Circular economy
Ecosystems
Biodiversity

TOWARD A JOINT APPROACH

Institut National
de l'Économie
Circulaire

SUMMARY

INTRODUCTION

The pressure of human activities on the environment is having an increasing impact on the stability of the Earth's natural processes. The IPCC (Intergovernmental Panel on Climate Change) reports on climate change, the MEA (Millennium Ecosystem Assessment) on ecosystems, the IPBES (Intergovernmental Platform on Biodiversity and Ecosystem Services, i.e. the equivalent of the IPCC for biodiversity) on biodiversity warn of the ever-accelerating degradation of the components of the Earth system and the importance of changing this trend. While climate change is now at the heart of concerns, another crisis remains relatively unknown and little understood: biodiversity loss. Yet this is the one of the nine «global limits» described in the Rockström et al report that is now most widely exceeded, well beyond that of climate change[1].

The circular economy is defined as a solution to the challenges of resource scarcity, aiming to decouple the creation of societal value from its impact on the environment. This model implies the implementation of new ways of design, production, consumption and use that are more sober and efficient (eco-design, industrial and territorial ecology, economy of functionality, etc.) and to consider waste as a resource.

The environmental issue is therefore at the heart of the definition of the circular economy. However, in the implementation of this model, the environment often takes a back seat to economic objectives. This can be explained by the fact that «environment» is a vague term, which in reality encompasses many different but interconnected notions: climate change, loss of biodiversity, depletion of natural resources, land artificialisation... all these notions cover specific issues to be addressed in the framework of environmental protection, and biodiversity is one of the most critical. However, the **protection of biodiversity** and **natural ecosystems** is a **missing link** in the circular economy: this note therefore aims to address this issue, which is still overlooked.

1 Rockström, J., et al, Planetary Boundaries : exploring the safe operating space for humanity, Ecology and Society 14(2) : 32, 2009. Disponible sur https://www.ecologyandsociety.org/vol14/iss2/art32/

In October 2020, a Leaders' Commitment for Nature was signed **to promote an integrated approach to policies to preserve ecosystems and promote the circular economy.**

The signatories, including Ursula von der Leyen, Emmanuel Macron and Angela Merkel, representing 64 states (as well as the EU), express their will to tackle the challenge of biodiversity loss at the same time as those relating to the degradation of oceans and freshwater, the degradation of resources, etc. «which are all closely related crises». Among the commitments made, the circular economy is strongly emphasised: **the transition to sustainable production and consumption patterns and value creation decoupled from our use of resources** should help to reverse the loss of biodiversity[2].

In this respect, the director of the French committee of the International Union for Conservation of Nature (IUCN) reminds us that «**the integration of biodiversity conservation into the various sectoral policies which put pressure on ecosystems, such as fishing or agriculture, is fundamental**[3]» .

This note **questions the links between the circular economy and biodiversity: to what extent can the circular economy contribute to the mitigation of pressures on biodiversity and be integrated into its protection?**

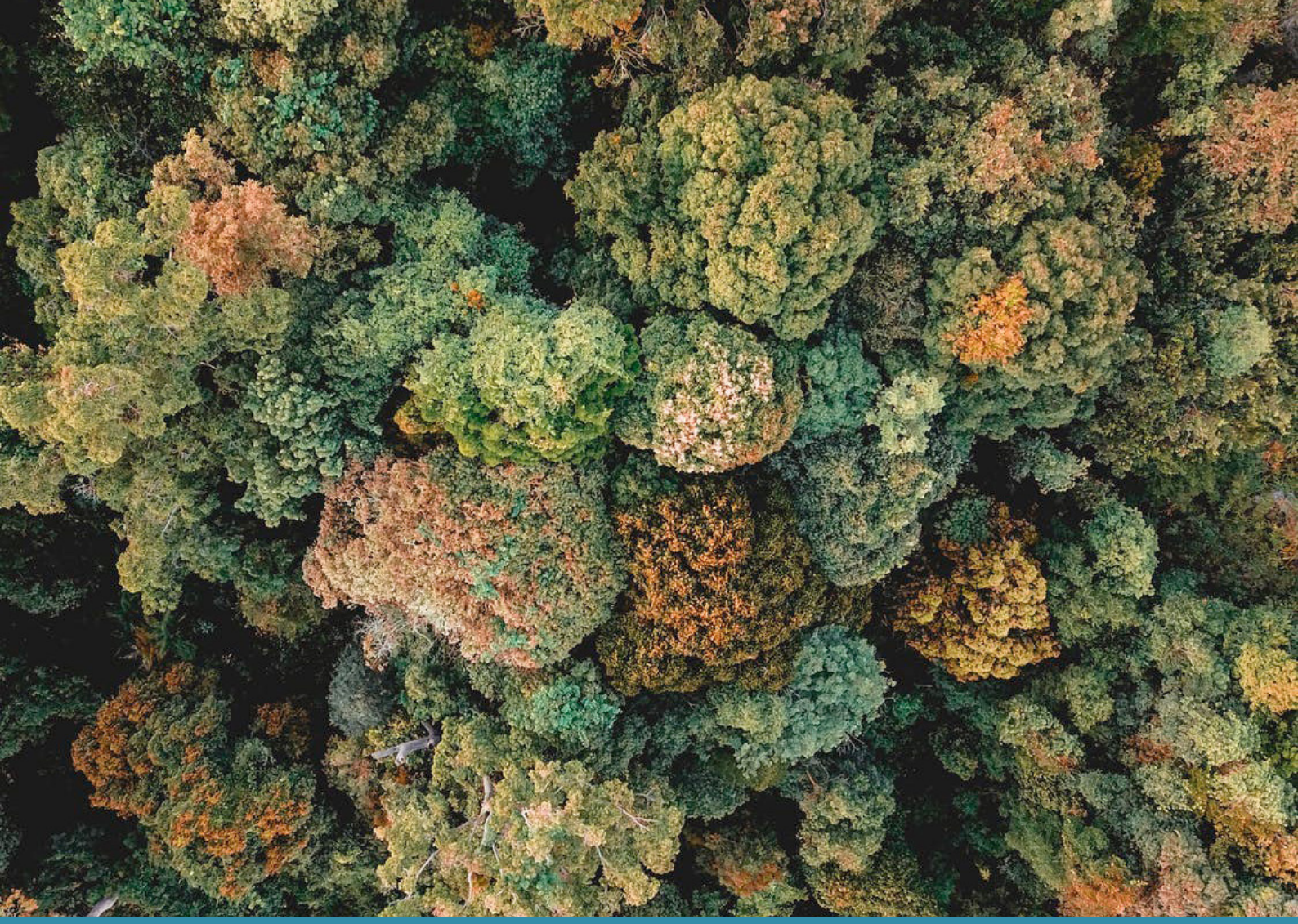
What are the limits? Is it relevant to deal with these two issues jointly in companies, local authorities, and other economic and territorial actors?

The circular economy and biodiversity correspond to the Sustainable Development Goals (SDGs) defined by the United Nations: the circular economy refers in particular to goal 12 «Responsible consumption and production», and biodiversity to goals 14 «Aquatic life» and 15 «Terrestrial life». The aim is therefore to identify the concrete links between these two concepts.

In this note, we have chosen to address the issue of natural ecosystems, as it allows us to identify biodiversity issues in an **integrated manner** and to confront them at the **territorial level**. Environmental policies must be considered in a cross-cutting manner in order to better understand and limit the causes of biodiversity erosion. The notion of ecosystems also makes it possible to focus the analysis on certain «common goods»: water, land, atmosphere, etc. By questioning and integrating these parameters, circular economy actions will be able to combine their benefits on resource management with ecosystem preservation issues.

