



## **D1.1 Open Access Transdisciplinary Dataset**

*FLOW Encyclopædia*



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## ABOUT D1.1. Open Access Transdisciplinary dataset: FLOW Encyclopædia

### Introduction

*D1.1. Open Access Transdisciplinary dataset: FLOW Encyclopædia* is the first deliverable of *WP1 Knowledge Integration and inFLOW lens*, in the project *FLOW: Future Lives with Oceans and Waters*. In contribution to the EU mission Restore our Oceans and Waters by 2030, [FLOW](#) is an international and interdisciplinary project studying young generations relations and engagement with water and oceans, their expectations, and emotions. The FLOW consortium consists of four partners: Radboud University, Fraunhofer ISI, UiT The Arctic University of Norway, and Volonteuropa.

The main objectives of FLOW are to connect the young generations with sea and waters, and to co-create actionable, scalable, and reflexive stewardship assemblages, which are designed on the basis of research, evidence, and foresight on human-waters relations. The project seeks to increase the understanding of the engagement that young generations have with the oceans, seas, and waters, by developing iteratively the conceptual transdisciplinary inFLOW lens that synthesises theory and empirical research findings on changing human-water relations, which is then followed by a foresight study on changing human-waters relations. This will be achieved by capturing signals, drivers, and expectations, hopes and fears of the young generation, as portrayed in cultural sources.

Furthermore, the project aims to study already existing five pioneering stewardship initiatives focused on oceans and waters, as well as the motivations of involved young people to act for nature, their emotional relation to oceans and waters. It also focuses on creating experiential futures workshops for young people from seven regions across Europe, thus engaging the young generation and enhancing their ocean literacy. With participant observation methods during these workshops, the project is going to involve young people, who will be diverse in terms of gender, age, ethnicity, education, socio-cultural and geographical aspects. We aim to understand the participants' relations to sea and waters, their expectations, and future perspectives, through dialogue and by encouraging them to get actively involved in the workshops. Co-creation of blueprints for Stewardship Assemblages with young people, refining, communicating, and testing them with stakeholders, from research, innovation, education and policymaking, are going to contribute to the objectives of the UN Decade of Ocean Science for Sustainable Development

The **purpose** of *D1.1. Open Access Transdisciplinary dataset: FLOW Encyclopædia* is to facilitate exchanges on the topic of “changing human-water relations” from both a domain- and critical-perspective, by clarifying a series of concepts and theories. This clarification is the stepping-stone to proceed with the interdisciplinary research tasks that will be undertaken in order to achieve the objectives of the FLOW project, as described above.

The methods used to develop the deliverable are described in Methods. The elements of the deliverable are explained in section Description. The envisaged users of this deliverable are described in section Users. In this document, all references are included as endnotes and all other observations as footnotes.

If the reader wants to know more about this deliverable, please contact Melania Borit ([melania.borit@uit.no](mailto:melania.borit@uit.no)).



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## Methods

*D1.1. Open Access Transdisciplinary dataset: FLOW Encyclopædia* was developed by the FLOW research team, which includes experts in the following domains: natural resource management, socio-ecological systems, futures studies, science and technology studies, critical theory, literature studies, and arts. The team used methods of “integration through conceptual clarification and theoretical framing”, as described in Bergmann et al., 2012<sup>1</sup>. The work process was divided in five phases as follows:

1. **Phase 1:** *Identifying the core concepts with which the problem at hand (i.e., changing human-waters relations) may be described in a way that renders it available for research.* This identification was done by extracting relevant concepts from the text of the FLOW project and by discussions among the experts. During the initial discussion, the team used the SPIDER research tool<sup>2</sup> to describe the boundaries of their conceptual exploration (e.g., what is the phenomenon of interest, what is the relevant population). While the compiled list is not exhaustive per se, it does include all the items that were deemed necessary by the expert team.
2. **Phase 2:** *Defining the concepts identified in Phase 1.* These concepts were defined by the relevant expert in the team.
3. **Phase 3:** *Identifying the domain-specific theories.* In this phase, each expert put forward the theories that are central to the problem being researched from the perspective of their own domain. The compiled list includes all the domain-specific theories deemed relevant by the expert team.
4. **Phase 4:** *Identifying the critical theories.* Critical theories are approaches to social philosophy that focus on society and culture to attempt to reveal, critique, and challenge power structures. In FLOW, they will be used as an analysis lens to the domain-specific theory, in order to increase the societal relevance of the project results. Some of these theories are developed by specific individuals and thus gesture to a defined and coherent set of ideas; other theories are instead movements that organize together quite distinct scholars who write on similar subjects (a similarity which may itself be attributed by outside observers and not the theorists themselves). As such, these definitions and explanations in some cases cannot be more precise than to simply lay out the spirit of an idea. Various critical theories on this list are commentaries on one another, building upon or challenging each other’s ideas, whereas some theories are in relative isolation. What unites them is what makes them *critical*: that they critique and challenge hierarchies of power and the ways in which knowledge is produced. This aspect is crucial when creating knowledge with direct application in society. The expert team strived to compile a comprehensive list of such critical theories.
5. **Phase 5:** *Recording all the information.* The recommendations of PRISMA statement<sup>3</sup> were used to structure the activities of searching and recording items. This phase unfolded in a continuous way, in parallel with the other four phases. The recording was done by one single person, to avoid overlaps. In order to ensure the transdisciplinarity<sup>a</sup> of the encyclopaedia, the expert team ensured that non-academic sources of information were included (e.g., films, games, literary sources).

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<sup>a</sup> Following Tress et al., 2005, **interdisciplinarity** is defined as research integrating several unrelated academic disciplines in a way that forces them to cross subject boundaries to create new knowledge and theory and solve a common research goal and **transdisciplinarity** as interdisciplinary research that integrates non-academic non-



## Description

The *FLOW Encyclopædia* is a compendium providing a summary of transdisciplinary knowledge on the specific topic of “changing human-water relations”. The *FLOW Encyclopædia* includes the following files (Figure 1):

- 1) a Glossary that comprises:
  - a. a domain-specific vocabulary (this document, Section Concepts)<sup>b</sup>
  - b. a list of domain-relevant theories (this document, Section Theories)
  - c. a list of critical theories (this document, Section Critical Theories)
- 2) a Spreadsheet that includes:
  - a. metadata of the items recorded in the Glossary
  - b. metadata of items collected from other sources (e.g., conferences, films, games, research projects, high-level reports (e.g., IPCC), surveys (Eurobarometer) etc.)
- 3) a Bibliographic file (made using Mendeley as Reference Management Software).

All these files are available in Open Access format as part of the archive file “FLOW D1.1 FLOW Encyclopædia”, which can be downloaded from the website of the project and Zenodo.

## Users

The FLOW Encyclopædia has two envisaged main types of users:

1) **The FLOW consortium.** The FLOW team will use the *FLOW Encyclopædia* to map human-nature connectedness, considering different youth variables, such as gender, age, ethnicity, education, socio-cultural, and geographical aspects. As such, the *FLOW Encyclopædia* will function as a reference point for shared understanding of concepts and theoretical perspectives in the FLOW transdisciplinary team (academics and non-academics) and for developing the inFLOW conceptual lens.

2) **Other persons (academics and non-academics) interested in the specific topic of human-water relations or the wider one of human-nature relations**, to broaden their knowledge on this subject and possibly find sources of inspiration for individual learning, discussions with peers, or debates in society.

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academic knowledge body (Tress, B., Tress, G., & Fry, G. (2005). Defining concepts and process of knowledge production in integrative research. In *From landscape research to landscape planning* (pp. 13–26). Springer Netherlands. [https://doi.org/10.1007/978-1-4020-5363-4\\_2](https://doi.org/10.1007/978-1-4020-5363-4_2)).

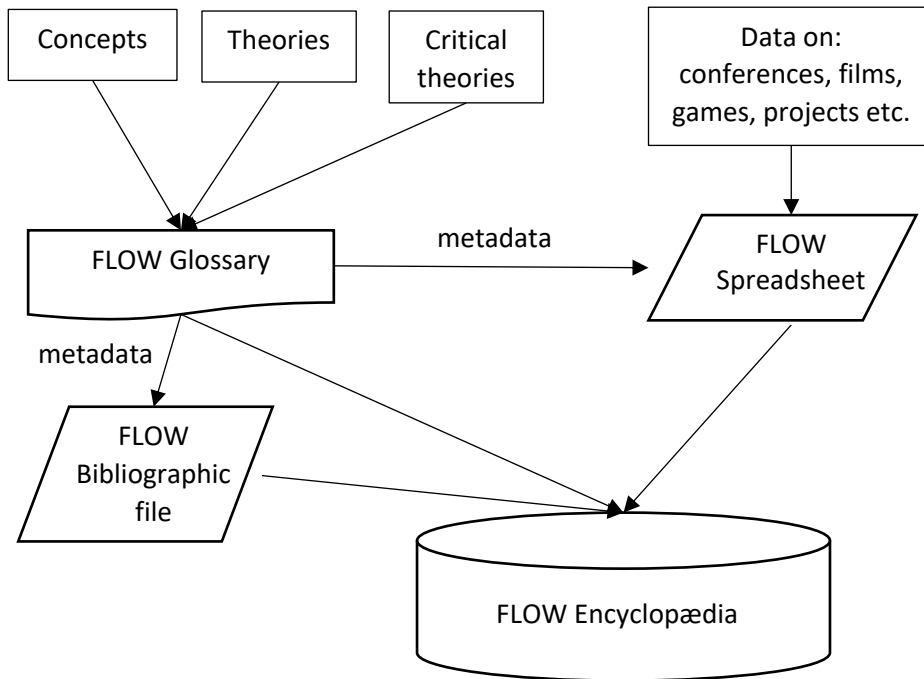
<sup>b</sup> This vocabulary is inspired by similar work, such as Section 7 in the Intergovernmental Panel on Climate Change special report on the impacts of global warming of 1.5 °C (IPCC, 2018: Summary for Policymakers. In: *Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty* [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA, pp. 3-24, doi:[10.1017/9781009157940.001](https://doi.org/10.1017/9781009157940.001)).



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**Figure 1.** Components of the FLOW Encyclopædia.

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# FLOW GLOSSARY

This Glossary defines some specific terms that the FLOW project expert team authors find relevant for discussions (academic but not only) related to oceans and waters. The FLOW project expert team includes experts in the following domains: natural resource management, socio-ecological systems, futures studies, science and technology studies, critical theory, literature studies, and arts. While this document includes all the information deemed necessary for the implementation of the FLOW project, this document is not exhaustive. For more details about how this document was made, see Zoheb Mashiur, Melania Borit, Riyan J. G. van den Born, Bernadette F. van Heel, Max Priebe, Aaron Rosa, Philine Warnke (2023). *D1.1. Open Access Transdisciplinary dataset: FLOW Encyclopædia*. Zenodo 10.5281/zenodo.7977610.

The FLOW Glossary comprises:

- a. a domain-specific vocabulary (Section Concepts)
- b. a list of domain-relevant theories (Section Domain Theories)
- c. a list of critical theories (Section Critical Theories)
- d. references

Within the list of Concepts/Critical Theories, the linked concepts/critical theories are indicated with bold. Within the list of Domain Theories, linked concepts are indicated with italics. Not all possible links are indicated.

If you have questions or comments about this glossary, please contact Melania Borit ([melania.borit@uit.no](mailto:melania.borit@uit.no)).

