



8 Future environmental priorities: some reflections

Unprecedented change, interconnected risks and increased vulnerabilities pose new challenges

The previous chapters highlight the fact that the world is experiencing environmental change and hence new challenges on a scale, speed and interconnectedness that are unprecedented.

Decades of intensive use of stocks of natural capital and ecosystem degradation by developed countries to fuel economic development have resulted in global warming, loss of biodiversity and various negative impacts on our health. Even though many of the immediate impacts lie outside Europe's direct influence, they have significant consequences and will create potential risks for the resilience and sustainable development of the European economy and society.

Emerging and developing economies have in recent years replicated this trend but at a much faster speed driven by increasing populations, growing numbers of middle class consumers, and rapidly changing consumption patterns towards levels in developed countries; unprecedented financial flows chasing scarcer energy and raw materials; unparalleled shifts in economic power, growth, and trade patterns from advanced to emerging and developing economies; and, delocalisation of production driven by price competition.

Climate change is one of the most obvious effects of these past developments: breaching the 2 °C target is probably the most tangible example of the risk of going beyond planetary boundaries. The long-term ambition of achieving 80 to 95 % reductions in CO₂ emissions by 2050 in Europe to stay in line with the above target, strongly argues for a fundamental transformation of Europe's current economy, with low-carbon energy and transport systems as central planks of the new economy — but not the only ones.

As in the past, future climate change impacts are expected to affect disproportionately the most vulnerable in society: children, the elderly, and the poor. On the positive side, greater access to green

spaces, biodiversity, clean water and air benefit people's health. However, this too raises the question about the sharing of access and benefits, since often spatial planning and investment decisions favour the rich at the expense of the poor.

Well-maintained ecosystems and ecosystem services are essential to support climate change mitigation and adaptation objectives, and preserving biodiversity is a prerequisite for ensuring this. Balancing the role that ecosystems can play as a buffer against expected impacts with possible increased demands for new settlements on water and land, brings new challenges, for example, to spatial planners, architects and conservationists.

The ongoing race for substitution from carbon-intensive to low-carbon energy and materials is expected to further intensify demands on the terrestrial, aquatic and marine ecosystems and services (first and second generation biofuels provide an example here). As these demands increase, for example for chemical substitutes, there are likely to be increasing conflicts with existing uses for food, transport and leisure.

Many of the environmental challenges assessed in this report have been highlighted in previous EEA reports ⁽¹⁾ ⁽²⁾. What is different today is the speed at which interconnectedness spreads risks and increases uncertainties across the world. Sudden breakdowns in one area or geographical region can transmit large-scale failures through a whole network of economies, via contagion, feedbacks and other amplifications. The recent global financial crash or the Icelandic volcano episodes have demonstrated this ⁽³⁾ ⁽⁴⁾.

Crises such as these have also shown how difficult it is for society to deal with risks. Well signposted and numerous early warnings are often widely ignored ⁽⁵⁾ ⁽⁶⁾. At the same time, recent times offer many experiences, both good and bad, from which we can learn and so respond more quickly and more systematically to the challenges we face (for example, through multiple crisis management, climate negotiations, eco-innovations, information technologies, or global knowledge developments).

Against this back-drop, this final chapter reflects on some emerging future environmental priorities:

- **Better implementation and further strengthening of current environmental priorities** in climate change; nature and biodiversity; natural resource use and waste; environment, health and quality of life. Whilst these remain important priorities, managing the links between them will be paramount. Improving monitoring and enforcement of sectoral and environmental policies will ensure that environmental outcomes are achieved, give regulatory stability and support more effective governance.
- **Dedicated management of natural capital and ecosystem services.** Increasing resource efficiency and resilience emerge as key integrating concepts for dealing with environmental priorities, and for the many sectoral interests that depend on them.
- **Coherent integration of environmental considerations across the many sectoral policy domains** can help increase the efficiency with which natural resources are used and thus help greening the economy by reducing common pressures on the environment that originate from multiple sources and economic activities. Coherence will also lead to broad measures of progress rather than just against individual targets.
- **Transformation to a green economy** that addresses the long-term viability of natural capital within Europe and reduced dependency on it outside Europe.

