patriarchal, often Western, leadership in the “Global North” (Thomsen, 2022). However, as mentioned above, with an expanding human population, the global consumption (of fish, among other “resources”) has been devastating for the environment (Kopnina, 2016a). As Dunlap and York point out, challenging the assumption that the poor do not support such “luxury” issues as environmental protection, national wealth is not correlated with environmental concerns (2003). A lack of basic resources or damage to ecosystems – “empty seas” or water pollution – is not sustainable whatever the level of national wealth entailed.

A similar tension attends the overuse of freshwater which degrades waterways and places the surrounding ecosystems under increasing strain, threatening water, food, and energy security. The World Bank points to a fast-approaching shortfall between water supply and demand, with related conflicts and increasing numbers of refugees¹². Decisions about water management and use are often driven by

¹² <https://www.worldbank.org/en/news/feature/2021/08/23/going-with-the-flow-water-s-role-in-global-migration>

short-term responses to these pressures that, as well as sacrificing the rights, needs, and interests of less powerful human communities, override those of non-human species and ecosystems. Thus, more sustainable engagements with the non-human domain are often sacrificed to trade-offs aiming to alleviate poverty, and to encourage the economic growth that is deemed to be essential to this goal.

Human and non-human interests alike lie in having healthy and robust ecosystems. However, if these ecosystems are used for the welfare of a single species only, the notion of balance and biological food-chains needs to be rethought. At present most of the total biomass on the planet is used for human consumption, while wild species and their habitats are destroyed, creating a spiraling rate of extinction (Barnosky, 2008; Ceballos, Ehrlich and Raven 2020). The potential for circumscribing a balanced proportion of resources for the use of other species, sufficient to enable their flourishing, depends on social policies emphasizing the need for voluntary, non-coercive means of addressing population growth to achieve a smaller ecological footprint (Washington et al. 2018). As Dietz and O'Neill point out: "we need smaller footprints, but we also need fewer feet" (2013: 78). Aside from population concerns, a radical reform of economic system is necessary in order to address unsustainable production and consumption. Priority spending needs to be on projects that promote a "circular economy" (Nobre et al., 2021), steady-state economy (Daly, 1991), degrowth, and de-materialization (Dietz and O'Neill, 2013). These initiatives would include the production of long-lasting – and ideally fully reusable – appliances, and a similar approach to clothing and textiles. There is also a need for the development of products in material categories that are difficult or impossible to make "circular", such as food, with alternatives involving vegetarian/vegan diets (Kopnina and Poldner, 2022). Other reforms addressing broader issues of sustainability, especially in the human-dominated "half" of the planet, include housing policy that promotes repurposing and counters built-in obsolescence, and moves businesses to areas with unused housing and underemployment, rather than encouraging further growth and housing expansion into the green belt in regions that already have full employment. As this implies, there is a need for joined-up thinking in all areas, for example tying all developments to a requirement for compensatory planting of vegetation supportive of biodiversity.

All areas of production depend on water, and similarly joined-up thinking needs to be applied to water management to enable more sustainable water use practices. This is partly a matter of encouraging farmers to focus on crops that do not require high levels of irrigation (or fertilisers, herbicides and pesticides),

and partly a need for holistic river catchment management with better land use and conservation throughout (e.g., Lampayan et al., 2015; Baloch and Tanik, 2008). This would assist a move to create the continuous ecological corridors that are vital to wildlife conservation (Lawton 2010). A shift away from infrastructural violence to “green engineering” would both encourage wildlife conservation and provide better flood risk management.

Achieving such balanced outcomes sufficiently to save the planet requires us to challenge the all-pervasive notion of “ecosystem services” that makes human-non-human relations such a one-way street. This entails a shift away from anthropocentricity and the “othering” of non-human beings into a separate category of “nature”, which underpins all forms of exploitation. In this sense, even being “nature positive” risks affirming the dualism that lies at the heart of the problem. In terms of water management, but also in general, we need to rethink the notion that one “side” has to be balanced against the other with “trade-offs”: there are not two “sides” that are in competition with (or even complementary to) each other.

5. Re-imagined communities

A vision of ‘re-imagined communities’ proposes a different theoretical starting point for thinking about river catchments (Strang 2017, 2021). Inspired by indigenous engagements with waterways, and by debates about ecological justice and ecological democracy (Baxter, 2005; Gray et al., 2020), this seeks more equitable engagements with ecosystems’ human and non-human inhabitants. Broadening Anderson’s concept of “imagined communities” (1991) to encompass all living kinds, it suggests a methodology enabling a deeper understanding of the diverse – and sometimes conflicting – water needs of the non-human beings and ecosystems within catchment areas. Strang proposes that, to promote this understanding, the agencies responsible for water management should build on efforts to “speak for” rivers and the non-human inhabitants of ecosystems. They should formally appoint a Council of Experts, or a similarly representative body, incorporating a range of disciplinary and local knowledges about non-human beings in the catchment area. The members of this body would apply their expertise to articulate the needs and interests of a cross-section of human and non-human actors within the ecosystem and ensure that, in all decisions affecting waterways, these needs and interests would not be ignored or overridden.

To avoid a common problem, in which watershed management groups are captured by stakeholders aiming to protect their own access to water, these representatives should be impartial and without conflicts of interest (Strang 2009). These bodies should be formally appointed, given financial support, and made central to policy and practice. A network of local groups could provide a pool from which similar national and international representational bodies might be drawn. Critically, they should be empowered by appropriate legislation at each scale, so that non-human rights, needs, and interests are necessarily taken into account in all decisions about rivers and related ecosystems. Such legislation could draw on the concepts of “ecodemocracy” (Kopnina et al., 2021) and “ecojustice” developed by groups such as the Earth Law Centre (2018); or the Earth Protectors Trust Fund created by the late Polly Higgins, lawyer, and campaigner against ecocide. This suggests an important potential for universities to work in partnership with policymakers, non-governmental organizations (such as the Earth Charter or Parties for Animals in various countries), and intra-governmental networks such as The Harmony with Nature program of the United Nations.

Such an approach challenges ingrained assumptions of dominion over the non-human world, questions the idea of water as a commercial asset, and rivers as mere providers of ecosystem services. It requires creative and practical solutions that work with ecosystems and their inhabitants instead of acting upon them. There are signs of hope: the United Nations’ 2018 report promoted “nature-based solutions”, and its 2021 report focused on diverse values in water (United Nations 2018, 2021). The International Water Association is seeking paradigmatic shifts in its approach, and water companies are coming under pressure to do things differently. There is widening recognition that “business as usual” is no longer an option. The current outbreak of the coronavirus demonstrates that there is at least some potential for governments and societies to respond with alacrity to global crises. Similar mobilization on water issues could be transformational, averting a greater long-term danger to public health and the viability of global ecosystems.

6. Conclusion

NNH is uniquely situated to engage in public policy and scholarly debates about conservation practices that tackle environmental change at a variety of scales. Using examples provided by Sea Shepherd and Greenpeace, this article suggests that even for non-profits concerned with water (and non-human rights), some

ethical trade-offs and difficult choices remain. The examples of how different branches of these NGOs operate – at least judging from their mission statements and action reports – offer some ways to move towards ecocentric water management and sustainable water policies and practices.

Such a move implies the combination of clearly articulating non-human needs and interests; providing legal protection for their rights; and above all promoting a vision of ‘re-imagined communities’ that relocates humankind within a world of living kinds, can provide more sustainable ways of thinking and doing. Creating a world in which humans and all other species can flourish means ensuring sufficient habitat for other species while living prudently and justly in the remainder. Such a moral commitment is owed not only to non-human beings but also to future human generations, who will otherwise inherit a severely damaged planet. Ultimately, we must live so as to make not just half, but all the Earth, livable for all the planet’s inhabitants.

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Authors

Helen Kopnina, Faculty of Business and Law, Northumbria University (UK)
helen.kopnina@northumbria.ac.uk *Corresponding author*

Veronica Strang, School of Anthropology and Museum Ethnography, Oxford University (UK) veronica@veronicastrang.com; <https://www.veronicastrang.com/>

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Life's shared dependence on water: A potential wellspring of ecocentric concern and interspecies kinship

Joe Gray

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1. Intrinsic value and moral standing in the more-than-human world
2. Dissolving boundaries: Water as a universal life-need
3. Placing ecocentric wisdom at the heart of wise water use
4. Concluding thoughts

Keywords: Ecocentrism; ecological ethics; intrinsic value; water; world views

Abstract. *The ecocentric world view holds that non-human life has intrinsic value – a worth that is independent of any benefits that may be derived from such lives by humans. Exemplifying this, a salmon matters for reasons that are immeasurably greater than simply representing a target for anglers or a potential flavour on a human tongue. A fundamental tenet of the ecocentric philosophy is that moral standing permeates beyond the merely human world and into wider nature. Furthermore, this world view foregrounds the unfolding mass extinction of life on Earth as the moral and existential arch-crisis of our time. This arch-crisis is being driven, in turn, by an array of interconnected emergencies that include, among others, rapid anthropogenic climate change and diminishing freshwater supplies. In the case of water,*

shifting rainfall patterns and increasing pressures on abstraction to support a growing human population are causing suffering, and rendering landscapes unlivable, to humans and non-humans alike. For life is united in its dependence on water. This shared elemental need offers a potential touchpoint for citizens, both younger and older, to develop a sense of kinship with non-human others and to become more ecocentric in their value systems. Ultimately, a groundswell of ecocentric concern will help generate policies and foster practices that support broad socio-ecological justice in water usage and in other domains of our interconnected lives as Earth-kin.

1. Intrinsic value and moral standing in the more-than-human world

I begin this paper by noting that, when it comes to water, the priority that an individual gives to wider nature over narrowly human interests will be influenced by their world view. To provide some data to substantiate this non-controversial introductory assertion, I will briefly describe some of the findings from an internet-based study of 577 residents of the US state of Colorado. Participants were split into economy-centred, environment-centred, and neutral segments based on a set of four dimensions that included ecocentric orientation (Burtz et al., 2020). Respondents were asked to indicate their priority for water allocation during times of shortage across various usages including “natural environment/management, such as fire suppression, fish and wildlife habitat, and forest health” and “households for utilities, such as drinking, cooking, showers, etc.” (Burtz et al., 2020, p. 309). For the environment-centred segment, preference for “natural environment/management” was second only to that for “households”, while for the other two segments this option came in fourth, behind “households”, “irrigated farmland”, and “industry”.

The world view on which the present paper focuses is ecocentrism, a philosophy which holds that non-human life has intrinsic value – a worth that is independent of any benefits that may be derived from such lives by humans (Curry, 2018). Exemplifying this, a salmon matters for reasons that are immeasurably greater than simply representing a target for anglers or a potential flavour on a human tongue. This way of thinking about the world, which has modern roots in Deep Ecology (Næss, 1973) and Aldo Leopold’s Land Ethic (Leopold, 1968), lays down a fundamental challenge to the assumption of human supremacy on the

planet. This premise, which is the foundation on which modern economic and political thought is built, is one that many scholars have called out in recent decades for its arrogance and recklessness (*e.g.* Ehrenfeld, 1981; Crist, 2017; Curry, 2018). Ecocentrism, as compared with anthropocentrism, offers a pathway into a better future (Washington et al., 2017; Crist, 2019), one in which humans strive to share the Earth with the incredible richness of cohabiting life forms, rather than precipitating the ever-graver consequences that must surely follow from continued depletion of the planet's life-giving qualities.

A fundamental tenet of the ecocentric philosophy is that moral standing permeates beyond the merely human world and into wider nature (Curry, 2018). It follows that ecocentrism demands an ethical analysis of the impact that humans are having on the community of life on Earth and the physical systems on which the members – human and non-human – are dependent. Through such an analysis, ecocentrism foregrounds the unfolding mass extinction of life on Earth (Monastersky, 2014) as not only the existential but the moral arch-crisis of our time (Gray and Crist, 2019).

The arch-crisis of mass extinction is being driven by an array of interconnected emergencies that include, among others, rapid anthropogenic climate change and diminishing freshwater supplies. In the case of freshwater, “this life-sustaining resource,” Kallhoff (2017, p. 416) has written, “is endangered by processes of industrialization, population growth, and climate change.” Shifting rainfall patterns and increasing pressures on abstraction to support a growing human population are causing suffering and rendering landscapes unlivable (Gosling and Arnell, 2016). Here, the term *unlivable* applies to humans and non-humans, and the latter are even more vulnerable than the former. This is because modern humans have drastically reshaped the flow and stasis of the precious life-giving liquid within most of the watersheds that they inhabit.

The goal of manipulating the movement of water, in broad terms, is to increase the security of the supply and the convenience of abstraction from a human perspective. A devastating corollary is that the availability and the dynamics of this liquid – both as a source of hydration and as a medium for fulfilling vital life-purposes, such as long-distance movement or egg-laying – decrease and degrade from the perspective of numerous other species within the watershed. “In biopolitical economies,” as Strang (2013, p. 161) has noted, “few things express dominance over other species as clearly as damming and redirecting flows of water to give primacy to human needs.” An underground reservoir, for instance, is available to few life forms. Exceptions who may benefit from the outputs of

humanized water systems are domestic animals like pet dogs and garden visitors such as wild birds.

In the ecocentric world view, to “possess intrinsic value is to be valuable in one’s own right, and inherently worthy of moral consideration,” as Mathews (2016, p. 143) has written. With this extension of intrinsic value and, thus, moral standing to the non-human members of ecosystems, profound ethical dilemmas arise both from the massive scale of abstraction—much of it for trivial ends—and from the narrow-minded reshaping of flows. Life, after all, is united in its dependence on water. Or as Krause and Strang (2013, p. 95) have expressed it: “For many people water epitomizes the connections and integration of living processes: as the life-giving element enabling production and reproduction, and as a substance of community and belonging.”

2. Dissolving boundaries: Water as a universal life-need

A scene on the television screen: large mammals at a watering hole, with heads dipped to the surface of the liquid. This hole is drying up, the narrator tells us, and rains will not fall for many weeks yet. Immediately, and empathically, we feel the animals’ plight. The quality of this story from the perspective of a documentary-maker lies in its instant emotional resonance for humans; and so relatable is the drama on which it centres that no anthropomorphism is required.

The above instance of empathy-generation relates to close relatives of humans in the evolutionary tree. It is my contention, though, that the universality of hydration as a life-need allows powerful emotional responses to emerge, also, through reflecting on the wants of more distantly related *Earth-kin* (a term I use to refer to, and honour the shared ancestry of, all living beings on Earth). By way of illustration, I will present two further examples.

My first case, which comes from the writer Ed Abbey, will expand the sphere of empathy beyond mammals and out past the margin of vertebrate life. In *Cactus Country*, Abbey (1973) describes a hike in the Pinacate region of the US desert south-west. Heading back from a climb of a volcanic peak in the “awful heat of May,” Abbey and a companion pass *La Tinaja Alta*, which is the highest natural water tank in this arid region. They are out of water and still have two hours’ walking to go, and so they fill a canteen. In doing so, they almost drain what is left in the basin. From this, a quandary emerges:

La Tinaja Alta is a very small *tinaja* to begin with and this was the dry season. The bees crawled over the damp rim of the basin, bedraggled and

puzzled. Now the bird cries seemed forlorn. Out in the rocks and brush somewhere crouched other small animals waiting for us to leave, waiting their turn for a drink. We didn't see them, we didn't hear them, but we felt them [...] All the water we had was in the one canteen. We emptied it back into the little stony basin (Abbey, 1973, p. 165).

My second case is a personal one – one which I have previously described elsewhere (Gray, 2021) – and it will push the sphere of empathy out further, beyond the limits of the animal kingdom. Several summers back, I found myself in the middle of a large clearing in a woodland near my home in east England. The plant-life was wilting and sickly coloured following an unusually long dry spell. At last, though, it seemed that the rains were coming.

The storm announced itself with flashes of lightning and claps of thunder in the distance, and soon it rolled in over the woodland. After a rapid crescendo from the first gentle drops of water, the rain began to pound violently into the dry earth. I stayed out in the open, as if I had suddenly planted roots [...] My clothes got drenched, but I was not particularly conscious of this development. For I can state, without any poetic exaggeration, that I was experiencing the downpour more as a plant than an animal. The full extent of my empathy surprised me when I reflected on it after the storm had passed through: I had truly relished every drop (Gray, 2021, p. 94).

The empathy of the documentary-watcher, the humility exhibited by Ed Abbey, and my long moment of acutely heightened sensitivity to the needs of the broader community of life are all examples in which water's universality as a life-need can engender strong emotional responses to the interests and wellbeing of non-human others. And, together, they illustrate how empathetic understanding can emerge both from direct experience of the lives of these others and through the relaying of their circumstances through narrative. Rock and Gilchrist (2021) observe that, in a rapidly changing world, stories that spotlight more-than-human interests have a vital role to play in empathy-generation. Crucially, the perspective and wisdom thus gained – via direct or vicarious experience – lay a path towards positive environmental actions and ecologically sounder lifeways (Gruen, 2009).

Empathy, it should be noted, is far from being the only emotional response that can motivate positive environmental behaviours. Considering our feelings towards other animals specifically, Kasperbauer (2015, p. 817) goes as far as arguing that empathy is “not psychologically central to producing moral concern” and that “other moral emotions, particularly anger, are more strongly

engaged with producing moral concern for animals, and are thus more capable of achieving various normative aims in animal ethics.” For my present argument, the precise nature of the emotional response is not important as long as it can be an inspiration and a fuel for positive action.

As a touchpoint between human and other-than-human lives, the shared elemental need has great potential in triggering emotional reactions for people both younger and older. And such reactions offer fertile ground for fostering a sense of kinship with Earth’s cohabiters, a reverence for water as a sustainer of life (e.g., Hawke, 2012), and a shift in value system towards ecocentrism. These closely interlinked developments in one’s outlook will all serve as further drivers towards ecologically sounder behaviours, not least in relation to water usage.

In order to tap the rich potential described above, it is of course necessary for people to gain a familiarity with the circumstances of non-human others in regard to water needs – to enrich their water literacy, in other words. As a minimum, this could be aided by taking in the kind of bare-facts information presented in a newspaper report, but ideally it would also be nurtured through a mixture of story-driven vicarious appreciation and direct experience. For the latter, Hawke and Spanring (2022) have written, the process of active engagement with the life dynamics within a watershed – through deep listening and being in place – offers significant scope for renewing the human connection to the more-than-human world. As they note:

Being with, is embodied through conscious contact and connection with more-than-human life and worlds, through practices such as deep listening which is about being still and tuning in to the changing tones, murmurs and sounds of waterscapes and *their* companion species, such as croaking frogs and bird song (Hawke and Spanring, 2022, p. 199).

Colin Fletcher, in his account of a hike through the Grand Canyon in 1963, describes the outcome of such a process, which unfolded during two days spent observing the life sustained by the Colorado River at a spot he named Beaver Sand Bar:

I was no longer a stranger in the deep and ancient world of Beaver Sand Bar [...] I had moved closer to the pulse of life [...] And in it I recognized the common grain that ran through everything I knew existed, including me [...] On Beaver Sand Bar, the sense of union had become explicit, intimate, totally involving. It embraced everything (Fletcher, 1989, p. 177).

