Guidance
16

ethics in common

Referral

Exploration, exploitation and preservation of pristine or minimally anthropised environments

The deep seabed: a case in point

June 2024

INRAE • Cirad • Ifremer • IRD

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This Guidance was translated from the French by Glyn Orpwood (https://www.glyneltconsultant.com/profile).

Summary

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Text of the referral from the four CEOs

The exploration of natural environments that are currently unknown because they are inaccessible, and environments where there is little human activity, calls into question the "ethics of virginity"[1]. As Axel Kahn eloquently put it at the symposium "Ensemble, protéger la biodiversité marine: connaître pour agir" (Together, protecting marine biodiversity: knowledge to act upon)[2] organised by Ifremer and the Office Français pour la Biodiversité on 12 March 2020. The exploration of unknown or minimally anthropised environments can lead to their exploitation, which is rarely without consequences for biodiversity and the local populations. At the recent World Conservation Congress organised by the International Union for Conservation of Nature (IUCN[3]), we were reminded that *"pristine landscapes and seascapes must be fully protected from industrial-scale activities, including seabed mining"*[4].

The specific case of the "ethics of the commons"[5] is a subject of interest to INRAE, Cirad, Ifremer and IRD. For environments such as the deep seabed, it is at the heart of calls for a moratorium on the exploitation[3], or even exploration[6], of these ecosystems, as well as being the subject of negotiation on the protection of biodiversity in the high seas (*cf.* BBNJ[7]); it is also one of the many challenges of the United Nations Decade of Ocean Sciences for Sustainable Development[8]. This topic also covers other environments that are not easily accessible or are subject to human activities with only slight impact, such as the primary lowland forests of equatorial, tropical, temperate or boreal zones, as well as the polar regions. All these ecosystems, considered as reservoirs of terrestrial or marine biodiversity, are also under threat of major and irreversible alterations associated with global warming, *e.g.* fires, melting ice, thawing permafrost, which will shortly be accessible to exploration, or even human exploitation, with the risk of destroying species before they have even been observed and described. Last but not least, this subject provides an opportunity to make a comparison with "the ethics of individuals". Approached from an anthropological angle, it can be extended to issues at the human-nature interface, →

1. Remarks by Axel Kahn during his presentation at the conference "Together, protecting marine biodiversity: knowledge to act upon", *cf.* footnote 2,, cf. 2 **https://www.youtube.com/watch?v=DQz8Hyfra-Q** (from 1:37:58)

2. **https://wwz.ifremer.fr/journeebiodiversiteifremerofb/Revivre-le-colloque**

3. **https://www.iucn.org/fr**

4. **https://www.iucncongress2020.org/fr/programme/manifeste-de-marseille**; motions in preparation

5. Common, in the sense of "natural environments exploited by man", remarks by Axel Khan at the symposium, *cf.* footnote 2

6. **https://www.iucncongress2020.org/fr/programme/official-programme/session-43493**

7. Biodiversity beyond National Jurisdiction, **https://www.un.org/bbnj/fr**

8. **https://oceandecade.org**

→ notably for certain human populations who still live isolated from the rest of the world in primary tropical forests, where they find their own resources and shelter, and have established their unique culture; and more generally for indigenous people[9], or "First Nations", who maintain a special relationship with their lands and the natural spaces they occupy, as was highlighted at the recent IUCN World Conservation Congress in Marseille.

When it comes to exploring uncharted ecosystems and those where human action and imprint are slight, what are the responsibilities of the research organisations contributing to their knowledge for their preservation and future? How can we implement and apply the "*principle of deferred knowledge*", which Axel Kahn defined in March 2020 as *"an extraordinary prudence respectful of what deserves to be known, but which we have not yet protected sufficiently to guarantee that knowledge will not lead to degradation, without knowing how to stop it effectively and without sufficient collective appropriation*"[1]? These are just some of the central questions that we plan to raise with the members of the INRAE-Cirad-Ifremer-IRD Ethics in common committee.

9. **https://fr.unesco.org/indigenous-peoples**

Preamble

We advocate a procedure of reflection to clarify the ethical questioning of the different players involved in research, in response to a request for information on research in minimally anthropised environments. This was inspired by current questions about deep-sea exploration/exploitation. Our joint committee is faced with a fundamental challenge, as it brings together four institutions whose research areas are very contrasting in nature: agriculture, food, marine environments and development. As Axel Kahn noted in one of the last texts he wrote as Chairman of our committee, "*the aim of the ethics committee of our four organisations is to make avenues for progress available to governments, researchers and all personnel in this context of divergent and seemingly irreconcilable objectives, interests and analyses. There may be a path, but identifying it requires a method, and following it requires a will*"[10]. To meet this challenge, we have opted for an empirical approach, proceeding from the specific to the general. Instead of starting from general considerations of research ethics, which we would then apply to the case of minimally anthropised environments, we start from an in-depth investigation of the case of deep-sea research, in order to identify ethical issues that can be integrated into a general reflection on the exploration and exploitation of minimally anthropised environments. In our view, this approach is more effective than that of applied ethics in taking into account the context and practical conditions of research, and firmly places ethical reflection in concrete situations. We therefore propose a first section devoted to deep-sea investigation, from which we have identified two major ethical issues of relevance.

The first concerns the interests at stake in research and the risks involved in exploration, which may prove greater than the risks associated with forgoing exploration and the potential associated knowledge that can be gained. Given the practical challenges of exploring minimally anthropised environments, current concerns about the scarcity of natural resources and warnings about the extinction of biodiversity, does it make sense to embark on the conquest of a final frontier?

The other concerns the reasons behind the research: minimally anthropised environments - space, the deep sea, the poles - are often treated as the common heritage of mankind. But what does this common status mean? What does it exclude? What does it entitle us to do? How can we prevent the plundering and destruction of fragile environments that play an essential role in the climate of the planet? →

10. Axel Kahn, joint preface to Guidance 13 and 14 on "Human needs, natural resources and preservation of the biosphere", entitled "Ne pas se résoudre à l'irréductibilité des contradictions".

Exploration, exploitation and preservation of pristine or minimally anthropised environments

The deep seabed: a case in point

→ The guiding principle of our approach is to place the ethics of research as a core concern in line with our vocation, as in the case of the question of how research should relate to environments described as "minimally anthropised", and in particular the deep seabed. It should be noted from the outset that we do not propose to deal here with questions of environmental ethics in general, which would include, for example, the issues of tourism, trade, heritage management or the limits to be imposed on the anthropised world, but with the questions that the researchers of the four organisations are constantly confronted with in their specific scientific approach. Our aim is not to provide turnkey ethical solutions, but rather provide conceptual procedures that will enable those involved in research to clarify for themselves the ethical issues at stake in their scientific approach.

I. I. Ethical questions of deep-sea exploration[11]

I.1 Why deep-sea exploration?

This choice is dictated by the pressure of the current context. In July 2020, the report of the Mission "Stratégie nationale d'exploration et d'exploitation des ressources minérales dans les grands fonds marins" was published after being commissioned in November 2019 by the Secrétariat Général de la Mer. In October 2021, as part of the "France 2030" investment plan, President Macron announced that he was investing 300 million euros in "the field of the deep seabed", "for a better understanding of living things". In March 2022, several exploration missions were approved as part of "France 2030", including one involving drones sent to depths of over 6,000 m (exploitation is not planned, but "it is not ruled out a priori in the long term"). In June 2022, the Senate Information Mission on "The exploration, protection and exploitation of the seabed: What strategy for France?", published its report "Abysses: The final frontier? At the same time, in February 2022, the French Ministry of the Armed Forces published its strategy for "mastering the seabed", with the aim of creating or consolidating a French base capable of acting in this field (being able to intervene, protect underwater infrastructures or protect against illicit exploitation). On several occasions during 2022 (*e.g.* One Ocean Forum, Brest; United Nations Oceans Conference, Lisbon; COP27, Sharm-el-Sheikh), President Macron supported a "ban on all exploitation of the seabed", basing his strategy "solely for scientific exploration, by Ifremer and the CNRS, to understand and better protect our oceans", as explained by Mr. Berville, Secretary of State for the Sea. On 17 January 2023, members of the French National Assembly voted by a large majority to ban deep-sea mining. At the 28th session of the Council of the International Seabed Authority (ISA), which ended on 31 March 2023 in Jamaica, France spoke on behalf of 13 states, calling for the formation of a broad coalition of nations to oppose deep-sea mining. Opposition to deep-sea mining, whether through a ban, a moratorium or a precautionary pause, is supported by 24 countries. France has the most restrictive position.

I.2 The current situation

A hidden world

The deep sea encompasses the vast oceanic domain beneath the euphotic layer which is the upper well-lit layer of the ocean.
It starts at around 200 meters below the surface and extends to the ocean floor, reaching depths of over 11,000 meters in the Mariana Trench, the deepest point on the planet. This extreme environment is characterised by enormous pressure, near-freezing temperatures and limited availability of nutrients. →

11. See the sources used for this section in Appendix 1.

Exploration, exploitation and preservation of pristine or minimally anthropised environments

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For the purposes of this Guidance, the deep seabed is defined as the area beyond a depth of 1,000 meters, which can extend to depths of over 11,000 meters in the oceanic trenches[12]. This vast inhospitable zone (covering a surface area of around 320 million square kilometers) is difficult to access and totally devoid of sunlight. Moreover, the environment is aphotic, making it unsuitable for photosynthesis[13]. Temperatures are relatively stable between 0.5°C and 4°C, pressures are extreme and dissolved oxygen levels are low. Despite the challenges of access, the deep sea is home to a wide range of unique and often strange forms of life, from bioluminescent organisms to the giant tube worms that survive near hydrothermal vents, and even bacteria capable of thriving at extremely low light intensities thanks to geothermal conditions. The deep seabed is made up of a variety of landscapes and ecosystems. Structurally, we can distinguish between abyssal plains (between 2,000 and 5,500 meters deep), which account for 80% of the deep ocean and are essentially made up of sediments, hydrothermal vents (black and white smokers) located near ocean ridges in areas of magma upwelling, volcanoes, seamounts, canyons and hadal trenches in subduction zones.

