Biodiversity and the 2030 Agenda:

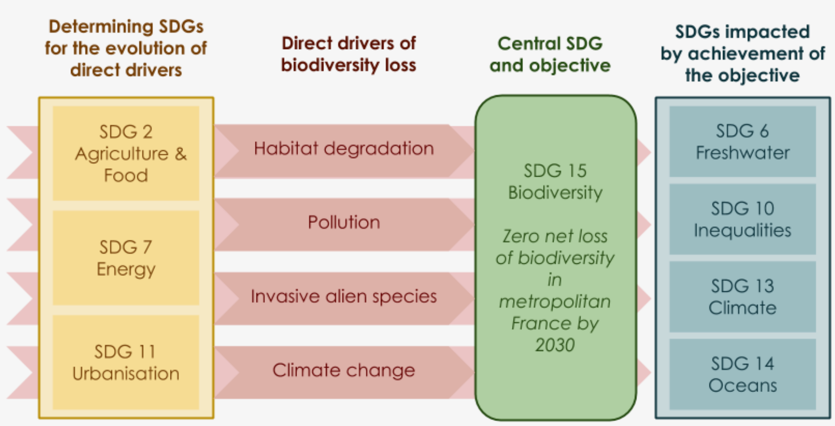
WHAT PATHWAY FOR ZERO NET BIODIVERSITY LOSS IN METROPOLITAN FRANCE?

Context, objectives and methodological approach

Future Earth is leading the *Science-Based Pathways for Sustainability* initiative, which aims to promote integrated and forward-looking approaches to the Sustainable Development Goals (SDGs), to further our understanding of socio-ecological systems and inform public debate and policy. A series of multi-actor workshops at national, regional and international levels are providing an opportunity to discuss and analyse options for advancing the environmental goals of the 2030 Agenda, to identify the main uncertainties associated with these options, their potential synergies and trade-offs with the other SDGs and the social transformations they entail.

In October 2019, the Pathways initiative ran a workshop in Tours, France, which brought together around 20 scientists and practitioners.[1] They built a scenario and a pathway for attaining the objective of "zero net biodiversity loss in metropolitan France by 2030."[2] The biodiversity scenario was developed by integrating this objective into the framework of the 2030 Agenda, recognising that a sustainable development pathway must address a wide range of environmental and societal challenges. The scenario takes account of the interactions between biodiversity and those human activities with the greatest impact on its evolution. A first set of assumptions for 2030 was based on the analysis of synergies and trade-offs between the objective of "zero net biodiversity loss" and existing scenarios on transitions to sustainable energy, food and urban systems in France.[3] We then refined these assumptions by exploring the implications of those transitions for the SDGs on Ocean, Climate, Freshwater and Inequalities (Figure 1).

Figure 1: Objective of the scenario, direct drivers of biodiversity loss[4] and studied SDGs



1 Cyrille Barnerias (Agence française pour la biodiversité); Gilles Benest (France Nature Environnement); Joshua Berger (CDC Biodiversité); Alice Colsaet (IDDRI); Olivier Dangles (IRD); Lise Geijzendorffer (Tour du Valat); David Giron (CNRS); Benjamin Javaux (Suez Eau France); Claudy Jolivet (INRAE); Alexandra Langlais (CNRS); Paul Leadley (Université Paris-Sud); Pascal Marty (ENS Lyon); Camille Mazé (CNRS); Edouard Michel (CNRS); Laetitia Plaisance (CNRS); David Renault (Université Rennes I); Améline Vallet (AgroParisTech); Nadia Vargas (Ministère de la transition écologique et solidaire); Claire Varret (Electricité de France); Maxime Zucca (Agence régionale pour la biodiversité - Ile de France).

2 The full report of the Biodiversity workshop, summarised in this document, is available on the Future Earth website: https://futureearth.org/initiatives/earth-targets-initiatives/science-based-pathways/. Metropolitan France refers to mainland France and Corsica. The Biodiversity workshop is the first in a series of three workshops held in France. The two others are focused respectively on freshwater and land.

3 Poux, X. & Aubert, P.-M. (2018). An agro-ecological Europe in 2050: multifunctional agriculture for healthy eating. Iddri-AScA. 74 p.; Solagro. (2016). The Afterres2050 scenario 2016 version. Couturier C., Charru M., Doublet S. & Pointereau P. Toulouse, Solagro. 104 p; Négawatt. (2017). NégaWatt scenario 2017-2050: A blueprint for a successful energy transition in France. Association négaWatt; Theys, J., Vidalenc, E. (2013). Repenser les villes dans la société post carbone. ADEME/Ministère de l'écologie, du développement durable et de l'énergie.

