



HAL
open science

Global Perspective of Natural Resources

Matthieu Brun, Pierre Blanc, Halka Otto

► **To cite this version:**

Matthieu Brun, Pierre Blanc, Halka Otto. Global Perspective of Natural Resources. CIHEAM; FAO Organisation des Nations unies pour l'alimentation et l'agriculture. MEDITERRA 2016, Zero waste in the Mediterranean. Natural Ressources, Food and Knowledge, Presses de SciencesPo, pp.35-48, 2016, 9782724619201. <hal-01620873>

HAL Id: hal-01620873

<https://hal.science/hal-01620873v1>

Submitted on 21 Oct 2017

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



HAL Authorization



PART ONE

NATURAL RESOURCES

in the Mediterranean





GLOBAL PERSPECTIVE OF NATURAL RESOURCES

Matthieu Brun, *Sciences Po Bordeaux*
Pierre Blanc, *Bordeaux Sciences Agro and Sciences Po Bordeaux*
Halka Otto, *FAO*

The intense negotiations of 2015 led humankind to question development models, given the consequences of climate change and the deepening of inequalities. Two major concerns continue to dominate the agenda: how to feed a growing population, and how to do so while protecting the environment and natural resources for future generations.

People living on the planet are hungry for land and thirsty for water, and tensions abound over the resources needed to meet their needs in terms of food, housing, heating and entertainment. All these activities which, at local level, are in growing competition with one another, have an impact on the state of natural resources, at times erupting into crises and violent conflicts, which threaten the peace and security of countries or entire regions, as can be seen today in the Middle East (Werrell and Femia, 2013, p. 15; IRIN, 2009). If the current trend for waste and applying pressure on ecosystems, primary forests, water and land escalates, people's living conditions could undergo a profound transformation in the future, with far-reaching consequences. A paradigm shift is therefore not only desirable, but essential, and massive but crucial efforts will be needed for the collective management of natural resources at both global and local level.

The Mediterranean is by no means exempt from this alarming state of affairs. On the contrary, it reflects all the tensions that revolve around the management of natural resources and agriculture. Although its demographic weight in the world is declining, the region's growing population continues to exert strong pressure on already scarce natural resources. Indeed, population growth coupled with strong coastal urbanization is leading to overexploitation of resources and is compromising the potential for development in the region. Before embarking in the following chapters on a detailed analysis of the state of natural resources in the Mediterranean region, this first chapter offers a global perspective of the environment, as well as the threats and challenges that menace natural resources on the planet as a whole.

Between scarcity and unequal distribution: Some global perspectives on the state of natural resources

The planet is being subjected to a range of transitions, all at the same time. Two of these have a direct impact on natural resources: demographic transition, taking the world population to new levels, and the food transition, with a rise in daily intake, generating unprecedented production requirements as a result. People living on all the continents have therefore intensified their use of land and water, and extended the area of land under cultivation. At times, this has been at the expense of forests and terrestrial biodiversity, which is receding in an alarming manner in certain parts of the world. In an effort to meet increasingly demanding requirements, people are turning to the planet's seabeds, which offer huge reserves of food and a biodiversity that is starting to be affected in some areas. The demographic transition, coupled with the global rise in average income, also tends to place a burden on energy resources.

Marine and fisheries resources

For a significant share of the world's population, marine and fisheries resources are key to subsistence and prosperity. Their exploitation, from the shores of the Mediterranean to the inland seas of Europe and Asia and the continental waters of Canada, Brazil and China, has enabled great civilizations and major powers to flourish. The contribution of fisheries and aquaculture products to human diets has been recognized by member states of the Committee on World Food Security, proof of the key importance of this sector in combating hunger and malnutrition (HLPE, 2004). However, as a result of human activity, fisheries resources have become fragile and are often overexploited to satisfy the needs of a soaring population, whose members have never before consumed so many food products drawn from seas and rivers (FAO, 2014a). Technological progress, rising population density along the coasts and increasing urbanization all add to pressure on resources and the biological diversity of marine environments. Already dramatically affected by pollution and overexploitation, these areas are also being transformed by a wide range of economic activities, such as fishing, extraction of minerals, sand, gas and oil, transport and leisure activities, as well as being threatened by climate change, whose negative impact is now making itself felt on aquatic resources and ecosystems.