## CONCEPTS

Concept	Definition/Explanation
Acting for Nature	<p>Acting for Nature covers a broad spectrum of activities, and actors for nature are equally diverse in their motivations and involvement (Ganzevoort &amp; van den Born, 2020).<sup>4</sup> In addition to everyday pro-environmental behaviour (e.g. Steg &amp; Vlek, 2009<sup>5</sup>; Grilli &amp; Curtis, 2021<sup>6</sup>), action for nature in the form of nature volunteering is often categorized along four types: recording numbers of species, maintaining landscape, educating others, and administration and management of nature organisations (Ganzevoort &amp; van den Born, 2020)<sup>7</sup>. People’s engagement to all degrees of action for nature is crucial for environmental conservation and people who voluntarily act for nature are even considered “The foundation for nature conservation” (Sloane and Pröbstl-Haider, 2019, p.158).<sup>8</sup></p> <p>Research shows the importance of <b>relational values</b> for action for nature (Chan et al., 2016),<sup>9</sup> such as connectedness with nature, learning, care, and meaningfulness (Van den Born et al., 2018).<sup>10</sup> Higher commitments toward action for nature may be limited by all kinds of factors. These may be higher personal or material costs and (time) constraints (Kashima, Paladino &amp; Margetts, 2014).<sup>11</sup> Moreover, emotions such as feeling powerless or even environmental grief may hinder action for nature. Through emotion-focused coping, for example, people try to get rid of these feelings by denying the problem, instead of taking action for nature (Ojala &amp; Bengtsson, 2019).<sup>12</sup> Problem-focused (do something about a problem) and meaning-focused (find meaning in aiming to solve a problem together) coping can however drive action for nature (Sass et al., 2014<sup>13</sup>; Ojala and Bengtsson, 2019<sup>14</sup>). In that way environmental grief can also be transformative (Barnett, 2022).<sup>15</sup></p>
Anthropocene	<p>The Anthropocene is a proposed term for the current geological epoch. The Anthropocene concept argues that we have moved on from the current scientific consensus that we live in the Holocene, due to the profound environmental impact of human civilization. The term was first coined by biologist Eugene F. Stoermer in the 1980s and then popularized by chemist Paul Crutzen in 2000.<sup>16</sup> In their study of the Anthropocene concept, Lewis &amp; Maslin (2015)<sup>17</sup> argue that we are indeed living in the Anthropocene, which they propose could have started at either 1610 with the Columbian Exchange or in 1964 which represents the peak of environmental results of nuclear bomb testing. The authors suggest that picking either era as the beginning of the Anthropocene has discursive implications for what social forces (colonialism, nuclearization, etc.) are most impactful upon the planet, and the possibility of positive future action. The Anthropocene concept highlights that human activity profoundly changes the environment of Earth, but unlike previous environmental-altering phenomena in Earth’s history, humans are self-reflexive and thus also have the agency to reverse negative transformational affects. The Anthropocene concept has, however, been criticized for painting a picture of human beings as a whole having the power and responsibility over a changing climate, not taking into account the differences in energy consumption and impact of climate change across societies (Malm and Hornborg, 2014).<sup>18</sup></p>

Anthropomorphism	<p>Anthropomorphism means to ascribe human-like qualities to non-human entities. As a largely imaginative exercise, the anthropomorphism of nature underlies both modern and pre-modern cultures across the world; the notion of “Mother Earth” is a particularly famous example of the phenomenon.</p> <p>Anthropomorphism allows entities to be perceived as agents capable of social influence, and also as “worthy of moral care and consideration,” informing environmental policies that extend personhood and legal rights to non-human entities (Waytz, Epley &amp; Cacioppo, 2010, p. 59).<sup>19</sup> Anthropomorphism is particularly valuable in pedagogical approaches to conservation – but the effects of increasing nature-connectedness and protectiveness are not restricted to children (Tam, Lee and Chao, 2013).<sup>20</sup></p>
Aquatic Ecosystem	<p>See <b>Ecosystem</b> for the general definition.</p> <p>Aquatic ecosystems are water-based ecosystems in general. Related terms may specialize the focus on various environments, such as “riparian ecosystem” for ecosystems centered around rivers (in general or a specific river), and “marine ecosystem” for oceans. We may also speak of ecosystems through the lens of human activity, i.e. a “fishery ecosystem”. Like ecosystems in general, aquatic ecosystems are tremendously complex and varied, self-organizing and self-sustaining, and the interactions within any given ecosystem remain poorly understood by humans.</p> <p>A typology of global aquatic (and other) ecosystems may be seen at: <a href="https://global-ecosystems.org/">https://global-ecosystems.org/</a><sup>21</sup></p> <p>See also <b>Large Marine Ecosystem</b>.</p>
Automatization	<p>Automatization is the process of using technology to do tasks instead of humans. Automatization has been a long-standing source of debate and discussion due to on the one hand the promise of greater productivity and economic output and the possibility of reducing (or even ending) the human workload – and, on the other hand, worries about job loss, job degradation and job precarity. The rapid proliferation of public awareness of AI capabilities has enhanced worries over the impact of automatization in jobs hitherto seen as safe due to creative or intellectual requirements. Scholars have argued that the criticisms of automatization are born out of current trends of wealth inequality and worker disempowerment, and automatization can indeed be utopian under conditions of socioeconomic transformation (Spencer, 2018).<sup>22</sup></p>
Biodiversity	<p>Biodiversity is a shortening of the term “biological diversity”, generally attributed to Edward O. Wilson from his book <i>The Diversity of Life</i>.<sup>23</sup> The United Nations <i>Convention on Biological Diversity</i> defines the term as “the variability among living organisms from all sources including, inter alia, terrestrial, marine, and other aquatic ecosystems, and the ecological complexes of which they are part: this includes diversity within species, between species and of ecosystems” (1994, p.3).<sup>24</sup> Biodiversity is taken as an important good to safeguard, for the instrumental reasons of human enjoyment and economic importance, but also due to the importance of species diversity to complex ecosystems.<sup>25</sup> Biodiversity is being lost rapidly, though exact estimates vary due to an inability to know precisely how many undiscovered species there are that are going extinct before humans discover them: however, estimates agree the rate of species and thus</p>

	diversity loss is at least “extinction rate is hundreds, or even thousands, of times higher than the natural baseline rate” of extinction that would take place without human activity (Smithsonian). <sup>26</sup>
Biogeography	“Biogeography is the study of the distributions of organisms in space and time. It can be studied with a focus on ecological factors that shape the distribution of organisms, or with a focus on the historical factors that have shaped the current distributions” (Brown University). <sup>27</sup>
Biogeographical Regions	Biogeographical Regions are those that share distinct biogeographical characteristics. The European Environmental Agency (2016) <sup>28</sup> has defined a set of terrestrial biogeographical regions of Europe (see <b>Large Marine Ecosystems</b> for the oceanic counterparts of these terrestrial regions.) These biogeographical regions are sites of conservation. These regions are the: Alpine; Anatolian; Arctic; Atlantic; Black Sea; Boreal; Continental; Macaronesia; Mediterranean; Pannonian; Steppic.
Bioregion	Bioregion is a concept wherein human society shifts away from communities organised around the nation-state model and instead embrace a smaller scale paradigm that is in harmony with the surrounding ecology. It provides an alternative model for conceptualizing communities. Bioregions are cultures determined by the ecological characteristics of the region in which they are located, and culture arises in harmony with these ecosystem characteristics. <sup>29</sup>
Biophilia	Biophilia, first coined by E.O. Wilson (1986), <sup>30</sup> is the “love of all that lives or, more simply, nature-friendliness” (Van den Born et al. 2001). <sup>31</sup> The “Biophilia hypothesis” argues that biophilia is innate to humans, “hereditary and hence part of ultimate human nature” (Kellert & Wilson 1993, p. 31). <sup>32</sup> This assertion has since found empirical support (Kahn 1999). <sup>33</sup>
Blue Economy	According to Crona et al. (2021, p. 1-2): “The term Blue Economy has gained immense traction, reflecting the enormous commercial interest in, and efforts devoted to, claiming ocean resources and space in the Anthropocene era. Yet, as a concept it remains ambiguous. When it emerged, in the run-up to the 2012 UN Conference on Sustainable Development process, the expression was invoked to connect the ocean to the “green economy”. Since then, the concept has been repackaged and conceptualized to match a diversity of discourses anchored in specific geographies and linked to experiences of particular sectors and actors, some of which see the ocean as natural capital and a foundation for business development, while others regard it as a means of development for small island states and small-scale livelihoods. The latter indicates a concern for a socially equitable development of the ocean, yet this view is far from ubiquitous in contemporary discourses. While the Blue Economy is generally discussed in an aspirational light with expectations of positive outcomes, it is not unproblematic. The rapid expansion of industrial activities in the ocean continues to outpace global regulatory efforts and generate negative consequences for local communities, small-scale operators and the ocean ecosystem.” <sup>34</sup>

Blue Humanities	The Blue Humanities are an emerging field of scholarship that seeks to critically analyse humanity’s relationship with seas and oceans. To the fields of humanities and social science the blue humanities contribute an understanding of the sea as more than just a backdrop for human activity, to see how water bodies are understood and experienced by humanity, with a particular interest in colonialist appropriations of the sea, capitalist and state-military exploitation and degradation of water, and a highlighting of indigenous views and relations with water. <sup>35 36 37 38</sup>
Care	“Caring is not only an attitude of concern for the well-being of another, but also and foremost a practice” (Jax et al., 2018, p.23). In this practice, people seek to meet the needs of another human or non-human entity regardless of the benefits this has for oneself. Care, moreover, relates to concern (caring about) and action (caring for) (Jax et al., 2018). <sup>39</sup> As care emerges in the relationship between humans and nature, care is also a relational value (West et al., 2018). <sup>40</sup>
Capitalocene	The Capitalocene is an alternative viewpoint to the notion of the <b>Anthropocene</b> wherein the concept of human activity fundamentally reshaping nature is itself reformulated; it is not humanity as such but rather capital, and capitalism, that has in the current era organized the uses and values of nature. The Capitalocene concept attempts to solve some of the objections to the Anthropocene concept by pinpointing not humanity as a whole but rather the interests of industrial capitalism as the driver of ecological reordering and change on Earth. <sup>41</sup>
Citizen Science	Providing an exact definition for Citizen Science is difficult as it knows different definitions in different contexts, and as the field is rapidly developing (Haklay et al. 2021). <sup>42</sup> However, generally, citizen science is the collaborative approach between scientists and lay-volunteers, wherein new knowledge about the natural world is created through their collaborative efforts and citizens additionally are empowered and strengthen their scientific literacy (Bela et al 2016). <sup>43</sup>
Co-creation	Co-creation in its widest sense means creating something together within a group of stakeholders. The approach is used with different connotations in different communities of practice most prominently in design, innovation management (user-led innovation), <b>foresight</b> , responsible research and innovation (RRI), and participatory research. <sup>44</sup> In the design oriented literature, co-production and co-creation tend to be associated mainly with the participation of users or citizens to service implementation, whereas co-design implies participation as initiators of a new solution in the “front-end” stages of a service development process of exploration and idea generation. <sup>45</sup> One may distinguish different rationales for co-creation, i.e. (i) normative (democratic principle), (ii) substantive (improvement of quality of the outcome), (iii) social-learning (enabling networks), and (iv) facilitating implementation. <sup>46</sup> Often there is one key actor initiating or facilitating the co-creation process however the notion of “commons-based peer production” <sup>47</sup> describes groups that cooperate in a self-organised way to generate shared goods without using market incentives.



<p>Connectedness</p>	<p>Connectedness with nature is an example of a relational value that drives action for nature (Schultz, 2001; 2002)<sup>48 49</sup> and is considered crucial in nature conservation (Zylstra et al., 2014; Restall and Conrad, 2015).<sup>50 51</sup> It is associated with a multitude of terminologies, definitions, and conceptualisations as it is studied from multiple disciplines (Braun and Dierkes, 2017).<sup>52</sup> This diversity may be challenging in studying and discussing connectedness with nature (Restall and Conrad, 2015) and the plurality of and continuum within the concept should be acknowledged (van Heel et al., 2023).<sup>53 54</sup></p> <p><i>Types of connectedness with nature</i></p> <p>Van Heel et al. (2023) distinguish three different types of understandings of connectedness with nature in scientific literature.</p> <ul style="list-style-type: none"> <li>● Humans and nature are considered as separate entities that are somehow related and <i>intertwined</i>;</li> <li>● Humans and nature are considered as being part of each other, or as for example, nature <i>including</i> humans, or humans including nature. This understanding is often rooted in the work of Schultz (2001);</li> <li>● Humans and nature as one, <i>indistinguishable</i>, entity.</li> </ul> <p>Connectedness with nature may reflect individual or collective beliefs (Tam, 2013; Bruni et al., 2018).<sup>55</sup> In addition to different types of understandings of connectedness with nature, the meaning of connectedness with nature varies with different types and scales of “nature” humans connect (Klaniecki et al., 2018).<sup>56</sup></p> <p><i>Dimensions of connectedness with nature</i></p> <p>Connectedness with nature encompasses different dimensions (Ives et al., 2018).<sup>57</sup> Ives and colleagues distinguish five such dimensions or types of connections:</p> <ul style="list-style-type: none"> <li>● <b>Material</b> (e.g. consumption of materials from nature);</li> <li>● <b>Experiential</b> (e.g. direct interactions with nature);</li> <li>● <b>Cognitive</b> (e.g. knowledge about nature);</li> <li>● <b>Emotional</b> (e.g. positive and negative feelings about nature);</li> <li>● <b>Philosophical</b> (e.g. reflecting on values of nature and on how humans should interact with nature).</li> </ul> <p>These dimensions are not strictly separated and range from external (material) to internal (philosophical) connections, where the internal connections are considered to have most leverage in sustainable transformation (Ives et al., 2018).</p>
<p>Connectedness (with Sea and Waters)</p>	<p>More specifically than connectedness with nature in general, people connect to water, seas or other specific aquatic ecosystems. Despite its relevance, there are only few studies where connectedness with nature is specified to connectedness to water (Ehl, 2023).<sup>58</sup> In studying for example ocean connectedness, specifications of scales on nature connectedness have been used (Nuojua et al. 2022).<sup>59</sup></p>
<p>Deep ecology</p>	<p>Deep ecology is an environmentalist movement that argues for a reformation of human relationships with nature. Deep ecologists argue that modern, capitalist society values nature solely through its usefulness for humans, and they seek instead a “transformation of values and social organization” (Devall 1980, p.303)</p>