4 Drivers related to changes in land use and direct exploitation of organisms are grouped in the habitat degradation driver.

futurearth Research. Innovation. Sustainability.
IDDRI
COMITÉ NATIONAL FRANÇAIS DES CHANGEMENTS GLOBAUX
cnrs
FRB FONDATION POUR LA RECHERCHE SUR LA BIODIVERSITÉ

Biodiversity scenario: main assumptions and uncertainties

The scenario forms part of a transition towards agroecology and towards diets better aligned with nutritional recommendations. Losses, waste and consumption in excess of nutritional guidelines are drastically reduced. The decrease in consumption of animal-based products is offset by an increase in consumption of fruit, vegetables and protein-rich plant-based foods. Local food systems become more widespread and demand for high-quality products increases. Agroecological practices are widely implemented and accompanied by the growth of agroecological infrastructure and agroforestry. As a result, water consumption for irrigation decreases between 2020 and 2030 despite climate change impacts. Livestock systems are transformed by extensification and a return to the system of mixed crop and livestock farming. In ten years, French agriculture achieves a two-fold and four-fold reduction in mineral nitrogen and pesticide consumptions respectively, as a step towards their elimination in 2050. "Rigorous" agroecological practices (no inputs) are developed more rapidly in zones of special importance for biodiversity conservation. Organic farming, which occupies half of French cultivated areas in 2030, benefits from rapid knowledge improvements that reduce organic-to-conventional yield gaps. Our scenario is uncertain about the evolution of permanent pasture areas. A decrease causes a net biodiversity loss by 2030, but maintaining cattle numbers has repercussions for greenhouse gas emissions, and hence for climate change and, in the longer term, for biodiversity.

The urban transition in our biodiversity scenario is characterised by a slowdown of urban sprawl. Private cars are increasingly replaced by public transport, favouring compactness and limiting greenhouse gas emissions. In 2030, French cities combine a more balanced functional mix (employment and housing) and social diversity. They are denser, but with a focus on the development of green spaces, green roofs and walls, community gardens and urban agriculture. Species, varieties and cultivation practices are chosen in accordance with local conditions and climate change. The development of these "natural" amenities in city centres is a pull factor for populations, thereby helping to limit urban sprawl, and reduces the environmental impacts of densification. Our biodiversity scenario rethinks the definition of context-based thresholds of sustainable urban density, balancing objectives of improving quality of life, and of protecting and developing biodiverse and interconnected green spaces.

Energy conservation and efficiency measures allow for rapid reductions in final energy consumption and primary energy production between 2020 and 2030. The deployment of renewable energies, i.e. siting and installation size, and the processes used to build the necessary infrastructure, notably the materials employed, are conditional upon the findings of studies conducted throughout the lifecycle to assess impacts on terrestrial and marine biodiversity, greenhouse gas emissions and the quality of life of surrounding populations. Our scenario makes no conclusions about the scale of biomass energy production as the implications of a massive development of wood energy and methanisation for biodiversity are too uncertain. Coal, fossil gas and oil-based energy production are not totally absent from the energy mix in 2030, but our scenario is consistent with a pathway towards total decarbonisation by 2050. As a consequence, and since it makes no assumptions about the scale of biomass energy production, our scenario is necessarily uncertain as to the speed of nuclear power phase-out.

Protected areas and forests: essential components of a biodiversity scenario

The agroecological, urban and energy transitions are not sufficient in themselves to reach the objective of "zero net biodiversity loss by 2030" as they do not address zones of special importance for biodiversity conservation. Protected areas and forests are key components of our biodiversity scenario. In 2019, 13.5% of terrestrial areas in metropolitan France were designated as protected areas, and just 1.39% were strongly protected.[5] The capacity of a network of protected areas to contribute to the objective of "zero net biodiversity loss by 2030" depends on their distribution across the territory, their management, their connectivity and their protection levels. The choice of protection levels, and of authorised (or prohibited) human activities, must be decided in accordance with the characteristics of each territory, balancing conservation objectives on the one hand and social-economic objectives on the other. French forest ecosystems are threatened, especially by climate change which increases natural risks (storms, drought, fires, pests and pathogens) and modifies the species distribution ranges. The future of forests depends on our capacity to devise and implement appropriate regional and national strategies and management methods that create the strongest synergies and the fewest trade-offs between climate change mitigation and adaptation, and protection of biodiversity and the diverse services it provides.