The ongoing study on The Economics of Ecosystems and Biodiversity (TEEB) aligns with these ideas from the perspective of biodiversity and the ways in which investment in natural capital can be encouraged (7). Recommendations to policymakers include broad actions such as investing in green infrastructure to increase resilience, introducing payments for ecosystem services, removing harmful subsidies, establishing new regimes for natural capital accounting and cost-benefit analysis, and initiating specific actions to address the degradation of forests, coral reefs and fisheries as well as the links between ecosystem degradation and poverty.

Natural capital and ecosystem services provide an integral starting point for managing many of these interconnected issues, the systemic risks inherent in them, and the transformation to a new, greener, more resource efficient economy. There is no single 'quick fix' for the challenges that Europe faces. Rather, as this report shows, there is a clear case for long-term, interconnected approaches to deal with them.

What this report also provides is evidence that existing European environmental policies present a robust basis on which to build new approaches that balance economic, social and environmental considerations. Future actions can draw on a set of key principles that have been established at European level: the integration of environmental considerations into other measures; precaution and prevention; rectification of damage at source; and the polluter-pays principle.

Implementing and strengthening environmental protection provides multiple benefits

Full implementation of environmental policies in Europe remains paramount, as key targets are still to be met (Chapter 1). However, it is clear that targets in one area can inadvertently, through unintended consequences, disrupt or counteract a target in another. Synergies and co-benefits thus need to be sought throughout the process of developing impact assessments of policies in different domains, by using approaches that fully account for natural capital.

Past decades' environmental policy efforts have provided a wide array of social and economic benefits through regulations, standards and taxation. These in turn have driven infrastructure and technological investments to mitigate against environment and human health risks, for example, by setting air and water pollution limits, creating product standards, and by building wastewater treatment plants, waste management infrastructures, drinking water systems, clean energy and transport systems.

Such policies have permitted the economy to grow well beyond what might otherwise have been feasible. For example, without tightening

air pollution standards and sewage treatment improvements, the transport, manufacturing and construction sectors of the economy could not have grown as fast as they have without severe health effects.

As such, health, quality of life and environmental services have improved for most people in Europe, awareness and concerns are higher than ever, environmental actions and investments unprecedented. Other key benefits to date include: pro-growth investment strategies creating new markets and sustaining employment; level playing field for companies in internal market; driving innovation and rolling out of technological improvements; and consumer benefits.

Employment is a major benefit with an estimated quarter of total European jobs linked either directly or indirectly to the natural environment ⁽⁸⁾. Europe can make further progress here through eco-innovation in products and services, building on patents and other knowledge that has been acquired by governments, businesses and universities through 40 years of experience.

By contrast, however, government spending on environment and energy research and development typically remains at less than 4 % of total government spending on research and development. This has declined dramatically since the 1980s. At the same time research and development expenditure in the EU at 1.9 % of GDP ⁽⁹⁾ lags way behind the Lisbon strategy target of 3 % by 2010 and behind major competitors in green technologies such as the USA and Japan and, recently, China and India.

Still, in many areas (such as air pollution reduction, water and waste management, eco-efficient technologies, resource-efficient architecture, eco-tourism, green infrastructure and green financial instruments) Europe already has first-mover advantages. These could be exploited further within a regulatory framework that fosters further eco-innovation and sets standards based on efficient use of the natural capital. Past decades' efforts have borne fruit: the European Union, for example, has more patents related to air pollution, water pollution and waste than any other economic competitor ⁽¹⁰⁾.