The state of fisheries stocks and resources gives considerable cause for concern. While global production of marine fisheries reached its peak in 1996 at 86.4 million tonnes, overall fisheries production, which rose to 93.7 million tonnes in 2011 (FAO, 2014a, p. 23), is still growing. According to the FAO State of World Fisheries and Aquaculture report published in 2014, the Northwest Pacific showed the highest level of production in 2011, followed by the Southeast Pacific. In the Indian Ocean, captures continue to rise, with a growth of 17% between 2007 and 2011. The fishery resources in the Atlantic have suffered greatly from high levels of exploitation. While some stocks in the north Atlantic have shown signs of recovery due to improved management systems, in the southeast, 55% of stocks monitored were being fished at a

level that is not biologically sustainable in the long term. At global level, overexploited stocks have increased since the 1970s, accounting for 28.8% of harvested fish stocks in 2011. In the Mediterranean and Black Sea, 52% of stocks surveyed were fished at unsustainable levels. For example, those of cod and mullet are overexploited, while those of sole, sardines and anchovies (pelagic species) are considered to be fully exploited. According to the Red List of threatened species drawn up by the International Union for the Conservation of Nature (IUCN), 43 species of native marine fish are threatened at regional level (Abdul Malak *et al.*, 2011, p. 17). The position of bluefin tuna in the Mediterranean, whose reproductive potential has declined by 50% over the past forty years, remains extremely worrying, despite the 2006 launch of a recovery plan, with revised fishing quotas, which has led to a slight improvement.

Water resources: towards a global deficit?

While the International Decade for Action *Water for Life* came to an end in 2015, water resource management faces greater challenges than ever. Unequal access to an increasingly scarce resource, whose quality is far from optimal for assuring a balanced, healthy lifestyle, exacerbates social tensions and conflicts throughout the world, while triggering ambitions for power on the part of governments (Blanc, 2012; Galland *et al.*, 2008). The planet's water resources are increasingly sought to meet human needs. Volumes that can be mobilized through human intervention are extremely small: more than 97% of the Earth's water is salty, and once the water contained in glaciers and permanent snow is taken into account, human beings only have 0.7% of the Earth's water for their various uses, such as agriculture, sanitation and industry, etc.

The geographical distribution of water on the planet is extremely unequal. Today, one-third of humanity suffers hydric stress – less than 1,700m³ of freshwater available per inhabitant per year – when the global average is between 5,000 and 6,000m³. The UN forecasts that by 2025, nearly 1.8 billion people will be living in areas affected by water shortage, while currently, 9 countries share 60% of all renewable natural freshwater resources¹. According to AQUASTAT², the level of dependence on external water resources is more than 95% in Egypt, compared with 8% in the United States of America, and these figures are set to become even more acute in the future for countries such as Egypt, Malta, Libya, Jordan, Cyprus, Yemen and the Gulf Emirates, which have extremely low or almost non-existent levels of water availability. While global reserves of water resources have remained sufficiently stable throughout the history of humankind, its needs have risen constantly (FAO, 2011). First of all water-consuming sectors is agriculture, which has to feed a population that grew by a factor of 4.5 between 1914 and 2014. Water withdrawals for irrigation have risen by more than 60% since the 1960s and now account for some 70% of total water extraction. The global surface area of irrigated land increased fivefold during the 20th century, mainly in Asia and the arid or semi-arid regions, where populations growth is strongest. With the spread and promotion of technological and

1 - These are Brazil, Russia, Indonesia, China, Canada, the United States of America, Colombia, Peru and India.

2 - AQUASTAT is FAO's global water database and information system.

organizational innovations, irrigated surface areas are expected to increase by 14% by 2035, in an effort to raise still low levels of productivity in some African regions (FAO, 2011). Urbanization and industrialization are also factors that influence levels of water consumption. The growth of cities and the process of urbanization taking place in Africa and Asia are combining to exert even greater pressure on resources, as well as increasing pollution of the water already available. The number of megacities with more than 10 million inhabitants could reach 50 by 2025, while in 1950 there were just 3. As a result, the prospect of a global water deficit (if it is possible to measure water resources on such a scale) looms large, unless there is a change in the way this resource is used and distributed (UNESCO, 2015). The United Nations World Water Assessment Programme (WWAP) predicts that 40% of the world's population will be living in areas of high water stress by 2030 and highlights the risks to groundwater (WWAP, 2015): currently, aquifers supply drinking water to half the world's population; already, one in five is overexploited.

