



Biodiversity in Danger: What Can Economics Do?

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The global collapse of biodiversity is now well documented. The erosion is massive and rapid. This statement holds for France. Biodiversity ensures irreplaceable goods and services, preserving nature's capacity to provide food, raw materials and medicines, to protect us against natural risks, to store carbon, to recycle waste and to contribute to the quality of our living environment. The main drivers of biodiversity loss are now well identified: in France, the artificialisation of soils, the fragmentation of natural environments, intensive farming practices and the draining of wetlands are important causes.

Biodiversity preservation policies show disappointing results and main issues have been underestimated for too long. They lack coherence and are based on protection schemes that are too fragmented, and focus too often on species or animals rather than on full ecosystems. This *Note* shows that instruments exist to make better use of dedicated budgets, to make regulations more coherent and ambitious and, above all, to provide effective incentives for protection.

The rate of ecosystem degradation no longer allows time for inaction. We recommend to include large investments in biodiversity-friendly development actions in the Recovery Plan in response to the Covid-19 crisis. Furthermore, a unified national strategy needs to be defined quickly. From there, different territorial levels can implement this strategy

effectively linking the missions of the French biodiversity office (OFB), regional structures and local authorities.

At the same time, we propose to implement a renewed range of instruments inspired by an economic approach. The goal is to better account for the positive externalities of biodiversity. We therefore recommend a reform of the “avoid, reduce, compensate” sequence currently in force in major development projects as well as a more conditional access to public subsidies. Tax systems should be reviewed to reduce the actual incentives to artificialise soils. In particular, the excessive taxation of non-built areas and the failure to take into account the cost of artificialisation in development projects indirectly encourage the destruction of habitats. Agricultural subsidies must be redirected towards remunerative conservation contracts, aiming at a long-term commitment to biodiversity. Regarding to international trade, we recommend strengthening tourism and trade inspections to limit the import of invasive species and pathogens. It can be done by making the biodiversity-related environmental clauses of preferential trade agreements more operational and encouraging coordinated policies. However, to prevent actions in favour of biodiversity from shifting the problem abroad, governments must integrate all the measures into a global framework for changing consumption patterns, particularly of animal products, and reducing waste.

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Biodiversity refers to the variety of forms of life on Earth. It is assessed by considering the diversity of ecosystems, species and genes in space and time, as well as the interactions within and between ecosystems. Although one cannot directly attribute the Covid-19 pandemic to the decline in biodiversity, it points out the importance of the interfaces between humans and nature out: almost two-thirds of infectious human diseases stem from pathogens shared with animals. The extent of the role played by the degradation of ecosystems, particularly deforestation, in the phenomenon of infectious diseases “jumping the species barrier” can be measured (Box 1).

More generally, maintaining functional and evolving ecosystems makes it possible to ensure numerous free services, preserve potentially decisive genetic resources to face future threats and maintain the major planetary balances. The protection and restoration of habitats requires the reduction of pollution, overexploitation and pressure on natural environments and less destructive forms of agriculture. To make sure national measures do not result in the destruction of biodiversity being shifted elsewhere, they must be accompanied by better regulation of trade but also by structural changes in lifestyles so that they are less dependent on the degradation of natural resources and wasteful consumption.

The collapse of biodiversity

A large-scale phenomenon

Biodiversity decline is even more difficult to analyse than climate change. In the case of climate change, a single indicator (the stock of greenhouse gases in the atmosphere) can summarise pressures. There is no equivalent for biodiversity: the complexity of living organisms means that a multiplicity of indicators must be considered. Moreover, one must consider different scales, taking into account both the global and very local dimensions of the phenomenon (Cognie and Péron, 2020).¹

However, there is no doubt, based on the available information, that biodiversity is collapsing. The Global Assessment Report on Biodiversity and Ecosystem Services published in 2019 by the Intergovernmental Science-Policy

1. Biodiversity and pandemic

With the Covid-19 pandemic came increased research on the links between biodiversity loss and pathogen prevalence.² The greater the biodiversity, the more pathogens there are, but these circulate weakly and a ‘dilution effect’ reduces the threat to humans. Damages to this balance lead to an increase in the prevalence and the transmission rate of pathogens at the local level. One of the underlying effects is that of a “genetic funnel”: the decline in biodiversity causes a selection of the most harmful pathogenic strains. Moreover, the destruction of habitats brings species closer to each other and to humans. Overcrowding between several species, whether in the wild, in captivity or on farms, increases the risk of transmission and mutation of pathogens and makes transmission to humans more likely. Increased trade and international population mobility increase the international transmission of a disease. Rather than a specific factor, it is therefore the combination of biodiversity loss, prolonged contact with wild species and destruction of natural habitats for human practices that favours pandemic episodes linked to emerging infectious diseases.

² See in particular the work of Jones K.E., N.G. Patel, M.A. Levy, A. Storeygard, D. Balk, J.L. Gittleman and P. Daszak (2008): “Global Trends in Emerging Infectious Diseases”, *Nature*, vol. 451, no 21, pp. 990-994 and Keesing F., L.K. Belden, P. Daszak, A. Dobson, C.D. Harvell, R.D. Holt, P. Hudson, A. Jolles, K.E. Jones, C.E. Mitchell, S.S. Myers, T. Bogich and R.S. Ostfeld (2010): “Impacts of Biodiversity on the Emergence and Transmission of Infectious Diseases”, *Nature*, no 468, pp. 647-652.

Platform on Biodiversity and Ecosystem Services (IPBES) shows that the average abundance of local species in most terrestrial habitats has declined sharply since 1900. Above all, the rate of extinction has accelerated in the recent period. A few figures show the scale of the problem. The Living Planet Index,² which tracks the abundance of mammals, birds, reptiles and amphibians, records a decline in populations of around 68% between 1970 and 2016. Out of a total of 96,500 species on the International Union for Conservation of Nature Red List of Threatened Species, 27% are threatened with extinction, representing 40% of amphibians and 14% of

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¹ Cognie F. and M. Péron (2020): “Mesurer la biodiversité”, *Focus du CAE*, no 46-2020, September.