There are also ancillary benefits from combined implementation of environmental legislation. For example, combining climate change mitigation and air pollution abatement legislation could deliver benefits in the order of EUR 10 billion per year through reductions in damage to public health and ecosystems ^(A) ⁽¹¹⁾. Environmental producer responsibility legislation (such as REACH ⁽¹²⁾, WEEE Directive ⁽¹³⁾, RoHs Directive ⁽¹⁴⁾) has contributed to push multi-national companies, for example, to design production processes at global level that meet EU standards and so deliver benefits for consumers across the world. In addition, EU legislation is often replicated in China, India, California and elsewhere, highlighting further the multiple benefits of well-designed policies in the globalised economy.

European countries have also invested substantially in monitoring and regular reporting of environmental pollutants and wastes. They are beginning to use the best available information and communication technologies and sources to develop information flows from in-situ instruments to Earth observation with specialised sensors. The development of near-real time data and regularly updated indicators help to improve governance by providing stronger evidence for early interventions and preventative actions, supporting greater levels of enforcement and enhancing overall performance reviews.

There is now no shortage of environmental and geographical data in Europe to support environmental objectives, and many opportunities exist to exploit these data through analytical methods and information technologies. However, restrictions on access, charging fees or intellectual property rights have meant that these data are not always easily accessible to policymakers and others working in the field of environment.

There are a number of information policies and processes in place or being negotiated in Europe to support swifter responses to emerging challenges. Rethinking their uses and links between them could radically improve the efficacy of existing and proposed information gathering and harvesting activities in support of policies.

Key elements in this mixture include research from the European Research Framework Programmes, the new European space and Earth observation policy (including the Global Monitoring for Environment and Security initiative and Galileo), Europe's new legislation on spatial data infrastructure INSPIRE, and an extension of e-government in the form of the Shared Environment Information System (SEIS).

The opportunity also exists now to implement these information systems fully and in doing so support the EU 2020 strategy ⁽¹⁵⁾ objectives in this area, using the latest information technologies, such as smart grids, cloud computing and mobile geographical information systems (GIS) based technologies.

Past experience shows that it often takes 20 to 30 years from framing an environmental problem to a first full understanding of impacts (for example, through reporting by countries on conservation status or environmental impacts). Such extended time-lags cannot prevail given the speed and scale of challenges. Interconnected policies that take the long-term view, are monitored based on risk and uncertainty, and have built-in interim steps for review and evaluation, can help to manage the trade-offs between the need for long-term coherent action and the time it takes to put such measures in place.

There are also numerous examples, based on credible early warnings from science, where early actions to reduce harmful impacts would have been extremely beneficial ⁽¹⁶⁾. They include climate change, chlorofluorocarbons, acid rain, unleaded petrol, mercury and fish stocks. These show that the time-lags from the first scientifically based early warnings to the point of policy action that effectively reduced damage, was often 30 to 100 years during which time exposure, and future harm, increased considerably. For example, over a decade of extra skin cancers could have been avoided if action had been taken on the first early warning in the 1970s, rather than on the discovery of the ozone hole itself in 1985 ⁽¹⁶⁾. Experience in the climate change field with addressing long-term impacts ⁽¹⁷⁾ ⁽¹⁸⁾ may be helpful in other fields that face similar timescales and scientific uncertainties.

Dedicated management of natural capital and ecosystem services increases social and economic resilience

The desire to make economic and social progress that does not come at the expense of the natural environment is not new. Many European industries have decoupled emissions of key pollutants and the use of certain materials from economic growth. What is new is that management of natural capital requires decoupling of economic growth not only from resource use but also from environmental impacts within Europe and globally.

Natural capital embraces many components. It is the stock of natural resources from which ecosystems goods and services can be derived. Such capital provides the sources of energy, food and materials; the sinks for wastes and pollution; the services of climate, water and soil regulation; and the environment for living and leisure — in essence, the core fabric of our societies. Using it often involves trade-offs between different services and striking a balance between maintaining and using stocks.

