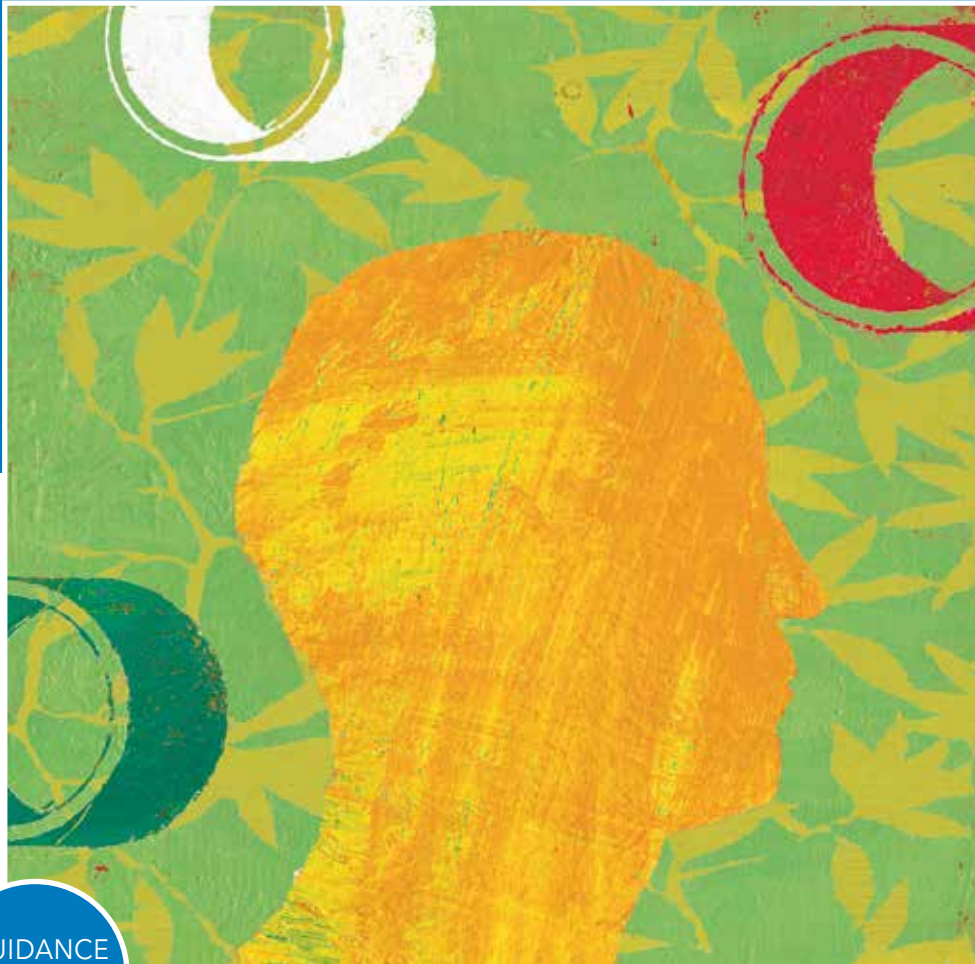


INRAE-Cirad-Ifremer-IRD Joint Consultative Ethics Committee



GUIDANCE
13

on Human needs, natural resources
and preservation of the biosphere:
the case of coastal waters

INRAE-Cirad-Ifremer-IRD
Joint Consultative Ethics Committee



on human needs, natural resources
and preservation of the biosphere:
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Contents

- 7 FOREWORD
- 9 PREFACE BY AXEL KAHN: WE CANNOT RESIGN OURSELVES TO THE IRREDUCIBILITY OF CONTRADICTIONS
- 10 HUMAN NEEDS, NATURAL RESOURCES AND PRESERVATION OF BIOSPHERE:
THE CASE OF LITTORAL WATERS
- 11 PART A: PROGRESS REPORT - OCTOBER 2020
- 11 I ■ PURPOSE, AMBITIONS AND PROGRESS OF THE REFERRAL
- 13 II ■ CONFLICTING USES AND OBJECTIVES: HOW ARE THE DEBATES CONDUCTED? WHAT INITIAL LESSONS CAN BE DRAWN FROM THEM?
- 14 III ■ SOME ELEMENTS OF METHODOLOGY / INITIAL PROPOSALS FOR THE APPROACH FOR RESEARCHERS
- 15 PART B: REFLECTION NOTE - DECEMBER 2019
- 16 I ■ SENSE OF PURPOSE, THEME AND TOPICALITY OF THE REFERRAL
- 18 II ■ POLLUTION AND COMPETING USES OF WATER: A FEW EMBLEMATIC CASES
 - 18 1- Land-sea coupling and competing uses of freshwater on the mainland coast: the case of the Charente region
 - 19 2- The case of diffuse pollution in the land-sea continuum in the Pays de Loire region and the Pollusols research project
 - 20 3- Green algae, invasive species, asphyxiated ecosystems: eutrophication as a social issue
 - 22 4- Chlordecone: the serious health problem of water contamination in the West Indies
 - 22 5- Sargassum: brown algae, an ecological disaster or an opportunity for development in the Caribbean?
- 24 III ■ INITIAL LESSONS LEARNED FROM THE CASES ANALYSED AND PROSPECTS FOR CONTINUING TO EXPLORE WATER-RELATED ISSUES
 - 28 Appendix: The emergence of a concern for the balance between needs and the biosphere in the West
- 30 IV ■ APPENDICES
 - 30 APPENDIX 1- Background of the guest speakers / Members of the working group set up by the Ethics Committee to examine this recommendation, which was debated in plenary sessions and finally adopted on November 16, 2020
 - 32 APPENDIX 2- Composition of the INRAE-Cirad-Ifremer-IRD Committee (July 2022)
 - 34 APPENDIX 3- Joint secretariat of the INRAE-Cirad-Ifremer-IRD ethics committee
 - 34 APPENDIX 4- Principles and values of the INRAE-Cirad-Ifremer-IRD ethics committee

FOREWORD

Since 2019, the INRAE-Cirad-Ifremer-IRD Joint Consultative Ethics Committee has been conducting an ethical review on the research work of four organisations. This work is a self-referral, *i.e.*, on our own initiative- and focusses on the trade-off between the fulfilment of human needs, natural resources and the preservation of the biosphere.

It has based this reflection on two case studies: coastal waters (this Guidance) and soils (Guidance 14). In both cases, by taking into consideration interviews with researchers, it has endeavoured to identify areas of potential conflict and the issues at stake in existing controversies. Its Guidance notices are aimed at identifying potential issues and call for a more-in-depth examination, including input from researchers.

These two specific analyses have already helped the Committee address a number of general issues whose ethical significance goes beyond each of the themes studied. Three themes have emerged: the management of the 'commons', the value but also the limits of the concept of ecosystem services, and the differences in approach depending on the nature and culture of the territories concerned, the North *versus* the South. These issues are addressed in both Guidances, but cannot claim to be exhaustive at this stage: the Committee will consider them in greater depth in subsequent Guidances.

Axel Kahn was at the origin of the Committee's approach. He set out the "raison d'être" in a short text that we have included as a preface to the two Guidances produced by the Committee. It is a tribute to his work as Chairman of the Committee.

Members of the INRAE-Cirad-Ifremer-IRD Joint Consultative Ethics Committee

January 2022

Not resigning ourselves to the irreducibility of contradictions

Humans, like all living things, need nutrients, food, water and air to live. But that is not all. Their development has required social interaction, and they have benefited from the richness of nature, the intellectual stimulation and aesthetic pleasures it has afforded. Furthermore, what modern humans have been able to use to establish their humanity will also be a determining factor in the building blocks for future generations. It is the responsibility of those involved in the present to preserve this legacy. From another point of view, our fellow human beings are certainly legitimate in their concern for themselves and their descendants but, outside of religious thought, they are not the ultimate goal of biological evolution. They are not the only living beings with intrinsic value. Responsibility, the prerogative of our species, is therefore not limited to our own species, but encompasses the living environment to which we belong. That said, are not organisations involved in targeted research activities in open environments faced with irreconcilable contradictory constraints? We must sacrifice nothing: the economic relevance of our businesses and sectors, their sustainability, the conflicting interests of the stakeholders involved, concern for future generations and also for the biosphere as such, its delicate balance and its own evolution.

An easy solution would be to accept the coexistence of different objectives, each legitimate but incompatible with the other. Depending on the circumstances, it would only be a matter of giving priority to certain objectives that are seen as priorities because they are adapted to the urgency of the moment or to the most pressing demands. Our organisations and their Joint Consultative Ethics Committee have a different, more dialectical ambition: to accept the contradictions, but aim to overcome them in the form of an innovative solution that does not deny any of the contradictory injunctions at the outset. This is not a totally utopian objective, and a few examples can be given from strategies of the fishing industry. Scallop stocks in Brittany, bluefin tuna in the Mediterranean and Atlantic, cod in the North Atlantic and halibut in the North Pacific have all been re-established under conditions that preserve the activities of fishermen today and for the future, while respecting the environment. Concern for the present and the future, and consideration for the inherent value of the biosphere have been combined.

The aim of the Ethics Committee of our four organisations is to use real-life situations as a starting point to provide governments, researchers and staff with avenues to explore in this context of divergent and seemingly irreconcilable objectives, interests and analyses. A path may exist, but identifying it requires a method, and following it requires a will.

Every year or so, the Committee will submit the fruits of its reflections and proposals to the organisations, to add weight to their own analyses and decisions. Our first Guidance document concerns conflicts over water management in coastal areas. Farmers, oyster and shellfish farmers, tourism professionals, environmentalists and industrialists all have very different, often conflicting, views and interests. What can be done, and how? We are now tackling a huge issue, that of soil. It will undoubtedly be the subject of several issues.

The long-term project we are launching may seem ambitious. This is because the importance and challenge of the tasks incumbent on the bodies whose thinking and decisions on which we are trying to shed light, require them always to combine the reality of situations with the height of their ambitions. The Committee desires to contribute to this.

HUMAN NEEDS, NATURAL RESOURCES
AND PRESERVATION OF THE BIOSPHERE:
THE CASE OF COASTAL WATERS

PART A: PROGRESS NOTE - OCTOBER 2020

The following note was drafted, discussed and approved by the Committee before the Covid-19 pandemic disrupted its activities, as was the case for most people on the planet. However, it has not been significantly altered, precisely because this crisis has cruelly underlined the importance and urgency of the questions posed.

It seems almost certain that Covid-19 was an assault on the biosphere. The consumption of meat from non-domesticated animals was cited as the root cause that triggered a catastrophe whose consequences have compromised the fulfilment of the most basic human needs of millions of people around the world.

This note reaffirms, summarises and updates the content of a more comprehensive document presented in Part B (concept note of 17 December 2019), to which reference may be made to obtain more details on the cases analysed.