² The Living Planet Index is an indicator of the state of the world’s biological diversity, taking into account trends in a large number of terrestrial, marine and freshwater vertebrate species. This indicator was adopted by the Convention on Biological Diversity, an international treaty adopted at the United Nations Conference on Environment and Development in Rio in 1992.

³ Brondizio E.S., J. Settele, S. Díaz and H.T. Ngo (eds) (2019): *Global Assessment Report on Biodiversity and Ecosystem Services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services*, IPBES, Bonn, Germany.

birds.³ Regarding insects, their biomass is collapsing and more than 40% of species are threatened with extinction worldwide.⁴ Natural forests declined by 6.5 million hectares per year between 2010 and 2015, an area larger than the UK.⁵ Natural wetlands decreased by 35% between 1970 and 2015. Cultivated biodiversity has not been spared either, with a standardisation of varieties that weakens the capacity to adapt to global changes.

This global observation is valid for France, which is home to a rich biodiversity, at the crossroads of four biogeographical regions and two marine regions. With its ultra-marine territories, France is home to 10% of known species and is one of the ten countries with the highest number of threatened species in the world. However, the 2019 edition of the Report on the State of the Environment in France⁶ points out a poor state of conservation of habitats and species depletion.

Well-identified causes

The main drivers of biodiversity loss have now been identified. The “Millennium Ecosystem Assessment” and the IPBES listed and classified them.⁷ At the global level, habitat degradation, intensive agriculture, overexploitation of renewable resources, climate change which is disrupting ecosystems slowly built by evolutionary processes, biological invasions, and pollution are the most important factors.

In France, artificialisation of soils is a major factor in the decline of biodiversity. The fragmentation of natural environments and the draining of wetlands are also important factors. The expansion of cultivated plots, the destruction of hedges, drainage and the specialisation of farms have a major impact on biodiversity in agricultural areas. Indeed, biodiversity is mainly concentrated in areas of rupture (hedgerows, ditches, borders) and is much higher in the landscape mosaic of mixed cropping-livestock farming, hedgerows, permanent and diversified meadows than in large, uniform plots.

There are many types of pollution that are harmful to biodiversity. Whether they are of agricultural origin (crop protection products, antiparasitic treatments for animals), industrial (solvents, heavy metals, polychlorinated biphenyls, etc.) or domestic (drug residues, phosphates, plastic degradation products), chemical pollution in aquatic environments particularly affects invertebrates at the base of

the food chain. Added to this are air pollution, such as ozone, which is a great enemy of vegetation, noise pollution and light pollution, which disrupts the functioning of nocturnal species.

Other human activities are putting pressure on French biodiversity. Overfishing affects many species. Hunting increases the pressure on particular species that have been weakened by the destruction of habitats and food chains. The development of pathogens imported and/or benefiting from climate change has a major impact on flora, particularly on forest species, some of which have disappeared (elm) or could disappear in the near future (spruce subject to bark beetles, ash subject to the fungus *chalara fraxinea*, etc.). Invasive exotic species put pressure on the local fauna (bullfrog, Asian hornet, American mink, etc.), flora (long-horned beetle, boxwood borer, etc.), sometimes with repercussions on health (tiger mosquito, ambrosia, giant hogweed, etc.) or the economy (primrose, Louisiana crayfish that damage hydraulic infrastructures).

Although the causes of biodiversity decline can be ranked in a hierarchy, they are highly dependent on the scale one considers. For example, at the local level, a particular factor (overfishing or, in some countries, poaching) may be more important than habitat destruction and global warming. Furthermore, future drivers are likely to differ from those of the past. Climate change and pollution might have the most serious effects on biodiversity in the future, with rising temperatures and water stress already explaining the increasingly chronic pathologies of forest species and the growing spread of pathogens. Climate change also increases the risk of breakpoints and irreversibility because species may not adapt at a sufficient rate to rising temperatures or ocean acidification.

Public policies with limited effects

Faced with these challenges, the overall results of biodiversity preservation policies are disappointing. At the European level, the shortcomings of the Biodiversity Strategy for 2020 adopted in 2011 have been highlighted.⁸ In France, the main successes come from moratoria on very specific areas or species and a few agri-environmental measures. However, successive national biodiversity strategies have not succeeded in halting the decline recorded by the main biodiversity indicators.

⁴ Sanchez-Bayo F. and K.A.G. Wyckhuys (2019): “Worldwide Decline of the Entomofauna: A Review of its Drivers”, *Biological Conservation*, no 232, April, pp. 8-27. Caspar A. Hallmann C.A., M. Sorg, E. Jongejans, H. Siepel, N. Hofland, H. Schwan, W. Stenmans, A. Müller, H. Sumser, T. Hören, D. Goulson and H. de Kroon (2017): “More Than 75 Percent Decline Over 27 Years in Total Flying Insect Biomass in Protected Areas”, *PLoS one*, vol. 12, no 10, record a 76% decline in the biomass of flying insects in Germany in an annual monitoring at 63 sites between 1989 and 2016.

⁵ OECD (2019): *Biodiversity: Finance and the Economic and Business Case for Action*, Report for the ‘G7 Environment Ministers’ Meeting’, 5-6 May.

⁶ Commissariat général au développement durable (CGDD) (2020): *Rapport sur l'état de l'environnement en France*, Edition 2019, La Documentation française.

⁷ Millennium Ecosystem Assessment (2005): *Current State and Trends Assessment*, Island Press, Washington DC. See also IPBES (2019) *op. cit.*

⁸ European Commission (2015): *EU Assessment of Progress in Implementing the EU Biodiversity Strategy to 2020*, Document SWD 187 final. See also European Court of Auditors (2020): “Biodiversity on Farmland: CAP Contribution Has not Halted the Decline”, *Special Report*, no 13.

