# PLANET B
# MODULE FOR SUSTAINABILITY AND CIVILIZATIONAL ISSUES

***We only have one planet. However, due to human activity, the Earth's ecosystem is changing irreversibly, and everything else will change accordingly: the way we live, produce, move, eat or communicate. How will this process unfold and what will Planet B look like, is (partly) up to us.***

# WINTER SEMESTER 2023: AQUATIC ALLIANCES

**Water is so much more than a transparent, homogeneous fluid. It mediates relationships and dependencies between living and non-living matter, while its various forms and manifestations are symptomatic of long-term, hardly perceivable processes of climate change. In fact, most climate impacts are directly related to water – too much, too little, or too dirty – yet the ways water systems are cared for remain largely inadequate. The question is, how can we engage with these intricate assemblages, and what do we need to know to do so ethically and effectively?**

**Both fresh- and seawater ecosystems need to be treated holistically. That requires a thorough consideration of complex entanglements across places, objects or concepts we often approach in isolation: Hydrosphere is inseparable from atmosphere and biosphere, just like "urban" environments can't be detached from "rural" ones. Technological innovation needs to go hand in hand with traditional water management practices and abstract (e.g., financial) valuation must reflect material conditions of the water cycle. Luckily, hydrological systems demonstrate deep integration of various processes in a tangible way – and we can learn a lot from them to restore the links that have seemingly evaporated.**

**Aquatic Alliances are emerging more-than-water compositions that include various agents: raw inorganic matter, vegetal, animal and other non-human species, low-tech and high-tech tools, human-imposed rules and humans themselves. These systems may be steered into hopeful directions, yet they will always entail contradictions and ambiguities. Be it with the focus on floodplains restoration, biotechnologies or fish farming, we'll map interactions among the diverse entities in various scales and based on observable tendencies and possible civilizational pathways, we'll draft imaginative scenarios of their potential developments. We'll imagine artifacts and concepts intrinsic to these futures and watch what they can tell us about the uncertainties of tomorrow and the opportunities of today.**

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# A. CONCEPTUAL FOUNDATION

## a. ZOOMING OUT: WATER AS A PLANETARY MEDIUM

**This chapter offers a high-level overview of the global water-related developments, rhetoric and agenda. Although planetary waters need to be approached as a whole, given our own situatedness in a specific political and geographical context, we will focus predominantly on freshwater systems and also consider the more localized drivers of and pressures on aquatic developments in the European region.**

### Setting the Scene: Global Water Rhetoric

In spring 2023, global water-related issues have gained quite significant international attention: almost half a century since its first-ever edition, the UN Water Conference took place in New York City, under the joint presidency of the Netherlands and Tajikistan. The conference has made a case for water as a **shared matter of concern** that both human and non-human populations rely on and are often threatened by simultaneously. This is because the way water moves through the world is symptomatic of the planetary metabolic processes shaped by the changing climate. Indeed, "[o]*ver 90 per cent of ‚natural'disasters are water-related, including drought and aridification, wildfires, pollution and floods.*"[1] Or in the words of Charles Iceland, director of the World Meteorological Institute, "*climate is the shark, but water is the teeth*".[2] The conference

**1** Addressing water-related disasters and impacts, *UNEP*, https://www.unep.org/explore-topics/water/what-we-do/addressing-water-related-disasters-and-climate-impacts, retrieved on July 31, 2023.

**2** Nina Lakhani – Oliver Milman, First global water conference in 50 years yields hundreds of pledges, zero checks, *The Guardian*, March 24, 2023, https://www-theguardian-com.translate.goog/world/2023/mar/24/united-nations-water-conference-new-york-pledges?_x_tr_sl=en&_x_tr_tl=cs&_x_tr_hl=cs&_x_tr_pto=sc, retrieved on July 31, 2023.

took place in order to accelerate the so-called **Water Arction Decade** that is supposed to culminate by 2028 and bring about significant progress in the context of the 6th Sustainable Development Goal (SDG 6): *Ensure access to water and sanitation for all*.[3] In accord with this mission, the conference has concluded that "*the global water cycle is a common good*"[4] – a statement that may seem self-evident, but is sparsely acted on in practice, while the prospects of SDG 6 being reached by 2030 are slipping away quickly.[5]

In reality, aquatic issues are rarely directly embraced in climate policies and decision-making. More often than not, climate negotiations are centered around greenhouse gas emissions and energy transitions, while the impacts of climate change *on* water (availability, quality) and *through* water (extreme weather and disastrous events) tend to be overlooked.[6] Mitigation efforts are generally prioritized over adaptation measures – and however sensible it is to focus on the causes, the consequences are already inevitable. It is mainly the domain of adaptation where the material realities and processes of the climate and water intersect, and it also needs to be pointed out that mitigation projects often come at a cost in terms of their significant water footprint – which may further complicate the achievement of SDG 6.[7] Moreover, stakeholders involved in the UN-sponsored conversations repeatedly pointed out that the progressive water-related agenda lacks **adequate financing** and that only a tiny fraction of climate finance is devoted to water systems.[8]

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**3** "*Today, 2.2 billion people lack access to safely managed drinking water, and more than 4.2 billion people lack safely managed sanitation. Climate change is exacerbating the situation, with increasing disasters such as floods and droughts. 80 per cent of wastewater in the world flows back into the ecosystem without being treated or reused, and 70 per cent of the world's natural wetland extent has been lost, including a significant loss of freshwater species. […] In December 2016 the United Nations General Assembly unanimously adopted the resolution "International Decade for Action – Water for Sustainable Development" (2018–2028) in support of the achievement of SDG 6 and other water-related targets*." Water and sanitation, *United Nations*, https://sdgs.un.org/topics/water-and-sanitation, retrieved on July 31, 2023.

**4** *Summary of Proceedings by the President of the General Assembly*, 2023, https://www.un.org/pga/77/wp-content/uploads/sites/105/2023/05/PGA77-Summary-for-Water-Conference–2023.pdf, retrieved on July 31, 2023.

**5** *The Sustainable Development Goals Report 2022*, https://unstats.un.org/sdgs/report/2022/The-Sustainable-Development-Goals-Report–2022.pdf, retrieved on July 31, 2023.

**6** *United Nations 2023 Water Conference Global Online Stakeholder Consultation for the Proposed Themes of the Interactive Dialogues. Summary Report*, October 2022, https://www.un.org/sites/un2.un.org/files/final_water_consultation_report_19_oct.pdf, p. 24, retrieved on July 31, 2023.

**7** Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, *Climate Change 2022. Impacts, Adaptation, and Vulnerability*, Chapter 13: Water, https://report.ipcc.ch/ar6/wg2/IPCC_AR6_WGII_FullReport.pdf, p. 557; *The Sustainable Development Goals Report 2022* (footnote n. 5).

**8** See *United Nations 2023 Water Conference Global Online Stakeholder Consultation* (footnote n. 6), p. 17; First global water conference in 50 years yields hundreds of pledges, zero checks (footnote n. 2).

Because of its uncompromising tangibility though, water itself, rather than more abstract adaptation protocols, can be foregrounded in climate negotiations and used as leverage for the implementation of policies and mechanisms that may seem rather immaterial or obscure. **Water as Leverage** is an existing, articulated approach to channel attention and investment towards water-related projects that turn out to support climate resilience.[9] On the one hand, partnering with water and entering into multivalent aquatic alliances may therefore be considered as a pragmatic strategy to avoid the escalation of climate crisis followed by a social collapse. The President of the UN General Assembly stated that the global water crisis requires a transformational change stemming from **inclusive and transparent cooperation** across communities, sectors and boundaries. He stressed the importance of innovative and integrative solutions, efficient risk management, financial mechanisms restoring the value of water, distributed aquatic education or institutional and legal infrastructure able to support such transformation.[10]

Such is the rhetoric of a part – mainly the Northern part – of the global political elite, large NGOs and private companies setting the tone of the UN Water Conference. It surely constitutes one of the strands of politics related to the management of the Earth's water, however, just like major sustainability, climate or biodiversity summits and agreements, the water agenda still lacks **binding commitments and accountability**.[11] It has been also pointed out that despite the claims of the participating stakeholders, indigenous communities and marginalized groups still lack proportionate representation in these negotiations[12] and the "planetary political will" is therefore incomplete and unbalanced. So, if we want to be thorough and take "aquatic alliances" seriously, perhaps we need to look further and deeper, under the surface of water as a mere resource.

## Behind the Scene: More-than-Water Systems

The **UN's Sustainable Development Goals** are the number one political program related to environmental and social sustainability that serves as a benchmark for a significant portion of the ecologically-minded agenda

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**9** Water as Leverage Programme, *World Water Atlas*, https://www.worldwateratlas.org/curated/water-as-leverage/, retrieved on July 31, 2023.

**10** See *Summary of Proceedings by the President of the General Assembly* (footnote n. 4).

**11** See Lakhani – Milman (footnote n. 2).

**12** Ibidem.

declared by governments, organizations or companies around the globe. Since the end of the 1980s, the **concept of sustainability**, since then promoted by the hegemonic rulers and the most powerful international organizations of the Global North, has been tied to the idea of preserving what is – including the existing social and economic order. In other words, the Sustainable Development Goals are representative of the status quo and suggest to keep humanity at the center and in control of the planetary wellbeing. As has been pointed out by many, though, if it is precisely the existing global paradigms that are to blame, then we may need to revisit these notions and turn to other ones: perhaps we should not ask how to make the current social order *sustainable*, but how to ensure that the Earth will remain *habitable* at all (for both humans and non-humans).[13] That may require a fundamental review of the world's economies (be it through the lens of **degrowth**[14] or other transformational concepts) as well as a rethinking of the dominant adaptation approaches – that may need to be more radical than we'd like,[15] demanding of the humans to partly **relinquish (seeming) control** over the planetary metabolism.[16]

Relinquishing control means leaving some of the modern concepts, attitudes and approaches behind. One of them is the concept of **"modern water"** – the kind of neutral, universal, transparent liquid that has been labeled "H2O" in the 18th century.[17] As cultural theorist Astrida Neimanis explains, however, water as a pure, isolated substance has never really existed.[18] Modern science has rendered it deterritorialized and decontextualized and made it into an abstract, measurable quantity, while in fact, it has always been a **medium of human-nature relations**: "'*Water' constitutes one of the so called Anthropocene's most urgent, visceral,*

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**13** Dipesh Chakrabarty, The Planet. An Emergent Humanist Categor*y, Critical Inquiry XL*VI, Autumn 2019, pp. 1–31. (Available at: https://monoskop.org/images/9/94/Chakrabarty_Dipesh_2019_The_Planet_An_Emergent_Humanist_Category.pdf)

**14** See for example Giacomo d'Alisa – Federico Demaria – Giorgos Kallis (eds.), *Degrowth. A Vocabulary for a New Era*, New York – London 2015, https://www.researchgate.net/profile/Federico-Demaria/publication/309291920_DEGROWTH_A_Vocabulary_for_a_New_Era_E-BOOK/links/5808829f08ae63c48fec833e/DEGROWTH-A-Vocabulary-for-a-New-Era-E-BOOK.pdf, retrieved on August 1, 2023.

**15** Jem Bendell, Deep Adaptation. A Map for Navigating Climate Tragedy, *IFLAS*, 2018 (revised 2020), https://www.lifeworth.com/deepadaptation.pdf, retrieved on August 1, 2023.

**16** For example, biologist Edward O. Wilson makes a case for "Half-Earth" – a complete retreat of the human population from one half of the planet in order for the natural ecosystems to regenerate. Edward O. Wilson, *Half-Earth. Our Planet's Fight for Life*, New York 2016.