I ■ PURPOSE, AMBITIONS AND PROGRESS OF THE REFERRAL

This self-referral, which is the subject of the memorandum, raises three questions:

1. How can the four research organisations ensure that their various actions are consistent, taking into account, on the one hand, the very legitimate objectives of satisfying short- and medium-term human needs (food, housing, heating, etc.) and on the other hand, the long-term objectives of preserving natural resources?
2. How can we position ourselves at the heart of conflicts of use or objectives between producers and consumers? How can we analyse and explain the facts behind these conflicts, propose trade-offs and prime concerns, and prioritise them?
3. How can the four public research bodies contribute to public policies that safeguard the collective interest?

The answer to these three questions is all the more delicate because, beyond scientific and technical considerations, it questions philosophical conceptions that cannot claim to be unanimous: the relationship between Man and Nature, views on risk management and uncertainty, etc.

The notion of human needs, for example, is a key subject in the debate on the future of the environment. For instance, is not the notion of human needs already open to debate? Doesn't the preservation of natural resources and the biosphere, on the sole grounds that it concerns the long term, correspond to the fundamental need for survival of the human race? Furthermore, the very definition of human needs is far from apparent, and certainly not the same for everyone. Who defines needs? Which stakeholders are consulted? On what scale of values and in what economic, environmental or cultural context are needs assessed? Can we prioritise them by considering, for example, as Maslow's debatable pyramid¹ suggests, that relational needs are less important than physiological needs? How should we define these needs without decreeing them? Moreover, the tensions between the short and long term are even more pronounced in countries of the South compared to those of the North. Deforestation and bush fires are for example often a response to short-term poverty alleviation requirements and compromise the environment. Countries with exceptionally fragile economies are forced by Western countries to accept toxic industrial waste disposal on their land in order to solve immediate and specific funding problems, to the detriment of the health of their population and the environment (soil and water quality, etc.). Moreover, there are cases of pollution of surface water by local industries that create jobs and added-value for agricultural products, and infiltration of groundwater by untreated or inadequately treated industrial effluent that

¹ Hierarchical classification of human needs proposed by the American psychologist Abraham Maslow in 1943. His theory, based on his work on motivation, has since been widely criticised, although it continues to be taken seriously in some management and higher education circles.

flows into coastal waters and infiltrates groundwater. These problems are even more pronounced in the South than in the North². In order to identify sufficiently precise ethical principles and avoid getting bogged down in generalities, the Committee has chosen to investigate a selection of emblematic cases which are real life situations observed by researchers from the four organisations. The first theme chosen was the management and preservation of water resources, whether on land or at sea, with all the issues this raises in terms of pollution, competing uses and conflicts of objectives in the land-sea continuum.

During the first year of this referral, the Committee examined five significant cases, holding debates with researchers and programme managers, as well as studying the literature. These case studies are detailed in part B.II of this Guidance. They concern the following situations:

- *Land-sea coupling and competing uses of freshwater along the Charente coast*. Agricultural, wine-growing and industrial activities result in the discharge of high quantities of water into the marine environment that are both polluted and detrimental to shellfish farming. This case raises questions about both economic and social choices and the difficulties of ensuring the coherence of public policies that are too sector-based.
- *Diffuse pollution in the land-sea continuum in The Pays de Loire*. This pollution, which originates mainly from the chemical industry, affects not only activities in the coastal zone (fishing, tourism, shipping, etc.), but also extends into the open sea. This case was studied in the multidisciplinary Pollusols research programme and illustrates the difficulties of governance, particularly when French regulations prove to be more restrictive than European directives.
- *Eutrophication*. The phenomenon of the proliferation of invasive green algae resulting from polluting effluents from agricultural activities, which asphyxiate marine ecosystems, has already been the subject of numerous studies by researchers and a CNRS-Ifremer-Inra collective report. The social visibility of the problem has meant that civil society has played a decisive role in shaping public policy on this issue.
- *Chlordecone*. The long-lasting and much-publicised effects of this insecticide, which is an endocrine disruptor, was used on a massive scale in the banana plantations of the French West Indies for over 20 years up to 1993. It has also been the subject of a great deal of research and innovative consultation initiatives, such as a series of participatory workshops involving public bodies, researchers, producers, trade unions and environmental associations.
- *Sargassum*. This brown algae is currently being washed up on the beaches of the Caribbean and large parts of the Gulf of Mexico. These algae are a major source of pollution, and their foul-smelling decomposition has a serious impact on fishing, human health, tourism and biodiversity. Researchers at the IRD are very active on this issue. Paradoxically these algae are not just harmful, but can also be recycled to improve the soil.

We believe - after an in-depth examination of the cases cited below - that the inability to reconcile the initial contradictions is not inevitable. It may simply be due to a lack of information about the problem, or a lack of mutual understanding of the points of view of the stakeholders or the levels of governance. In such cases, the contribution of researchers and engineers from the four organisations can make a significant contribution to breaking the deadlock.

² Examples given by Mireille Dosso.

II ■ CONFLICTING USES AND OBJECTIVES: HOW ARE THE DEBATES CONDUCTED? WHAT INITIAL LESSONS CAN BE DRAWN FROM THEM?

Although the five cases studied are very different, they present several similarities, and the Committee has already been able to learn a number of lessons from them.

Firstly, it should be noted that in some cases, additional information is all that is needed to clarify the issues and impact. For example, many farmers are unaware of the consequences of stocking up their water reserves or even discharging what they consider excess waste water into the sea, but which in fact has polluting effects. However, it is clear that providing information is not enough to bring all the players to a consensus.

Examination of the cases studied reveals several diagnostic issues.

- Firstly, the issues of pollution and competing uses of water are not just scientific and technical questions. They are also questions of economic and social choice, where often divergent options clash, for example in terms of agricultural models and territorial development. But very often the players involved are unable to come to an agreement on the scientific and technical characterisation of the issues in question and their potential solutions.
- Secondly, there are cultural distinctions: differences in approach between professional cultures (agriculture, shellfish farming, fishing, tourism, etc.) or between institutional cultures (research, administration, etc.) and, lastly, contradictions in the way in which Man, society and nature relate, as shown by the case of chlordecone in the West Indies.
- Thirdly, different temporal and spatial scales come into conflict. Short-term aspirations for maximum productivity clash with long-term environmental concerns. But sometimes the conflict is played out on even narrower scales, as illustrated by the case of snow cannons in ski resorts, which require using the low levels of water available in winter to function. This supply is also necessary in particular for the production of drinking water. The water is abundant in summer, when it is needed for irrigation in agriculture. There is also a spatial divide between upstream, where the resorts are located, and downstream, the plains occupied by agriculture.

There is also the issue of governance.

- How can effective consultation practices be developed? What can be done to ensure that all the stakeholders concerned can make their voices heard and contribute to the development or reform of public policies? The ways in which conflict is managed and debate conducted vary from case to case. Two examples show that all the stakeholders - and not just the public authorities - are involved in water governance.

- Research institutes have an important role to play in these areas. In the case of eutrophication, a collective scientific assessment (ESCo) has been set up in accordance with European directives on the protection of aquatic environments. Coordinated by the CNRS, with the active participation of Ifremer, Inra and Irstea, the ESCo was commissioned by a number of public institutions. Some fifty scientists from a wide range of disciplines (including human and social sciences) contributed to the work over a two-year period, in search of solutions to reduce the phenomenon and to explore new avenues of research.

- In the case of chlordecone, at the initiative of the National Chlordecone Committee, and as part of a "river contract", players as diverse as ONEMA³, researchers, producers, trade unions, environmental associations, etc. were brought together for a series of participatory workshops. These workshops showed that there was no compatibility between "good agricultural practice" and the good environmental status of the islands in terms of water resources. Throughout the workshops, farmers became swiftly aware of the catastrophic effects on rivers

³ Office national de l'eau et des milieux aquatiques, now part of the Office français de la biodiversité (OFB).

of the use of certain substances they were using. This revelation convinced some of them to give up using pesticides, which interestingly is not far from their cultural attachment to natural elements, which is considered an integral part of the Antillean identity. The workshops also helped to break down barriers between agricultural sectors. Participants realised that techniques tried and tested on banana plants could be profitably used on sugar cane. Neighbours began to talk to each other, whereas they had never spoken before. Magalie Jannoyer⁴ notes that "water establishes compulsory solidarity". Beyond questions of governance, the simple fact of enabling dialogue between stakeholders has an impact on the resolution of problems.

- There are sometimes contradictions between scales of governance (territorial, national, European in particular)⁵. There are also conflicts of interpretation between land-based and maritime governance systems. How can we simplify this administrative jungle, often denounced as one of the reasons for the failure to reduce conflicts of objectives in the field of water management?
- Furthermore, the various debates held by the Committee highlighted the issues faced by researchers from the four organisations when it came to informing public decision-making. Many of them, invited to take part in expert committees, said they find themselves in a delicate position where too much freedom of expression exposes them to being taken to task in public debate or putting them at odds with their superiors, which can compromise their careers. Other respondents pointed to the constant need to clarify positions within their own institutions, in particular to reconcile vertical sector-based approaches with cross-functional environmental ones⁶.
- Even if this point goes beyond the scope of the referral, we must take into account possible differences of position between researchers and their management. As we have seen above, researchers have a certain amount of expertise and freedom of expression, and it is normal for them to contribute different points of view based on their own research findings. The existence of ethical charters in the institutes is not enough to settle the question of these divergent positions. In any case, a contribution on this subject would be helpful for our work⁷.

Finally, the Committee found that sometimes opposing points of view stem from contrasting priorities or differences in values. A stakeholder debate can help overcome a conflict. In most of the cases studied, we noted that, in addition to recognising conflicts, public authorities, researchers and civil society have reacted, either through traditional consultation processes or by exploring new models of debate that should be publicised more widely. It is along these lines that the Committee would now like to propose some initial elements of methodology.

III ■ SOME ELEMENTS OF METHODOLOGY / INITIAL GUIDE PROPOSALS FOR RESEARCHERS

To guide the implementation of this methodology, it should be remembered that although the chosen theme (human needs, natural resources and preservation of the biosphere) is very broad, C3E4's ambition is by no means to deal with it exhaustively, but simply to assist the researchers, technicians and management of the four organisations in discerning their ethical dimensions and taking them into account in their research practices.

It is too early at this stage to offer researchers a kind of 'discourse on method' to help them to be in a better position to interact in situations such as those summarised above. But we can already distinguish the following areas.

Researchers and technicians have several roles to play in debates on the theme of "human needs, natural

⁴ Deputy Director General for Research and Strategy (DGD-RS) at CIRAD.

⁵ For example, conflicts over water use around the Etang de Thau, cf. Barone, S. (2010). *Les conflits d'usage de l'eau et leurs régulations. L'exemple du bassin de Thau et de la basse vallée de l'Ain*. *Annuaire des Collectivités Locales, Les enjeux de la gestion locale de l'eau*, 30, 177-188.