This inefficiency is the result of multiple factors: a tangle of competences and zoning that fragments governance; taxation that provides little incentive to protect the environment⁹ or even maintains damaging incentives; public subsidies in agriculture that fuels systems contributing to the decline of biodiversity whereas it could be an important lever to promote its protection. Finally, public budgets directly benefiting biodiversity (LIFE programme¹⁰ and agri-environmental measures) remain low.

2. Protecting biodiversity: success stories

In the spring of 2020, containment due to Covid-19 has benefited the reproduction of many animal species. It gives a picture of the restoration of biodiversity that could occur if industrial pollution, car traffic, shipping, spring logging and the most intrusive tourism were reduced. When strong measures in favour of biodiversity are implemented, they often produce results on a fairly rapid timescale. One example is the rebuilding of fish stocks when exploitation pressure is reduced. The protection granted in France since the 1970s has led to the return of the common buzzard or grey heron. The management of large ungulates (protection of certain species, respected hunting quotas) has also led to a rise in numbers. Where excessive fishing on foot is regulated, environments regenerate fairly quickly. Natural experiments (transition from agriculture to “organic” farming, restoration of the landscape mosaic) show effects over a few years. Efforts pay off if they are ambitious and carried out on a sufficient scale to restore functional ecosystems.^a

Nevertheless, this positive message is not universal: overexploited cod stocks have not recovered in the North Atlantic despite the cessation of fishing; puffin colonies in the Channel seem to have disappeared forever after oil pollution. There are irreversibilities: like a spring, an ecosystem is resilient, but only up to a certain point. It is therefore necessary to act early enough.

^a Godet L. and V. Devictor (2018): “What Conservation Does”, *Trends in Ecology & Evolution*, vol. 33, no 10, pp. 720-730.

As shown by Bureau *et al.* (2020),¹¹ actions in favour of biodiversity have important economic co-benefits: the restoration of wetlands, the planting of hedges and the re-watering of rivers are also beneficial in terms of flood prevention; the creation of ecological-networks (green and blue belts) and urban greening contribute to the fight against heat islands; and the restoration of polluted soils reduces land pressure and provides health benefits. In addition, ecological engineering projects and tax incentives can create medium-term local and “non-relocatable” jobs in environmental restoration and maintenance. In North America, the creation of local jobs has in fact proven to be an important factor in supporting environmental conservation.¹² All too often, public stimulus plans have favoured artificial infrastructures. The recovery plan to counter the effects of the Covid-19 crisis provides an unprecedented opportunity to invest in biodiversity: it must be seized.

Recommendation 1. Use the recovery plan to invest more in biodiversity: finance projects for the renaturation of rivers, hedgerows, wetlands, diversified plantations, etc. and ecological engineering projects with significant social co-benefits.

The mobilisation of private means is necessary to have a leverage effect commensurate with the challenges. The failure in this respect is obvious: private spending has not increased since 2003 and that of companies has even fallen in real terms.¹³ The direct private benefits of biodiversity protection are limited in scope, at least in the short term, so that spontaneous action to protect biodiversity cannot be expected in the absence of coherent public regulations.¹⁴ By relying mainly on voluntary approaches and awareness-raising, we have ignored the fact that economic agents are primarily guided by their private interest. Therefore, it is now important to align private and collective interests.

The ineffectiveness of policies also stems from fragmented visions centred on the species or animal rather than on ecosystems. The tensions of civil society create inefficiency, for example in the rural world where some approaches are considered stigmatising. Possible congruences are not being realised. The case of hunting is an illustration of this:

⁹ The OECD points out that the share of taxation that could provide incentives for environmental protection is particularly low in France: see OECD (2016): *Environmental Performance Reviews: France*, OECD, Paris.

¹⁰ LIFE program: Financial instrument of the European Commission dedicated to the financing of public or private projects in the fields of environment and climate. Budget 2014-2020: 3.4 billion euros, for the whole of Europe.

¹¹ See Bureau D., J-C. Bureau, K. Schubert, C. Desrieux and M. Péron (2020): “Plan de relance et biodiversité”, *Focus du CAE*, no 48-2020, September.

¹² OECD (2019) *op. cit.*

¹³ See Ministère de la Transition écologique et solidaire (2019): *La dépense de protection de la biodiversité et des paysages*, Coll. Fiches thématiques. Available on <https://ree.developpement-durable.gouv.fr>

¹⁴ Levrel H. (coord.) (2020): *D'une économie de la biodiversité à une économie de la conservation de la biodiversité*, Fondation pour la Recherche sur la biodiversité, June.

two worlds confront each other while their interests should converge (Box 3).

3. Hunting and biodiversity

While hunters and environmental associations are joining forces in other countries, such as the Ducks Unlimited organisation in North America for the protection of wetlands, in France, their concepts of nature protection seem irreconcilable.

Opposition to hunting is based on concerns about animal suffering, but also often on a conception of biodiversity attached to the protection of species rather than an ecosystem: short-hunting, for example, crystallises opposition without having a significant ecological impact; trapping foxes is unworthy, but their population is increasing. Although protection organisations rightly denounce 500,000 birds hunted by illegal but little sanctioned methods, they mobilise little around their proposals in the face of predation by pets: the 13 million domestic cats impose a heavy toll on lizard and pipistrelle populations, and probably more than 100 million birds fall victim to them in France every year.

Overall, hunting is less of a determining factor in the decline of populations of huntable species than environmental deterioration or pollution. However, the hunting of species in decline is not defensible: populations of shorebirds have fallen sharply as a result of the destruction of wetlands and the proliferation of imported invasive species. The main cause of the collapse of wheat quail and lark populations is agricultural practices, but this collapse has not led to their removal from the list of huntable species either.

In spite of their unbridgeable divisions on animal condition, hunters and environmental organisations could agree on common interests if they shared an approach to biodiversity centred on ecosystem protection

Until now, public decision-makers have therefore lacked both a prior global reflection on the functioning of ecosystems and an economic approach to integrate all the issues and to design effective instruments. The recent “French Assessment of Ecosystems and Ecosystem Services”¹⁵ has nevertheless enabled the collection of information allowing now for a more global approach. Furthermore, in May 2020, the European Commission proposed a strategy for 2030 to the Member States and the European Parliament, which is intended to

be ambitious within the framework of the “Green Deal”. This new European ambition is likely to give a new impetus to fix these two shortcomings.