5 MTES. (2020). Aire protégées en France. Ministère de la Transition Écologique et Solidaire.

Sustainable development goals: a variety of interactions and research questions

The agroecological, urban and energy transitions generate a variety of co-benefits for the SDGs on biodiversity, freshwater, climate, oceans and inequalities. For instance, the decline of fossil fuels is associated with less offshore extraction and related marine ecosystem degradation. The development of agroecological infrastructure and agroforestry is beneficial to freshwater quality and ecosystems. The rapid decrease in pesticide use reinforces these benefits and, associated with changes in livestock rearing practices, has significant positive effects on estuaries, coastal areas and oceans through reduced eutrophication. Urban greening and control of urban sprawl reduce water runoff and pollution of groundwater, coastal areas and oceans. Densification, well-developed public transport, urban greening and functional mixing in urban hubs facilitate universal access to amenities, socialisation activities and services.

However, synergies across SDGs are dependent on the spatial and time scales considered. Certain actions to mitigate climate change will be beneficial to biodiversity by 2030. This is the case for all actions that encourage frugal use of natural resources. Others may result in trade-offs. For example, decarbonising our energy system through the massive development of renewable energy may contribute to biodiversity erosion, especially when this energy is generated from biomass. The delays in implementing climate change mitigation measures imply that their impacts on biodiversity and oceans will not be perceptible by 2030. Likewise, if these measures are limited exclusively to one country or one region, they will have little impact at national or global levels. In this respect, the transitions explored in our scenario only become fully meaningful if they take place on a pan-European scale at the very least (see Box).