A vital aspect of water literacy is the emergence of an understanding of the ways in which non-human circumstances might intersect both with the small decisions that we make as individuals in our everyday lives and with the larger impacts effected, on our behalf, by politicians and business leaders. This is something that applies not just to our home watersheds but to those we influence from afar through our behaviours as consumers. In order to better facilitate the emergence of such an understanding, however, there is a need – one that is both massive in scale and urgent – for improved availability and flow of information. If I purchase a new pair of jeans, for instance, what does this mean for the inhabitants – human and non-human – of the watersheds in which the materials were grown and the garment manufactured? What is the difference for watershed inhabitants if I buy seasonal locally grown seasonal fruit compared with imported out-of-season produce? And who is harmed if I take a twenty-minute shower every day, jet-hose my driveway, and belong to a golf club where the fairways are watered till the grass is near-luminous? Conversely, what might it mean for wildlife if a far-sighted political candidate who proposes to decommission a dam is elected?

As an individual consumer, I will freely admit that I am nowhere near to being as well informed as I would like when it comes to the water implications of produce and of manufactured items, although I have spent some time trying to learn more. More generally, the large majority of people with whom I have spoken about this issue are aware of an overarching need to save water but know very little of specific impacts. For many individuals, water prudence begins and ends with the opening and closing of taps in their home and workplace; and, even here, there is little knowledge of the impacts of using excessive amounts of water, other than increasing the probability of a hosepipe ban or a similar restriction.

By way of an example, I will briefly discuss the watershed that I have inhabited for the past fifteen years, the Colne catchment. Here, over-abstraction by humans reduces water levels in a chalk stream known as the River Ver (Figure 1), leading to the death of wild fish and turning off a cascade of life. Despite an impetus for action resulting from the global rarity of chalk streams as a habitat, coupled with commendable campaigning efforts by a charity called the Ver Valley Society, few people in the area seem aware of the connection between the water usage of local humans and the health of the river and other dependent organisms (Gray, 2021; Figures 2 and 3).



Figure 1. A bench depicting the seventeen-mile course of the River Ver, sited near the stream's confluence with the River Colne.



Figure 2. Canada geese on the River Ver.



Figure 3. A mating pair of banded demoiselles in marginal vegetation along the River Ver.

Without the improved availability and flow of information called for above, a huge opportunity is being missed for people in the Colne catchment, and other watersheds inhabited by modern societies across the world, to enrich their water literacy, to connect with the interests of non-human others via a shared elemental need, to strengthen feelings of interspecies kinship, and to find the motivation to act in ways that are kinder to the Earth's living systems.

3. Placing ecocentric wisdom at the heart of wise water use

I move now away from discussion of the behaviour of individuals to briefly consider policy-level approaches to water. The ways in which humanity draws from, and reshapes the flow of, freshwater sources can be described as *water ethics*. Kallhoff (2017) sketches a spectrum of possible water ethics, in which the extremities are (a) approaches that focus on the life-maintaining services of water to human beings and (b) those that are ecocentric in their orientation. One proposed approach that sits near the latter end of the spectrum comes from Ziegler et al., (2017), who argue against the idea of maximum safe abstraction of freshwater by humans and suggest that we should instead be striving to achieve a sufficient but ecologically just usage level. In other words, they are calling for an “ecological ceiling” that respects the water needs of humans and non-humans rather than being guided by a “safe space” for humanity.

An obvious but crucial weakness of ecocentric water ethics, notes (Kallhoff, 2017, p. 418), is that “they rely on premises that are not necessarily shared by many people.” And therein lies a key challenge to be met if the unfolding mass extinction is to be slowed and then halted and if water is to be shared more fairly with our non-human kin. Returning to the survey presented at the start of this paper (if I can be permitted to generalize its results to the global context), it seems that, in order to feel confident that ecocentric water policy would be supported by a populace, it would be necessary for the environment-centred segment to be valuing the needs of the “natural environment” at least on a par with those of “households” and for that category to encompass the large majority of individuals. In other words, the shoots of ecologically wise water will only grow with vigour in the soil of a culture evolving towards ecocentric wisdom.

4. Concluding thoughts

In this short paper I have suggested how ecocentrism and interspecies kinship might emerge and be strengthened by an improved understanding of the water needs of non-humans. Conversely, I have discussed how ecocentrism and interspecies kinship can inspire water practices that are ecologically sounder. These two relationships are, of course, mutually reinforcing.

Ultimately, a groundswell of ecocentric concern will help foster practices and generate policies that support broad socio-ecological justice in water usage and in other domains of our interconnected lives as Earth-kin. For, as Crist et al. (2021, p. 1) have remarked:

By protecting nature generously, and simultaneously contracting and transforming the human enterprise, we can create the conditions for achieving justice and well-being for both people and other species. If we fail to do so, we instead accept a chaotic and impoverished world that will be dangerous for us all.

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Author

Joe Gray, Independent Researcher, United Kingdom. joe@deepgreen.earth

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Oceanic and Tethysian being-in-the-world

An essay on the human self and world understanding in the Anthropocene

Michael Paulsen

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1. Introduction
2. A first characterization of our current understanding of and relation to water
3. The Anthropocene crack and limitations of the Late Holocene understanding of water
4. Into a new Anthropocene understanding of our being-in-the-world
5. Conclusion

Keywords: Being-in-the-world; human self and world understanding; Thales; water; Tethys; Oceanus; life forgetfulness; Anthropocene crack; ecological crisis; Berl-Berl; swamp.

Abstract. *This essay proposes that we, as human beings, especially in the West and in the Holocene epoch, have developed a life-negating understanding of ourselves and the world. This is uncovered in the Anthropocene, through what is called 'the Anthropocene crack': a painful eco-wound revealing how we forgot that we are living beings in a living water-world, coexisting with other living water-beings. Yet the Anthropocene crack is also a gateway to a new Anthropocene world understanding that acknowledges our oceanic and tethysian being-in-the world, which is an ecological understanding of life,*

living beings and the world in which water is seen as the arche (ἀρχή) of everything in this world.

1. Introduction

This philosophical, free-floating essay aims to dive into a stream of thought that begins to catch the essence of our relationship with water—or what I’m going to term “our oceanic and tethysian being-in-the-world”—of which an understanding is arriving today, in the Anthropocene¹, as wanting to be thought (instead of remaining in its hiding), saying not just something about “humans” and “water” but about human *being-in-the-world*, in the Heideggerian sense.²

Whether such an attempt can succeed depends on whether we can think of man’s being-in-the-world in terms of water and about what is revealed and hidden in the Late Holocene³ regarding man’s specific being-in-the-world-with-water as it comes to the fore today, in what I later in this essay call “the Anthropocene crack.”⁴ In short, the attempt is to dive into a thought stream that can disclose how man’s being-in-the-world is an *aquatic*⁵ being-in-the-world (and what the implication of this might be). As a foreshadowing of what follows, this will eventually point us in the direction of what may rescue us from the ecological crisis we have brought ourselves and all life into, by misunderstanding water, our own being and the world in which we live—and through this overlooked that the Anthropocene environmental problems essentially are linked to our lack of

¹ There are many good critical introductions to the term, concept, and idea that we today live in an *Anthropocene age*. See Paulsen et al. (2022). The aim with this essay is not to discuss the term.

² The inspiration for the essay is the late Heidegger and young Coccia. The main thesis of the essay is, to some degree, a combination of these two. The primary works are Heidegger (1977) and Coccia (2019).

³ The term *late Holocene* signifies the part of the Holocene, starting with the development of writing, in relation to the great river cultures that arose in ancient times. See Paulsen (2021) for further details and arguments.

⁴ This essay focus on what is forgotten in Western thinking and tries to develop some new thoughts here. Other routes that focus on non-Western thinking and First Nation perspectives, cosmologies and ontologies would also be valid and perhaps even more obvious and fruitful rivers to follow.

⁵ The Latin term *aquatic* is used to signify general or Late Holocene emphasis on water. *Hydrological* signifies a more technical term, linked to the hydrosphere and comes from the Greek; *oceanic* and *tethysian* are used to signify our relation to water, as revealed in the Anthropocene crack or other functional equivalences.

understanding our own and life's aquatic being-in-the-world—what also could be called our life-negating *life forgetfulness*⁶.

2. A first characterization of our current understanding of and relation to water

If one Googles “water,” the first answer that comes up is Wikipedia⁷ saying that water “is an inorganic, transparent, tasteless, odorless, and nearly colorless chemical substance [H₂O], which is the main constituent of Earth’s hydrosphere and the fluids of all known living organisms.” (“Water,” 2022)

This definition both reveals and hides the essential features of our current understanding of water.⁸ First, it demonstrates that we think of water today as something abstract that can be defined and described, as if it was a universal that can be found out in the empirical world, in instances of other abstract things, for example, “the hydrosphere” and “living organisms.” What is hidden is its historical specificity. It presents itself as universally valid, not as specific to a Late Holocene understanding. I am not saying that this understanding is just a mere human construct or that it is wrong. What I mean is only that the abstract conception of water presupposes and is part of a historically specific disclosure that reveals something true about water but also hides its own limitations. Yet before we can dive deeper into this, let me bring forth the second way water presents itself to us today.

If we ask ourselves, at least as Westernized global citizens, how water presents itself in our daily lives, the answer is straightforward: we *use* water in many of our activities, without thinking much about it. I use water when I take a shower, make a cup of coffee, water my plants, wash my floor, make soup, clean my bike, and, more indirectly, when I use electricity from the hydroelectric plant or consume things produced and transported using water or eat grain from drained and sprayed fields. Yet all this conceals my essential relation to water. Why? Because it turns water into something contingent and abstract: a “transparent, tasteless, odorless, and nearly colorless chemical substance”—something I approach as an

⁶ The concept of *Life-forgetfulness*, or what I also call *earth forgetfulness* or *water-world forgetfulness*, is explained in Nørreklit and Paulsen (2022) and Paulsen (2022), including its roots, going back to Heidegger.

⁷ I here only use Wikipedia as an *empirical* indicator of our common understanding of water today.

⁸ The concept of *understanding* is used in the broad radical hermeneutical sense (Caputo, 2018), implying that it signifies how we interpret our self and the world, explicit and implicit, including our whole interpretative framework and horizon of meaning, imbedded in everything we think, do, sense, dream, feel, and speak.

abstract thing that I do not know—in its totality—where it comes from; and even more important, what matters is only *what it does*, as a substance, *when needed*. If it can be *substituted* with other things doing the work, then it is not a problem; what counts is only the result. This understanding turns water into something replaceable and calculatable that can be drawn out of being, controlled, utilized, and directed here and there. In short, the Late Holocene everyday understanding of water as a forced standing reserve we can use coincides with the Late Holocene understanding of water as an abstract substance. This unique historical coincidence and revealing is central to our current understanding of water, our connection with water, and the environmental crisis we have put ourselves and other living beings in.

It might be true that the technical-scientific understanding of water is historically specific, but *to use water* is not specific to any period. The lion drinks water, and so does prehistoric man. However, the specific abstract way of using water, as something we forcefully extract as a pure resource, transforming it into different things, leading it, steering it, controlling it, as an abstract substance; this is a historically specific understanding of water. Nevertheless, this does not mean that this understanding is incorrect. It reveals some truth about us and water.

This truth was not revealed to the pre-Holocene man. Before the Holocene, man *did* use water, like lions and other living beings, but water was a gift that humans praised and lived together with. Water was not an abstract substance, neither was it a product of human engineering; it was not “redirected by humans”—through “construction of irrigation, ditches, canals, dams, reservoirs, the diversion of rivers and streams, the digging of wells, to extract groundwater, and other water control systems designed to support agriculture production and human settlements” (Ellis, 2018. P. 58). Yet it is important to notice a further difference, which appeared in the Late Holocene, made explicit, for instance, in Pamuk’s novel *The Red-Haired-Woman*. In this, we witness the shift from the old well-diggers of the beginning of the twentieth century, who relied on idiosyncratic water sensitivity and knowledge of where and how to dig for groundwater, to the total replacement in the end of twentieth century by technological tools that made this superfluous. Both the “old” and the “new” well-diggers “redirect water”; but the latter forced it out of being, without any personal water sensitivity or effort to listening to or caring for the earth-water-place. The old diggers looked for special places to dig, got into a relationship with the digging place and with the people living in the area, as well as those who were apprenticed to the well-diggers. The machine diggers did not need this. Because they could dig fast and deep with their machines, they did not need to sustain their personal knowledge of well

digging. For them, one place was no different from another; what they met was only challenges in the soil layers that had to be overcome so that water could be forced up and out for use. The same could be said about the differences between old and new industrialized agriculture, old mountain paths and contemporary tunnels, and other similar shifts in how we relate to water and the earth. Thus, the Late Holocene understanding shifts from a redirection of water and use of water based on personal water knowledge, care, and sensitivity to where it is, where it comes from and how it circulates, to forcing water out of being, as an abstract universal substance that can be steered and controlled. By the same token, we paradoxically become water ignorant the more we seem to master water.

Philosophically, *the shift* started in the West, with Thales or, more precisely, Aristotle. Since Aristotle, every book on Western philosophy has stated that Thales was the first philosopher and that Thales thought that *water* (*hudōr* in Greek) is the grounding substance, origin, or principle (*arche* (ἀρχή)) in Greek) of everything.⁹ Yet what Thales meant is not clear. The best evidence is the words of Aristotle in his *Metaphysics* and *De Anima*.¹⁰ Yet Aristotle uses his own terms to articulate what Thales might have thought. Nevertheless, some hints are hidden in Aristotle's sayings. According to Aristotle, Thales is the first philosopher because he is the first to think about the *arche* of *everything*. For Aristotle, Thales thought that the world *consists* of a material *substance, water*, that everything is composed of and eventually will dissolve into, explaining that all changes are fluctuations of one and the same matter. From this, according to Aristotle, developed an elaborated thinking of what everything consists of, up till Aristotle's own theory of matter and, we could add, leading further to today's understanding of everything as composed of abstract substances. So water (and *eo ipso* the world), understood as an abstract substance, goes all the way down to the birth of Western thinking. Yet more important things are hidden. For the Greek, *arche* could also mean "that from which something springs": the *arche* of a child is, for instance, its mother and father. Also, *arche* could mean the central basis of a thing, for example, the ship's keel is the ship's *arche*.¹¹ If we pay heed to this, Thales might have seen water as the progenitor of everything or as the central basis of the world we live in (Hawke, 2018). Furthermore, it is telling that Aristotle is *puzzled* about what Thales meant. Thus, Aristotle affirms:

⁹ I draw in the following on Pinto (2016).

¹⁰ The two famous places where Aristotle talks about Thales is his *Metaphysics*, Arist. Met. 983 b and his book on the soul, *De Anima*, Arist. De an. 405 + 4011 a.

¹¹ *Arche* is a notoriously difficult Greek concept. The meanings of the concept I present in this essay are not novel. See Mansfeld (1985) for an overview, and Hawke (2018) who takes it up as the primordial being at the dawn of Time.

[Thales got] the notion [about water as the arche of everything] perhaps from seeing that the nutriment of all things is moist, and that heat itself is generated from the moist and kept alive by it [...] and from the fact that the seeds of all things have a moist nature, and that water is the origin of the nature of moist things. Some think that even the ancients who lived long before the present generation, and first framed accounts of the gods, had a similar view of nature; for they made Ocean and Tethys the parents of creation (Ross, 2009). (DK A 12; Arist. Met. 983 b)

The last sentence refers to the myth about Oceanus and Tethys, two titans who were brother and sister and married to each other; in the *Iliad*, they were said to be the primeval father and mother of all gods and the genesis of all—thus being the begetters and authors of creation (γένεσις) (Pinto, 2016, p. 255). Oceanus is a river that *surrounded the world* and the origin of all rivers and springs, while Tethys is perhaps identical to Tiamat, the Mesopotamian primordial goddess of the sea, the symbol of chaos (Χάος) and primordial creation, which *forms all things* or the body parts of which constitute *the earth and heaven*. Which of these layers was still alive when Thales lived is hard to say. Yet it is certain that both Oceanus and Tethys refer to mythologies about the creation of the world out of water: Oceanus as the surrounding river and Tethys as parts of the world, along with their copulation - the interplay between the living world and its living beings - as creating a chaosmos¹². What is striking is that Aristotle is aware that Thales is inspired by such older mythology¹³, in which everything is ultimately aquatic or, more precisely, an *oceanic* and *tethysian* in combination (Pinto, 2016). Furthermore, in *De Anima*, Aristotle says that Thales thinks everything is full of gods.¹⁴ This indicates animism, hylozoism, or even pantheism; or maybe that Thales has an idea of water as fundamental to the world which is somehow—by the same token—divine. If water is an ancestral arche of the living world and, thus, the generic origin of all living (i.e., existing, (self)moving) things, it could also be regarded as divine, not least if we keep in mind the mythological background.¹⁵ Here, the world of living beings *owes* its existence to water and is full of divinity (“aliveness”, self-movement) because of that. They are oceanic and tethysian in nature.

¹² *Chaosmos* is a term coined by Joyce and frequently taken up by Deleuze (1993, p. 81).

¹³ Leading back to the Egyptian and Mesopotamian river-cultures.

¹⁴ *De an.* i 5.411a7-8 = DK A22.

¹⁵ That “everything is full of gods” is congruent with “everything (in sum) has water as its arche,” which is also the conclusion reached by Pinto, who says, “If water for Thales is just an ancestral, generative principle of which all things originally came, water would be the creator of all things and so could easily be regarded as divine” (2016, p. 253).

So, at the dawn of Western thinking, we do not only find the roots of an abstract view of everything, hence detachment, but we also find an oceanic and tethysian understanding of the world as a sacred living place, of which *water* is the generic and ancestral life-principle—*arche*—which is only partly covered up by Aristotle. This hidden understanding of water is somehow still alive in contemporary stories and songs.¹⁶

To sum up the first characterization of our current mainstream understanding of water, embedded in the way we in our Westernized society and culture treat and live with water is that we understand water as something abstract, that we use for many things, not knowing exactly, in our daily lives, from where it comes or where it goes or what happens with it. As a shadowy complement to this, we also understand water as a life-significant place. Both understandings work in the background of our lives, yet if we pay attention to them, they reveal aspects of our self and the world. As implied in the Google definition, we, as living beings, *consist* of water; likewise, the living world, here understood hydrospherically, consists of water and, ultimately, we living beings can only live within this water-world.

Yet the essential features remain in the dark: our oceanic and tethysian being-in-the-world is unclear. Even if one grants that the mainstream Late Holocene understanding of water is as suggested, one might object that this concerns not specifically water but rather our whole relationship to the earth: mountains, woods, landscapes, and ourselves understood as bodies, as abstract calculable and replaceable units and, as socialized and culturalized beings, something we can attend to now and then. True but not the whole truth. To dive deeper and see more, we must pay attention to the specificities of our current relationship with water and water itself as it calls out to us today. This calling can be heard if we move from where we have been in this essay until now, namely in the Late Holocene, before the problems of the Late Holocene understanding of ourselves, our water-being, and the water-world seriously began to crack. This crack in the Anthropocene reveals the essence of the Late Holocene world understanding, thereby setting us free if we pay attention to the revealment, making it possible to limit the later Holocene understanding and make ourselves ready to receive a new world understanding. This might sound mystical and cloudy. Yet behind clouds, a kind of clearness might be (or as we are going to dive more deeply into, clouds are better than their reputation). What matters is to open ourselves to what emerges, however murky it might be, if we focus on oceanic and tethysian

¹⁶ Such as Springsteen's "The River" or Enos "By this river", or Le Guin's "The Earthsea" cycle, to name a few.

being-in-the-world and let water have a voice about: 1) “the Anthropocene crack”; 2) how this opens to seeing the Late Holocene understanding of water in its limitations; and 3) how this points toward a new Anthropocene understanding of ourselves as essentially an oceanic-tethysian being-in-the-world; and which also includes 4) a new understanding of water and *eo ipso* the world *as* water, which deviates from but also makes the Late Holocene understanding of water (as abstract and exceptional places) *(im)possible*¹⁷. A first sketch of this follows in the next two sections, seeking to dive again into the same spot, to finally becoming a part of this place of truth and thereby bringing from it as a new home and dwelling place, where we intrinsically belong and can see ourselves truly as water-beings in a world that inevitable surrounds us. Or as I will hint at in the end, the essence of water is “environment” or “surrounding” or “milieu”. However, to understand or even to reject this, we must go through the outlined steps, leading us down to and into the tethysian ocean, where we have always been, like a move from Middle-Earth to Earthsea.