**17** Jamie Linton, *What is Water? The History of a Modern Abstraction*, Vancouver 2010.

**18** Astrida Neimanis, *Bodies of Water. Feminist Posthuman Phenomenology*, London 2017, p. 19.

*and ethically fraught sites of political praxis and theoretical inquiry. Our reshaping of this planet is occurring not least through the rechoreography and rematerialization of its waters: ancient aquifers are being rapidly depleted; rivers that once ran fast are now exhausted before they reach the sea; dams, canals, and diversions undermine many vital waterways."*[19]

Not only is (modern) water deeply entangled with the processes that resulted into the rise of a geological era dominated by human agency. Water as matter is intimately enmeshed with human and non-human bodies: "*With a drop of cliché, I could remind you that our human bodies are at least two-thirds water, but more interesting than these ontological math is what this water does – where it comes from, where it goes, and what it means along the way. Our wet matters are in constant process of intake, transformation, and exchange – drinking, peeing, sweating, sponging, weeping.*"[20] Our bodies *are* water, they give water shape and structure, and through water, they are interconnected with each other and with the diverse and numerous entities that constitute the material world from the lithosphere right up to the atmosphere. Water mediates the relationships among in/organic matter and is never "empty" – just like the human is always more-than-human, water is always **more-than-water**. Looking at the planet and the human through the lens of **embodied water** poses a challenge to the anthropocentric self-conception of society and civilization. It also complicates the understanding of water as a mere resource to be extracted and used for whatever purpose people need it. It is not an inanimate substance to be activated by humans – it is already active, full of life and meaning.

That said, even Astrida Neimanis herself points out that "modern water" should not be undone entirely. The idea that water is universal has opened up the possibility to understand it as a **universal human right** too – a concept we certainly need to preserve. It is important, however, to keep a close eye on the dynamic between universalism and multiplicity, and to be mindful of the fact that every single human is different from another. Feminist thinkers have long struggled with the paradox of the body – that it is a fragile, vulnerable organism we need to listen to individually and care for collectively, but at the same time, it is a web of interdependent entities and processes that is constantly evolving and therefore cannot be defined and delimited once and for all.

If we are to understand water as a commons, as something that is fundamentally shared among all people and the planet, that cannot be fully

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**19** Ibidem, p. 20.

**20** Ibidem, p. 2.

captured and privatized, then we also need to look at it as a substance that mediates differences. It is the role of international organizations such as the United Nations to guard and promote modern principles of universal human rights and to some extent, they are equipped to extend these concepts to also embrace the idea of commonality. That, however, requires indeed a much tighter cooperation and focused attention towards (indigenous) communities and relationships that make up a "site" and specifics of more-than-water systems. Just like there is no pre-existing *terra nullius*, a no man's land that was or is up for seizure, there is nothing like *aqua nullius*, discrete and homogeneous.

## Getting Strategic: STEEP Analysis

Understanding, not to mention intervening in such complex systems requires close observation and detailed research. More-than-water ecosystems are composed of flows and bodies that continuously enter into multivalent relationships that are difficult, or even impossible, to disentangle. If we want to interact with these assemblages – even if that only means looking at them from a distance – we need to accept that our ability to know and control is undeniably constrained and that we inevitably depend on incomplete, simplified and provisional theories, concepts and categories that perhaps bring us closer, but never enable us to fully grasp what is happening.

In other words, to map a system often entails the violence of breaking it down into compartments – and however problematic that may be, for the sake of interim exploration, we'll follow the methodology of **systems or strategic thinking** and will look at the current state of planetary more-than-water systems through the lens of their social, technological, environmental, economic and political aspects. The so-called **STEEP analysis** is usually employed in order to describe existing dynamics of systems that have been and will continue to be shaped by humans (whether we want it or not). It is a tool that helps us understand **present trends and tendencies** and enable us to experimentally prolong them into the future. What follows is an analysis based on recent reports related to various agendas of the UN and major institutions of the European Union (European Commission, European Environmental Agency) (see Resources).

### Environmental

As mentioned in the introduction, the global water crisis is tightly connected to climate change. Not only do we experience climate change

through events of which water is the main protagonist – it exacerbates physical water insecurities that might have been caused by other socio-economic factors.[21] Simply put, the **changing hydrological cycle** works like this: "*Global heating adds moisture in the atmosphere, causing increasingly intense torrential downpours and prolonging droughts. It is also causing sea levels to rise, threatening coastal areas with inundation, while storm surge can cause contamination of drinking water supplies.*"[22] The planetary water systems are much more than just water itself and while we may be accustomed to imagine aquatic ecosystems as mainly "horizontal", spreading out as blue surfaces over the globe, in fact, they cut through all the vertical layers of the planet, from below the oceanic beds up until the **clouds in the sky**.[23] It also needs to be said that water is just one – urban water and water running through "rural" land blend into each other,[24] just like freshwater depends on seawater and vice versa.[25]

With every degree of global warming, **drought and flood risks** will increase (although the projections for different regions vary). If the global warming levels rise up to 2°C to 4°C, between 3 and 4 billion people will be exposed to water scarcity.[26] In Europe, the **vulnerability to extreme weather** and climatic events is generally lower than in other parts of the world, however, water scarcity, coastal or riverine flooding and storms will occur with increasing frequency. Besides rising temperatures and changes in precipitation patterns, it is also **irrigation developments, population growth and agricultural policies** that have had and will continue to have a strong impact on European water systems.[27] Particularly Western and Central Europe are likely to suffer more and more from floods (mainly due to heavy rainfall), while Southern regions will be most affected by all kinds of drought. Streamflow and soil moisture drought are expected to be more intensive in most of Europe,

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**21** See *Climate Change 2022. Impacts, Adaptation, and Vulnerability* (footnote n. 7), p. 555.

**22** Nina Lakhani – Oliver Milman, UN Conference Hears Litany of Water Disasters Linked to Climate Crisis, *The Guardian*, March 23, 2023, https://www.theguardian.com/environment/2023/mar/23/water-un-conference-climate-crisis-disasters, retrieved on August 1, 2023.

**23** Patrick W. Keys – Lan Wang-Erlandsson – Michele-Lee Moore et al., The Dry Sky: Futures for Humanity's Modification of the Atmospheric Water Cycle (preprint), *EarthArXiv*, 2022, https://eartharxiv.org/repository/view/4849/, retrieved on August 1, 2023.

**24** Neil Brenner, *New Urban Spaces*, Oxford 2019.

**25** Source-to-Sea Platform, *Stockholm International Water Institute*, https://siwi.org/source-to-sea-platform/, retrieved on August 1, 2023.

**26** See *Climate Change 2022. Impacts, Adaptation, and Vulnerability* (footnote n. 7), p. 61.

**27** Ibidem, p. 1823.

though – except for the Northern regions and perhaps Russia –, under all climate scenarios.[28]

Climate change, together with **land use changes** (such as overexploitation or excessive groundwater extraction) and **water pollution**, is also one of the key drivers of loss and degradation of freshwater ecosystems.[29] For instance, droughts disrupt habitat connectivity, thus reducing their resilience. With rising temperatures, pests may expand, while **wetlands or peatlands** will get increasingly damaged. Indeed, over the past three centuries, more than 85 % of the planet's wetlands have been lost already due to extractive land use practices (drainage, land conversion). Not only does their degradation lead to biodiversity loss, it also causes releases of the wetlands' stored carbon which further accelerates climate change itself.[30] In Europe, the losses of wetlands in Western, Central and Southern regions continue to be balanced by their expansion in Northern countries – however, that won't be the case if global warming levels hit 4°C.[31]

Anthropogenic impacts on aquatic environments are not related solely to climate change, but are also due to **direct physical alterations of water bodies** and their surroundings: "*For decades, humans have altered the shape of water bodies and the flow of river courses to farm the land, facilitate navigation, generate energy and protect settlements and agricultural land against flooding. For these purposes, rivers have been straightened, channelised and disconnected from their floodplains; land has been reclaimed, dams and weirs have been built, embankments have been reinforced and groundwater levels have changed. These activities have resulted in altered habitats, changed flows, interruptions in river continuity, loss of floodplain connectivity and severe impacts on the status of the aquatic environment.*"[32] Through modifications and introductions of barriers, **sediments** and their transport are affected and wetlands or **floodplains** reduced – and in consequence, habitats get disturbed and the natural capacity of river adjacent soils to channel nutrients and absorb surplus water gets compromised. Ironically enough, some of the conventional flood protection measures have actually curtailed the ability of water systems to keep in balance.

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**28** Ibidem, pp. 1827–1828.

**29** Ibidem, p. 39.

**30** See *The Sustainable Development Goals Report 2022* (footnote n. 5), p. 39.

**31** See *Climate Change 2022. Impacts, Adaptation, and Vulnerability* (footnote n. 7), p. 1835.

**32** European Environmental Agency, *Drivers of and Pressures Arising from Selected Key Water Management Challenges. A European Overview*, 2021, p. 31, https://www.eea.europa.eu/publications/drivers-of-and-pressures-arising, retrieved on August 1, 2023.

Furthermore, **water quality** also presents an issue of global relevance. In 2020, an assessment of rivers, lakes and aquifers in 97 countries showed that 60 % of water was of good quality. However, only 1 % of these waters were in the poorest countries, and so the quality of water that billions of people depend on remains unknown.[33] On the European scale, only about 31 % of surface waters and about 75 % of groundwater are of good chemical status. The sources of pollution are above all agriculture (mainly the use of **fertilizers**), atmospheric deposition of **mercury** (emitted into the air from the burning of fossil fuels and waste), **mining** (risks especially high in Czechia among others), and **point sources** such as wastewater treatment plants, industrial and contaminated sites or sites disconnected from the sewers. Some of the consequences of these pressures are **nutrient enrichment** (nitrogen, phosphorus), **chemical pollution** (pesticides) or **altered habitats**.[34] The ubiquitous presence of pharmaceuticals, microplastics or the so-called "forever" chemicals (per- and poly-fluoroalkyl substances or PFAS) in water bodies is also of concern.[35] Other environmental pressures on European waters arise from **aquaculture** – or farming of vegetal and animal species in water – and the proliferation of **invasive alien species**.[36]

### Technological

It is quite evident that the environmental trends, drivers and pressures are tightly connected to the (historical) employment of diverse technologies and infrastructural or management systems. Water-using sectors such as agriculture, energy production, mining, aquaculture and navigation have been developing over centuries and largely independently from each other – which is something that must change if water ecosystems are to remain resilient. Technologies usually bring about both benefits and risks and their employment always requires careful consideration. In the context of water systems, **hydropower**[37] or geoengineering projects (such as

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**33** See *The Sustainable Development Goals Report 2022* (footnote n. 5), p. 39.

**34** See *Drivers of and Pressures Arising from Selected Key Water Management Challenges. A European Overview*, 2021 (footnote n. 32).

**35** Cayla Cook – Eva Steinle-Darling, The Microplastics and the PFAS Connection, *Water Online*, April 13, 2021, https://www.wateronline.com/doc/the-microplastics-and-pfas-connection–0001, retrieved on August 5, 2023.

**36** See *Drivers of and Pressures Arising from Selected Key Water Management Challenges* (footnote n. 32).

**37** Hydropower is the largest renewable electricity technology (38 % globally, 33 % in Europe) and it is likely that the situation won't change into the 2030s. See Hydropower, *International Energy Agency*, https://www.iea.org/energy-system/renewables/hydropower, retrieved on August 1, 2023.

**weather control**[38]) are believed to play a role in the solving of the climate crisis. However, the unintended consequences of these systems may outweigh their benefits, while their prioritization may hinder the implementation of slow and more complex interventions with actual transformational potential.

Climate adaptation measures are in a large proportion shaped in response to water-related hazards and involve aquatic interventions such as **rainwater harvesting, soil moisture conservation, reforestation** etc.[39] The nature of such measures varies: *"Adaptation responses in developing countries tend to be autonomous, incremental and focused on managing water-related risks in agriculture. In contrast, responses are more policy-oriented and urban-focused in developed countries."*[40] It remains unknown, however, if – or to what extent – adaptation measures actually entail **climate risk reduction** as well and scientists claim that their effectiveness falls sharply beyond 2°C of global warming.[41]

In any case, the so-called **Nature-Based Solutions** (NBS), such as **peatland and wetland restoration, restoration for upstream retention, restoration of river channels or widening riverbeds for natural flood retention**, have been considered in many local and international adaptation strategies across the world, particularly in Europe. However, implementation of these measures is constrained by a continued belief in the naturally high adaptive capacity of ecosystems or due to competition with other functions including mitigation technologies (**carbon capture storages**) or agricultural production that take up extensive amounts of land.[42]

One of the technological principles that come up most in the current debates about aquatic systems is **integrated water resource management**.[43] This approach is based on the understanding of the fundamental interconnectedness of both ecosystems and infrastructures that rely

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**38** Louis J. Battan, Weather Modification, *Britannica*, https://www.britannica.com/technology/weather-modification, retrieved on August 4, 2023.