The challenges of an economic approach

What to protect?

There are strong scientific arguments for not prioritising species but in practice it will be difficult to protect everything identically. It is true that “living things are priceless”, but the objective of preserving everything would have an unacceptably high cost. It is an extreme form of “strong sustainability” requiring an absolute absence of pressure on nature. One can conceive that a part of natural capital can be replaced by manufactured capital or human capital as a source of well-being (this is the so-called “weak sustainability” approach). Nonetheless, it is clear that substitutability is not total: humanity would not subsist without nature. So what should we preserve? How can choices be enlightened? The approach cannot be the same as with the climate, of managing a “carbon budget”. The challenge here is to maintain a living heritage in a satisfactory and sustainable state.

The evolution of this heritage is determined by the biological dynamics of species renewal, by the complex interaction clusters that exist between them and with their environment, and by human pressures. The protection of particular species is not sufficient to maintain this heritage. Neither is the conservation of genes in zoos or gene banks sufficient: it does not allow populations to evolve in the face of genetic drift or external disturbances (climate change, pathogens). It is necessary to consider ecosystems as a whole and to preserve their functionality and their capacity to evolve and adapt. To do this, large connected habitats must be protected, and therefore productive activities, or at least a certain degree of intensity of these activities, must be abandoned over a significant part of the territory. The European Commission’s proposal of May 2020 is to devote 30% of Europe’s land and seas to effectively managed protected areas and to ensure that at least 10% of the agricultural area consists of topographical features with high biological diversity. It seems undersized in this respect. In addition, it is not enough to have a sufficient quantity of protected areas; the quality of the protection must also be ensured. In France, while national parks are more sanctuaries for nature, protection in regional nature parks is limited. The latter, which cover 15% of the territory, try to reconcile environmental protection with economic activity and the development of the 300,000 businesses present there.

¹⁵ Puydarrieux P., Y. Kervinio and O. Darses (2016): *Évaluation française des écosystèmes et des services écosystémiques (EFESE) Rapport intermédiaire*, Thema, Ministère de la Transition écologique et solidaire, December.

We also need to consider the protection of the outside protected areas. Natural resources are over-exploited as long as they are freely accessible and the impacts of human activity on their renewal process remain ignored by economic players. This is the “tragedy of the commons”: as the benefits of biodiversity protection are generally diffuse, the solutions to pay for it are not spontaneous. Payments for environmental services (see Box 4), for example, almost never emerge without public incentives.¹⁶

4. Payments for environmental services and biodiversity

Payments for Environmental Services (PES) are contracts whereby users of ecosystem services participate in their financing. Typical examples are contracts between companies and farmers to reduce their nitrogen or phosphorus discharges rather than investing in costly clean-up techniques themselves. In France, such contracts exist only in a few cases to reduce pollution of mineral water sources. In the United States, this type of payment to avoid water pollution results from the obligation to comply with a regulation requiring some results. In Australia, some states have established mechanisms for private landowners to reward biodiversity conservation actions undertaken on their land.

The agricultural and forestry world could potentially benefit greatly from PES. Several organisations, including the European Landowners Organisation (a federation of agricultural organisations) have proposed that the Common Agricultural Policy (CAP) should make a radical shift towards PES and provide a real remuneration for services to the community, particularly for biodiversity. The idea that the provision of landscapes, the opening up of spaces and the protection of fauna and flora and carbon storage could be economic activities in their own right becomes more and more admitted. Other sectors, such as public works, could also move towards offering ecological engineering services to users, if public policy gave them incentives to do so.

An economic approach is necessary for biodiversity protection, and must be based on three axes: recognising that biodiversity produces value, well beyond the ecosystem services that can give rise to spontaneous payment by the market; reconciling biodiversity protection and the economy; and, designing effective regulatory and fiscal intervention instruments. The State must set up a framework such that biodiversity protection ceases to be a cost for the actors who implement it.

The value of ecosystem services

Policies affecting biodiversity inevitably weigh the costs or sacrifices of protection against the benefits of it, or the costs of non-action. It is therefore important to clearly identify the services that biodiversity provides or will provide. These so-called “ecosystem services” are generally classified into four categories: provisioning, regulating, cultural and “supporting” or maintaining the ecosystem.

Provisioning ecosystem services include the provision of wild and cultivated natural products (food, timber, biomass, fibre, medicinal plants, etc.). Regulating services include natural controls of agricultural pests and disease vectors, filtering of pollutants to maintain air and water quality, buffer zones against natural hazards, services that sequester and store carbon, recycle waste, etc. Cultural services are the intangible benefits obtained from contact with nature, in recreational, aesthetic, and cognitive activities, such as hiking, bird-watching, fishing, etc., derived from the use of nature. Finally, the self-sustaining (sometimes called supporting) services of the ecosystems themselves include soil formation, nutrient cycling, photosynthesis and the provision of habitats. The ecological efficiency of this self-sustaining service is crucial for the proper functioning of the ecosystem, on which the level and quality of the other services derived from biodiversity will then depend, or simply the reality of the option of being able to use its services.

The value of ecosystem services is often equated with the expenditure that the community would be willing to make in order to obtain the service in question, which may cover different forms of ‘value’ to humans:

- Use value when nature provides free services that are costly or impossible to replace with artificial techniques (drinking water purification, pollination);
- Existence value (e.g. for a species to which citizens are attached);
- Option value (e.g. that of natural organisms likely to provide new remedies);
- Insurance value, as species diversity is essential in adapting to major disturbances, e.g. a diverse forest in relation to climate change, a pool of banana varieties when a fungus destroys the main commercially grown variety, etc.