	<p>that recognizes the inherent value of nature.<sup>60</sup> The movement originated with the writings of Arne Naess in the 1970s, wherein he argued for “deep ecology” that contrasted against the “shallow ecology” of environmentalism that, in his view, focused only on environmental problems as they impacted humanity.<sup>61</sup> Deep ecology advocates a sense of human self as deeply embedded in nature. While deep ecology has been influential in subsequent ecological thought, deep ecology itself is often criticized as mysticism, and for not giving sufficient critical thought to the workings of power via race, gender, and class.<sup>62</sup></p>
Ecosystem	<p>“An ecosystem is a geographic area where plants, animals, and other organisms, as well as weather and landscape, work together to form a bubble of life. Ecosystems contain biotic or living, parts, as well as abiotic factors, or nonliving parts. Biotic factors include plants, animals, and other organisms. Abiotic factors include rocks, temperature, and humidity.</p> <p>Every factor in an ecosystem depends on every other factor, either directly or indirectly. A change in the temperature of an ecosystem will often affect what plants will grow there, for instance. Animals that depend on plants for food and shelter will have to adapt to the changes, move to another ecosystem, or perish. Ecosystems can be very large or very small. Tide pools, the ponds left by the ocean as the tide goes out, are complete, tiny ecosystems.</p> <p>The whole surface of Earth is a series of connected ecosystems. Ecosystems are often connected in a larger biome. Biomes are large sections of land, sea, or atmosphere. Forests, ponds, reefs, and tundra are all types of biomes, for example. They’re organized very generally, based on the types of plants and animals that live in them. Within each forest, each pond, each reef, or each section of tundra, you’ll find many different ecosystems” (National Geographic).<sup>63</sup> In 2022 the International Union for the Conservation of Nature created a systemic, top-down typology of Earth’s ecosystems “to guide the transformation of ecosystem policy and management from global to local scales” (Keith et al., 2022, p.513).<sup>64</sup> The typology may also be viewed in combination with a world map detailing the incidences of various ecosystems at: <a href="https://global-ecosystems.org/">https://global-ecosystems.org/</a><sup>65</sup></p>
Ecosystems Services	<p>Ecosystem Services are the direct benefits that a given ecosystem affords to humans. A view of ecosystems as providers of benefits to humanity arose out of a perceived lack of appreciation for the value of ecosystems to human existence, and the ecosystems services view provides at the very least a sense of appreciation – but can extend further to putting these benefits into economic terms, to create a more accurate estimation of the costs and benefits of nature conservation (or the failure to enact nature conservation.)<sup>66 67 68</sup></p>
Engagement	<p>Public engagement can be used as an umbrella term for practices such as communication, consultation, participation or co-creation. There are various ways of theorizing engagement, including Arnstein’s ladder of participation<sup>69</sup> that portrays different degrees of engagement/participation or Gaventa’s power cube.<sup>70</sup> Engagement plays a role in many different governance contexts, including engagement with nature.</p> <p>There are different forms and levels of engagement with nature. A distinction can be made between instrumental engagement and idealistic engagement. Within</p>

	<p>instrumental engagement, this may be in the form of support (acceptation of policy), contribution to achieving goals (e.g. through volunteering), to recreation and education for support. Idealistic engagement may run from legitimacy, co-construction of nature (shared responsibility in nature conservation), and meaningfulness and health (allowing for personal development). Three discourses can be recognized in the types of arguments for engagement and instrumental/idealistic engagement: “Ecology First”, “Co-creation and Economy”, and “Broadening and Embedding” (Buijs et al., 2017).<sup>71</sup></p> <p>Research also distinguishes four other types of citizenship orientation: engaged trustful, engaged distrustful, unengaged trustful, and unengaged distrustful (Tzankova et al. 2021).<sup>72</sup></p>
<p>Environmental Attitudes</p>	<p>In environmental psychology many different concepts and measures are dedicated towards Environmental Attitudes. They all have in common that they portray "a psychological tendency expressed by evaluating the natural environment with some degree of favour or disfavour"<sup>73</sup>. Research on the differences in people's attitudes toward, and concern for, the environment reveal that in the majority of OECD countries gender differences in reported understanding and knowledge of climate change are small or non-existent and that differences between age groups are as yet unclear or little. Education, however, seems to be the biggest determinant of individuals' concern for the environment. Meanwhile, environmental concern is reduced during periods of economic recession and high unemployment. However, there are ongoing debates about the impact of experiencing natural disasters and other environmental problems on people's environmental attitudes; while an OECD survey argues that experiencing natural disasters is likely to increase environmental concern, the World Values Survey suggests that economic conditions and tical ideologies are much more important, and that countries that lack affluence and have low educational attainment may not have the resources to attain environmental goals regardless of their level of exposure to natural disasters.<sup>74 75 76</sup> Meanwhile, a survey of environmental attitudes in Germany revealed more environmental consciousness in women and young people (age 14-29), and that a growing percentage of the population are environmentally conscious and engaged.<sup>77</sup></p>
<p>Environmental Degradation</p>	<p>Environmental Degradation is the deterioration of biodiversity and health of an environment. It decreases the ability of ecosystems to maintain their core characteristics which enables ecosystems to function. These core characteristics can be diversity of species in a given ecosystem, the different environmental niches available for the various diverse species that it degrades, makes it difficult for diverse species to flourish in a given ecosystem and the ecosystem loses its function as well.<sup>78</sup></p>
<p>Environmental Grief</p>	<p>In a time of environmental and biodiversity loss, Environmental or Ecological Grief describes grief over these lost species and landscapes. Increasingly scholars are questioning how to grief for environmental losses and what practices and language is needed to do so (van Dooren, 2014; Albrecht, 2019).<sup>79</sup> This goes hand-in-hand with feelings of guilt, anger, anxiety, but also love and hope. Environmental grief is highly relational and often specific to certain species and landscapes. What</p>

	<p>one grieves for tells much about what one feels connected to (Cunsolo &amp; Landman, 2017).<sup>80</sup> Much of this grief is anticipatory, already grieving for that what is still around but will likely disappear in the near future. Grief can also be transformative, thereby having the potential to make those in grief reflect and take action to live together better with the more-than-human species still around (Barnett, 2022).<sup>81</sup></p>
Eudemonic Values	<p>While justification of nature conservation is often based in moral and instrumental values, Eudemonic or Relational Values are overlooked in policy despite their importance for people to act for nature.</p> <p>Eudemonic values include a long-term perspective and can be understood as referring to a “meaningful or worthwhile” life (van den Born et al., 2018, p.844; Knippenberg et al 2018).<sup>82 83</sup>It includes a long-term perspective and making a difference in the world, fulfilling one’s potential, and awareness that one needs to make choices and act for nature (Van den Born et al., 2018).<sup>84 85</sup></p>
Eutrophication	<p>Eutrophication is a process whereby excess nutrients – from human activities, such as sewage, farming and industrial runoff – enter a water body, stimulating the growth of algae and plants. “Eutrophication sets off a chain reaction in the ecosystem, starting with an overabundance of algae and plants. The excess algae and plant matter eventually decompose, producing large amounts of carbon dioxide. This lowers the pH of seawater, a process known as ocean acidification. Acidification slows the growth of fish and shellfish and can prevent shell formation in bivalve molluscs. This leads to a reduced catch for commercial and recreational fisheries, meaning smaller harvests and more expensive seafood.”<sup>86</sup></p>
Experiential Futures	<p>Experiential Futures “involves designing and staging interventions that exploit the continuum of human experience, the full array of sensory and semiotic vectors, in order to enable a deeper engagement in thought and discussion about one or more futures, than has traditionally been possible through textual and statistical means of representing scenarios” (Candy, 2010, p. 3).<sup>87 88</sup> This method is a relatively recent advancement of the scenario method and especially suitable to address emotional relationships as it is using artefacts and experiences to mobilise tacit and implicit knowledge about possible futures.<sup>89</sup> Genres of intervention include, but are not limited to: Immersive scenarios,<sup>90</sup> (tactical) guerilla futures,<sup>91</sup> future jamming,<sup>92</sup> speculative design,<sup>93</sup> diegetic prototypes<sup>94</sup> and “serious” games”.<sup>95</sup></p>
Extinction of Experience	<p>Not only millions of species go extinct, our experiences in nature risk extinction too (Pyle, 1993).<sup>96</sup> There are fewer opportunities to interact with nature, especially for children, as nature is further away and lives are increasingly overscheduled (Soga and Gaston 2016).<sup>97</sup> This is problematic, as a lack of direct contact with nature has consequences for health, well-being, emotions, attitudes towards nature and behaviour (Miller, 2005; Soga and Gaston 2016).<sup>98 99</sup> In short; the extinction of experiences is detrimental to both humans and nature (Colléony et al. 2020).<sup>100</sup></p> <p>General accessibility to nature, particularly in urban environments wherein greenery can be treated by planners as a luxury rather than a necessity, is crucial to prevent a negative feedback loop of increasing alienation from nature, with the</p>

	<p>process of nature exposure particularly important for children (Miller, 2005; Soga and Gaston 2016; Colléony et al. 2020).<sup>101 102 103</sup> The Extinction of Nature is thus a problem that requires deeper collaboration between environmental scientists, conservationists, and urban planners and designers, to ensure wider access to nature near where people live and work, and where children study (Miller, 2005; Soga and Gaston 2016; Colléony et al. 2020).<sup>104 105 106</sup></p>
Extractivism	<p>According to Parks (2021, p.353): “Extractivism is a term most often understood in relation to large-scale, profit-driven operations for the removal and processing of natural resources such as hydrocarbons, minerals, lumber, and other materials. In an extended sense, the term refers more generally to a mindset in which resources serve a means-ends function, becoming commodities to be extrapolated and turned to profit.”<sup>107</sup> Extractivism’s “conceptual axis” incorporates:</p> <ul style="list-style-type: none"> <li>• Foregrounding the phenomenon of resource extraction as fundamentally important (this is a relevant reminder because resource extraction can often occur out of sight and out of mind of urbanized populations in the “West”)</li> <li>• “Extraction” as more than the extraction of raw material from the Earth, but also extraction as the usage of human-labour, ideas, emotions and so on (consider, for example, “data mining”) – a conceptual opening up of the idea of “extraction” that does not equate these phenomena of extraction with the traditional definition but is more than a metaphorical exercise because...</li> <li>• ... Extraction, of raw resources, people and the more ephemeral realm of ideas, feelings and concepts, is the fundamental practice of capitalist exploitation and the transformation of the world into resources is the basis of the modern economy</li> <li>• “Extraction is a process that reshapes and uses up the natural environment, with consequences for both those who live close to the sites of extraction and those far from these sites, who have no option but to live in an atmosphere and on a planet transformed by extraction” (Szeman 2017 p.445).<sup>108</sup></li> </ul>
Foresight	<p>Foresight is a forward-looking approach that aspires to help people explore and anticipate <b>futures</b> and change processes. Rather than merely predicting the future (forecasting), foresight typically involves systematic, participatory, future-intelligence-gathering. The practice of foresight evolves around “structured dialogues” for co-creating imaginaries of possible or desirable futures.<sup>109</sup> Foresight methods, such as scenario development or <b>horizon scanning</b> or experiential futures, structure and inform these dialogues in order to mobilise collective intelligence out of a diversity of perspectives and to support people in questioning linear anticipatory assumptions and go beyond the extrapolation of today.<sup>110</sup></p>
Futures Literacy	<p>Futures Literacy is the capacity to systematically challenge linear anticipatory assumptions and to recognise the rich diversity of phenomena characterising the potential of the present to evolve in a myriad of diverse futures. The key argument is that humans can systematically train their capacity to “use the future” to increase their freedom in the present. The concept was developed by Riel Miller who first proposed “rigorous imagining” as a way to hone futures</p>