2 Leaders' pledge for nature, *United to Reverse Biodiversity Loss by 2030 for Sustainable Development*, « Accelerating the transition to sustainable growth, decoupled from resource use, including through moving towards a resource-efficient circular economy (...) «.

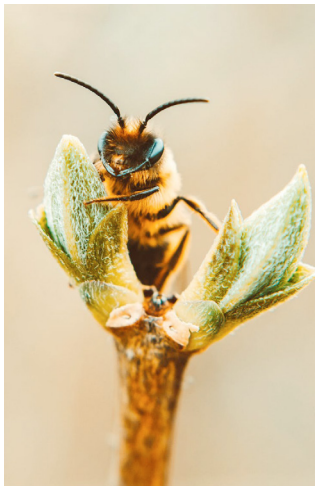
3 Le Monde, «Sixty world leaders pledge to halt biodiversity loss by 2030», published on 29 September 2020, accessed online on 29 September 2020. https://www.lemonde.fr/planete/article/2020/09/29/une-soixantaine-de-leaders-mondiaux-s-engagent-a-mettre-fin-a-la-perte-de-biodiversite-d-ici-a-2030_6053984_3244.html



ECOSYSTEM PROTECTION ISSUES

WHAT IS AN ECOSYSTEM?

According to the CNRS definition (France's national scientific research center), an ecosystem is a «**living whole formed by a group of different species in interrelations (nutrition, reproduction, predation, etc.), between themselves and with their environment (minerals, air, water), on a given spatial scale**».



It is therefore a **complex** system made up of communities of living beings forming the biocenosis, **interacting with each other and with their living environment**, which we call the biotope. The relationships between individuals are of various kinds: They depend on the biotope and its characteristics (light, water and nutrient resources, temperature, etc.), which influence the distribution of species and the dynamics of their populations, but also participate in the structuring of this biotope, through energy and material flows (water, carbon, nitrogen, minerals, etc.) as a result of processes such as photosynthesis, feeding, evapotranspiration or erosion. The ecosystem is thus made up of interdependent living and non-living parts that are in **constant interaction**. Its size does not have a strict definition and can vary from a mountain range to a pond, a forest or even an individual (the digestive system of a cow is thus considered to be an ecosystem in its own right comprising millions of microorganisms). It can be impacted by disturbances that change populations or resources, but it can be resilient as long as the disturbance does not reach a certain threshold. It is important to understand that the disturbance of one component of the ecosystem (e.g. overexploitation of a fish population or soil pollution in a grassland) can disrupt the entire ecosystem by impacting all the interactions that the component has with its environment.

Biodiversity therefore encompasses the diversity of ecosystems, the diversity of animal, plant and microbial species and their populations, and the diversity of genetic material within each species. The notions of biodiversity and ecosystems are therefore interconnected: the erosion of biodiversity implies a drastic change in the organisation of terrestrial ecosystems; similarly, the transformation of territories and their ecosystem components accelerates the erosion of biodiversity.

In this note, we use the term «biodiversity» in the general sense of life, and the term «**ecosystem**» in the more **territorial** sense of biodiversity, involving non-living components.

WHAT ARE THE IMPACTS OF HUMAN ACTIVITIES ON BIODIVERSITY AND ECOSYSTEMS?

Biodiversity loss is caused by the intensification of human activities around the world. In particular, IPBES has identified the 5 main direct causes of biodiversity loss in terrestrial and aquatic ecosystems, which are, in descending order[4]:

4 IPBES, The Dangerous Decline of Nature: An 'unprecedented' and accelerating rate of species extinction. Available at https://ipbes.net/news/Media-Release-Global-Assessment-Fr

- **Changes in land and sea use:** mainly through the increase in agricultural land and urbanisation, which leads to land artificialisation at the expense of forests, grasslands and wetlands.

- **Direct exploitation of certain organisms:** overexploitation of natural animal and plant resources through agriculture, logging, hunting, and fishing, which prevents sufficiently rapid regeneration.

- **Climate change:** global warming due to greenhouse gas emissions which modifies habitats, promotes fires, impacts the availability of water resources.

- **Pollution:** air pollution from industry, energy and agriculture, chemical pollution of water and soil from industrial and agricultural waste, and plastic pollution

- **Invasive alien species:** voluntary or accidental introductions of invasive species, favoured by the globalisation of trade and human flows, which endanger native species

In the case of marine ecosystems, the direct exploitation of organisms by fishing is the primary factor, ahead of changes in sea use.

	Direct impacts of human activities	Consequences
Biomass	o **Withdrawals for consumption** (fishing, wood supply, etc.) o **Intentional destruction** (deforestation) or **accidental destruction** (non-selective fishing nets, land and marine pollution, etc.)	o **Disappearance of animal and plant species** o **Disruption of food chains**
Water	o **Intensive use** in agriculture and industrial processes, conflicts of use with drinking water o **Organic pollution of groundwater and surface water** by nitrogenous agricultural effluents o **Pollution by toxic chemical compounds** from industrial processes o **Plastic pollution and microplastics**	o **Depletion of aquifer resources** o **Drying of certain regions**, increased by global warming o **Eutrophication of wetlands, toxic algal blooms** o **Transport and accumulation of plastics in the oceans**
Soils	o **Increased land use** by agriculture and urbanisation o **Chemical and organic pollution** from agriculture and industry	o **Artificialisation, erosion, acidification, compaction, sealing, salinisation of soils** o **Fragmentation and destruction of biodiversity habitats** o **Disturbance of soil microfauna and decline in soil fertility**
Atmosphere	o **Local" air pollution by toxic compounds** (fine particles, heavy metals, toxic gases...) from agriculture, industry, transport, heating systems o **Pollution of the atmosphere by greenhouse gases** (CO_2, methane, nitrous oxide, etc.), also from industry, agriculture and transport	o **Acid rain, risks to human health through inhalation, reincorporation of toxic compounds in nature and bioaccumulation in certain species...** o **Global warming** and all that it entails (ocean acidification, droughts, intense rainfall, rising sea levels, increased temperatures, etc.)
Biogeochemical cycles	o **Disruption of nitrogen and phosphorus cycles** by agricultural inputs and effluents and urban wastewater o **Disruption of the carbon cycle** through fossil fuel consumption and carbon dioxide emissions o **Disruption of the water cycle** through deforestation, groundwater depletion, river diversion, global warming	o **Opening of biogeochemical cycles with the depletion of certain elements upstream** (e.g. fossil fuels) **and the creation of stocks downstream** that natural processes can no longer absorb (nitrogen and phosphorus in water and soil, greenhouse gases in the atmosphere, etc.) o **Risks of invasion of ecosystems by new species, decrease in soil fertility, water pollution...**

Table 1: The impact of human activities on ecosystems can also be broken down into biogeochemical components.

Each change in one of the ecosystem parameters can affect the other parameters, often in the form of feedback loops.

What the Institutions say...

The worrying state of ecosystems and the biodiversity crisis are recognised by institutions.

At the international level, **the Convention on Biological Diversity (CBD)** was concluded at the United Nations Conference on Environment and Development in Rio in 1992, with the aim of protecting biodiversity in the signatory countries. The Conference of the Parties to the CBD in Nagoya in 2010 set targets for the mitigation of pressures on biodiversity, the enhancement of ecosystems and their services and protective planning by 2020: the 20 **Aichi Targets**.

The 1971 **Ramsar** Convention on Wetlands is one of the oldest international conventions in the field of nature protection. It aims at the conservation and wise use of wetlands and their resources, and covers 2394 sites worldwide.

At the European level, the Commission published a **Biodiversity Strategy** for 2030 in May 2020. The pandemic has reaffirmed the urgency of addressing this issue and the Commission has identified several priorities: the creation of protected areas with legally binding targets for nature restoration.