Soils: a threatened resource neglected by policy

Although 2015 was declared the International Year of Soils, political mobilization is still relatively weak on this issue. Yet, as highlighted by FAO, 33% of land is moderately or severely degraded due to erosion, salinization, compaction, acidification and chemical pollution of soils (FAO, 2011, p. 138). The extent of soil degradation threatens the capacity of future generations to satisfy their dietary and energy needs. By 2050, supply for foodstuffs, animal feed and fibres will have to increase by 60% to feed a global population of between 8 and 11 billion people (Dorin *et al.*, 2010, p. 31). The scope for expanding areas of arable land is limited, since most of the land still available is not suited to agricultural production. Land suited to crop cultivation is almost non-existent in Southeast Asia, the Near East or North Africa. In many other countries, the issue arises of which agricultural models to adopt in order to increase the productivity of land that is already cultivated. The agricultural intensification practised by some European countries during the second half of the 20th century has revealed its limitations through environmental degradation, especially soil and water pollution, as well as through the impoverishment of biological diversity of species that it has caused. In common with other natural resources, land is threatened by human activity and climate change. Artificialization via land use, pollution of soils and sub-soils, and erosion – these are the three major constraints affecting soils at global level, reinforcing the need for coordination around Sustainable Development Goal (SDG) No. 15 to conserve and restore land ecosystems. The issue of land is not just one of surface area, but also of distribution. Growing agrarian capitalism is targeting countries that find themselves in difficulty, with a trend towards investment in land throughout the world. The result is that many producers are prevented from having access to farmland. Nearly sixty years after the period of major agrarian reforms, a form of re-concentration of land ownership is being seen, which is profoundly changing rights and regimes for farmland management. Such competition is forcing family farmers to work land that is inadequate to ensure either their food security, or that of local and regional supply channels.

Forests: reversing a negative trend?

Mobilization to protect and conserve forest resources – particularly evident in 2011, which the UN declared the International Year of Forests – has found a special resonance in civil society, leading to a decline in the global pace of deforestation. Forests serve functions that are crucial to the survival of life on Earth, acting as lungs for humankind, barriers against soil erosion, carbon sinks and reservoirs of biodiversity, food and energy resources. Yet during the past three centuries, forests worldwide have diminished by about 40%, and 29 countries have lost almost 90% of their forest cover (FAO, 2010). Some 6.6 million hectares of forests disappeared each year between 2010 and 2015, when FAO mapped 3.7 billion hectares of forests (FAO, 2015). It should be noted that the annual rate of forest loss declined between 1990 and 2015. Between them, Russia, Brazil, Canada, China and the United States of America account for half the world's forested areas.

Forests formed of indigenous species, in which there is no trace of visible human activity – so-called primary forests – represent 36% of forested surface area (FAO, 2010, p. 87). However, these expanses have declined by nearly 40 million hectares since 2000, according to FAO. Planted forests accounted for 7% of total surface area in 2010 and increased by 5 million hectares between 2000 and 2010. This rise is closely linked to the increase in demand for raw materials for timber related industries (energy, construction, etc.). Some 12% of forests are targeted for biodiversity conservation. At global level, there is wide diversity among forests, with local characteristics and particular phenotypic features. Tropical and subtropical forests (61% of global forested area), which are evergreen, are extremely rich in biodiversity: in these complex ecosystems, there are more than 50,000 species of trees. Boreal forests, made up of conifers and found around the polar circle in the northern hemisphere, account for 25% of global forested area, and temperate forests with deciduous leaves (birch, oak, etc.) and conifers account for 13%. There are other types of forest, such as tundra and Mediterranean forests. In 2010, these latter covered 25 million hectares in countries of the Mediterranean region, which has a total forest area of 85 million hectares (CIHEAM, 2013). Particularly fragile, their surface area has declined dramatically, despite the important ecological role that they play in Mediterranean ecosystems. Their disappearance is a major cause for concern in the region. Certain species are especially emblematic of these lands and their history, such as the cedar, the Aleppo pine and the argan tree. In fact, more than 3,500 rare endemic species out of the 6,000 mapped in the Mediterranean are vulnerable or threatened. Demographic pressure coupled with forest fires³, overgrazing and reduced forest cover to make way for agriculture all pose a direct threat to the Mediterranean forest ecosystem, and on a more global scale, to forests worldwide.