**39** See *Climate Change 2022. Impacts, Adaptation, and Vulnerability* (footnote n. 7), p. 556.

**40** Ibidem.

**41** Ibidem, p. 557.

**42** See *Climate Change 2022. Impacts, Adaptation, and Vulnerability* (footnote n. 7), p. 1830–1839.

**43** What Is Integrated Water Resource Management?, *UNEP*, https://www.unep.org/explore-topics/disasters-conflicts/where-we-work/sudan/what-integrated-water-resources-management, retrieved on August 5, 2023. Integrated water management is also one of the targets of SDG 6, see: Goal 6: Ensure Availability and Sustainable Management of Water and Sanitation for All, *United Nations*, https://sdgs.un.org/goals/goal6, retrieved on August 5, 2023.

on water. It requires an integrated assessment of the different functions' demands, a consideration of the multivalent trade-offs between the functions and a design that takes these relations into account. It is mostly the **food-energy-water nexus** that is frequently discussed, however, the approach also implies the need for a higher-level deliberation over the links between the hydrological cycle and the socioeconomic processes. Indeed, a truly holistic water management includes a reflection of the **"source-to-sea" connections, inclusive transboundary governance or disaster risk management**.[44]

As mentioned above, water-using sectors bring about significant challenges and hazards that are often mitigated by technological means. Efforts to generally reduce harmful practices (such as the use of chemicals in various industrial and agricultural processes) do occur,[45] however, technical solutions are often indispensable or prioritized.[46] Point source pollution, for example, is avoided by means of various kinds of technologically sophisticated **membrane filtration**.[47] Or, to mitigate negative impacts of hydropower production on fish migration, **fishways** (upstream) or fish-friendly **guidance systems** (downstream) are introduced in order to help disoriented aquatic organisms find their way in waters interrupted by dams.[48]

With regards to integrated water resource management, it is **multi-benefit measures** such as natural water retention measures that seem the most useful. These techniques restore and maintain (water and soil) ecosystems by natural means and processes.[49] As the language used in relation to these practices suggests, living organisms are often employed as a distinct kind of "technology": For instance, the so-called **catch crops** are used in agriculture in order to reduce nutrient (mainly nitrogen and phosphorus) leaching from the soil after the main crop is harvested: the crops retain the nutrients in the soil and prevent rain and irrigation from carrying them away, which can cause diffuse water pollution along the

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**44** See *Summary of Proceedings by the President of the General Assembly* (footnote n. 4), p. 17.

**45** Especially on the European level. *Climate Change 2022. Impacts, Adaptation, and Vulnerability* (footnote n. 7), p.

**46** Michael Huesemann – Joyce Huesemann, *Techno-Fix. Why Technology Won't Save Us or the Environment*, Gabriola Island 2011.

**47** What Is Membrane Filtration?, *Alfa Laval*, https://www.alfalaval.com/products/separation/membranes/what-is-membrane-filtration/, retrieved on August 5, 2023.

**48** Ethan Bilby, Hydropower Dams Make a Fish-Friendly Splash, *Horizon. The EU Research & Innovation Magazine*, February 16, 2022, https://ec.europa.eu/research-and-innovation/en/horizon-magazine/hydropower-dams-make-fish-friendly-splash, retrieved on August 5, 2023.

**49** Natural Water Retention Measure, *Natural Water Retention Measures*, http://nwrm.eu/concept/3857, retrieved on August 5, 2023.

way.[50] Or, **buffer strips and hedges** are created at the margins of arable land or water courses in order to help restore floodplains,[51] reduce nutrient run-offs from the fields, improve riparian habitats, increase water retention, reduce soil erosion etc.[52]

In cities, natural water retention measures have been increasingly employed as well as part of **blue-green infrastructures** boosting the value and "services" of more-than-water ecosystems and enhancing their resilience.[53] **Rainwater harvesting, retention ponds, urban forests or permeable surfaces** have been on the upswing in response to rising temperatures or urban droughts. Low water availability in particular is a problem requiring complex, integrated solutions: technical processes such as **desalination** or **water recycling** are perhaps promising, however, even the most advanced technologies won't render water resources limitless.

On the European level, water management efforts used to be aimed at the supply-side in the past – digging new wells and building reservoirs. Recently, though, the focus has been shifting towards the demand-side – reinforcing **efficiency in water use** (through precision irrigation, for example), promoting water saving, controlling water losses etc.[54] This, however, is of course an approach applicable mainly in regions with ubiquitous access to water and excessive water use.

Many of these practices and measures depend on **observation and monitoring technologies** allowing for the collection of diverse sets of data. On the high level, both ground-based data and data collected via **remote**

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**50** Cover Crops Help to Reduce Diffuse Water Pollution, *Agricology*, https://agricology.co.uk/resource/cover-crops-help-reduce-diffuse-water-pollution–0/, retrieved on August 5, 2023.

**51** An example of a successful floodplain restoration project is the Dutch Room for the River Programme: *"In 2007 the Dutch Government started with the development of the Room for the River Programme. Main goal was to manage higher water levels in rivers by lowering the levels of flood plains, creating water buffers, relocating levees, increasing the depth of side channels, and the construction of flood bypasses."* See Room for the River Program, *Dutch Water Sector*, https://www.dutchwatersector.com/news/room-for-the-river-programme, retrieved on August 3, 2023.

**52** Buffer Strips and Hedges, *Natural Water Retention Measures*, http://nwrm.eu/measure/buffer-strips-and-hedges, retrieved on August 5, 2023.

**53** Shalini Dhyani – Sunidhi Singh – Mrittika Basu et al., Blue-Green Infrastructure for Addressing Urban Resilience and Sustainability in the Warming World, in: Shalini Dhyani – Mrittika Basu – Harini Santhanam, *Blue-Green Infrastructure across Asian Countries*, Berlin – New York 2022.

**54** See *Drivers of and Pressures Arising from Selected Key Water Management Challenges* (footnote n. 32), p. 44.

**sensing**[55] provide people with data about the status of global surface and groundwater hydrological systems. Some of this information is publicly available, such as the data collected in **AQUASTAT** (Global Information System on Water and Agriculture, operated by the Food and Agriculture Organization),[56] **HydroSOS** (Global Hydrological Status and Outlook System, operated by the World Meteorological Organization) or the **Global Water Monitor** (run by NASA).[57] As sufficient, legible and shareable data becomes vital for holistic water management (and the achievement of SDG 6), the UN-associated **Water and Climate Coalition** is now building the new **Global Water Data Portal** that is supposed to aggregate all relevant data – now scattered around various platforms – into one centralized portal.[58] Such resources can be used for informed environmental decision-making, climate adaptation planning or the establishment of **early-warning systems** as part of disaster risk management efforts. Other monitoring systems are used to measure the performance of efficiency of various water-related processes and combined with machine learning, they can enhance predictions or control over a system's behavior.

Advanced tools used in water management are often based on **nano- or biotechnologies**, for instance, those employed in **wastewater treatment**. Various nanomaterials are utilized to separate water from microbes, chemicals and other contaminants.[59] Some of the cutting-edge technology also includes micro- and nanomotors or smart, autonomous micro- and nanorobots that push the sophistication of water purification even further.[60] **Microorganisms**, such as diverse bacteria, help with some of these tasks as well, degrading pollutants in wastewater while also producing energy in the form of biogas.[61] In recent years, a lot of hope in

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**55** What Is Remote Sensing?, *Earth Data*, https://www.earthdata.nasa.gov/learn/backgrounders/remote-sensing, retrieved on August 5, 2023.

**56** AQUASTAT – FAO's Global Information System on Water and Agriculture, *Food and Agriculture Organization*, https://www.fao.org/aquastat/en/, retrieved on August 5, 2023.

**57** *Global Water Monitor*, https://blueice.gsfc.nasa.gov/gwm, retrieved on August 5, 2023.

**58** Global Water Data Portal, *United Nations*, https://sdgs.un.org/partnerships/global-water-data-portal, retrieved on August 5, 2023.

**59** How Is Nanotechnology Used for Water Purification?, *Water Resources Alliance*, https://alliancewater.com/nanotechnology-and-water-purification/, retrieved on August 5, 2023.

**60** Smart Micro- and Nanorobots for Water Purification, *Nature Reviews Bioengineering* I, 2023, pp. 236–251, https://www.nature.com/articles/s44222–023–00025–9, retrieved on August 5, 2023.

**61** John Fulcher, Biotechnology's Vital Role for Efficient and Sustainable Water Purification, *Water Technology*, https://www.watertechonline.com/wastewater/article/14270446/biotechnologys-vital-role-for-efficient-and-sustainable-water-purification, retrieved on August 5, 2023.

terms of advancements in water treatment, nutrition, agriculture or even climate mitigation has been put in **microalgae**. Microalgae live in fresh and seawater, depending on light supplies, CO2 and nutrients such as nitrogen and phosphorus. By definition, they are able to reduce greenhouse gas concentrations in the atmosphere and purify (agricultural) wastewater rich in the above-mentioned nutrients. To uncover the potential of these organisms, bioreactors – devices or systems that support the growth of microorganisms and maintain their optimal environmental conditions – are designed.[62] Constraints to the developments of the microalgae industry include extensive amounts of costly biomass produced or difficulties in achieving optimal spatial and light conditions for microalgal growth.[63]

However, as much as innovative technologies can indeed foster more integrated water management, they need to be paired with **traditional tools** and procedures derived from situated local knowledge formed over centuries-long engagement with land and water bodies.[64] Far from being simply pragmatic or instrumental, knowledge intertwined with cultural or religious meaning can enhance more recent methods, while its employment is vital for the preservation of a community's self-determination and sense of belonging.[65] In this context, **citizen science** initiatives can be very beneficial – be it in terms of pollution monitoring, collection of situated knowledge and memory, or sharing of skills and experience.[66]

### Social

Citizen science is indeed one of the social trends that may shape the way we manage and care for water systems in the future. The importance of bottom-up initiatives is acknowledged also at the level of international

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**62** The term "bioreactor" refers to any device where a biologically active environment can be cultured. Besides industrial bioreactors, also domestic-use bioreactors are increasing in popularity. See projects in Ruth Morrow – Ben Bridgens – Louise Mackenzie (eds.), *BioProtopia. Designing the Built Environment with Living Organisms*, Basel 2023.

**63** Luisa Barreira, Diving Into the Potential of Microalgae for Human Health and Environmental Sustainability, *Earth.org*, April 24, 2023, https://earth.org/microalgae-benefits/, retrieved on August 5, 2023.

**64** See *United Nations 2023 Water Conference Global Online Stakeholder Consultation* (footnote n. 6), p. 19.

**65** An example can be the HYDROUSA project developing water management technologies for water-scarce Mediterranean regions that combine innovative nature-based solutions, ICT, automation systems and traditional handcraft and ancient technologies. See hydrousa.org.

**66** A database of Czech citizen science projects (including some related to water systems) can be found here: https://db.citizenscience.cz/. The British Citizen Sense project combines citizen engagement and sensing technologies: https://citizensense.net/.

organizations, stressing the significance of **inclusive action and multi-stakeholder cooperation**.[67] Such approaches go hand in hand with **education and capacity development**: The **Institute for Water Education** in Delft, for instance, promotes open science and collaborations between scientists and local communities to foster holistic, evidence-based water management.[68] UNDP's **International Capacity Development Network for Sustainable Water Management** (or Cap-Net) has a similar agenda, focusing on knowledge sharing and institutional support on all scales, from regional to source-to-sea.[69]

Paying careful attention to the social aspect of water systems and their management is crucial as it is evident that changes in the hydrological cycle and water-related hazards disproportionately impact communities that are already vulnerable and underprivileged.[70] These impacts – combined with other climate-related drivers – are projected to intensify migration and given the expected increase in **urbanization** and **population growth** (by 2050, nearly 7 of 10 people will live in cities), informal settlements will likely grow and urban infrastructure will find itself under significant pressure.[71] **"Social infrastructure"** of cities – inseparably interconnected with "rural" lands – will matter just as much as its technical counterpart: making sure that the water tap always provides us with clean water is equally important as the way these infrastructures are governed or the support of our neighbors who might bring the water to us in the time of crisis.

### Political

The aspect of governance is of utmost importance for all scales of water systems. Today, political deliberations related to water systems are stratified according to the structure and hierarchy of international, national, regional or municipal/communal political institutions. There's a broad consensus, however, that it is **transboundary governance** that is required for truly effective and holistic water

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**67** See *Summary of Proceedings by the President of the General Assembly* (footnote n. 4).