In France, the protection of biodiversity has been framed by the **National Strategy for Biodiversity (SNB)** since 2004, integrating with the objectives of the CBD. In 2017, **the French Agency for Biodiversity** was created by the law for the recovery of biodiversity, nature and landscapes. It carries out «missions to support the implementation of public policies in the field of knowledge, preservation, management and restoration of biodiversity in terrestrial, aquatic and marine environments. «Since 2020, the AFB and the National Office for Hunting and Wildlife (ONCFS) have been grouped together within **the National Office for Biodiversity (ONB).**

HOW SHOULD ECONOMIC ACTIVITIES BE POSITIONED IN RELATION TO ECOSYSTEMS?

While ecosystems can be transformed or endangered by natural disturbances (fires, diseases), human activities have also been shown to impact on them, either on an ad hoc or on-going basis. However, in addition to their intrinsic value, ecosystems are essential to our society and to human well-being in general. Their biological processes are indeed the source of many benefits for humans, which are called «*ecosystem services*».

Ecosystem services are therefore the result of an **anthropogenic view** of ecosystems, and are generally divided into four categories[5]:

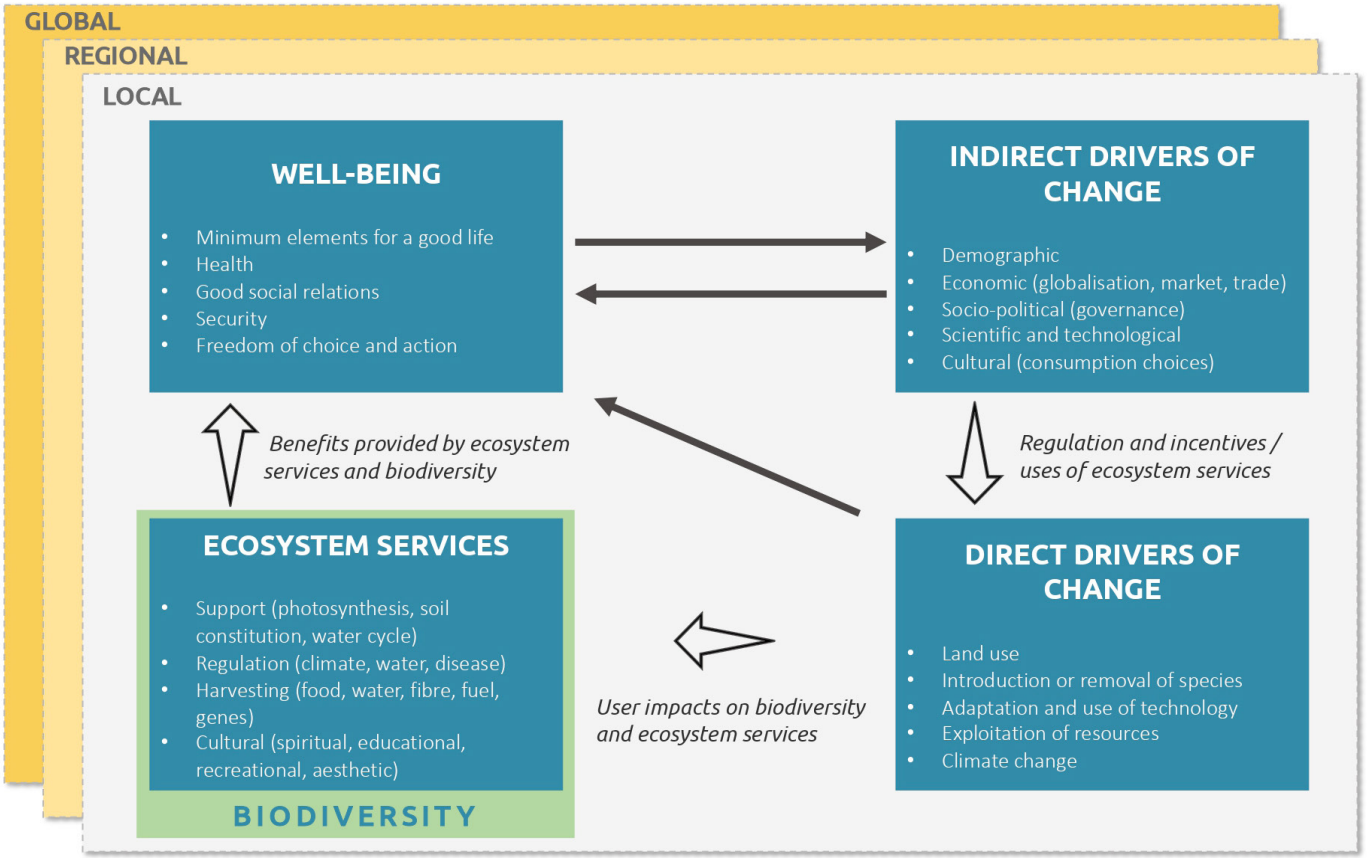
- **Provisioning or withdrawal services:** ecosystems provide resources of water, food, energy, medicines, biomass fuel, etc. that can be directly used by humans.

- **Regulatory services:** the natural functioning of ecosystems ensures pollination, water filtration, and the regulation of parameters such as temperature, flooding, soil erosion, disease, etc. It allows for effective resilience in the event of a specific disturbance.

- **Supporting services:** ecosystems support processes that are essential to economic activities such as primary production, photosynthesis, nutrient cycling, soil formation.

- **Cultural services:** finally, ecosystems have heritage, aesthetic, spiritual and recreational value for humans.

Figure 1: Ecosystem services. Source: MEA



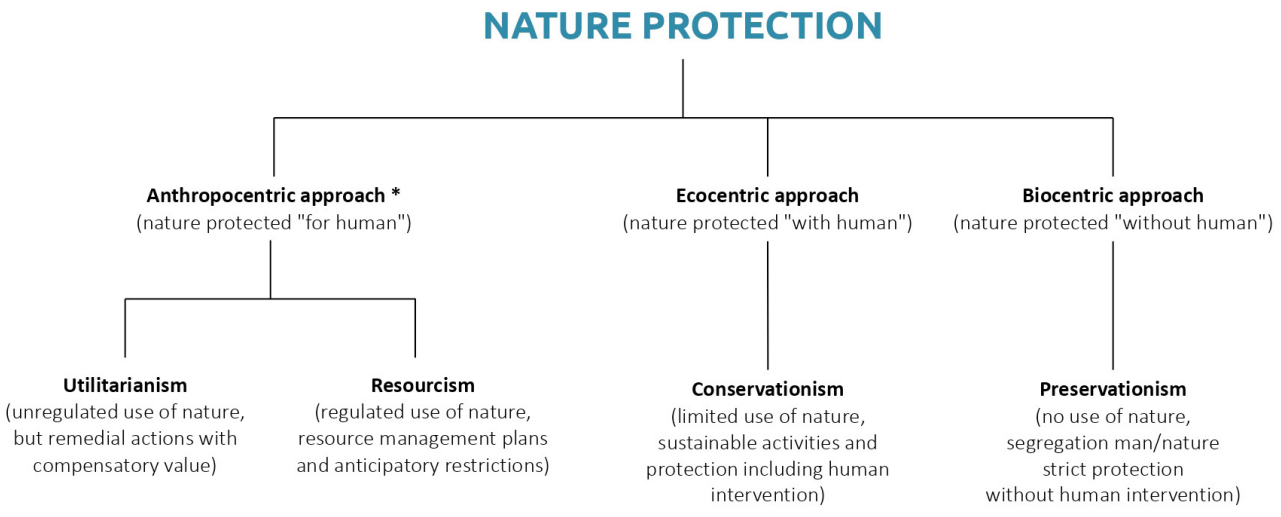
5 Millenium Ecosystem Assessment, Ecosystems and human well-being, 2005

These ecosystem «services» are essential for the functioning of our societies: our agri-food system relies on provisioning services, regulating services allow us to benefit from viable habitats, supporting services are essential for economic activities such as agriculture, and cultural services play a key role in human well-being.