Getting this balance right depends on appreciating the many linkages between natural capital and the other four types of capital that hold together our societies and economies (i.e. human, social, manufactured and financial capital). The common features between such capitals, for example over-consumption and under-investment, indicate the potential of much more coherent action across policy domains (such as spatial planning, integration between economic sectors and environment considerations), deeper longer term approaches to knowledge that recognise many of these risks may emerge over many decades (such as scenario planning), and smart decisions on near-term actions that anticipate long-term needs and avoid technological lock-in (such as infrastructure investments) ⁽¹⁹⁾.

There are three main types of natural capital (Chapter 6) which require different policy measures to manage them. In some cases, natural capital that is depleted can be substituted by other types of capital, such as non-renewable energy resources that are used to develop and invest in renewable energy sources. However, more

often, it cannot. Much natural capital, for example biodiversity, cannot be replaced at all and needs to be preserved for current and future generations to ensure the continued availability of basic ecosystem services. Similarly, non-renewable resources need to be managed carefully so as to prolong their economic life while investing in possible substitutes.

What the explicit management of natural capital and ecosystem services offers, is a compelling and integrating concept for dealing with environmental pressures from multiple sectoral activities. Spatial planning, resource accounting and coherence amongst sectoral policies, implemented on different geographical scales, can help manage the trade-offs between preserving natural capital and using it to fuel the economy. Such an integrated approach would provide a framework for measuring progress more broadly. One advantage would be the ability to analyse the effectiveness of policy actions across a range of sectoral objectives and targets.

At the heart of managing natural capital therefore are the twin challenges of maintaining the structure and functions of ecosystems that underpin natural capital and enhancing resource efficiency by finding ways of using fewer resource inputs and having less environmental impacts.

In this context, increasing resource efficiency and security through an extended life cycle approach for energy, water, food, pharmaceuticals, minerals, metals and materials can help reduce Europe's dependence on resources globally and promote innovation. Prices that take full account of the consequences of using resources will also be an important instrument for spurring business and consumer behaviour towards higher resource efficiencies and innovation.

This is especially important for Europe given the growing competition for resources from Asia and Latin America and the growing pressures on the EU-27's current status as the world's largest economic and trading block. Japan, for example, has long been recognised as the front-runner on resource efficiency, but other countries — such as China — are setting ambitious targets in this respect, recognising the twin benefits of cost reductions and future market opportunities.

Since the industrial revolution there has been a shift away from using renewable resources to non-renewables to fuel our economy. Towards the end of the 20th century, non-renewables accounted for some 70 % of total material flows in industrialised countries compared to about 50 % in 1900 ⁽²⁰⁾.

Europe relies heavily on the rest of the world for non-renewables, and increasingly some of these non-renewables — such as fossil fuels or rare earth metals used in information technology products — are becoming difficult to source cheaply, if at all, often for geo-political as much as supply reasons. Such trends make Europe vulnerable to external supply shocks that may result from an over-reliance on non-renewables. Addressing this bias could be a key element in meeting the resource efficiency objective under the EU 2020 strategy ⁽¹⁵⁾.

A broader argument for shifting towards long-term development based on natural capital management is that today's poor governance of natural resources is forwarding risks to future generations. Environmental impacts, as reflected by climate change, biodiversity loss and ecosystem degradation, have steadily built up as a result of decades of over-consumption and under-investment in maintenance and substitution of resources.

These impacts, often concentrated in developing countries, will be difficult to mitigate and adapt to. Moreover, property rights for natural capital are often undefined, especially in developing countries, and the relative invisibility of natural capital degradation leads *inter alia* to passing on of accumulated 'debts' to future generations.

Ecosystem-based approaches offer coherent ways of managing the existing and expected demands for non-renewable and renewable resources in Europe and avoiding further over-exploitation of natural capital. Particularly land and water resources offer viable entry points for strengthening integrated ecosystem-based approaches to resource management. The Water Framework Directive, for example, has the aim of protecting ecosystems — aquatic and terrestrial — at its core. Approaches that recognise the multi-functional benefits of ecosystems are central to proposals for post-2010 biodiversity policies and gaining traction in the marine, maritime, agriculture and forestry sectors.