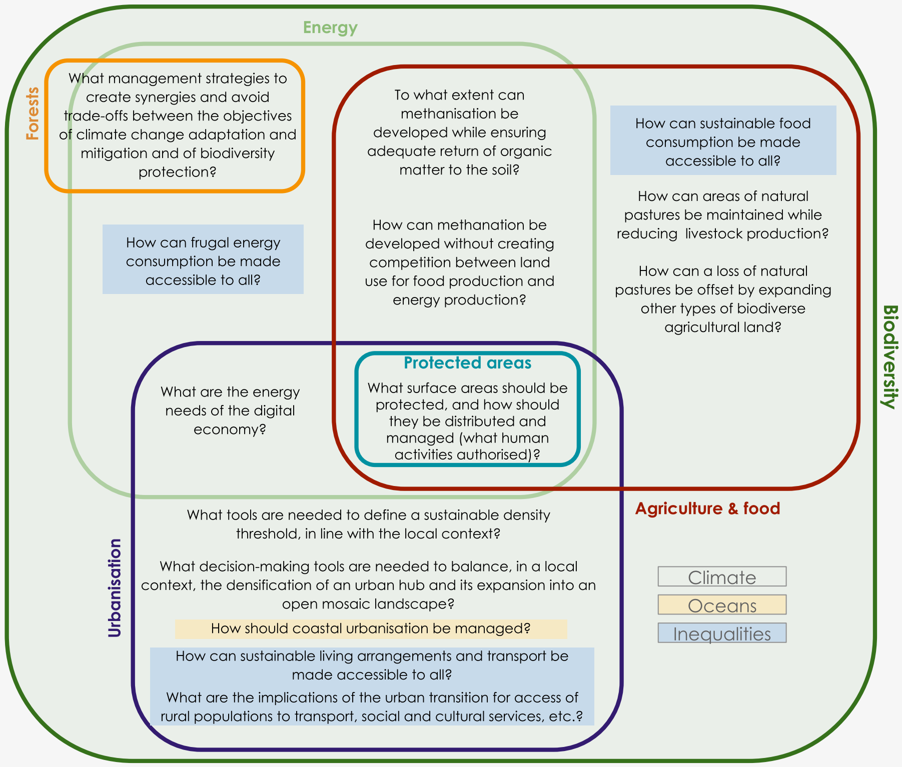
Local transitions, global challenges

If the transitions required under the biodiversity scenario occur not only in France but also on a European or even broader scale, the implications for the SDGs at global level are numerous. In particular, agroecological and energy transitions generate cross-scale interactions decisive for global biodiversity. The implications for other regions of an agroecological transition that restores French or European plant protein self-sufficiency are considerable, given that plant protein imports for animal feed accounted for 44% of imported deforestation in the European Union in 2008.[6] Furthermore, the drop in French agricultural exports under the biodiversity scenario suggests a potential imbalance between food supply and demand at global level, especially if the agroecological transition occurs on a European scale. A transition of this kind is notably contingent upon rapid agricultural development in sub-Saharan Africa, and this poses numerous questions for the countries of that region: How will land use be affected, forested areas in particular? What are the pathways for reducing the yield gap (green revolution with a sharp increase in inputs or agroecological revolution)? How will eating habits change and how will this affect the surface areas devoted to livestock production? As for the development of renewable energies, it is radically modifying the geography of strategic resources. It relies on finite raw materials whose extraction and treatment have considerable social and environmental implications for local communities, as they are major sources of habitat degradation and pollution. Advances in energy conservation, efficiency, and recycling will be key for biodiversity at all scales.

By identifying uncertainties about the implications of the energy, food and urban transitions for biodiversity and other SDGs, our scenario highlights a variety of research questions on potential options for reducing trade-offs (Figure 2). The research questions on inequalities reveal the extent to which inequalities are powerful obstacles to the transitions envisaged. If energy-efficient homes, sustainable modes of transport and healthy food are not affordable for most people, the objective of zero net biodiversity loss will be unattainable.

6 European Commission. (2013). The impact of EU consumption on deforestation: Comprehensive analysis of the impact of EU consumption on deforestation. Study funded by the European Commission, DG ENV, and undertaken by VITO, IIASA, HIVA and IUCN NL.

Figure 2: A variety of research questions that intersect across a variety of sustainable development challenges



Transformations are held back by the systemic nature of modes of development and contradictions between objectives

The biodiversity scenario assumes rapid changes in our agricultural model, eating habits, energy system, modes of transport, residential choices and biodiversity conservation strategies. The invited experts chose to focus on two specific areas: the transformations needed to reverse current trends in land take and in pesticide consumption. Pollution caused by chemical inputs and land take are among the primary factors of biodiversity loss in metropolitan France. While the reduction of pesticide consumption and the deceleration of land take have been on the national political agenda for more than ten years, no real progress has yet been made. The obstacles to these transformations are linked both to the systemic nature of our modes of development and to the trade-offs between competing development objectives.

The shift away from conventional agriculture is made difficult by the interdependence of the agri-food system which creates powerful lock-in mechanisms. Farmers are often dependent on cooperatives which impose demanding yield criteria and strict specifications to comply with the standardised product requirements of the food processing and retailing industries. The transformations pursued by farmers wishing to reduce or eliminate pesticide use extend well beyond changes in farming practices but modify their "relations with other "objects": soil, outputs, crop rotation, work organisation, sales, social networks, skills learning".[7] Inequalities of consumer access to organic food and to the dietary habits envisaged in our scenario are the results of numerous demographic and socio-cultural factors. They cannot be attributed to price and income effects alone but are also linked to nutritional education, cooking skills and living conditions. For example, the downtrend in meat consumption over the last 20 years in France is attributable to a change in eating habits among people in higher-level occupations. Likewise, women in the lowest socioeconomic categories spend more time cooking than women with higher incomes, but they use fewer raw and fresh ingredients.[8]

Under the biodiversity scenario, the current growth of urban sprawl and land take is reversed.[9] French people have a marked preference for single-family housing which accounted for 55.4% of homes in metropolitan France in 2017.[10] This

7 Lamine, C., Meynard, J.M., Perrot, N., Bellon, S. (2009) Analyse des formes de transition vers des agricultures plus écologiques : les cas de l'Agriculture Biologique et de la Protection Intégrée. Innovations Agronomiques (2009) 4, 483-493.

8 Méjean, C., Si Hassen, W., Gojard, S., Ducrot, P., Lampuré, A., Brug, H., Lien, N., Nicolaou, M., Holdsworth, M., Terragni, L., Hercberg, S., & Castetbon, K. (2017). Social disparities in food preparation behaviours: A DEDIPAC study. Nutrition Journal, 16(1), 62.