There is thus a **close interaction between human activities and ecosystems**, with in particular a **direct or indirect dependence** of economic sectors on natural resources and ecosystem services. The erosion of biodiversity and changes in ecosystems are thus threats to the economic development and stability of our societies.

It is therefore essential to define the approach to ecosystems and nature in general, in order to clarify the role of society and the economy in relation to its environment and to prevent the gradual destruction of the majority of the earth's ecosystems. Several approaches can be considered:

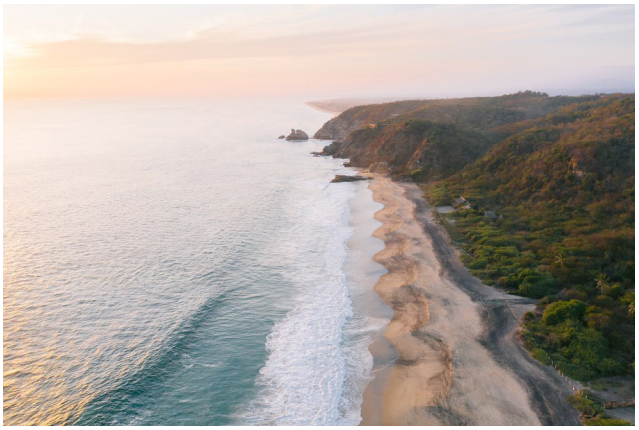
Figure 2: The different approaches to nature conservation. Source: Geoconfluences[6]



** other variants are possible, depending on whether the utility of nature for man is estimated narrowly on the economic basis of maintaining the supply of natural resources for production, or includes more broadly the social conditions of well-being linked to nature (e.g. aesthetics, landscape).*

6 Samuel Depraz, Protecting, preserving or conserving nature, Géonconfluences, 2013. Available at http://geoconfluences.ens-lyon.fr/informations-scientifiques/a-la-une/notion-a-la-une/notion-a-la-une-proteger-preserver-ou-conserver-la-nature

In many parts of the world, we are currently faced with a kind of paradox where, on the one hand, nature is sanctuarised and placed under a bell in small parts of the territory, but where it is also exploited without regulation in other parts. How can we achieve an approach that respects nature and is viable for humans, without having such opposite approaches within the same territory?



The current economic system has a tendency to adopt a «utilitarian» stance, i.e. unregulated use of nature, possibly with remedial and compensatory actions, but without taking environmental protection into account upstream. Depending on the territory and the actors, the economy sometimes also resorts to «resourcing», by integrating nature protection issues into activities upstream and regulating the use of its resources, but with the aim of renewing the resource for human exploitation. The circular economy is, in our opinion, part of another type of relationship, aiming at a **reasoned management of the resources present in nature, with an awareness of ecosystem balances** (closer to the «conservationism» presented below).

MEASURING AND ACTING: WHAT SCALES AND WHAT MEANS?

Sustainable management of natural resources requires, first and foremost, knowledge and understanding of the processes of renewal, as well as the causes of erosion of these resources. It is therefore important to use scientific indicators that characterise the state of ecosystems and enable their evolution to be monitored, to know what limits should not be crossed. An indicator is an often-quantitative measure that can be used to summarise complex phenomena relating to biodiversity and ecosystems, and thus qualify their state of health and their evolution over time. At the territorial level, **several sets of indicators** exist to characterise the pressures exerted on ecosystems, the state of ecosystems and the means implemented to protect them, notably :

- **Indicators of the state of biodiversity used in ecology:** for example, the «species richness» to characterise the biodiversity of a habitat based on the number of species present, or the «equitability index» to characterise the proportion of abundant and rare species.

- **The indicators developed by the ONB (National Biodiversity Observatory)** as part of the SNB (National Biodiversity Strategy) since 2011: for example, changes in nitrate pollution of waterways in metropolitan France, or the conservation effort of remarkable nature areas. These indicators make it possible to monitor the effects of policies and behaviours on biodiversity and are made available to the actors in charge of evaluation, reporting, expertise, commu-

nication and research. They are scientifically reviewed by the FRB (Fondation pour la Recherche sur la Biodiversité).[7] The ONB also publishes a map of France of human pressures on biodiversity.[8]

- **Regional indicators defined by the ORB (Regional Biodiversity Observatory)**, identifying the specific challenges of regional territories.

It should be borne in mind that an indicator only reflects one aspect of an ecosystem in relation to a given concern, and that it is necessary to use a **battery of relevant and complementary indicators** to be able to characterise the overall state of and pressures on biodiversity at the scale of a territory.

In addition, it is interesting to study the impact of a company or infrastructure on the environment. Knowing its impacts and dependencies on ecosystems allows companies to integrate a strategy to reduce their ecological footprint and contribute to the achievement of international biodiversity targets. Several firms and institutions have developed tools to assess the footprint of business activities on biodiversity and ecosystems:

- **B/L Evolution** offers companies a tool for calculating their biodiversity footprint based on the pressures that their activities and value chain place on biodiversity.[9]
- **I Care & Consult and Sayari have developed a Product Biodiversity Footprint (PBF) tool** with Ademe that makes it possible to distinguish the biodiversity impact of different variants of a product and to integrate biodiversity into the LCA while covering all the causes of biodiversity erosion.[10]
- **CDC Biodiversité has developed the GBS (Gobal Biodiversity Score) tool** to calculate the biodiversity footprint of a company or financial institution by characterising the «integrity» of ecosystems based on the average abundance of species. This tool takes into account pressures on terrestrial and aquatic biodiversity.[11]

7 Biodiversity Research Foundation, Available at https://www.fondationbiodiversite.fr/analyse-scientifique-des-indicateurs-de-la-strategie-nationale-pour-la-biodiversite-snb/
8 Observatoire National de la Biodiversité, Cartographie des pressions. Available at http://indicateurs-biodiversite.naturefrance.fr/cartographie-des-pressions
9 BL evolution, Biodiversity footprint, https://www.bl-evolution.com/nos-expertises/notre-expertise-biodiversite/
10 I Care & Consult, Product Biodiversity Footprint, https://www.i-care-consult.com/references/empreinte-biodiversite-produit/
11 CDC Biodiversité, Measuring my company's biodiversity footprint, https://www.cdc-biodiversite.fr/laction-volontaire/mesurer-lempreinte-biodiversite-de-mon-entreprise/

THE CIRCULAR ECONOMY AND ECOSYSTEMS

We have seen that the protection of ecosystems is a sort of missing link in the circular economy. While this notion is well understood in the decoupling of value creation and environmental impact, which is at the heart of the definition of the circular economy, it is less obvious when the circular economy is defined by its «operational pillars»: sustainable sourcing, eco-design, industrial and territorial ecology, functionality economy, responsible consumption, extension of the useful life, and recycling. **Their link with the prevention of ecosystemic impacts remains indirect**, although this is beginning to be taken into account through life cycle analysis (LCA), the preferred tool for objectifying eco-design. It is therefore useful to reflect on the very essence of the circular economy and to redefine its founding principles in order to strengthen its link with ecosystems.