Box 8.1 Accounting for natural capital can help illustrate trade-offs between uses

The following examples provide a flavour of the challenges related to accounting for natural capital:

- *Soil*: Europe's soils are an enormous carbon reservoir, containing around 70 billion tonnes, and poor management can have serious consequences: a failure to protect Europe's remaining peat bogs, for example, would release the same amount of carbon as an additional 40 million cars on Europe's roads. Other less intensive agriculture regimes, based on diverse genes and culture can be more productive ^(a), while respecting the soil carrying capacity. Under these regimes, nature protection is no longer a burden imposed on farmers but an important contributor to soil maintenance and food quality, and therefore to agriculture, the food industry, retailers and consumers. Accounting for the benefits of nature protection for all economic actors is missing in current accounting regimes ^(b).
- *Wetlands*: There has been an estimated loss of 50 % of wetlands globally since 1900, mainly due to intensive farming, urbanisation and infrastructure development. In this way natural capital has been traded for physical and manufactured capital, but accounting systems to check whether the value of the new services balance the value of the depleted services is missing. Economic impacts range across scales from those on local economies (for example, fisheries), European (when all year round strawberry south-north supplies compete with wetlands for water) and global health (increased risks of bird flu pandemic owing to degradation of wetlands habitats along migratory pathways). Such impacts are not recorded in accounts.
- *Fish*: Fish are only accounted for in terms of primary production at 1 % of total GDP in EU, with a declining trend. Broader measures of the uses of fish across the economic chain — food processing, retailers, logistics, and consumers — put the true benefits to society at many times the conventional GDP proportion. Depletion of fish stocks is often due to excess harvesting in relation to the regeneration capacity, and the stock recovery is limited by pressures (climate change, emissions) that take advantage of the marine ecosystem as a sink. Accounting for the benefits of marine ecosystems and services for all economic actors is missing in conventional accounts.
- *Oil*: Oil is the source for almost all organic chemicals contained in day-to-day products and services. It is also the primary source of environmental impacts on ecosystems and people — pollution, contamination, climate warming. The recent oil spill in the Gulf of Mexico has strongly highlighted issues of ecosystem vulnerability, economic welfare, liability and compensation. Rules for calculating the true costs in such instances are not part of existing accounting regimes. Also, in line with oil becoming scarcer, and concerns about security increase, the chemicals industry is increasingly sourcing its needs from biomass. This is creating conflicts over land use, increasing pressure on agricultural ecosystems, and calling for accounting regimes to support discussions on the trade-offs inherent in resolving such conflicts.

Source: EEA.

As integrated management of natural resources becomes more prominent, competing demand for resources increasingly requires trade-offs. This creates a need for accounting techniques — including, in particular, comprehensive accounting of land and water resources — that make transparent the full costs and benefits of ecosystem use and maintenance.

The information tools and accounting approaches to support integrated natural capital and ecosystem services management, including their relationship to sectoral activities, are not yet part of the standard administrative and statistical systems. Much can still be gained from asking new questions of existing accounts, for example, on the true benefits to society of nature derived from agriculture, fishing and forestry which currently account for 3 % of EU GDP (as far as priced) but produce benefits many times that across the economy.

In addition, the identification of critical thresholds in resource use and the development of ecosystem accounts, ecosystem service indicators and ecosystem assessments are ongoing in Europe and globally. Examples of such initiatives are The Economics of Ecosystems and Biodiversity (TEEB), the revision of Integrated Environmental and Economic Accounting (SEEA) by the United Nations ⁽²¹⁾ ⁽²²⁾, the European Strategy for Environmental Accounting ⁽²³⁾, and ecosystem accounting work at EEA.