3. The Anthropocene crack and limitations of the Late Holocene understanding of water

The Anthropocene can be seen as an epoch in which we begin to - and are asked to - reconsider our understanding of ourselves and the world. Understood in this way, as an epistemological term, rather than only a name for a specific part of earth history (Paulsen 2019), we are pushed to a reevaluation of how we have looked at our past, present, and future. Yet how so? The link between human activities and current ecological global catastrophes (global warming, unstable climate etc.) *indicates* that there is something wrong with the Late Holocene way of understanding and being present in the world; this being-in-the-world seems to be life-negating, limited, and flawed (Nørreklit and Paulsen, 2022).

Understood in this way, the Anthropocene can be seen as a crack, not only ontologically and epistemologically but also, axiologically, and existentially. We live in a wounded time, we are this wound, we feel we are responsible for the wound, we are hurt by it, we are thinking and beginning to respond from this woundedness, and, in solidarity with others, we are wounded by effects and domino-effects of our Late Holocene abstract self and world understanding. Understood in this way, the Anthropocene says, “We did it, we are sorry, we are hurt, we hurt

¹⁷ The Derridean concept *(im)possible* means that an undeconstructable condition of something constructed makes the latter possible as constructed, but also not possible, in the sense that it can be deconstructed (Caputo, 2018).

others, we are lost, we realized what we have done, we want to start all over.” That is it.

Yet what matters is to see how the Anthropocene crack reveals 1) the life-negating water-world-forgetfulness of our Late Holocene understanding of our self and the world, but also 2) what has been forgotten: a different understanding of water. Thus, the crack is an oceanic and tethysian event: our tears, our declining fertility, the melting poles, the rising sea levels, global warming, and other calamities, these wounds, are related to our misunderstanding of water. Of course, we have also misunderstood other things, but our misconception of water is a misunderstanding of the *arche* of all living things and the living world, including ourselves. From the crack we begin to sense how we forgot the most important aspect: that we are living beings in a living world, where all life is comprised, bound together, and surrounded by water. It is not that we have totally forgotten this. All the way up until now, we have known that water is “the main constituent” of the living world. Yet it is first with the Anthropocene crack that we feel that all life, as we know it, exists and only can exist, as far as we know, in this life-critical zone, slightly above and below the surface of the earth (Latour, 2017). To realize that we live *in* an oceanic-tethysian zone is only possible when the understanding of the world as a *stage*, *scene*, or *spaceship*, we are *on*, begins to dissolve.¹⁸ However, when, this happens, as now, we cannot understand how anyone, including ourselves, could go so mad to think that the earth was a ship that we could and should steer and control, where water is not the constituent arche or surrounding of all life, from within and without, but only an abstract entity we can extract. This point when normal becomes madness and unimaginable becomes sensible is also the point where the ecological crisis not only signifies a catastrophe, but also a turning point to a new world. In the last section, I will dive down through the Anthropocene crack to this tethysian ocean.

¹⁸ For an account of the philosophical-historical and conceptual roots of the understanding of the world as a scene, stage, or spaceship, see Paulsen (2021, 2022), who argues it can at least be traced back to the Renaissance.

4. Into a new Anthropocene understanding of our being-in-the-world

The Anthropocene crack is not just words or theory. It happens in many ways. Now. A telling crack-wound-case is *Berl-Berl*, a 2021 artwork by Jacob Kudsk Steensen, an immersive installation that is both a function of the Anthropocene crack and an expansion of it, a doubling out of the wound. The curator, Emma Enderby, describes *Berl-Berl* in the following way:

Berl-Berl starts with a swamp as its protagonist – its ecosystem, history and mythologies – and pays tribute to Berlin’s origin as a wetland that formed over 10,000 years ago and was drained in the 1700s. “Berl,” the ancient Slavic word for swamp, is [...] the origin of “Berlin” and gives the exhibition its name. The artist spent months researching the remaining wetlands of Berlin-Brandenburg, creating an archive of images [and] renders his findings in a 3D plan to create an immersive, absolute landscape [...]. Partnering with the Museum für Naturkunde Berlin, he also wove local specimens from their extensive archive into the visual and acoustic world of *Berl-Berl*. As songs were essential to ancient wetland culture and used to navigate the swamp and to share its mythologies, Kudsk Steensen collaborated with sound artist Matt McCorkle and singer Arca to create the world’s soundscape [...] *Berl-Berl* is not only an image of the wetlands – it holds the memories of its past mythologies. Before it was drained, this saturated landscape proved ideal for the settlement of Slavic communities.¹⁹ Sorbian folklore permeates the work’s narrative wherein a Triglav, a deity, appears as a great tree. The artist connects the mythology of this three-headed deity representing three dimensions of Slavic cosmology – Prav (Heaven), Yav (Earth) and Nav (Underworld) – to his understanding of the swamp. In *Berl-Berl*, the ecology is also a Triglav, it moves from undergrowth and fungi to water, leaves, and trees and sky – an entire, holistic landscape [that] becomes a gateway in which relics of the Ice Age connect to present-day wetlands, drawing attention to our current environmental reality. Kudsk Steensen reveals a perspective that would otherwise be impossible to see or experience with the hope of sparking a newfound appreciation for the swamp and to reimagine our role within this ecosystem that sustains us.²⁰

¹⁹ The *Berl-Berl* exhibition catalogue (2021) points out that, with the drainage of the swamp areas of Central and Eastern Europe, a large portion of the Slavic population became homeless, and their culture, myths, and languages were rendered almost extinct.

²⁰ See <https://berlberl.world/introduction>

My impression, as a spectator, is that the installation absorbs me into a living world, pulsating, wet, fishy, scaly, metamorphosing and transmuting without any clear-cut distinctions between flora, fauna, and other things, including digital entities. It gives me a feeling of witnessing the (re)birth of life, transgressing the time-space scales through which we usually perceive the world. My fifteen-year-old daughter, Yrsa, wrote some lines on her impression of the installation I want to add to give a sense of what Berl-Berl can do:

It feels like time is stopped but at the same time faster.

As if you are a small reptile, an insect that can both fly and swim, and this little insect just observes everything it can, takes it in. Up and down land and water what is what? Anything can be anything. A tree or a snake?

A plant or a grasshopper?

Perhaps a mixture? Mountain or tree stump?

One moment it's black and dark dramatic and creepy, the next calm serene bright like the clouds or is it clouds?

Snow, ice, water

Winter Spring Summer Fall.

Everything changes, but we just follow and observe everything that moves, even when it seems like everything is standing still, it changes.

Vanishing, coming, staying?

How long, how short, what?

Everything and nothing.

Really and yet not.

Things that seem familiar but also so unreal.

And what is important?

So simple, yet so complicated

“Just a Swamp”

But no, just no.

It's so incredible.

But most of all it made us, me, you, think. About everything between earth and heaven or nothing at all.

Sounds, high, low, soft, hard.

The water that ripples, the birds that chirp and sing.

The sounds of everything moving and changing.

A bit like people and our lives.

One day we are small and crawling, the next we are old and have difficulty walking.

You don't feel like you're changing, but you still think it's going too fast.

New, old.

Now, tomorrow, in a year.

So much to say, so many words but still empty of words. Nothing to say because the work says it all. Everything you are willing to hear listen see

Just stand sit be here be in the work, be the work.

A human could never say as much as the work says, but still, it doesn't say anything in words, but maybe that's why it says so much. But still, it is people who have created the work, but still because the swamp is there for itself.

Another language that we don't understand but we might try. There is so much that we cannot see and hear so much that we long for.

Many things could be said, but my aim here is only to pay heed to two essential features of Berl-Berl: 1) It is not a coincidence that the artwork is a swamp—otherwise overlooked; it demonstrates what we have forgotten. As Kudsk Steensen makes clear, we have drained most swamps on the earth; only one percent of land is now covered by swamp, but this space holds about ten percent of all biodiversity.²¹ From the perspective of a Late Holocene understanding of water, this draining demonstrates enlightenment, progress, and rationality, making room for cities like Berlin, industrialized agriculture, and so on. However, from the perspective of biodiversity, this draining has been life-negating. 2) It is neither

²¹ Concerning wetlands, the artist Kudsk Steensen has worked together with Dane Sutherland, who, in the exhibition catalogue, links the Berl-Berl installation to the poet, philosopher, and “patron saint of swamps” Henry David Thoreau. For an account of the link between swamps, wetlands, and our aquatic being-in-the-world, see Ryan (2020).

a coincidence that the artwork understands the swamp as an ecology, where everything seems to flow, mutate, and mix with and into everything else, including past, present, future, Slavic culture, sounds, and images, seemingly paradoxically in an artificially made digital world, that nevertheless creeps into our physical sensing bodies. By this, Berl-Berl has opened my senses and body as no influx²² before. Not only did I see something I never had seen before, but I also began to see differently. A *kaleidoscopic shift*²³ in how I sense the world happened. Expanding the Anthropocene crack in my being. Thus, the artwork opens the gate to an oceanic and tethysian understanding of the world. By this, I mean that the artwork is not a *landscape*, as Enderby puts it; it is a *waterscape*²⁴, a living whole, *revealing* that “landscapes” are not really landscapes, but appear so only if seen from the lenses of the Late Holocene. The swamp, with its layers, reaching up to the sky and down to the underworld, lets us see both the smallest and biggest, the things most close to us and the things farthest from us, all part of one sensible dripping whole, with birth and decay, pulsating intrinsically wet; it becomes a realization of a lost understanding, where water is the *arche* of everything; the swamp as a uterus and us, the living beings, as sensing, breathing, in an exchange with the world (Coccia, 2019). What the artwork reveals is a new world understanding that we can dive into and be drenched by. Instead of the earth as a plane, drained of water, where we have tried to order everything according to its usefulness, we can move around, but without intrinsic value, we are called to seeing the world ecologically, here in the sense of a water-world, where all has value, is “godly,” a lost world, drained away, but imaginable, and perhaps restorable. Thus, it destroys our misleading idea of landscapes and clarifies that any life-scape is *oceanic* in the sense that it is surrounded by and invaded by water in which life can evolve, copulate, and spread, and *tethysian* in the sense that it is pregnant with a rich and complex life, gathered in a pulsation of ever becoming living beings. Thus, Berl-Berl remembers what we have forgotten: that we are part of water-life, that flows in us, and which we breathe in, as the water creatures we are, in streams of influx and outflux, sensing and responding, along with other pulsating water creatures, on the blue planet, in the great blue, deep dark ocean that sustains us.

*

We can now sum up the difference between the mainstream Western Late Holocene human understanding of our self and the world *and* the early

²² The concept of *influx and efflux* is developed by Bennett (2020).

²³ This concept *Kaleidoscopic shift* comes from Bennett (2017, p. 103).

²⁴ For the concept of *waterscapes*, see Hawke and Spanning (2022).

Anthropocene. The Late Holocene sees the earth as a scene, stage, or spaceship we are *on*, as a world where humans are at the center, acting upon the world, forcing and extracting abstract substances out of the earth, to progress humanity in the direction from the past (premodern) to a projected (late modern) future, with everything else in the background as piles of resources. Here, water is a contingent abstract substance among others. The cosmos, understood as the universe is meaningless, only on the scene, where human acts, things receive meaning in relation to human plans. The surface of the earth is accordingly manipulated, like a LEGO-ontology; water courses are straightened, groundwater is pumped up, wetlands are drained, life is not understood in its essence. The early Anthropocene, on the other hand, sees the earth through the ecological crack-wound that the former self and world understanding has caused, as a living whole, we humans are *in*, together with other living beings, as a pulsating world where water is the *arche*—generative principle, origin, surrounding and “fons et origo, the reservoir of all potentialities of existence”²⁵—of this world, where all life beings, both as singularities and as a whole, have intrinsic value. In this world, there are no clear borders; no one-linear progression, only many simultaneously time–space scales. The human being is not seen as the main actor but is absorbed into the surrounding environment, as a creature among others witnessing the wonder of life. Accordingly, life, water, and living beings are listened to and appreciated *as they are*.

5. Conclusion

We are living beings, living *in* a world of water. The world and living beings have evolved together: two sides of the same pulsating event, gathering and spreading life. Our being-in-the-world is oceanic and tethysian. It is oceanic in the sense that we breath and spread life through and in surrounding water, together with other co-living-beings. It is tethysian in the sense that we are gatherings of life holding water inside and outside, mixing and differentiating us from each other. This is the basic structure of life, of living beings, and of the living world. All three hang together, are aspects of one and the same immersive whole. The principle—*arche*—of this life is water. The result is our godly earth, the tiny life-critical zone, remaking itself, through its relation to itself and to everything else, including the sun. Pulsating, still pulsating. In this cloudy and sparkling divine water-world, in this uterus, deep dark ocean, we humans live and become alive. Yet we are apparently one the most forgetful creatures. In the Late Holocene, a

²⁵ Eliade, 1991: 151, quoted from Hawke and Jackson, 2013: 124.

climatically stable period, of the undulating life-critical zone, we almost forgot that we were living beings in a living world; at least, we forgot what life means and why we live, despite life being in our veins as our basic structure. This took place in a tiny part of the world called *the West*. Here, the mainstream thinkers misunderstood their first philosopher, who said that *water is the origin of everything*, and *everything is full of gods*. They could not understand it. Instead, they believe in another philosopher and, with him, others who thought that the world consists of only of abstract substances, and human reason. This spread to the whole globe and become pure madness, and the climate was not stable anymore; at this point, the Anthropocene crack opened the gateway to a deeper sense of our self and the world, sitting around the corner of the ecological crisis. Yet still in this moment, only a passage, into a being-in-the-world as humans, we can only hope for and aim for, through making artworks like Berl-Berl, through writing this as I am, through paying more attention to our more-than-human life-companions, and through a thousand other things, that we still can do if we dare love this oceanic-tethysian world in which we live.

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Author

Michael Paulsen, Associate Professor, Southern University of Denmark, Denmark.
mpaulsen@sdu.dk

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A part of Nature or apart from Nature. A case for bio-philiation

Shé Mackenzie Hawke

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1. **Biophilia, Love and Alienation – on the Spectrum**
2. **Bio-philiation: an original ‘part of’**
3. **Apart from**
4. **A Bridge Between or a Bridge too Far**
5. **Moral Capacity Building**
6. **Ecological Longevity**

Keywords: Bio-a-philiation, climate change, comparative religion, cross-cultural, ecological-longevity, First Nations ontologies, life, love, nature.

Abstract. *Diverse inheritances of knowledge and experiences, along with current explorations of holistic sustainability, shows the potential for ecological longevity and how entanglements with natural worlds might be rethought toward a better sharing of the world. Through an interdisciplinary lens, this article re-considers Edward O Wilson’s rendering of biophilia, as a response to present Anthropocene crises. The paper further argues for a stronger re-turn to First Nations ontologies, sustainability practices and dialogue, in the hope of re-discovering how being ‘a part of’ nature might better endorse a ‘love of nature’. Embedded in such inter-disciplinary and critical embodiment praxis are signification systems shown through nature/culture*



confluences, spiritual beliefs and traditions, that form part of a knowledge plexus that calls on humanity to act urgently.

1. Biophilia, Love and Alienation – on the Spectrum

American environmental educator David Orr prophetically asserts in his essay: ‘Love it or Lose it: the coming biophilia revolution’ (Orr, 2011, pp. 186-211), that unless we can love nature, we stand to lose it. Statements such as this build on his earlier work and a genealogy of writers and researchers who speak of the love of nature, as well as the increasing alienation from nature that humans appear to have developed. In *Earth in Mind* (2004), Orr credits E.O Wilson and Erich Fromm for creating the neologism – biophilia. He references further definitions of biophilia (in addition to his own development of Wilson and Fromm’s work), to draw out the reverential aspect of human relations with nature, broadly understood. This can help humans to work toward a re-evaluation of how meanings and actions change over time, especially in relation to love of those other than ourselves. Love, then, appears as a leitmotif in what I propose here.

This paper argues that untangling such a plexus of cross-cultural and spiritual/religious knowledges is critical to re-imagining how humans can better bio-affiliate and act as caring planetary stewards with an increasing capacity for love. In building a case for *biophiliation* that is a running together of biophilia and affiliation i.e., bio-a-affiliation, I have coined it thus to advance future and inclusive possibilities of love of *all* life, and capacity to ‘be with’, both estranged and familiar lives and beings, both loved and yet to be known and loved (Hawke and Spannring, 2022). Additionally, I apply the ‘slow philosophy’ espoused by Michelle Boulous Walker (2017) as an intentional yet spacious mechanism to weave together poetic veneration of nature and cosmogenic creation through creative and cultural practice and scholarship from First Nations ontologies, religion and epistemes.¹

E.O. Wilson has defined ‘biophilia’ as ‘the urge to affiliate with other life forms’ (1984, p. 85). Psychologist, Erich Fromm, also speaks of biophilia within a

¹ This paper does not seek to re-define what nature or religion is or is not, nor to ‘persuade’ the reader one way or another. It does however, seek to reevaluate interconnections and reconciliation between people places, things, and beliefs that offer biophilic possibilities. The author intentionally cites primary examples from Maori and Australian First Nations scholarship rather than drawing only from the predominantly white, male Eurocentric gaze.

context that pre-supposes the proposition of re-wilding human consciousness while simultaneously engaging in slow and conscientious relationship and love between nature and culture:

Biophilia is the passionate love of life and of all that is alive; it is the wish to further growth, whether in a person, a plant, an idea, or a social group. The biophilous person prefers to construct rather than to retain. He wants to **be** more rather than to **have** more. He [sic] is capable of wondering, [...]. (Fromm, 1973, p. 366)

According to Orr (2004, p. 132), 'Both agree, however, that biophilia is innate and a sign of mental and physical health', in which awe and wonder are embedded. Orr follows through with an important question that is sustained throughout the argument of this paper, that is:

To what extent are our biological prospects and our sanity now dependent on our capacity for biophilia? To that degree it is important that we understand how biophilia comes to be, how it prospers, what competencies and abilities it requires of us, and how these are to be learned (Orr, 2004 p. 132).

To address that provocation, in particular relation to our 'biosocial prospects', prosperity and sanity, Orr (2004, pp. 131-35) considers that there is a dangerous looming opposite to biophilia, namely biophobia. My stance is to look more in terms of a spectrum. Steffen, Crutzen and McNeil (2007) never-the-less, argue along with others that biophobia arose from the 'Great Acceleration', born from the Industrial Revolution (IR) and more recently the Cold War period. The IR catapulted the planet into the Anthropocene Epoch, through which the excessive burgeoning of human impact through industry and its associated pollution knocked the planet out of balance to a critical 'tipping point' (p. 614). This is not to say that historically nature has always been good and pristine. On the contrary the spectrum is valid here as well as evolution, where keystone species prey on lesser species and so on. The difference is that from the Neolithic Age to the Anthropocene age the bio-phobic evolution of man, in which Steffen et al. (2007) say that the 'sustainability of the Earth's life support system' (618) is now compromised and may not be able 'to provide the services required to maintain viable human civilizations' (p. 614) is dangerously more apparent. During the IR, many western humans, and industrialised countries lost respectful or pre-existent seamless contact with their own natural worlds and those they were conquering. In this historical scenario, market driven governance, territorialised nature-oriented governance and connection (Potter, 2019; Strang, 2012), in which the carbon producing metropolis proliferated.