9 The term land take refers to the transformation of grassland, wetlands, farmland and forests to develop built and unbuilt spaces (housing, industrial buildings, construction sites, quarries, mines, waste dumpsites, etc.) but also green spaces (parks and gardens, sports and leisure facilities, etc.).

10 French National Institute of Statistics and Economic Studies..

important driver of land take is combined with major demographic and societal trends, such as population growth, de-cohabitation and the growing number of second homes, which stimulate demand for housing. The rising cost of housing relative to transport and the growth of activities that use peri-urban land (logistical activities, recreational sector) are in turn increasing land take, the process of peri-urbanisation especially. State intervention in this area aims primarily to support housing construction as a means to address the housing shortages that mainly affect the most disadvantaged French households. The instruments for containing land take available to local authorities (taxation, zoning) do not allow them to avoid pressure from developers and landowners, and competition to attract business and jobs.

Integrated and participative approaches to sustainable development strengthen the role of knowledge in transformations

Knowledge and its appropriation by stakeholders has an important role to play in removing the obstacles to change by enabling stakeholders to revise their values and preferences and to modify the formal and informal rules governing their decisions. By providing insights on the consequences of choices and by driving technological and societal innovation, knowledge broadens the range of options for decision-making and action. For instance, consumer information on the implications of diet for personal health and the environment have already transformed the values associated with food as well as eating habits. More information on the relationship between residential choices, land use and environmental impacts would foster greater public consultation and engagement in urban planning projects. More comprehensive knowledge of land and soil is key to designing and implementing public policies capable of responding to housing needs while reducing land take and protecting biodiversity.

While substantial knowledge of the interactions between socioeconomic systems and ecosystems is readily available, and has often been so for many years, the transformations themselves have barely begun. By designing and applying integrated approaches to sustainable development, the scientific community can contribute more actively to societal transformations. Given the multiple synergies and trade-offs that exist between the Sustainable Development Goals across time and space, it is important for public and private decision-makers (including citizens) to grasp the systemic – and hence necessarily complex and sometimes conflictual – nature of our modes of development. Reducing pesticide use does not simply come down to a choice between maintaining crop yields on the one hand or improving water quality on the other. It generates direct benefits for water and biodiversity and preserves the services they provide over the long term. Pesticide reduction is also beneficial for coastal zones – in terms of ecosystems and economic activity – for oceans and for health. Indirectly, the implementation of alternative agroecological practices broadens and amplifies the benefits of reducing pesticide use. Pesticide reduction calls for complementary transformations in farming practices, in agricultural training, in the deployment of strategies by all stakeholders and in modes of consumption. There is little point in asking farmers to reduce pesticide use without simultaneously transforming the other components of the system.

Deploying integrated approaches to sustainable development shows that the problems, the solutions and the necessary trade-offs are highly context-dependent. When the aim is to limit the environmental impacts of human activities, the wide diversity of situations becomes a key component in several respects. First, solutions originate from the "living environment" and no longer from its homogenisation. For example, pulse crops can be used to fix atmospheric nitrogen, and nature-based solutions such as swales or "rain gardens" which capture rainwater at source and facilitate infiltration can limit disruptions to the water cycle caused by urbanisation. Second, the question of balancing the different objectives associated with the use of natural resources (employment, income, mitigating climate change, protecting biodiversity and water resources, etc.) is posed differently on different spatial scales and must take account of each distinct social and ecological context. The agroecological transition, for example, is built upon knowledge of agro-ecosystems at farm, landscape and regional levels.

Both stakeholders and researchers took part in the workshop and contributed jointly to building a biodiversity scenario. Working with stakeholders was fundamental, not only to benefit from their expertise but also to acknowledge the normative dimension of sustainability sciences. As pointed out by Schneider and colleagues, "systematic engagement with societal actors is essential to consider the plurality of societal value perspectives and to inform the kind of science that is needed to address the complex and pressing challenges that are at the heart of the 2030 Agenda. For example, societal actors can be involved in jointly assessing what sustainability challenges are most relevant and require further scientific inquiry [...]. They can also help co-develop novel sustainability visions for specific regions or sectors that contextualize the 2030 Agenda".[11]

11 Schneider, F., Kläy, A., Zimmermann, A. B., Buser, T., Ingalls, M., & Messerli, P. (2019). How can science support the 2030 Agenda for Sustainable Development? Four tasks to tackle the normative dimension of sustainability. Sustainability Science, 14(6).