More integrated actions across policy domains can help in greening the economy

Environmental policies have primarily influenced production processes and protected human health. They therefore only partly address today's systemic risks. This is because many of the causes of environmental problems, such as over-use of the land and oceans, are overwhelming the progress being made (Chapter 1). Such causes often originate from multiple sources and economic activities that compete for short-term benefits from resource exploitation. Reducing them will require cooperation across several domains to deliver coherent, cost-effective outcomes that address the trade-offs inherent in maintaining capitals in line with society's values and long-term interests, and contribute to greening the economy.

The need to integrate environmental concerns into sectoral activities and other policy domains has long been acknowledged — as attempted, for example, in the EU Cardiff integration process since 1998 ⁽²⁴⁾. As a result, many EU-level policies explicitly take into account environmental considerations to some degree; for example the Common Transport Policy and the Common Agricultural Policy for which sectoral reporting initiatives like Transport Environment Reporting Mechanism (TERM), Energy and Environment Reporting Mechanism and Indicator Reporting on the integration of ENvironmental concerns into Agricultural policy (IRENA) are well established. In future they would benefit further from integrated analysis of environmental, economic and social impacts, trade-offs, costs and policy effectiveness through broader use of established environmental accounting techniques.

Furthermore, there are many links between environmental issues as well as links between environmental and socio-economic activities (see especially Chapter 6) that go beyond single cause-effect relationships. Often several activities combine to enhance environmental problems: this is well recognised, for example, in the context of greenhouse gas emissions, which stem from a wide range of sectoral activities, not all of them accounted for in monitoring and trading systems.

In other cases, multiple sources and economic activities interact to either enhance or counteract each others environmental impacts. Taken together, they result in clusters of environmental pressures. Addressing such clusters can offer opportunities for more cost-efficient responses. The co-benefits between climate mitigation and air quality improvements provide an example (Chapter 2). In other cases, such clusters carry the threat that environmental action in one sector counteracts efforts done in another. An example for this is the setting of ambitious biofuels targets, which may help climate mitigation, but increases pressures on biodiversity (Chapter 6).

Either way, where environmental pressures correspond to multiple sources and economic activities, there is a need to ensure coherence in the way we tackle them as far as feasible. Clustering of sectoral policies dependent on the same resources also has the potential for improved coherence in tackling common environmental challenges to

maximise benefits and avoid unintended consequences. Examples of achieving such coherence include:

- **Resource efficiency, public goods and ecosystem management.** Building on established and emerging practice around ecosystem management in environment and sectoral policies to ensure the long-term viability and efficient use of renewable resources by the main sectors (i.e. agriculture, forestry, transport, industry, fisheries, maritime).
- **Agriculture, forestry, maritime, green infrastructure and territorial cohesion.** Developing green infrastructure and ecological networks on land and at sea to secure the long-term resilience of Europe's terrestrial and marine ecosystems, the goods and services provided by them and their distributional benefits.
- **Sustainable production, intellectual property rights, trade and aid.** Implementing existing product standards and patents for innovation that accelerate substitution out of scarce and insecure non-renewable resources, reduce Europe's trade footprint, promote recycling potential, improve Europe's competitiveness and contribute to welfare improvements worldwide.
- **Sustainable consumption, food, housing and mobility.** Bringing together the three areas of consumption that together contribute more than two-thirds of major worldwide life-cycle environmental pressures from consumption in Europe.

More coherent policies across multiple sources of environmental pressures are already emerging in recognition of inter-linkages and aimed at developing cost-efficient solutions. For example, the links between climate mitigation, reduced reliance on fossil fuels, substitution by renewables, energy efficiency and multi-sectoral energy needs underpin the design of the EU Climate and Energy package. This marks a key difference compared to the situation 15 to 20 years ago and provides precedent for more effective collaboration between sectoral and environmental interests.

Stimulating fundamental transition towards a greener economy in Europe

Greening the European economy, as discussed already, can help further reduce environmental pressures and impacts. However, more fundamental conditions and actions that enable the transition to a truly 'green economy', centred on natural capital and ecosystem services, will be needed to stay within planetary limits.