Mapping the spectrum between biophilia and biophobia, as Orr and others have argued, can help us understand how biophilia can continue to ‘come to be’, and how it co-evolves; its being and becoming constantly in play.² But is that enough and is it relevant to the twenty-first century human world that seems determined to remain alienated, cloistered by its own disaffection? Wilson (1984) suggests, our urge to affiliate ‘is to some degree, innate’ (p. 85), and rediscovery of that innateness could be enough to facilitate bio-philiation, and draw us closer to sane and equitable futures and a better sharing of the world. ‘Water literacy’ (Hawke, 2012; Hawke and Spannring, 2022), ‘eco-literacy’ (Capra, 1997), and environmental literacy all reflect eco-centric methods of engagement and knowing, and through which the biophilic spectrum can flourish—so that we do not kill ‘the thing we love, our Eden, progenitrix, and sibyl’ (Wilson, 1984, p. 12).

2. Bio-philiation: an original ‘part of’

Religious and spiritual traditions throughout the world, talk about creation through song cycles and verse reiterated through a different cadence than that of academic scholarship. The *Psalms*, and *Book of Lamentations*, of the First Testament, and the Song Cycles of Indigenous First Nations Australians, and Maori People are just some examples. Indicated in these creation stories is the idea of love and protection of what is created, from whom it was created, and for whom it was created. As Makere Stewart-Harawira says:

Maori oral traditions tell us that in the beginning, the world was ‘sung into being’ ... and is documented in traditional songs, chants, ... in traditional practices and in language, and is increasingly sought for its contributions to the preservation of biodiversity (Stewart-Harawira, 201, pp. 74-75).

Conversely, modern western philosophy has greatly shifted our understanding of knowledge be it natural, cultural or cosmic knowledge, away from nature. Bouslous Walker (2017) argues for the ‘love of wisdom, the instituting moment of Western philosophy’ (p. 2) that so moved Socrates, as ‘the *philo-sopher* – the lover of wisdom’ (p. 2). Yet in her treatise, she explains how the very instituting

² For example, in the work of Montana-Hoyos and Fiorentino (2016), biophilia and indeed biophiliation are used in the context of urban and post-industrial design – still working with nature respectfully, but not in the context of love and affiliation with all life, in the way that I use it here. Until I came across their work, I thought I had created the neologism. See also Barbiero and Berto (2021) who explain biophilia deftly along the lines of ‘both evolutionary adaptation and psychological orientation’, referencing E. O Wilson’s ‘phylogenetic perspective’ and E Fromm’s ‘ontogenetic perspective’.

moment of love and wisdom is gradually replaced: ‘The love of wisdom gives way to a particular form of the desire to know and this desire dominates the gradual institutionalization or sedimentation of scholarly philosophical inquiry, as we know it today’ (3), and in which any sense of elemental philosophy is largely lost. The argument I present here, in line with Bouldous Walker’s (2017) notion of ‘slow philosophy’, is slow and different readings and understandings of how nature ‘means’ across time, place, religion and cultures.

Before we turn to the current planetary crises of survivability, which recently included COVID-19 ³, let us revisit another old source in which human understandings and instructions for the care of earth are evident and expressed seasonally and elementally, and that have also changed over time. The decree of *Bal tashchit*, loosely translates from the Hebrew as ‘do not destroy creation’ (Bauckham, 2012), and is evidenced throughout the First Testament and its accompanying eco-theological history, particularly Deuteronomy (20:19-20). The instructions from Isaiah could not be clearer: ‘God, who formed the earth ... did not create it as a wasteland’ (45:18). Nor was it created as a singular entity, but a constellation of co-evolving entities. Such reverential respect and loving appeal or affection for nature is evident in most myths and religious traditions of the world as Charles Darwin, Alexander von Humbolt and others discovered. Yet these readings and knowings are prophetic and instructive because they emerge from the oldest of times when the human interface with nature was more intimate, set against the backdrop of harsh weather such as the desert conditions of the Middle East North African region (MENA), in this instance.⁴ Equally prophetic stories emerge from communities landlocked by ice and snow. Such history and stories conveyed through diverse spiritual and cultural traditions and ages serve to remind us of shared care for: people, creatures, the earth and the living waters *Mayim Chayim* (Bauckham, 2012). But how does that make sense in current times and in different global contexts and can it include a ‘slow’ devotion, to borrow from Bouldous Walker’s ‘slow philosophy’?

First Nations Peoples narrate a similar duty of care almost universally, made culturally specific through localised ontology, protocols and ritual and seasonal performativity. This care was also affected by internal cultural and biological conflict,

³ As well as intensified climate change and human global failure to reduce CO₂ emissions as reported at the COP26 gathering in Glasgow in November 2021 <https://ukcop26.org>.

⁴ See Jeanette Mathews (2019) ‘Led through Grief: Old Testament Responses to Crisis’ in *Stellenbosch Theological Journal* Vol. 5, No. 3. 621-642, in which she pastorally narrates human response to environmental and geo-socio-political and personal crises. Her reading of the Book of Lamentations is perceptive and warmly invitational to a modern reader experiencing modern crises.

and the effects of extreme weather events. Moreover, however, it was deeply wounded by European colonialism and its attendant philosophy and industrial imperatives. Reparation and reconciliation with land and water, and between peoples is clearly apparent in many areas more latterly.⁵ For example, in Aotearoa/New Zealand, *Te Awa Tupua*, a river known as the Whanganui River in Pakeha/English held special cultural significance for the local *Iwi*, and economic significance for settler-descendants. After a decades long process for recognition of its elemental and cultural value, this body of water was eventually accorded 'legal personage', sovereign status on 5 August 2014 because both settler-descended people (white/migrant) and Maori people recognised the river as a living being with power and agency of its own, with strong socio-cultural, economic and spiritual ties. It was later ratified in 2017. This case demonstrates that while water can be sacred, it is also somewhat business like – and acts according to its own volition, in the physical life and sustenance that it provides for both neighbouring ecosystems and people; it has physical and ecological value, cultural and spiritual value, and commercial value (Hawke and Palsson, 2017).

With the river as a meeting place, and through a cross cultural merging of concerns, *Te Awa Tupua* sovereignty was eventually recognised and upheld. By so doing, the humans of the region both Maori and Pakeha as well as visitors, entered into an affiliation with the river, a *bio-philiation*, borrowing from Wilson and Fromm's ideas of affiliation with nature, and in which the confluence between nature and cultures is readable, knowable and embodied. *Philia*, for the Greeks was one of the three words to denote love: 'Eros, meaning love of beauty or romantic love aiming to possess; agape, or sacrificial love, which asks nothing in return; and *philia*, or the love between friends' (Orr, 2004, 142). For my purposes *biophilia* is also representative of a transcendent love between friends of the earth, its airs and waters, as *bio-aphiliates*, where 'the patience involved in "sitting with" the world and being open to it' (Boulous Walker, 2017, p. 7), matters and yields different knowledge, connection, and 'a kind of non-institutional reading' (p. 17) not dominated by 'the corporate nature of today's institutional demands' (p. 17), of an 'only human' world.

Such possibilities as non-dominant demands, and concepts of entitlement and legal rights in natural environments, are discussed in judicious detail in *Should Trees have Standing* by American Law Professor Christopher D. Stone in the 1970s (and revised in his later 2010 edition). Wilson, who is so optimistic in what we

⁵ This is not to say many colonials/visitors did not imbue a love for nature, but that nature and love are variously understood and impacted by colonialism.

might do for nature, also references this work in his *Biophilia*, (1984) asking as Stone does, why don't we extend ... 'protection to other species and to the environment as a whole' (Wilson, 1984, p. 131). Stone explains that 'the common law makes natural objects rightless [and] has to do with who is regarded as the beneficiary' (2010, p. 5). In the Western Tradition, the law of economic development and profit have been the primary beneficiaries and eroded much of the broader and more holistic sense of natural, religious, or ancestral cultural law and beneficence in much of the colonised world, as the historical record attests. As Wilson further surmises, 'Humans beings are a contractual species ... who easily discriminate against strangers' (1984, p.131). Since the Industrial Revolution, nature has increasingly become the stranger, and 'advances in conservation ... have been equally subordinate to whim and short-term social [and industrial] needs' (Wilson, 1984, p. 125). Maori academics James Morris and Jacinta Ruru drew on Stone's work to frame the case for the Aotearoan case of *Te Awa Tupua* (Whanganui River) waterway. It is important to recognise Maori apprehensions of their own circumstance rather than relying exclusively on Pakeha observations. Four years before the legal personage was granted, they proposed that:

Applying Stone's idea to afford legal personality to New Zealand's rivers would create an exciting link between the Maori legal system and the state legal system. The legal personality concept aligns with the Maori legal concept of a personified natural world. By regarding the river as having its own standing, the mana (authority) and mauri (life force) of the river would be recognised, and importantly, that river would be more likely to be regarded as a holistic being rather than a fragmented entity ... (Morris and Ruru, 2010, p. 58)

In the 'Whanganui River Deed of Settlement Initialled' of March 24, 2014, the intentions of the Title were explicated by the Honourable Christopher Finlayson, in which it was stated that

The *Te Awa Tupua* Framework ... Establishes the river as a legal entity, with its own legal standing, reflecting the view of the river as a living whole, and enabling the river to have legal standing and an independent voice.⁶

⁶ For the full discussion of the 'Settlement' over *Te Awa Tupua* see Maori Law Review 2014 *The Whanganui River Settlement* <https://maorilawreview.co.nz/2014/05/ruruku-whakatupua-te-mana-o-te-awa-tupua-upholding-the-mana-of-the-whanganui-river/> accessed September 09 2014

Once the river received its legal entitlement, spokesperson for the Whanganui Iwi Gerrard Albert, expressed the celebratory mood of the people, (a sentiment also shared by the Pakeha community of the district): ‘Our entire existence as a people is intrinsically linked to the river as reflected in our saying *Ko au tea wa, ko tea wa ko au – I am the river, the river is me*’⁷. (Scoop Independent News n.d. 2014). The results of this ecological and cross-cultural campaign I argue, represent a philial love between friends inter-culturally, and a love of elemental relation. The possibilities to increase in awe and wonder and ‘read’ how lines of connectivity draw us into a cultural and elemental family tree are infinite, and in which ‘Authentic or genuine love welcomes the strangeness of the other’ (Boulous Walker, 2017, p. 134), in this case the former ‘strangeness’ of nature, ‘and the generosity that emerges from this encounter’ (p. 134). It further points to a ‘righteousness’ of nature, and the value of the ‘natural library’, in which water might be read as a ‘canonical text’ (Hawke, 2012, p. 239).

Prior to colonialism, in which many formerly sovereign nations and their environments and resources suffered, the openings between nature and culture were less defined, and ownership/custodianship differently understood and applied, yet symbolic orders were readable and knowable, if obliquely to the western eye. ‘As Indigenous people have been explaining ... Aboriginal and Torres Strait Islander cultures inhabit a profoundly different relationship to land and to what a western episteme would term the non-human world. “Country” is genealogic, epistemic and ontological’ (Potter, 2019, p.1346); there is no separation except those imposed by others. In post-colonial times, many First Nations and Indigenous Peoples have sought a renewal of tangible and intangible connections for

See also Jacinta Ruru. 2018. ‘Listening to Papatūānuku: A Call to Reform Water Law’, *Journal of the Royal Society of New Zealand* 48.2-3: 215-24. DOI:

10.1080/03036758.2018.1442358.<https://www.tandfonline.com/author/Ruru%2C+Jacinta>

And: ‘Hundreds Celebrate Signing of Whanganui River Settlement’

<http://www.scoop.co.nz/stories/PO1408/S00074/hundreds-celebrate-signing-of-whanagnui-river-settlement.htm> accessed September 09 2014

Ruruku Whakatupua Te Mana O Te Awa Tupua, <http://nz01.terabyte.co.nz/ots/DocumentLibrary/140805RurukuWhakatupua-TeManaOTeAwaTupua.pdf> (accessed on 14 December,

2015). See also Strang, V. (2020) *The Rights of the River: Water, Culture and Ecological Justice*. In H.

Kopnina and H. Washington (eds.), *Conservation*, Cham: Springer, p. 105-119.

https://doi.org/10.1007/978-3-030-13905-6_8 for a western scholarly perspective on *Te Awa Tupua/ Whanganui River*.

⁷ Gerrard Albert has represented the Iwi in the media such as in Scoop Independent News, over the ‘Settlement’. For more information see the full coverage in Maori Law Review 2014 *The Whanganui River Settlement*, as noted above.

themselves and to re-establish kinship ties broken by the effects of colonialism. Many also see it as a way towards a sustainable and intelligent partnership future for all people, in which the economic, natural and cultural values of the river are recognised more constructively towards a dialogic cross-cultural future, in which spirit is embedded.

Australian Aboriginal elder Auntie Pauline Gordon of the Widjabul People, for example, explains that not only are the lines between values, and nature and culture tangible and intangible, there is also the factor of the co-existence of past present and future: “There is “the ordinary physical world” and “another connected world from which it is derived”, often called the dreaming or Dreamtime” (Bragg, Acret and Gordon, 2007, p. 12). And these worlds do not travel in straight lines, but are rather co-existent in a ‘complex adaptive system’ (Prigogine and Stengers, 1984; Spannring and Hawke, 2021), interlaced with other complex adaptive systems from the human and more-than-human realm. Such Indigenous renderings and measurements of value, as Muecke (2011) also notes, do not fit neatly into western ‘phenomenological orthodoxy’ (p. 2) or disciplinary systems and are hence often misunderstood, despite Indigenous scholars who ‘consistently re-iterate a Dreaming as existing absolutely and beyond (...) human intervention’ (p. 3). Such renderings do however serve to inform saner prospects for future sustainability. The thematic of complexity, adaptivity and inter-connected systems, works well for this prospect, socially, elementally and spiritually.

Whitt, Roberts, Norman and Grieves argue along similar lines: “The land and living entities which make it up are not apart from, but part of, the people. Nor is the “environment” something surrounding a people. The relation of belonging is ontologically basic’ (p.7). The stories they have passed on, the signification system with which they are endowed, is co-constitutive of a 60,000 years old narratology, in which elements and creatures are main protagonists as much as people in ‘Country’, and the eco-fluency between all actors is acknowledged; historically the community is centred around the spiritual endowments of the natural environment and its creatures – the Dreaming. For Stewart-Harawira:

This relationship between Indigenous peoples and the environment as the most fundamental aspect of Indigenous identity is widely accepted amongst a large number of scholars involved in the study of Indigenous conservation practices. ... there is no sense of the individual as dominant over creation or that creation exists for humankind to exploit, but rather one of the individual as being one with and a part of creation. It is a relationship that carries particular responsibilities of caretaking, of guardianship, of protecting’ (2012, p. 83).

And if one part of creation, or indeed a creature or elemental friend or object was hurt, the custodians would respond, as an act of love, care, and cultural responsibility. Stone explicates this ontology of care broadly in the following way: ‘On a parity of reasoning we should have a system in which, when a friend of a natural object perceives it to be endangered, he [sic] can apply to a court for the creation of a guardianship’ (Stone, 2010, p. 8), which in a summative sense, is what *Te Ava Tupua/Whanganui River Deed of Settlement* began, until the rivers endangerment passed, and its sovereignty was restored. Embedded in that process is the healing of wounds on the nature/culture spectrum in which natural and cross-cultural entanglements are appropriately re-appraised and re-lived. Here I further seek to advance the ontological premise of ‘partner-ship’ and care through the broader theme of biophilia, and *being with* nature.

3. Apart from

*Nature in itself, or eternal Nature, is just mind born into objectivity,
the essence of God introduced into form,
save only that in Him [sic] this introducing immediately grasps the other unity.
(Schelling, 1803, p. 51)*

Schelling, writing at the advent of the Industrial Revolution, perceives nature and the mind that can behold it, as transcendent, unlike (Goldsmith 1794 as cited in Strang, 2004, p.19) who viewed extrinsic value in how such God given nature might be harnessed and commoditised. The latter, constitutes part of how we got to a place in history in which we would need to recover the former reverence for nature and cultural traditions that date back to the beginning of homo sapiens appearance on the planet.

Several geological epochs explain the adaptations of human beings across time and place, our current Anthropocene Epoch, preceded by the Holocene (last 12,000 years), and the Pleistocene prior to that. For the purposes of this discussion, let us travel back to the beginning of the Industrial Revolution and the Great Enlightenment of the Western Tradition that heralds the beginning of the Anthropocene, and follow the journey forward, and ask ourselves how we might now ‘be of service’ to the ‘service of life’ (Steffen et al., 2007, p. 618) in a non-possessive act of philial love. Here is Goldsmith (1794) cited in the carefully arranged book by Veronica Strang, *The Meaning of Water* (2004, p. 28):

God has endowed us with abilities to turn this great extent of water (The Thames) ... He has given us faculties, to convert them to our own purpose ... Let us boldly affirm, that the earth, and all its wonders, are ours; since we are furnished with powers to force them into our service.

Goldsmith's proclamation was not solitary, as Strang further narrates through a history of exponential depletion, pollution and disassociation of humans, from sources of water over the next few hundred years. She further notes an elemental 'hydrolatry', that echoes the 'idolatry and impiety' of social and religious issues that so concerned Athanasius (*On the Incarnation*): 'And everything was completely full of impiety and lawlessness, and neither God, nor his Word, was recognised, even though he had not hidden himself invisibly from human beings' (*Inc.* 11, in Behr 2014, p. 61). For First Nations Australian Peoples, God might be understood as the Dreaming (tangible, intangible, past, present, future, elemental and abiotic) embedded also in other creation narratives, understood as pantheistic and timeless (enduring).

Physicists Prigogine and Stengers (1984), who came up with the theory of 'Complex Adaptive Systems', also note attitudes to the Great Acceleration although before the Epoch had been named as the Anthropocene. They refer to both the perils and promise of industrialisation and technology and turn in part to philosophy to try and understand the evolving human 'apartness' from the natural world. For example, they adduce that: 'Heidegger is not concerned about the fact that pollution for example, has destroyed all animal life in the Rhine. What does concern him is that the river has been put to man's exclusive *service*' (p. 33). Such a mis-use of power is easily seen in hindsight. But in all fairness how could we know that the development of the engine, for example, would alter the global quality of the air we breathe for ever. Now that we do know, of course we are called to action to reverse or at least slow the continued accelerated growth of human industry and recklessness that speaks in the name of profit and economic development and denies the idea of nature as both sentient and rational. This involves taking a fairly thorough inventory of past practices, that no longer serve life, or a biophilization of the future. Capra (1997) coined the term 'ecoliteracy' – that may help us serve to dissolve apartness and concrete lines of separation.

4. A Bridge Between or a Bridge too Far

Landscapes are continually co-produced by a plethora of authors, no one of which, as an individual, is definitively responsible for what results from the writing. (Mangiameli, 2013, p. 148)

Jan Morgan (2013) refers to the great apartness as 'creation de-natured' (p. 104) and our collective dominant 'culture as ontologically crippled' (p. 125). The beginning of the license to bend nature to human will and make it 'other' starts with the Great Acceleration of the Anthropocene Epoch as Steffen et al., (2007) describe by stating, 'the Earth System has left its natural geological epoch' (p. 614).