	literacy <sup>111</sup> and then at UNESCO developed this further into the concept Futures Literacy Laboratories. <sup>112</sup>
Futures	The pluralisation of the word future aims to reify important tenets of the field of futures studies: a) that “the future” does not exist as such, b) that multiple, often contending, images of the future do exist and influence behaviour and decision-making in the present, and c) articulating a “preferred future” is the socio-political act of using alternative futures to better direct action. <sup>113</sup>
Green Economy	The United Nations Environment Programme defines a Green Economy as one that is “as low carbon, resource efficient and socially inclusive. In a green economy, growth in employment and income are driven by public and private investment into such economic activities, infrastructure, and assets that allow reduced carbon emissions and pollution, enhanced energy and resource efficiency, and prevention of the loss of biodiversity and ecosystem services.” <sup>114</sup> Critics of the green economy paradigm suggest it is flawed because of maintaining a status quo fixation on growth-oriented economies, that greening the economy is a notion that still places the growth of the economy at the forefront, and such unrestricted growth is incompatible with the goal of ensuring environmental sustainability. <sup>115</sup> “Specifically, if political, economical, and cultural constraints are not considered, green economy strategies will not be successful in their goals to end environmental degradation and reducing poverty,” as Ulrich Brand put it (2012). <sup>116</sup>
Generation	The term Generation term is often used in reference to specific birth or age cohorts” of humans within a society. <sup>117</sup> It is an important term for discussing concepts of intergenerational justice, <sup>118</sup> responsibility to future generations <sup>119</sup> , and other policy matters like future discounting. <sup>120</sup>
Human-Nature Relationship	Humans have a deeply complex relationship with the natural world, and this human-nature relationship is increasingly the object of scientific study across multiple disciplines. Indigenous authors have argued that the human-nature relationship is much more profound for indigenous populations, and conservation approaches should be taken with respect to the centrality of nature to indigenous ways of life (Salmón 2000). <sup>121 122 123 124 125</sup> Images of relationship are worldviews people hold about the appropriate relation between humans and nature (Van den Born, 2008). <sup>126</sup> Van den Born (2008) distinguishes four different images of relationship between humans and nature: <ul style="list-style-type: none"> <li>● Master over nature</li> <li>● Steward of nature</li> <li>● Partner with nature</li> <li>● Participant in nature</li> </ul> Over time, both within and between generations, human relationships with water or nature changes. Moreover, also the water and nature humans relate to changes, which influences the relationship as well. Also between cultures, there are different perspectives on the Human-Nature Relationship. Outside of the in Western societies nature-culture divide, there are other, non-dualistic perspectives such as animism and naturalism (Fourrier et al., 2021). <sup>127</sup> Recent

	<p>research has moved beyond these divides and find ways to build on an increasing societal belief that humans are not a separate entity standing above nature, but are part of nature (Plumwood, 2006; Zylstra et al., 2014).<sup>128 129</sup></p>
Human-Water Relationship	<p>The human-water relationship has been defined by Simmons, Woog &amp; Dimitrov (2007) as the point of intersection between the human economy and the hydrological system (groundwater, glaciers, seas, rivers, etc.). “Although water is vital for human survival and growth, the point where human endeavor intersects is the most variable and uncertain in the hydrological system” (p.276). The inherent uncertainty of the hydrological system – accelerated by human economic activity – has, Simmons, Woog &amp; Dimitrov argue, lead to responses of humans attempting to reduce the uncertainty through the creation of systems of regulating water such as dams, dykes and irrigation, but with the long-term consequence of shortening water availability. Human economies have reached a critical point of running out of the long-term option of exploiting water, and instead adaptation to the hydrological system is required: “the concept of living with water as a complex entity rather than as a commodity may be the only way open to us” (p.283.)<sup>130</sup></p> <p>The need to understand and live in harmony with water has in particular inspired much Chinese scholarship that studies the historical experiences of Chinese interactions with the hydrological systems of large river basins,<sup>131 132 133 134</sup> and the proposal of new indicators for assessing the sustainability of human-water relationships in regions – indicators such as the Human-Water Harmony Index (Ding et al. 2014.)<sup>135</sup></p> <p>As humans can have a relationship with nature and a connectedness with nature, humans can have a relationship and connectedness with water as well.</p>
Horizon Scanning	<p>Horizon Scanning is a <b>Foresight</b> approach that supports people to widen their perception towards a richer spectrum of possibly emerging changes. In particular, Horizon Scanning systematically opens our view for “weak signals” i.e. changes from the fringes of current attention which is often dominated by attitudes and perspectives today”s or even yesterday”s generations.<sup>136</sup> Key aspects of Horizon Scanning are challenging biases that structure perception and assessment of such “signals“ including “anticipatory assumptions“ about the future. This can be done by systematically including sources outside ones standard peripheral vision (“fringe sources“), sources with special alertness for change e.g. from art or literature. Another increasingly important Horizon Scanning approach is to screen large amounts of sources both structured (e.g. scientific papers) and unstructured (e.g. social networks) with automatised algorithms that use Natural Language Processing (NLP) to find patterns of change (topic modelling).<sup>137</sup> In any case the identification of potentially emerging changes will always have to involve a sense making process where diverse actors co-construct what the “signals” of interest.</p>
Images of Nature	<p>Images of Nature which relate to questions of what nature is and what the types of nature are that people distinguish. Characteristic Western / European examples of such images are wild nature and arcadian nature (Van den Born et al., 2001):<sup>138</sup></p> <ul style="list-style-type: none"> <li>● Arcadian Nature – well-ordered, park-like landscapes (Van den Born et al., 2001; De Groot &amp; Van den Born 2003)<sup>139 140</sup></li> <li>● Penetrative Nature – nature that “creeps into places we have designed to</li> </ul>



	<p>be our own”, such as rats, mosquitoes (Van den Born et al., 2001, p. 71)<sup>141</sup></p> <ul style="list-style-type: none"> <li>• Wild Nature – untamed landscapes where you can see the greatness and forces of nature (Van den Born et al., 2001; De Groot &amp; Van den Born 2003).<sup>142 143</sup></li> </ul>
Inclusion Principle	The Inclusion Principle is used to value the importance of words and the impact they have, as well as different modes of communication for different needs of specific audiences.
Interdisciplinary Research	Interdisciplinary Research is research that involves the integration of several academic disciplines or separate bodies of specialized knowledge in a way that forces them to cross subject boundaries to advance fundamental understanding and/or to solve problems whose solutions are beyond the scope of a single disciplines or area of practice. <sup>144</sup>
Instrumental Values	Instrumental Values are a type of values where something, for example water, is valued not for what it is but for their attributes and for what it is used for by humans (Lockwood 1999). <sup>145</sup> In instrumental values something is a means to an end rather than an end in itself (Hirose and Olson, 2015). <sup>146</sup> Also, within this category, hedonic values may be distinguished, where something is valued because it provides people with pleasure or positive feelings, “reflecting a concern with improving one”s feelings and reducing effort” (Steg et al., 2014, p. 167). <sup>147</sup> Hedonic well-being is positively associated with connectedness with nature (Pritchard et al., 2020). <sup>148</sup>
Intergenerational Justice	This concept of Intergenerational Justice invokes the question of rights due to unborn generations and responsibilities of current generations to not impinge on those rights. Inspired by justice theories, such as the works of John Rawls, the discourse on intergenerational justice has seen contributions from many different fields of research (spanning from the natural sciences over sociology to legal scholarship) and has shaped debates in environmental ethics (e.g. (Agius and Busuttill, 1997) <sup>149</sup> ). Beyond this, the concept has a very long history outside the global north (see critical indigenous theory). This concept has a very long history. Within the present structures of global institutions, the UN Declaration is a notable explicit document on the matter. <sup>150</sup> Literature on intergenerational justice extends nearly 30 years to either side of this UN declaration. <sup>151 152 153</sup>
Large Marine Ecosystem	<p>“Large marine ecosystems are areas of ocean with impressive characteristics in terms of spatial extent, ecological functions and economic importance” (Charles, 2000, p.35).<sup>154</sup> The size of an LME is on the order of 200,000 square kilometres, and they are shaped by unique characteristics of geography and biosphere.</p> <p>Of 64 LMEs defined worldwide, 13 are described as Pan-European Marine Ecosystems by the European Environment Agency, and represent a political geographical unit of conservation and research. These Pan-European Marine Ecosystems are: East Greenland Shelf; Barents Sea; Norwegian Shelf; North Sea; Baltic Sea; Celtic-Biscay Shelf; Iberian Coastal; Mediterranean Sea; Canary Current; Iceland Shelf; Faroe Plateau; Black Sea; Arctic Ocean<sup>155</sup>.</p>

Master Over Nature	Master Over Nature is one of the four images of human-nature relationships described by Van den Born, 2008. “The Master over nature stands above nature. In his interactions with nature he is not restricted by moral constraints or knowledge about nature’s fragility. Economic growth and technology are expected to provide answers to his problems.” (Van den Born, 2008, p. 88). <sup>156</sup> The master over nature is the image of human-nature relationships that is generally adhered to least (van den Born et al., <i>forthcoming</i> ). <sup>157</sup>
Mission	Missions, such as the EU’s Restore our Ocean and Waters Mission <sup>158</sup> , aspire to address societal challenges by mobilizing different actors, resources and institutions from science, research and innovation around a common goal that is clearly defined (both temporal and substantive). Missions thus help to coordinate action and aspire to bring about innovation and/or transformative change. “The concept of a mission lends itself to drive such transformations [new ways of production, distribution, and consumption] in various ways, including targeted techno-scientific developments (“breakthroughs”) and empowering societal stakeholders to articulate their needs and use their inventiveness” (Janssen et al. 2021, p.249). <sup>159</sup>
Moral Values	Moral Values, also often called intrinsic values (Van den Born et al., 2018), <sup>160</sup> describe the idea that something, for example water or an ecosystem, has a value on its own (Lockwood 1999; Van den Born et al., 2018). <sup>161 162</sup> “As a single illustrative example, a farmer may have a strong held value regarding fairness (which is also moral), and also apply this notion of fairness to the context of pesticides in a relational (and moral) principle that careless pesticide applications are wrong because they undermine the utility of the chemical for other farmers (by fostering the evolution of resistance among pests). The same farmer may also care deeply for the land in a way that is crucial to her identity and well-being (a relational and eudaimonic value), while simultaneously fostering pollinators primarily for yield gains (following instrumental/economic values), and believing in the inherent rights of all species to exist (an intrinsic value). These values are deeply intertwined (e.g. caring for the land may be stronger when reinforced by the benefits yielded, tangible or otherwise).” (Chan et al., 2018, p. A3). <sup>163</sup>
More-Than-Human perspectives	More-Than-Human Perspectives refers to the worlds of the “different beings co-dwelling on Earth, including and surpassing human societies” (de Souza, 2021, p. 1). <sup>164</sup> Within a system that tends to focus on human experiences and benefits, taking a more-than-human perspective makes other species and systems than humans more visible and allows for (better) acknowledgement and representation of their perspectives. Such perspectives can for example be useful in guiding nature conservation practices (Lorimer, 2012). <sup>165</sup> In including more-than-human perspectives, different methodological approaches are applied that focus on noticing and listening to more-than-humans and their worlds (Dowling et al., 2016). <sup>166</sup>
Motivations to Act for Nature	Peoples’ Motivations to Act for Nature are complex and diverse, and understanding these motivations requires an interdisciplinary approach (Admiraal et al. 2017). <sup>167</sup> Previous studies have demonstrated the importance of eudemonia,