Between 2000 and 2010, 13 million hectares of forests were converted each year to other uses, compared with a figure of 16 million in the 1990s. While this conversion and deforestation has subsided in the past twenty years, the pace at which these phenomena occur remains highly alarming. South America, compromised by large

3 - According to the FAO Department of Forestry, between 2010 and 2016, 269,000 forest fires were recorded in Mediterranean countries, burning more than 2 million hectares.

tracts of land given over to soya monoculture, and the African continent are both experiencing net forest losses that are among the highest in the world. Australia, renowned for its endemic species, has also seen massive forest losses caused by drought and fires (FAO, 2010, p. 18). The total area of forests remains relatively stable in North America and has increased in Europe and Asia. But while there have been net gains of forest land in some parts of the world, there is a growing risk of primary forests being converted to monocultures of rubber or palm oil, which endangers local biodiversity in tropical areas. Threatened by humans, destructive insects, diseases and climate change, sustainable forest conservation must occupy a central position in the 2030 sustainable development agenda, as highlighted by UN Secretary General Ban Ki-Moon, in March 2011.

Biodiversity: towards a “sixth mass extinction”?

The Millenium Ecosystem Assessment revealed the extent of the consequences of modifications to ecosystems to meet the needs of the world’s population. According to the final report, ecosystem transformations during the past fifty years have taken place at the fastest pace ever in the history of humanity (Millenium Ecosystem Assessment, 2005). These changes have made it possible to meet needs for food, freshwater, rubber, fibre and energy, but have led to substantial and irreversible losses of land-based and aquatic life. The protection of biodiversity, which is defined in the 1992 Convention on Biological Diversity as “the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species and of ecosystems”, has been placed on the agenda of the international community. Each day, science makes progress in categorizing, discovering and assessing threatened species. There is considerable scientific controversy about the pace of disappearance and extinction of living species. But whether the rate is 50, 100 or 1,000 times greater than that at the beginning of life on earth, the consequences for the human race and its environment are catastrophic. Some scientists are talking openly about a sixth mass extinction, the last one being during the Cretaceous age, which saw the disappearance of the dinosaurs, 65 million years ago (Billé *et al.*, 2014; Dirzo *et al.*, 2014; Ceballos *et al.*, 2015).

Among the many ecosystems that are threatened are coral reefs, which have higher levels of biodiversity than tropical forests. According to one Australian researcher, 30% of these reefs have been damaged by fishing, disease and pollution (Wilkinson, 2004). Some 35% of mangroves have also disappeared during the past two decades due to conversion to aquaculture, overexploitation and storms (Millenium Ecosystem Assessment, 2005). The latest version of the IUCN Red List, drawn up in 2015, classifies 22,784 species out of 77,340 studied as “threatened with extinction”: 41% are amphibians, 13% birds, 31% sharks and 25% mammals. Megafauna (elephants, rhinoceroses, polar bears, etc.) and invertebrates (butterflies, spiders, ladybirds, etc.), which have declined by 45% since 1980, have seen the sharpest drop (Dirzo *et al.*, 2014).

There are five major sources of pressure weighing on biodiversity: degradation of natural environments (e.g. deforestation), overexploitation of natural resources (e.g.

fisheries resources), the introduction of invasive species (farmed fish, exotic pets, shellfish introduced into the Mediterranean through the Suez Canal and ballast water, etc.), pollution (for example, that caused by heavy metals) and climate change. Due to the opening up of commerce, increased trade and greater movement of goods and people in the Mediterranean, the risks of introducing and disseminating harmful organisms is increasing in an alarming manner⁴. The fight to halt losses linked to harmful organisms is particularly important to conserve food security in the Mediterranean, which is a net importer of cereals.

In terms of production, the agricultural intensification seen in some countries in recent decades has major impacts on the diversity of genetic resources for food and agriculture. Noteworthy among the many examples is the selection of certain breeds of dairy cow, which is causing other supposedly less productive breeds to be abandoned and disappear, and a trend for some regions to focus on producing a limited number of crops.