**68** Of course, knowledge sharing is just as important on the level of science-policy interaction. See Capacity Development, *Institute for Water Education*, https://www.un-ihe.org/what-we-do/capacity-development, retrieved on August 5, 2023.

**69** Our Work, *Cap Net*, https://cap-net.org/our-work/, retrieved on August 5, 2023.

**70** See *Climate Change 2022. Impacts, Adaptation, and Vulnerability* (footnote n. 7), p. 555.

**71** Ibidem, p. 12–13; Urban Development, *The World Bank*, April 3, 2023, https://www.worldbank.org/en/topic/urbandevelopment/overview#1, retrieved on August 5, 2023.

management as bodies of water often cross administrative borders and bind together places and communities that, at first sight, might seem distant.[72] From this perspective, the local – global distinction could be effectively replaced by a **regional – basin district – source to sea scalar hierarchy**.

We should not omit the **links between the hydrological and atmospheric systems** either: "*Every day, minerals and microorganisms journey across the planet, wafted aloft into the atmosphere among the clouds, maintaining vast and elaborate planetary relationships. These winds have shaped the rise and fall of empires and influenced pivotal political developments, all unbeknownst to humans*," says Roman Shemakov, while describing the effect of Chinese reforestation efforts on precipitation levels in California: due to a decrease of dust particles from the Taklamakan desert in the atmospheric rivers passing over the American southwest, California receives less rainfall and droughts intensify.[73]

Shemakov also refers to political theorist Karl August Wittgofel, who, in 1957, coined the term **"hydraulic despotism"**, pointing out the role of centralized control over water resources in the formation of empires around the world.[74] And while in the case of the China-California connection, the impact on atmospheric flows is rather an unintended consequences of state-level management and planning, **"atmospheric control"** (cloud seeding, artificial fogs, chemical alterations and so on) can also be employed as a tool of articulated political or military strategy.[75]

Increasingly, water is instrumentalized in ways that cannot be labeled anything other than criminal. **"Water crimes"** are a kind of environmental crimes (sometimes also called "ecocides") that can be defined as "*illegal activities harming the environment and aimed at benefiting individuals, groups or companies through the exploitation of, damage to, trade or theft of natural resources*."[76] These crimes vary in nature – they may constitute a damage done to a water resource (such as the recent pollution of the river Bečva

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**72** See *The Sustainable Development Goals Report 2022* (footnote n. 5), p. 39.

**73** Roman Shemakov, The Linked Ecological Futures Of America And China, *Noema*, May 9, 2023, https://www.noemamag.com/the-linked-ecological-futures-of-america-and-china/, retrieved on August 5, 2023.

**74** Ibidem.

**75** Yuriko Furuhata, *Climatic Media. Transpacific Experiments in Atmospheric Control*, Durham 2022.

**76** Lorenzo Segato – Walter Mattioli – Nicola Capello, Water Crimes within Environmental Crimes, in: Katja Eman – Gorazd Meško – Lorenzo Segato et al., *Water, Governance, and Crime Issues*, Berlin – New York 2022, pp. 31–45.

investigated by *Deník Referendum*[77]), an action related to water as an object (such as a drinking water theft or an armed conflict over water resources) or weaponization of water (such as intentional flooding or poisoning of water).[78]

Not only investigation of criminal actions, but also **trade regulations** and **accountability** for the condition of water systems require political deliberation and a legal structure. However, existing legal frameworks remain largely insufficient – for instance with regards to the incorporation of **indigenous rights**. Indigenous voices, though, are often excluded even from informal negotiations. As stated in the report summarizing the results of the UN Water Conference stakeholder consultation, "[t]*oday, one-fourth of the world's land base outside of Antarctica is overseen by Indigenous Peoples who protect 80% of the world's richest and rarest biodiversity across land and water. Yet, Indigenous Peoples and youth are largely excluded from UN fora and dialogues on water.*"[79] Such ignorance still prevails in international political debate, despite the UN's own bodies' calls for ethical co-production of environmental policies with indigenous communities.[80] Research and advocacy in **"water law"** or "water justice" are thus mainly provided by international NGOs such as the **International Association for Water Law**,[81] or **Water Witness**.[82]

On the European level, the primary water protection legislation has been the **Water Framework Directive** (WFD) introduced in 2000. "*It applies to inland, transitional and coastal surface waters as well as groundwaters. It ensures an integrated approach to water management, respecting the integrity of whole ecosystems, including by regulating individual pollutants and setting corresponding regulatory standards. It is based on a river basin district approach to make sure that neighboring countries cooperate to manage the rivers and other bodies of water they share.*"[83] These

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**77** Otrava Bečvy, *Deník Referendum*, https://denikreferendum.cz/tema/otrava-becvy/1, retrieved on August 5, 2023.

**78** See Lorenzo Segato – Walter Mattioli – Nicola Capello (footnote n. 76).

**79** See *United Nations 2023 Water Conference Global Online Stakeholder Consultation* (footnote n. 6), p. 35. See also Indigenous Peoples' Declaration for the 2023 United Nations Conference, *United Nations*, https://sdgs.un.org/sites/default/files/2023–03/Indigenous%20Peoples%E2%80%99%20Declaration%20for%20Water%20Conference_ENG.pdf, retrieved on August 5, 2023.

**80** See *Climate Change 2022. Impacts, Adaptation, and Vulnerability* (footnote n. 7), p. 564.

**81** *International Association for Water Law*, https://www.aida-waterlaw.org/, retrieved on August 5, 2023.

**82** *Water Witness*, https://waterwitness.org/, retrieved on August 5, 2023.

**83** Water Framework Directive, *European Commission*, https://environment.ec.europa.eu/topics/water/water-framework-directive_en, retrieved on August 5, 2023.

objectives are further specified in distinct legislations for groundwater and surface water and in the **river basin management plans**, the key implementation tool of the WFD designed in accordance with the fact that over one-third of European river basin districts cross administrative borders.[84] Other European strategies related to water include the EU Adaptation Strategy,[85] the 2030 EU Biodiversity Strategy,[86] the Zero Pollution Action Plan[87] or the Farm to Fork Strategy[88] (an important element of the European Green Deal) and a subset of more detailed directives (such as Habitat Directive, Birds Directive, Urban Waste Water Treatment Directive etc.).

Unsurprisingly, there are multiple obstacles hindering the WFD's and other strategies'successful implementation: **lack of funding**, inflexible planning, failure to adopt measures on the national level or insufficient coordination of efforts between different sectors.[89] Even so, European legislation is one of the few international frameworks that do aim to mainstream integrated water management.

### Economic

Water is, of course, extremely valuable. Under the present-day economic paradigm, though, its actual **use value** is subordinated to the **abstract price** of water as a resource that is established by market forces (and that we pay with money). Globally, the price of water is relatively low as the operational costs of its provision are distributed over a substantial total volume of water supplied to consumers. However, it doesn't feel as low to large populations of the Global South due to limited supply and low incomes and so it is in these regions where the actual value of water becomes much more apparent. In other words, "*water is a good with a very*

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**84** Surface Water, *European Commission*, https://environment.ec.europa.eu/topics/water/surface-water_en, retrieved on August 5, 2023.

**85** EU Adaptation Strategy, *European Commission*, https://climate.ec.europa.eu/eu-action/adaptation-climate-change/eu-adaptation-strategy_en, retrieved on August 5, 2023.

**86** Biodiversity Strategy for 2030, *European Commission*, https://environment.ec.europa.eu/strategy/biodiversity-strategy-2030_en, retrieved on August 5, 2023.

**87** Zero Pollution Action Plan, *European Commission*, https://environment.ec.europa.eu/strategy/zero-pollution-action-plan_en, retrieved on August 5, 2023.

**88** Farm to Fork Strategy, *European Commission*, https://food.ec.europa.eu/horizontal-topics/farm-fork-strategy_en, retrieved on August 5, 2023.

**89** See *Drivers of and Pressures Arising from Selected Key Water Management Challenges* (footnote n. 32), p. 54.

*high value, as no one could survive without it; however, in the industrialized world, we pay a much lower price than other goods that are not essential for life."*[90] The actual value of water increases as the population grows and the climate crisis deteriorates. However, because nature is usually considered a mere externality in market calculations, the gap between value and price of water only grows – it remains **underpriced, yet unaffordable for many** at the same time.

The price of water can be corrected through **water pricing schemes** (or water tariffs) established by the states' regulatory bodies – the hope being that a higher price of water truly accounting for related infrastructural and environmental costs will result in higher water use efficiency.[91] As a means of price correction, concepts like **"embedded"** or **"virtual water"** have emerged that refer to water "hidden" in products, services and processes people use and depend on in their daily lives.[92] These concepts are supposed to enable and compel capitalist economies to adjust to new circumstances, such as the ones defined by the climate crisis. Indeed, the **"green economy"** that strives to account for "ecosystem services" and "natural resources" and subsume them to the logic of financial capital has become the new mainstream especially in the Global North. And, there has been a growing understanding of the fact that "*there is no green without blue* economy".[93]

The World Economic Forum (WEF) acknowledges that "(...) *water can be used as a universal lens to focus on, serving as an enabler and impact multiplier. Water has the ability to enable economic activity to grow and human health to thrive both directly (through a healthy environment) and indirectly (where green infrastructure leads to better mental health outcomes), as well as contributing to resilience and sustainable development agendas in less obvious ways."*[94]
WEF says that water is vital for "greening" the economy and the decarbonization efforts. For example, it is indispensable for the mining of metals used in the production of batteries for electric vehicles. However, lithium and other metals are often mined in water-scarce regions (at

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**90** What is the value of water? And its price?, *We Are Water Foundation*, April 12, 2022, https://www.wearewater.org/en/what-is-the-value-of-water-and-its-price_349991, retrieved on July 31, 2023.

**91** Water – The right price can encourage efficiency and investment, *OECD*, https://www.oecd.org/env/resources/water-therightpricecanencourageefficiencyandinvestment.htm, retrieved on July 31, 2023.

**92** What Does Virtual Water Mean?, *Water Footprint Calculator*, https://www.watercalculator.org/footprint/what-is-virtual-water/, retrieved on July 31, 2023.

**93** https://www3.weforum.org/docs/WEF_A_Freshwater_Future_2022.pdf, emphasis added.

**94** Ibidem, p. 3.

considerable environmental costs) and so the supply chains become increasingly unreliable.[95] The response of the political and economic elites to such a problem stays loyal to the ruling ideology of economic growth: Just like in the case of greenhouse gas emissions, they call for its **"decoupling" from the growth of water resource use** by means of technological innovation and financial incentives.[96]

Nevertheless, despite undeniable benefits of various policy and technological advancements, the theory of decoupling remains a theory – and a largely problematic one. Even EU-associated institutions state today that a complete decoupling (especially in terms of material consumption) is unlikely.[97] In relation to water, UNEP has concluded that "[n]*o single policy or set of practices will achieve resource or impact decoupling at the global, national and regional scales simultaneously. Inherent complexities, uncertainties and ignorance still limit current understanding of hydrological cycles and the complex relationships of water with other sectors.*"[98]

The UN's stakeholder consultation has shown that a lot of organizations invested in sustainable water management is deeply concerned about the continued primacy of profit-seeking private entities in matters such as water provision and water management. Water systems are indeed under significant pressure from multinational companies and investors who become richer as water becomes scarcer.[99] That water is not "blue gold", but is rather different and more important than gold, is compellingly demonstrated by a collective of Czech activists arguing in favor of the concept of **remunicipalization**.[100] In their view, water management should be taken from under the control of private actors and entrusted to municipalities. Governed locally and managed with public interest at heart, water systems could develop into resilient infrastructures fostering

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**95** Ibidem, p. 10.

**96** Ibidem, p. 7–10.

**97** Growth without Economic Growth, *European Environmental Agency*, https://www.eea.europa.eu/publications/growth-without-economic-growth, retrieved on August 5, 2023.

**98** Options for Decoupling Economic Growth from Water Use and Water Pollution: A Report of the Water Working Group of the International Resource Panel – Summary for Policy Makers, *UNEP*, 2015, https://wedocs.unep.org/handle/20.500.11822/7539, retrieved on August 5, 2023.