	<p>moral values, and connectedness with nature (Admiraal et al. 2017; Van den Born et al., 2018; Ganzevoort and van den Born, 2020)<sup>168 169</sup> as motivations to act for nature.</p> <p>Deci and Ryan (1985)<sup>170</sup> suggest in their self-determination theory that people are more motivated to act for something if they are self-determined or autonomously motivated. This requires that people need the competence to perform actions, have meaningful relations with others and feel autonomous in their actions (Deci and Ryan 1985; Ryan and Deci 2000).<sup>171 172</sup> Ganzevoort &amp; Van den Born (<i>forthcoming</i>)<sup>173</sup> show that in the context of action of nature, this relatedness with others should be broadened to relatedness with nature.</p>
Multi-Species Justice	<p><b>Multi-Species Justice (MSJ)</b> seeks to understand the types of relationships humans ought to cultivate with more-than-human beings so as to produce just outcomes.<sup>174 175 176</sup> At the core of MSJ is a <b>justice theory that recognizes rights of non-human nature</b> (“more than humans”). Beyond rejecting the belief that humans alone merit ethical or political consideration, multispecies justice rejects three related ideas central to human exceptionalism:</p> <p>a) that humans are physically separate or separable from other species and non-human nature (=relational ontology),</p> <p>b) that humans are unique from all other species because they possess minds (or consciousness) and agency and</p> <p>c) that humans are therefore more important than other species.</p> <p>MSJ rests on a number of background theories and roots in particular animal rights, political ecology, posthumanist (feminist) theories, actor network theory (ANT), new materialism and indigenous philosophies. It is however unique in its focus on justice theory and aims to resolve tensions between individual rights and ecosystem perspective which are problematic e.g. in animal rights through concepts like sympathetic imagining and shared vulnerabilities.</p> <p>Key aspects of MSJ are:</p> <ul style="list-style-type: none"> <li>• <b>Relational ontologies:</b> In MSJ understanding all beings are entangled in “thick relational webs” or “ecological arrays” and therefore equally entitled to justice and dignity.</li> <li>• <b>Recognition:</b> MSJ recognizes the multiplicity of different types of being, in their own terms. Misrecognition and disrespect are seen as the reasons for maldistribution of rights. This entails <b>radically rethinking the subject of justice:</b> Human and nonhuman animals, species, microbiomes, ecosystems, oceans, and rivers – and the relations among and across them – are all seen as subjects of justice. All ecosystems merit <b>capabilities-based conception of flourishing</b> i.e. the right to actualize their capabilities and follow their life projects.</li> <li>• Consequently, <b>multispecies injustice</b> comprises all the human interruptions of the functioning of this broad array of relations. If human practices create conditions that undermine the integrity of ecological systems, and</li> </ul>

	<p>harm their basic functioning, those practices should be considered unjust status injuries.</p> <ul style="list-style-type: none"> <li>• <b>Non- anthropomorphism:</b> MSJ emphasises sensitivity to how different beings experience the world and recognises the limits of our capacity to understand.</li> <li>• <b>Modes of immersion:</b> To enact MSJ humans need to strive to do better at knowing and understanding others and cultivate “arts of attentiveness”: modes of both paying attention to others and crafting meaningful response. Approaches range from researching communication systems of non-humans such as plants, recognizing alternative ways of knowing about non-human systems e.g. embodied knowledge, theory based practices like sympathetic imagining or intimacy through art practices.</li> <li>• <b>Decolonization:</b> MSJ recognizes indigenous knowledge as critical intellectual resource but at the same time refrains from its appropriation.</li> <li>• <b>Transformative Orientation:</b> MSJ is aware of the risk that minor changes (e.g. personhood for some human like animals) obstruct larger transformation and aims to avoid such a lock-in.</li> </ul>
Ocean Literacy	McKinley and colleagues (2023) have a broad understanding of Ocean Literacy, including knowledge, awareness, attitudes, communication, activism, behaviour, emotions, access/experience, adaptive capacity, and trust and transparency in relation to the ocean. <sup>177</sup>
Partner with Nature	Partner with Nature is one of the four images of human-nature relationships described by Van den Born, 2008. “The Partner with nature stands side by side with nature. Humans and nature are considered to be of equal value. Humans should work together with nature with the aim that this interaction will benefit both.” (Van den Born, 2008, p. 88). <sup>178</sup>
Participant in Nature	Participant in Nature, also referred to as oneness with nature, is one of the four images of human-nature relationships described by Van den Born, 2008. “The Participant in nature is part of nature, not just biologically, but also on the spiritual level. Although humans are a (small) part of nature, they are active participants. For the Participant, the bond between self and nature is very important; it co-constitutes the self.” (Van den Born, 2008, p. 88). <sup>179</sup>
Polycentric Commons Governance	<p>In decades of empirical investigation of governance arrangements for diverse types of common goods, Elinor Ostrom and her team (Ostrom 2008, 2010, 2005)<sup>180 181 182</sup> have identified polycentric design principles that characterise long sustained governance regimes for commons (Ostrom 2010, pp. 12–13):<sup>183</sup></p> <ol style="list-style-type: none"> <li>1. Boundary rules (how actors were to be chosen to enter and leave these positions) <ul style="list-style-type: none"> <li>• 1A. User Boundaries: Clear and locally understood boundaries between legitimate users and nonusers are present.</li> <li>• 1B. Resource Boundaries: Clear boundaries that separate a specific common-pool resource from a larger social-ecological system are present.</li> </ul> </li> <li>2. Position rules (set of position and how many actors hold one) <ul style="list-style-type: none"> <li>• 2A. Congruence with Local Conditions: Appropriation and provision rules are congruent with local social and environmental conditions.</li> </ul> </li> </ol>

	<ul style="list-style-type: none"> <li>• 2B. Appropriation and Provision: Appropriation rules are congruent with provision rules; the distribution of costs is proportional to the distribution of benefits.</li> </ul> <p>3. Choice rules (which actions are assigned to an actor in a position)</p> <ul style="list-style-type: none"> <li>• 3. Collective Choice Arrangements: Most individuals affected by a resource regime are authorized to participate in making and modifying its rules.</li> </ul> <p>4. Information rules (Information sharing)</p> <ul style="list-style-type: none"> <li>• 4A. Monitoring Users: Individuals who are accountable to or are the users monitor the appropriation and provision levels of the users.</li> <li>• 4B. Monitoring the Resource: Individuals who are accountable to or are the users monitor the condition of the resource.</li> </ul> <p>5. Scope rules (specify outcomes)</p> <ul style="list-style-type: none"> <li>• 5. Graduated Sanctions: Sanctions for rule violations start very low but become stronger if a user repeatedly violates a rule.</li> </ul> <p>6. Aggregation rules (decision making)</p> <ul style="list-style-type: none"> <li>• 6. Conflict Resolution Mechanisms: Rapid, low cost, local arenas exist for resolving conflicts among users or with officials.</li> </ul> <p>7. Payoff rules (distribution of benefits and costs to actors in positions)</p> <ul style="list-style-type: none"> <li>• 7. Minimal Recognition of Rights: The rights of local users to make their own rules are recognized by the government. 8. Nested Enterprises: When a common-pool resource is closely connected to a larger social-ecological system, governance activities are organized in multiple nested layers.</li> </ul> <p>These design principles were later tested and refined in laboratory and field studies revealing that individuals can and do embark in cooperative behaviours for thriving common pool resources especially when they are able to communicate directly and agree on a set of rules (Ostrom 2010, pp. 15–16).<sup>184</sup></p>
Relational Values	<p>According to Mattijssen et al. (2020):<sup>185</sup></p> <p>“Relational values can be distinguished from instrumental and intrinsic values in several ways. The value of the relationship between a person and a tree (or for instance an animal or place) is not found in either the person or tree, but in the connection between the two. With the concept of relational values, humans and nature are therefore not seen as separate entities: humans are part of nature and value their relationship with it (Knippenberg et al. 2018).<sup>186</sup> This does not imply that nature’s instrumental and intrinsic values are not important, but recognising relational values shifts our focus to also acknowledging the qualities of the relationships themselves (Chan et al. 2016).<sup>187</sup> A second distinguishable aspect of relational values compared to instrumental values is that they are non-substitutable (Himes and Muraca 2018).<sup>188</sup> In the same way that cherished friends or loved ones cannot be replaced by an equivalent other with similar characteristics, so too are the landscapes and species with which we bond not easily replaced by something “just like it”. Relational values thus raise fundamental concerns regarding practices such as biodiversity offsetting: while instrumental values of nature (e.g. timber supply) can be effectively offset, relational values cannot. People bond with a specific forest landscape, not with “forests” as a general abstraction. Third, whereas intrinsic values of nature are</p>

	<p>inherent to a natural entity, and instrumental value is a one-way street (nature has value for a human valuer), relational values concern relationships that are reciprocal. With this, it is recognized that humans and nature also shape and influence each other and how we as humans fundamentally depend on nature. This reciprocity is emphasized by activists, scientists and indigenous communities to express how nature provides for us, but we should also provide for and take care of nature (Diver et al. 2019; Gould et al. 2019).<sup>189 190</sup></p> <p>Relational values can serve as a “guiding principle in the life of a person”. (Schwartz, 1992, p. 37).<sup>191</sup></p> <p>Riechers et al. (2020, p. 2602)<sup>192</sup> highlight how relational values are expressed at an individual level (such as personal identification with nature) but also at a more collective level (for instance social bonds mediated by nature or cultural identity tied to natural landscapes). The authors also note the importance of responsibility, as both an individual feeling of responsibility for taking care of nature, as well as a collective sense of responsibility experienced within groups.</p>
Sea-Emancipation	<p>Sea-Emancipation refers to conceptualizing seas as agents that own themselves, with political and legal status and the rights and the consequent rights. Related to notions of non-human personhood rights. In FLOW, for example, we work with the pioneering initiative The Embassy of the North Sea, which works to listen to and represent the North Sea and its non-human inhabitants.<sup>193</sup></p>
Shifting Baseline Syndrome	<p>The Shifting Baseline Syndrome, also referred to as generational amnesia, describes the process of new generations accepting degraded biodiversity as the baseline. Each generations considers the biodiversity they know in their youth as “normal” and baseline. But, as biodiversity declines, each new generation has a lower and inappropriate baseline for biodiversity (Pauly 1995; Soga and Gaston, 2018).<sup>194</sup></p> <p>Causes of the shifting baseline syndrome are a lack of data, loss of interaction, and loss of familiarity with nature. The main consequences are increased social tolerance to biodiversity loss, altered expectation of what “healthy” nature is, and setting diminished baselines as standards and aims in policy (Soga and Gaston 2018).<sup>195</sup></p> <p>As loss of interaction and familiarity with nature is one of the main causes of the shifting baseline syndrome, the <b>extinction of experience</b> further amplifies the shifting baseline syndrome (Soga and Gaston 2016; 2018).<sup>196</sup> Moreover, as generational shifts happen in what we consider “normal” interactions with nature, a shifting baseline syndrome also takes place in relationship to a loss of experiences in nature (van Heel et al. 2022).<sup>197</sup></p>
Social-ecological systems	<p>All social systems are embedded in so called Social-Ecological Systems (SESs) that consist of multiple subsystems (e.g organisms, tissues of cells, resource systems, users of the resource systems such as fishers) (Ostrom, 2009).<sup>198</sup> SESs are complex (adaptive) systems in which social and ecological (biophysical) elements are intertwined and interact on multiple spatial and temporal scales (Janssen and Ostrom, 2006).<sup>199</sup></p>
Stakeholder	<p>Stakeholders are “People, groups, or institutions which are likely to be affected by a proposed intervention (either negatively or positively), or those which can affect</p>

	<p>the outcome of the intervention. (...) Stakeholders are those people who stand to gain or lose something by a project or policy intervention, or those who are capable of affecting the outcome of the intervention” (Rietbergen-McCracken &amp; Narayan, 1998, p. 79).<sup>200</sup> The constitutive group of stakeholders is always dependent on the proposed project, and a broad body of literature exists on the best practices and theories of how to identify and work with stakeholders relevant for a project.<sup>201 202</sup></p>
Stakeholder Analysis	<p>Stakeholder Analysis precedes stakeholder inclusion. The literature on stakeholder analysis<sup>203</sup> often distinguishes three different steps albeit in varying degree of refinement. Basically these are 1) stakeholder identification 2) stakeholder categorisation 3) analysis of stakeholder relationships 4) stakeholder strategy/management. Step 2 and 3 are sometimes merged into “stakeholder mapping”.</p> <p>Categorisation can be done along several different criteria, and the most established are: influence, affectedness, interest, power, urgency. Sustainability studies often also define attitudes such as transformational readiness or adaptiveness.</p>
Steward of Nature	<p>Steward of Nature is one of the four images of human-nature relationships described by Van den Born, 2008. “The Steward of nature also stands above nature, but manages nature. Nature is not owned by the Steward, but entrusted to him. The steward owes responsibility to God or future generations” (Van den Born, 2008, p. 88).<sup>204</sup> The steward of nature is the image of human-nature relationships that is generally adhered to most (van den Born et al. <i>forthcoming</i>), although in a more ecocentric variant.<sup>205</sup></p>
Stewardship Assemblage	<p>The notion of Stewardship Assemblages in the social sciences has come to highlight that phenomena are composed of various elements - human and non-human - and the relations between these elements. Assemblages are conceptualized as contingent and dynamically changing. Assemblages thinking has its roots in works by Guattari and Deleuze further Actor Network Theory (ANT) authors such as Latour, Woolgards and Law and also in anthropological work like by Tsing. Thus, the notion of assemblages has been circulating in various research fields, which adapted it with slightly differing focus and meanings, including political ecology.<sup>206</sup></p>
Sustainability	<p>Sustainability is the capacity of a system to maintain and renew itself. It is a concept that has different meanings and implications across disciplines and over time. The ecological definition is “the ability of biological systems to remain healthy, diverse, and productive over time” (Fedkin n.d.).<sup>207</sup> The issue of sustainability has become increasingly salient in economics, environmentalism and development discussions, with “sustainable development” becoming a key area of focus since the 1970s. Sustainability is “multidimensional” in that different disciplines have interpreted the notion in distinct yet related modes, and the wide currency of the notion at times creates slippages and uncertainty on what exactly it means (and puts it at risk of being treated as a buzzword).<sup>208</sup> Social, economic and environmental pillars of discourses around sustainability combine to create initiatives and discussions around sustainable energy, business, environmental</p>