Energy at the heart of an interconnected system for food security

In the 20th century, the development of industry and transport has mobilized a growing quantity of resources, increasing total energy use more than twentyfold. More than 30% of this consumption is currently absorbed by the agrifood sector, mainly for agricultural production. But this is not the only energy intensive sector: transport, heating and construction require more and more energy to satisfy human requirements. According to a scenario drawn up by the International Energy Agency, by 2040, global energy demand will increase by 37% (IEA, 2014), and the global energy mix will be almost equally divided into four parts: oil, gas, charcoal and “low carbon emission” energy sources. In a situation in which climate constraints contribute to the reshuffling of cards in the global energy game, acute problems are forecast regarding limited natural fossil resources, the need for public policies to support renewable energy and interdependence between energy production and consumption sectors. Climate change and the increase in greenhouse gas emissions are the main factors exerting pressure on levels of consumption and national policies. Given that the agrifood sector alone accounts for as much as 20% of greenhouse gas emissions⁵, there is an urgent need to plan decarbonized development pathways⁶. Today’s food systems are strongly dependent on fossil fuels at all stages of production. Continuing down this path is not a viable option for the agriculture sector, nor for the heating and transport ones. The balance between food security and energy requirements has become a burning issue and a source of political instability, as demonstrated by the rise in food prices after 2007, which was partly linked to the growing demand for biofuels. It is crucial to adopt an approach that takes into

4 - CIHEAM’s *Watch Letter* No. 33 (CIHEAM, 2015) examines various phytosanitary threats, such as the tomato leaf-miner pest and *Xylella fastidiosa*, which has already contaminated olive groves in Puglia, southern Italy and is threatening Mediterranean arboriculture. Publications underscore the need for cooperation to explore the threats and develop measures for prevention and sanitary protection.

5 - More than 3% if changes in land use are taken into account.

6 - On this subject, see the *Deep Decarbonization Pathway* project carried out by the Institute for Sustainable Development and International Relations and the Sustainable Development Solution Network.

account the interconnection between different resources, shaping a system in which any intervention on one part of the system (for example a policy to encourage ethanol production) has a knock-on effect on others (levels of water or an aspect of food security). So it is important to taken into account the positive and negative spin-offs, as well as the interdependencies between policies and useage of water and energy for food production at various levels, from local to global (FAO, 2014b). For example, we know that cultivating cereals to produce agrofuels, thereby securing energy supplies, consumes both land and water and enters into competition with food production. The question should also be asked as to the levels of fossil fuels required in different contexts for the production of ethanol, analysing if this approach does not actually make very little economic or environmental sense. Water, energy, food and land are all crucial resources for meeting human needs. It is worth remembering that nearly 800 million people have no access to good quality water and that 1.5 billion inabitants do not have electricity. Access to these natural resources and their sustainable management is a priority to enable economic and social development to take place and to fight poverty. Water supply, and even autonomy, should be assured for farmers suffering from food insecurity and poverty. They have a very important role to play, both in increasing output and mitigating global warming, provided that they adopt solutions that are compatible with food crops. Farmers vulnerable to the scourge of food insecurity and economic uncertainty are the first actors with the scope to intervene in this water, energy and food nexus, by reducing losses and wastage, adopting energy saving practices and developing local energy sources and decentralized management systems for all resources. However, in the South as in the North, such change will only be possible with public policy support and the engagement of the private sector, as well as that of technical and financial partners, such as development banks, coupled with implementation of cooperation policies between countries. Nor should we neglect the effects of decentralized management of natural resources such as energy on the democratization of societies and the participation of everyone in collective choices.

Humans and their environment: Advocacy for natural resource management

“Where there is danger there is also salvation”. As Hölderlin suggested as long ago as the 18th century, humanity is bound to find responses to the threats that emerge and which, in this case, are self-inflicted. Humankind is being invited to bring about a real revolution if it wants to manage the resources available to it. Already, a number of technical and institutional initiatives are under way.

Sound management for future generations

We have seen that protecting the environment and natural resources is more crucial than ever in order to address the many challenges posed by climate change and population growth. Given the urgent nature of ecosystem degradation, there have been many calls during the course of modern history for women and men to plan and manage the way in which they interact with their environment. For example, the report published by the Club of Rome in 1972, titled *The Limits to Growth*, better

known as the *Meadows Report*, used a series of scenarios to show that excessive consumption of natural resources to satisfy the appetite for growth could result in a major and sustained economic crisis. Although, in spite of technical progress, human beings cannot bring an extinct species back to life or make desert land once covered with forests bloom again, in the course of their history, societies have developed models for the collective management of natural resources, and these have formed a common heritage. Agriculture, and the exploitation of these resources to meet the needs of humankind, have made it possible to build society and today still offer a means for forging a social link on many levels. Farmers should be at the heart of this revitalized social fabric.