Different methods are developed to evaluate the corresponding values by referring, for example, to replacement costs when other techniques are possible. As many ecosystem services have no market equivalent, it is often necessary to mobilise declarative or experimental methods to directly estimate what economic actors would be willing to pay for them; or to identify goods whose price is affected) to estimate them

¹⁶ Levrel *et al.* (2020) *op. cit.*

indirectly (e.g. land prices in relation to landscape quality or the proximity of a nature park).

The importance of the self-maintenance service

The valuation of ecosystem services provides insight into the social cost of biodiversity loss. It helps to integrate biodiversity into private and public decision-making because it shows the mistake society is making by taking so little account of natural capital in its economic choices. It enables projects to be classified and some to be excluded.

Several points of vigilance are necessary. Measured values of ecosystem services are based on fragile methods that leave the self-sustaining service in the dead angle. This service is particularly degraded while other services depend on it, especially for future generations. Measuring it is a challenge: it requires considering non-linearities and irreversibilities and integrating the network aspects of biodiversity for which any disturbance has cascading effects. Finally, we must not ignore that when a good disappears, the willingness to pay will increase in the future. Already today, access to highly preserved resources and natural areas is coveted and when this access is subject to payment, the soaring price illustrates the economic error of protecting this natural capital so poorly (Guesnerie, 2004).¹⁷

The need to pay more attention to the self-sustaining service in analyses applies also to the design of public policies and not only to evaluation programmes. The example of fisheries illustrates this point. Historically, policies have focused on fishing effort to rebuild viable stocks. Now, the issues of climate change, ocean acidification and marine pollution must be integrated and the impact of fishing on other species must be reduced.

The design of the corresponding policies still requires a great deal of scientific insight, as shown by the debates on whether or not efforts should be targeted at particular areas (e.g. high nature value): for example, should intensive economic activity be developed in some places in order to better protect elsewhere? This question opposes those who favour integrating biodiversity protection into human activities (land sharing) and those who favour land sparing. Both approaches have valid arguments, although the overall assessment of the two strategies in terms of biodiversity is disputed. In France, strict protection (national parks, coastal conservation) concerns small areas. This suggests that producers should be at the heart of biodiversity protection policies through ambitious agri-environmental programmes. Overall, the best

strategy depends on the species locally present and their response to human activity. This justifies clarifying national objectives and governance at regional and local levels.¹⁸

For strengthened and effective protection policies

Clear governance

In France, the logic of strict protection of certain natural areas, the broader heritage logic and the European logic of networking of zones for the protection of fauna and flora have been combined. These three logics resulted in a very complex administrative system. Public responsibilities frequently overlap, as well as protection programmes often with divergent ideas of protection. In the recent period, the role of local authorities (inter-municipalities) increased. They are decisive in the definition of land uses through Local Urban Development Plans, Territorial Coherence Schemes, Water Development and Management Schemes, etc. This institutional complexity leads to complex interactions between experts and, more importantly, to less sustainable financing schemes. The aggregation of different agencies within the French Office for Biodiversity (OFB) is likely to bring more institutional coherence. Nonetheless, the inadequacy of the legal framework often hampers its actions: the case of the meshing that is gradually fragmenting wooded areas is an example. Its cooperation with local actors, although essential, is not always easy. On the one hand, the imposition of regulations defined at the national level and perceived as poorly adapted locally exposes the OFB to rejection by these actors. On the other hand, the local actors' competence in terms of land use leaves the OFB with little means to deal with habitat degradation. The Regional Biodiversity Agencies remain heterogeneous structures in terms of capacity. However, the definition of biodiversity strategies at the regional level, integrating water, soil and environmental policies, is desirable in order to adapt the national strategy and provide a framework for action by local authorities. The latter should have the powers and the corresponding responsibilities in this domain. They should be accountable for their policies in favour of biodiversity with monitored results.

Recommendation 2. French local authorities actions must set explicit biodiversity protection objectives that are legally binding and with regular monitoring of results.

¹⁷ Guesnerie R. (2004): "Calcul économique et développement durable", *Revue Économique*, vol. 3, no 55, pp. 363-382.

¹⁸ Salles *et al.* (2017) show the importance of adapting "land sharing" and "land sparing" strategies to local conditions. Salles J.M., F. Teillard, M. Tichit and M. Zanella (2017): "Land Sparing versus Land Sharing: An Economist's Perspective", *Regional Environmental Change*, no 17, pp. 1455-1465.

Incentive instruments to reduce pressures

A coherent institutional and regulatory framework from national to local scale is necessary but will not be sufficient. Private economic interests most often prevail over global considerations in favour of the creation of infrastructures, the artificialisation of soils by residential development, or conventional agriculture. In addition, the richest areas of biodiversity are often those where humans are seeking to settle, such as valleys and coastal areas. Despite recent developments, the value of biodiversity is not sufficiently taken into account: it is urgent to make it clearer to decision-makers through an appropriate accounting framework.¹⁹ The preference for the present is known to be strong such that the long-term benefits of conservation, even if they are extremely important, can fail to outweigh the short-term gains of development.

Even when conservation decisions are made, the range of instruments currently used to implement them over emphasises the norm and does not rely much on incentives. Regulatory-type tools have proved their worth in marine protected areas, for example. But they require a high level of information from the regulator on ecosystem dynamics as well as on costs and damage. Moreover, regulations often ignore the fact that some stakeholders will circumvent them. For example, restrictions on fishing are compensated for by over-investment in capacity, leading to continued pressure on the species to be protected, an increase in demand or their price.

This is why the pricing of impacts and the remuneration of environmental services are necessary to leverage private actors with a price signal reflecting the scarcity of environmental resources in a legible and long-term manner. In parallel, the subsidies and tax incentives that are harmful to biodiversity must be definitely suppressed. Most of them have been clearly identified in a report by the Centre d'analyse stratégique.²⁰ Furthermore, subsidies should be conditional on good environmental practices.