**99** See *United Nations 2023 Water Conference Global Online Stakeholder Consultation* (footnote n. 6), p. 35.

**100** Michaela Pixová – Anna Kárníková – Eda Acara, *Voda nad zlato. Vodohospodářství mezi veřejným zájmem a soukromým ziskem v čase klimatické krize*, Praha 2021, https://rosalux.cz/wp-content/uploads/2022/03/voda_web_02_02.pdf, retrieved on August 5, 2023.

more general climate adaptation efforts. Approaching water as a commons that is made use of and cared for collectively may also encourage choosing one technology over another – for example rainwater harvesting over desalination (as an example from Spain shows).[101]

**101** Laia Domènech – Hug March – David Saurí, Degrowth initiatives in the urban water sector? A social multi-criteria evaluation of non-conventional water alternatives in Metropolitan Barcelona, *Journal for Cleaner Production* XXXVIII, 2013, pp. 44–55, https://www.sciencedirect.com/science/article/abs/pii/S0959652611003519, retrieved on August 5, 2023.

# b. ZOOMING IN: SELECTION OF AQUATIC CONCERNS

**The overview above offers a number of issues, ideas and open questions that could be elaborated on. The following are just a few possible entry points into the topic that provide more specific directions and situated contexts for research and practice. The topics below will be further discussed with external experts during Planet B's events and field trips.**

## 1. Vertical Flows: Prague as a Body of Water

Maps and city plans usually show cities as horizontal, flat surfaces, as if it were mostly the two-dimensional coordinates that make up the spatial and operational character of a city. What happens if we look at the city as mainly a vertical structure consisting of fluid flows and interactions rather than stable and solid blocks of matter? And, does water as a liquid medium help us interpret and imagine urban dependencies in a new way?

The most prevalent considerations of verticality in urban contexts relate to cities' skylines as a matter of concern in heritage conservation and to "verticalization" (and densification) of cities as a means to maximize utilization of urban land. And of course, in the case of coastal cities, the vertical aspect comes to the fore more and more with regards to the rising sea level. However, cities don't end with the roof of the highest skyscraper – the cloudy sky is where urban metabolic flows connect to much larger biophysical and biochemical systems. The same is true for the underground, where urban infrastructures form complex compounds of the "natural" and the "artificial". Water runs through these systems up and down, mediating material exchanges between various in/organic bodies and processes. Looking at the city as a vertical structure also enables us to consider the governance and institutional layers that contribute to the shaping of the urban aquatic flows just as well.

As of yet, the city of Prague hasn't come very far in terms of conscious employment of strategies and tools that would reflect the fact that the city itself is a "body of water" and needs to be treated as such to resist the most crushing impacts of climate change. So, what does vertical "watery"

Prague look like? What are the layers and the dynamics of its aquatic becoming? How does it connect to systems exceeding its administrative boundaries? And how would the city change if it was run as an “aquatic alliance”?

## 2. Water as a Process: Dynamics of the Vltava river

Rivers are simultaneously solid and fluid. They represent a reliable constant that helps us navigate space or remind us of historical and cultural sediments of a place. At the same time, they're continuously evolving: water levels rise and fall, the speed and force of the current varies, its chemical composition fluctuates and the information it carries is hardly ever unequivocal. Is it possible to grasp a river? And what does its temporality tell us about the temporality of human civilization that depends on its dynamics?

Vltava, the longest Czech river, is a heavily humanized and technologically "tamed" watercourse that today runs through a carefully delimited corridor. Of course, it is in the city of Prague where it has been regulated the earliest and the strongest, although at the latest since the mid–19th century, its flow has been altered or interrupted all along in many ways. Besides the numerous barriers appearing in the riverbed, its floodplains have been substantially modified. Normally, floodplains allow the river to pour out of its banks, slow down its runoff and store flood water. They retain humidity in the soil, enable groundwater recharge, contaminant filtration or nutrient transport and provide conditions for various habitats to originate. Such an agency, though, and the many ways the river can enhance the resilience of systems that people are part of, has been substantially limited by the fragmentation of floodplains through infrastructure or industrial sites (and associated privatization of land). It is also its composition and contents that has been both intentionally and unintentionally "regulated": the river mediates chemical exchanges between all of the bodies of water, animate or inanimate, that constitute the city and connect it to areas beyond its boundaries.

As such, human presence and activity along a river's shores does not necessarily mean negative disruption – some agricultural practices, for instance, can even enhance its ecosystemic functions. Symbiotic relationships between the river, human and non-human populations can indeed be formed – though these endeavors require a strategic, horizontal and inclusive approach. So, how can we balance the needs of those who have a stake in the river? And what would the city look like if it was to adapt to the river's dynamics and not the other way around?

## 3. Beyond Nature: Shaping the Landscape with Zlatá stoka

Over the past centuries, a large proportion of European water bodies has been modified by humans. When we leave the city for “nature”, more likely than not, we’re going to find amalgamations of objects and flows co-created by human and non-human agents that can’t be disentangled from one another anymore. Confusing enough, these assemblages foreground the significance of political negotiations while providing all participating entities with agency and autonomy. How can we move beyond the dichotomies between nature and culture without inadvertently legitimizing debatable human interventions? Which voices need to be heard and how can we make sure we don‘t put words in the mouths of others?

Zlatá stoka is an artificial, 48 km long waterway built at the beginning of the 16th century as a means to regulate water systems of the Třeboň basin (in Southern Bohemia) and to provide fresh water supplies to a web of local ponds. The geological structure of the territory primarily consists of remains of ancient flora, transformed over time into various soil types, including peat bogs. Today, the channel that diverts water from the river Lužnice is commonly considered a “natural” structure. In fact, though, it is a part of human endeavor to shape bodies of water in ways that benefit their way of life. For centuries, it has been a source of prosperity for local fish farming, mills or breweries. It used to provide drinking water and served as a transportation corridor for timber rafting. And it continues to nurture industries that connect “rural” environments with “urban” consumers.

Traditionally, oxygenated water distributed through Zlatá stoka to the ponds and the fish in them has been considered “living”, while water running off the fields and forests has been seen as “dead”. Such a distinction is by no means “natural” – it only bears witness to the kind of incarnation of life people view as important. Zlatá stoka now has the status of cultural heritage and as such, it invites us to ask: Who benefits and who is disadvantaged by the biopolitics of (aqua)culture that have shaped these systems? How far do these systems actually reach? And what can we do – or not do – to foster their future resilience?

## 4. The Heritage of Aquaculture: The Ponds'Ecologies of Třeboňsko

Aquaculture, or farming of aquatic organisms, is an economic activity dating back to ancient China where carp – the fish species culturally appropriated for Czech Christmas traditions – was first domesticated. It has grown into an interconnected global industry where the species' evolution is increasingly shaped by artificial interventions and infrastructural processes. It is a way of orchestrating ecosystemic relations that entails hardly controllable repercussions. So, what can we learn from the operations of fish farms and what does aquaculture without exploitation look like?

Pond farming has been an important part of the Southern Bohemian economy since the 14th century. Originally, it was controlled and made use of by feudal rulers who dominated the land and water bodies. Its "golden era" in the 16th century has been marked by the construction of the Zlatá Stoka waterway, but also of the most significant local ponds such as Rožmberk. The original water-related modifications were mainly of water management importance and were created by damming shallow valleys with gentle flowing streams and rivers. People with great ecological empiricism merely distributed naturally occurring water to economically viable sites, without removing it from the surrounding landscapes. Today, the pond network near the city of Třeboň consists of more than 500 individual ponds – a number that makes the system a global rarity. Not only were the ponds used as an infrastructure for fish farming, they also enabled the drainage of untillable, soggy land and provide flood protection. However, aquaculture can also become a source of pressure for larger water systems (be it in the form of pollution, water abstraction or introduction of alien species), while the Czech Republic has been identified as one of countries where such pressures can be observed.

Aqua-*culture* extends beyond the managed breeding of fish as such. It is a practice constitutive of the way of life of local communities that embodies historical developments and complex links between the governance, economic and infrastructural systems. What are the current and potential future issues of such a culture and is it possible to form an aquatic alliance in the context of fish farming?

## 5. Breathing Water: The Scales of Algal Agency

In recent years, (micro)algae has become something of a potential panacea for some of the most pressing environmental issues. Based on "services" it's been providing to keep the planetary metabolism going, ideas started to emerge about possibly making use of these aquatic plants in climate change mitigation, (waste)water purification, nutrition, biofuel production and so on. Algae can certainly do a lot, but how do we acknowledge and take advantage of its qualities without regarding it as an easy fix?

The various kinds of algae are among the most widespread organisms on Earth, inhabiting both marine and freshwater bodies. It constitutes the basis of (aquatic) food webs and either directly (in the form of various nutrition supplements) or over multiple trophic levels it feeds humans as well. It is not only algae as a material substance that is vital for life as we know it – through photosynthesis, it generates about 40 % of the planet's oxygen by metabolizing carbon dioxide. Besides CO2, algae requires sunlight and nutrients to grow. If the levels of nutrients are sufficient but not excessive, the proportion of algae to other aquatic organisms is just about right and it is regulated by fish and insects. Through human activity, though, the concentrations of nutrients increase – especially as a result of fertilizers' run-offs from agricultural lands – and thus algal populations grow to scales unmanageable through "natural" ecosystemic processes. This is how algae has previously acquired its bad rep – and obviously unjustly so.

In reality, algae has always been an ally – not only to humans though, but to life as such. Much research is underway that is trying to find ways how we can cultivate these alliances. How do we make sure, though, that the proposed relationships are symbiotic and not one-sided? And what kinds of "cultivation" are required in the context of human practices and their approach to non-human entities?

# c. RESOURCES

**Science – Technology – Policy (General)**


- IPCC: AR6 – Climate Change 2022. Impacts, Adaptation, and Vulnerability
- UN: Thee Sustainable Development Goals Report 2022
- UN: UN 2023 Water Conference Global Online Stakeholder Consultation
- European Environmental Agency: Drivers of and Pressures Arising from Selected Key Water Management Challenges. A European Overview, 2021
- Global Commission on the Economics of Water: The What, Why and How of the World Water Crisis, 2023
- Michaela Pixová – Anna Kárníková – Eda Acara: Voda nad zlato. Vodohospodářství mezi veřejným zájmem a soukromým ziskem v čase klimatické krize, 2021
- A2 Magazine, Drought, edition n. 15/2019


**Science – Technology – Policy (Research Areas)**


- Strategie adaptace hl. města Prahy na změnu klimatu
- Klimatický plán hl. města Prahy do roku 2030
- Strategie přizpůsobení se změnám klimatu v podmínkách ČR
- Koncepce pražských břehů, 2014
- Ukázkové řešení BGG systému modrozelené infrastruktury v Praze
- Augustin Kotil – Zdenka Kociánová: Příběh zlaté stoky. 500 let jedinečného díla Štěpánka Netolického, 2018
- Dagmar Dykyjová: Třeboňsko. Příroda a člověk v krajině pětilisté růže, 2000
- Amos Richmond: Introduction (from Handbook of Microalgal Culture, 2013)
- Veronika Miškovičová – Jiří Masojídek: Transdisciplinary Collaboration in Architecture. Integrating Microalgae Biotechnologies for Human and Non-Human Perspectives, 2023
- Víceletý národní strategický plán pro akvakulturu 2021–2030, 2020
- Záplavy a sucho budou častější. Pomoci mohou i rybníky (interview with Vladimír Žlábek, director of the CENAKVA research center, 2022)

**Theory**

- Astrida Neimanis: Bodies of Water. Feminist Posthuman Phenomenology, 2017 (selected chapters)
- Edward O. Wilson: Half-Earth. Our Planet's Fight for Life, 2016 (selected chapters)
- Donna Haraway: Making Kin. Anthropocene, Capitalocene, Planatationcene, Chtchulucene (from Staying with the Trouble. Making Kin in the Chthulucene, 2016)
- Neil Brenner – Christian Schmid: Planetary Urbanization (from Implosions/Explosions: Towards a Study of a Planetary Urbanization, 2013)
- Liam Young (ed.): Planet City, 2020 (selected chapters)
- Lukáš Likavčan: Deep Politics (from Vertical Atlas, 2022)
- Carolina González Vives: Dehydrated Architecture (from Climates: Architecture and the Planetary Imaginary, 2016)
- Frédéric Rossano: Floodscapes. Contemporary Landscape Strategies in Times of Climate Change, 2021 (Introduction & Summary)
- Yuriko Furuhata: Climatic Media. Transpacific Experiments in Atmospheric Control, 2022 (Introduction)
- Peter Del Tredici: The Flora of the Future (from Projective Ecologies, 2020)
- Manon Mollard: Behind the Front. Rethinking Urban Waterways beyond Pretty Views and High Prices (from The Site. A Field Guide to Making the Future of Architecture, 2016)