Natural resource management as practised today revolves around three primary moral and ethical principles, as presented in the Brundtland report, *Our Common Future*, which institutionalized the concept of sustainable development⁷:

- The principle of stewardship states that natural resources are an asset that goes beyond human existence. Since natural resources are inherited, they should be passed on to future generations, with as few changes as possible.
- Natural resource management should be supervised by representatives of users, first and foremost farmers and their organizations, but also entrepreneurs, consumers and civil society. In a world in which urban and rural boundaries are shaping new networks of territories, users and managers of natural resources should be represented at each scale of decision-making, be it at the level of a village, watershed, region, country or government or multilateral organization.
- Access to natural resources, like their redistribution, must be fair and transparent.

These three dimensions argue strongly for collective action and implementation of new dynamics for local and international development. Without greater global awareness and full realization of international agendas that have already been launched, such as the Aichi targets adopted in 2010 by the Convention on Biological Diversity or commitments undertaken at COP21 in Paris, the trend towards degradation of the environment and productive resources can only accelerate, with scant prospects of reversal. According to a report from the OECD, the costs of inaction on soil conservation, climate change and biodiversity degradation will be massive, if no new policy is put in place (OECD, 2012). According to these forecasts, by 2050, land-based biodiversity will decline by a further 10% and more than 40% of the global population will live in water catchment areas subject to high levels of hydric stress, as in North Africa. Challenges regarding food, shelter and heating will continue to increase and irreversible changes will jeopardize gains in improved living conditions made over several centuries. It is therefore crucial to reverse this trend and work towards mobilization on the widest scale possible for a major shift in the energy, agriculture and food sectors.

7 - The report, written in 1987, defines sustainable development as development “that meets the needs of the present without compromising the ability of future generations to meet their own” (Brundtland, 2011).

Better management means less waste!

To address future challenges of food security, prosperity and environmental degradation, it is unthinkable to continue following the pathway taken by consumer societies in Europe, the United States of America and some emerging countries. The growth model passed on by the so-called Thirty Glorious Years, pushed to extremes, is leading to serious overexploitation of natural resources. The time has come to ask ourselves about the share of resources that are wasted in meeting our needs. Such waste involves a large part of the world, so it is not a question of heaping opprobrium on one country in particular. Future generations will grow up in a world in which income disparities between countries will decline, while they continue to rise within the same country. In this regard, the question of using natural resources at national scale must be connected to the issue of social and economic inequalities. These latter are not just the result of scarcity and poor management of natural resources, but are themselves a source of growing problems related to the environment and ecosystem degradation. Moreover, the most inegalitarian growth models, which are rapidly developing in emerging countries, weaken citizens' consensus on the management of common assets, promoting in its place a movement for private appropriation of resources (Genevey, Pachauri and Tubiana, 2013). Redistribution policies drawn up in a collective and participatory manner, in the spirit of the declaration adopted at the Rio Summit in 1992, would help to combat inequalities and accelerate the transition towards sustainable economic and social models. As such, food and energy consumption are strongly affected by these socio-economic inequalities. Levels of consumption and waste of natural resources are testimony to the disparities of wealth between countries and to choices of development models. While a Californian consumes 4,500 litres of drinking water per day, a Parisian uses 240, and the global average is 40 litres. Food, shelter and transport are sectors where there are not just glaring inequalities, but they are also the greediest in terms of natural resources. The massive waste caused by lifestyles in which a large part of the world's population is now trapped – at times against their will – represents losses of resources that can never be retrieved. Some 40% of primary energy used in the world by 2050 could be saved by systematically tracking and reducing waste (Perthuis, 2009, p. 182). According to FAO, one-third of global food production, from farm to fork, is lost or wasted each year, the equivalent of 1.3 billion tonnes of food (Gustavsson, 2011). And let us not forget another form of waste, that of knowledge and knowhow. Combating losses and waste in all geographical settings and at all stages of production and consumption is therefore a powerful lever for conserving natural resources and hence an opportunity to rethink the sustainability of food systems. Addressing food losses also has an impact on the three dimensions of sustainable development: economic, social and environmental (Brun and Agamile, 2015, p. 96).

A great many initiatives are now in hand to help reduce the carbon footprint of our food systems and consumption patterns, with consideration being given, for example, to developing shorter supply circuits, agroecology, high environmental quality buildings and the sharing or collaborative economy, which is revolutionizing ways of consuming and using individual services. Public policies should be mobilized to enable these innovative and alternative models to emerge and find outlets. The

Mediterranean region has already tackled this problem of losses and waste, as shown by the Mediterranean Action Plan (MAP) and initiatives launched by international organizations such as CIHEAM, OECD and FAO, as well as, recently, the G20 under Turkey's presidency. G20 Ministers Agriculture meeting in May 2015 in Istanbul committed to setting up an exchange platform for food and agricultural losses and waste.