GUIDING PRINCIPLES OF THE CIRCULAR ECONOMY

The circular economy is built around several principles, which need to be used as a common thread in resource management. These founding principles are described below:

1. **Non-toxicity** to limit the use of substances harmful to humans and the environment

2. **Sobriety** in production and consumption, with the challenge of reducing the amount of resources used and taken from nature

3. **Resource efficiency**: the aim is to create maximum added value for a given quantity of material, so as not to waste resources and to use them sustainably while respecting the earth's stocks and their natural renewal.

4. **Renewability**, which favours the extraction and use of renewable resources at a rate consistent with the regeneration capacity of ecosystems.

5. Lastly, a **closing of flows**, which makes it possible to regenerate value for materials that have already entered the economic system, by reusing, reemploying and recycling them, so that they can be substituted, as far as possible, for «new» materials, and to avoid the production of waste and polluting emissions in the environment.

These principles, by contributing to better resource management, offer a solution to the current problem of overexploitation of natural resources and its role in the biodiversity crisis.

THE CIRCULAR ECONOMY AS A MODEL OF SUSTAINABILITY

Although the circular economy is intended to achieve a «conservationism», in which the uses of nature are limited and economic activities are integrated into the protection of ecosystems, in practical reality it often tends to move towards a more «***resourcist***» approach mentioned in the first part of the document, with **regulated use of nature and planning of resource management** for human use. The transition to the circular economy must therefore be coupled with greater consideration of biodiversity issues, by integrating them into the heart of its implementation. To do this, several levers of action can be mobilised and call on scientific knowledge on the subject.

It is important to clarify that the circular economy is not intended to replace environmental science: **rather, it is about integrating economic activities within the boundaries of eco-**

systems, based on the scientific data provided by ecology and the study of ecosystem functioning.

The circular economy is thus a principle of economic organisation that aims to mobilise a set of action levers and to inscribe human development within the limits of ecosystems set by science, in order to guarantee their conservation.

THE NEED FOR A TERRITORIAL APPROACH IDENTIFYING LOCAL ISSUES

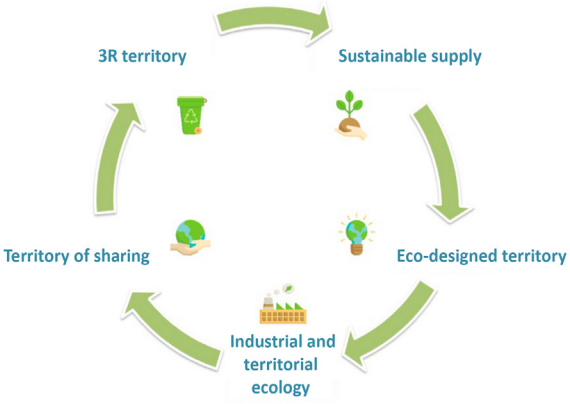
As all ecosystems are unique, it is important when implementing economic, political or regulatory measures to think on a territorial scale, in order to identify local biodiversity issues: these will not be the same whether we consider a wetland on the Mediterranean coast or a forest in northern France. **Biodiversity is also diversified according to the territory**: the MNHN has formalised a **network of «irreplaceable» biodiversity** in France, i.e. species that are **endemic or very localised**, and has shown that one third of the French territory plays an irreplaceable role for biodiversity, particularly in coastal areas. By cross-referencing this data with the spatial analysis of protected areas and the analysis of pressures on ecosystems, the MNHN and the CGDD (General Commission for Sustainable Development) have highlighted areas of vigilance with regard to national biodiversity issues, and these areas represent at least 17% of the territory of Metropolitan France.[12]

The economic and social issues are also very different from one territory to another. Having a more decentralised approach adapted to each territory is therefore an important step in the implementation of the circular economy.
It is therefore important, upstream of **development projects** for example, to have a good knowledge of **local** material and energy **flows**, local stakeholders, the geographical and biological context and local pressures on ecosystems. Tools for calculating material or energy balances at the scale of a territory, in the form of input, output and stock volumes, exist and are very useful for better understanding the dynamics of resources, but they cannot be exhaustive for a complete understanding of local environmental issues. This is why it is also necessary to rely on geographical and environmental sciences applied to the territory.

Operating on a territorial scale makes it possible to set up relevant economic projects within the limits set by the local environment, in terms of availability of natural resources and pressure on biodiversity. This allows for the emergence of synergies between local actors, in a logic of proximity that allows for both limiting the transport of materials and energy, which emit carbon, and also for better traceability of economic activities and their potential impacts on local ecosystems.

12 Commissariat Général au Développement Durable, Les enjeux de biodiversité en France métropolitaine : analyses croisées, 2019. Available at https://www.ecologique-solidaire.gouv.fr/sites/default/files/Th%C3%A9ma%20-%20Les%20enjeux%20de%20biodiversit%C3%A9%20en%20France%20m%C3%A9tropolitaine.pdf

The circular economy applied to the territories is based on a strategy consisting of **five interconnected axes**:



- **Sustainable supply**: Develop responsible consumption on a territorial scale, based on the exemplary role of public actors. Several levers can be deployed, such as the implementation of local circuits, complementary currencies or the promotion of renewable materials and energy. Informing public and private buyers plays a key role in the deployment of this pillar.

- **Eco-design on a territorial scale**: Optimise the efficiency of use of a good or service from the design stage, and reduce its environmental impact throughout its life cycle (design - construction - use - end of life). On a territorial scale, this method must be applied to all development projects.

- **Industrial and territorial ecology**: Optimising material and energy flows on a territorial scale by developing synergies between economic players. It is essential to build and maintain an active animation for a sustainable economic development by giving a key role to local companies.

- **Sharing territory**: To optimise the use of goods and resources, territories must encourage their sharing between several users. The two main vectors for achieving this transformation are the **economy of functionality**, which aims to replace the sale of a good or service by its use, and the **collaborative economy**, which aims to share goods, tools, spaces and knowledge.

- **3R Territory** : The last lever, more focused on the end-of-life of products, is structured around the 3R triptych: **reduce, reuse and recycle**. It is part of a perspective of reducing waste and efficient waste management, and involves prevention, sorting and selective collection, as well as optimised waste recovery. In accordance with the waste treatment hierarchy, it allows us to «close the loop» and transform waste into resources.

However, it is essential that these territorial approaches are part of **cooperation and coordination with other territories**, in order to implement **complementary** approaches, exchange good practices and manage certain resources together. This implies larger-scale normative frameworks for regulations, practices and common objectives between territories, and a collective agreement on the ambitions for ecosystem conservation.

The operational action dynamics detailed above are useful for understanding how the circular economy is implemented, but are not sufficient to account for the «political» and «economic» dimension of its effective implementation within the territories. These dynamics must therefore be considered and fully integrated by the more classic public action levers that can be mobilised by institutional decision-makers: planning, taxation, investments, etc.