⁶ For example, the fact that the French Ministry of Agriculture is organised by production sectors (cereals, meat, forestry-wood, etc.), while the Ministry of the Environment is organised by cross-disciplinary themes (water, biodiversity, risks, energy, etc.), does not encourage their departments to work together.

⁷ Since this guidance was written, a charter for public expression has been drawn up at INRAE: [https://www.inrae.fr/sites/default/files/pdf/Charte-ExpressionPublique_INRAE-\[Fr\].pdf](https://www.inrae.fr/sites/default/files/pdf/Charte-ExpressionPublique_INRAE-[Fr].pdf)

resources and preservation of the biosphere":

- To provide information, to say what they believe to be scientifically founded in the analysis of problems and in the search for solutions and therefore reduce areas of uncertainty to a minimum, even if it means showing that some of them cannot be resolved in a short period of time.
- Contribute to the definition and analysis of alternative solutions to current practices, and to the comparison of their impact.
- Listening to - but not deriding - alternative proposals to those of the technostructure, which tends to present only one, and seeking ways of enhancing them.

To participate effectively in the debate, it is necessary to:

- Highlight the limits to the validity of the results put forward by the various participants;
- Put into perspective the positions of the various scientific disciplines involved (in particular biology/ecology, human and social science/others);
- Identify and clearly formulate the points of contention with opponents, decision-makers, etc.;
- And to take account of their positions and those of their institutions.

All this presupposes that we reflect on the 'position' of researchers and technicians in a working group, between representatives of the technostructure, elected representatives and NGOs. Do they represent their discipline, their laboratory, their organisation, or just themselves as scientists, or even as citizens or activists?

The Committee also felt it appropriate to add two additional Guidances:

- The introduction of training for researchers and technicians in the culture and territorial issues involved in their area of expertise. This should be initiated as soon as a research programme is launched, in the form of a meeting of stakeholders. In particular, this would involve ensuring that everyone is aware of the plurality of viewpoints and cultural references, in a spirit of extra-technical openness and the ability to suspend judgement.
- Their training in the techniques, possibilities and limits of public debate in the form of a course or any other form deemed effective.

PART B: CONCEPT NOTE - DECEMBER 2019

The internal working group of the Inra-Cirad-Ifremer-IRD Ethics Committee started working on this self-referral in the summer of 2019 and in spite of difficulties due to the workload of its schedules and unavailability of some of its members, it has been able to shed some light on the complex and essential issue of the conflicts of objectives between human needs and the preservation of the environment. The subject is so vast and all-encompassing that the Committee as a whole decided, in the summer of 2019, that it could not be examined within the timeframe and in the form of referrals to which it is accustomed. A long-term process has therefore been initiated, punctuated by progress notes, of which this is the first, and enhanced by innovative forms of debate which will be more or less public and in particular, will be organised in the coming months with the support of the four bodies.

As it stands, this note is initially intended for the members of the INRAE-Cirad-Ifremer-IRD Ethics Committee. It is an initial attempt to get to grips with this issue, and a basis for a shorter and more detailed progress report, focused on methodological Guidances for researchers, which will be discussed at the Committee's meeting in January 2020.

I ■ THE SPIRIT, THEME AND THE UPDATE OF THE REFERRAL

Let us briefly recall the starting hypotheses of the referral. There is no doubt that the work of researchers in these four organisations is geared towards improving human well-being. But improving this well-being, cannot be dissociated from the major objective for the long term and the common good of the preservation of natural resources and the biosphere. The short-term requirements to satisfy immediate needs can come into direct conflict with the long-term needs to improve the quality of life on the planet.

Even in the short or medium term, the quest to satisfy human needs can give rise to conflicts of objectives between researchers, producers and consumers. For example, the demand to develop agriculture and water management on land may conflict with the need to preserve marine environments and develop coastal crops, as we shall see later. This raises the question of the ways in which conflicts are made explicit and debated, and the trade-offs to be considered: what will have made it possible, in specific contexts, to propose these trade-offs? What successes can be observed, what failures, what encouragement and what discouragement? How can the demands of well-being, constraints and long-term objectives be prioritised? How can the objectives of satisfying human needs (food, housing, heating, etc.) from natural resources be reconciled with the objectives of preserving the biosphere? Is it possible to make the collective interest and collective responsibility coincide, other than in well-meaning speeches with no real impact? And how can public research bodies contribute to public policy that should guarantee this collective interest and responsibility? As Paquita Morellet-Steiner, State Councillor and specialist in public law, pointed out during a speech in the public debate on nuclear waste management in 2019,⁸ "the role of public policy is not to make people happy in the short term, but to enable everyone to benefit from the rights they are entitled to."

The sustainable development objectives adopted by the member countries of the United Nations, on which the Committee has issued a Guidance highlighting the ambiguities⁸, give a fairly broad list of these rights: after citing the fight against hunger and poverty as priorities, they go on to list the rights of access to health, education, clean water, gender equality and so on. In the French context, and based on the Aarhus Convention⁹, the 2005 Constitutional Charter for the Environment defines two of these rights, which are of practical significance for structuring public policies in our field of reflection:

1 "Everyone has the right to live in a balanced environment respectful of health" (Article 1).

2 "Everyone has the right [...] to have access to information relating to the environment held by public authorities and to participate in the taking of public decisions which have an effect on the environment".

As the appended note points out, this type of concern is certainly not recent. For three centuries now, Western scientists and philosophers have been warning of an ecological imperative that is nothing new, and to a certain extent they are in line with the holistic worldviews that have been prevalent in Asia, Africa and Andean America for centuries.

Within the working group, we agreed to avoid general and overly theoretical considerations. We began to base our thinking on the observation of real-life cases specific situations identified within the fields of competence of the three organisations which were likely to highlight the possible ranking of interests and duties, social demands and constraints, technical, scientific and environmental performance, and so on. In a spirit of in-situ philosophy, these real-life situations, if analysed in depth, will, we hope, make it possible to draw out principles for reflection that can be extended to other contexts.

⁸ Cf. Guidance no. 10 on the ethical dimension of major international agreements (2017). As Axel Kahn notes, "on a superficial analysis, the objectives of sustainable development might seem completely contradictory. How can we meet the immediate needs of employees, as well as those of a dynamic industrial and commercial sector, while preserving the resources of the future? Is there a total incompatibility between the advocates of biocentrism and those of anthropocentrism, and is it impossible for them to talk to each other? The Committee assumes that something can be done and is looking for ways to affirm these priorities and show that, in some cases, they can be pursued in parallel". (Extract from the minutes of Axel Kahn's meeting with Ifremer management in February 2019).

The aim of this referral is therefore to provide the research teams of the three organisations with the basis for the ethical reflection required for the "proper use of nature", which must be based on a fair assessment of short- and long-term needs, a clear vision of the interdependent relationships between the various components of an environment, and a range of expert opinions with a view to making informed and fair decisions.

We would like to emphasise a number of points to bear in mind in this work:

- Vigilance with regard to the notion of human needs and its definition. Who defines needs? Which stakeholders are consulted? On what scale of values and in what economic, environmental or cultural context are needs assessed? How can needs be defined without being decreed? How can the notion of need be considered differently in the short, medium and long term?

- Vigilance with regard to the often-proposed notion of the acceptability of research activities. This implies a dissymmetry between players, with some (researchers) finding technical solutions and then wondering how to get them accepted by others, the "beneficiaries" - another ambiguous and dangerous term - who know or assume what is good for them. Moreover, while some of the latter may 'accept', others may not. The idea of general acceptability is therefore illusory. One of the current difficulties is also that some research programmes are aimed at understanding and producing knowledge without having an operational purpose, whereas, on the contrary, the professional sectors expect all research activities to have a purpose that will have an impact on them in the long term¹¹.

- Vigilance with regard to the diversity of players interviewed as part of the referral process. We did not want to limit ourselves to the testimony of researchers, but to look at the places where research policies are debated. Stakeholder committees have been set up here and there: how do they work? What impact do they have?

Are they a place for making proposals, confirming or changing research policies, or simply providing information? What is the role of these committees, whether to make proposals, confirm or change research policies, or simply to provide information? Independently of these committees, how can we take into account the views of all the stakeholders (in particular groups of fishermen or oyster farmers, farming unions, farmers' movements, environmental protection associations, industrialists, distributors, etc.) without losing sight of the fact that their views may reflect the defence of corporate interests? As for the testimonies of the researchers themselves, how can we guarantee a fair balance between those from the North and those from the South¹²?

- Finally, we need to be vigilant with regard to the variety of cultural, normative and governance frameworks specific to each society, within which trade-offs and hierarchies may be made. As in other referrals, the Ethics Committee is keen to take account of the intercultural dimension of research policies.

Our choice of case studies reflects our concern not to get bogged down in overly broad themes. We therefore agreed to concentrate initially on issues relating to the management and preservation of water resources, whether on land or at sea. We had initially thought of extending our work to the issue of soil, but it soon became clear that such an extension was not immediately desirable¹³.

What have we observed and learnt so far from the case studies we have seen in this area, thanks to debates with around ten researchers from the three organisations¹⁴ and an analysis of some of the literature?

⁹ The Aarhus Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters is an agreement aimed at "environmental democracy", signed in 1998 by 39 states including France.

¹⁰ The IRD had not yet joined as a member of the joint ethics committee.

¹¹ A comment from P. Gouletquer.

¹² Philippe Gouletquer notes on this subject that "The governance of marine nature parks is worthy of note, as they have a management committee made up of all the stakeholders and the recommendations given are compliant (with the exception of major national projects such as offshore wind farms). In other words, a Guidance issued from a marine park can "restrain" a prefectural authorisation. This was the case with a recommendation against a proposed pig farm in Finistère, whose effluents were likely to impair the quality of the water in the marine park. Despite prefectural authorisation, the project did not go ahead. The interesting thing here is that it is a "collective of stakeholders" that is the source of the Guidance and not the State."

¹³ This subject will be dealt with in Guidance 14 "Human needs, natural resources and preservation of the biosphere: the case of agricultural practices and soil quality".

¹⁴ In particular:

a. Debate on 14/03/2019 with Philippe Gouletquer, Ifremer; Magalie Jannoyer, CIRAD; Olivier Le Gall, former Director General for Science at INRA, co-author of INRA's 2025 guidelines; and Thierry Caquet, ecologist, former teacher at Orsay, INRA Scientific Director for the Environment.

b. Debate on 21/06/2019 with Françoise Vernier, Environment, Territories and Infrastructures research unit, Irstea; Christine Charlot, Inra; Philippe Gouletquer, Ifremer; Thierry Burgeot, ecotoxicologist, director of the Biogeochemistry and Ecotoxicology unit, Ifremer; and Lucile Delmas, Ifremer coordinator for the implementation and scientific expertise for the Marine Strategy Framework Directive (MSFD), which is the environmental pillar of the European Union's Integrated Maritime Policy.