While changes are essential in food consumption and production patterns, the question also arises about the extent of changes needed and the efforts of each person. Better management and protection of natural resources is a common responsibility for all. Yet the efforts required to achieve this are different in each case, for the legislator, the consumer and the private operator. The International Year of Family Farming declared in 2014 underscored the importance of this type of agriculture for food security, global agricultural biodiversity and sustainable use of natural resources. In a world marked by climate uncertainty, competition for land and growing urbanization of lifestyles, coupled with agricultural modernization in countries of Europe and North America, transformation of this kind of smallholder and household farming is a major issue. Aside from the economic and social consequences that it will have on millions of small-scale farmers, it is the coexistence between industrial agriculture and family farming that today warrants careful scrutiny by decision-makers and civil society. These two types of agricultures do not have the same level of access to financial, political, technical and organizational resources. National and local public policies must therefore be defined to help family farmers to meet their food needs, market their output in local supply chains, produce their own energy, etc., as well as to support innovative initiatives such as agroecology, which enables production and processing methods to be adapted to natural environments and economic and social systems. While an essential prerequisite, regulating and setting in place standards is not the only way to achieve better management and use of natural resources. For example, environmental information and labelling can help to unlock technological and social barriers in production chains through a business to business perspective. It is therefore important to adopt a systemic approach to promote change, while attempting to make the various actors accountable for their commitments. Such accountability will be a decisive factor in achieving the Sustainable Development Goals, along with governance of the changes that ensue from them.

Innovative processes for natural resource management

Difficulties in conserving natural resources despite the fast pace of population growth are affecting production methods and require differentiated policy responses. What is needed is to take action against the destructive processes already under way, while supporting innovative approaches that offer a promising alternative, constantly exploring new solutions. Science and technical progress have certainly led to an improvement in our knowledge of ecosystems, but this remains inadequate. Although controversies serve to drive science, there are too many when it comes to assessing biodiversity or the impact of human activity on other natural resources. Research-development needs are therefore massive. Research needs to leave the laboratories and go out and question practices, helping to set up supportive policies for

innovators, especially producers, who can then create local solutions to protect the environment. Nor should we overlook the contribution of human sciences to improving natural resource management. For example, science should question the way in which a market value is attached to ecosystem services, as well as the limits of such attribution. Likewise, a considerable volume of research developed in the early 1990s has shown the contribution of participatory management to the conservation of natural resources, and *a contrario* the inadequacy in this respect of administrative decisions that follow a top-down approach. The success of early initiatives conducted in Tunisia, through the Douar development programme, or in Morocco, through watershed management projects, demonstrates the importance of involving local communities (including agricultural producers and fishers) in the design, implementation and evaluation of environmental policies (Pintus, 2009, p. 29). Paying closer attention to participatory natural resource management is also proving crucial, given the recent interest in going back to the land shown by urban communities in Mediterranean countries. This innovative process, which involves profound changes in terms of governance and public action, call for public policies that intervene at various levels, from local to international – if it is possible to talk of international public policies – that are designed to be consistent with agendas for sustainable development and poverty reduction. Their implementation will be a powerful lever for the ecological and energy transformation desired by civil society.

Natural resource management and sustainable development – a question of scale

While a number of threats menace ecosystems at global level and in the Mediterranean, there is a wide range of solutions on offer and the international community is negotiating common agendas for action. The year 2015 marked a new turning point, with events that will be remembered for decades to come, such as the Paris conference on climate change, the financing for development conference in Addis Ababa and the definition of the post-2015 development agenda for the United Nations. Three objectives specifically target natural resources, but their protection is also critical to the achievement of the other fourteen goals. Indeed, access to natural resources and their conservation for future generations will have direct consequences for poverty reduction, the eradication of hunger and malnutrition and the promotion of women's rights and education for all. Competition for water, land and energy and the destruction of ecosystems can also result in violent conflicts, as happened in Liberia or Angola, and lead to violations of human rights⁸. Acknowledging the role of environmental issues in violent conflicts or the fight against poverty underscores the importance of natural resource management in peace-building and, more generally, in developing or promoting democracy.

⁸ - According to the United Nations Environment Programme, since the 1990s, at least 18 violent conflicts have been fuelled by exploitation of natural resources. Timber, diamonds, gold, precious minerals or hydrocarbons, and competition for high value natural resources, are acknowledged as having played a dramatic role in several recent civil wars (UNEP, 2009).