THE TOOLS AND CHALLENGES OF THE CIRCULAR ECONOMY APPLIED TO THE PROTECTION OF ECOSYSTEMS

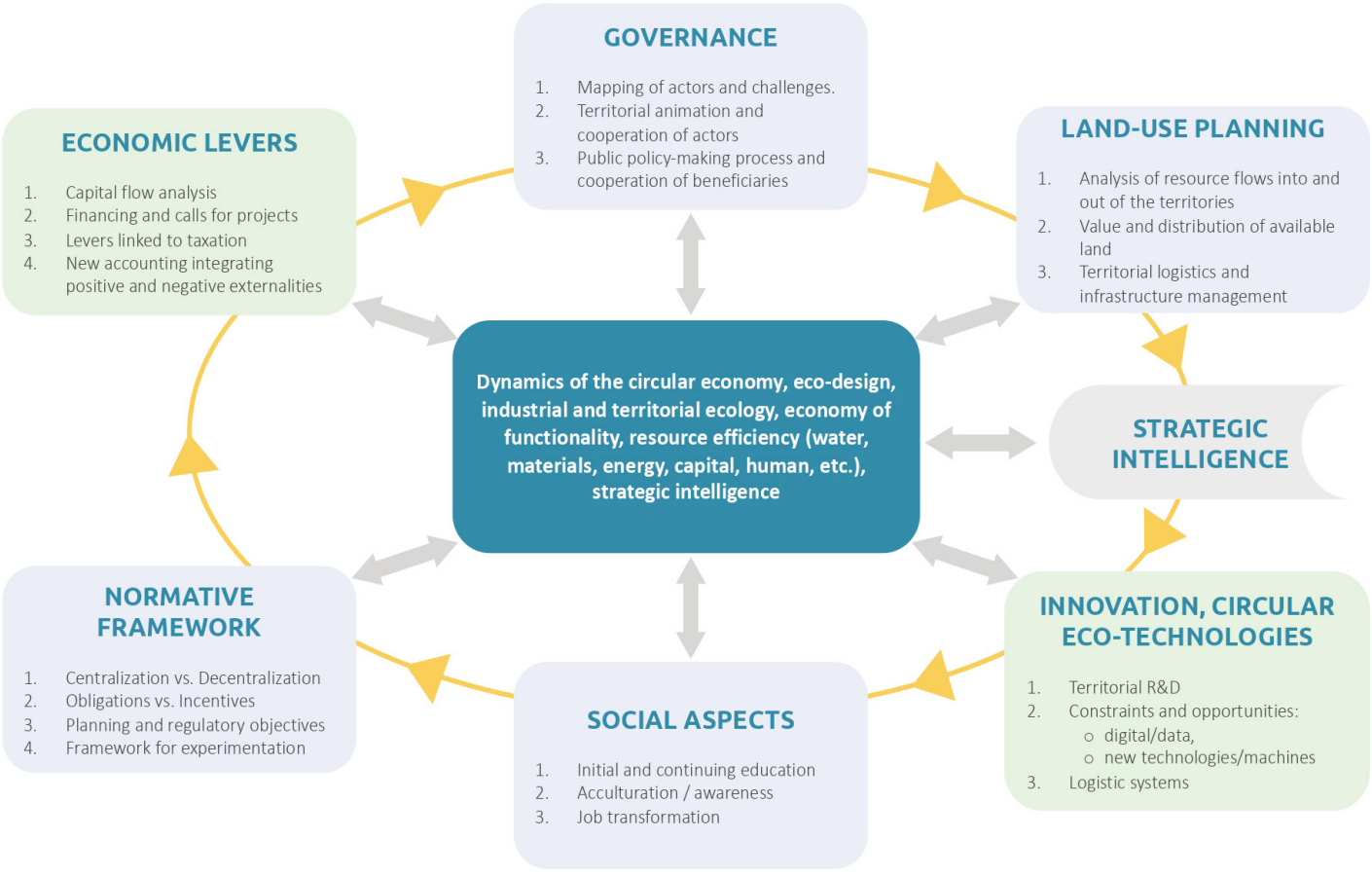


Figure 3: Strategies of circular economy actors in local authorities Source: JC Lévy, A. Deboutière, H. Maurer, M. Weber, V. Aurez

The circular economy calls for several levers of action that can be applied at the territorial level. Some of these levers can be activated to participate in ecosystem protection dynamics. The challenge is to understand how to use them. We can already mention a few tools and mechanisms that help to reduce pressure on biodiversity:

- **Spatial planning:**

It is essential to understand and take full account of the functioning of ecosystems and their conservation in a land-use planning policy: this involves, in particular, the drawing up of green and blue networks and their inclusion in urban planning documents, but also measures to combat soil artificialisation, by making the granting of planning or building permits conditional on the conservation of ecosystems, etc.

- **Land value issues**: Land is a very important aspect of land management, and offers several mechanisms for conserving ecosystems. In particular, urban and industrial wastelands are abandoned spaces that are gradually recolonised by nature, to the point of becoming biodiversity hot spots. In the case of companies wishing to redevelop some of their brownfield sites, it is essential that they have planned upstream impact mitigation measures on these ecosystems by carrying out studies on the state of the biodiversity of the sites. Another example of a land-based ecosystem protection scheme is the real environmental obligation (REO): since 2016, according to Article L.132-3 of the Environmental Code, private individuals can set up an environmental protection attached to their property, which will be passed on to subsequent owners of the property.[13]

- **The green and blue framework**, set up in 2007 as part of the Grenelle Environment Forum, is the organisation of the French territory into a network of biological corridors and biodiversity reservoirs, in order to allow animal and plant species to move around the territory and to counteract the fragmentation of habitats.

- It is based in particular on the Regional Ecological Coherence Scheme (SRCE), on **local authorities and on territorial development plans**, such as the SRADDET, SCoT and PLU, which allow local ecosystems to be taken into account.

- **Urban developments** in favour of biodiversity, such as sustainable urban agriculture or green roofs, are sources of «islands of biodiversity» in the heart of cities, especially when they use agroecological practices.

13 Ministère de la transition écologique et solidaire, Obligation Réelle Environnementale - Fiches de synthèse. Available at https://www.ecologique-solidaire.gouv.fr/sites/default/files/Guide-methodologique-obligation-reelle-environnementale.pdf

Towards the integration of biodiversity conservation in urban planning

Integrating nature into the city is a source of multiple benefits: the ecosystem services of regulating water quality, runoff and temperature, the services of supporting pollination in urban areas, and the cultural and recreational services provided by green areas all improve the quality of life of city dwellers[14].

Integrating nature into the city also makes it possible to limit habitat fragmentation for certain species of insects, amphibians or small mammals.
Several areas of action are involved in developing biodiversity-friendly urban spaces.

- Studying **the impact of infrastructures before they are developed** makes it possible to identify local biodiversity issues and to limit the pressures generated by the development as much as possible. The Biodi(V)strict tool developed by Vinci and Agroparistech is an example of a diagnostic and decision-making tool for reducing the impacts of developments on ecosystems.[15]

- **Gouvernance**

As presented above, circular economy actions have a strong territorial dimension. This territorial dimension has benefits: the valorisation of resources present within a territory reduces imports and dependence on distant resources.

Efficient use of local resources requires the development of exemplary governance, underpinned by two principles.

- Firstly, this governance must enable the **diversity of local issues** to be better taken into account, by relying on spokespersons who are representative of the territory's human and non-human stakeholders.

- Local governance must, however, **be articulated** with the different levels of public policy, notably the national and supranational.

14 ADEME, Les cahiers techniques de l'AEU2: Ecosystèmes dans les territoires, Guide: Réussir la planification et l'aménagement durables. Available at http://multimedia.ademe.fr/catalogues/CTecosystemes/index.html#1
15 http://www.biodivstrict.com/

Including citizens in the governance of impact projects: the example of methanisation sites

Methanisation consists of the degradation of organic matter of animal or vegetable origin in the absence of oxygen (anaerobic), thanks to the action of micro-organisms. This degradation produces two types of components: biogas (which will be called biomethane after purification) and digestate (which can be used as a fertiliser). Methanisation is often cited for its inclusion in the principles of the circular economy: recovery of «waste» into energy and fertiliser materials, used locally. It also has benefits for the protection of ecosystems. By replacing chemical inputs, the digestate from methanisation causes less disruption to the biogeochemical cycles of the soil. Furthermore, the supply of recovered energy (biomethane) reduces the pressure on non-renewable fossil resources.

The construction of an anaerobic digestion site near agricultural farms meets **societal obstacles**.