The need for a green economy also becomes stronger in this time of financial and economic crisis. Intuitively, a slumping economy might be considered positive for the environment: income drops or grows only slowly, accessing credit that allows overspending is more difficult and hence we produce and consume less, with a reduced burden on the environment. However, stagnant economies are often not able to make the necessary investments to secure a responsible environmental management, and see less innovation and less attention to environmental policy. Instead, when the economy returns to its previous growth path (as it usually does), it also tends to return to its previous pattern of eroding natural capital.

Thus, a green economy will require dedicated policy approaches embedded in a coherent, integrated strategy covering demand and supply aspects, both economy-wide and at the sectoral level ⁽²⁵⁾. In this context, the key environmental principles of precaution, prevention, rectification of damage at source, and polluter pays, combined with a strong evidence base, remain most relevant and need to be more broadly and consistently applied.

The **precautionary and prevention principles** were inserted in the EU Treaty in order to help cope with the dynamics of complex natural systems. Their broader application during the transition to a green economy will steer innovations that break away from the often monopolistic and conventional technologies that have been shown to cause long-term harm to people and ecosystems ⁽²⁶⁾.

The **rectification of damage at source** can be maximised through deeper integration across sectors and further advance the multiple

gains from investments in green technologies. For example, investment in energy efficiency and renewable energies delivers benefits to the environment, employment, energy security, energy costs, and can help combat fuel poverty.

The **polluter pays principle** can stimulate a greening of the economy through taxes that allow market prices to reflect full costs of production, consumption and wastes. This can be achieved via greater use of fiscal reform which in addition to removing harmful subsidies, replaces distortionary taxes on economic 'goods' such as labour and capital, with more efficient taxes on economic 'bads', such as pollution and inefficient resource use ⁽²⁷⁾.

In a broader perspective, 'prices' as a facilitator of trade-offs can help improve further progress in sectoral integration and resource efficiency but more fundamentally shift behaviours across governments, businesses and citizens in Europe and globally. However, for this to happen — as known for decades, but rarely applied — prices need to reflect the true economic, environmental and social value of resources, relative to available substitutes.

Evidence of the benefits of fiscal reform has grown in recent years. Such benefits include environmental improvements, employment gains, a stimulus to eco-innovation and more efficient tax systems. Studies show the benefits from modest environmental tax reform in several European countries that have been implemented over the last 20 years. Similarly, they convincingly demonstrate the advantages of additional reforms designed to achieve the EU climate and resource efficiency goals ⁽²⁸⁾ ⁽²⁹⁾ ⁽³⁰⁾ ⁽³¹⁾ ⁽³²⁾ ⁽³³⁾.

The revenues from environmental taxes vary significantly across EU Member States, from more than 5 % of GDP in Denmark to less than 2 % in Spain, Lithuania, Romania, and Latvia in 2008 ⁽³⁴⁾. Despite the large benefits of such taxes, and consistent policy support over the last 20 years from OECD and the EU, environmental tax revenues as a proportion of overall tax revenues in the EU are at their lowest level in more than a decade, even if the number of environmental taxes is increasing.

There is substantial potential for fiscal reform in support of the triple objectives of greening the economy, supporting deficit reduction policies in many EU Member States and responding to ageing populations. These range from removing harmful subsidies and exemptions on fossil fuels, fisheries and agriculture, to establishing taxes and extending permits on the consumption of the critical natural capital that underpins a green economy (such as carbon, water and land).

A further component of a green economy transition is to move to accounting fully for natural capital — and to thus go beyond GDP as a measure of economic growth. Doing so will enable societies to record the full price of our way of life, reveal concealed debts being forwarded to future generations, make explicit ancillary benefits, highlight new ways for economic development and jobs in a green economy based on green infrastructure, and reframe the base for fiscal revenues and their use.