12. No direct account is taken of benthic and suprabenthic environments, or of ecosystems in the water column, *e.g.* mesopelagic.

13. There are, however, some exceptions. A few years ago, it was discovered that photosynthesis can take place in environments illuminated by geothermal conditions. Green sulphur bacteria from a deep-sea hydrothermal vent are anaerobes that need light to develop. They are able to develop by photosynthesis at extremely low light intensities (Beatty *et al*., 2005).

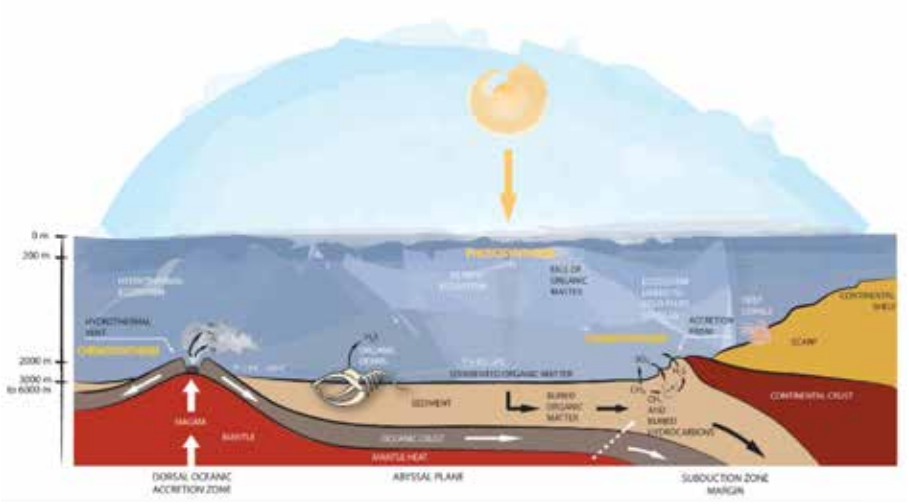

Figure 1. *Cross-section of the ocean illustrating the different deep-sea ecosystems*[14]

Deep-sea ecosystems: a wide range of habitats

• **Oceanic ridges with hydrothermal vents** (hot and cold) are remarkable, highly complex and emblematic ecosystems in the deep ocean, whose basic metabolism relies on the use of chemical energy (as opposed to solar energy) by the microorganisms that live there. These extremophilic microorganisms can use hydrogen sulfide or methane transported by hydrothermal fluids to produce organic matter, usually through symbiosis, that in turn provides matter for other organisms of the meio- and/or macro-fauna (tube worms, mussels, shrimps, crabs). These ecosystems are characterised by low diversity but high biomass, the presence of ingenious species living in symbiosis, and high temporal instability.

• **Seamounts** are submerged geological structures formed by volcanic activity. They are located in various oceans around the world and play a crucial role in ocean ecosystems, providing unique habitats for a wide range of marine species. They also have potential as deposits of mineral reserves, particularly cobalt. The geological processes that form seamounts often lead to the concentration of cobalt and other key minerals such as manganese, nickel and rare elements. These minerals, with the exception of rare elements, are generally found as crusts or nodules on the surface of seamounts, making them potential targets for deep-sea mining operations.

Beyond their mineral wealth, seamounts are also hotspots of biological richness and diversity. Their complex topography and nutrient-rich currents create ideal conditions for the growth of diverse marine life, including numerous species of fish, corals, →

14. Extract from Sarrazin & Desbruyeres (2015)

→ sponge beds and invertebrates. Seamounts play a crucial role in attracting large pelagic fauna. These structures are hotspots for biodiversity due to their complex topography and nutrient-rich currents. They are essential habitats and feeding grounds for a variety of marine species, including marine mammals, sea turtles, pelagic seabirds, sharks, tuna and other large fish.

• **Abyssal plains** receive organic matter from detrital inputs from the ocean surface. They are home to a wide diversity of species, albeit at a low biomass density. These plains are inhabited by fixed suspension-feeding fauna and numerous micro-organisms that play a role in metal mineralisation.

• **Reefs and cold deep coral gardens** located on continental margins and seamounts exist in an environment of cold water (<14°C) and currents. Their detrital nutrient supply comes from the surface. These corals form clusters that serve as refuges, nurseries and food sources for a multitude of species.

• **Aggregations of deep-water sponges**, which thrive in the deep ocean, especially seamounts, canyons and continental shelves, form unique and complex habitats. These often- ancient sponges grow in a variety of shapes, such as fans, cups or branching trees, creating complex structures. Their habitats are rich in marine life. Sponges filter nutrients from the water and maintain a diverse ecosystem of small invertebrates, bacteria and even certain species of fish. These colonies are essential for marine biodiversity, providing shelter and food in the somewhat sterile environment of the deep sea.

• **Deep-sea canyons**, carved out of the ocean floor, are remarkable geological formations. These steep-sided valleys, which often extend thousands of meters below the surface, are hotspots for marine biodiversity. Formed by ancient river systems or as a result of tectonic activity, they exhibit unique geological features such as vertical cliffs, overhangs and complex sedimentary structures. These canyons are home to diverse ecosystems, from hardy deep-water corals and sponges to fish and invertebrate species adapted to the dark, high-pressure environment. Nutrient-rich currents flow through these canyons, supporting life and enabling dynamic communities to exist. The interplay between the dynamic geology of canyons and the rich array of life forms they harbour, makes these deep-sea environments essential to our understanding of ocean ecosystems and the Earth's geological history.

• **Cold springs**, located on continental margins, emit hydrocarbon-laden fluids, including methane. Sulfides and methane are produced and used by microbial consortia through chemosynthesis. These ecosystems are characterised by sparse biological diversity and high animal biomass.

• **The carcasses of large marine animals** (whales, sharks) or wood debris that sink to the bottom of the oceans can constitute massive organic inputs that serve as food for a succession of organisms, enabling the creation of highly diverse ecosystems over several decades.

In conclusion, even if 95% of deep-sea ecosystems remain unexplored in relation to their surface area, it is estimated that they contain a rich biodiversity adapted to extreme and variable environments, based on the 5% known.

I.3 Why explore these environments?

Unparalleled biological diversity

These environments are ecologically significant, harbouring a rich biodiversity that is essential not only for the health of ocean ecosystems, but also for our understanding of the evolution of living organisms. In a sense, the seabed is a snapshot of evolution and the origins of life. The challenge is to understand how ecosystems function and how they evolve.

It has often been said that deep-sea bioprospecting could lead to the discovery of new genetic resources and new compounds (particularly enzymes) with promising applications in health, industry and the environment. In addition to cataloguing diversity, facilitated by recent advances in environmental DNA analysis, we still need to understand how organisms function, their interactions and resilience, as well as their role in the planet's major geochemical cycles, in the ocean's carbon pump and, more broadly, in climate regulation. However, as this exploration of marine biodiversity mainly concerns microorganisms that can be sampled and then cultivated in research laboratories, this type of research appears minimally intrusive for the ecosystem, with only a slight impact on the environment. It must also be said that the cultivation of these microorganisms is not trivial and may require complex and time-consuming technical developments. A large number of patents are filed on the basis of the promise of genetic resources in hydrothermal springs, without addressing the issue of intellectual property and the equitable sharing of the benefits derived from these potential resources.

Highly coveted mineral resources (EEZ and Zone[15])

In the current race to acquire the raw materials needed for certain technological developments, three types of marine mineral deposit are of particular interest to manufacturers.

• **Polymetallic nodules** are found on the seabed of abyssal plains, often partially covered by fine sediments. They contain a wide variety of metals, including manganese, iron, copper, nickel, cobalt, lead and zinc, as well as minor but significant concentrations of molybdenum, lithium, titanium and niobium. →

15. Unlike Exclusive Economic Zones (EEZs), which consist mainly of the extended continental shelf under the authority of individual states, the 'Area' refers to the high seas beyond national legal zones (*i.e.* 64% of the ocean's surface area). It comes under the International Seabed Authority, which alone has the power to issue authorisations for exploitation (Fondation de la Mer, 2022).

→ • **Cobalt crusts** accumulate on seamounts at depths of between 400 and 7,000 m. They are formed by the precipitation of minerals from seawater, and contain iron, manganese, nickel, cobalt, copper and various rare metals, including rare earth elements.

• **Polymetallic sulphides** located on hydrothermal vents are rich in copper, iron, zinc, silver and gold. These deposits formed over thousands of years as a result of hydrothermal activity, when metals precipitated from water were extracted from the earth's crust through hot springs at temperatures of up to 400°C.

• **Rare earth elements**, also known as rare earth metals, are a group of seventeen chemical elements on the periodic table. They are not really rare in terms of abundance, but they are essential for the manufacture of electric car batteries, X-ray equipment and smartphone chips.

I.4 Debates surrounding the exploitation of deep-sea mineral resources

In the face of the growing pressure on terrestrial mineral deposits and the increasing demand for rare earth metals due to the ecological and digital 'transition' (batteries for electric cars, drones, MREs, solar panels, consumer electronics, medical equipment, telecommunications, etc.), industry and certain governments are advocating the commercial exploitation of deep-sea minerals as the new Eldorado.