# B. AQUATIC ART & DESIGN RESEARCH (REFERENCE PROJECTS)

**The complexity of more-than-water issues described above requires responses that weave together different kinds of knowledge, a cacophony of voices involved and a multiplicity of dependencies across scales. Art, architecture and design are among the disciplines that have traditionally addressed the unknown and continue to do so while boldly crossing the boundaries of other fields of research and practice. What follows is a pool of art & design research projects dealing with aquatic concerns that together make up a collage of perspectives and considerations reflecting the uncertainty of future developments.**

## PROSPECTING OCEAN

by Armin Linke
2018

“Armin Linke investigates international regulations and laws related to the seabed and the rising sea levels. *Prospecting Ocean* attempts to create a new visualization to frame the complex kaleidoscopic images that are connected with the Anthropocene into a linear narrative essay. The work aims at understanding and possibly creating new solutions to design the future. Exemplary issues are the acidification of the ocean, the

implication of the usage of fertilizers, the practice of ice drilling to get information on the history of climate, ocean current measurement and modeling, negotiations on new legislations that relate to the ocean boundaries and regulations, and eventually economical practices like oil and mineral drilling, fisheries, issues related to vessel transport, and ice melting in the Arctic region." (source: tba21.org)

## 4 WATERS: DEEP IMPLICANCY

by Denise Ferreira da Silva and Arjuna Neuman
2019

"*4 Waters: Deep Implicancy* is an immersive film installation (...) which considers urgent global issues including migration, displacement, legacies of colonialism and ecological devastation, and asks what is possible if ethical thinking is stripped of value? Presenting a reimagined cosmos – an alternative to the violent, segregated world we have inherited – the film seeks a primordial moment of entanglement prior to the separation of matter evolving into the planet we know (...). Crossing four waters: the Mediterranean, the Pacific, the Atlantic and the Indian Ocean, we follow the displacement of peoples alongside the movement of clouds, ideas, earth, and migration of matter, at a quantum level, from one state to another. (...)" (source: e-flux.com)

## MAKING OF EARTHS

by Geocinema (Asia Bazdyrieva and Solveig Qu Suess)
2021

"As a contribution to understanding weather modification and environmental control, *Making of Earths* explores the persisting modern trope that the future is manageable. Following a year-long, documentary-led research, the film traces current efforts made across China and South-East Asia, to predict the future of Earth's increasingly strange climates, in the shadow of attempts to control land and territory. A chasm widens between the lived experience of overwhelming uncertainty and the mass of data collected to profit from this instability. Life on the ground is mismatched with the planetary scale infrastructures of observation and management. (...)" (source: onassis.org)

## HIDROSCOPIA LOA

by Claudia González Goday
2018

"Through this artistic inquiry we analyze the river Loa, one of the most contaminated rivers in Chile, in its very complexity: from the micro level, in its chemical composition and microorganisms, to the people living along the river and facing increasing problems. Due to the enormous extraction of water, the river is receding, and the area is becoming more and more dry. Industrial overutilization and chemicals arriving through the air from places of excessive mining have led to severe contamination of the stream. In this installation, data collected about the volume of water in the river over the last seventeen years in combination with water samples from five points in the river translate its alteration into a language of image and sound." (source: zkm.de)

## SALMON: TRACES OF ESCAPEES

by Cooking Sections
2021

"This immersive film installation explores the environmental impact of salmon farms, which can be traced far beyond the circumference of open-net pens. Originally developed in Norway in the past decades, modern salmon companies have expanded globally into less saturated (and less environmentally restrictive) waters, ranging from Scotland to Chile, Canada or Australia. *Salmon: Traces of Escapees* is a recognition that nothing can be removed without leaving traces, no divestment can be disassociated from extractivism, and no domestication comes without the colonisation of the gut." (source: cooking-sections.com)

## SKY RIVER: POLITICS OF THE ATMOSPHERE

by Elise Hunchuck, Jingru (Cyan) Cheng, Marco Ferrari with Henry Valori, Lena Geerts Danau and Nico Alexandroff (ADS7)
2019–2020

"The group analyzes the Chinese project *Sky River*, which will conduct what may be the largest artificial rain experiment ever attempted, potentially causing rainfall over an area of 1.6 million square kilometers. The project aims to divert clouds from southern China and India to fill the sources of

China's main rivers, which spring from the Tibetan Plateau. Through this observatory, the group traces how the old geopolitical order of land sovereignty extends to the realm of the atmosphere. With maps and data visualizations, they develop "sensors" that detect the transformations on the ground as well as in the atmosphere, culture, politics, and law." (source: zkm.de)

## DATA GARDEN

by Kyriaki Goni

"The starting point of this work is the recent scientific research on the data storage capacity of the living organisms' genetic material, as well as on the challenges and moral dilemmas concurrently posed. The artist invites the audience to envision a network of plants on the Acropolis rock, in which digital information is circulated and stored. The network is protected by a community of users who in this way maintain the self-disposal of their data. As the storage space transitions from the "cloud" to the earth, and as control passes from the companies to the users, the life circle of data follows that of a plant, fostering a relation of interdependence and care." (source: onassis.org)

## DROUGHT IN THE DELTA

by Studio Marco Vermeulen (as part of the IABR – Atelier)
2020

"The use of the surface and subsurface of the Dutch Delta landscape is becoming increasingly intensive, with new transitions such as renewable energy, sustainable food production and an increased urbanization adding to this space scarcity. A robust fresh water strategy will need to react to these transitions, an integrated approach of different functions is essential. The results of this research by design project have been visualized in the form of two cross-sections of the Dutch delta, the delta in 2020 and in 2050, explaining the interdependence above and below the surface and the benefits that arise when designing with both of them." (source: marcovermeulen.eu)

## FOOD FOREST FANTASIES

by The Center for Genomic Gastronomy
2022

"*Food Forest Fantasies* is a suite of tools, rituals and recipes for testing and tasting food systems that can withstand water stress and survive the climate emergency. There is a mismatch between the speed required to address the climate emergency and the patience to cultivate food forests. To overcome this misalignment we are creating menus for future generations while cultivating slow-growing crops. *Food Forest Fantasies* invites diners to book a reservation today for a dinner only being served in 10 years time, once our forest has grown. No one knows how high the water will rise or how long the droughts will last, but it seems inevitable that the culinary world we inhabit today is ending. *Food Forest Fantasies* is a form of edible eschatology: eating at the end of a world while preparing for another." (source: genomicgastronomy.com)

## WATERSCHOOL

by Studio Makkink & Bey
since 2018

"The *WaterSchool* (...) is a speculative school designed and organised around water as an essential material, subject and social and political phenomenon. It proposes rethinking of the economic and infrastructural model of education. *WaterSchool* is displayed in working exhibitions around the globe, meanwhile building a curriculum for the subjects to be taught (education) and constructing all spaces needed separately (architecture)." (source: smb-waterschool.nl)

## ROOM FOR THE RIVER

by the Dutch Government
2007–2022

"The risk of flooding in the Netherlands is steadily growing. The capacity of flood plains and rivers are decreasing and water levels rise due to more frequent and heavier rainfall. This was especially the case in the 1990s when parts of the Netherlands suffered severe flood damage. Due to these extremely high water levels, ‚room for the river' became the new starting point for the flood protection approach in our river areas. In 2007 the Dutch Government started with the development of the *Room for the*

*River Programme*. Main goal was to manage higher water levels in rivers by lowering the levels of flood plains, creating water buffers, relocating levees, increasing the depth of side channels, and the construction of flood bypasses. The programme consists of over 30 projects, most of them were completed at the end of 2018. The complete programme is expected to be finished in 2022." (source: dutchwatersector.com)

## RED MUD: ALTEO'S LICENSE TO POLLUTE THE MEDITERRANEAN SEA

by INTERPRT
2021

A spatial and visual investigation and a production of an evidence file about the ecocide mock trial on industrial pollution in the Mediterranean Sea: "From 1967 to 2015, ALTEO-Rio Tinto dumped more than 30 million tons of toxic red mud into the Mediterranean Sea. In 2016 ALTEO stopped discharging solid waste into the Mediterranean. However, liquid effluent containing toxic metals continues to be released into the sea until today. The long-term smothering of the seafloor by the release of the red mud has had severe impacts on the local ecosystems. Loss of cold-water coral reefs and contamination of fish habitats at multiple depths of seabed led to depletion and contamination of fish stock, resulting in a loss of livelihood for local fishermen." (source: interprt.org)

## MERA

by Nabi Agzamov, Antonia Burchard-Levine, Olga Cherniakova, Nashin Mahtani, Evgenia Vanyukova
2019

"The fragmented governance of ecological bodies is misaligned with the necessity to make cohesive decisions about ecological systems that extend beyond state borders. The combination of spatial incoherencies with the short-term logic of current political and economic structures have fueled anthropogenic activities resulting in the overexploitation and progressive shortage of natural resources. How might we define alternative spatial and temporal logics of governance more consistently linking the deep time and shifting dynamics of ecological systems with the micro-scales of human temporal perception? (...) Mera is a speculative proposal for the redefinition of territory based on the primary logic of watersheds, the dynamic relations they offer and

require, and the cascading flows of resources they shape." (source: youtube.com)

## TREES AS INFRASTRUCTURE

by Dark Matter Labs
since 2020

*Trees As Infrastructure* "is a model for the distributed management of our 'live' green infrastructures that helps us to develop cities that bring people into symbiosis with urban forests. Our proposition involves a sequence of institutional paradigm-shifts that 1/ pool the necessary financial resources to maintain a thriving green infrastructure, 2/ develop new practices to care for and maintain our urban ecosystems, and 3/ monitor and evaluate the environmental, health and social impacts driving our urban afforestation targets." (source: darkmatterlabs.org)

## MICROFLOWS

by Studio of Architecture III, UMPRUM
2020

"The project examines the possibility of interconnection between the biological intelligence of microalgae – the oldest unicellular organisms – and the human, within a dynamic inner structure using technology for interspecies collaboration. Technologized landscape in the prototype of the photobioreactor makes use of two basic elements – motion and light – in order to cultivate the photosynthetic medium. The motion of the medium in transparent containers and tubes ensures optimal circulation and a continuous flow in space, while the natural and artificial light enables photosynthetic growth in cultivation units." (source: umprum.cz)

## CLOUD STUDIES

by Forensic Architecture
2020

"Mobilised by state and corporate powers, toxic clouds colonise the air we breathe across different scales and durations. Repressive regimes use tear gas to clear democratic protests from urban roundabouts. Carcinogenic plumes of petrochemical emissions smother racialised

communities. Airborne chemicals such as chlorine, white phosphorus, and herbicides, are weaponised to displace and terrorise. Forest arson in the tropics creates continental-scale meteorological conditions, forcing millions to breathe toxic air. It is a basic principle of forensics that, between solid objects, "every contact leaves a trace". By contrast, clouds are the epitome of transformation, their dynamics are governed by nonlinear, multi-causal logics. This condition was apparent throughout the history of painting, when clouds, moving faster than the painter's brush could capture them, needed to be imagined rather than described." (source: forensic-architecture.org)

## OCEANS IN TRANSFORMATION

by Territorial Agency
2020

"Informed and catalysed by global sea-level rise, one of the most visible sign of climate emergency, *Oceans in Transformation* considers the oceans as a sensorium; that is, a sensing body which absorbs and registers the intensified activities of humans in its circulations, ecosystems and dynamics. At the same time, it is being registered by different cultural, economic, scientific, legal, and conservationist groups in their efforts to understand the changes the oceans are undergoing. Noticing these pervasive transformations sets a whole new agenda, one that addresses human and nonhuman needs, with deep care, imagination, and far-sightedness." (source: ocean-space.org)