Finally, consumers need in-depth information on damage in order to exercise their power to discriminate according to their preferences for more environmentally friendly products. The complexity of biodiversity and the partial nature of the indicators nevertheless open the door to claims that are not scientifically well-founded. Codes of conduct on environmental signage could be developed with regard to the biodiversity dimension, in partnership with public research.

Recommendation 3. To make private stakeholders accountable, integrate biodiversity-related assets into business accounting, enhance efforts via an incentive system of public aid, develop consumer information and eliminate subsidies that are harmful to biodiversity.

Expand and redesign the avoid-reduce-compensate sequence

The french regulation requires that foreseeable damage to biodiversity caused by a construction project must be compensated for, in accordance with their ecological equivalence. Offsetting measures can be implemented directly by the project owner, or by entrusting actions to a “compensation operator”, or by acquiring “compensation units” as part of a natural compensation site (an “offer” compensation).

This mechanism aims for no net loss of biodiversity. It encourages prevention, i.e. avoiding and reducing upstream damage, while leaving the choice of means to the developer concerned to compensate the rest of the impact. As the cost of residual damage is borne by the “polluter”, the approach makes it possible to protect biodiversity without public budget resources. A strict impact compensation might also be more acceptable if a flexible mechanism for the possible exchange of biodiversity credits is associated with it (see Bureau and Schubert, 2020).²¹

The Clean Water Act to protect wetlands in the United States since the 1980s requires developers who destroy a marsh to “create, improve or restore” another marsh “of similar functions and values” located in the same watershed. This mechanism was later extended to the preservation of habitats for endangered species. Investors then created “conservation reserves”, which were fed by restoring or creating from scratch suitable habitats for endangered species. Then, investors sell the credits created to developers subject to the requirements of the Endangered Species Act. This flexibility makes it possible to remove sticking points, if combined with a rigorous definition of “similar ecological values”. At the contrary, the rigidity of the regulations can lead to many exemptions through political pressure, all the more convincing when the possibilities of immediate compensation in the vicinity of the work are limited.

¹⁹ Recently, there have been promising attempts to integrate environmental costs not internalised by private agents into the accounting framework. These initiatives need to be encouraged by financial and accounting regulations. National accounting could also take better account of the losses of natural capital linked to the erosion of biodiversity. See Rambaud A. and C. Feger (2020): “Method 3: Comprehensive Accounting with Respect to Ecology Model” in *Improving Nature's Visibility in Financial Accounting and more Broadly the Chair in Ecological Accounting*. See Cognie and Péron (2020), *op. cit.*

²⁰ Sainteny G., J-M. Salles, G. Ducos, V. Marcus, P. Duboucher, E. Paul, D. Auverlot and J-L. Pujol (2012): *Les aides publiques dommageables à la biodiversité*, La Documentation Française. See also OECD (2019) *op. cit.* which lists subsidies harmful to biodiversity and gives examples that concern France, such as the exemption from fuel tax for fishing vessels.

²¹ Office D. and K. Schubert (2020): “Compensation écologique: à la demande ou par le développement d'une offre? L'analyse de Yolande Hiriart mise en perspective”, *Focus du CAE*, no 47, September.

So far, the French approach is very different. The avoid-produce-compensate (EPC) mechanism is conceived as administratively controlled procedures rather than economic incentives. As things stand, both businesses and ecologists are unsatisfied, as the interpretation of complex texts has taken over the understanding of environmental issues. In addition, multiple derogations reduce the scope of the mechanism and thus the incentive nature of the sequence. This approach to the ERC sequence is too restrictive since it is reserved for major projects and mainly for areas sheltering protected species. It is also a source of insecurity for operators and encourages poorly performing compensation projects. The offer of “quality” compensation is considered too expensive and the solutions chosen favour compensation projects that are too small to be effective. In addition, natural compensation sites currently represent a very limited area. This weakness of the offer can be explained by the complexity of the systems and the anticipated lack of demand. The development of a compensation offer would make it possible to extend the obligation to compensate to all projects regardless of their size. Compensation price levels that provide an incentive to avoid or reduce could emerge as the public regulator would keep control over the validation and effectiveness of compensation credits to ensure the absence of net loss. It is not currently the case. Successful wetland protection policies, for example in Florida, have been built up through supply-side offsetting and can be used as a model.

France needs increased recourse to contractual protection measures to achieve the two objectives of the European Biodiversity Strategy 2030. Among the possible ways forward, one is to make the Real Environmental Obligations (ORE) introduced by the 2016 law more operational. Thanks to this means, which is still little used, a natural site manager who does not own certain plots of land can secure their future by proposing to the owner to enter into an ORE, so that the environmental vocation of the land “survives” to successive lessors and owners. ORE wait for the planned incentive mechanisms to be put in place before they can take off.

Recommendation 4. Generalise the obligation to compensate for foreseeable damage to biodiversity to all development operations. Develop a compensation offer based on transferable credits subject to long-term commitments under the supervision of an independent authority.

Linking climate and biodiversity policies

Although the fight against global warming and the preservation of biodiversity often go hand in hand, possible antagonistic effects can arise. For example, the development of photovoltaic energy on natural areas artificialises soils; wind energy has an impact on birdlife; and incentives for the use of biomass encourage production to the detriment of natural areas. Carbon labels sometimes award fast-growing single-species forests detrimental to the biodiversity.

Policies that combine climate and biodiversity must be more consistent with coherent global scenarios. In particular, forestry policy must ensure that the increase in carbon sinks promotes biodiversity. This means encouraging diversified forests, avoiding spring felling during the nesting period, avoiding clear-cutting which causes erosion and clogs up aquaculture spawning grounds. More generally, it has to make long-term protection of environments (riparian zones in particular) more attractive. Coherence is also necessary in agricultural policy, where the coordination of actions in favour of climate and biodiversity is sometimes complex. The recent increase in aid for extensive cattle farming aims to promote the preservation of hedgerows and permanent meadows, which are particularly rich in biodiversity, but offset the effects of methane emissions from this farming requires appropriate public policy instruments.²²

Including biodiversity in public policies: some key areas

The five main factors of biodiversity erosion identified by the IPBES (land use, pollution, overexploitation of certain species, climate change, biological invasions) should be cross-cutting issues of future biodiversity plans and be systematically integrated into the evaluation of sectoral policies. For the sectors exerting the greatest pressures, the transformations to be undertaken are structural and urgent. The areas concerned are numerous. They cannot therefore be limited to the three mentioned below.