The proponents of mining take advantage of Objective 14 of the Sustainable Development Goals: '*Objectives relating to the protection of aquatic life*'. This is a paradoxical debate, since the exploitation of these mineral resources would involve the deployment on the seabed of tracked vehicles, in the case of polymetallic nodules on the abyssal plains, or of vehicles to harvest, that would break or sever the mineral deposits in order to detach them from their support in the case of cobalt-rich crusts and polymetallic sulphides. The extracted materials, once mixed with seawater, would then be brought to the surface by a pumping system, then processed on board a mining vessel and finally transported ashore by barge. This technology, which is destructive to the ecosystems concerned, would also produce a plume of sediment that would persist for thousands of years. This plume of sedimentary debris would inevitably affect the entire water column and could interfere with the plumes of fluids emitted by the hydrothermal springs, causing lasting disruption to the habitat, as a 2017 study points out: "the major impact envisaged would be the lasting destruction of the habitat and associated fauna during the ore collection phase. This phase will be accompanied by the formation of a cloud of fine particles that could modify the turbidity and chemical composition of the water column[16]." In addition, the exploitation of deep-sea mining resources could certainly have an as yet unknown detrimental impact on carbon sequestration by the ocean, which absorbs and then stores the CO_2 emitted into the atmosphere through

16. Sarradin *et al.* (2017)

two phenomena, the physical pump and the biological pump: the CO_2 dissolved in surface waters and then sequestered at depth could rise to the surface as a result of the turbulence created, and the storage of CO_2 by living organisms would be reduced as a result of the disappearance of the biodiversity associated with these areas.

Moreover, the real economic viability of an industrial sector exploiting deep-sea mining resources has not been proven as a way

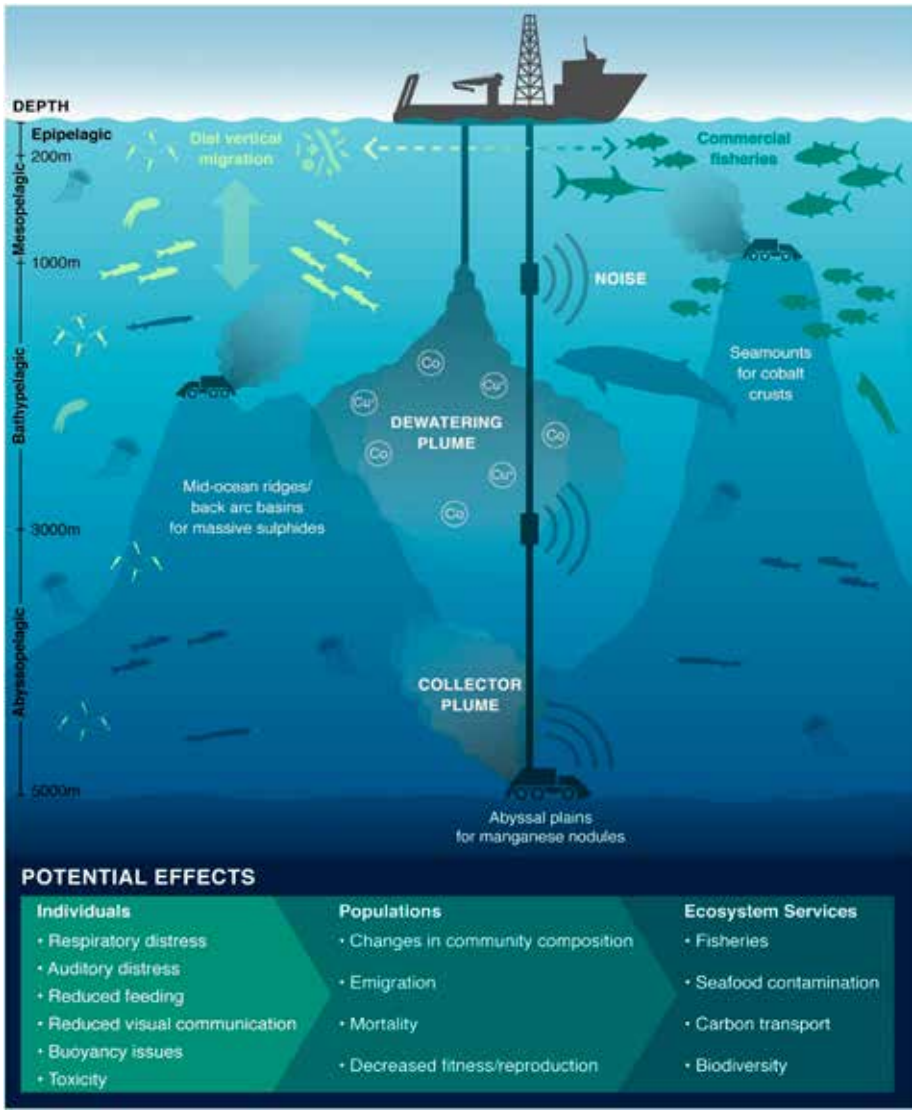

Figure 2. ***Mining-generated sediment plumes and noise have a variety of possible effects on pelagic taxa. (Organisms and plume impacts are not to scale.) Image credit: Amanda Dillon (graphic artist).***[17]

17. Figure in Drazen *et al.* (2020)

→ forward to ensure the energy and digital 'transition'. In addition to the undeniable environmental cost of deep-sea mining, there has been no study of the societal cost/benefit balance undertaken. And yet, the operating and processing costs are undeniable (manufacturing costs, carbon costs, the cost of transporting and operating equipment and ships to access the deep seabed, the cost of processing nodules and waste, the life cycle of the sector), as well as the cost of the environmental monitoring that would have to be carried out. Other avenues need to be examined and pursued, such as recycling, sobriety, changes in behaviour and the emergence of new technologies that are independent of or at least less dependent on metals and rare earth elements.

Finally, to avoid being impulsive and to encourage a certain degree of humility, it would be wise to note the time scale involved: it takes hundreds of millions of years for these sediments to be formed and they are destined to endure; compare this with our immediate and perhaps transitory needs, dictated by the demands of a new form of industrialisation with little concern for equity. This highlights just one of the many reasons why any intervention on the seabed must be carefully considered beforehand.

I.5 International legal and regulatory frameworks

In 1970, three years after the courageous and visionary speech by Maltese diplomat and jurist Arvid Pardo on 1 November 1967, the United Nations (UN) General Assembly declared that *"the seabed and ocean floor and the subsoil thereof, beyond the limits of national jurisdiction, and the resources thereof are the common heritage of mankind"* (General Assembly Resolution 2749 (XXV)). In his speech, Pardo called for international regulations to maintain peace at sea, combat pollution and preserve marine resources. His proposal to consider the seabed as a shared heritage was taken up in Article 136 of the United Nations Convention on the Law of the Sea.

• **The United Nations Convention on the Law of the Sea (UNCLOS):**
The United Nations conference convened in Montego Bay (Jamaica) with the signing of a Convention on 10 December 1982 which came into force on 16 November 1994, following ratification by the 60th State. France ratified the Convention on 11 April 1996. The European Union ratified it in 1998.
The Convention defines a global legal regime for the world's oceans and seas, setting out detailed rules for all uses of the oceans and access to their resources. It brings together in a single document the traditional rules relating to the uses of the oceans and, at the same time, introduces new concepts and legal regimes and takes account of new concerns. The Convention also provides a framework for clarifying certain specific areas of the law governing the sea.

• **The application of the Nagoya ABS Protocol to Exclusive Economic Zones (EEZ):** In 1991, the Convention on Biological Diversity (CBD) defined, within the framework of an international treaty, the objectives and main principles of: i) the conservation of biological diversity, ii) the sustainable use of biological diversity and iii) the fair and equitable sharing of the benefits arising out of the use of genetic resources. Subsequently, the Nagoya Protocol, adopted in 2010 and which came into force in 2014, sets out the implementation of access and benefit sharing linked to the use of genetic resources (ABS). The protocol has so far been ratified by 165 countries, including France. It aims to ensure the fair and equitable sharing of the benefits arising from the use of genetic resources (GR) and the traditional knowledge associated with these resources. As far as the marine environment is concerned, the Nagoya Protocol applies to each State within its EEZ and, if necessary, where extensions to the continental shelf have been validated. Some EEZs include deep-sea areas (France, Portugal, Norway, Ireland, etc), so the exploitation of genetic resources in these regions falls within the scope of the Nagoya Protocol for those countries that have ratified it[18].

• **BBNJ (Biodiversity Beyond National Jurisdictions)** is an international initiative focused on the conservation and sustainable use of marine biological diversity in areas beyond national jurisdiction. This generally includes the high seas and the seabed outside the exclusive economic zones of countries.
Negotiations on the BBNJ were concluded in 2023. The High Seas Agreement, which is a key element of the BBNJ, was finalised in March 2023 and formally adopted by UN member states in New York on 19 June 2023.
This landmark agreement is an important addition to the United Nations Convention on the Law of the Sea (UNCLOS) and has been a priority for the European Union and its Member States.
The BBNJ agreement puts in place a procedure for establishing large-scale marine protected areas in the high seas, thus facilitating the attainment of the target of conserving and managing 30% of the land and seas by 2030, agreed under the Kunming-Montreal Global Biodiversity Framework. It also includes the sharing of benefits arising from marine genetic resources, clear rules for the conduct of environmental impact assessments, and provides for capacity building and the transfer of marine technologies between the relevant parties. →

18. It should be noted, however, that the application of the Nagoya Protocol to Exclusive Economic Zones (EEZs) and, in particular, to the extended continental shelf is a complex issue. These zones have a different legal status to those located within a country's territorial limits or on the high seas. The application of the Nagoya Protocol in these areas may be subject to the specific legal frameworks and interpretations of each State. In addition, there may be complexities and challenges in applying the Protocol in these areas, particularly in relation to transboundary or migratory genetic resources.