In practical terms, looking 'Beyond GDP' means creating measures that convey not just what we have produced in the last year but also the state of the natural capital that determines what we can produce sustainably now and in the future. Specifically, these measures would comprise two additional items, beyond the depreciation of our man-made, physical capital: the depletion of our non-renewable natural resources and how much income they generate; and the degradation of our ecosystem capital and how we should reinvest to maintain the current capacity of using ecosystem services.

A genuine measurement of natural capital depreciation should take account of the many functions of natural ecosystems to ensure that management of one function does not result in the degradation of other functions. In the case of ecosystems, the management objective is not to maintain a flow of income but to maintain the ecosystem capacity of delivering the full bundle of services. Therefore a key element of any valuation of ecosystem degradation needs to be an appraisal of required restoration costs. This can be done, for example through estimates of the reduction of yields, replantation, pollution abatement, and green infrastructures restoration. The methodology for this approach is already being tested for Europe.

Accounting fully for natural capital will also require new classifications, ideally linked to existing ones as described in the statistical frameworks and system of national accounts (SNA). Important examples are emerging, for example in the area of ecosystem services ⁽³⁵⁾ or carbon accounting and carbon crediting.

In addition, a new information environment will have to address the widespread lack of accountability and transparency, and the loss of trust amongst citizens in governments, science and business. The challenge now is to improve the knowledge base in order to support more accountable and participatory decision making. Providing access to information is essential for effective governance; but engaging people in collecting data and sharing their lay knowledge is arguably just as important ⁽³⁶⁾ ⁽³⁷⁾ ⁽³⁸⁾.

A further reflection concerns equipping Europeans with the skills to make the transformation to a green economy. Education, research and industrial policy have roles to play here by providing the next generation of materials, technologies, processes and indicators (for example related to systemic risks and vulnerabilities) that help reduce Europe's dependencies, increase resource efficiencies and enhance economic competitiveness in line with the EU 2020 strategy ⁽¹⁵⁾.

Other factors include incentives for businesses using new financial mechanisms, retraining existing workers to contribute to green industries, and deploying unskilled workers displaced by delocalised production. A good example is the European recycling industry which holds a 50 % global market and has been increasing employment by some 10 % annually, mostly for unskilled workers ⁽³⁹⁾.

More generally, many multi-national businesses are also responding to the natural capital challenge, recognising that the future economy must have the means to manage, value and trade such capital ⁽⁴⁰⁾. There is scope to foster further the role of small and medium enterprises in natural capital management.

In addition, new forms of governance will also be needed to better reflect this shared dependence on natural capital. Over recent decades the role played by civil society institutions — such as banks, insurance companies, multi-national companies, non-governmental organisations, and global institutions such as the World Trade Organisation — has increased compared to the power of territorially bounded nation states. Balancing interests will be essential to manage shared interests and dependencies around natural capital. On the eve of the 20-year anniversary of the UN Commission for Sustainable Development in 2012, the slogan *think global, act local* seems more appropriate than ever.

The responses to recent systemic shocks highlights society's predilection for short-term crisis management over long-term decision-making and actions while at the same time showing the benefits of coherent, albeit short-term, global responses in dealing with such risks. The experience should not be a surprise given the strong bias towards governance that deals with short-term considerations aligned to the policy cycle (4 to 7 years) at the expense of long-term challenges, although there are examples in several EU Member States of structures being established to consider long-term challenges ⁽⁴¹⁾.

The transformation towards a greener European economy will help secure the long-term sustainability of Europe and its neighbourhood, but it will also require shifts in attitudes. Examples include encouraging wider participation by Europeans in the management of natural capital and ecosystem services, creation of new and innovative solutions to use resources efficiently, introduction of fiscal reforms, and involvement of citizens through education and different forms of social media in tackling global issues such as meeting the 2 °C climate target. The seeds for future actions exist: the task ahead is to help them take root and flourish.