II ■ POLLUTION AND COMPETING USES OF WATER: A SELECTION OF EMBLEMATIC CASES

Some call them "tensions", others "conflicts of use" or "competing objectives". There is no shortage of issues surrounding water. In each and every case, the need for more integrated management and a better global vision is apparent.

1- Land-sea coupling and competing uses of freshwater on metropolitan coasts: the case of the Charente region

When water discharges into the sea laden with pollutants from: agriculture (pesticides), wine-growing (copper in particular), or industry (refineries), trophic chains are modified. Fish and oyster resources are degraded through mutation. Philippe Gouletquer, deputy scientific director of Ifremer, notes that they have been closely monitoring these phenomena for the last thirty years, using their observation network of chemical contamination of coastal waters (ROCCH) and its associated database thanks to biomarkers that detect the accumulation of metals in shellfish. Legislative and regulatory measures could help to prevent these phenomena, but current regulations are inadequate because of the constant appearance of new chemical products that are not taken into account.

In addition to the problem of quality, there is also a problem of quantity: oyster and shellfish farming need sufficient amounts of freshwater, particularly for the nutrients it contains (nitrogen, phosphates, etc.) and this is generally not the case. Here we see a major misunderstanding between farmers and oyster/shellfish farmers: for the former, water that goes out to sea is lost water. They therefore believe that they can stock up on fresh water during the winter to irrigate the rest of the year without any harm being done. On the other hand, freshwater shortages in both winter and summer are hampering shellfish growth, which is why shellfish farmers are protesting against these practices¹⁵. In Charente-Maritime, the prefecture has had to apply a water policy that limits the building of water reserves for irrigation. The latest projects in this area are the subject of appeals by nature protection associations.

The Charente is precisely the sector on which Françoise Vernier is working. She is from the Environment, Territories and Infrastructures research unit at Irstea (Institut national de recherche en sciences et technologies pour l'environnement et l'agriculture) Bordeaux and is studying both the relationship between the development of agricultural and human activities and water resources in the Arcachon basin and the Charente region, where she is coordinating a European project. In these regions, there is particularly strong competition between the demands of farmers for water storage and the needs of shellfish farming. Demand for water in summer is enormous, due to irrigated agriculture (which can absorb up to 80% of available water resources), tourism and shellfish farming. Conflicts are exacerbated over the years, as droughts become more frequent.

In this case, the issues of public policy and governance are crucial, not least because of the dissociation between inland water management and maritime management. The administrative, local, regional and European red tape does not make things any easier¹⁶. The need for a multi-stakeholder approach to the issues is all the greater. According to Françoise Vernier, farmers, who are far from the coastal zone, do not feel that they have a vested interest in what happens on the coast. Yet the quantity of water available is not infinite, and we need to come to an agreement on how to share the resource, and on the type of development we want for the area concerned: how do we adapt economic activities to the changes that are coming? Do we want, as many do, a status quo that favours activities with high added value, or do we need to move towards a genuine change of system? Although the vines that produce cognac are not irrigated, they may need to be in the future, as a result of climate change." The real difficulty, lies in growing maize, which requires a lot of water and is not necessarily suited to this

¹⁵ Some farmers have become aware of the problem, as a quantitative shortfall in freshwater inflow can lead to unwanted seawater flowing back inland.

¹⁶ For example, the European Union has issued a directive on maritime spatial planning, the purpose of which is to specify and prioritise activities within the exclusive economic zones of member countries. In this case, if the State defines priority zones for aquaculture, it is necessary to have coherence in the management of land-sea activities, particularly for its water policy". See <https://eur-lex.europa.eu/legal-content/FR/TXT/PDF/?uri=CELE:32014L0089&from=FR>

geographical area", notes Philippe Gouletquer. It is the financial value of this crop on world markets that has encouraged farmers to develop it (which has no historical legitimacy) in order to support their short-term income.

In this region, surface drinking water catchments are increasingly being called into question, notably concerning water quality. The creation of water storage reservoirs by farmers or municipalities (e.g., La Rochelle) to take advantage of rainy periods, has given rise to violent conflicts. For producers, storage operations are necessary and do no harm. A lot of water resources stagnate in winter, so why not store it? Scientists disagree. They point out that there is a continuum, a global water cycle, and they note that with climate change, such practices could become disastrous. In fact, the very existence of irrigated crops is being called into question. Faced with these tensions, F. Vernier is seeking to move beyond the confrontation of two antagonistic positions. "We believe," she adds "that there are scenarios that would enable us to move towards more diversified systems, with better management of water resources, metering of reserves, intermediate storage, etc. "An analysis of the region is currently underway, which will help to unravel the controversy surrounding water storage. But, she adds, in the conversations that are being set up, we are trying to go beyond the polarisation of the debate. We can use participatory tools and system modelling (all storage, intermediate storage, etc.). All this is linked to societal choices about agriculture, the prospects for organic farming, the crisis in livestock farming, competition for space, etc.

To complete the picture of water problems in this region, there is also the case of the Trézence dam project. Philippe Gouletquer, who worked on water issues in La Tremblade for many years recalls that in the 1980s and 1990s the construction of a dam in this area was envisaged in order to boost low-water flows in the Charente, in response to scientific studies that had highlighted the need to guarantee the valid ecological status of the Charente's channels. The of had already invested in the purchase of the The conflicts in this region were between agriculture in the catchment area, which was in favour of increasing irrigated areas, particularly for growing maize, and shellfish farming, which was in favour of harvesting young oysters in the summer and the primary production (phytoplankton) needed for oysters and mussels to grow.

Low-water flows were almost non-existent in the summer. One of the technical options available at the time was to build a dam on the Trézence to create a significant reservoir. This option was rejected. Today, the conflict persists at various levels, including in the nearby Sèvre Niortaise, which flows into the Breton Pertuis, where mussel and shellfish farming flourishes and which has been classified as a regional park in the catchment area (a classification that is highly contested due to agricultural lobbying)¹⁷.

2- The case of diffuse pollution in the land-sea continuum in The Pays de Loire and the Pollusols research project

Pollution caused by human activities can affect vast areas of land over a long period of time, even if only slightly. This is known as diffuse pollution.

In The Pays de Loire, researchers from a range of disciplines (biology, geology, sociology, chemistry, physics, etc.) have been working together since 2015 as part of the Pollusols project on the issue of diffuse pollution in the land-sea continuum in the Loire catchment area¹⁸.

The aim of the project is "to structure research on this topic, improve understanding of the entire pollution cycle and propose relevant tools for managing polluted soils and sediments."¹⁹ Thierry Burgeot, ecotoxicologist and director of the Biogeochemistry and Ecotoxicology unit at Ifremer, oversees the Pollusols project. His work focusses mainly on the environmental impact of the local

¹⁷ Information provided by P. Gouletquer on 15 July 2019. Bibliographical indications for further reading:
- An article: Gerard, T., Roger, K., Maurice, H. (1999). The Charente, a shellfish estuary. *La revue d'information de l'Ifremer Recherches Marines*, 22, 20-25.
- Three reports: Bacher, C., Fillon, A., Prou, J., Heral, M. (1997). Barrage de la Trézence: impact sur la productivité du bassin de Marennes-Oléron; Bacher, C., Fillon, A., Prou, J., Heral, M. (1997). Bassin de la Charente et Baie associée de Marennes-Oléron. <https://archimer.ifremer.fr/doc/00077/18796/>; Ravail, B., Heral, M., Razet, D., Robert, J.-M. (1986). Incidence de la diminution des débits de la Charente sur la production primaire du bassin de Marennes-Oléron. Progress report No. 1.
- A recommendation: Merckelbagh, A. (1995). Ifremer recommendation on the Trézence dam and its possible influence on the Marennes-Oléron oyster basin. Ministère de l'Environnement, Direction de l'Eau, 75.

¹⁸ Burgeot's unit is also involved in the Seine-Aval project, which integrates the land-sea continuum, and in Labex in Gironde. Like Pollusol in the Pays de Loire region, these two projects focus on chemical contamination and its effects on the natural environment.

¹⁹ <https://osuna.univ-nantes.fr/recherche/projets-de-recherche/pollusols/pollusols-pollutions-diffuses-de-la-terre-a-la-mer-1304013.kjsp>

chemical industry. Pollusols is developing indicators to assess the impact and biological effects of these contaminants not only in coastal areas but also in the open sea. T. Burgeot notes that there is an increase in the number of molecules produced by the chemical industry in marine environments, which are increasingly diverse and take new forms, and the need to rank these molecules in order to assess their impact on the environment and the consequent risks and effects of exposure (endocrine disruptors). From a societal point of view, T. Burgeot argues that regulations should take account of changes in contamination profiles.

Lucile Delmas, Ifremer's coordinator for scientific expertise and implementation for the European Marine Strategy Framework Directive (MSFD), who also attended the debate, and Thierry Burgeot, point to the major problem of governance in these areas. The European directive defining marine governance is based on 11 descriptors. The European Water Framework Directive is based exclusively on indicators, or biomarkers, developed in freshwater and not in the marine environment, whereas the approach of the Marine Framework Directive is more encompassing. In addition, the spatial scope of the two directives partially overlaps, which makes it difficult to provide consistent recommendations. In the long term this does not suit some European countries. The European DCSMM directive is entirely ecosystem-based, covering species, habitats, food webs, non-native species, fisheries, contaminants, noise and health issues. The French Environment Ministry has chosen to combine the Water Directive with the Marine Directive. Many directives are in conflict (between environmental protection and socio-economic activities). Furthermore, decisions are generally taken at the top, at a national level, and do not take local governance into consideration. There is a façade of consultation at the local level, but everything is negotiated at the ministerial level.

When asked to list the points of conflict in her field, Lucile Delmas cites, in no particular order: fishing *versus* scuba diving, birds, plastic in the sea, fishing *versus* pleasure boating, tourism *versus* species protection (should we approach dolphins just to satisfy the curiosity of holidaymakers?).

3- Green algae, invasive species, asphyxiated ecosystems: eutrophication as a social issue²⁰

Eutrophication is linked to the accumulation of organic matter and nutrients such as nitrogen and phosphorus in rivers, lakes and coastal waters.

These external inputs come mainly from the discharge of domestic (wastewater), industrial and agricultural effluents, contaminated run-off from agricultural and non-agricultural surfaces, and pollution-laden atmospheric depositions. When the concentration of these elements increases, we see a bloom of toxic cyanobacteria in lakes and rivers, and a proliferation of green algae in coastal areas, one of the consequences of which is to prevent the penetration of light into water columns. This proliferation is fatal for ecosystems, as they run out of the light and oxygen they need. This is known as asphyxiation of aquatic ecosystems.