→ The BBNJ agreement will enter into force 120 days after the deposit of the 60th instrument of ratification or approval with the UN Secretary-General. The European Union has pledged to support the ratification of this treaty and its swift implementation through various programmes, and has encouraged the members of the High Ambition Coalition for BBNJ to do likewise.

• **ISA:** The International Seabed Authority (ISA) is a UN organisation set up in 1994 to organise and regulate the mining of the seabed which is the common heritage of mankind. Its headquarters are in Kingston, Jamaica. The Authority is composed of 168 members, representing all the parties in the United Nations Convention on the Law of the Sea of 1982 (known as the Montego Bay Convention). It issues exploration and exploitation permits to governments, which in turn deal with private mining companies. Ifremer has a strong presence within the ISA. It contributes its technical and environmental expertise to the French delegation, which is helping to draw up the mining code. Ifremer is thus helping to establish the legal and environmental framework of the ISA[19] and has been granted two exploration contracts (the Mid-Atlantic Ridge and the Clarion-Clipperton Zone in the eastern Pacific). The ISA is entrusted with two mandates, the coexistence of which is problematic as they are potentially conflicting: to regulate the mining industry and to protect deep sea environments, the common property of mankind. Concomitantly, the Authority has a business model to one day becoming self-financing through a levy on the profits generated by the marketing of extracted minerals. For several years now, the ISA has been working at a 'UN-like' pace to draw up a mining code that will specify the environmental standards to be met. Under pressure from society, in particular environmental NGOs, news on this subject has recently come to the forefront and received a great deal of media coverage. To date, 22 States have proposed adopting a moratorium or a pause on this exploitation in order to give research time to carry out in-depth environmental impact studies, bearing in mind that, according to the ISA statutes, the adoption of such a moratorium requires the approval of 111 countries. To date, the ISA has not issued any mandate for exploitation, but the debates at the last meeting in July 2023 were very heated between representatives of the States in favour of a moratorium and those in favour of immediate deep-sea mining. A case in point is the island nation of Nauru, official sponsor of the disreputable mining company The Metals Company, which applied to the ISA for a mining licence in 2021. The Republic of Nauru has made use of a legal loophole in the ISA, the '2-year rule', after which a mining mandate is acquired by default. This situation has led to an outcry from the scientific community, the IUCN and the European Parliament, with the aim of mobilising the Member States to rapidly adopt a moratorium on exploitation.

19. Proceedings of the Seabed Fact-Finding Mission - hearings of 5 April 2022.

In conclusion: this investigation into the case of the deep seabed reveals a very strong tension between three legitimate value-adding systems:

- the desire to explore these uncharted and highly complex ecosystems (epistemic interest);
- the promise of finding potential solutions for the ecological transition (technological interest);
- the concern not to disturb these environments and to avoid irreversible damage (ecological interest).

It is the intertwining of these three motives that poses the problem. Should these environments be valued as ecosystems (to be explored), as resources (to be exploited), or as ecosystem services (to be preserved)?

II. The stakes for knowledge and the risks of exploration

Minimally anthropised environments, which are often mysterious and difficult to access, are generally seen as the "final frontier" of our planet and a promise of new resources to be explored and exploited. But this common vision needs to be questioned in the light of the practical conditions of current research.

Research is faced with contradictory requirements: the attachment to the intrinsic value of knowledge that characterises the culture inherited from Greek antiquity is undermined when access to knowledge becomes dependent on costly techniques - in ecological and financial terms - and on a political and economic regime that is likely to impose its purposes, its actors and its temporality. It is thus inevitably involved in a web of incentives, interests and tensions between opposing forces.

II.1 The stakes for knowledge

In order to clearly define the ethical problem raised by gaining knowledge of minimally anthropised environments, we propose the notion of the stakes for knowledge[20]. It brings together the basic orientations of all research, as defined by the different players involved. These are not just material or strategic stakes. For example, knowledge for knowledge's sake is a powerful stake, associated with the satisfaction inherent in intellectual curiosity which is a widely shared aspiration, particularly among scientists. In the case of the seabed, the cognitive challenge is heightened by increasingly powerful and sophisticated techniques that make it possible to observe highly original ecosystems and to understand the ecological and evolutionary processes that take place there. In this sense, all knowledge is fraught with challenges. The crucial point is that the stakes for knowledge are inevitably multiple: we can seek knowledge to understand, but also to preserve, to use, →

20. A related concept is that of 'meaning' proposed by the philosopher Philip Kitcher (2001)

→ to imitate, to inform, to warn, to sound the alarm, to exploit, to teach, to act or to legislate; to name but a few.

Because it is multi-faceted, the notion of the stakes for knowledge leads to an over-narrowly utilitarian vision of research, by exposing a whole range of stakes that can claim their own legitimacy: for example, understanding in order to preserve biodiversity does not respond to a utilitarian interest in knowledge, but to the interest of valuing living things for their own sake - this respect for a value is totally unrelated to utilitarianism. This concept therefore makes it possible to link the knowledge itself with the different visions of the world held by the stakeholders involved in this research. In all these cases, research responds to multiple and varied stakes for knowledge. It is essential, from an ethical point of view, to highlight them in all their plurality and diversity, including their conflictual nature. The widespread use of public/private partnerships in research programmes is exacerbating these tensions.

This first part of the ethical question therefore involves *untangling the web of different stakes for knowledge*, those of scientists as well as those of participants from outside research (who may, for example, have a cultural interest in promoting their vernacular knowledge as well as sharing their knowledge), and last but not least those of the research sponsors, who have a duty to steer the research in line with their own agenda. It must be possible to clarify the issues of all the stakeholders.

Nevertheless, it is essential to keep track of the players involved in the various *stakes* on a long-term basis[21]. In the course of their research, some of them may chop and change their interests. Finally, it is important to be transparent about the issues that drive decisions. Openly stated stakes are sometimes mere rhetoric and, especially in the case of collaborative research with agents from outside research organisations, may conceal implicit or unspoken stakes for knowledge, which may be exploiting the research for undeclared

21. The notion of the "stakes for knowledge" must be carefully distinguished from two closely related notions. The first is motivation, a psychological concept that refers to the subjective aspirations of those involved, from researchers to the heads of organisations and programmes. However, the *subjective motivation* of a researcher may be different from the stakes for knowledge that their motivation serves: he or she may - often - be motivated by the intrinsic value of knowledge, whereas this motivation is put at the service of an issue that is not knowledge as such. Symmetrically, the stakes for knowledge may be independent of a motivation: the sponsors of a research project may aim to exploit an area, without their motivation corresponding to these stakes (they may be motivated by the reputation that the research will bring them, and not by the desire to exploit it). Subjective motivation therefore does not necessarily correspond to the notion of knowledge stakes, even if overlaps are possible. The second concept to be distinguished from knowledge challenges is that of research goals, although here too there are possible overlaps. The purpose of a research project - which is made explicit, unlike the motivations, which are more often than not implicit - may be simply to gain knowledge, but it may also serve other goals for knowledge, such as ensuring the supremacy of a country. In this case, the aim of the project is knowledge, but the knowledge issue that guides this aim (which guides the research itself) is politico-strategic.

ends or a hidden agenda. The discrepancy between the two is often acutely perceived by researchers, and requires specific ethical reflection.

II.2 Distinguishing between the value of knowledge and the consequences of acquiring it

In the tradition of the Enlightenment, the major interest of knowledge is the emancipation of citizens. The fundamental idea is that knowledge frees one from servitude, and that an educated mind becomes an autonomous mind[22]. However, we need to distinguish between knowledge as a value - better to know than not to know, who could deny this? - from the process of acquiring knowledge. Knowledge, yes, but at what price? That is the question. The first discussions on knowledge "at any price" arose in biomedical research, where certain experimental practices were banned for moral reasons of infringement of human dignity and in turn animal welfare.

Another type of questioning has developed in the field of space research, which is apprehensive about the financial and environmental cost of its research. This is borne out by an unsolicited contribution from several hundred researchers to the CNES (Centre national d'études spatiales - National Centre for Space Studies) forward study[23]. The signatories point out that equipment is costly and also consumes energy and raw materials, and indirectly contributes to global warming. Other members of the community oppose the economic (space tourism), military and geostrategic interests that drive space research[24]. The questions may be forward-looking in nature. In the 2010s, official bodies such as the US National Academy of Sciences, the UK Royal Society and France's Agence Nationale de la Recherche are questioning whether geoengineering should be included in the climate change research agenda[25]. The doubts relate to the environmental and political consequences, as well as to the players in charge of the trials. These examples suggest that the question "should we be seeking knowledge at all costs" concerns i) the assessment of the environmental impact of the research process; ii) the conditions under which the research is carried out.

Assessing the impact of research

This practice has already been recommended by several bodies such as the ISA. Before undertaking any research, the impact of →

22. See Kant - Qu'est-ce que les Lumières ? 1784, Gallica - les Essentiels Littérature, **https://gallica.bnf.fr/essentiels/anthologie/lumieres**

23. "Minimising the environmental impact of scientific space projects", contribution by 260 researchers to the CNES 2024 foresight seminar on the "Environmental footprint of scientific space activities".

24. Lachièze-Rey (2023)

25. For France, see Boucher *et al*. (2014)

→ its carbon footprint and its potential environmental, societal and geostrategic consequences on the subject of the study needs to be assessed. It is essential to give priority to cases where new knowledge can be acquired through modelling, data analysis or processing existing images, without necessarily involving direct physical exploration of the environments in question. Such an assessment calls into question the responsibility of research communities that risk worsening the climate situation, but also the failure of these communities in the quest to provide solutions.