Indeed, it may generate doubts, or even fears or opposition from local residents: this is an issue of social acceptability. It is therefore interesting to include the creation of such sites in multi-party agreements (local authorities, farmers and residents). Local authorities wishing to involve their citizens in their transition actions can also propose forms of participatory financing[16]. Project leaders can open up the capital of the methanisation unit to a citizen shareholding, in order to make the process part of a desire for sharing and co-construction.

In this respect, we can mention that the **Citizens' Climate Convention** proposes (pt 11.2) that renewable energy development projects should involve citizens, local companies and associations and local authorities. This co-construction of projects could be extended to recycled energy.

16 Guide: Auvergne-Rhône-Alpes & all, *Methanisation: why and how to integrate participatory financing in your project?* August 2012

PERSPECTIVES

The possibility of reintegrating the commons into public policy[17]: is biodiversity a good like any other?

A «**commons**» has been defined by Elinor Ostrom and the Bloomington School by its characteristics: it is a resource whose uses are defined by rights; rights established by a community interested in the sustainability of the resource over time. Elinor Ostrom, in The Governance of the Commons: For a new approach to natural resources (2010), had identified 8 essential conditions for the constitution of such a community:

- Clear definition of the resource and management rules
- Consistency between the rules on the management of the resource and its nature is ensured
- Users can change the business rules but must consult each other
- Supervisors ensure that the resource is used according to the rules
- Sanctions for non-compliance are graduated
- Access to local dispute resolution bodies is facilitated
- External authorities recognise the right to self-organisation by the community
- Ownership, enforcement and conflict resolution activities are multi-level

The «natural commons» are at risk of destruction through «unregulated» use, which explains the renewed interest in «common» management, inspired by the theory of Elinor Ostrom, according to the jurist Judith Rochfeld.

Legal recognition of biodiversity elements for theirconservation?

There are many examples abroad: the Ganges (India), the Yamuna (India), the Whanganui (New Zealand) etc. Rivers are endowed with legal personality, which confers rights on them and thus limits the uses to which they are put.

In France, a similar process has been underway since October 2019 for the Loire. The Centre-Val-de-Loire Region, accompanied by several entities such as the Commissariat général à l'égalité des territoires (CGET), the art and ecology association COAL and CLILIC, have set up a commission to create the first parliament of a non-human entity, where «the fauna, flora and the various tangible and intangible components of the Loire would be represented.».[18]

The management of a resource can therefore involve the constitution of a legal status, established in a concerted manner, and the creation of rights with regard to the resource (and concomitant duties with regard to the users).

17 LEGROS C., «Judith Rochfeld : '*Les citoyens obligent leur gouvernement à réintégrer les communs en politique*'», Le Monde, published on 27 July 2020

18 The Parliament of the Loire, https://www.valdeloire.org/Actualites/Articles/Tous/Pour-un-parlement-de-la-Loire

- **Economic levers**

Ecosystem preservation must be a priority in the deployment of circular economy actions. Economic incentives are powerful levers to drive a transition to the circular economy that integrate biodiversity objectives.

- **Funding**, which can take different forms: public and private investments but also through public orders or calls for projects that support innovations.

- **Environmental taxation**, or ecological taxation, allows taxes and charges to be applied to products and services that have a negative impact on the environment, notably through carbon pollution, waste or the consumption of scarce resources. This helps to encourage actors to pollute less, according to the «polluter pays» principle. It also generates revenue that can be reinvested in financing environmental public policies.

- **Integrated accounting** makes it possible to take into account financial and non-financial capital, and to integrate the conservation of natural and human capital into the overall strategy of companies.

Accounting adapted to the renewal of the environment: the CARE programme tested in PACA region

The CARE programme, which stands for Comptabilité Adaptée au Renouvellement de l'Environnement, is dedicated to the performance of companies and was born of the observation that conventional accounting did not take into account the externalities of the activities of economic and public players. The firm ComptaDurable, ADEME and INEC have thus conducted an experiment with 10 companies in the PACA region to put into practice this method of conserving the capital of natural and human resources.

The role of accounting is to maintain the company's capital. However, **capital** is a **multi-dimensional concept** and cannot be reduced to financial values. Through CARE, the aim is to reintroduce the value of «natural» and «human» capital (the value of labour power) into this accounting.

The benefits are **manifold**. By applying the CARE accounting model, the company's management is strengthened because it secures its supplies of raw materials and increases the loyalty of its employees and customers. In addition, it stimulates innovation by encouraging the development of more virtuous and less capital-intensive technologies and practices. It also allows the company to be valued, to anticipate standards and facilitates obtaining additional financing for CSR projects.

- **The EPR** (Extended Producer Responsibility) **channels** are waste management systems that are the responsibility of the producer of the waste, according to the «polluter pays» principle

- **PES** (Payments for Environmental Services) are market-based mechanisms, where a 'provider' of ecosystem services 'sells' these services to a 'recipient': in particular, a contract between a farmer who establishes a vegetation cover on his land and a water treatment company that will benefit from cleaner water due to natural filtration by vegetation. This encourages the conservation of ecosystems and their services.

Channel Payments for Ecosystem Services : un programme INTERREG 2017-2021 (Source : Sara Hernandez Consulting)

The European project CPES (Channel Payments for Ecosystem Services) conducted between July 2017 and April 2021 brought together 6 partners between the UK and France. Through the implementation of Payments for Environmental Services, the objective was to improve water quality in the Channel Region, and particularly in 6 selected catchments.

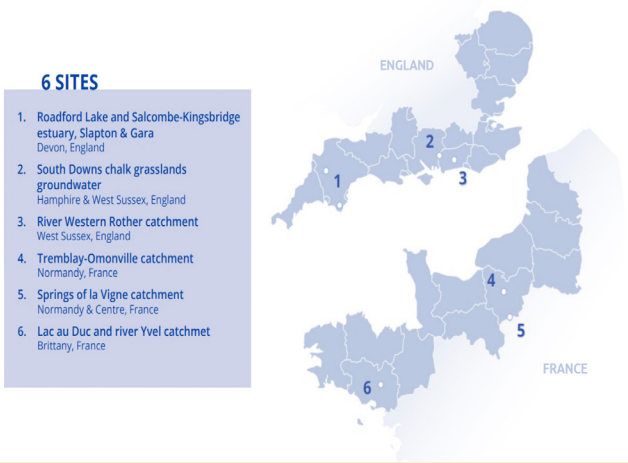


Figure 4: CPES project catchments. Source: Sara Hernandez Consulting.

In several cases, the discrepancy between the service rendered by the farmers through the establishment of a vegetation cover on his land and the benefit for society justified the implementation of a PES payment.

Once established, the vegetation cover has other positive externalities. The «environmental and social return on investment» is therefore high: reduction in the amount of nitrogen fertiliser to be added for the next crop; reduction in the amount of nitrates in groundwater; improvement in the quality of the soil and its capacity to capture and store carbon.
Thus, the ecosystem services identified went beyond improving water quality: local crop yields were also improved, more carbon sequestration could take place, flood risk was reduced and rivers supported more biological diversity.

- **Innovations**

Innovation policies (national and territorial) must aim at converging human well-being and territorial resilience:

- R&D to **replace mineral materials with biodegradable or even compostable materials** that can be directly reinjected into organic nutrient cycles.
- R&D for **more energy-efficient** products and processes (recovered energy, decentralised heat/cold production systems, etc.)
- **Logistics systems** promoting industrial and territorial ecology and the linking of material and energy flows
- R&D for **recyclable materials** with the least possible loss of quality, especially for plastics and cardboard

- **Social dimensions**

The circular economy is spreading, in particular thanks to the law enacted in February 2020. Several measures of the law concern environmental education and resource issues, which become mandatory in various training courses. Nevertheless, the training modules can be considered fragmented and only deal with «waste» or «eco-design», without mentioning the importance of preserving ecosystems.