During this ‘departure’ and coupled with our apparent denial of ‘the fact of living, life itself, life as such, or bare life ... an anthropology of life’ (Palsson 2013, p. 27), that recognises a broader milieu of life may serve the planet more equitably. However, the current state of play suggests that the ‘service of life’ (Steffen et al., 2007, p. 614) hangs in a precarious balance, however it is read. ‘An ethical engagement with the other [in this case nature] ... opens us and changes us – transforming us over time’ (Boulous Walker, 2017, p. 179), yet the pace of our transformation continues to lag. The 2019 United Nations Environment Program (UNEP) “Emissions Gap Report” clearly states:

We need to reduce emissions by 7.6 per cent every year from 2020-2030. If we do nothing beyond our current, inadequate commitments to halt climate change, temperatures can be expected to rise 3.2 degrees Celsius above pre-industrial levels, with devastating effect.⁸

The new call, after at least 250 years of full industrialisation or ecocide the world over, is to recognize that humans are not the only storytellers in the progressive narratives of creation. As Mangiameli’s work also suggests: ‘it would be helpful to focus attention not only on the process of reading, but also on that of the writing ... the world writes itself’ (2013, pp. 146-48). How well are we co-authoring the world for the next generation of readers? Failing our “Emissions Gap Report” by falling so short with carbon emission reductions, may not have propelled us sufficiently as recent history continues to show. However, the outbreak of COVID-19 in late 2019 certainly provided clear evidence that while humans tragically struggled to breathe, the biosphere was breathing anew, suddenly unhindered by human industry – discreetly proposing a new kind of ‘acceleration’, more reverent of all Creation, and the circulatory system of the planet, as well as delivering a new lexicon, to describe our transformations and their enactment. It remains to be seen how history will write its retrospective on the COVID-19 pandemic.

⁸ See The UNEP Emissions Gap Report online: <https://www.unenvironment.org/resources/emissions-gap-report-2019> that goes into considerable detail about what the the gap is as a measurement tool and what needs to be achieved to reduce it.

5. Moral Capacity Building

To possess intrinsic value is to be worthy of moral consideration.
(Freya Mathews, 2016, p. 143)

Under the current environmental, economic and socio-cultural rock bottom planet earth is facing, serious amendments to the human-centric habits and practices do now require transformation into bio-centric principles and practice and in which an appreciation of the 'intrinsic value' of all creatures and entities is recognised. 'To possess intrinsic value is to be valuable in one's own right, and inherently worthy of moral consideration' argues Freya Mathews (2016, p. 143), who further notes that "Biocentrism ... attributes intrinsic value, and hence moral considerability, to non-human entities in their own right' (p. 143), adding weight to the case for the combined agency of nature a sentient, rational and of diverse value. Where a sense of spirit sits in all of this, remains to be seen, but serving the naked truth of the vulnerable and attending to the fragile, seems logical and conscientious. Yet, as Indigenous elders, environmental justice activists, and scientists around the world have said so many times, we have defined the problem, we have the knowledge to fix the problems on all levels, so why not act with more affirmation, inclusion, intelligence, and reverence for life? Continuing to argue the case for biophilia and re-engagement with spiritual traditions and stewardship, is thereby essential to create space for more intimate connection to nature that is a critical part of the way forward. Reverence, respect and relationship underpin moral behaviour, but an evolved sense of global moral responsibility, affected by turning towards nature and its human allies for the answers, suffice? Popular culture mediums such as film and music, also produce naked-truths. Creative culture has a freedom of expression that politics, and scholarly engagement ultimately lacks, and perhaps this is where a rewilding of human consciousness might first flourish.

For example, in the film *Tommorrowland: A World Beyond* (Bird 2011) there are several key messages about doing life differently. Aimed at youth, and directed by Brad Bird, the dystopian film of the end of the world, sagaciously presents the epiphany for the teenage main protagonist Casey, who realises humans are broadcasting the self-fulfilling prophecy of doom, environmental degradation and negativity willingly, as if a micro-chip has been installed into our collective head. Not only are humans spiritless, their complicity in global devastation is both acute and chronic. This human neurosis is eloquently narrated in the soliloquy from

the main antagonist Governor Nyx who speaks of the terminal viral paradox of human self-obsession and complacency:

Let's imagine if you glimpsed the future ... politicians, captains of industry ... how would you convince them? Data, facts. Good luck! The only facts they won't challenge are the ones that keep the wheels greased, and dollars rolling in. But what if there was a way of skipping the middle man, and putting the critical news directly into everyone's head ... what reasonable human being wouldn't be galvanised by the potential destruction of everything they've ever known or loved. ... How do you think people responded to the prospect of imminent doom? ... They didn't fear their demise, they re-packaged it. ... The entire world wholeheartedly embraced the apocalypse, and sprinted towards it with gleeful abandon. Meanwhile your earth was crumbling all around you. ... Bees and butterflies start to disappear, the glaciers melt, algae blooms, all around you the coal mine canaries are dropping dead – and you won't take the hint! ... So, yes, you saw the iceberg, warned the Titanic, and all steered for it [the iceberg] anyway[...] (Bird, 2011).

Are we really so galvanised towards our own destruction? Is it true that 'What we love only from self-interest, we will sooner or later destroy' (Orr, 2004, p. 142)? Or can we skid to a halt and re-activate imagination, appropriate innovation and better ways of sharing the world, a *metanoia* that involves a complete transformation of being and knowing and that 'alters the character of our entire civilization' (Orr 2004, p. 145) and relationships between nature, culture and the cosmos/God. We will need many Carpathians to rescue in titanic proportions: this ship, this mission, this creation, to seek out those with a capacity to embody the earth and what it gives and shares and develop some insight into its concomitant daily crucifixions at the hands of human enterprise. As Freya Mathews says of the current age, 'It will take our best poets along with our best scientists and natural historians to compose, generation by generation, the great Song Cycle that could unite, at the level of moral obligation, multiple cultures and societies' (2011, p. 275).

While culturally different, the story of Genesis, and the stories of the Dreamtime and First Nations Spirituality all narrate a Creation story and the concurrent moral human responsibility to protect that which has been created, as the elected stewards of creation, as kin. Political ecologist, Ariel Salleh, does warn however that the equity of that care and stewardship is variously realised (and enacted) by 'species, gendered and postcolonial others' (2017, p. 25).

6. Ecological Longevity

*The once-neon reef
bubble wrapped and bleached
asks to be seen. (Author)*

Ecological longevity is predicated on getting things very right in the next decade, and indeed the nearer future, as the planet is faced with re-assembling itself after the prolonged fall out from COVID-19 virus, that has seen other species flourish and breathe with greater ease, while the lives of vulnerable humans have expired. Continued mitigation strategies for guardianship of vulnerable, people, places, species and elements will be crucial. We must ask to see and be seen in *all* our vulnerability, if we are ever to accept the precariousness of *our* standing on the earth, and the standing of other creatures and things, as a part of the ongoing story of life – of love. As Braun and Cavagnaro said in their perceptive book *Living Water*, in relation to nature's articulation of the body of the world, 'nature may consider him [man] an experiment as yet unproved' (Braun and Cavagnaro, 1971, p. 24). Writing at a similar time, and at the advent of the deep ecology movement Gregory Bateson (2000 [1972]) aptly said: 'The unit of survival is organism plus environment. We are learning by bitter experience that the organism which destroys its environment, destroys itself' (p. 491). This sentiment is pre-supposed by Rachel Carson (1962) in *Silent Spring*, in which she says 'Water, along with other resources, has become the victim of man's indifference' (Carson, 1962, p. 50). She provides a tragic plethora of examples of environmental damage caused by pollutants used in agriculture (and by extension aquascapes and the respiratory system of the planet) to turn the earth and its crops into hyper production – the bigger the better – denying for decades the 'earth's green mantle' (p. 69) an opportunity to 'rest' and revive. She warns, 'Future historians may well be amazed by our distorted sense of proportion' (p. 26). The 1970s, while the peak of the Cold War politically, also represented the new peak of the 'Great Acceleration' and the bedrock of environmental pollution that the era propagated, where exchange value of nature was all it stood for, and the pace at which we have consumed it, and paradoxically disembodied it, irrelevant.

What now are the actual strategies, and ways of knowing and reading that are in place, to both empower people in the re-assemblages of everyday life, and support of industry and economics in appropriate scale. Icelandic philosophers Þórgeirssdóttir and Jóhannesdóttir

speak of how we *be* and *become* and discover (or mis-cover) nature through our entangled being in the world: 'There are parts to nature (as both our inner and external environment) that are still concealed. We are continuously in the process

of discovering nature, either with the help of science, or our own lived experience' (Thorgeirsdottir and Jóhannesdóttir 2016, p. 41). Such a re-posturing they suggest, involves '*sensing and experiencing* like embodied beings' (p. 41), the embodied beings we actually are, not as appendages to a perception of nature that exists somewhere 'out there' as the exotic 'other' known only as strangeness.

How well we listen in to our inner and external environments, and as students to older cultures who demonstrate affiliation – bio-affiliation – with the earth, its waters and airs, and to other more and differently knowledgeable others, can steer us through the latest in a series of bio-phobic crises and help us make meaning of what we encounter (Hawke and Spannring, 2022).

Re-purposing human thinking and agency then, seems to be a valid alternative cognisant of potent interactions such as bio-philiation, and feedback, and in which the vast assemblage of life and co-creation adapt for a future we cannot yet see or read. How well we read the signs that nature is showing us now, about *its selves*, and *ourselves*, is worthy of deep consideration. Where might convention and re-viewed symbolic systems lead and can they adapt to otherwise knowledges and naturalisms?

Human cultures have indeed inherited a rich body of knowledge, both from inter-disciplinary and cross-cultural fields, spiritual and religious traditions and the murmuration and articulations of nature itself. But as this paper has proffered, our challenge rests in the human capacity to re-institute some of what we have lost, by 'heading towards a new naturalism' (Prigogine and Stengers 1984, p. 56) that, includes *bio-a-philiation* at the core. Incorporated in such a new naturalism or whatever twenty-first century lexicon and praxis we invent, must be a reverence for life, 'as the only possible basis for a philosophy [broadly imagined] on which civilization might be restored from the decay ... of the modern world' (Orr 2004, p. 138) that has become estranged from its source and in so doing de-ranged our physical, mental and spiritual selves. If, as Ariel Salleh (2017) suggests 'ecology reframes history', how will a re-constituted composite ecology of the future look, and can it include all life in intelligent measure, by discovering some unifying and dedicated thread – possibly love?

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Author

Shé Mackenzie Hawke, University of Sydney, Sydney, Australia,
she.hawke@sydney.edu.au, she.hawke@yahoo.com.au

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Invasion biology and its discontents. Human supremacy, language, and animal treatment

Helen Kopnina and Simon Coghlan

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Abstract. *Invasion biology is increasingly facing criticism, including for its moral attitudes towards “invasive alien species.” In this paper, we argue that invasion biology relies upon ethical assumptions of human supremacy that are reflected in and reinforced by language used to categorize introduced animals in morally problematic ways. We discuss how denigratory scientific, official, and widely used terms such as “invasive,” “alien,” “pest,” and “feral” interact with the dubious treatment of animals, and we examine several aspects of how the demonizing meaning of these terms are shaped. The shaping*



factors we focus on are the differential treatment of “invasives” versus humans and other ecologically damaging animals, namely animals in agriculture, and the stock and performative treatment of animals labelled “invasive aliens.” We propose that such language should be essentially removed from biological and conservation sciences and consigned to history’s dustbin. Indeed, invasion biologists should come together to find a new name for their discipline – or rather, for the discipline “invasion biology” might become when it jettisons its assumptions of human supremacy.

1. Introduction

Invasion biology has faced criticism and controversy over recent decades (Davis, 2009; Elliott-Graves, 2016; Inglis, 2020; Simberloff, 2012). The controversy manifests in diverse academic and conservation communities and is associated with empirical, conceptual, and ethical disagreements about the nature and practice of that discipline and allied disciplines (Cassini, 2020; Castelló and Santiago-Ávila, 2022; Lidström et al., 2016; Probyn-Rapsey and Lennox, 2022; Ricciardi and Ryan, 2018; Sagoff, 2018, 2020; Valéry et al., 2013). Although invasion biology focuses on achieving scientific understanding of adverse ecological impacts caused by what it classifies as “invasive alien species” (also abbreviated IAS), it is also informed by divergent understandings of what the natural world in the Anthropocene will and should look like. Moreover, invasion biology is increasingly witnessing colliding ethical perspectives concerning nonhuman animal interests, sentience, and treatment (Courchamp et al., 2017; Vucetich and Nelson, 2007). Indeed, there is growing critical attention in conservation and ecological scholarship to notions of anthropocentrism, human exceptionalism, and human supremacy (Kopnina et al., 2018; Wallach et al., 2018) - notions that point to the relative underestimation, dismissal, and denigration of nonhuman creatures (Midgley, 1998).

Human supremacism refers to the way that humans often regard human life as vastly more morally significant than nonhuman life (Kymlicka, 2018). On this view, humans and their lives are taken to be worthy of strong and extensive protections from harmful and lethal treatment, while nonhuman animals and their lives are not. Increased awareness of this inherited moral view is helping to drive discontent about invasion biology. It is important to note that most invasion

biologists would agree that humans are not the only loci of value, since the natural world too has value and is worth protecting. But this element of non-anthropocentrism can and often does co-exist with human supremacism. Human supremacism is arguably evident, for example, in the way that invasion biology divides animals into categories of invasive and alien *versus* native and domestic. Arguably, the designation of some animals as “invasives” or “aliens” not only reflects certain ecological effects and qualities of “non-nativeness” but also embodies attitudes towards those animals’ intrinsic value or moral worth.

In this paper, we argue that the language and categorization of animals as “invasive aliens,” and the associated treatment of those animals, is ethically problematic. In fact, we contend that the very name of the scientific discipline - *invasion biology* - needs rethinking (Inglis, 2020). Similar “official” and authoritative labelling - such as by government agencies and conservation organizations - also needs reexamination, as does the use of such terms in less technical or less official and more ordinary or everyday ways. Despite our criticisms, we acknowledge that “non-native” species are indeed implicated in morally difficult and practically wicked problems that defy straightforward and uncontentious solutions. Nonetheless, we shall argue that the role of language and classification here is not trivial or merely “theoretical,” for it can shape and even distort our thinking about appropriate or necessary practical conservation responses. It is a simple fact that so-called “invasive” animals have often been treated with little or no moral consideration (Lidström et al., 2016), and still are. As we shall argue, terms like “invasive” both express and perpetuate a belief in human supremacism that fails to give animals due moral consideration. Our essay explores how both labelling and treating animals as “invasives” is a consequence of an ethically problematic yet often unquestioned allegiance to human supremacy.

The paper proceeds as follows. Section 2 outlines the official classification of IAS, and Section 3 introduces recent ethical critiques of invasion biology and traditional conservation. Section 4 canvasses some initial possible objections from invasion biologists to ethical criticisms, while Section 5 reveals the assumption of human supremacism in invasion biology. Section 6 discusses the ethical nature and implications of language and the categorization of animals. Subsequently, the paper examines the mutually reinforcing nature of language and animal treatment in terms of the differential treatment and demonizing labelling of other ecologically damaging animals, especially humans and “livestock” (Section 7), and the stock and performative treatment of animals deemed “invasive aliens” (Section 8). The conclusion briefly looks to how problematic language and

assumptions of human supremacism that harm animals and ecosystems might be addressed.

2. Classification of invasive alien species

Invasion Biology is partly defined by facts about “natural”¹ and historical animal migration and anthropogenic introductions of species into new environments (Crees and Turvey, 2015). In Earth’s natural history, members of different species have sometimes moved into new territories beyond their historical ranges (e.g., Johnson et al., 1996). Such movement has been integral to the lives of many animal species and is also a major cause of speciation or the birth of new species (e.g., Teitelbaum and Mueller, 2019). However, invasion biology focuses on so-called “introduced” species - that is, species introduced by *humans* (USDA National Invasive Species Information Center, 2021).

Human-mediated movement of life forms have radically changed the “natural” situation. Before humans, species mobility was more profoundly hampered by natural barriers; some, like oceans, were virtually insurmountable. Natural barriers can promote evolution, and long-term isolation of populations on islands and continents have generated unique endemic species existing nowhere else (Johnson et al., 1996; Teitelbaum and Mueller, 2019). Endemism is among the most significant dimensions of Earth’s biodiversity and is intimately tied to “biodiversity,” or the uniqueness of different places on Earth. By both design and accident, humanity became the most formidable influence on the global distribution of species. Consequently, numerous endemic species have experienced unprecedented risk or been driven to extinction, and the planet has become increasingly bio-homogenous - a situation further exacerbated by planted monocultures grown for human and animal consumption.

Even so, not all species introduced intentionally or unintentionally by humans into new environments - so-called “alien species” - wreak ecological havoc. Many perish, while others become assimilated with few ill effects. Some introduced species may have initial negative impacts but eventually become nativized, established, and ecologically integrated. Nonetheless, if emergent conditions facilitate explosive reproduction amongst introduced species sometime after their introduction, these species can become deleterious to other (“native”) species, both plant and animal.

¹ We note that “natural” and “nature” are complex terms that are currently subject to scholarly discussion and disagreement (see, e.g., Ducarme and Couvet, 2020).

The term “invasive alien species” (IAS) is a technical or official term in invasion biology. The designation applies to species beyond the perimeter of certain human uses that are judged to have deleterious current or future consequences for biodiversity in wild environments and/or for humans (e.g., human health and economic activity). This subset of introduced species may kill, outcompete, infect, or displace “native” species and contribute to extinctions and global loss of endemism and biodiversity. For example, the similarity of fish species in US freshwater systems has increased dramatically because of the introduction of game fish across the North American continent (Rahel, 2007). Globally, many of the most ecologically damaging species - including highly adaptable animals like rats, cats, feral dogs, pigs, and goats - contribute to epoch Homogenocene, as our biogeological time has been christened (Mann, 2011).

Some animals arguably occupy a grey zone between fully native, introduced, and “invasive.” Consider the dingo. Brought by humans to Australia several millennia ago, dingoes may have played a role in the mainland extinction of the Tasmanian tiger (Balme et al., 2018) (though this is debated). In any case, this relatively recent arrival has become nativized and established. Indeed, conservation biologists sometimes applaud the dingo’s present ecological role as an apex predator, since dingoes help control invasive meso-predators like foxes and feral cats (Johnson and VanDerWal, 2009). However, some agriculturalists persecute dingoes as pests and enemies of livestock to protect their livelihoods and economic interests, sometimes killing dingoes and hanging their corpses from trees and fences on display.

The dingo illustrates the definitional quandary of how long a species needs to be present in a new area and what level of integration it needs to have for it to earn the title “native.” Nonetheless, there are many species that are much easier to classify; indeed, invasion biologists have had little difficulty in calling many animals invasive aliens and advocating for their removal, often by harmful and lethal means. However, both the biological classification and the treatment of animals as invasive aliens has begun to be questioned, including from the perspective of ethics.

3. Emerging ethical critiques of invasion biology

Strong ethical concerns about individual animals have often been lacking in more mainstream conservation circles and certainly in much actual conservation practice (Wallach et al., 2018). Historically, values and goals related to the integrity of ecosystems and viability of native (and especially endemic) species tended to

trump concerns about the well-being and lives of individuals that are labelled invasive or pests. The tide has begun, albeit slowly, to change. There is now greater interest in animal welfare in conservation (Beausoleil, 2020; Hampton et al., 2019) and in the welfare effects of poisons, snares, and guns. Moreover, concern for animals can go beyond a basic interest in animal welfare and the avoidance of suffering. For example, some critics note that we often fail to give serious moral regard for animals and their desire to continue living, their inherent or intrinsic value, and their fair and just treatment (Lynn et al., 2019; Santiago-Ávila and Lynn, 2020).