It is now accepted that research can be halted if it is likely to have an irreversible impact on its subject or if it increases social inequalities and infringes on fundamental rights.

Assessing the conditions of research

Whatever value we place on knowledge, we need to consider the conditions under which it is acquired. A "society based on knowledge" or "an economy based on knowledge" established by the European Community's science policy following the Lisbon Agenda in March 2000, values knowledge as a means to an explicit end: "To become the most competitive and dynamic knowledge-based economy, capable of sustainable economic growth with more and better jobs and greater social cohesione[26]". In this case, knowledge may be a blessing, but it is not an end in itself: it is a means to an end, the conquest of markets, leadership and power. Thus, reconfigured in the context of economic competition, knowledge has lost its intrinsic value. It has an extrinsic value as a means to an end, which may be the exploitation of resources revealed by exploration. Knowledge is treated as a lever for growth, a form of intangible capital, a more powerful means of production than tangible or material capital. The interests promised by this capital are not, strictly speaking, epistemic interests - fruitful, enriching knowledge for the individual and the community - but rather economic or political interests. The question then becomes: does such an end justify all means, especially if these means risk disturbing or even destroying the environment in question? The value of knowledge must now be weighed against other values, such as the biodiversity and the Earth's habitability. Echoing Kant's injunction to "dare to know", shouldn't we in some cases "dare to forgo certain knowledge if the cost of acquiring it is too high"? Wondering whether it might not be better to renounce exploring a few rare environments that remain sparsely populated is not necessarily condemning oneself to ignorance. Rather, it means admitting that to know is precisely to be able to assess the price of the information we are seeking to obtain. And this leads us to favour

26. "Lisbon European Council: Presidency Conclusions", European Parliament, 24/03/2000. **https://www.europarl.europa.eu/summits/lis1_en.htm**

quality research that is public, transparent and open, incorporating the notion of assessing the price of the new information sought[27].

II.3 How to reconcile the benefits and risks of explorations?

The ethical assessment of research is all the more desirable because some people object that not undertaking research is tantamount to not responding to the challenges posed by demographic pressure, the scarcity of resources or climate change in the case of geoengineering. It would be a form of non-assistance to humanity in danger. Faced with such an array of stakes for knowledge, can we hope to base decisions on an assessment of the benefit/risk trade-off? This would seem to invite a comparison of the risks associated with the condition of ignorance and the condition of knowledge.

The risks of ignorance

Lack of knowledge about minimally-anthropised environments can lead to under- or over-estimation of the resources they contain. This can lead to unforeseen and potentially irreversible environmental and climatic damage. We risk inadvertently causing damage that could have been avoided or mitigated with better information.

Ignorance of the potential environmental, social and economic consequences can lead to indulgent or restrictive regulation, thereby compromising the sustainable management of environments with low levels of human activity. In fact, these environments have already been damaged without our knowledge. For example, deep-sea trawling, plastic waste and nuclear waste have sometimes had severe impact on the seabed[28].

From an ethical point of view, ignorance is not the same as innocence. We are responsible for the unintended consequences of our actions. Ignorance breeds *negligence*, which consists in failing to foresee or prevent risks[29]. Moral agents are expected to be aware of the limits of their knowledge and to think about such risks, weigh them up and decide whether they are justified.

It should be pointed out, however, that a research endeavour does not necessarily dispel ignorance in the same way as light dispels darkness. We have learned in recent decades that industrial interests can fund research to cast doubt on well-established scientific findings about the carcinogenic effects of smoking or the link between the petrochemical industry and global warming[30]. This deliberately sown doubt is ethically criminal, as Bertolt Brecht had →

27. From this point of view, it should be remembered that research funded by the European Union is based on three pillars: one that prioritises research based on criteria of quality and the acquisition of new ideas, a second that establishes priorities including competitiveness objectives and a third that is innovation in a broader sense.

28. Santos *et al.* (2012)

29. Douglas (2003)

30. Oreskes & Conway (2012) voir aussi Proctor & Schiebinger (2008)

→ already made clear in his play *The Life of Galileo*: "I tell you, anyone who does not know the truth is a fool. But whoever knows the truth and calls it a lie is a criminal. Get out of my house[31]". What's more, research unintentionally creates new gaps in knowledge. Researchers responding to calls for projects spontaneously favour approaches to the theme that are deemed to be a priority in their discipline or field of expertise, thus neglecting other issues that could have proven important for public health or the environment. This "undone science" is a form of unintentional ignorance, consistent with the project-based funding system[32]; hence the importance of defining research priorities. There are also other forms of systemic ignorance that are more difficult to accept, because they involve the more or less unconscious elimination of data that does not fit with the hypotheses, or of uncomfortable results that are likely to offend. Such behaviour is a breach of scientific integrity.

Risks associated with acquiring knowledge from minimally anthropised environments

Acquiring knowledge can in itself be a source of risk. Investigating minimally anthropised environments - which are generally difficult to access - requires a large number of technical resources that are more or less invasive and just as costly in financial and environmental terms as space exploration.

Furthermore, the impact of this knowledge can be ethically questionable insofar as the tools and methods developed for research can be misappropriated by players whose objectives are completely at odds with those of sustainable development. Mapping sparsely populated areas, studying biodiversity and understanding the phenomena that occur there is a knowledge initiative that can open the door to mining or oil prospecting with a view to continuing the process of extraction and irreversible consumption of natural resources. But it can also provide justifications against such exploitation.

In the current system of research involving private/public partnerships, it is not possible to hide behind the watertight partition of the distinction between pure and applied research to avoid ethical and political questions. Projects for future exploitation or extraction are not exempt from the interests of governments, institutions and industrialists who invest in scientific research on minimally anthropised environments. Because research never takes place in an economic and geopolitical vacuum, there is an indissoluble link between the exploration and exploitation of sparsely populated environments. And the current context of energy transition is whetting the appetite for exploitation because

31. Bertolt Brecht (1943) The Life of Galileo - scene 9, trans. Eloi Recoing (1990). Paris, l'Arche, 85 p.

32. Hess (2016) see also Girel (2017) and Barbier *et al.* (2021)

of the need for certain mineral resources in metals for technologies that are very demanding in terms of rare and very diverse metals. The link between exploration and exploitation can be reinforced by the spectre of the scarcity of natural resources, a theme often brandished to encourage the conquest of new areas, rather than to encourage sobriety.

Finally, it has to be said that knowledge does not always provide the right information for action. Increased perception of the threats to the oceans, the Arctic and Antarctic poles, and the need to protect them, has not led to concrete action along any particular lines[33]. Despite our stated commitment to sustainable development, deep-sea oil drilling and bottom trawling continue. The current gulf between in-depth scientific understanding of the problems and political inaction is either a *sign of indifference* to the commitments made to protect minimally anthropised environments[34], or of hypocrisy when it is fuelled by short-term political and economic interests. This situation raises important questions about the way in which scientific and environmental knowledge is used (or ignored) in the formulation and implementation of public policies. And it reinforces the need for independent research, the results of which are accessible to the whole of society in an open access. On balance, the risk/benefit trade-off is inconclusive because of the intertwining of heterogeneous interests. The trade-off between the risks of knowledge and ignorance does not provide a straight cut line of conduct, as illustrated by the diversity of stances taken on exploration in the Exclusive Economic Zone. Some countries, such as Norway, are in favour of exploration with a view to rational exploitation; others, such as France and Portugal, are in favour of prohibition; and yet others are calling for a conditional moratorium that would adapt the mining code to the individual ridges to be explored.

III. What is the legal status of minimally anthropised environments?

The second ethical stake concerns the status conferred on the very object of "minimally anthropised environments". The crux of the problem is that environments with low levels of human activity, due to their inhospitable nature or difficult access, are seen as the final frontiers to be explored and conquered. Even though we are now acutely aware of the fragility of natural environments and of the environmental and human damage caused by their colonisation and exploitation, the world at the boundaries of the known, continues to attract attention. Attention to the status of minimally anthropised environments is essential, as it determines the course of action to be taken. The survey of the deep seabed has highlighted three types →

33. Nature editorial (2023)

34. Recklessness consists in knowingly taking an unreasonable risk (unlike negligence) for oneself or someone else. See Douglas (2003).

→ of status: these environments are seen either as ecosystems to be explored, resources to be exploited or ecosystem services to be preserved.

What legal status could ensure ethical practice in relation to these environments so as to avoid their plundering and irreversible damage? Here again, several options are conceivable, requiring varying degrees of ingenuity and political innovation.

III.1 The concept of the common good

Its origin

The concept of "the commons" is an age-old one. It refers to communal goods, which are available for use by all members of a community[35]. However, the privatisation of these commons during the enclosures, mainly in the 18th century, deprived the poorest rural dwellers of a resource that was essential to them. As far back as the 17th century, John Locke proposed that the right to appropriate natural resources should be subject to the condition that no one should subsequently be prevented from taking the same amount. It is therefore clearly a concept based on the status of a *resource*, and the ethical stakes are to guarantee social justice, in the form of equal access to resources such as water, which are part of fundamental human rights; such as food, clothing and access to quality water. On a global scale, the question of the commons has re-emerged since the Rio Summit (1992).