## CREATURES OF THE LINE

by Sonia Levy and Heather Anne Swanson
2021

The artist film "explores how desires for economic growth and linear progress have produced straightened forms in England's watery terrains and asks what risks are associated with the conversion of once-curvy and braided worlds into a linearised landscape. (...) As arteries of British Empire, canals linked Indian cotton fields to domestic textile mills, facilitating vast ecological transformations from monoculture agriculture in the colonies to industrial discharges in England's waters, soils, and air (...). Attempting to work from within muddy, submerged sites, rather than from grand narratives or "god's-eye" viewpoints, the work begins inside canals, telling stories from within the lines. Making use of the open-ended

sensibilities of ethnography and natural history, it raises questions about ecological transformations and their ties to infra/structures of global political economy." (source: sonialevy.net)

## LEARNING FROM POULATI

by DECA Architecture
2021–2022

"The installation is about water: The traditional water management methods of Poulati in the past and the stresses that the island's water supply is experiencing in the present. During the last twenty years, our architectural practice has taken us to most of the Cyclades where we have experienced firsthand how water is one of the most fragile and mismanaged resources on the arid island landscapes. We have understood that the current trend of touristic development is going faster than the bearing capacity of the islands. This realization has had an important influence on our design priorities, and it has also triggered our curiosity to research contemporary and traditional practices of water management." (source: deca.gr)

## COP 26 NOWCAST

by Open Weather (Sophie Dryer & Sasha Engelmann)
2021

"What would it mean to collectively image, and in doing so, reimagine the planet? To see its details and patterns from multiple perspectives and many situated positions? If we could each take a photo of our home from space, could we build a patchwork, an impossible view, another whole earth? On the first day of the COP26 climate conference in Glasgow, a network of people operating DIY satellite ground stations around the world captured a collective snapshot of the Earth and its weather systems: a 'nowcast' for an undecided future. Tuning into transmissions from three orbiting National Oceanic and Atmospheric Administration (NOAA) satellites, members of the network collected imagery and submitted field notes from their geographical locations. Combined, these contributions generate a feminist and fractal image of the earth." (source: open-weather.community)

## OPEN WETLAB

by Waag Futurelab
ongoing

"The Open Wetlab is a leading laboratory for biodesign, bioart and do-it-together biology. The lab researches biotechnologies and their impact on society and ecology. The Open Wetlab offers an annual Bio-Hack Academy, in which participants learn to set up their own lab using open hardware, conduct experiments, and reflect critically on the field of synthetic biology. The BioHack Academy runs annually on four continents (Europe, North America, South America and Asia) and is now being expanded to multiple countries through European collaboration in the Hybrid Lab Network." (source: waag.org)

## INDOOR GREYWATER SYSTEM

by Katherine Ball
2013

A DIT (do-it-together) manual for building a greywater system. It is based on the design of a system at Field Work, a public classroom at Portland State University. This indoor system uses mushrooms to clear water from a sink and plants to transpire the water into the air.
(source: katherineball.com)

## FERTILE FUTURES

by Andreia Garcia (head curator), Ana Neiva and Diogo Aguiar (deputy curators)
2023

"A vital element for human and non-human species, as well as a metaphorical and emotional element, fresh water is simultaneously political and economic. Therefore, it is urgent to have a public discussion about the protection, management, and future of this natural resource. These are global issues with dramatic manifestations in different areas of the Portuguese territory. Focusing on seven distinct hydrogeographies, Fertile Futures commissions young architects, in collaboration with experts from other areas of knowledge, to present propositional models for a more sustainable tomorrow, in non-hierarchical cooperation between disciplines, generations, and species." (source: fertilefuture.pt)

# C. METHODOLOGICAL FOUNDATION

**Planet B builds on a rich foundation of art & design research and is based on principles that support the kind of critical, unorthodox and open-ended creative work that – as we believe – the planet-to-come needs. Project work on Planet B is based on systems thinking, drafting of possible future scenarios and creation of artifacts or concepts that help to materialize them.**

## a. OPERATIONAL MODE OF PLANET B

As an institutional platform, Planet B broadens the existing studio system of the academy.

**Interdisciplinarity**: Planet B interconnects creative disciplines developed at UMPRUM as well as other scientific fields or domains of human activity. Theory and contextual knowledge will merge with practical work organically.

**Emphasis on research and process**: Project work will result in concrete outcomes, however, the process of research and practice is considered more important than formal and technical execution of the final object.

**Teamwork**: Everyone involved will use the knowledge and skills specific to their specialization, however, the aim is to foster collaboration and to temporarily “dissolve” these specifics into a new collective creative entity.

**“Diffused” leadership**: The coordinators of the project work will involve a variety of mentors from both artistic and non-artistic fields. The coordinators themselves will take on the role of “leading learners” rather than teachers.

# b. METHODOLOGICAL ESSENTIALS

**PRODUCTIVE NAIVETY**
A school is a place to learn and to experiment. We do not need to save the world – instead, we are here to ask relevant, difficult questions and to make bold, provocative propositions. In order to do so, it is useful to explore our own standpoints, experiences and understanding of a given problem – we all have a stake in it and therefore our views matter. Experts in different domains may find the ideas that we put forward naive or far-fetched, however, this may be a sign that our inquiries are insightful and our ideas brave and ambitious, reaching beyond the status quo of the present.

**DEALING WITH COMPLEXITY**
Complexity of the civilizational issues may be crippling. Problems we’re facing are often “wicked”, meaning they are constantly evolving, they imply and affect way too many stakeholders and therefore they can’t be precisely defined and fixed by one-dimensional solutions. Not everything can be solved by technology, although most likely, technology has to be part of a multi-layered response to ill-defined challenges. In order to design and deploy any intervention, systemic thinking needs to be applied – and in order to map a system, we may need to ask relevant actors relevant questions. Generally, though, art and design allow for indeterminacy and uncertainty to be acknowledged in the scenarios of the future and are able to navigate complexity with curiosity and unorthodoxy rather alien to standardized industrial or even scientific practices.

**DEALING WITH CROSS-SCALARITY**
Both the past and the future of Planet B transcend us greatly. When thinking about what is ahead of us, we need to take the unknown of long-term horizons into account and always keep them in mind – because regardless of the urgency of such a perspective, only few actually

take it on, and because imagination and prefigurative thinking is what characterizes the kind of practices we develop.

This goes hand in hand with thinking at a planetary scale as – for the time being – the planet represents the ultimate spatial limit of humanity and is already implied in all global projects (be it the market or the technological infrastructures). Large temporal and spatial scales should not be overlooked even in projects that primarily address the local or even the microscopic. Everything is connected and every intervention has a relevance for the whole.

**SYSTEMS, SCENARIOS AND STRATEGIC THINKING**
Project work on Planet B is based on exploration and observation that aims at a provisional understanding of systemic dependencies related to a given issue. We need to be mindful of the fact that our conceptualizations and descriptions of systems will always remain partial and inevitably incomplete – that, however, doesn't mean that the attempt to map actors and connections among them is not valuable in itself.

Drafting of possible future scenarios based on systems mapping enables us to consciously choose specific perspectives, account for uncertainty and uncover systemic ambiguities or implications of various events. They help us imagine distinct possible futures and identify opportunities for strategic decisions. Thus, they also make us see that such decisions require careful deliberation and difficult value judgements.

**PRAGMATIC SPECULATION**
Art and design act strongly in both material (concrete) and symbolic (abstract) domains. As such, they are apt to address civilizational issues that usually span across physical realities, cultural representations or political discourses. As creative practitioners we need to be mindful of the interconnectedness of these realms and of the fact that any symbolic gesture or speculative idea is politically charged and ultimately has material consequences. Whatever we speculate about is real and powerful and ideas can therefore be deployed as utilitarian and pragmatic. Thus, artists and designers can become relevant public servants and political agents.

**METHODOLOGICAL PROTOTYPING**
Entering a multidisciplinary space and aiming for research-based projects is an endeavor that in itself requires a lot of experimentation. Project work on Planet B therefore has a meta-level of a collective methodological reflection leading to a creation of a methodological prototype. Such a prototype can't be designed differently than on the go, through trials and errors, and will require further testing in the next cycles of Planet B.

# c. AQUATIC ALLIANCES: PROCESS & OUTPUTS

The project work related to the theme of Aquatic Alliances will consist of three main parts:

## 1. RESEARCH & SYSTEMS MAPPING (WEEKS 1–6)

The initial part of the process will be centered around **learning, observing and debating** different aspects of and approaches to more-than-water issues. We'll collect information and look for specific, situated problems that cannot be solved in a straightforward way (for example by a single technological innovation) and require a multi-layered response.

We'll look at various problems from a **multiscalar perspective**, while also being mindful of the fact that hydrological concerns are **dynamic processes** mediating between different "bodies of water". Water systems will be approached as webs of dependencies that require **political positioning and deliberation** over the problem of what is actually an "alliance".

At the end of this phase, we'll have assembled information and observations in various forms and media that will constitute a **collective database** of insights, ideas and newly emerged research questions.

## 2. DRAFTING OF FUTURES SCENARIOS (WEEKS 7–11)

Scenario Planning is an established methodology employed both in the business and policy contexts in order to **navigate complexity of the present and uncertainty of the future**. While managers and policy-makers usually opt for these tools because they need to reduce uncertainty and understand potential risks, we – as artists and designers – are not bound by the instrumental logic of "planning". However essential planning is, we have the freedom to employ scenarios primarily as **a means of critical exploration.** Our visions of the future may follow long time horizons, reflect diverse theoretical and value standpoints, and articulate radical, transformational propositions. As opposed to fairly static systems mapping, scenario drafting encourages us to ponder **temporal and political dynamics, ambiguities and conflicts** without necessarily resolving them once and for all.

A narrative scenario can be understood as a kind of **recomposition** of what is knowable into what is possible. A recomposition itself is a product of artistic or design research that exceeds the practice of "raising awareness" but doesn't strive to devise definite solutions either. In other words, a recomposition is a creative reframing and restructuring of available information that results in an articulation of a critical, convincing and innovative message that can inspire or induce further reflection, discussion or action.

The scenario planning process consists of several phases:
**a)** learning about a specific domain and mapping existing trends and tendencies in this domain
**b)** consideration of important future uncertainties that may shape the future in the domain in question
**c)** articulation of specific scenarios that may unfold in different versions of the uncertain future
**d)** reflection on the implications of the scenarios produced and deliberation over next steps

*For example, the authors of the* **Radical Ocean Futures** *project combined scientifically grounded scenarios with speculative storytelling to explore the socio-ecological futures of the world's oceans. After researching the trends in marine ecosystems and fisheries science, they established the main axis of future uncertainty in this domain: In ecological terms, they considered the possibility of a sustained future and, on the other side of the spectrum, an environmental collapse. In social terms, they looked at possible developments toward a connected and a fragmented global society. These conceptual constraints lead them to an articulation of four distinct scenarios titled "Fish inc.", "Back from the brink", "Rime of the last fisher" and "Rising Tide".*

In the case of Aquatic Alliances, the **overview (the STEEP analysis)** provided in the chapter Zooming Out: Water as a Planetary Medium together with **research outcomes** collected over the first weeks of the semester will form a basis of the scenario drafting itself. The problem space to focus on, however, needs to be narrowed down to a more **specific, situated issue** – such as the ones described in the chapter Zooming In: Selection of Aquatic Concerns, or other cases articulated by the project teams themselves. No matter the case of choice, though, the trends and facts described in the conceptual foundation need to be approached in a **critical way**.

Teams will conduct research of their chosen area and will test ways to represent (visualize, communicate) their findings in the form of maps, diagrams, images and other. Subsequently, teams will articulate **four distinct imaginative scenarios** related to their own research areas. The axis of uncertainty will be common for all groups and will be further specified. The scenarios will be articulated on a general level, but will also target the **political, social, economic and environmental contexts** of specific sites or situations. The outputs will have the form of **short texts** (possibly combined with maps, diagrams, sketches and other visual material).

In the final stage of the scenario drafting, the teams will focus on a **detailed elaboration** of one selected scenario. They will zoom in on the kind of aquatic world the scenario implies and create **situated artifacts, concepts or stories** that will enable us to partly experience given situations in their complexity. Each team will also consider the implications of the selected scenario and will draft a **conclusion** pointing out the main tensions, ambiguities, but also necessary next steps to support or avoid certain developments.

## 3. PRODUCTION OF FINAL OUTCOMES (WEEKS 12–15)

The final weeks of the semester and the “klauzura” period (January) will be dedicated to the production of the final output. As specified in the following chapter (Deliverables) the “minimal” final output will have the form of **a video** (while any supplementary outputs in any media are welcome). The video will present a **narrative sequence** of information, events and circumstances making up a scenario including a detailed elaboration of the specific concept / story / artifact as described above. Although the content will inevitably be **speculative and imaginative**, the video should present it in the form of a logical line of reasoning culminating with a set of **learnings and conclusions**.