This phenomenon, which highlights the conflict between the short-term interests and demands of farmers and industrialists, and environmental protection is far from new - it has been observed since the beginning of the last century in industrialised countries - However, as a result of population growth, urbanisation, industrialisation and the use of increasingly harmful chemical inputs in agriculture, it has developed considerably since then, particularly in the American Great Lakes region and Lake Geneva, and also in the Baltic Sea, the Gulf of Mexico, and along the coasts of Brittany and the Mediterranean sea. Climate change is also becoming a major factor in exacerbating the phenomenon, whose economic (impact on shellfish production, fishing, tourism, etc.), ecological (reduction in biodiversity) and social costs are considerable everywhere.

²⁰ Elements collected during the presentation made to the Ethics Committee on 12 November 2018 by Chantal Gascuel, Inra co-leader of the collective scientific expertise on eutrophication (ESCo), and Philippe Souchu, ESCo expert. They are co-authors of: Pinay, G., Gascuel, C., Ménesguen, A., Souchon, Y., Le Moal, M. (coord). Eutrophication: manifestations, causes, consequences and predictability. Synthèse de l'expertise scientifique collective CNRS-Ifremer-Inra-Irstea.

A collective scientific expertise committee (ESCO) was set up in order to help assist decision makers of public policies likely to find solutions to this problem, particularly in the context of the implementation of European directives aimed at protecting aquatic environments²¹. ESCO is coordinated by the CNRS, with the active collaboration of Ifremer, Inra and Irstea, and has been commissioned by a number of public institutions²². Around fifty scientists have been working on the project for two years, looking for solutions to reduce the phenomenon and to explore new avenues of research.

One of the major characteristics of this process, which is important to take into account in the context of our referral, is the use of human and social sciences: These have been very useful in analysing the facts of the problem, and in understanding how public policies have come to tackle it. We understand that "it is very often the combination of several dynamics that leads to eutrophication issues being put on the agenda, following the classic analysis of the social construction of public environmental problems: knowledge, temporal alignment, a certain amount of chance, dramatic events and the mobilisation, on the ground, of whistle-blowers and cause-builders"²³. The role of "social movements putting pressure on the authorities to change their attitude towards powerful economic players who may have an interest in the status quo" should not be underestimated. [...] The case of the regulation of phosphate levels in detergents is an enlightening example²⁴. In France, the role of local environmental mobilisation in stepping up the government's efforts to combat coastal eutrophication has also been highlighted by research into the handling of green tides in Brittany²⁵. France has also been singled out for criticism over the quality of its water in Brittany (nitrate levels in excess of regulations) following complaints from nature conservation associations. It should be noted that the issue of green algae in Brittany had already been raised in Guidance no. 9 of our Ethics Committee on "The ethical issues involved in assessing the impact of public agronomic research" in 2016²⁶.

Nutrient pollution is not visible to the naked eye in its early stages, but as soon as it becomes visible, the stench and the illnesses - sometimes fatal - that follow, have an impact on daily life (swimming bans, cuts in supply of drinking water, limits on the consumption of seafood, etc.) affecting animals and humans alike. These green tides sway public opinion, bolstered by the media, cause a series of social tensions which expose a real social issue. As the authors of the summary of the ESCO's work note, "the intensity of the conflicts depends less on the seriousness of the effects of eutrophication than on the social visibility of the issue and the level of structuring of the players, whether they be institutions, professional groups, whose responsibility is engaged or whose activity is threatened, or civil society". These conflicts are all the more complex in that they not only "bring together economic interests, but also generate very different representations of the environment, conceptions of public action, social responsibility and scientific knowledge", and that "dependence on the same water resource is at least as much a factor in strengthening solidarity and negotiation as in lasting antagonism. In this context, those involved in political and social conflicts can use environmental problems as arguments and pressure tactics. Environmental problems can also constitute an invisible infrastructure on which social, economic or political inequalities are reproduced or accentuated, without translating into explicit conflicts. This is the case, for example, when the deterioration in water quality mainly affects populations with few resources, making their access to other forms of water supply more costly or limiting the possibility of enjoying environmental amenities free of charge for their leisure activities".

Finally, to complicate matters further, there is the structural gap between water policies, which have historically been devised and applied at a local level, and agricultural policies, which have been devised on a much wider scale. In this context, note the authors of the study, "the specific governance efforts put in place in areas where eutrophication is an issue may, in the short term, produce tensions and frustrations: they confront managers, representatives of civil society and agricultural players with the structural limits of their own action".

²¹ Nitrates Directive, Water Framework Directive (WFD), Marine Strategy Framework Directive (MSFD) and Urban Wastewater Directive (UWWWD).

²² Ministry of Ecological Transition and Solidarity, French Biodiversity Agency (AFB) and Ministry of Agriculture and Food.

²³ Summary of the ESCO study mentioned in the previous footnote.

²⁴ P. Gouilletquer notes that this is true for phosphates, whose levels have fallen as a result of regulations, but the problem is mainly with nitrates, which have risen steadily as a result of environmental practices. As a result, he adds, "phytoplankton populations have changed dramatically along the coast. It is the N/P ratio (Redfield ratio) that determines which species are 'favoured'. The mere increase in nitrates is enough to cause green tides (macrophyte algae) to develop.

²⁵ Summary of the ESCO study, op.cit.

²⁶ Annex 3, pp. 31-32.

4- Chlordecone: the severe health problem of water contamination in the French West Indies²⁷

Chlordecone, an organochlorine insecticide, was used on a massive scale for over 20 years (1972 to 1993) in banana plantations in the French West Indies. It was selected to combat the banana weevil. However, it is an endocrine disruptor and neurotoxicant and the product was consequently banned from sale in the United States in 1976, but was however not banned in France until 1990. Nonetheless, this did not prevent it from being used for three further years, due in particular to exemptions obtained by producers, legislative ambiguity and illegal sales. The chemical caused high levels of pollution in groundwater, and led to the poisoning of animal feed and contamination of food products for humans.

According to a Santé Publique France survey published in 2018, 92% of Martinique residents and 95% of Guadeloupe residents now have chlordecone in their blood²⁸! In fact, the effects on people's health have given rise to violent controversy.

Philippe Gouletquer also points out that the effects of this pollution "are having a highly significant impact on the marine environment, with fishing zones being closed and fish being unfit for consumption. As a result, the government is directing fishermen towards more offshore based activities for which they are not equipped. Hence the need for new boats, and a new way of life for fishermen, which would entail several days at sea instead of a day's work, which they refuse. Added to this is the development of illegal fishing, which poses a public health problem.

It was only recently, that on the 15 October 2019, the French government, represented by Annick Girardin, Minister for Overseas France, acknowledged the State's responsibility in this scandal.

Of course, chlordecone is far from being the only case of damage caused by chemicals used by producers. Magalie Jannoyer, an expert on the subject at CIRAD, deplores the fact that lessons have not been learned from this case to prevent further problems, especially as she believes in the virtues of dialogue in this area. As part of a "river contract" and on the initiative of the national chlordecone committee, a series of workshops brought together players as diverse as ONEMA²⁹, researchers, producers, trade unions and environmental associations. Surveys have shown that there is no correlation between good practice and good environmental status. The workshops provided an opportunity to debate this, as well as the representations associated with pesticides and pollution.

Throughout these participatory workshops farmers became acutely aware of the catastrophic effects on rivers of some of the chemicals they were using. This revelation led a few of them to stop using pesticides, which curiously is not unconnected with a cultural attachment to natural elements, which is considered an integral part of the Antillean identity. This close relationship with nature is much stronger than in mainland France³⁰ and sometimes of a sacred nature. The workshops also helped to break down barriers between agricultural sectors. Participants realised that techniques tried and tested on banana plants could be profitably used on sugar cane. Neighbours began to talk to each other, whereas they had never spoken before. Magalie Jannoyer notes that "water establishes compulsory solidarity". One final comment: contrary to what happens all too often, the results of scientific research were shared with all the stakeholders before being published.

5- Sargasso: Brown algae, an ecological disaster or an opportunity for development in the Caribbean?

The French Prime Minister's visit to Guadeloupe, to close the very first international conference on sargassum in October 2019, put the spotlight on the scale of the invasive phenomenon of brown macro-algae, which are increasingly being washed up on the beaches of Mexico, Florida and several Caribbean islands. Our working group felt that this case was sufficiently illustrative of the theme of

²⁷ Case presented by Magalie Jannoyer, CIRAD. The study by Pierre-Benoit Joly (INRA/SenS and IFRIS) is also of interest: "La saga du chlordécone aux Antilles françaises - Reconstruction chronologique 1968-2008." Document produced as part of action 39 of the Chlordecone plan. Afsset-Inra collaboration agreement, July 2010.

²⁸ <https://www.lefigaro.fr/actualite-france/en-martinique-et-en-guadeloupe-sols-et-eau-sont-pollues-pour-des-siecles-20191021>

²⁹ Office national de l'eau et des milieux aquatiques.

³⁰ See the subject of this study by Bernard Morandi (CNRS) for l'Office de l'eau de la Martinique (<https://halshs.archives-ouvertes.fr/halshs-01314217>).

self-referral that we thought it should be considered as a textbook case to be analysed, in particular with the IRD researchers working on it. We have not yet done so, but we will summarise a few facts about the problem here³¹.

The phenomenon seems far from new. Christopher Columbus is said to have noticed brown algae floating in the Atlantic, but it is especially true, that since 2011 we have witnessed an unprecedented proliferation in the Gulf of Mexico, the Caribbean Sea and as far as the West African coast. A study published in July 2019 in the journal *Science*³² puts forward the (as yet unproven) hypothesis that the origin of this upsurge is to be found in the suspended matter discharged in recent years by the Amazon River, which is a potential nutrient for algae, and whose abundance could be due to deforestation and increased agricultural activity using fertilisers. Rising currents from West Africa would also have brought these effluents to the surface, bringing them into contact with the algae. In Guadeloupe, this invasion affects public health and tourism, as beaches are buried under masses of rotting algae, with toxic fumes (ammonia and hydrogen sulphide) and a particularly nauseating odour. It destabilises ecosystems and harms fishing and shellfish farming. Frédéric Ménard, a researcher at the IRD, explains that when it reaches the coast, "it rots and consumes the oxygen in the water column, endangering the organisms that live there, particularly those that are immobile (shellfish, coral reefs, etc.³³)".