Implications

The title of ''the common good'' prevents the private or national appropriation of the environments concerned and ensures that they are used in the interests of all. It calls into question the legal concept of property based on liberal individualism, which guarantees an exclusive relationship between the owner and the thing they own. Its precise aim is to defend the common interest, and it operates on the basis of a number of rules[36]. The law of the commons has been the subject of much controversy. On the one hand, Garrett Hardin saw it as a tragedy that the commons might be depleted or degraded for want of an authority capable of arbitrating between those entitled to its use. In his view, there are two possible solutions: either nationalisation, which confers on the community the management of the commons (we could then say that the nationalised commons become a public good), or privatisation, which is supposed to

35. On the notion of common good, see INRAE-Cirad-Ifremer-IRD joint consultative Ethics Committee - Guidance N°14 (2022), **https://www.ethique-en-commun.org/en/Our-guidance/Guidance-14-Human-needs-natural-resources-and-preservation-of-the-biosphere-2.-Agricultural-practices-and-soil-quality**

36. It includes operational rules that define the rights of access to the resource, the capacities for appropriation and their modalities (practical and technical); rules of 'collective choice' that define the rights of intervention on the rights of access and use; rules of 'constitutional choice' that define the rights of modification of the rules of collective choice (Weinstein, 2013).

make private entrepreneurs more accountable (by definition, this would mean the end of the privatised commons, in the same way that enclosures once put an end to communal areas). On the other hand, Elinor Ostrom sees a solution in cooperative management, based on case studies carried out in several rural communities, particularly in the field of irrigation. Although the local scale of her observations makes it impossible to replicate her conclusions identically in environments as vast as the ocean, space or the poles, her idea of cooperation remains a promising avenue for reflection. In the case of minimally anthropised environments, the law of the commons implies that any decision to explore or exploit is based on the Lockheed Clause. We therefore need to ensure that there is no risk of depleting the resource, and no disruption to the environment serious enough to compromise other forms of development in the future. And, if this is the case, the law of the commons calls for the principle of precaution. Scientists involved in such an operation may then refuse to be associated with it, or even consider it legitimate to denounce it publicly[37].

III.2 The concept of the "common heritage of mankind"

Origin of the concept

Formally proposed for the first time by the Maltese ambassador Arvid Pardo to the United Nations in 1967, who described the high seas as the "common heritage of mankind", this concept follows on from that of "common property". It led to the inclusion of the seabed and subsoil in the category of "international goods of common interest" in the Montego Bay Convention in 1982, and aims to guarantee "free access to the resource in the sense that no one is excluded *a priori*, and possible rivalry between claimants in the sense that the resource is not unlimited". However, the term "heritage" adds another dimension to the commons, that of a legacy passed on and to be passed on to future generations. This gives the environment concerned the status of an *ecosystem service* to be maintained and nurtured. From an ethical point of view, this notion implies a *responsibility* not only towards contemporary society but also, and above all, towards future generations.

Implications

For the Deep Seabed Area, the principles invoked are the basic principles of public ownership, namely the non-appropriation, peaceful use and inalienability of "all solid, liquid or gaseous mineral resources in situ in the area which are found on the seabed or in its subsoil, including polymetallic nodules[38] ". As for the EEZs - which are by definition under the jurisdiction of coastal States as →

37. Ethics in Common Committee- Guidance N°15 (2023), **https://www.ethique-en-commun.org/en/content/download/8139/file/Guidance15-VF.pdf**

38. Art. 133 of UNCLOS. For this characterisation of the Area as a common heritage, see Delfour-Samama (2023)

→ far as resources are concerned - they should be considered less as a common good than as a public good, *i.e.* a territory placed under the authority of a public administration, in this case a State. Such a configuration would not exempt the coastal State from its obligations with regard to the high seas, since the physical realities are identical. It is up to research staff to be equally vigilant, whatever the territorial boundaries. To what extent does this status of heritage of mankind constitute a response to the ethical problems that scientists may face?

Although the principle is worthy, it has been the subject of debate and controversy. Some argue that it hampers the commercial exploitation of seabed minerals, while others feel that it does not go far enough in protecting this environment. In any event, the legal status of "heritage of mankind" presupposes international cooperation, collective governance and a central authority rather than an inter-state authority[39] (of which the ISA could be a forerunner) capable of arbitrating between the interests involved. For although the sea is the common heritage of mankind, we have to recognise that mankind is not a community that is immune to tensions and conflicts.

From an ethical point of view, the notion of the common heritage of mankind fosters a sense of global solidarity and responsibility, as it underlines the connected nature of the global community and the importance of cooperation, equity and sustainability in the management and use of planetary resources. Without repeating the provisions of the international agreements on the deep seabed mentioned above, it is worth noting their objective of regulating possible interventions in these environments. From the point of view of distributive justice, it is also worth noting that the interests of the poorest countries, either landlocked or with very narrow access to the sea, are taken into account. Without going into detail about these international provisions, it should be emphasised that they provide a framework for the possible exploration and exploitation of minimally anthropised environments. This legal status can therefore provide scientific staff with a *framework* to assist them in decision-making on the subject.

III.3 The Earth's common heritage

Is it not paradoxical to declare as the common heritage of mankind environments that are only slightly affected by human activity and that have escaped the human hold on the Earth? Insofar as humans are responsible for the advent of the Anthropocene, is it wise to entrust them with the management of the few areas still spared, or at least only slightly affected, by the footprint of their activities?

We could then consider defending the interests of environments that have been little affected by human activity by moving

39. Voir à ce propos Lascar (2023)

away from an anthropocentric vision and giving priority to the interdependencies between terrestrial environments. The status of "common heritage of the Earth" does not exist; it has yet to be defined. It is clearly based on the status of an *ecosystem* (rather than an ecosystem service) to be protected. From an ethical point of view, it would be more in line with the *ethic of care*, which has already been extended to non-humans.

It could be inspired by the international movement in favour of the rights of nature, known as Wild Law, which "gives formal recognition to the reciprocal relationship between humans and the rest of nature". In order to go beyond the classic notion of individual ownership authorising the owner to enjoy his property, it obliges the owner to take into account and give priority to the interests of the terrestrial community, including the wildest species.

Legally, the competent authority to ensure the governance of such a right should be the World Health Organisation (WHO), provided that the concept of health is redefined in accordance with the "One Health" programme, which proposes an integrated approach to the health of humans, animals and ecosystems.

III.4 Legal personality

The reconceptualisation of law could go further by fully recognising the importance of non-human members of the Earth's community and endowing them a legal status.

Origin of the concept

The international movement in favour of the rights of nature, initiated in connection with a domestic case by the American jurist Christopher Stone, acquired a general significance in the 1990s. Michel Serres' proposal for a "natural contract" that would bring nature into the political arena, followed by Bruno Latour's invitation to a Parliament of Things, encouraged the conferring of legal status on non-human members of the community[40].

Implications

It is a question of balancing powers by including natural entities (rivers, forests, lakes or glaciers) in a political framework by treating them not as objects of law but as *subjects of law*. From an ethical point of view, such a status is part of an ecocentric ethic, aimed at protecting the interests of all the components that make up ecosystems and condition their health. Legal status has already been conferred by various governments: on the Atrato River by the Colombian Constitutional Court in 2016, on the Whanganui River in New Zealand and the Ganges and Yamuna Rivers in India in 2017, on the Turag River in Bangladesh in 2019, and then on the Magpie River in Canada. In all these cases, it is up to the indigenous populations →

40. Stone (1972), Serres (1990), Latour (1999)

→ to represent these subjects of law and to defend their interests with the decision-makers.

However, the extension of such status beyond the perimeter of a territory comes up against the practical difficulty of representation, especially as, by definition, human populations are rare in sparsely populated environments.

This legal qualification is nevertheless interesting because it invites us to question the traditional conception of the relationship between man and nature that has become dominant in industrial civilisation. Even if it is difficult today to envisage a "subject of law" without the capacity to defend its rights, research communities must take into account the aspirations expressed in the debate on the rights of nature. Whatever the uncertainties surrounding this point of law, the discussions that have taken place in this debate are likely to help scientific organisations and researchers take a more informed stance on the issue of minimally anthropised environments.

IV. Propositions

Without claiming to cover the whole topic, we have endeavoured to present a wide range of possible options on the two questions of the value of knowledge and the legal status of minimally anthropised environments. Faced with such a pluralism of viewpoints, it would be unethical to conclude that since no solution is truly satisfactory, there is nothing to be done but wait and see how things unfold.

Far from favouring a complacent and disillusioned relativism, the Ethics in Common committee would like to demonstrate that the search for technical solutions is only one facet of the response to ecological challenges and that social, political and legal innovation is just as essential. The aim of this Guidance is therefore to encourage the research communities to face up to the problem and debate it openly before adopting a position.

It invites the communities concerned by exploration projects in minimally anthropised environments to:

1) Place at the top of the priority scale the objective of preserving the Earth's long-term habitability, which includes concern for biodiversity and geodiversity (the diversity of minerals) in addition to human health.

2) Prioritise establishing together a common scale of values to guide decisions made in research.

3) Bringing all the stakeholders in the research community together so that they can present the research stakes for each of them in a transparent way, and monitor how they evolve over time.

IV.1 The dilemma posed by the stakes and risks of exploration calls for ethical reflections and a firm legal framework

Faced with such an ethical dilemma, it is necessary to make clear what the priorities are, and to establish a scale of values in order to choose between several possible options, which are more or less restrictive:

• ***Appeal to the notion of responsible research and innovation*** by promoting international cooperation and knowledge-sharing to guarantee responsible and sustainable practices, as well as transparency in decision-making processes to avoid implicit hidden knowledge issues concealed behind declared stakes.

• ***Drawing up strict regulations governing*** activities in minimally anthropised environments. These regulations must be based on the best available knowledge and give priority to environmental protection, resource conservation and safety. Above all, they must be accompanied by binding measures to ensure that they are applied without being abused or hypocritical.