Reorienting agricultural budgets

Temporal monitoring of common birds shows that, in France, the decline of the populations is the fastest in agricultural areas. However, most of the public aid to agriculture takes the form of a per-hectare aid that is not very differentiated

²² Even with the recoupling aid for suckler cows implemented in France after 2013, it is still very challenging to reconcile those objectives, quite contradictory. France Stratégie’s recent work proposes bonus-malus systems directly targeting positive and negative externalities and shows the social feasibility of such a reform. See Fosse J. (2019): *Faire de la politique agricole commune un levier de la transition agroécologique*, France Stratégie Report.

and subject to environmental obligations with little impact. This public aid of €15 billion represents an effective lever to encourage practices that are more favourable to biodiversity. The “greening” of direct aid desired by the European Commission in the Common Agricultural Policy (CAP) of 2013 has had little effect, as the conditionality of aid for maintaining “areas of ecological interest” and crop diversification has been emptied of its content.²³ The aid is thus distributed without any real environmental counterpart. Its effect is even unfavourable because this flow of aid encourages the producer to choose simpler farming systems saving time and material. Indeed, it reduces the risk aversion of a producer who would spontaneously choose to diversify his production and contributes to the destruction of the landscape mosaic.

Aid specifically remunerating efforts to promote biodiversity appears in the CAP. But they only represent 2% of all public aid to French farmers.²⁴ Moreover, their specifications multiply obligations of means that are not always adapted to local situations, with uncertain sustainability and legal security.

There is a need to redirect all agricultural support to pay for new functions. The provision of environmental services must be seen as an economic activity in its own right, together with food production. Specific payments must be set, explicitly aiming at the verified provision of identified services and leaving more freedom of means. The framework of future “Ecoschemes” should be used on a large scale to do this. Experiments with results-oriented environmental contracts must be developed, such as those set up in France in which the granting of payments is partly conditional on the floristic diversity of grasslands. We can also draw on the many initiatives of local authorities to promote local supplies (territorial food plans) and ensure that they also include the provision of a bouquet of ecosystem services (protection of catchments, flood control through the maintenance of wetlands and hedgerows, etc.). Reforming the aid system is a priority to encourage shared efforts to preserve habitats at sufficient scales. In sensitive areas or areas of major environmental interest, the introduction of a minimum income based on conservation efforts would clarify a situation where today, aid often represents more than 100% of current pre-tax income.

Recommendation 5. Redirect a significant proportion of aid from the first pillar of the CAP towards remunerative contracts, aiming at a long-term commitment to biodiversity. Experiment with agri-environmental contracts for collective actions on a larger scale and, in return for conservation efforts, establish a guaranteed income for farmers in areas of high natural value.

Reviewing taxation for better land use

Artificialisation of soils contributes to the erosion of biodiversity, vulnerability to flooding, reduction of carbon storage capacity and the ugliness of our landscapes. In France, the phenomenon is largely explained by the low density of new construction, the “residential sprawl”. From an economic point of view, it is a problem of externalities: there is an excess of artificialisation because the actors of development do not take into account the associated social costs in their technical choices of construction, density and location. Therefore, they are not encouraged to look for alternative solutions.

Given the diversity of situations, a normative approach, prohibiting, for example, any construction or conversion of agricultural land or imposing minimum densities, would exacerbate opposition and conflict with economic development and housing issues. Such approach would ignore existing congruencies between the necessity to reduce pressures on soils and the aim of revitalising the town centres of small and medium-sized municipalities. Incentive approaches should be favoured encouraging a logic of sustainable territorial development and not a zero-sum game one.

In addition to the PES mentioned above, other instruments can be mobilised: the mechanisms of tradable development rights²⁵ and incentive taxation. In particular, the development tax was initially designed to participate in the financing of the public amenities induced by development. This pricing of external costs ignores the costs on biodiversity. Thus the

²³ European Court of Auditors (2020) *op. cit.*

²⁴ In France, only 390 million euros are devoted to agri-environmental measures in 2018 or 1.6 billion if one considers that the natural handicap compensation program has a positive effect on biodiversity.

²⁵ Tradable development right systems exist in various forms in more than 100 counties in the United States. It allows steering urban development without pressure from owners of land outside building zones, by a transfer of their building rights to developers in need providing them with income equivalent to that of a conversion.

amount of development tax for the rehabilitation of a non-artificialised industrial wasteland is now equal to that for a new (highly artificial) building. The same applies to shops, to the detriment of city entrances and the vitality of their centres. A bonus-malus system can correct this bias, as well as a systematic taxation of artificialisation. In that case, the revenue of this tax would be redistributed so as not to affect the overall cost of new housing. Thus reconfigured, the development tax could guide a more economical (and ecological) use of land.

However, the effectiveness of new incentive instruments is conditional on the revision of existing tax systems that are harmful to natural heritage. In particular, undeveloped land is a highly taxed form of capital even though it provides environmental benefits.²⁶ In this respect, the findings are edifying: peatland areas and wetlands are penalised in relation to other land uses. Environmental rural leases are interesting instruments: they allow for the introduction of environmental clauses in an agricultural lease since 2007. Nonetheless, they result in a drop in revenue in France without tax compensation, which makes this tool little used.

Recommendation 6. For a better use of land, apply a bonus/malus on the development tax and revise the property tax on non-buildings in order to no longer encourage the conversion of agricultural and forest areas.

Regulating international trade

International trade and tourism play a non-negligible role in the degradation of biodiversity in France through imports of pathogens and predators of local fauna and flora. French consumption of imported natural resources also has a significant impact on global biodiversity. Moreover, in an open world, national biodiversity protection policies can lead to the problem being shifted elsewhere, following the example of the carbon “leakage” of climate policy.