Critics also contend that maligning and disparaging invasive species make them appear dispensable and can even constitute an intrinsic injustice. Philosophers C.E. Abbate and Bob Fischer recently argued that when conservationists and influential conservation bodies designate some but not other animal species as invasive and worthy of extermination, they *demean* the animals so labelled and treated (Abbate and Fischer, 2019). These authors argue that wrongful discrimination occurs when conservation treats different sentient nonhuman animal species that have the same moral worth as if they had radically different moral worth. Holding, say, that wild-living cats - but not bilbies - are simply “not worthy of existence” (Abbate and Fischer, 2019, p. 8) in Australia constitutes wrongful discrimination, insofar as cats and bilbies have equal moral worth and are both worthy of existence. Abbate and Fischer contend that this form of differential attitude and treatment is itself a demeaning or degrading wrong to those targeted animals, *independently* of any associated harm done to them (such as suffering) and any other infringements of their rights.

A significant ethical development within conservation biology occurred recently with the emergence of compassionate conservation (Ben-Ami, 2017; Bobier and Allen, 2021; Coghlan and Cardilini, 2021). This philosophy and movement is currently mounting a sustained critique of ethical values traditionally assumed in conservation and invasion biology (Ramp and Bekoff, 2015; Wallach et al., 2018) and has generated some opposition (Callen et al., 2020; Driscoll and Watson, 2019). Its practitioners claim that we should not lose sight of individual animals and their wellbeing when we address ecological problems. On the contrary, they argue, we should place certain ethical principles that value and protect individuals front and center, or alongside rather than subordinate to principles that value and protect collectives such as species. According to this approach, principles such as “Individuals matter”, “First do no harm,” and “Peaceful co-existence” should replace the moral anthropocentrism that underlies and shapes much conventional conservation practice (Wallach et al., 2020).

While compassionate conservationists do not deny that introduced species can sometimes be a real ecological threat, they do argue that conservation policy should respect individual animals and their self-determined relational lives, modes of social organization, and interests in living as the kind of individuals and communities they are. Arian Wallach and colleagues write that as “people who care about wildlife and nature, the conservation community should ask itself not only what kind of nature (ecology) it aims to preserve but also what kind of nature (character) it aspires to manifest. That conservationists have normalized the perpetuation of substantial, intentional, and unnecessary harm against wildlife individuals is a tragic failure to exercise compassion” (Wallach et al., 2018, p. 1263).

We shall argue that one fundamental way to treat animals justly and compassionately is to stop categorizing certain creatures as *alien invaders* (and similar) and to cease treating them in a spirit that reflects an underlying assumption of human supremacy. This change entails altering the language with which we scientifically and otherwise officially classify animals, and also unofficially describe them. It further entails altering the treatment that characteristically accompanies such categorization and description. As we shall argue, the language and the types of classification of certain animals on the one hand, and their wrongful treatment on the other, are interwoven.

4. Initial objections from invasion biology

Our claim is that the scientific or official designation and the casual labelling of animals as “invasive,” “aliens,” “pests,” and the like - plus a great deal of the treatment that accompanies that language - is ethically problematic. In response to this claim, invasion biologists could advance at least two initial objections. Some invasion biologists may first remind us that non-native, introduced animals often have profoundly damaging effects on native species and ecosystems. Indeed, there no shortage of examples of such ecological damage. Invasion biologists may further claim that efforts to eradicate those damaging species can sometimes benefit native species and should at least be tried, given the great environmental harms that may otherwise ensue. Such action, it may be said, is ethical even though it is harmful to animals and even though the ecological benefits of harmful action are often not certain (and may be far from certain).

Second, invasion biologists might argue that categories and descriptions like “invasive” and “alien” accurately reflect the ecological realities. They may acknowledge that animals are due moral consideration for their welfare, but that these values and duties are typically outweighed by duties to conserve threatened

native species and ecosystems. Nonetheless, they may stress that minimization of animal harm and suffering within such activities should occur where possible. All this, invasion biologists may conclude, is consistent with continuing to officially designate and to unofficially describe many introduced animals as invasive aliens and pests.

In our view, these objections from invasion biology are problematic. Specifically, they tend to be grounded in an ethically dubious assumption of human supremacy and they relatedly underplay the ethical import of labelling and classifying animals in the ways that they do. We will argue that case in a moment. But before that, we want to again stress that introduced species can indeed create difficult practical and ethical problems. This point is sometimes resisted. For example, some critics of invasion biology point out that if certain introduced species tend to cause damage, they do so not single-handedly but in conjunction with other key causes, often anthropogenic drivers such as fossil fuel burning, deforestation, land agriculture, pollution, and overfishing.² Critics of invasion biology may also note that eradication of introduced species can be an empirically contested measure: eradication programs sometimes work but often they do not. In the last two to three decades, for example, introduced rats have been eradicated from about a thousand small islands (the most recent case is South Georgia Island near Antarctica, the biggest island thus far of rodent removal success after a decade-long campaign (Martin and Richardson, 2019)). By contrast, operations on continents to eradicate the Nutria (a large rodent originating from South America) from the Chesapeake Bay region (US), Burmese pythons (native to Southeast Asia) from the Everglades (US), or cats and rabbits in Australia have been largely unsuccessful (Kearney et al., 2018).

Some critics of invasion biology also claim that introduced species can increase biodiversity locally even as they reduce Earth's biodiversity overall. Introduced species that flourish in new environments may be regarded as especially ecologically valuable when those species are threatened in their original ranges. It is also possible to argue that species movement is a natural phenomenon and that humans are "natural" too; thus, human artifacts such as parking lots and monoculture plantations are in a sense a part of nature. And because it is ultimately *nature* that is driving biological invasions, resulting ecosystems abounding with introduced species are simply "novel ecosystems" or "the new wild" (Pearce, 2016).

² Critics can of course recognize exceptions in which an introduced species has almost single-handedly caused extinctions. An example could be the adverse effects of the brown tree snake which was accidentally brought to Guam (Wiles et al., 2003).

Some of these criticisms contain insights. For example, it is true that there are other important drivers of ecological damage that need to be addressed more seriously (we return to this point in the conclusion). It is also very important to appreciate, partly for moral reasons, that eradication programs can often fail, especially in the long term. Furthermore, the idea that we may challenge “nativism” and re-imagine the ecological role of non-native species is important and worth debating further (Peretti, 1998).

Nonetheless, we might question the unequivocal naturalization of human impacts on nature and the acceptance of homogenization in Earth’s biota. While the human-induced movement of animal species may sometimes entail a “resetting” of evolutionary history under which biodiversity eventually recovers, “eventually” here may mean thousands or millions of years. And although humans are indeed part of the natural world, they also possess a profound ability to wreck it. Finally, while we agree with some critics of invasion biology that it is important to recognize the limitations of effective control of unwanted species, that fact alone does not demonstrate that it is ethically problematic to label those animals as “invasives” and to seek their eventual eradication for ecological reasons, even if doing so involves causing great suffering and mass death and even if the success of the programs is uncertain. Such criticisms of invasion biology must be buttressed by further arguments about the classification and treatment of animals as “invasive aliens”. We shall now make one such argument.

5. The assumption of human supremacy

Attempts to justify the classification and treatment of “invasive alien species” relies on an assumption of human supremacy. This claim needs some explanation. Human supremacism is the moral view that humans have the right to dominate and routinely harm and kill nonhuman animals - but not other humans - for the sake of human interests, including economic interests. A human supremacist implicitly or explicitly holds that the moral difference between humans and nonhuman animals is so large that we may regard animals as essentially our tools to use. This position is consistent with a belief in an ethical obligation to minimize suffering and other welfare harms in the pursuit of ecological or human interests. But for a human supremacist, such constraints are relatively weak and would never be applied to humans in that form, since humans are owed much greater consideration. For example, poisoning or shooting animals but never humans to protect collectives may be routinely seen as justified and “necessary”.

Human supremacism, then, severely downgrades the vital interests of nonhuman animals relative to humans and grants them far weaker protections. Human supremacism can also contain other elements. For instance, some human supremacists believe, as Eileen Crist puts it, that the “Earth belongs to humanity [and] that the planet consists in resources for the betterment of people” (Crist, 2017, p. 62). Political theorist Dinesh Wadiwel suggests that human supremacism can accompany a sense of entitlement concerning the domination and management of nature (Wadiwel 2015).

In fact, the assumption of human supremacy came under attack several decades ago just as the field of invasion biology was beginning (Adams and Gruen, 2014; Gruen, 2011; Regan, 2004; Singer, 1995). This critique, from disciplines as diverse as philosophy, political theory, and certain sciences, claims that human supremacy is a moral prejudice that lacks substantial ethical and scientific foundations. Given that many animals are sentient creatures with a range of emotional, social, and cognitive abilities, and given that a number of these psychological properties are similar to those found in human beings (even if they are not identical), many contemporary moral thinkers believe that the total or relative ethical dismissal of animal interests is a human prejudice (Korsgaard, 2004; Rachels, 1990). At the least, there seems to be an onus on those who place little weight on animal interests to show how that stance is not a mere prejudice that we have inherited.

Yet virtually no one in the fields of invasion biology or conservation more generally has attempted to provide solid foundations for the human supremacism that underlies their position. On the contrary, some conservationists (Callen et al., 2020; Driscoll and Watson, 2019; Oommen et al., 2019) have tended to respond to ethical criticisms of the treatment of introduced animals by simply ignoring or avoiding the challenge or by begging the question about the correctness of human supremacy and its implications for animals (Coghlan and Cardilini, 2020). The relative lack of reasoned argument is a key reason why it is often reasonable to refer to the *assumption* of (rather than just the belief in) human supremacy in the context of invasion biology.

The assumption of human supremacy explains why many invasion biologists, conservationists, and others are inclined to call for eradication programs so readily, including when the evidence that those programs will have the desired and sustained effects are uncertain or relatively weak. Because human supremacism sets the ethical bar for harming animals that much lower, nonhumans are often effectively treated as morally disposable even when harming them is regretted (though human supremacism can tend to displace moral regret as well (Batavia et al., 2020)). Furthermore, an attitude of human supremacy helps explain why

some people think it acceptable to officially (and colloquially) label some animals as “invasive aliens”.³

Such language can be regarded as itself an *expression* of supremacist prejudice against animals. Furthermore, those means of classification also help to *perpetuate* that prejudice. In other words, human supremacism and the language of classification are interconnected and mutually reinforcing phenomena. Because some will resist these claims, we shall now examine the language of invasion and its connection to the supremacist treatment of animals in some detail.

6. Language, classification, and treatment

In this and the following sections, we attempt to shed more light on the problematic meaning and implications of language in invasion biology. We aim to show that in parts of conservation, certain words, classifications, and treatment, which bear the imprint of an undefended faith in human supremacism, can shape and feed into one another.

Some of the language used to describe non-native species is part and parcel of a major ethical problem in invasion biology (Larson, 2005). Terms like invader, invasion biology, invasive species, and aliens are not “neutral” descriptions of facts but rather controversial and meaning-rich metaphors. Metaphors are ubiquitous in language, including in science, and are no doubt fundamental to thought (Lakoff and Johnson, 2008). In fact, language has its own life and can morph in ways beyond individual usage and denotation. Metaphors often suggest themselves in response to phenomena and can make those phenomena more lucidly intelligible; equally, metaphors can imbue phenomena with an ambience that has unintended or problematic implications. For example, metaphors of *war*, such as the war on drugs or poverty, can be problematic in various social contexts (Flusberg et al., 2018).⁴

Dictionaries define “invasion” along the following lines: “an instance of invading a country or a region with an armed force; an incursion by many people or things into a place or sphere of activity; or an unwelcome intrusion into another’s domain” (Lexico.com, 2021). Some of those who show discontent with invasion

³ We would also suggest that unquestioned or undefended attitudes of human supremacy sometimes also drive a reluctance to consider critically questioning nativism or being open to imagining new kinds of ecosystems that involve introduced species.

⁴ In contrast to these uses, the “war against animals” is arguably a more illuminating use of the term, especially for those who oppose human supremacism (Wadiwel, 2015).

biology have explored possible extended aspects or meanings of such language. For example, Brendon Larson argues that narratives of invasive animals interact with sociocultural phenomena and that the tag of invasive alien species is associated with politically charged ideas of militarism, nativity, and nationalism (Larson, 2005).

Some critics argue that talk of invasive alien species can insidiously invoke xenophobia and racism because of that language's genealogy or broader history. "Invasive" connotes "threat" and the occupation of a territory by someone or some group that does not belong. Political scientist Claire Jean Kim argues that the category of "alien," like that of "race, lumps and splits" (Kim, 2015, p. 24); it tends to construct a logic of exclusion in which those who are not like us, and those who do not belong, are located outside the political community and moral circle (see also Wadiwel and Taylor, 2016). Such exclusionary language has, controversially, been applied to refugees, asylum seekers, and displaced peoples (Elder, 2003).

Dinesh Wadiwel gives a related explication of the meaning of some biological language that describes displaced animals. He argues that humans typically assume a position of epistemic, legal, and political dominion over nonhumans that entails a brute right to arbitrarily decide how we label them, which of them is worthy of moral considerability, and who will be killed (Wadiwel, 2015, pp. 9, 22). Thus, connotations of arbitrary power and implications of "might is right" could conceivably affect the meaning of invasion language. It might also be argued that once the metaphor of biological invasion enters the public domain, it can lead to additional demonizing tropes. Consider phrases like "the cancer of invasion" and promises such as "government gets tough with invasive aliens." For some scholars, the framework of biological invasion tends to create binaries of "good" versus "bad" species while bringing into subliminal play polarizations between "nationals" and "foreigners" and the "other" (Lidström et al., 2016).

We believe that exploration of the above possible meanings and connotations is important. However, our contribution to the elucidation of problematic meanings of classifications and labels in invasion biology focuses more directly on two other important features: (1) the differential treatment of "invasive" animals versus humans and other animals, especially animals in agriculture; and (2) the stock and performative treatment of "invasive" nonhumans. This discussion will also serve to illustrate how demonizing language and classification can be informed by the human supremacist treatment of animals; and conversely, how the human supremacist treatment of animals can be promoted by demonizing language and labelling of a scientific or other official kind (e.g., by scholars and

by conservation and invasive species organizations) as well as by a more colloquial kind of talk in the general population.

7. Differential treatment: Animals in agriculture and humans

The first feature we will discuss which shapes the meaning of the language of invasion concerns the differential classification and treatment of various sentient beings. In particular, invasion biology embodies very different attitudes and treatment directed toward introduced animals as compared to: (a) other non-endemic animals, especially animals in agriculture; and (b) human groups. This separation or division occurs in cases in which (a) and (b) are (like the targeted introduced species) similarly causing ecological damage. Let us consider these two comparatively protected groups in turn.

Take non-endemic animals in agriculture first (Gurevitch and Padilla, 2004). Earlier we encountered Abbate and Fischer's identification of ethical problems associated with the differential treatment of "invasive" species and native species (Abbate and Fischer, 2019). Our point here focuses on differential labelling and treatment of "invasive" animals and animals in agriculture. Invasion biology and its language is clearly molded by human interests that go beyond the ecological. This is shown in the fact that domestic species amply qualify for the label "invasive," but, despite being called "invasive" when they go "feral," are not deemed "invasive" when they are kept as legal human property.⁵ In this way, certain non-endemic species are regarded as not worthy of existence or as apt for special singling out, but this is not the case when they are of economic value to humans. What appear to be irregularities from an ecological perspective about which species are labelled invasive and which are exempted can be accompanied by calls for practical action: invasion biology sometimes supports killing introduced animals for economic interests. In New Zealand, for example, eradicating introduced possums and stoats is regularly backed by the allegation that these species carry bovine TB and threaten farm animal losses and associated economic interests. Similarly, in the United States, the US Wildlife Services has killed hundreds of thousands of starlings (among innumerable other animals) in just a few decades in the service of agricultural interests (Paini et al., 2016).

The fact that many introduced animals are marked as "invasive" and are branded as removable - while the spread of agricultural animals is generally not so

⁵ We do not mean to imply that animals in agriculture are treated justly; but that is a separate question.

criticized and is often implicitly or explicitly taken as a reason for killing “invasives”, including in ways that would not generally be tolerated even for farmed animals - is ecologically curious. The massive biological “invasion” of animal and crop agriculture (what Alfred Crosby famously called “ecological imperialism”) is often invisible as a bona fide and orchestrated biological-invasion event. As such, it tends to be treated as impervious to the framing of “invasive alien species.” By far the greatest threat to biodiversity are processes such as climate change and deforestation, of which animal agriculture is a large part. Climate change may be the final blow to Earth’s biodiversity, barring unprecedented, concerted social changes to reverse the ever-worsening forecasts. The number of anthropogenic climate-related natural disasters per year has doubled over the last 20 years, and, according to the World Wildlife Fund, there was a decline of 58% in the number of reptiles, birds, mammals, and fish between 1970 and 2012 (McRae et al., 2016, p. 19).

Today, “livestock” and humans comprise 96 percent of the aggregate weight of land mammals on the planet (Bar-On et al., 2018). Agriculture is a salient and sometimes leading cause of many major problems: global warming; species extinctions; killing of big herbivores and carnivores; massive insect species and population declines; devastation of freshwater species; nitrogen, pesticide, and greenhouse pollution; homogenization of domestic plants and animals; and emergence of devastating zoonotic and other infectious diseases (Coghlan et al., 2021; Hayek et al., 2021). We tend to think of “habitat destruction” and “invasive species” as distinct and equal contributors to biodiversity collapse. Yet such thinking tends to be molded by the fact that we call some lifeforms “invasive” but not others. The latter include domestic species like cattle, sheep, goats, chickens, and pigs. Huge portions of cropland are dedicated to feedstock for confined farm animals. If we imaginatively loosen the mental grip of the idea that “habitat destruction” and “invasive species” are balkanized categories of impact, we can appreciate that the human-mediated biological “invasion”⁶ of farmed animals is behind much of the habitat loss, wildlife killing and death, pollution, and climate change that are most responsible for biodiversity collapse.

That habitat destruction for agriculture (as well as for other reasons), combined with the mass killing of wild animals and climate change, have been or will be the

⁶ As we will soon stress, it is ethically problematic to call *any* sentient nonhuman animal “invasive”. A key part of the present point is the failure to fully register the primary causes of biodiversity loss and ecological destruction and how this is related to the demonizing labelling and the denigration of certain “invading” animals.

primary drivers of biodiversity loss does not mean that “invasive” species are not also drivers (Kearney et al., 2018). Of course, the degree of contribution of different factors that are ecologically damaging can vary by ecoregion or time, and in the case of past extinctions, causation is sometimes unknowable. Furthermore, most threatened species face more than one threat. Life is afflicted by adverse synergies which decrease the odds of survival (biologists call this predicament the “one-two-three punch”) But our point is that certain animals that are sometimes equally or more ecologically damaging than “invasive” species are excluded from that designation because they are regarded as beneficial to human beings. Farmed animals are not classified in the way that “alien invaders” are even when there is no major difference in their ecological impact. While the reasons for this make sense from an economic vantage point, the difference in labelling nonetheless helps color the meaning of “invasive” and associated biological language and classification.