The measures to be implemented to deal with the problem of sargassum do not necessarily all point in the same direction, for the simple reason that it is not always... a problem! For Frédéric Ménard, "we shouldn't think of sargassum as a nuisance to be disposed of. Inevitably, it is a major problem when it washes ashore, but in the open sea it's neither toxic nor harmful, and it plays an ecological role. It is a refuge for many species of fish and a nursery for certain species"³⁴. However, this seaweed always ends up sinking when it doesn't wash up on the coast, and can threaten the biodiversity of the seabed. The issue of sargassum is therefore particularly diverse and complex, and we can imagine that opinions on how to deal with it may differ widely. How can we anticipate the arrival of brown seaweed, how can we collect it and how can we recycle it?

There is every reason to believe that the masses of seaweed, collected by the various contributors involved in clearing it from the beaches, can be recycled and exploited in a way that is useful to the community and that the environmental problem could be transformed into an opportunity for development. Research into recycling formulae is currently in full swing, with some particularly inventive ideas presented at an "international exhibition of innovative techniques for forecasting, monitoring, surveillance and collection of sargassum seaweed". held in Pointe-à-Pitre at the same time as the international conference mentioned above.

The University of Antilles-Guyane (UAG) is heavily invested in this research, which could be useful in pharmacology, construction (biomaterials obtained from algae) or at the initiative of the team led by Sarra Gaspard, a professor at UAG, to combat chlordecone pollution, as mentioned in the previous case: when heated to a temperature of 600°C, sargassum becomes activated charcoal, which can contribute to water decontamination. For the moment, "explains Gaspard, "with sargassum charcoal, we can sequester around 80% of the chlordecone"³⁵. In Mexico and the United States, there are also a number of projects to convert sargassum into bioplastics.

The ECO3SAR research project (CNRS-MNHN-SU-IRD-Université Caen Normandie-Université des Antilles) aims to explore the use of brown seaweed as an enrichment for compost, a practice already tested by a biotechnology company, Holdex, which uses seaweed as an additive in the manufacture of compost. Sargassum is being spread on certain tropical crops on an experimental basis, however the results are not yet conclusive mainly due to the salinisation of the soil. A Martinique start-up even

³¹ Our provisional data were taken mainly from:
<https://www.geo.fr/environnement/lorigine-des-invasions-dalgues-sargasses-sur-les-plages-des-caraibes-enfin-elucidee-196894>
https://www.huffingtonpost.fr/entry/les-sargasses-un-fleau-pour-les-plages-une-opportunite-pour-dautres_fr_5db1aaee4b01ca2a858e50d
<https://www.europe1.fr/societe/guadeloupe-comment-le-fleau-des-sargasses-pourraient-aider-a-lutter-contre-la-pollution-au-chlordecone-3927608>
https://www.liberation.fr/france/2019/10/30/algues-sargasses-muer-la-plaie-en-aubaine_1760398

³² <https://science.sciencemag.org/content/365/6448/83>

³³ <https://www.afp.com/fr/infos/3734/la-prolifération-des-sargasses-phenomene-encore-mysterieux-doc-11g08k2>

³⁴ *Ibid.*

³⁵ <https://www.europe1.fr/societe/guadeloupe-comment-le-fleau-des-sargasses-pourraient-aider-a-lutter-contre-la-pollution-au-chlordecone-3927608>

recently came up with the idea of manufacturing "ecological coffins" for cremation, made from 60% sargassum and the rest from banana and coconut fibres! In Martinique and Guadeloupe, efforts are also being made to produce energy from the biomass made up of sargassum.

So here we have an original case of a land-sea continuum where potential interactions are two-way: from land to sea; if the hypothesis of effluent discharges from the Amazon River is proven, and from sea to land, if the masses of algae collected can be used on the islands as both fertiliser and pollution depollutant.

III ■ MAIN LESSONS LEARNED FROM THE CASES ANALYSED AND PROSPECTS FOR CONTINUING TO EXPLORE WATER-RELATED ISSUES.

What lessons can we draw from examining the various cases that have just been cited?

Lesson 1 seems to us to be that the issues of pollution and competing uses of water are far from being just scientific and technical questions. They are also:

- *Societal issues*, where often divergent choices are made in terms of agricultural models (priority to productivity, organic farming, intensive or extensive farming, etc.), territorial development models (fishing versus scuba diving or pleasure boating, tourism versus species protection, etc.).
- *Cultural issues*: different conceptions of the relationship between man, society and nature (as in the West Indies, where farmers' deep cultural attachment to their land has helped them to renounce the use of pesticides), the clash between a culture of quality and prestige in agricultural production and a maritime or island culture, and clashes between different institutional cultures, even within agricultural and maritime research. Everyone has different rationales, values and professional cultures, with no real space for dialogue.
- *Economic issues of clear importance* (diverging interests).
- *Information issues*: when it comes to the transfer of water from catchment areas to marine aquatic ecosystems, many farmers are simply unaware of the consequences of their practices and of what is released into the environment, whether rivers or the sea, thinking that what they are discharging is just harmless excess water. In addition, public opinion often focuses only on the visible, local aspect of contamination phenomena, when in fact it occurs on a much wider scale in space and time.
- *Questions of temporal scale* (short-term productivity versus long-term environmental concerns); the question of the long term appeared to be particularly important during the debates, especially in the field of impact assessment.
- *Questions of scale and modes of governance*: administrative red tape, local national and European levels, practices (or lack of practices) of consultation and participation of all the stakeholders in drawing up public policies, etc. In the event of conflicts of use, the public authorities are obviously in the front line to organise dialogue between the stakeholders and prepare arbitrations accepted by all. But it is not that simple: when you want to protect the common good (water quality, for example), "how do you deal with the fact that something has deteriorated without making those who caused the deterioration pay?" ask Olivier Le Gall and Thierry Caquet³⁶. How can we apply the 'polluter pays' principle to farmers? How can we contribute to a necessary activity (food production) while at the same time contributing to the common good? Another important point is the need to reconcile the sectoral approach (regulation of a particular industry) with an integrated approach to governance that takes all the stakeholders into account when making trade-offs. Gouletquer suggests that we look into the EFESE project (French evaluation of ecosystems and ecosystem services)³⁷ of the Ministry of Ecological Transition and Solidarity, and perhaps hear from the protagonists. In any case, the question is what

³⁶ Hearing on 14/03/2019 at INRA, with Olivier Le Gall, former Director General for Science at INRA, co-author of INRA's 2025 orientations and Thierry Caquet, ecologist, former teacher at Orsay, INRA's scientific director for the environment. du 14/03/2019 at INRA, with Olivier Le Gall, former Director General for Science at INRA, co-author of INRA's 2025 orientations, and Thierry Caquet, ecologist, former teacher at Orsay, INRA's Scientific Director for the Environment.

³⁷ <https://www.ecologique-solidaire.gouv.fr/evaluation-francaise-des-ecosystemes-et-des-services-ecosystemiques>

researchers themselves can do to take into account the rationale of all stakeholders outside the research sector.

Lesson 2, following on from our last comments on governance. Governance is far from being the sole responsibility of government departments. Research institutes (and not necessarily individual researchers³⁸) have a clear responsibility, not only to provide as much information as possible and inform people of the dangers of a particular practice, but also for:

- *Clarifying internal positions*, which is one of the major concerns expressed by Olivier Le Gall and Thierry Caquet (INRAE). Within (and outside) research institutes, two very different organisational approaches converge. The first is the vertical, sector-based approach (a "siloe" organisation), where it is difficult to reconcile partial rationalities and where decisions are often taken on a category basis). The second is the horizontal, cross-cutting nature of environmental and ecosystem issues. The metaprogrammes are presented as one of the instruments for confrontation of standpoints and dialogue between the two approaches.
- *Clarify the way in which researchers participate in expert committees*, which is not easy either: in particular, there is the question of researchers' freedom of expression and their ambivalent role, as they are not necessarily inclined to put themselves in a position to take part in public debate, when this does little to forward their careers (which also explains why it is the most senior researchers who are the most involved in this debate). It's also worth noting that you can't remain an expert forever, and that it's always essential to update your expertise.
- *Diversifying strategies*, in particular by giving greater importance to the economic and human and social science aspects of conflicts of use. A holistic, interdisciplinary approach (health, environment, agronomy, physics, chemistry) was needed to solve the chlordecone issue (including how to trap it in the soil by harnessing the properties of the chlordecone molecule). Magalie Jannoyer notes, however, that human and social sciences played only a very small part in this interdisciplinary approach.

Lesson 3, the case of the French West Indies and eutrophication, particularly highlighted that not everything is a conflict. Indeed, if there are genuine conflicts of interest and usage between the various players, an exchange of dialogue can reveal that disagreements often arise from a lack of information. When everyone's points of view are made sufficiently clear, there is sometimes a consensus, even for subjects that were initially highly controversial. Michel Badré says that he has sometimes observed this phenomenon in the debates that took place on the treatment of nuclear waste, on his watch in 2019.

Lesson 4: in most of the cases studied, we obviously did not just passively observe conflicts of interest and competing objectives. The active phase was for public authorities, researchers and civil society to provide solutions, either through regulatory measures and traditional consultation processes, or by exploring new models of debate. These new models include the participatory workshops mentioned by Magalie Jannoyer in the French West Indies, and the multi-agent models mentioned by Hervé Théry, a role-playing experiment organised by CIRAD, notably in Cochabamba, Bolivia. The various stakeholders who were in a conflict over water use, were invited either to play their own role, or to put themselves in the shoes of players with opposing interests, in order to explore each other's standpoint.

How can we move forward? Several ideas were proposed at the March 2019 meeting of the Ethics Committee in Tours:

- The organisation of an Inra/Ifremer (and CIRAD?) forum to discuss land-sea water conflicts. One notable example, is the case of Inra (which is more concerned with land issues) and Ifremer (which is more concerned with coastal issues). These institutes should allocate as much time together as

³⁸ Cf. Olivier Le Gall and Thierry Caquet's questioning of the role of the researcher and his attitude to things outside his field. Reservations about the political role of the researcher: "I didn't come to INRA for that. I'm not here to manage the landscape, but to find out how things work. It's not my job to say how it can satisfy human needs. (...) We are in water systems where there are commitments, but which leave researchers some room for manoeuvre".

possible to discuss different compromise solutions. This is also an opportunity to confront institutional cultures that may be somewhat different.

- Organising a day or half-day with representatives of the three institutes who have taken part in expert committees: how do they see their roles, how do they construct their positions, etc.?
- The organisation of an Ifremer meeting on fish population concentration with fisheries specialists and researchers in the human and social sciences with totally divergent points of view.

Another idea is to launch a series of debates over the coming months and years on issues relating to the land-sea continuum. For Axel Kahn, the idea is to go beyond the recognition of contradictory objectives and propose a methodology for negotiation that accepts the validity of each objective. At the Ethics Committee meeting on 8 July, Michel Badré outlined the methodological elements on which we intend to base our work.