The costs of introducing pathogens and invasive alien species are insufficiently taken into account when assessing the gains from international trade.²⁷ For example, long-horned beetles that appear to have travelled on wooden pallets and destroy forest species, the boxwood borer introduced by poorly fumigated potted plants, or, in another register,

the zebra mussel that clogs pipes and turbines represents very high economic costs. There are also indirect social costs due to the loss of biodiversity linked to these invasive species, which are very difficult to measure. Trade also leads to the introduction of pathogens, harmful organisms such as olive bacterium and brown roughy virus from tomatoes. Even if precise assessments are lacking, the cost of these externalities is likely to justify more drastic border controls. The European Union has become aware of the problem and has adopted a Regulation on invasive species in 2014. It includes the creation of a list of species supposed to be controlled and eradicated and an information network (European Alien Species Information Network). In France, a set of measures was adopted in 2017.²⁸ Nonetheless, even today, border controls and controls on the transport of invasive species still seem weak, especially on tourist arrivals. Sanitary and phytosanitary control of trade should be recognised as a regulation of major public interest, must be effective, and not seen only as a potential barrier to trade. The general exceptions recognised by the WTO allow for this. We recommend strengthening these controls and that importers bear the costs.

Our consumption of natural resources through our imports of soya, palm oil, wood, rubber, tropical fruits, cocoa and cotton has an impact on biodiversity abroad. Environmental clauses in European preferential agreements could help to reduce the corresponding biodiversity losses. The European Union already introduces such clauses in the agreements, but they are drafted in general terms and do not translate into truly effective conditionality or sanction mechanisms.²⁹ Most European imports that have a major impact on biodiversity are in fact not taxed even outside preferential agreements: introducing clauses on biodiversity, for example in an agreement with Mercosur, could only concern a few products currently taxed in the general regime (beef, ethanol), but not minerals or soya. Nevertheless, this should not lead to resignation. Proactive action by the European Union is needed to make the full application of trade preferences conditional on biodiversity objectives, for example the fight against deforestation, illegal timber trafficking, fishing for protected species, etc. The recent creation of the post of Chief Trade Enforcement Officer at the European Commission could contribute to this.

There is a real risk of relocation to the least environmentally demanding countries (pollution haven effects). A border tax adjustment, which the President of the European Commission

²⁶ See Sainteny G. (2018): “Fiscalité et biodiversité”, *Note de la Fondation pour la Recherche sur la Biodiversité*.

²⁷ Scalera R., P. Genovesi, F. Essl and W. Rabitsch(2012): “The Impacts of Invasive Alien Species in Europe”, *European Environment Agency (EEA) Technical Report*, no 16/2012.

²⁸ Muller S. (coord.)(2017): *Stratégie nationale relative aux espèces exotiques envahissantes*, Ministère de l'Environnement, de l'Énergie et de la Mer, March.

²⁹ See Bellora C., J-C. Bureau, B. Bayramoglu, E. Gozlan and S. Jean (2020): *Trade and Biodiversity*, [contract] PE 603.494 European Parliament, Policy Department for External Relations.

has pledged to carry out in terms of carbon, is undoubtedly even more complex to implement in practice for the loss of imported biodiversity. Article XX of the GATT 1947 gives legal possibilities for action at borders to limit damage to “natural finite resources”. The partially local nature of biodiversity has limited its scope in the case law of the World Trade Organisation, but it does not prevent any action.³⁰ International cooperation directly addressing the subject is possible.

Recommendation 7. Strengthen tourism and trade controls against the importation of invasive species and pathogens, with dissuasive sanctions. Make the environmental clauses in the EU’s preferential trade agreements more controllable and operational. Promote coordinated global action on biodiversity at European level with trading partners.

Beyond these considerations, effective actions against the loss of imported biodiversity goes along with questioning consumption patterns. Large-scale consumption of a product

such as meat, for example, has indirect consequences on deforestation or the transformation of wooded savannahs and natural meadows into soya at the other end of the world.³¹ National policies can reduce the loss of imported biodiversity: even if major European plans to substitute local proteins for soya have been quite unsuccessful, the integration of legumes into European cropping systems would combine the reduction of polluting inputs, self-sufficiency and the reduction of imported deforestation.

For the ambitious Green Deal targets for organic farming to succeed in halting the decline in biodiversity,³² it must be accompanied by a reduction in waste, a major research and development effort on organic crops and a change in European diets towards a reduction in meat and dairy consumption. More generally, local actions in favour of biodiversity must be accompanied by a reduction in the consumption of products that require the extraction of minerals, the production of fibre and energy, which put strong pressure on biodiversity. Reducing waste and changing consumption habits are essential for the protection of biodiversity on a global scale. Following the Citizens’ Climate Convention,³³ these are societal debates that cannot be ignored. ●

³⁰ Jean S. (2017): “Mieux lier les accords commerciaux à des clauses non commerciales: pourquoi et comment?”, CEPII Blog, October. Lamy P., G. Pons and P. Leturcq (2019): “Verdir la politique commerciale de l’Union européenne”, *Institut Jacques Delors (Notre Europe) Policy Paper*, no 245.

³¹ Godfray H.C.J., P. Aveyard, T. Garnett, J.W Hall and T.J Key (2018): “Meat Consumption, Health, and the Environment”, *Science*, vol. 361, no 6399.

³² For example, simulations by the Centre d’études prospectives et d’informations internationales (CEPII) show that an ambitious shift towards “organic” agriculture in Europe, if not accompanied by a change in demand, would have an uncertain impact on biodiversity at the global level. Bellora C. and J.-C. Bureau (2016): *How Green Is Organic? The Indirect Environmental Effects of Making EU Agriculture Greener*, Conference ‘Analytical Foundations for Cooperation in a Multipolar World’, World Bank, Washington DC, 15-17 June.

³³ See the official website: www.conventioncitoyennepourleclimat.fr



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