Let us now consider a relevant aspect of the differential treatment of humans as compared to non-endemic nonhumans. Human beings generally, as well as certain groups of humans driving specific ecosystem traumas, also amply qualify in ecological terms for the designation “invasive.” Yet it goes without saying that we would find it wrong to officially label certain groups of humans, such as some farmers or timber workers, as “pests”, “invasives” or “aliens” within the biological or ecological sciences, in conservation organizations, and so forth. Were such a definition to be made seriously and without irony in a biological textbook, for instance, it would be swiftly and rightly condemned as both obscene and dangerous, regardless of any degree of ecological merit it might possess. Clearly, we readily recognize that such scientific or technical labelling and classification of humans or groups of humans (except when it is not meant quite seriously, has an ironic twist, etc.) is morally repugnant. In contrast, the completely serious and unequivocal biological labelling of animals as “invasive pests” is often simply taken for granted.

This practice is problematic. For instance, when we turn a species into a “pest” or “feral” or “invasive,” the first casualty can be humane and just treatment. Indeed, the alliance between label and mistreatment describes the status quo: worldwide, millions of animals branded as pests or invasives are killed as a matter of course and with little moral acknowledgement (van Eeden et al., 2020). Imaginatively turning this troubling language for once upon ourselves - e.g., entertaining the (objectionable) idea of humans being seriously described in textbooks or official documents as “invasive pests” - has at least some merit: it may prompt reflection about historical, current, and future human responsibility. “Invasion”

can also highlight the fact that humans are sometimes morally responsible for the harm they do to other species, including when that harm stems from human supremacism, indifference, and a sense that it is permissible or proper to subjugate other sensitive creatures.

We should note that an imaginative notion of all humans-as-invasive species ignores the fact that different peoples have had very divergent impacts. It has been argued that the global North or West, have developed material and ideological cultures based on conquest, takeover, killing, and enslaving. It is true that wealthier nations have caused much of the damage. Thus, “invasion” in a political sense of subjugation of nonhuman and human realms, has been a regrettable hallmark of European civilization and the developed world’s mode of operation. At the same time, it is also true that humans, across the globe, and by virtue of being large, intelligent omnivores on top of the food chain, are the most destructive animal species in earth’s history (Harari, 2014). Thus, both humans and “livestock” are in an intelligible ecological sense often just as “invasive” as so-called “invasive animal species.” Yet only the latter are scientifically and officially branded as such—and this conveys and reinforces the thought that such animals are especially odious and worthy of eradication, typically with relatively little ethical consideration or moral regret.

However, having made this point we now want to emphatically claim that *no being of significant moral worth* deserves to be in those ways demonized and put at routine risk of brutal and uncompassionate treatment. Biologically, officially, or authoritatively categorizing any morally significant group—be they humans, “livestock,” or “non-endemic alien” species— as “invasive” or as “alien pests” is an ethically dubious act that normalizes unjust treatment. Indeed, when humans categorize, describe, and treat sentient animals in those ways, they express an underlying allegiance to human supremacism.

While we may wish to reduce over time the numbers of certain animals (including future humans) that can cause ecological damage, we should not do so by unjust and cruel means or with contemptuous or dismissive attitudes. Our argument here is simply that the selective application of terms like “invasive” to certain groups but not to other often equally or even more ecologically disruptive ones (principally human beings and the domestic animals they create and use for their own benefit), expresses and shapes human supremacy in relation to the animals that invasion biology calls “invasive aliens”. Animals like foxes, dogs, possums, rabbits, cats, and many more species frequently bear the brunt of this denigration and the suffering and violence that attends it, including the infliction of harm and death in the pursuit of worthy conservation goals.

8. Stock and performative treatment of “invasives”

In addition to the semantic effects of such differential treatment, various other ways that so-called “invasive” and “pest” animals have historically been and continue to be treated also contributes to the meanings of invasion biology language. A prime shaper of meaning is the widespread belief (which may take the form of a virtually reflex reaction) that introduced species have no place in their non-natural environments and ought to be eradicated by virtually any means necessary. This includes practical means that are violent, inflict great suffering and mass death, and sometimes have a performative element. In this section, we discuss, first, the stock and historically typical responses to “invasive” animals and, second, animal treatment that has performative dimensions. Both features contribute to the meaning of the language of invasion.

“Stock” calls are calls for the elimination and harming of animals that are routine, unexceptional, normalized, and sometimes automatic or relatively unreflective. Stock responses can be made even when it is far from certain that the action will result in successful and sustained removal of the animals concerned. Indeed, invasion biology often supports continuous harmful micromanagement actions like the indefinite or perennial killing of animals to protect parts of the environment. While humans are often implicated in precipitating the ecological risks, it is the animals that often pay a painful or a fatal price. Consider, for example, the recently instituted policy by the US Fish and Wildlife Service in which barred owls - who have been moving into the territory of endangered spotted owls possibly due to anthropogenic degradation of habitat - are shot to save spotted owls (Lynn, 2018; Wiens et al., 2020). Should this policy be deemed “effective,” it may result in an indefinite killing of barred owls with far from any guarantee of long-term success. Such responses, which have been commonplace in conservation, carry and reveal the imprint of human supremacism. The unargued assumption behind those actions is often that is perfectly legitimate and unproblematic to intentionally deprive unwanted yet sensitive animals of their lives on a large and perhaps indefinite scale.

The example of New Zealand provides a case study of treatment of unwanted animals that has human supremacist overtones. Like Australia, New Zealand is a hotspot of species introductions that threaten endemic species, such as the flightless kakapo and kiwi birds. The country recently announced its “Apollo program” to become predator-free by 2050 (and remove all predators from nature reserves by 2025) (Greshko, 2016). The program’s focus is on exterminating eight introduced species: four species of rodents, three species of mustelids (commonly known as weasels), and the common possum. The announced

program has been high-profile and was praised by conservationist Sir David Attenborough, who stated that “the knees of rats shake when New Zealand is near” (NZ Herald, 2019). The ecological concerns themselves are all too real. The country’s conservation minister observed that “New Zealand’s unique native creatures and plants...evolved for millions of years in a world without mammals and as a result are extremely vulnerable to introduced predators which kill around 25 million native birds every year” (Barry, 2016).

One criticism of the New Zealand program is that it is quite uncertain whether it will succeed. Permanent removal of “invasive species” is challenging enough on smaller islands,⁷ let alone the large islands of New Zealand. Critics who focus on such intractability urge that seeking alternative solutions to killing might be preferable to a perpetual treadmill of eradication. Another criticism is the readiness to use methods which cause great suffering. A variety of eradication methods are used in New Zealand, including fences and traps, and more methods are under consideration including species-specific poisons (and also genetic techniques (like CRISPR-Cas9) to produce sterility) (Predator Free NZ Trust, 2019). No method, however, is more controversial than the use of 1080, which has been deployed in New Zealand since the 1950s.

1080 is an indiscriminate poison that can kill non-target animals like dogs and horses (and sometimes even endangered animals themselves) and that, moreover, causes an agonizing death. The Society for the Prevention of Cruelty to Animals recently criticized the New Zealand government for using 1080, stating that the poison causes “intense and prolonged suffering” and should be banned and replaced with more humane methods (SPCA New Zealand, 2022). However, New Zealand’s Environmental Protection Authority defends the use of 1080 for environmental and agricultural purposes (Environmental Protection Authority NZ, 2022). The use of killing methods that cause enormous suffering for target animals have, of course, been stock and normalized responses in conservation.

Our next point relates to the idea that “invasive” animals are also sometimes treated in *performative* ways (Desmond, 2016). The performative element can both reflect and contribute to the meaning of demonizing classifications and categorizations. Once again, the New Zealand case is illustrative, this time for the performative treatment of some animals deemed “invaders” in that country, such as Australian brush-tailed possums. The NZ public, including schoolchildren, were urged to join in the killing of targeted animals. Individuals and the general

⁷ In one of the Pitcairn Islands of the South Pacific, for example, the rat population was reduced to 80 individuals but rebounded to 10,000 individuals in a few years.

population were exposed to the spectacle of the killing of animals performed with an element of relish or fun. As one conservation scientist put it, “we’re in a relatively unique position in New Zealand, where people are really, really willing to kill for conservation. It’s a kind of national pastime” (quoted in Owens, 2017). In rural schools, possum hunts and killing competitions are held and killed possums have been entered in best-dressed possum competitions. People may even be encouraged to swerve and run over possums on the roads (McCrow-Young et al., 2015). Such performative displays are depicted as harmless fun and humorous, but they clearly condone cruelty and teach children and adults to have no or minimal moral regard for some sentient beings

There is, in fact, a broader supremacist practice of displaying slain animals as spectacles —whether in the context of trophy hunting, bounty killings, killing contests of despised or feared animals, pest exterminations, or culling “invasive” animals. Such displays take the form of hangings, lining up corpses, exhibiting the yawning mouths large carnivores, and “decorative” mountings of animal corpses or heads (Desmond, 2016). As mentioned earlier, dingoes, or dingoes taken to be wild dogs (Probyn-Rapsey, 2015), are strung from trees by some Australian farmers (ABC NW Qld reporters, 2021). Although one can sympathize with, say, farmers and the domestic animals that are preyed upon, such normalized “grotesqueries” nonetheless exhibit and reinforce the supremacist moral exclusion of nonhuman animals. In addition to being ethically dubious, such performative actions also help to condition the contemporary meaning of terms like “invasive pests” and thereby to promote future wrongful attitudes and action.

As Eileen Crist has observed, the rhetorical force of some performative spectacles is to reaffirm what has been called (by John Rodman) the Differential Imperative: the urge to reiterate the immeasurable distance between human and animal (Crist, 2017, p. 62). One way to illustrate this idea is by a simple thought experiment: it is morally unimaginable that a human body, even the body of an outcast or enemy, would be displayed as we display killed animal “pests.” When such a performance does occur, perpetrated say by modern terrorist groups, it is rightly condemned as barbaric. Fictional representations, such as in the popular series *Game of Thrones*, make ample use of this general kind of performative treatment of human beings to reveal graphically that the purpose of exhibiting a slain corpse is to debase and demean the “alien” and the “other.” The fact that a slain animal can still, relatively unproblematically, be made into a spectacle that elevates its killer and denigrates the victim discloses another side of the supremacist attitude towards animals.

The performative treatment of animals, then, is another example of how human supremacism is reflected in the language and treatment of “invasive” animals and of how that language and treatment in turn reinforces the relative dismissal and denigration of animals. The language of invasion absorbs such connotations. This is the case even when individual scientists and others who deploy the language disavow such performative spectacles and other kinds of treatment. Thus, the conditioning of language in invasion biology partly occurs outside of that discipline as well as within it. But the fact that it partly occurs outside of that discipline does not imply that science’s embrace of those terms is ethically neutral. On the contrary, such language is, as we have sought in this paper to demonstrate, decidedly problematic.

9. Conclusion: Looking forward

In this paper, we argued that invasion biology has relied upon assumptions of human supremacism that lead not only to dismissal of conservation and ecological values - a consequence that invasion biology would lament - but also to wrongful yet common attitudes towards and treatment of so-called “invasive alien species.” Such assumptions are now facing growing reassessment and criticism: invasion biology increasingly has its critics and discontents. We also demonstrated how the language and official or scientific classification of introduced and non-endemic animals is intertwined with their ethically problematic, human supremacist treatment. Our focus was on several factors that help to shape the meaning of terms such as “invasive,” “alien,” “pest” and “feral.” The factors we examined were the differential treatment of “invasives” versus humans and other ecologically damaging animals, namely animals in agriculture; and the stock and performative treatment of animals scientifically and officially categorized as invasive aliens. Such factors are interwoven with language and classification in a reciprocal relationship that tends to promote and reinforce a lack of serious moral consideration of these animals and to sustain morally prejudiced attitudes against them.

Despite the history of ecological destruction and of animal abuse and injustice facilitated by human supremacism, there are things we can now do. For instance, we should put much more emphasis on seeking alternative and just and compassionate ways to address the real ecological threats caused by various animal species (Ramp and Bekoff, 2015; Wallach et al., 2018). A part of this shift could involve agitating to greatly reduce the number of farmed animals on the planet that are also often wrongfully exploited under human supremacist assumptions (Coghlan et al., 2021). We should seek to contract the range of grazing and

growing feedstock, freeing habitat for wild creatures. Mass reversion of habitat back to wild places would facilitate a sounder ecological negotiation between native and introduced species and assist in mitigating climate change (Searchinger et al., 2018). Problems, losses, and dilemmas would not thereby disappear; but they would become less acute and pressing in a more spacious world - hopefully a world in which wild inhabitants can more often work out their relations for themselves without widespread human coercion and violence.

Humanity's great task, one might say, is to stop destroying the natural environment, withdraw our occupancy from a substantial part of it (Kopnina, 2016), and dismantle the legacy of human supremacy associated with wrongful treatment of the nonhuman world. As we have argued, one vital part of changing our relations to that nonhuman world involves reassessing demonizing and denigratory language that supports human supremacy and propels the associated unethical treatment of animals. Terms like "alien," "invasive," and "pest" should, we suggest, be removed from biological and conservation sciences and consigned to history's dustbin. Children and university students should be educated about the value of the nonhuman world without encountering denigratory labelling of animals as "invasive aliens" and "pests" in textbooks and scholarly articles and without being taught by authoritative teachers and scientists that such language is unproblematic. Finally, invasion biologists might come together to find a new name for their discipline - or more accurately and hopefully, for the discipline "invasion biology" might become after it jettisons its human supremacist assumptions.

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Authors

Helen Kopnina, Northumbria University, Newcastle upon Tyne, UK,
helen.kopnina@northumbria.ac.uk; alenka1973@yahoo.com *Corresponding author*

Simon Coghlan, University of Melbourne, Melbourne, Australia,
simon.coghlan@unimelb.edu.au

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Spectral angle mapper algorithm for mangrove biodiversity mapping in Semarang, Indonesia

*Tjaturahono Budi Sanjoto, Vina Nurul Husna,
Wahid Akhsin Budi Nur Sidiq*

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Keywords: Mangrove biodiversity mapping; Remote sensing; Spectral angle mapper.

Abstract. *Monitoring biodiversity is a key component of sustainability research related to safeguarding ecosystems. Although there still exist limits to its application, remote sensing has been used to map mangrove biodiversity and its distribution using spectral reflectance. This study considers the mangrove ecosystem in the Semarang coastal area using the Spectral Angle Mapper (SAM) method for biodiversity identification at species level. The*

remote sensing data is SPOT 7 imagery, acquired on 24 December 2019. In situ spectral reflection measurements were performed using a USB4000 spectrometer. The result from in situ measurement is referred to as the spectral library used for mangrove classification. Eight mangrove species were identified by the SAM method in this study, with a preponderance of the species Avicennia marina in the northern part of the study area, an open area that directly faces the sea, corresponding to the original habitat of Avicennia marina. The study shows that while the SAM method can be considered accurate for species with larger concentrations, the classification results demonstrate an overall moderate-low accuracy of 52% because some species classes have small patches that are intermingled with areas of different land-use. Further developments in remote sensing analysis techniques and more research will be necessary to endeavor to overcome these limits.

1. Introduction

Indonesia is an archipelago country with the second longest coastline, after Canada (Dahuri, 2007). The coast has diverse ecosystems, ranging from the marine ecosystem to the mangrove ecosystem. It is estimated that 18-23 percent of the world's mangrove ecosystem is in Indonesia, and 80 percent of the world's mangrove species (Fawzi, 2016; Rusila Noor, Y., M. Khazali, 1999). However, Indonesia's mangrove ecosystem has faced gradual loss due to aquaculture development, urbanization, and agriculture (Ilman et al., 2016). Indonesia's annual mangrove loss is only six percent of total forest loss, but the impact rises to 31% of carbon emissions in the land-use sector (Murdiyarso et al., 2015). There is a real risk that mangroves will become extinct and relatively soon become a part of history (Julkipli et al., 2018).

The conservation of the mangrove ecosystem's high carbon stock is vital to help mitigate climate change in the land-use sector (Alongi, 2020). Mangroves constitute a vitally important ecosystem because they affect the wellbeing of many other ecosystems. Studying mangrove sustainability on the coast of Semarang, involves taking into consideration social and environmental issues, together with the roles of economic agents and policy makers (Dayan, 2020). Direct observation in the field allows us to observe several aspects of mangrove

sustainability at the research site. Mangroves are growing well where community participation can maintain and continue to expand the mangrove ecosystem.

At the same time, many people depend on mangroves to meet their daily needs, but their long-term survival is in jeopardy because of tidal flooding, garbage, confusion over the ownership of mangrove land and various other coastal problems (Kesemat, 2021). The results of interviews with the community in Mangkang Kulon show that the problem of ownership of mangrove land is one of the crucial problems. An activist group reports that its endeavors to protect and promote mangrove ecosystems have been hampered by landowners' desire to designate the land for other uses. Where the land currently used is not 100% owned by the community, there is always a risk of such groups being forced to move their mangrove land to another location. Certainly, the rehabilitation of mangrove land takes a very long time and increasing the area of mangrove land on the coast of Semarang City poses many challenges. Much more research is required into the sustainability of mangroves on the Semarang Coast and their relationship with other ecosystems.

Supporting their conservation needs reliable mangrove condition data, including its species and distribution. The main problem is the data that had been provided by the government is not up to date and it is hard to identify mangrove change. Rahadian et al. (2019) have stated that mangrove biodiversity information is a national problem, given the importance of having accurate and consistent historical data. Such data is essential for developing policies in mangrove management. In recent years, remote sensing data has begun to successfully provide mangrove ecosystem information (Pham et al., 2019). In the past, available mangrove data has usually not given information concerning specific species, but this is fundamental for mangrove management (Atkinson et al., 2016; Chow, 2018). Moreover, indiscriminate land use change, not in accordance with a specific designation, has led to increasing degradation of the mangrove area and consequent loss of mangrove species.

Accurate mangrove species mapping relies on the spectral characteristics of mangrove species in remote sensing images (Kamal et al., 2017, 2018). Every mangrove species has its signature of spectral reflection on a different wavelength. Hence, using the spectral library for mangrove species data in mangrove ecosystem mapping is efficient and cost-saving. In Indonesia, this method has not been widely used because it requires *in situ* measurement. A Spectral Angle Mapping (SAM) algorithm aims to become a reliable method for mangrove ecosystem mapping using spectral library data. In its application, the SAM algorithm has already proved successful as the most promising approach

for mangrove species mapping (Salghuna & Pillutla, 2017; Su et al., 2019). This research aims to map the mangrove ecosystem in Semarang coastal area using the SAM method for biodiversity identification.

2. Materials and Methods

2.1 Study Area

The research was conducted in Semarang coastal region (6°59'35" S 110°25'14" E). Semarang city has an area of 373.8 km² with 1.5 million inhabitants. The rainfall 2,800 mm per year. This research was conducted in two-site, Mangkang Kulon and Mangunharjo Village and Tugurejo and Tambakharjo Village. The research was conducted in these four villages because they have different mangrove characteristics. Mangkang kulon and mangunharjo have mangrove conditions that are still well preserved, while the other two villages are starting to be degraded by other developed land and fishponds. The difference in these characteristics can be used as a comparison material in the classification process later.

The data obtained covers an area of around 172.79 ha, most of which is located on the coastline of Mangunharjo Village with 69.47 ha and on the coastline of Tugurejo Village with 62.69 ha. Most of the mangroves in this location have a longitudinal distribution pattern on pond embankments and river borders. There are also some mangroves that have cluster patterns, such as in Mangunharjo Village and Tugurejo Village (Dukuh Tapak).