1. Identify the general domain in which the controversy or controversies lie. This domain should be defined fairly precisely, but not exhaustively. On the basis of the consultation of 21 June 2019 (Irstea and Ifremer), this could be the conflict between the water needs of producers (agriculture, oyster farming, aquaculture, etc.) and the challenges of preserving water quality and quantity, at the land-sea junction, in a geographical sector to be defined (a catchment area that is not too large). This could be extended to other needs (tourism, drinking water in towns, etc.).
2. The precise topic of controversy must be identified by our committee and also be validated by the participants. It could take the form, for example, of: "Is the construction of water storage reservoirs the right solution for better quantitative water management that meets the needs of users, while preserving water quality? Are there other promising alternative options?"
3. The contextual data must be clarified before the debate: firstly, are the technical and economic data on water resources and needs available and are they consensual or not? This includes data on flow rates (average, low-water and high-water) at sensitive points, on the water requirements of the various categories of users, on measured pollution levels (particularly nitrates), etc. In other words: is the controversy based on reliable, documented data (the question of the meaning of the measurement, of what it does or does not say, being central here), or does it stem in part from a lack of basic data? Secondly, are the conflicts of use clearly identified, in terms of their nature (for example: low-water flow at a given point lower than the cumulative needs of users at the same point, or pollution levels that are too high at certain periods, etc.) and their geographical location? Has any research been carried out on the subject in any field such as (biosciences, economics, sociology, etc.)?
4. The various possible solutions to the conflicts of use, referred to in point 3, should be identified: for example; building reservoirs (approximately how many and where?); regulating use; using taxation or fees; changing user practices, etc. Each solution would be the subject of a brief descriptive hand-out.
5. The arguments for and against each solution can be compiled in different ways: disputes between people charged with defending or attacking a point of view; joint group preparation of a list of arguments and counter-arguments; testimonies from locally involved players (producers, NGOs, government departments, etc.). Hervé Théry notes, that in a dispute, the main aim is not for the champion of one position or the other to triumph, but for the debate to move forward. The outcome should be to work towards a consensus of opinion.
6. The validation phase of the final summary report is essential (a comprehensive list of points for or against each option): the involvement and the presence of socio-economic stakeholders is undoubtedly necessary at this stage. This final summary should be geared, where appropriate, towards the additional work to be carried out in preparation for the decision to be taken: additional research or studies, consultations to be held, etc.

It remains to be seen what all this can produce, and how the results of these controversies can be disseminated, exploited and commented on within the research community. At the start of his term of office, Axel Kahn asked the presidents of the research institutes to change the way the Ethics Committee was constituted, so that while it would remain institutional, it would also be more in touch with the questions, reservations and concerns of the staff, by means of mechanisms yet to be defined. One way of doing this would be to design a specific site or part of a site for the joint Ethics Committee, with a mechanism enabling staff to contact the Committee, no doubt via the Presidencies and Directorates General³⁹. The members of the self-referral working group are also keen to see this happen.

³⁹ Extract from the minutes of Axel Kahn's meeting with IFREMER management in February 2019.

APPENDIX

The emergence of a concern for the balance between needs and the biosphere in the West

Michel Badré⁴⁰

We are hardly the first people to be concerned about the balance between needs and the biosphere. As early as the 18th century, Linnaeus set out the principles of an "economy of nature" in a 1749 work entitled "The Balance of Nature"⁴¹. One of his students, Biberg⁴², went on to explain: "By the economy of nature, we mean the very judicious disposition of natural beings, instituted by the Sovereign Creator, according to which they tend towards common ends and have reciprocal functions". In the eighteenth century, many manuals on "oeconomy"(from the Greek oikos, the home) taught us how to manage the household by balancing income and expenditure, inputs and outputs, making household products and recycling waste. This domestic economy, based on a very static notion of equilibrium, was extended to the management of natural resources with Quesnay and the Physiocrats. However, this highly order-oriented approach to economics was superseded by the growth economy paradigm based on the idea that nature is an unlimited resource. In the 19th century, a number of voices, albeit very isolated, asserted the need for a different way of looking at nature. Thoreau⁴³'s and Élisée Reclus⁴⁴'s concept of the "good life" came to the fore, as did a number of solid demonstrations of a desire to preserve the biosphere. In the United States, it was the creation of the first national parks from 1870 onwards, and above all the symbolic conflict over the Hetch Hetchy Valley in Yosemite Park, that attracted attention: A battle that lasted more than 20 years pitted the "preservationists" led by John Muir, founder of the Sierra Club, in favour of complete protection, against the "conservationists" behind Gifford Pinchot, a forester trained at the Nancy Forestry School and future governor of Pennsylvania, in favour of building a dam to supply water to the city of San Francisco. The latter ultimately prevailed, thanks to arbitration by President Woodrow Wilson in 1913. In terms of the arguments exchanged by the two parties and the difficulty of the political authorities in arbitrating them, this conflict foreshadows many of those of the twentieth and twenty-first centuries.

However, the idea that human happiness primarily implied material prosperity, with little concern for the preservation of the biosphere, remained fairly dominant until the 1970s, i.e., roughly until the end of the "post-war boom years", when the consequences in terms of the degradation of the biosphere led to the emergence of a new environmental ethic. Its most accomplished representative is undoubtedly the American forester and academic Aldo Leopold. His thoughts on environmental ethics, which date back 70 years and are quoted in his best-known book, *The Sand County Almanac*⁴⁵, still ring true today:

"An ethic is a limit imposed on the freedom to act in the struggle for existence. (...) An ethic can be seen as a guide to dealing with ecological situations that are so new or so complex, or involving consequences so remote, that the path of social interest cannot be seen by the average individual (...) Ethics may be a kind of community instinct in the making. (...)"⁴⁶

This line of thought, which underpins current developments in environmental ethics, has been taken up and developed in the United States by John Baird Callicott⁴⁷, and in France by Catherine and Raphaël Larrère⁴⁸. It was also during this period that the most spectacular progress was made in increasing agricultural productivity throughout the world, earning Norman Borlaug the Nobel Peace Prize in 1970 for his "green revolution". Yet the backlash against this revolution in terms of its impact on nature began to emerge in the 1960s, and even led a European Commissioner as sceptical of outrageous environmentalism as Sicco Mansholt, one of the fathers of the CAP, to warn all European governments in 1972, without success of the risks associated with this development, following the publication of the Club of Rome report.

In 1972, this report drew public attention to the possible consequences of continuing to extrapolate the trends observed at the time, in terms of consumption of natural resources and environmental impact on land, water and air. Strangely enough, it aroused little interest in environmental circles then, no doubt because it came mainly from established North American economists. Nevertheless, it provoked fierce opposition from economic circles throughout the developed world, who set out to discredit it, (generally without having read it, as the nature of the criticism levelled against it shows). However, an update of the data of the report, published 30 years later by its authors⁴⁹, shows its relevance.

At the same time, philosophical and sociological reflection on the risks affecting the biosphere evolved in the second half of the twentieth century. One of its origins lies in the questions raised by scientists such as Albert Einstein and Robert Oppenheimer regarding their moral responsibilities towards all life on earth, as a result of

⁴⁰ Summary of Michel Badré's speech at the Irstea-Ifsttar Ethics Committee meeting on 22 October.

Thoreau, H.D. (1854, et Gallimard 1922 pour la trad. française). *Walden ou la vie dans les bois*

⁴¹ L'Équilibre de la nature. Éd. J. Vrin (1972, first edition. 1749).

⁴² Deneault, A. (2019). *L'Économie de la nature*. Lux éditeur.

⁴³ Thoreau, H.D. (1854, et Gallimard 1922 pour la trad. française). *Walden ou la vie dans les bois*.

⁴⁴ Cf. notamment *Histoire d'un ruisseau*, J. Hetzel et Cie, 1869, et *Histoire d'une montagne*, J. Hetzel et Cie, 1880.

⁴⁵ Leopold, A. (1949). *L'Almanach d'un comté des sables*. Flammarion, 2000.

⁴⁶ Aldo Leopold, op. cit., p. 256-257.

⁴⁷ *Éthique de la terre*. Édition Wildproject, 2010.

⁴⁸ *Du bon usage de la nature*. Aubier, 1997, et *Penser et agir avec la nature*, La Découverte, 2015.

⁴⁹ *Les limites à la croissance, dans un monde fini*. Éd. Rue de l'échiquier, 2012.

the development of atomic weapons during the Second World War. One of the most striking reflections on these themes is that of Jacques Ellul⁵⁰, in his philosophical work on the effect of technical developments, whose very logic he believes, is to escape human control. At the crossroads of environmental issues and technological developments, Hans Jonas's *The Imperative of Responsibility*⁵¹ can also be cited, a principle defined as "an ethic for technological civilisation": refrain from undertaking any action that could jeopardise the existence, or the quality, of future life on earth. Another example is *Risk Society*⁵² by the German sociologist Ulrich Beck, published in 1986 shortly after the Chernobyl nuclear accident, which makes us reflect on the scope of the two distinct principles of prevention (in the face of a proven risk) and precaution (in a situation of scientific uncertainty). The French philosopher Jean-Pierre Dupuy took up these ideas in *Pour un catastrophisme éclairé*, arguing that considering a foreseeable disaster⁵³ to be inevitable is the only way to protect against it.

During the same period, this intellectual furore was reflected in strong institutional activity at a global level in the field of the environment: the Stockholm Conference in 1972, the Brundtland Report on sustainable development in 1987, the creation of the IPCC in 1988, the Rio Conference in 1992 with its three conventions on climate, biodiversity and desertification, the Johannesburg Conference in 2002 and the creation of the IPBES in 2012.

The concept of progress and happiness hitherto based on the fair distribution of growing material prosperity, which had been dominant for almost two centuries, has now been replaced by the search for a balance, albeit fragile, between the satisfaction of human rights as defined by the SDGs, including prosperity, the right to a balanced environment, and the democratic right to participate in decision-making.

⁵⁰ Cf. Notably *Théologie et technique. Pour une éthique de la non-puissance*. Éd. Labor et Fides, 2014.

⁵¹ *Das Prinzip Verantwortung*. Insel Verlag, 1979, French translation aux éditions du Cerf, 1990, et Flammarion.

⁵² *Risikogesellschaft*. Suhrkamp Verlag, 1986, French translation Flammarion, 2001.

⁵³ *Pour un catastrophisme éclairé. Quand l'impossible est incertain*. Le Seuil, 2004.

Appendix 1

BACKGROUND OF THE GUEST SPEAKERS:

THE MEETING OF 12 NOVEMBER 2018

Presentations and discussions on eutrophication, talks given by:

- **Chantal GASCUEL**, Director of Research at INRA (INRAE), Deputy Scientific Director for the Environment, INRA co-leader of the CNRS-Inra-Irstea-Ifremer collective scientific assessment (ESCo) on eutrophication, published in September 2017: "Eutrophication: presentation, causes, consequences and predictability";
- **Philippe SOUCHU**, **scientific expert** who contributed to this ESCo, biogeochemist at the Environment resources laboratory, Morbihan-Pays de Loire, Ifremer, Nantes.