• ***Implementing the precautionary principle***: This principle, which authorises public authorities to take the necessary →

→ measures to deal with possible risks, even though the scientific knowledge required to establish the existence of these risks is unavailable, does not prohibit research but can lead to a "no-action rule". The situation can be compared to that of archaeologists who decide not to excavate a site after a few soundings when the conditions for safeguarding it are too uncertain. The implementation of precaution has three components: the reference to zero damage, the need to avoid the worst-case scenario, the reversal of the burden of proof (it is no longer up to those who fear the risk to show that it exists, but up to those who are likely to introduce it to prove that it does not exist[41]). The challenge is to ensure that the impact studies carried out by risk managers are validated by an independent authority.

Other options are undoubtedly conceivable. They are under consideration and awaiting tangible implementation.

IV.2 The choice of an option on the legal status of minimally anthropised environments is a decision that implicates both the present and the future

We believe that it should not be left to a group of experts, but should be the subject of a wide-ranging public consultation on an international scale, on condition that it is made clear beforehand that the opinions expressed will in fact guide political decisions. There is an urgent need to open a debate in the form of a citizens' forum or conference to define precisely the material and legal conditions for research, and also to call on the collective intelligence to respond to the political and legal challenge posed by research in such environments.

41. Godard (1997)

Guidance
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Appendices

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Appendix 1

Sources and references

Feedback from researchers following their consultation using the "Martyred questions - May 2022" note[42]

Christine ARGILLIER, INRAE
Sophie ARNAUD-HAOND, Ifremer
Catherine AUBERTIN, IRD
Laurence BOUTINOT, Cirad
Victor DAVID, IRD
Géraldine DERROIRE, Cirad
Edmond DOUNIAS, IRD
Jean-Luc DUPOUEY, INRAE
Geoffroy FILOCHE, IRD
Sophie GERBER, INRAE
Valéry GOND, Cirad
Marie-Pierre LEDRU, IRD
Pierre Yves LE MEUR, IRD
Régis PELTIER, Cirad
Éric PETIT, INRAE
Olivier PRINGAULT, IRD
Sylvain RAFFLEGEAU, Cirad
Björn REINEKING, INRAE
Estienne RODARY, IRD
Plinio SIST, Cirad
Alexia STOKES, INRAE

Interviews during the Ethics in Common meetings

→ **16 May 2022:**
• **Chloé DESMOTS,** lawyer, in charge of the Nagoya project at the IRD: "The Nagoya Protocol, Access to Biodiversity and Benefit Sharing (ABS)"
• **Sabrina SLIMANI,** lawyer, head of Ifremer's legal unit: "Metallic mineral resources in the high seas"

→ **4 July 2022:**
• **Pierre-Yves LE MEUR,** Director of Research at the IRD, Anthropologist • **Valelia MUNI TOKE,** Research Fellow at the IRD, Linguist: "Deep seabed"
• **Élodie JOUSSET,** lawyer, head of Ifremer's legal and project engineering department: "Current status of BBNJ (Biodiversity Beyond National) discussions"

→ **19 September 2022:**
• **Olivier ROUXEL,** Ifremer researcher, head of the UMR Géo-Océan CNRS-Ifremer-UBO-UBS: "Ethical challenges in marine geosciences"
• **Pierre-Marie SARRADIN,** Ifremer researcher, head of the "Biology and ecology of deep-sea ecosystems" unit at Ifremer in Brest: "Lumière sur les abysses"

→ **3 July 2023:**
• **Geneviève PONS** and **Sébastien TREYER,** co-presidents of Ifremer's Stakeholder Committee: CPP's position on the issue of deep-sea exploration
• **François HOULLIER,** CEO of Ifremer

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42. See note in Appendix 2

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Appendix 2

Explore-preserve-exploit - Note on the Ethics in Common committee's "minimally anthropised environments" referral - List of questions to be validated (May 2022)

This note is the result of a referral to the Ethics in Common Committee from four organisations (INRAE, Cirad, Ifremer, IRD) on the concept of minimally anthropised environments.

The initial reflections of an internal C3E4 working group led to the identification of three specific aspects and a list of questions to be addressed. The members of C3E4 propose to submit this preliminary list of questions to the critical scrutiny of teams of researchers, to be selected by the C3E4 secretariats in the organisations. The Committee's working method for answering these questions will be defined at a later date: at this stage, the aim is to ask the right questions, and not to answer them yet.

1. Preamble: purpose of the approach

• The notion of "minimally anthropised environments"

The committee first noted that there are no environments that are totally unaffected by human activity. It also noted that pollution is the main marker of anthropisation: even in the absence of any human presence, the deep seabed is affected by various forms of pollution, particularly from plastic waste, and space itself is increasingly cluttered with waste from the vast number of space missions. It therefore seems more appropriate to speak of an "anthropisation gradient", based on multiple criteria including human population density and the various forms of pollution caused by human activity. The maps presented below (Figure 3) give some idea of the scale of human activity.

• The issues to be considered

In the light of the comments submitted by the four organisations, the committee has chosen to focus its ethical reflection on the coexistence of three issues relating to so-called "minimally anthropized" environments:

- *the desire to explore these environments* in order to acquire a better scientific understanding of their characteristics,
- *the desire to preserve the biosphere*, natural resources and the living conditions of local populations, including in some cases by refraining from exploring what is unknown,
- *the desire to exploit* the natural or mineral resources of these environments for *economic purposes*.

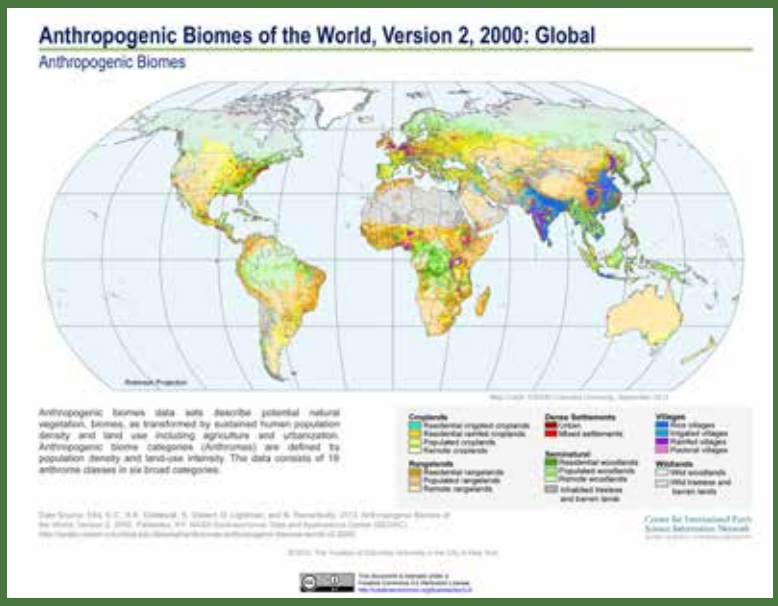
This is why the proposed title of the referral is:

"Explore, preserve, exploit",

with as a sub-title: "*Ethical issues raised by the intervention of research in minimally anthropised environments*"

• Types of environments warranting specific consideration
The committee discussed the following areas: the deep seabed, inter-tropical forests, the Arctic, deserts, areas undergoing natural "deanthropisation" (through the voluntary or forced departure of populations), and space occupied by satellites or their debris. Three of these areas have been selected on the basis of the current research themes of the four organisations: *the deep seabed, tropical forests and "deanthropised" European regions*.

A



B

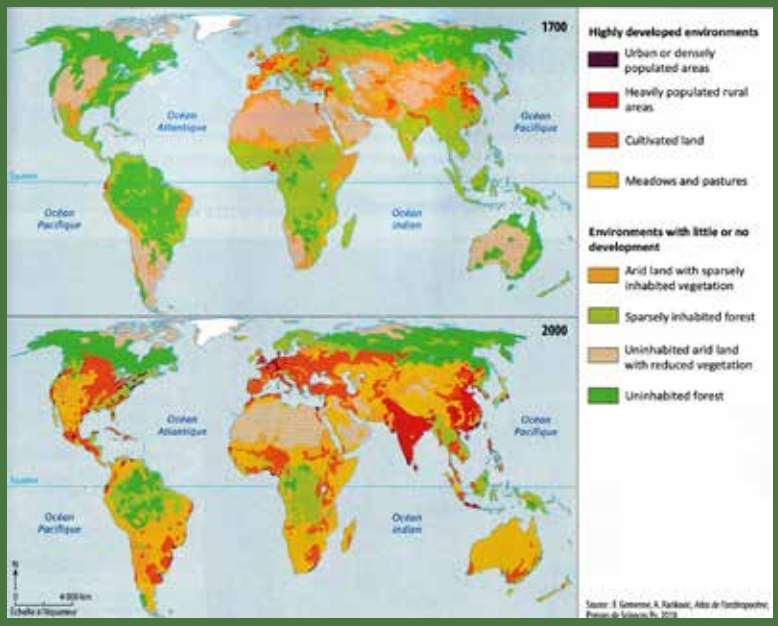


Figure 3. ***Examples of anthropisation maps.***

A. Anthropogenic biomes worldwide in 2000 (version 2) from Wikimedia Commons, CC BY licence. Extracted from Ellis, E.C., K.K. Goldewijk, S. Siebert, D. Lightman, and N. Ramankutty (2013). Anthropogenic Biomes of the World, Version 2, 2000. Palisades, NY: NASA Socioeconomic Data and Applications Center (SEDAC). http://sedac.ciesin.columbia.edu/data/set/anthromes-anthropogenic-biomes-world-v2-2000.

B. Maps of the anthropisation of the planet in 1700 and 2000. Extracted from Gemenne F., Rankovic A., Ansart T., Martin B., Mitrano P., Rio A. (2019). Atlas de l'Anthropocène. Presses de Sciences Po, 2nd edition. The figure captions were translated from the French by G. Orpwood.