Opening up the discussions during these training modules to this issue is a lever for building bridges between the circular economy and biodiversity. The same is true for awareness-raising actions that are more citizen-oriented and collective. These levers contribute to essential behavioural changes (see INEC focus on «*Circular economy and behavioural change*»).

- **Raising awareness and informing** citizens about ecosystems and the biodiversity crisis: today, the general public often only thinks of biodiversity in terms of a few emblematic and endangered mammal species (e.g. polar bears), but the complexity and importance of ecosystems is little known.

- **Training** can help citizens learn to adopt lifestyles that generate less waste, for example by setting up worm composters or promoting urban biodiversity through shared gardens.

- **Individual responsibility** is important to ensure that consumption patterns change towards recycled, eco-designed or longer-lasting products.

- **Normative framework :**

Regulatory levers allow certain practices to be prohibited, standardise frameworks for other actions and prove to be an incentive for actors. The major challenge of these levers lies in the balance to be found between impact prevention and resource efficiency.

- **Biodiversity regulations** (notably the laws resulting from the Grenelle de l'Environnement in 2009 and 2010 and the law for the reconquest of biodiversity in 2016) and those on the circular economy (the anti-waste law for a circular economy in 2020) guarantee by obligation the application of measures in favour of the protection of ecosystems and better resource management. Other laws also regulate industrial and agricultural pollution and thus limit their impacts on ecosystems.

- **Planning** (in national but also territorial strategies). At the national level, various actors are mobilised to achieve biodiversity conservation objectives: the National Strategy for Biodiversity, within the framework of the international convention on biological diversity (CBD), and the Biodiversity Plan aim to integrate biodiversity into sectoral policies, to limit pollution and to mobilise levers to encourage the restoration of degraded ecosystems. According to Jean-Claude Lévy, «planning» is a major tool for conducting territorial circular economy strategies. It is in this respect that the latter could also integrate ecosystem preservation objectives.

LIMITATIONS AND RISKS OF THE MODEL

If the circular economy appears to be a model of sustainability for territories and the protection of ecosystems, it is also necessary to underline some questions and avenues for improvement. First of all, applying economic concepts to ecosystems implies considering them as a «natural capital» to be conserved and managed sustainably. But how can monetary values be assigned to nature? How can we quantify, and how can we prioritise, the components of ecosystems according to these values?

In this respect, Jean-Claude Lévy recalled that the price of the tonne of CO2, which makes it possible to monetise carbon impacts, is **subject to significant fluctuations**. Moreover, while the tonne of CO2 makes it possible to quantify the impact of economic activities on global warming, **it does not take into account the complex interactions with biodiversity and ecosystems**. Similarly, assigning a monetary value to other biological indicators runs the risk of selecting data according to an anthropocentric vision and therefore preferring the indicators that are most «useful» to humans.[19]

Furthermore, a circular economy process can be **detrimental to ecosystem preservation objectives.** For example, the manufacture of fuels can be substituted by agrofuels from agricultural biomass, under the pretext of sustainable supply by reducing the use of fossil materials, wrongly emphasising the idea of organic production. However, the example of first generation biofuels in Germany has shown that this requires large quantities of biomass (rape, maize), which are supplied by **monoculture**, to the detriment of biodiversity and in competition with the food use of agricultural resources[20]. Similarly, the use of plant biomass as a fuel, as an alternative to coal, requires large quantities of wood pellets, often from forests in Northern Europe (e.g. Sweden). The question of **supply distance** and forest management arises. We must therefore be cautious as to the coherence of certain actions deployed.

On the other hand, the reuse or recycling of waste into new resources, while limiting the use of virgin materials, requires particular attention in view of their potential toxicity. It is therefore important to ensure the traceability and safety of materials derived from waste.[21]

19 Johanna Buchmann-Duck, Karen F. Beazley, An urgent call for circular economy advocates to acknowledge its limitations in conserving biodiversity, Science of the Total Environment, 2020. Disponible sur https://www.sciencedirect.com/science/article/abs/pii/S0048969720321185?via%3Dihub

20 Information report on agrofuels, submitted by the information mission on agrofuels, on behalf of the Committee on Sustainable Development and Land Use Planning, 22 January 2020. «The rapporteurs call for the impact of land use change to be better taken into account when studying the environmental benefits of different biofuels. »

21 INERIS, Dangerousness, risks and recovery of waste, Report, 2018. Available at https://www.ineris.fr/sites/ineris.fr/files/2019-01/CR_DebatONG_Dechets_2018-09-27_vDEF.pdf

CONCLUSION

Biodiversity is an essential aspect of the Earth system. It provides ecosystem services that are essential for the functioning of our societies and for human well-being. However, it is subject to pressure from human activities, and the state of ecosystems and species is greatly affected.

Although interconnected with the climate change crisis, there is a need to address biodiversity loss as an issue in economic activities. The circular economy offers solutions to the problem of natural resource management and can mitigate the causes of biodiversity loss. It is important to understand biodiversity conservation issues from a territorial perspective, taking into account local ecosystem issues. Many of the action levers of the circular economy can be activated to address these issues, including the political and economic dimensions, which are essential for the effective implementation of ecosystem conservation at the territorial level.

INEC PRESENTATION

Organization of reference and influence around ecological intelligence and the economy of the resource.

The Institut is gathering companies, communities, associations and universities.

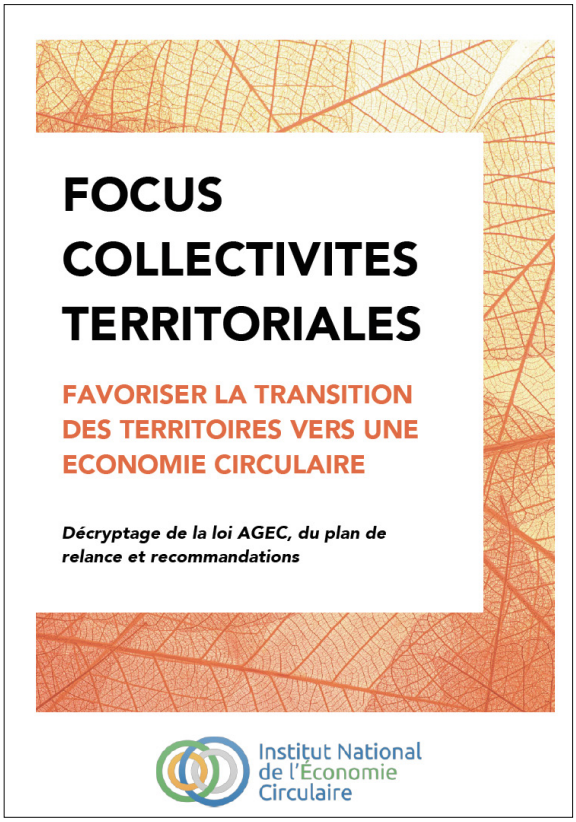
Its mission is to bring together all public and private actors to promote the circular economy and accelerate its development.

INEC's actions are mainly based on four axes: reflection, advocacy, operational implementation and awareness raising on the circular economy.

LATEST PUBLICATIONS

The National Institute of the Circular Economy has carried out more than fifty publications on all topics related to the circular economy: anti-waste law for a circular economy, circular industry, agricultural and agri-food systems, textiles, water waste...etc.

Access all INEC publications: https://institut-economie-circulaire.fr/categories/publications/



EDITORIAL AND CONTACT DETAILS

Amélie Vaz, Head of studies and prospective
a.vaz@institut-economie-circulaire.fr

Other authors : Jeanne Chaumon et Adrian Deboutière

Circular economy, ecosystems and biodiversity

Towards an joint approach

SEPTEMBER 2021