See: <https://www.inrae.fr/actualites/leutrophisation-mieux-comprendre-mieux-gerer>

THE MEETING OF 14 MARCH 2019

Discussions on conflicts of use in water management, in particular water management and the management of pesticides and/or herbicides: implications for the preservation and quality of water resources. Arbitration on issues of governance, agro-ecology and sustainable management.

Talks given by:

- **Olivier LE GALL**, former Deputy Director General for Science at INRA (INRAE), formerly Head of the Plant Health and Environment Department and of the SMaCH metaprogramme (sustainable management of crop health);
- **Thierry CAQUET**, Scientific Director for the Environment at INRA (INRAE), ecologist, previously Head of the Ecology of Forests, Grasslands and Aquatic Environments Department at INRA. Former lecturer and researcher in aquatic ecology and ecotoxicology at the University of Paris-Sud;
- **Magalie JANNOYER**, Deputy Director General for Research and Strategy at CIRAD (agro-ecology, water and pesticide management in the French West Indies / the case study of chlordecone, governance issues);
- **Philippe GOULLETQUER**, Deputy Scientific Director at Ifremer: water quality, conflicts of use and pollution from reservoirs to the coast (ROCCH chemical contaminants network, Ifremer), case studies of fisheries, shellfish farming, etc

THE MEETING OF 21 JUNE 2019

Discussions with a panel of scientists based on their feedback on conflicts of use, associated with water resources in the land-sea continuum: tensions between the objectives of a good ecological status of water and the socio-economic objectives of human activities in agriculture, fish farming, industry, etc. through topics such as pollution of freshwater and marine environment, economic activities such as fish farming or shellfish farming, agriculture and associated governance issues.

Talks given by:

- **Thierry BURGEOT**, ecotoxicologist, head of biogeochemistry and ecotoxicology unit at Ifremer, Chemical Contamination of Marine Ecosystems unit (Ifremer Nantes) and POLLUSOLS project (Diffuse Pollution from Land to Sea). See: <https://osuna.univ-nantes.fr/recherche/projets-de-recherche/aoi>;
- **Lucile DELMAS**, Department of the enhancement and monitoring of information for integrated management, Ifremer Nantes. Ifremer scientific coordinator for the implementation and scientific expertise of the MSFD (Marine Strategy Framework Directive) and WFD (Water Framework Directive), accompanied by Rémi BUCHET, WFD coordinator;
- **Françoise VERNIER**, Irstea (INRAE), Environment, Territories and Infrastructures Research Unit (ETBX) in Bordeaux - Relations between the development of agricultural and human activities and water resources in the Arcachon Basin and the Charente. The case studies of the Charente basin, the Pertuis Sea and the Charente coast. Feedback from the EU SPICOSA <http://www.spicosa.eu/> and EU COASTAL [https://h2020-coastal.eu/https://h2020-coastal.eu/ projects](https://h2020-coastal.eu/https://h2020-coastal.eu/projects);
- **Philippe GOULLETQUER**, Deputy Scientific Director of Ifremer: The case study of the Trézence reservoir and its possible impact on the Marennes-Oléron oyster basin (Ifremer recommendation and report in 1995, 1997: see <https://archimer.ifremer.fr/doc/00077/18796/>)

Members of the working group set up by the Ethics Committee to examine this recommendation, which was debated in plenary sessions and finally adopted on November 16, 2020:

- Michel SAUQUET (rapporteur),
- Hervé THÉRY (rapporteur),
- Michel BADRÉ,
- Françoise GAILL.

Appendix 2

COMPOSITION OF THE INRAE-CIRAD-IFREMER-IRD COMMITTEE (JULY 2022):

- **Michel BADRÉ**, Chairman of the Ethics Committee, Ingénieur général des ponts, des eaux et des forêts (École polytechnique, École nationale du génie rural, des eaux et des forêts), Vice-Chairman of the INRAE-Cirad-Ifremer-IRD Joint Consultative Ethics Committee since 2016; member of the Board of Directors of the Humanité et Biodiversité association; member of the Economic, Social and Environmental Council (CESE) from 2015 to 2021, vice-chairman from 2018 to 2021, as a member of the environmental associations group; member of the special commission for the public debate, then chairman since 2020 of the "orientations" commission of the Radioactive Materials and Waste Management Plan; former chairman of the Environmental Authority (2009-2014).
- **Bernadette BENSAUDE-VINCENT**, Vice-President of the Ethics Committee, Professor emeritus at the University of Paris 1 Panthéon-Sorbonne, attached to the Centre d'études des techniques des connaissances et des pratiques; agrégée in philosophy and Doctor of Letters and Humanities. Member of the INRAE-Cirad-Ifremer-IRD Joint Consultative Ethics Committee since 2016, and of Andra's Ethics and Society Committee since 2020. Member of the editorial board of the International Journal for the philosophy of Chemistry (Hyle). Member of the French National Committee for the History and Philosophy of Science. Member of the Académie des technologies.
- **Madeleine AKRICH**, research director at the École des Mines de Paris, (Centre for the Sociology of Innovation), an engineer from the École des Mines de Paris and a doctor in the socio-economics of innovation.
- **Catherine BOYEN**, director of Research at the CNRS, PhD in plant biology, Director of the Roscoff Biological Station (Centre for Research and Teaching in Marine Biology and Ecology, Sorbonne University-CNRS). Main scientific areas of interest: marine biology, algal biology, genomics, evolution, microbiome, marine biodiversity and marine biotechnology.
- **Denis COUVET**, professor at the Muséum National d'Histoire Naturelle, Chairman of the Fondation pour la recherche sur la biodiversité, associate professor at the University of Lausanne and Sciences Po Paris, agricultural engineer, doctor in evolutionary sciences and ecology.
- **Mireille DOSSO**, director of the Institut Pasteur de Côte-d'Ivoire, Professor of Microbiology.
- **Mark HUNYADI**, professor of social and political philosophy at the Catholic University of Louvain; associate professor at the Institut des mines-Télécom Paris and at EHESS; mines-Télécom Paris and EHESS; member of the Orange Ethics Committee; member of the Steering Committee and the Steering Committee of the Mobile Lives Forum.
- **Youba SOKONA**, professor, 40 years of experience in the field of water, energy, the environment and sustainable development in Africa. Involved in the work of the IPCC since 1990; elected Vice-Chairman in October 2015. Successively co-founder of ENDA-TM's energy programme, executive secretary of the Sahara and Sahel Observatory (OSS) and coordinator of the African Climate Policy Centre (ACPC). Until 2020, Senior Advisor for Sustainable Development at the South Centre. Member of the African Academy of Sciences.
- **Marie-Geneviève PINSART**, philosopher, professor at the Université Libre de Bruxelles, applied ethics research centre. Member of the IRD's Comité consultatif d'éthique pour la recherche en partenariat (CCERP).
- **Pere PUIGDOMENECH**, Research Professor at the CSIC (Spanish Higher Council for Scientific Research) at the Institute of Molecular Biology in Barcelona, specialising in the molecular biology of plants, PhD in Biological Sciences.

FORMER MEMBERS OF THE INRAE-CIRAD-IFREMER-IRD COMMITTEE

WHO CONTRIBUTED TO THIS GUIDANCE:

- **Céline BOUDET**, scientific coordinator at Ineris, specialising in risk analysis in the field of health and the environment (epidemiology, toxicology, biostatistics, etc.).
- **Jean-Louis BRESSON**, doctor, nutritionist, university professor, founder of the Necker-Cochin Clinical Investigation Centre.
- **Françoise GAILL**, CNRS research director, special advisor to the CNRS general management. Head of the Institute of Ecology and Environment (INEE). Biologist, specialist in deep sea ecosystems.

- **Stéphanie LACOUR**, CNRS research director, PhD in private law. Deputy director of the " Institut des sciences sociales du politique" (ENS Paris-Saclay). Director of the GDR standards, science and techniques at the CNRS.
- **Lyne LÉTOURNEAU**, Professor in the Department of Animal Science at Laval University in Quebec (Canada). She holds a doctorate in law and lectures on ethical issues in contemporary agri-food and research integrity and is also the Vice-Dean of Science and Technology Studies at the University.
- **Louis-Étienne PIGEON**, philosopher in environmental ethics, Doctor of Philosophy from the Faculty of Philosophy at Laval University (Quebec, Canada); lecturer at Laval University.
- **Michel SAUQUET** is a graduate of the "Institut d'études politiques" of Paris and holds a doctorate in applied economics. At present, lecturer specialising in intercultural issues.
- **Hervé THÉRY**, geographer, Associate Professor at the University of São Paulo (Brazil), Emeritus Research Director at the CNRS.

Appendix 3

JOINT SECRETARIAT OF THE INRAE-CIRAD-IFREMER-IRD ETHICS COMMITTEE

The secretariat for the committee is provided jointly by the 4 organisations, with administrative support provided by INRAE.

- **INRAE:** Christine CHARLOT, General Secretary, and Claire LURIN, with the support of Nathalie HERMET
- **Cirad:** Philippe FELDMANN and Marie DE LATTRE-GASQUET
- **Ifremer:** Philippe GOULLETQUER and Marianne ALUNNO-BRUSCIA
- **IRD:** Chloé DESMOTS

Appendix 4

THE PRINCIPLES AND VALUES OF THE INRAE-CIRAD-IFREMER-IRD ETHICS COMMITTEE

- **1** The Joint Ethics Committee considers the recognition of human dignity to be a fundamental value. In its recommendations, it will endeavour to give tangible form to 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 established over several decades by the United Nations and specialised organisations, in particular UNESCO, form part of its reference framework, including the protection and promotion of cultural expressions and biodiversity. This body of work is implemented through international standard-setting agreements.
- **3** The environment in which future generations live must not be deteriorated, and the future must not be irreparably jeopardised, in particular by depleting natural resources or undermining the balance of nature. This principle of sustainable development requires the Committee to work in both the long and very long term, not just in the short term. However, the principle of total reversibility appears utopian and impractical.
- **4** The world is a system. Any action taken on one part of it has an impact on other parts: the analysis must therefore explore the secondary and knock-on effects of an action, and the dynamics and strategies that it may encourage or promote. Problems must therefore be tackled primarily on a global basis, while at the same time ensuring compatibility between global and local, and by taking account the realities on the ground.
- **5** The Committee considers that the robustness and flexibility of a system are positive elements. Thus, even in an open society, a degree of self-sufficiency in systems of production is desirable at both the national and the regional level.
- **6** Progress implies a society that is open to technical and social innovations, in the knowledge that we need to analyse and predict the impact of these innovations on lifestyles, their contribution to human development, and ensure that the benefits they can bring are shared equitably.

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