2. Provisional list of issues to be addressed

The members of the Committee propose to address four types of questions:

1. Purpose: What for?
2. Methods: How should it be done? How to assess the risks in the various domains, and the various related ethical issues?
3. Implementation: how should the project be carried out, taking into account the reality of the situation (cultural, historical, legal, economic, etc.)? What is the implementation policy?
4. Regulation: prohibition? limitation? moratorium? *etc*.

This first list calls for comments, additions and amendments.

Goals

• Given the scarcity of current scientific knowledge on minimally anthropised environments, is it possible to dissociate the development of scientific knowledge from the development of the exploitation of the environments concerned? For example, very little is known about the role of ecosystems such as the deep seabed in ocean-climate interactions and their capacity for resilience. Hence the "risk of ignorance": how can we reconcile the obligation to explore in order to understand and preserve with the certain prospect of exploiting these environments?

• Given the dynamics of deep-sea ecosystems and their vulnerability to any human presence or activity, should we limit, or even prohibit, the physical presence of researchers or certain equipment in areas beyond national jurisdiction?

• Or, given the economic stakes in these areas beyond national jurisdiction, should research activities be limited to subjects that exclude the identification of exploitable natural resources (hydrocarbons, mineral resources)?

• Or should we prohibit research that is likely to create economic and political tensions?

• The development of logging and, even more so, the clearing of forests in the intertropical zone threatens the survival of the indigenous populations living there, most of whom depend on forest resources. Should the intervention of researchers in these environments be limited, or even prohibited, in order to protect these populations?

• What are the ethical implications of France's colonial past in certain areas such as the intertropical forests? What are the implications for researchers in their relations with local populations and politicians?

• Clearing land for agriculture or industrial plantations (oil palm, eucalyptus for paper pulp, etc.) is a major factor in deforestation and greenhouse gas emissions. How can researchers help to ensure that international agreements (the 1992 climate and biodiversity conventions, sustainable development objectives) are taken more

fully into account, even when local political authorities are not in favour?

• Given the ecological value of European territories that were once cultivated but are now abandoned (the European Strategy for Biodiversity calls for 30% of the Union's territory to be protected by 2030), what are the conditions for their "rewilding" to lead to stable ecosystems that are compatible with neighbouring populated areas?

• As it is difficult to predict how these ecosystems will evolve in the light of climate change in many European countries, should specific exploration tools be developed for these areas?

•Are farming systems in areas with low human populations, such as tourism and hunting, compatible with the protection of these areas? Can other types of exploitation, such as forestry, be compatible with their protection?

Methods

• How can the environmental impact of deep-sea exploration (for the pursuit of knowledge) be assessed and anticipated?

• How can the ethical (common goods), scientific (knowledge), legal (governance of the high seas) and economic (needs for minerals and rare metals, biotechnologies) issues of deep-sea exploration and exploitation be taken into account in an integrated, multidisciplinary way to inform political decision-makers?

• Are there models for managing and exploiting forests in the intertropical zone that can be considered "sustainable" in terms of the 17 SDGs? If so, how can they be developed?

• The exploitation of timber, like that of other natural resources in forests (*cf*. the case of gold panning in French Guiana), can have serious environmental and social impacts. How can researchers deal with these situations?

Implementation

• How should research institutes manage major geostrategic tensions when developing their research partnerships?

• How should local people be involved in defining the objectives of research in these areas?

• How can dialogue be conducted with local political authorities and representatives of indigenous populations on these research initiatives?

• For territories that are - at least in part - in the hands of private owners who are the recipients of the research results? How can the general interest be served over and above the interests of individuals?

• Should research institutes adopt specific policies on relations with indigenous peoples?

Regulations

• Given the current lack of knowledge, should a moratorium be recommended on the exploration and/or exploitation of deep-sea mineral resources outside national jurisdiction?

• Can seabed regulation be based on the distinction between inalienable "resources" and (appropriable) "minerals"?

• Are regulations appropriate to protect indigenous populations?

Appendix 3

Composition of the Ethics in Common Committee (March 2024)

Michel BADRÉ, Chairman of the Committee.
Ingénieur Général des Ponts, des Eaux et des Forêts, former Chairman of the French Environmental Authority (2009-2014), former member (2015-2021) and Vice-Chairman (2018-2021) of the French Economic, Social and Environmental Council (CESE) as a member of the Environmental Associations Group. Member of the French National Consultative Ethics Committee (CCNE). Chairman of the "orientations" commission for the radioactive materials and waste management plan.

Bernadette BENSAUDE-VINCENT, Vice-Chair of the Committee
Emeritus professor of philosophy of science and technology at the University of Paris 1 Panthéon-Sorbonne and member of the Académie des technologies.

Madeleine AKRICH
Director of Research at the École des Mines de Paris (Centre for the Sociology of Innovation). Engineer from the École des Mines de Paris. Doctor in socio-economics of innovation.

Catherine BOYEN
Research Director at the CNRS; Director of the Roscoff Biological Station (Marine Biology and Ecology Research and Teaching Centre). Doctor in plant biology.

Bernard BRET
Geographer, specialising in Latin America and Brazil in particular. Former professor at the University of Lyon III.

Denis COUVET
Chairman of the Foundation for Research on Biodiversity; professor at the Muséum national d'Histoire naturelle; associate professor at the University of Lausanne and at Sciences-po Paris. Agricultural engineer, doctor in evolutionary sciences and ecology.

Mark HUNYADI
Professor of social and political philosophy at the Catholic University of Louvain; associate professor at the Institut des Mines-Télécom Paris and the EHESS; member of the Orange Ethics Committee; member of the Steering Committee and the Steering Committee of the Forum Vies Mobiles. Doctor of Philosophy.

Paula MARTINHO DA SILVA
Lawyer specialising in intellectual property and life sciences. Member of the International Bioethics Committee (UNESCO), member of the Ethics Committee of the Champalimaud Foundation and the University Hospital of Lisbon Centre.

Marie-Geneviève PINSART
Philosopher, professor at the Université libre de Bruxelles, applied ethics research centre; member of the IRD's Consultative Ethics Committee for Research in Partnership (CCERP).

Pere PUIGDOMENECH
Research professor at the Higher Council for Scientific Research (CSIC) at the Barcelona Institute of Molecular Biology. Doctor of Biological Sciences, specialising in the molecular biology of plants.

Ricardo SERRÃO SANTOS
Professor at the University of the Azores. Permanent member of the Portuguese Academy of Sciences and emeritus member of the Portuguese Naval Academy. Former pro-rector at the University of the Azores, and President of IMAR (Inter-University Institute for Marine Research) in Portugal. Former Member of the European Parliament and Minister for the Sea. Doctor in animal biology and ecology.

Youba SOKONA
Vice-Chairman of the Intergovernmental Panel on Climate Change (IPCC); member of the African Academy of Sciences; coordinator of the African Climate Policy Centre (ACPC). Professor of water, energy, the environment and sustainable development.

• The secretariat

INRAE: General Secretaries, Christine CHARLOT and Claire LURIN, with the support of Nathalie HERMET
CIRAD: Estelle JALIGOT
Ifremer: Marianne ALUNNO-BRUSCIA
IRD: Ghislaine THIRION

• Former members of the Ethics in Common Committee who contributed to this Guidance::

Louis-Étienne PIGEON
Philosopher in environmental ethics, Doctor of Philosophy from the Faculty of Philosophy at Laval University (Quebec, Canada); lecturer at Laval University.

Hervé THÉRY
Geographer, Associate Professor at the University of São Paulo (Brazil), Emeritus Research Director at the CNRS.

Laurent THÉVENOT
Economist and sociologist. Director of studies at EHESS, member of the Georg Simmel Centre and member of the French Academy of Agriculture. Engineer from the École Polytechnique and ENSAE.

• Members of the working group that prepared this Guidance, which was discussed in plenary sessions and finally adopted on 18 March 2024:

Bernadette BENSAUDE-VINCENT
Catherine BOYEN
Denis COUVET
Mark HUNYADI
Ricardo SERRÃO SANTOS

Appendix 4

The Ethics in Common committee agrees on six principles that guide its reflections and work

1. The Ethics in Common committee considers the recognition of human dignity as a fundamental value. In its Guidances, it will endeavour to provide a palpable application of this value, implementing the rights set out in the 1948 Universal Declaration of Human Rights.

2. More generally, the Committee considers that the values of the body of declarations and conventions built up over several decades by the United Nations and its specialised organisations, in particular UNESCO, form part of its frame of reference, including the protection and promotion of cultural expressions and biodiversity. This body of work is implemented through international standard-setting agreements.

3. The living environment must not be degraded for future generations and the future must not be irreparably damaged, in particular by drawing on natural resources or jeopardising the balance of nature. This principle of sustainable development requires the committee to work on the long and very long term, not just the short term, even though the principle of total reversibility seems utopian and impractical.

4. The world is a system. Any action taken on one of its elements has an impact on other elements: the analysis must therefore explore the secondary and induced effects of an action and the dynamics and strategies that it may encourage or promote. Problems must therefore be addressed primarily on a global scale, while ensuring compatibility between the global and the local and taking account of the realities on the ground.

5. The committee considers that the robustness and adaptability of a system are positive elements. Thus, even in an open society, a degree of self-sufficiency in production systems is desirable at the national and regional level.

6. Progress implies a society that is open to technical and social innovations, in the knowledge that the impact of these innovations on lifestyles and their contribution to human development must be analysed and predicted, and that the benefits they can bring must be shared equitably.

INRAE

cirad
LA RECHERCHE AGRONOMIQUE
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