	justice, and a range of other interdisciplinary topics. <sup>209</sup>
Systems Approach	A Systems Approach is a way of addressing a given problem that looks at the wider context within which a phenomenon exists (Kumanyika, Parker and Sim 2010, p.74). <sup>210</sup> What is the whole picture? A systems approach is transdisciplinary; different disciplines of knowledge, methods and values are necessary in determining the full nature of a problem, thus allowing it to be fully described and address – moreover, the true nature of a problem and its solution may only be visible from outside the boundaries of a dominant paradigm. <sup>211</sup>
Transformative Innovation Policy	Transformative Innovation Policy can be described as follows: "Science, technology, and innovation (STI) policy is shaped by persistent framings that arise from historical context. Two established frames are identified as co-existing and dominant in contemporary innovation policy discussions. The first frame is identified as beginning with a Post-World War II institutionalisation of government support for science and R&D with the presumption that this would contribute to growth and address market failure in private provision of new knowledge. The second frame emerged in the 1980s globalising world and its emphasis on competitiveness which is shaped by the national systems of innovation for knowledge creation and commercialisation. STI policy focuses on building links, clusters and networks, and on stimulating learning between elements in the systems, and enabling entrepreneurship. A third frame linked to contemporary social and environmental challenges such as the Sustainable Development Goals and calling for transformative change is identified and distinguished from the two earlier frames. Transformation refers to socio-technical system change as conceptualised in the sustainability transitions literature." (Schot and Steinmueller 2018) <sup>212</sup>
Value of Nature	Values of Nature are studied from a range of fields. Values of nature encompass the reasons why nature is perceived to be important and are studied to understand and predict why people act for nature (van den Born 2008). These values are actualised in human relationships with nature (Rolston, 1981). <sup>213</sup> Values of nature are often categorized as instrumental values, moral or intrinsic values, and – increasingly - relational values (Van den Born et al. 2018; Matthijssen et al. 2020). <sup>214 215</sup>
Visions of Nature	Visions of Nature is used as an umbrella term composed of three elements: images of nature, values of nature and images of the human-nature relationship (van den Born et al. 2001). <sup>216</sup>
Water Ontologies	A Water Ontology asks (and answers) the question, “What is water?” Academics, activists and indigenous communities have provided a range of “water ontologies” to answer this question, a question that is itself asked in order to challenge a hegemonic ontology of water as resource, as chemical, or as is often the case simply an uninteresting backdrop, medium or boundary for land-based human activity, something to conduct our business by sailing across or exploiting for resources. Water ontologies seek to challenge these hegemonic views of water through a range of concepts such as water as a living being, water as an entity worthy of study and consideration for its own ends (beyond human



	instrumentality), and of ontologies of water that provide a metaphoric inspiration for better understanding the depth, fluidity and multiplicity of human activity in, on or out of water. <sup>217 218 219</sup>
Weak Signals of Change	<p>See <b>Horizon Scanning</b>.</p> <p>We define Weak Signals of Change as an observation that alerts the observer who then interprets it as a signal for change. It is important to note that in complex systems there are no “signals from the future” and even less weak or strong ones. Rather it is our own attentiveness that varies due to a number of cognitive framings.<sup>220</sup> It would therefore be more correct to talk of “disregarded seeds of change hypotheses.”<sup>221</sup> Therefore in Foresight we adopt a constructivist notion of weak signals<sup>222</sup> we therefore strive to open the perception to a wider range of phenomena and set up a socially robust process of “sense making”.</p>
Youth	<p>It is difficult to define Youth in any general framework, but for the purposes of the FLOW project we are interested in the generations who will be the drivers of social change within a world that they will inherit.</p> <p>A <b>generation</b> itself is a concept that argues that those who live during a particular timeframe and its formative events share commonalities in group experience. Furlong (2012)<sup>223</sup> argues that such an understanding, however, is less pronounced in (contemporary) scientific discourses on youth due to the perception that it lacks precision and adequate theoretical grounding. The claim that there exists something like a "generational consciousness" (Edmunds &amp; Turner, 2002)<sup>224</sup> that directly results from clash of values, most often triggered by a social, economic, or political crisis, is nowadays rarely supported in research.</p> <p>Research with and on young people does not necessarily have to ascribe a fixed set of generation-specific attributes to people segmented in different age groups. There is an extensive body of research and knowledge on young generations, (namely on what has been labelled generation Z and generation Alpha).<sup>225 226 227 228 229 230</sup></p>
Youth Mobilization	<p>The climate movement has been a particularly striking example of Youth Mobilization that has reversed long-running received wisdom that suggested that young people, particularly teenagers today, are politically apathetic and unwilling to work for change.<sup>231</sup> Young people have had other recent key moments of political mobilization that have been more locally confined, such as in democratic alliance-building in Serbia, Georgia and Ukraine, and over road safety in Bangladesh.<sup>232</sup> Despite an alienation from the power to enact the changes they demand, there is a growing awareness that young people are willing to work for change, and NGOs that work to facilitate youth empowerment are growing in number.<sup>233</sup></p>

## DOMAIN THEORIES

Theory	Description & <i>Connected concepts</i>
Actor-Network Theory	<p>Actor-Network Theory (ANT) is a theory largely developed through the work of Bruno Latour and John Law. Actor-Network Theory studies phenomena in terms of relationships between the human and non-human participants within any given phenomenon. Within ANT, all participants (“actants”) within a phenomena are given equal weight in its study (thus, an analysis of the fast food industry would see as equally valid actants the worker in the cold storage facility, the freezer unit, the child eating the kids” meal, the fry cook, and the hot dog). Social and technological actors alike are grouped together in networks that in ANT are called “assemblages”. Actants within assemblages may be further broken down into assemblages of their own (e.g. raw components of the hot dog, its supply chain and the actants therein). Actants are equally valid and interesting objects of analysis, but actants do not all share the same power within an assemblage, which are characterized by struggles for power and self-interest.<sup>234</sup></p>
Biophilia	<p>Biophilia, first coined by E.O. Wilson (1986),<sup>235</sup> is the “love of all that lives or, more simply, nature-friendliness” (Van den Born et al. 2001).<sup>236</sup> The “Biophilia hypothesis” argues that biophilia is innate to humans, “hereditary and hence part of ultimate human nature” (Kellert &amp; Wilson 1993, p. 31).<sup>237</sup> This assertion has since found empirical support (Kahn 1999).<sup>238</sup></p> <p><i>Connectedness with nature; Human-Nature relationships</i></p>
Blue Humanities	<p>The Blue Humanities are an emerging field of scholarship that seeks to critically analyze humanity”s relationship with seas and oceans. To the fields of humanities and social science the blue humanities contribute an understanding of the sea as more than just a backdrop for human activity, to see how water bodies are understood and experienced by humanity, with a particular interest in colonialist appropriations of the sea, capitalist and state-military exploitation and degradation of water, and a highlighting of indigenous views and relations with water.<sup>239 240 241 242</sup></p>
Deep ecology	<p>Deep ecology is an environmentalist movement that argues for a reformation of human relationships with nature. Deep ecologists argue that modern, capitalist society values nature solely through its usefulness for humans, and they seek instead a “transformation of values and social organization” (Devall 1980, p.303) that recognizes the inherent value of nature.<sup>243</sup> The movement originated with the writings of Arne Naess in the 1970s, wherein he argued for “deep ecology” that contrasted against the “shallow ecology” of environmentalism that, in his view, focused only on environmental problems as they impacted humanity.<sup>244</sup> Deep ecology advocates a sense of human self as deeply embedded in nature. While deep ecology has been influential in subsequent ecological thought, deep ecology itself is often criticized as mysticism, and for not giving sufficient critical thought to the workings of power via race, gender, and class.<sup>245</sup></p>



Doughnut Econ- mics	<p>The “doughnut” in Doughnut Economics is a diagrammatic illustration of sustainable economic activity. “The Doughnut consists of two concentric rings: a social foundation, to ensure that no one is left falling short on life’s essentials, and an ecological ceiling, to ensure that humanity does not collectively overshoot the planetary boundaries that protect Earth’s life-supporting systems. Between these two sets of boundaries lies a doughnut-shaped space that is both ecologically safe and socially just: a space in which humanity can thrive” (Doughnut Economics Action Lab).<sup>246</sup></p> <p>The “doughnut” was first proposed in a 2012 Oxfam report by Kate Raworth and has since found widespread appeal as a popular illustration of futures thinking within sustainable economics.</p>
Bioregion	<p>Bioregion is a concept wherein human society shifts away from communities organised around the nation-state model and instead embrace a smaller scale paradigm that is in harmony with the surrounding ecology. It provides an alternative model for conceptualizing communities. Bioregions are cultures determined by the ecological characteristics of the region in which they are located, and culture arises in harmony with these ecosystem characteristics.<sup>247</sup></p>
Extinction of Experience	<p>Not only millions of species go extinct, our experiences in nature risk extinction too (Pyle, 1993).<sup>248</sup> There are fewer opportunities to interact with nature, especially for children, as nature is further away and lives are increasingly overscheduled (Soga and Gaston 2016).<sup>249</sup> This is problematic, as a lack of direct contact with nature has consequences for health, well-being, emotions, attitudes towards nature and behaviour (Miller, 2005; Soga and Gaston 2016).<sup>250 251</sup> In short; the extinction of experiences is detrimental to both humans and nature (Colléony et al. 2020).<sup>252</sup> General accessibility to nature, particularly in urban environments wherein greenery can be treated by planners as a luxury rather than a necessity, is crucial to prevent a negative feedback loop of increasing alienation from nature, with the process of nature exposure particularly important for children (Miller, 2005; Soga and Gaston 2016; Colléony et al. 2020).<sup>253 254 255</sup> The Extinction of Nature is thus a problem that requires deeper collaboration between environmental scientists, conservationists, and urban planners and designers, to ensure wider access to nature near where people live and work, and where children study (Miller, 2005; Soga and Gaston 2016; Colléony et al. 2020).<sup>256 257 258</sup></p> <p><i>Human-nature relationships; Shifting Baseline Syndrome</i></p>
Field Theory and Habitus Theory	<p>Field Theory or Habitus Theory<sup>259</sup>, as developed by Bourdieu, explains how society is stratified (in fields, rather than simple models of class and how this stratification is reproduced (habitus, socialization). As a praxeological approach, it starts with empirical research that looks at people’s dispositions (what they like (to eat, to read, to dress etc.)). Based on the assumption that fields organize around the logics of social distinction, these dispositions are both formative and as well as expressions of fields (such as the field of working class people, or academics, or bankers etc.). Field theories (and lifestyle research)<sup>260</sup> have led to the development of typologies that are often used to inform environmental psychology and environmental sociology and devise ecological consciousness types or ecological awareness types,</p>

	which are statistically grounded descriptions of environmental attitudes.
Shifting Baseline Syndrome	<p>The Shifting Baseline Syndrome, also referred to as generational amnesia, describes the process of new generations accepting degraded biodiversity as the baseline. Each generation considers the biodiversity they know in their youth as “normal” and baseline. But, as biodiversity declines, each new generation has a lower and inappropriate baseline for biodiversity (Pauly 1995;<sup>261</sup> Soga and Gaston 2016<sup>262</sup>). Causes of the shifting baseline syndrome are a lack of data, loss of interaction and loss of familiarity with nature. The main consequences are increased social tolerance to biodiversity loss, altered expectation of what “healthy” nature is and setting diminished baselines as standards and aims in policy (Soga and Gaston 2016).<sup>263</sup> As loss of interaction and familiarity with nature is one of the main causes of the shifting baseline syndrome, the extinction of experience further amplifies the shifting baseline syndrome (Soga and Gaston 2016).<sup>264</sup> Moreover, as generational shifts happen in what we consider “normal” interactions with nature, a shifting baseline syndrome also takes place in relationship to a loss of experiences in nature (van Heel et al. 2022).<sup>265</sup></p> <p><i>Extinction of experience</i></p>
Sociology of Expectation	The Sociology of Expectations is a research community within the wider field of Science and Technology Studies that focuses on the role of expectations within the social shaping of technologies. <sup>266</sup> In several empirical studies they have shown expectations strongly shape technological trajectories e.g. by helping actors to mobilise resources. <sup>267</sup>
Sociotechnical imaginaries	Modern societies, as Jasanoff and Kim (2015) have argued, steer and develop themselves for an important part through “sociotechnical imaginaries,” defined as “collectively held, institutionally stabilized, and publicly performed visions of desirable futures” that are “attainable through, and supportive of, advances in science and technology.” <sup>268</sup>
Social-ecological systems	All social systems are embedded in so called social-ecological systems (SESs) that consist of multiple subsystems (e.g organisms, tissues of cells, resource systems, users of the resource systems such as fishers) (Ostrom, 2009). <sup>269</sup> SESs are complex (adaptive) systems in which social and ecological (biophysical) elements are intertwined and interact on multiple spatial and temporal scales (Janssen and Ostrom, 2006). <sup>270</sup>
Science and Technology Studies (STS)	Theories and concepts from the field of Science and Technology Studies (STS) help to understand the creation, development, and consequences of science and technology in their historical, cultural, and social contexts. They examine and describe the social construction of technology, <sup>271</sup> the co-production of science, <sup>272</sup> material semiotic relations, <sup>273</sup> and deliberative forms of opening-up science, technology and innovation. <sup>274 275</sup>
	<i>Assemblages, Sociotechnical imaginaries, Socio-technical Systems Theory</i>
Visions of	Visions of nature is used as an umbrella term composed of three elements: images