# D. DELIVERABLES

## WORK-IN-PROGRESS DELIVERABLES

Over the course of the semester, work-in-progress deliverables will be required for the interim presentations.

**November 6, 2023** – Interim Presentations (internal) – conclusion of the general research phase; individual collections of data, insights and possible research questions

**November 30, 2023** – Interim Presentations (with guests) – outcomes of research focused on a specific area / issue chosen by a team and the four future scenarios related to this area

**December 16, 2023** – Interim Presentations (with guests) – elaboration of the one selected scenario and specification of the more concrete concept / story / artifact the team will focus on

The exact formats of the work-in-progress deliverables will be further specified later in the semester. Content to be presented at the interim presentations needs to be submitted one day in advance.

## FINAL DELIVERABLES

Final Deliverables need to be submitted by **January 14, 2024.**

Presentations of the final projects (Jan 23–25; exact date will be specified) will have the format of a symposium. The students will be asked to prepare a slideshow presentation documenting both the process and the outputs of their team project. Supplementary forms of presentation (e.g. an exhibition) will be discussed collectively later in the semester.

The following will be required:

**Final Project (per team)**

- **a video** (min. length: 7 min; exact format will be further specified)
- **a written abstract of the project** (200 words)
- **10 videostills** (for online presentation of the project)
- **written abstracts to all 4 scenarios** (min. 100 words each)

(supplementary outputs in any media are optional and will be welcome)

**Documentation of the Process (per team)**

- **a team report documenting the creative process** (min. 400 words) – the report should answer the following questions:
  *In retrospect, how would you describe the process of your research and practice? What were the main milestones & decisions?*
  *What was the main motivation to focus on the research area of your choice?*
  *What was inspiring and/or challenging about applying the scenario methodology?*
  *What was inspiring and/or challenging about working in a multidisciplinary setting?*
  *How would you describe the dynamic of collaboration within your team?*
  *What were the most challenging parts of the process and what would you do differently next time?*

- **15 pcs of visuals documenting the creative process** (screenshots, sketches, photos, sound recordings, video, diary entries...)

The final deliverables will be published on the website of Planet B and the ocean comm/uni/ty platform (hosted by TBA 21–Academy).

**Feedback**

All students will be asked to submit their feedback on various aspects of the program. The feedback forms are to be submitted at three distinct times: by Nov 10, Dec 23 and Jan 30. Feedback forms will be shared with the students during the semester.

# E. PROGRAM

## OCTOBER 2023

**• Oct 5 + Oct 9**
**Kick-Off Session**
Lectures covering the conceptual and methodological foundation of the semester
Introductions of participants

**• Oct 9, 6.30pm (online)**
**Andreia Garcia (architect & curator, Architectural Affairs, PT) + Space Transcribers (architects & researchers, PT)**
a talk about the Fertile Futures project developed for the Portuguese pavilion at the current Biennale di Venezia that focuses on selected water ecosystems in Portugal

**• Oct 12**
**Symposium on to the sciences of water systems**
with guests from the Czech Globe CAS, the Institute of Chemical Process Fundamentals CAS, the Institute of Planning and Development, the Department of Sanitary and Ecological Engineering CTU and others

**• Oct 16**
**Visit to the "smart landscape" of the Czech University of Life Sciences in Lány and a lecture by ecologist Tereza Hnátková**
introduction to innovative technologies for water and land management, a lecture on landscape monitoring

**• Oct 19 (online)**
**Workshop with biologist and activist Xavier Coadic (FR) – Part I**
the workshop will focus on the problem of environmental data (its collection, verification and critique for investigative and creative purposes)

**• Oct 23**
**Talk by and a walk with landscape planner Jan Richtr**
the focus will be on blue-green infrastructure and the relationship between water and vegetation in urban context

• **Oct 23, 6.30pm (online)**
**Frédéric Rossano (landscape architect, ENSAS / Strasbourg School of Architecture, FR)**
the talk will focus on the ambiguous relationship between humans, landscapes and floods, oscillating between conflict and symbiosis

• **Oct 25–27**
**Field trip to Southern Bohemia**
exploration of the artificial waterway Zlatá stoka and the Třeboň ponds, visits to the laboratories of algal biotechnologies Algatech and the institute of water and landscape management ENKI, lectures by landscape ecologists, historians and botanists, and more

• **Oct 30**
**Visit to the T. G. Masaryk Water Research Institute**
introduction to water and wastewater treatment and other water management issues

• **Oct 30 (online)**
**Workshop with biologist and activist Xavier Coadic (FR) – Part II**

## NOVEMBER 2023

• **Nov 6**
**Interim Presentations** (internal)

• **Nov 6, 6.30pm (online)**
**Alina Nazmeeva (artist & researcher, MIT / University of Michigan, RU / US)**
a talk exploring the complex relationships between natural processes, physical environments and their digital representations

• **Nov 9 (online)**
**Symposium on research and speculative approaches in the context of art, architecture and design**
artists, designers and architects will speak about their interdisciplinary practices related to the theme of the semester

• **Nov 13**
**Workshop with designer and media theorist Paul Heinicker (Ruhr University Bochum, DE)**
the workshop will focus on diagrammatical, visual representations of natural processes and the challenges such efforts entail

• **Nov 16**
**Workshop with Klára Pelousková**
the workshop will focus on the methodology of scenario planning

• **Nov 27, 4.30pm (online)**
**Susan Reid (cultural theorist, University of Sydney / Ocean Justice, AU)**
a talk about "ocean justice" and multispecies interdependencies in the context of marine ecosystems

• **Nov 30**
**Interim Presentations** (with guests)

## DECEMBER 2023

• **Dec 4**
Workshop focusing on possible employments of audiovisual media in the context of the semestral theme and brief (TBA)

• **Dec 16**
**Interim Presentations** (with guests)

## JANUARY 2024

• **Jan 23–25**
**Final Presentations** (with guests)

Mondays and Thursdays (9–4pm) are dedicated to teamwork, peer reviews, consultations with coordinators or guests and other impromptu activities. If not indicated, specific times of the events will be announced. Students will be notified about all changes or additional events and activities.

Students are advised to sign up for related classes at UMPRUM such as:
- Mikrobiopolitické občanství (Michaela Pixová)
- Produktová ekologie (Vladimír Kočí)
- Současná teorie a metodologie designu (Klára Pelousková)

## Image Sources (in the order of appearance):

### Conceptual Foundation

Storm: https://earthobservatory.nasa.gov/images/149494/storm-ravaged-madagascar-faces-another-storm, image by: Lauren Dauphin/NASA

Water under the microscope: https://www.pond5.com/stock-footage/item/90828345-drop-water-dirty-pond-under-microscope-multitude, image by: Shakir_R

Floods: https://www.reuters.com/business/environment/flooding-california-what-are-atmospheric-rivers–2023–01–16/, photo by: David Swanson/REUTERS

Wetlands: https://chinadialogueocean.net/en/conservation/12925-water-lands-picturing-the-worlds-wetlands-and-their-peoples/, photo by: José Sabino/Wetlands International

Floodplain: https://education.nationalgeographic.org/resource/flood-plain/, photo by: Paul Nicklen/National Geographic

Satellite image: https://www.stantec.com/en/ideas/how-satellite-image-fusion-and-machine-learning-can-help-us-monitor-large-water-bodies

Citizen science: https://www.theswimguide.org/2021/01/07/5-things-to-know-about-citizen-science/

Weather control: https://www.newscientist.com/article/2234991-we-really-can-control-the-weather-but-it-may-not-be-very-useful/, photo by: Joshua Aikins

Lithium mining: https://www.theguardian.com/commentisfree/2021/jun/14/electric-cost-lithium-mining-decarbonasation-salt-flats-chile, photo by: Iván Alvarado/REUTERS

Blue-green infrastructure in Prague: https://iprpraha.cz/assets/files/files/67fff716c533791b23d1dd66a5d691b7.pdf, images by: Yuliana Kostyunicheva, Barbora Lišková

Peri-urban park at the confluence of VItava and Berounka: https://www.earch.cz/revue/clanek/jeden-z-nejvetsich-primestskych-parku-ve-stredni-evrope-ma-vzniknout-na-soutoku-berounky-a-vltavy-soutez-vyhral-mezinar, image by: EMF, NORMA, PARETO

Zlatá stoka: https://trebonsko.nature.cz/publikace/-/asset_publisher/gq2S8VK4OPJK/content/zlata-stoka-publikace

Fish harvest: https://www.trebon.rybarstvi.cz/podzimni-vylov-sveta–2018-fotografie

Algae cultivation: https://mbucas.cz/en/research/detashed-centers/algatech/

## Reference Projects

(If a photographer's name is not indicated, it is assumed that the authors of the projects, alternatively publishers or associated institutions, are the authors of the images.)

Prospecting Ocean: https://tba21.org/OCEANS_Dialoges, photo: Giuila Bruno, https://tba21.org/ProspectingOcean-prints

4 Waters: https://ehcho.org/conteudo/4-waters

Making of Earths: https://digitaldemocracies.org/geocinema/, https://www.onassis.org/art/works/making-of-earths

Hidroscopia Loa: https://amlatina.contemporaryand.com/events/hidroscopia-loa/, https://www.claudiagonzalez.cl/projects/hidrosciopia-loa-cu/, photo by: Benjamín Matte

Salmon. Traces of Escapees: https://www.cooking-sections.com/Salmon-Traces-of-Escapees, https://www.serpentinegalleries.org/whats-on/climavore/

Sky River: https://vimeo.com/643064271

Data Garden: https://www.e-flux.com/announcements/513026/kyriaki-gonidata-garden/, https://kyriakigoni.com/projects/data-garden

Drought in the Delta: https://marcovermeulen.eu/en/projects/iabr+drought+in+the+delta/

Food Forest Fantasies: https://genomicgastronomy.com/work/2022–2/food-forest-fantasies/

WaterSchool: https://iabr.nl/en/tentoonstelling/exhibition_wsm4h, photo by: Aad Hoogendoorn, image by: Studio Makkink & Bey with Juhee Hahm

Room for the River: https://urbannext.net/room-for-the-river/

Red Mud: https://www.interprt.org/?global_tag=mediterranean-sea

MERA: https://www.youtube.com/watch?v=lyl89CHQsBk

Trees As Infrastructure: https://provocations.darkmatterlabs.org/trees-as-infrastructure-aa141acdf227

Microflows: https://www.umprum.cz/cs/web/ateliery/architektura/architektura-iii/atelier-architektury-iii-na-designbloku–2020

Cloud Studies: https://themeteor.org/2021/08/13/cloud-studies-filled-with-hope-not-hate/, https://www.stirworld.com/think-opinions-reimagining-architecture-cloud-studies-by-forensic-architecture-at-visual-carlow, photo by: Ros Kavanagh/Visual Carlow

Oceans in Transformation: https://www.ocean-space.org/exhibitions/territorial-agency-oceans-in-transformation

Creatures of the Line: https://interactingminds.au.dk/events/single-events/artikel/creatures-of-the-lines, https://radar.lboro.ac.uk/events/creatures-of-the-lines-cut-1-a-workshop/

Learning from Poulati: https://deca.gr/project/learning-from-poulati/

COP26 Nowcast: https://open-weather.community/cop26-nowcast/

Open Wetlab: https://waag.org/en/lab/open-wetlab/

Indoor Greywater System: https://katherineball.com/Indoor-Greywater-System, photos by: Nolan Calisch

Fertile Futures: https://fertilefutures.pt/en/, images by: Corpo Atelier

## Methodological Foundation

Radical Ocean Futures: https://radicaloceanfutures.earth/home#the-science

# About Planet B

Planet B: Module for Sustainability and Civilizational Issues is a space for experimental practice and teamwork at the Academy of Arts, Architecture and Design in Prague. It invites students of various artistic or design disciplines to engage with pressing challenges of today in a multidisciplinary setting.

In the winter semester 2023, Planet B is led by Klára Pelousková (Department of Design / Department of Art History and Theory) and Veronika Miškovičová (Department of Architecture).

Texts in the Conceptual and Methodological Foundations:
Klára Pelousková

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