Mangroves that are currently growing are the result of planting carried out by the community with edutourism programs, government agency programs (DLH and DKP Semarang City), universities through community service activities and companies through Corporate Social Responsibility (CSR) programs. Only a small part of the Semarang City area has mangroves that grow naturally, and the vast majority is the result of the rehabilitation process carried out by residents and related parties. The tables and figures present information related to mangroves on the west coast of Semarang City, both spatially and in terms of their appearance in the field.



Figure 1. The study location in the coastal area of Semarang City, Central Java.

2.2 Data and Analysis

The remote sensing data in this research is the SPOT 7 image acquired on December 24, 2019. SPOT 7 has four multispectral bands and one panchromatic with 6 meter and 1.5-meter spatial resolution respectively (Astrium Services, 2013). The image was corrected geometrically and converted to top-of-atmosphere value ($W/cm^2.sr.nm$). The radiometric correction used the Fast Line-of-sight Atmospheric Analysis of Hypercubes (FLAASH) method.

Fieldwork was conducted on August 14-15, 2020, between 09:00 and 11:00 a.m., to collect eight mangrove species' spectral data. The purposive random sampling method employed provided as many as 30 samples. The samples were taken according to the number of species contained in the study area. In this area there were 8 species of mangroves to be covered and data was collected for each species 3 to 4 times in different locations. The sampling location was based on the ease of accessibility to permit measurement using a spectrometer. In addition, samples were taken only on vegetation that gets optimal sunlight. Each measurement at the sample point recorded coordinates to facilitate identification

at the time of processing using SPOT imagery where there was sufficient space for cables connected to the spectrometer.

The eight mangrove species were *Avicennia marina*, *Rhizophora apiculata*, *R. mucronata*, *R. stylosa*, *Bruguiera Gymnorhiza*, *Ceriops Tagal*, *Sonneratia alba* and *Xylocarpus granatum*. The measurement used a USB4000 spectrometer with sensor wavelength at 200 to 1100 nm. The wavelength of spectrometer calibrated with the wavelength on SPOT 7 image, with a range within 400 – 900 nm. Before using the spectrometer, it was calibrated with white and dark reference spectra to obtain reference spectrally. Spectral data from the spectrometer was calculated following this equation to obtain the spectral characteristic of each mangrove species (Optic, 2009).

$$R\lambda = \frac{S\lambda - D\lambda}{Ref\lambda - D\lambda} \times 100\%$$

The thirty samples were measured during two days of fieldwork. The data was converted into a spreadsheet for spectral library database input in mangrove classification using the SAM method. SAM is an algorithm based on the assumption that a pixel in the remote sensing imagery reflects an object on the earth's surface (Rashmi et al., 2014). This algorithm uses a deterministic similarity measure to compare with an unknown pixel based on the spectral library (Bertels et al., 2002). A pixel's spectral reflection can be described as a vector in a n-dimensional space or feature space, n being the number of wavelengths. Each vector must have a certain length and direction (Kruse et al., 1993). Classification using the SAM algorithm is done by calculating the spectral angle between the spectral reflection of a pixel and the spectral library. Each pixel is grouped into a class based on the lowest value on its spectral angle. The smaller the angle formed, the more suitably it reflects the spectral library. The spectral reflection pattern that is furthest away from the maximum threshold of the specified angle is categorized as unclassified (Cho et al., 2012). The SAM method is a supervised classification because it uses the spectral library from *in situ* measurement for the training area. The following equation was used (Jensen J. R, 2005):

$$\alpha = \cos^{-1} \left[\frac{\sum_{i=1}^{nb} t_i r_i}{(\sum_{i=1}^{nb} t_i^2)^{1/2} (\sum_{i=1}^{nb} r_i^2)^{1/2}} \right]$$

Where α is a spectral angle, nb is the satellite image band (four in SPOT 7), t is the spectral pixel, and r is the spectral library. The fieldwork data was also checked for accuracy measurement using the confusion matrix method, a specific table layout that allows visualization of the performance of an algorithm.

3. Results and Discussion

3.1 Mangrove Spectral Reflectance

The results obtained show that spectral reflectance from field measurement has two peaks at the green and near-infrared wavelength. The vegetation has a sharp change in leaf reflectance from red to near-infrared, also known as a red-edge (Horler et al., 1983). In mangrove species, the red-edge information can improve species classification (Schuster et al., 2012).

In Figure 2, the spectral reflection of each mangrove species shows the pattern of healthy vegetation. Healthy vegetation has absorbed the wavelength in blue (400-500 nm) and red (600-700 nm) and increase in green because of chlorophyll and red edge in near infrared (Kamal et al., 2018).

The *Bruguiera gymnorhiza* species has the highest spectral reflectance among the mangrove species. *A. marina* has the lowest reflectance value in the visible wavelength and *Sonneratia alba* in the near-infrared wavelength. Even where mangrove species have the same pattern of reflectance, every species has a different signature wavelength. So, despite having the same pattern, each species will have a different spectral reflectance (Arfan et al., 2015; Indarto, 2012). The difference is caused by age, health condition, and tree physiology, such as canopy and leaf geometry (Blasco et al., 1998).

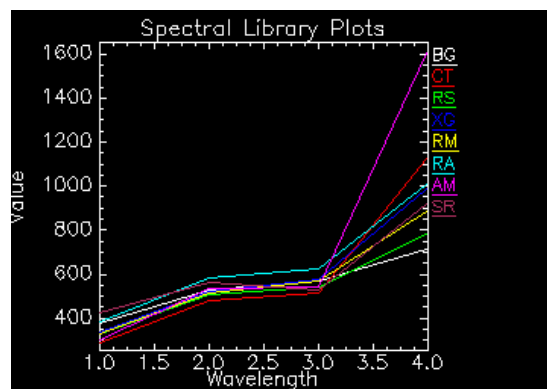
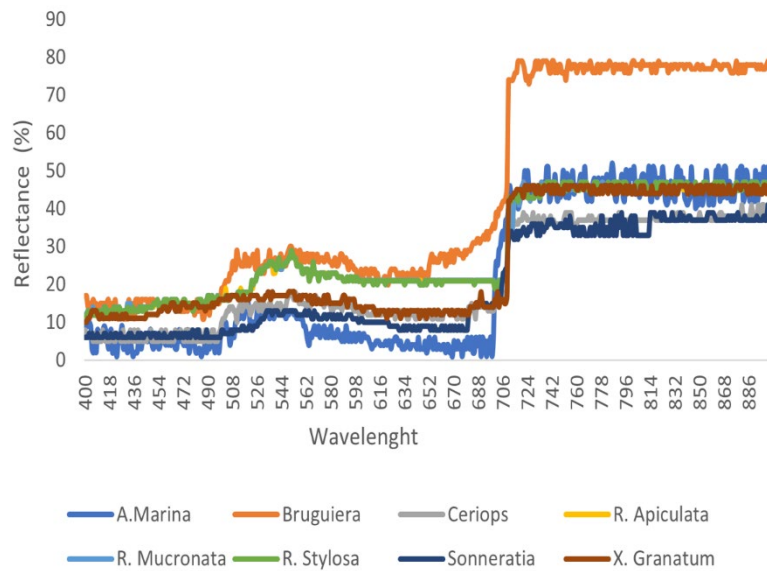


Figure 2. (a) the spectral reflectance of mangrove species from *in situ* measurement, and (b) spectral plot for classification in SPOT 7 image from *in situ* measurement.

3.2 Mangrove Mapping

The spectral library from *in situ* measurement became a reference for mangrove species mapping in SPOT 7. The results (Figure 3) show how *A. marina* dominated in the northern area of up to 30 hectares directly adjacent to the sea (Table 1). *Avicennia* has adaptation in high salinity with several adaptations, such as excluding the excess salt from metabolic mechanisms (Hogarth, 2017). The distribution followed by *Rhizophora* with a total from three species is over 29 hectares. The *Xylocarpus granatum* and *Ceriop tagal* dominated mangrove distribution on the mainland due to their adaptation to lower salinity. The study also detected a one-hectare presence of *Sonneratia*.

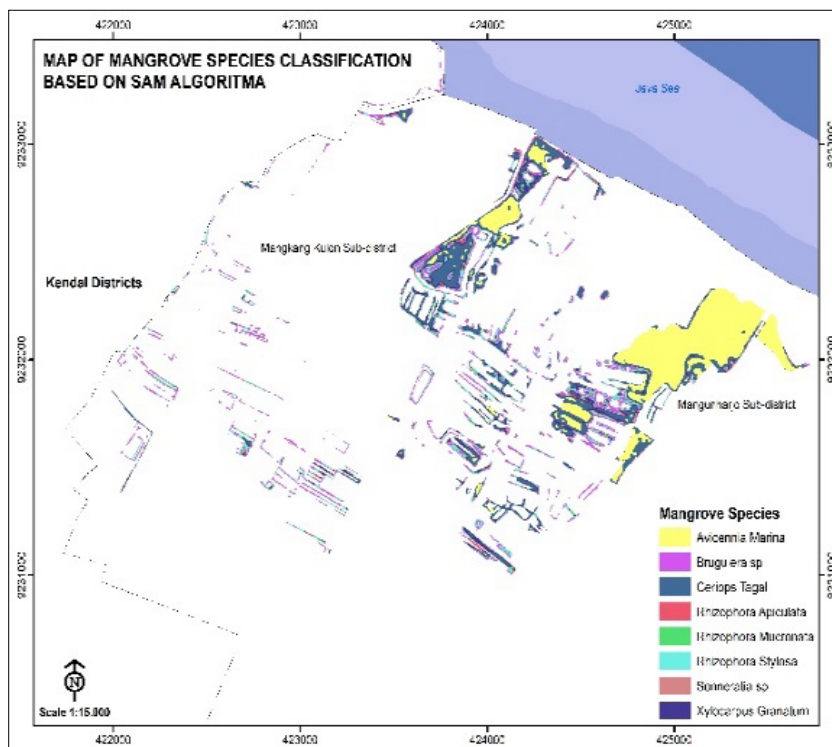


Figure 3a. the mangrove species map using SAM algorithm in Mangkang Kulon and Mangunharjo Village.

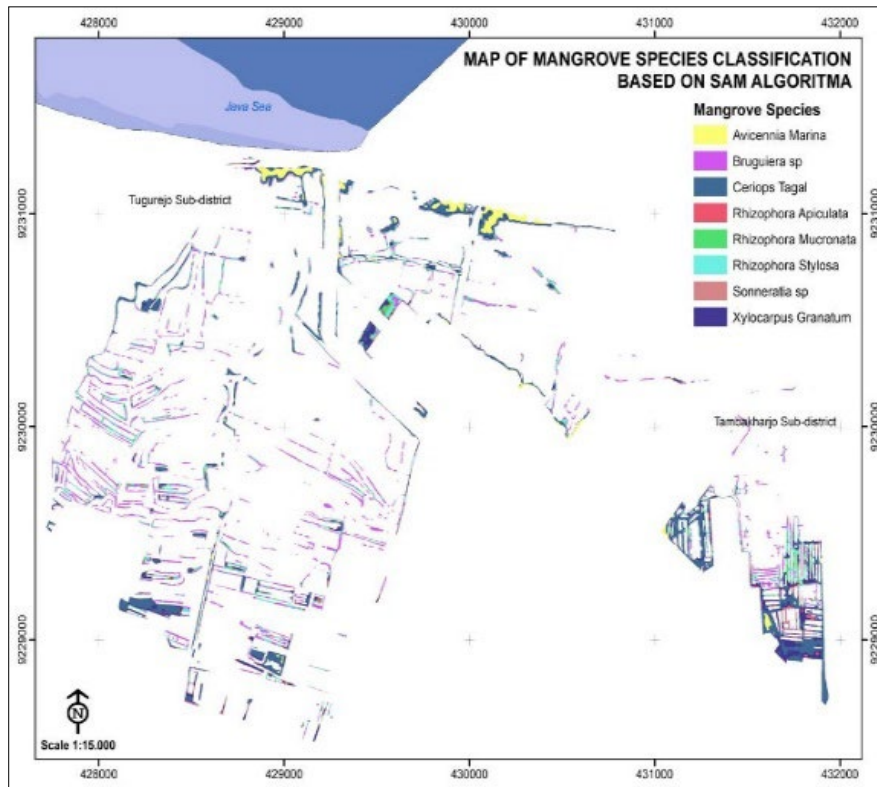


Figure 3b. The mangrove species map using SAM algorithm in Tugurejo and Tambakharjo Village.

Previous research (Tri Martuti, 2014; Tri Martuti et al., 2019) on the composition of vegetation in Tapak village, Tugu district, showed that Tapak has 16 vegetation species, consist of 12 families with dominance of *A. marina* and *R. mucronata*. This coincides with the result of our study and the reason is that Tapak village was designated as an artificial ecosystem for mangroves. *A. marina* and *R. mucronata* are the most widely grown crops in these kinds of ecosystems.

No	Mangrove species	Area(Ha)
1	Sonneratia alba	0.86
2	Rhizophora apiculata	5.05
3	R. mucronata	7.20
4	R. stylosa	15.56
5	Xylocarpus granatum	20.02
6	Ceriops tagal	27.42
7	Avicennia marina	29.63
8	Bruguiera gymnorhiza	29.87

Table 1. The total area of mangrove species from SAM classification

The classification results using the Sam method were tested for accuracy by comparing them with conditions in the field. The accuracy test was carried out using the confusion matrix or error matrix method. An error matrix is an arrangement of numbers arranged in rows and columns that is a representation of the number of sample units (such as pixels, pixel groups, or polygons), filled in according to categories, relative to actual categories (Congalton & Green, 2005). Matrix errors contain classes of image classification results in their rows, and field checking classes in columns, while matrix contents show the number of objects. The more objects there are that show the similarity of classes in rows and columns, the higher the accuracy of classification results. Matrix errors produce a reading of overall accuracy. Overall accuracy is the percentage of the number of pixels resulting from the correct SAM classification based on field data. In addition, matrix errors also produce producer and user accuracy. Producer's and user's accuracies are ways of representing individual category accuracies. Producer's accuracy is the number of errors of attribution. A commission error is defined as including an area in a category (one of the species) when it does not belong to that category (species). User accuracy is the number of errors of omission. An omission error is defined as excluding an area from the category (species) to which it belongs. Every error is an omission from correct category (species) and an attribution to a wrong category (species) (Congalton & Green, 2005).

The confusion matrix method to found overall accuracy is only 52%. This means that only half of the classified mangrove area has the correct species based on the conditions in the field. The reason for lower accuracy is from the scatter of

non-dominant species distribution. Scatter distribution leads to increased background noise from land-use around *Bruguiera* such as ponds and road. The decrease in the accuracy value can be seen in the following matrix containing information about producer accuracy and user accuracy for each species. Producer accuracy shows how well each species in the field has been classified. If producer accuracy produces a value of 100%, no pixels from that class are entered into other classes. Meanwhile, if user accuracy produces a value of 100%, the class does not misclassify by not taking pixels from other classes (Story & Congalton, 1986). In the matrix below, the highest user accuracy is in the classes *R. mucronata*, *R. apiculata* and *A. marina*. Conditions in the field also show that these three species dominate the mangrove area at the study site. Thus, the potential for misclassification can also be avoided.

However, the *R. stylosa*, *X. granatum* and *Sonneratia* species have low user accuracy, even as much as 0%. This is because these three species do not dominate in the research location, their distribution is sporadic and therefore does not meet SPOT pixels with a size of 6x6 meters. The image used is SPOT with a spatial resolution of 6x6 meters. If an object has an area of less than 36 m², it will produce mixed pixels meaning that the reflectance value of the pixel is not the value of a single object. In the field, the three non-dominant objects at the time of measurement have an area of less than 36m², and the pixel value at the location is heavily influenced by the reflectance of other objects such as roads, ponds, and pond embankments. Conditions like this can lead to a considerable risk of misclassification (Choodarathnakara et al., 2012).

The highest measure of user accuracy values was for the three species: *R. mucronata*, *R. apiculata* and *A. marina*. In contrast, other species did not measure a large accuracy value and even reached 0%. This causes the overall accuracy value to be low, and the resulting value is 52%. However, research on classification using the spectral library with the SAM method often produces an accuracy value that is not very high. Similar studies such as by (Kamal et al., 2018) regarding the classification of mangrove species on Karimun Java Island resulted in an accuracy value of 62%. Research on the classification of seagrass habitats using the SAM method on Tunda Island resulted in an accuracy value as low as 35.6% (Aziizah et al., 2016). Factors that cause low accuracy include mixed pixels and ambiguous classification results as occurred for some of the data in our study.

		Classified Value								
Thematic		B. gymnorhiza	C. tagal	R. stylosa	X. granatum	R. mucronata	R. apiculata	A. marina	Sonneratia	User accuracy (%)
	B. gymnorhiza	1	0	0	0	1	0	0	0	50
	C. tagal	0	1	0	0	1	0	0	0	50
	R. stylosa	0	0	0	0	0	0	2	0	0
	X. granatum	0	0	0	0	1	0	1	0	0
	R. mucronata	0	0	0	2	0	0	0	0	100
	R. apiculata	0	0	0	0	2	0	0	0	100
	A. marina	0	0	0	0	0	2	0	0	100
	Sonneratia	0	0	0	0	2	0	0	0	0
	Producer Accuracy (%)	100	100	0	0	28.6	100	40	0	52

Table 2. SAM classification results

4. Conclusions

Mangrove biodiversity mapping using the SAM method has been proven to show better results in Semarang coastal. Eight species dominated the study area. Fieldwork measurement using spectrometer found mangrove species also have a red-edge effect in near-infrared wavelength. Despite the opportunity to map mangrove distribution, our research only has 52% accuracy. Moreover, our remote sensing analysis was carried out only once. Subsequent research will need to repeat this at least three times to assess data reproducibility and the consequent reliability of the analysis.

In the future, there is a need for improvement in image processing to increase map accuracy. Methods of species identification using remote sensing still require considerable further development. This will necessarily require an improvement in the number of samples with different location variations so that the spectral library is richer, together with improvements to the algorithms used to better identify species. In terms of overall monitoring of biodiversity, SAM clearly has some current limits. Remote sensing analysis can only show how a certain distribution of vegetation changes with time. Further development is necessary to separate different mangrove species. Such an improvement in remote sensing analysis techniques will enable it to play an increasingly important role in building

monitoring systems that are able to provide the consistent, reliable biodiversity data necessary for safeguarding ecosystems.

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Authors

Tjaturahono Budi Sanjoto, Geography Department, Universitas Negeri Semarang, Indonesia Sekaran Campus, Gunungpati, Semarang city Indonesia, 50229. Phone: +6224 8508006. tjatur@mail.unnes.ac.id *Corresponding author*

Vina Nurul Husna, Geography Department, Universitas Negeri Semarang, Indonesia Sekaran Campus, Gunungpati, Semarang city Indonesia, 50229.

Wahid Akhsin Budi Nur Sidiq, Geography Department, Universitas Negeri Semarang, Indonesia Sekaran Campus, Gunungpati, Semarang city Indonesia, 50229.

Authors' contributions

This research was carried out by a team, consisting of Tjaturahono Budi Sanjoto, Vina Nurul Husna and Wahid Akhsin Budi Nur Sidiq. Conceptualization for the research was done by Tjaturahono BS, and developing the methodology, finding the appropriate software, validation, formal analysis, data curation, writing original draft preparation and editing was done by Vina NH. Supervising this project and project administration was done by Wahid Akhsin. Funding acquisition was done by Tjaturahono.

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