Nature	<p>of nature, values of nature and images of the human-nature relationship (van den Born et al. 2001).<sup>276</sup></p> <p><i>Images of nature; values of nature; Human-nature relationship</i></p>
Water Ontologies	<p>A Water Ontology asks (and answers) the question, “What is water?” Academics, activists and indigenous communities have provided a range of “water ontologies” to answer this question, a question that is itself asked in order to challenge a hegemonic ontology of water as resource, as chemical, or as is often the case simply an uninteresting backdrop, medium or boundary for land-based human activity, something to conduct our business by sailing across or exploiting for resources. Water ontologies seek to challenge these hegemonic views of water through a range of concepts such as water as a living being, water as an entity worthy of study and consideration for its own ends (beyond human instrumentality), and of ontologies of water that provide a metaphoric inspiration for better understanding the depth, fluidity and multiplicity of human activity in, on or out of water.<sup>277 278</sup></p>

## CRITICAL THEORIES

Critical theory	Definition/Explanation
AI Ethics	“The ethics of artificial intelligence (AI) is an upcoming field of research that deals with the ethical assessment of emerging AI applications and addresses the new kinds of moral questions that the advent of AI raises. (...) Just like a critical theory, the ethics of AI aims to diagnose as well as change society and is fundamentally concerned with human emancipation and empowerment” (Waelen 2022). <sup>279</sup>
Capitalist Realism	Capitalist realism is a theory made popular by Mark Fisher (2009) wherein he argues that the modern has entered a stage of ideological and economic deadlock that makes it impossible to imagine any future beyond the reality of a neoliberal capitalist world system. In Fisher’s view, legitimate alternative visions to capitalism are no longer possible to seriously pursue, because the capitalist economy has arrived at the point where it seems the natural state of things – and thus challenges to it seem fringe or naive. Indeed, even anti-capitalist critique becomes subsumed within neoliberal capitalism’s overriding logic and aiding the interests of capital and business. The degradation of life under capitalism as well as the growing incidences of global environmental and political crises create a need for change that people, especially the young, feel disempowered from enacting and creates a pervasive mental health crisis. <sup>280</sup>
Critical Geography	Critical geography or critical human geography is a field of geography that positions itself away from quantitative, technical geography and focuses instead on human habitation with the planet through the lens of critical theories. While critical geography emerged with a strictly Marxist lens and in opposition to a quantitative mainstream in geography, critical geography has since proliferated to embrace a much wider interpretation of critical theories and structures of oppression beyond the Marxist focus on class – and indeed, critical geographers have also come to include quantitative methods, which some theorists have argued are not in themselves antithetical to critical thought. <sup>281</sup>
Critical Indigenous Theory	Critical Indigenous Theory, or critical indigenous studies, is a broad field characterized by critical scholarship from indigenous scholars writing from across the world. As a distinct discipline, it positions itself as a successor to specific disciplines such as Sami Studies and Aboriginal Studies. Critical indigenous theory builds on the ideas of <b>Postcolonial theory</b> and <b>Decolonial theory</b> , and moreover: “Critical Indigenous Studies refers to scholarship grounded in resistance to the multiple forms of violence and micro-aggressions that Indigenous peoples and communities face every day in their neo-colonial realities. Third, Critical Indigenous Studies refers to scholarship that upholds sovereign claims to Indigenous lands, languages, cultures, ecologies, ontologies, and existentiality” (Hokowhitu 2021, p.3). <sup>282</sup>
Critical Race Theory	Critical Race Theory (CRT) is a hybrid movement of activists and researchers critically studying the origins, processes and impacts of racism and the very



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	<p>concept of race itself – with a view to transforming society past racism. CRT as a specific movement emerged from American legal scholarship, but has gained traction across disciplines and countries.</p> <p>Richard Delgado and Jean Stefanic (2001) in their introduction to CRT outline three tenets that characterize the movement. First, that racism permeates society and is normalized, making it difficult to address or solve. Secondly, racism brings benefits (material or otherwise) to some at the expense of racism’s victims, and thus there is little incentive for beneficiaries of racism to work to undo it. Thirdly, races are not biological but are instead social categories, wherein perceived physical characteristics and similarities across groups of people are used to ascribe a range of cultural and moral characteristics to these invented groups – thus, race concepts are not just about what people look like, but are about how they behave, or how intelligent or capable they are, and – crucially – these characteristics are used to create gradations of value across categories of human beings, enacting a hierarchy that uses the language of science and biology to sustain itself.<sup>283</sup></p>
<p>Critical Social Theory</p>	<p>Critical social theories are an interdisciplinary body of critiques of the organization of society with the purpose of enabling political transformation toward more emancipatory futures. Critical theories derive heavily from the critique of capitalist society and the historical materialism of Karl Marx (see <b>Marxist theory</b>). However, critical theory as a term applied to theory largely originated from scholarly work created by the ‘Frankfurt School’ in the 1930s, where the spirit of Marxist critique was applied to more than just a critique of capitalist economy but toward the ideological systems that pervaded through global society – with the intention of creating liberation. Just as Marx’s ideas are ‘critical theory’ for having inspired what would more formally become called ‘critical theory’, ‘critical theory’ is a label now applied to a range of ideas and theoretical paradigms inspired by the Frankfurt School (Bronner 2011)<sup>284</sup>.</p> <p>An overview by Ben Agger (1998)<sup>285</sup> of critical social theories laid out the key characteristics that are common to critical approaches:</p> <ol style="list-style-type: none"> <li>1) Knowledge is not neutral or objective, but is rooted in certain perspectives and social conditions. Social structures are historically contingent, that is, they are not natural and inevitable but they came about due to a historical process and thus can change further.</li> <li>2) Progress and positive transformation are possible through political action. Critical scholarship provides the necessary analysis and awareness-raising to bring about this change.</li> <li>3) Domination and hegemony are maintained through various structures: culture, economy, discourse (the ways in which things are spoken about or represented). Theorists may differ in their focus on structures to critique.</li> <li>4) Domination is produced through ideologies and worldviews that alienate people from noticing the unjustness of the social order, and critical scholars challenge these beliefs.</li> <li>5) People have agency and are capable of changing themselves and the systems around them; the oppressive social regime is not determined and inevitable.</li> <li>6) Transformation is not quick, simple or easy.</li> </ol>

	<p>Some of these theories are theories developed by specific individuals and thus gesture to a defined and coherent set of ideas; other theories are instead movements that organize together quite distinct scholars who write on similar subjects (a similarity which may itself be attributed by outside observers and not the theorists themselves). As such, these definitions and explanations in some cases cannot be more precise than to simply lay out the spirit of an idea. Various critical theories on this list are commentaries on one another, building upon or challenging each other’s ideas, whereas some theories are in relative isolation. What unites them is what makes them critical: that they critique and challenge hierarchies of power and the ways in which knowledge is produced. They each point to the possibility of social change.</p>
Critical Psychology	<p>Critical Psychology is a discipline within psychology, or an alternative to mainstream psychology, that seeks to transform mainstream psychology toward a discipline that takes mindful care not to perpetuate harmful socio-political and economic conditions. Critical psychologists criticize mainstream psychology’s assumption of apolitical science, and argue that psychology as practiced has a long history of reinforcing power relations and the status quo. An awareness of the politics of psychology can enable psychologists to enact racial change and challenge unjust power structures instead of unwittingly perpetuating them.<sup>286</sup></p>
Decolonial Theory	<p>See first <b>Postcolonial Theory</b>.</p> <p>Decolonization is the process of undoing colonialism; in the most obvious sense this means overthrowing colonial occupiers and restoring indigenous populations to power, but it extends also to the less obvious ways in which colonialism continues to structure the economy, academia, language – indeed, life itself, and impacts the very Earth itself. Decolonial theory thus addresses a perceived lack in postcolonial theory: there are many places in the world where the colonizer never returned power to indigenous populations, and the world at large remains firmly <i>colonial</i>. In short, there is nothing “post” about “postcolonial”, and the project of decolonization must necessarily be an ongoing one.</p> <p>Decolonial theorists are primarily focused on contexts of settler colonialism, wherein the colonialists came with the intention of staying in the territory they subjugated rather than retaining primary linkages to their countries of origins in an <b>extractivist</b> relationship with indigenous peoples and the land; under settler colonialism, this extractivist relationship is permanent, the indigenous populations subjugated and alienated from their lands and cultures, and the colonizer cannot be sent back to a homeland through national independence.</p> <p>Decolonial theory also distinguishes itself from postcolonial theory with a focus beyond the effects of European colonialism, examining the ways in which peoples from all over the world live under settler colonial relations that are little connected to European, race-based imperial logics. Decolonial theory thus invites an overarching call towards the awareness of colonial processes across the world – particularly important in societies where calls for decolonialism are met by the</p>

	<p>argument that the society never participated colonialism as it is typically understood. To quote theorist Breny Mendoza (2020 p.57): “Decolonization is trans, it is global, and it must be total.”<sup>287</sup></p> <p>In the context of the FLOW project, decolonial theory is of importance in considering the question of “Who owns the land and the water?” if indeed anyone does. It is also important to consider the exploitation of land and water in the perpetuation of imperialist, capitalist structures of production and consumption. Not least, decolonial theory reminds us of the importance of looking beyond Western academic thought toward indigenous and colonized ways of relating to water, for decolonizing the ways in which we relate to water is a fundamental change.</p>
Disability Studies / Crip Theory	<p>Disability studies may be understood in relation to <b>Gender Theory</b> and particularly <b>Queer Theory</b>. Just as Queer theory argues against the unspoken assumption that the so-called “normal” for humanity is heterosexuality and being cisgender, Disability Studies challenges the idea of “able-bodiedness” as the human norm. Indeed, just as queer theory reclaims the slur “queer” through the practice of “queering”, Disability Studies is also called “crip theory” (adopting a pejorative against the disabled) and its analysis “crips” social phenomena. Crip theorists argue that able-bodiedness is one of the spectrum of qualities taken for granted as “normal” within society, but unlike the complications of gender, race, sexuality and class, able-bodiedness remains stubborn within society as well as research as a given. Robert McRuer (2006) argues that the capitalist economy requires able-bodiedness within workers and thus most firmly resists the needs of the disabled.<sup>288</sup> An awareness of the needs and experiences of disability is fundamental to social transformation, particularly within fields such as environmentalism wherein the aim can be to reduce the usage of technology and facilitate unmediated experiences of nature which assume a fit, abled human body as the desired norm.<sup>289</sup></p>
Ecocriticism	<p>“Ecocriticism is an umbrella term for a range of critical approaches that explore the representation in literature (and other cultural forms) of the relationship between the human and the non-human, largely from the perspective of anxieties around humanity’s destructive impact on the biosphere. Other terms for the field include “environmental criticism” and “green cultural studies”, the latter term reflecting the increasing diversity of the field’s remit – its recent focus on film, TV, virtual worlds and popular music, for example, as well as its growing interest in representations of urban environments. How critics involved in this area choose to define themselves depends largely on their own position in relation to environmental issues and to their understanding of the implications of the individual terms” (Marland 2013 p.846).<sup>290</sup></p>
Ecofeminism	<p>Ecofeminism is a bridging of theory and activism that brings a feminist perspective to ecological issues – or adds an ecological dimension to feminism. Ecofeminists argue that the systems of patriarchal, imperial, and capitalist dominant that feminists challenge in the social sphere are exactly the same forces that are destroying the environment. An ecofeminist approach integrates social and ecological issues together in community-centered, careful, and empathic</p>



	<p>approaches that challenge the cold rigour of “objective” scientific knowledge and the capitalist alienation of humans from nature, and humans from each other.<sup>291</sup></p>
Extractivism	<p>According to Parks (2021, p.353): ““Extractivism” is a term most often understood in relation to large-scale, profit-driven operations for the removal and processing of natural resources such as hydrocarbons, minerals, lumber, and other materials. In an extended sense, the term refers more generally to a mindset in which resources serve a means-ends function, becoming commodities to be extrapolated and turned o profit.”<sup>292</sup> Extractivism”s “conceptual axis” incorporates:</p> <ul style="list-style-type: none"> <li>• Foregrounding the phenomenon of resource extraction as fundamentally important (this is a relevant reminder because resource extraction can often occur out of sight and out of mind of urbanized populations in the “West”)</li> <li>• “Extraction” as more than the extraction of raw material from the Earth, but also extraction as the usage of human-labour, ideas, emotions and so on (consider, for example, “data mining”) – a conceptual opening up of the idea of “extraction” that does not equate these phenomena of extraction with the traditional definition but is more than a metaphorical exercise because...</li> <li>• ... Extraction, of raw resources, people and the more ephemeral realm of ideas, feelings and concepts, is the fundamental practice of capitalist exploitation and the transformation of the world into resources is the basis of the modern economy</li> </ul> <p>“Extraction is a process that reshapes and uses up the natural environment, with consequences for both those who live close to the sites of extraction and those far from these sites, who have no option but to live in an atmosphere and on a planet transformed by extraction” (Szeman 2017 p.445).<sup>293</sup></p>
Gender Theory	<p>Gender Theory argues that “gender” and “sex” are not synonyms, but describe two distinct but often interrelated concepts. The classical distinction is that gender is a social construct, while sex is biological. This means that the differences between male and female bodies are then compounded by sets of rules, customs, expectations and limitations that are imposed by society upon these bodies. Raewyn Connell and Rebecca Pearse (2015) argue that these socially-constructed gender labels are defined by a relationship of difference between “men” on the one hand and “women” on the other, but gender theory is not concerned with the difference as such but the relations between and within gender. As they write:</p> <p>“Gender, like other social structures, is multidimensional. It is not just about identity, or just about work, or just about power, or just about sexuality, but about all of these things at once. Gender patterns may differ strikingly from one cultural context to another, and there are certainly very different ways of thinking about them, but it is still possible to think (and act) between cultures about gender. The power of structures to shape individual action often makes gender appear unchanging. Yet gender arrangements are in fact always changing, as human practice creates new situations and as structures develop crisis tendencies. Finally, gender had a beginning and may have an end.”<sup>294</sup></p>



	<p>Gender theory is associated with feminist thought, and the approaches are often treated interchangeably but there are important distinctions that some theorists insist upon. While gender theory is often associated with the study of femininity and women, gender theory is also concerned with masculinity and men.</p> <p>Moreover, gender theorists question the binary construction of men and women and thus experiences that cut across these seemingly rigid categories (transgender experiences, queer practices, intersex humans, historical and non-Western examples of gender experience beyond the binary such as South Asia’s hijras, etc.) are also core to the conceptualization of what “gender” is about. <b>Queer theory</b> takes up these concerns, examining gender and society through a lens that challenges disciplinary heteronormative and the gender binary.</p> <p>Gender theory is also by its nature interdisciplinary and transdisciplinary, because it deals with the practices and knowledges of people with gendered bodies, and thus gender theory is relevant regardless of the academic field.<sup>295</sup></p> <p>Gender theory has also been approached by writers working within postcolonial studies to chart out the historical creation of gender identities wherein modern notions of race, class and gender were built up together through the process of Western imperialism.<sup>296</sup> See <b>Intersectionality</b> for conceptualizing identities meshed together.</p>
Intersectionality	<p>Intersectionality is a concept developed by Kimberle Crenshaw, with which she argued that gender and race theorists and activists should attend not just to identities and experiences such as “woman” and “Black”, but to the junctures at which these identities intersect. Crenshaw’s argument was primarily on the important distinctions between the experiences of Black men, white women, and Black women, wherein the dual oppression faced by Black women for being both Black and female makes them much more vulnerable than those who are only Black or only female.<sup>297</sup> Crenshaw’s work has since been taken up by other scholars who have argued for an opening up the idea of intersectionality to examine the dynamics of oppression within groups, and which cut across seemingly disparate groups too.<sup>298</sup> In this respect, intersectionality is a continual invitation to consider the nuances of any given person’s identity and to ensure that no one is left behind or erased in efforts to transform society for the better.</p>
Labour Process Theory	<p>Labour Process Theory is a Marxist theory of the organization of work under capitalism. In Marxist theory, the labour process is that of the appropriation of nature in order to produce goods and services that satisfy human wants. This universal process of labour is itself socially organized under different modes of production, such as capitalism. In Marxist theory, capitalism organizes people into selling their labour to the owners of means of production, to create products that have greater value on the marketplace than that of the materials of production that went into the process. Human labour value becomes obscured in this relationship, as the capitalist extracts from the labourer commodities whose exchange value outstrips the true value of the worker’s labour.</p> <p>Braverman’s critique of the labour process under modern capitalism revives Marxist theory to argue that modern management techniques are designed to</p>

	<p>disempower workers as much as possible through the continual subdivision of labour into ever finer tasks that individually require little to no skill, thus making each labourer individually exchangeable for another and robbing workers of both negotiating power and fulfilment in the process and outcome of production.<sup>299</sup></p>
<p>Marxist Theory</p>	<p>Marxism is the body of socioeconomic analysis created by Karl Marx and his collaborator Friedrich Engels. "Marx's impact can only be compared with that of religious figures like Jesus or Muhammad. For much of the second half of the twentieth century, nearly four out of every ten people on earth lived under governments that considered themselves Marxist and claimed – however implausibly – to use Marxist principles to decide how the nation should be run" (Singer 1980, p.1)<sup>300</sup>. Inevitably, Marx's ideas have been widely interpreted, analyzed, and debated, and it can be daunting to provide a distillation of them: and yet such a profoundly influential thinker must be summarizable.</p> <p>In short, Marx produced a 'historical materialist' analysis of the capitalist economy of his time, narrating the concentration of wealth and power into a class of elites who owned the 'means of production' (the bourgeoisie) and exploited the labour of most of the population – the proletariat, who are the ones who produce goods and services. Marx argued that the exploitation of this working class had been motivated by the personal greed of the bourgeoisie, who had captured the means of production as private property and created a society that ideologically supported this system of labour exploitation and a state that defended and executed the interests of the wealthy at the cost of not just the working class in their own countries but also at the expense of peoples across the world (it is important to remember that Marx was writing in the heyday of industrial colonialism, and was a staunch critique of colonial exploitation.) This narrative of class exploitation is at the heart of the Marxist view of history and society. The final evolution of this exploitative class relationship was the capitalist mode of production built on using capital (goods that produce other goods; in Marx's time a textile mill, but today also software) – that produced more and more profit for the bourgeois owners of capital, while workers who actually produce goods and services become increasingly alienated from the value of what they produce, the wages they earn for their work becoming unsustainably small in relation to the profits of the bourgeois. Marx argued that this class relationship was fundamentally unsustainable, built on the shaky architecture of previous modes of production, and required increasing support from the state and ideological institutions such as the church in order to sustain itself; eventually the system would collapse in the face of a class revolt, a socialist uprising that would see the economy reorganized such that the means of production were commonly instead of privately owned and the purpose of economic activity was not to make a few people wealthy but to ensure a good way of life for everyone.</p> <p>Marx's ideas are thus a critique of social reality. By his analysis of how the society of his time came to be, Marx demonstrated that socioeconomic relationships were not inevitable or divinely-ordained but had been created, and thus they could be changed. "In other words, if a system is not as real and fixed as we first thought, because it has a particular and relatively short history in the broader course of</p>

	<p>humanity, then it becomes much easier for us to imagine the various ways it is challenged and how it could be transformed to a system that, Marxists hope, will better redistribute the wealth of the world. Marx himself wrote that philosophy is often too concerned with interpreting the world, when the real point is to change it” (Pal 2017, p.48)<sup>301</sup>.</p>
<p>Postcolonial Theory</p>	<p>Postcolonialism”s definition is the subject of debate, but Robert Young (2016, p.57) argues: “Many of the problems raised can be resolved if the postcolonial is defined as coming after colonialism and imperialism, in their original meaning of direct-rule domination, but still positioned within imperialism in its later sense of the global system of hegemonic economic power.”<sup>302</sup> Postcolonialism deals with the phenomenon of colonialism during and after the period of direct rule; largely, it deals with the colonial rule of Europe over much of the Earth”s population that officially ended in the decolonization movements of the mid-20<sup>th</sup> century.</p> <p>One of the key texts of postcolonial theory is Edward Said”s <i>Orientalism</i> (1978), wherein Said argues that colonialism was sustained by European bodies of “knowledge” that claimed to represent and demarcate the colonized. That is, the knowledge produced by the colonial project about, say, the Middle East (Said”s focus), was not an innocent exercise of scholarship but instead limited the ways in which the Middle East could be talked about – limited to ways of knowing the Middle East as inferior and susceptible to Western interventions. Colonial knowledge enabled and justified colonial rule and subjugation, and this rule over the colonized also enabled the production of “knowledge” over the colonized.<sup>303</sup> This focus on the intersection of power and knowledge is an influential throughline in postcolonial thought, and is of relevance to any academic inquiry that attempts to delineate and represent the knowledge over subjects whose own agency to speak and self-create knowledge may be relatively limited – in the context of the FLOW project such subjects may be stakeholders such as the youth themselves, and even nonhumans in the case of more-than-human approaches.</p>
<p>Queer Theory</p>	<p>See first <b>Gender Theory</b>.</p> <p>Queer theory arose as a critical field that broke with feminist and LGBT analysis, due to a perceived reification within these academic spaces of a gender binary. “Queer”, a word that means “strange” and was – and is – used as a pejorative term, has since been embraced by self-identified queers to describe those who do not conform to a gender binary or particular gender performance. Queer theory is thus that movement within gender theory that questions the idea of gender itself, not only its history, contingency, and impacts. Moreover, queer theory challenges the binary distinctions made in identity construction more generally – so, not just the binary of male/female, heterosexual/homosexual, but also the class distinctions of rich/poor and the global divides of West/Rest, North/South, and so on.<sup>304</sup></p> <p>One of the core concepts within queer studies is the practice of “queering”. While “queering” often implies observing a phenomenon through the lens of critiquing gender and sexual norms, it has since obtained a broader meaning that advocates challenging binary constructions and rigidity of all sorts. ““Queering” “is generally</p>

	<p>used as an umbrella term to refer to an active process of making an unquestioned and taken-for-granted idea or social relation into an unfamiliar or strange one to unpack its underlying power relations and to offer possibilities of resistance and other ways of thinking, doing, living, and loving” (Yep 2013 p.119).<sup>305</sup> Thus, <i>any</i> field can be queered to introduce new ways of thinking.</p>
Xenofeminism	<p>See first <b>Queer Theory</b>.</p> <p>The core idea of Xenofeminism is that everyone is an alien, a “xeno”, that there is ultimately no normality that characterises anyone’s experience – and thus, we are all to some degree alienated under global, heteronormative, patriarchal neoliberal capitalism. The <i>Xenofeminist Manifesto</i> lays out a theory of xenofeminist practice that is provocative and detailed, but in essence it argues for an abolishment of power differentials and a fundamentally <b>intersectional</b> view of identity. A post-capitalist future is possible through the seizure of technological capability, taking digital tools out of the hands of capitals and using them to express a politics of estrangement that then becomes a politics of unity and care, recognizing the inherent alienation of every human being and the impossibility of there being a “natural” state of society used to justify unjust conditions.<sup>306</sup></p>

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