The diagnosis set out at the start of this chapter, of a dangerously rapid degradation of natural resources, tends to be true of all areas that are now witnessing the impacts. It is therefore urgent to pay particularly close attention to coordinating various levels to reach a common objective: if natural resources are a common public good, policies for their management span a two-way horizon, from local to global and from global to local. When it comes to implementing international agendas, it remains critical to bear in mind how different countries will seek to achieve these objectives in a global and sectoral framework. The choice of local communities, including producers and the organizations that they represent, sometimes framed by proactive public policies, can have consequences for the authorities, or even the governments of neighbouring countries. The same can be true of water resource management for a river that crosses several countries, or a regulation on air quality. Political judgement must be exercised at several levels and, if action is to be consistent, dialogue must more than ever be promoted in democratic fora, at regional and global level. Implementation of the SDGs, and the imperative of sustainable natural resource management, can also be powerful drivers for revitalizing regional development. Indeed, managing natural resources sustainably or combating climate change as part of the post-2015 development agenda requires that private transnational actors and subnational authorities have space for expression, as a guarantee of their engagement, and above all, their accountability.

Bibliography

Abdul Malak (D.), Livingstone (S.), Pollard (D.), Polidoro (B.) and Cuttelod (A.) (2011), *Overview of the Conservation Status of the Marine Fishes of the Mediterranean Sea*, Gland and Malaga, IUCN.

Billé (R.), Cury (P.), Loreau (M.) and Maris (V.) (2014), *Biodiversité: vers une sixième extinction de masse?*, Montreuil, La Ville brûle.

Blanc (P.) (2012), *Proche-Orient: le pouvoir, la terre et l'eau*, Paris, Presses de Sciences Po.

Brun (M.) and Agamile (P.) (2015), “Les pertes et gaspillages alimentaires dans l’agenda du développement: une opportunité de repenser le système alimentaire”, in C. Lacirignola (ed.), *Terre et mer: ressources vitales pour la Méditerranée*, Paris, L’Harmattan, pp. 91-104.

Brundtland (G.) (2011), *Our Common Future. Brundtland Report*, s. l., Books LLC, Classics Series.

Ceballos (G.), Ehrlich (P.R.), Barnosky (A.D.), García (A.), Pringle (R.M.) and Palmer (T.M.) (2015), Accelerated Modern Human-induced Species Losses: Entering the Sixth Mass Extinction, *Science Advances*, 1 (5), e1400253.

CIHEAM (ed.) (2013), “The Future of the Mediterranean Forests”, *CIHEAM Watch Letter*, 25, June (www.ciheam.org).

CIHEAM (ed.) (2015), “Invasive Species in the Mediterranean”, *CIHEAM Watch Letter*, 33, June (www.ciheam.org).

Dirzo (R.), Young (H.S.), Galetti (M.), Ceballos (G.), Isaac (N.J.B.) and Collen (B.) (2014), “Defaunation in the Anthropocene”, *Science*, 345 (6195), pp. 401-406.

- Dorin (B.), Paillard (S.) and Treyer (S.) (2010), *Agrimonde. Scenarios and Challenges for Feeding the World in 2050*, Versailles, Quae.
- FAO (2010), *Évaluation des ressources forestières mondiales 2010: rapport principal*, Rome, FAO.
- FAO (2011), *The State of the World's Land and Water Resources for Food and Agriculture: Managing Systems at Risk*, Rome and London, FAO-Earthscan.
- FAO (2014a), *State of the World Fisheries and Aquaculture 2014*, Rome, FAO.
- FAO (2014b), *The Water-Energy-Food Nexus: A New Approach in Support of Food Security and Sustainable Agriculture*, Rome, FAO.
- FAO (2015), *The Global Forest Resources Assessment 2015*, Rome, FAO.
- Galland (F.), Bauer (A.) and Fauchon (L.) (2008), *L'Eau: géopolitique, enjeux, stratégies*, Paris, CNRS Editions.
- Genevey (R.), Pachauri (R.) and Tubiana (L.) (2013). *Regards sur la terre 2013. Réduire les inégalités: un enjeu de développement durable*, Paris, Armand Colin.
- Gustavsson (J.) (2011), *Global Food Losses and Food Waste: Extent, Causes and Prevention: Study Conducted for the International Congress "Save Food!" at Interpack 2011 Düsseldorf, Germany*, Rome, FAO.
- HLPE (2014), *Sustainable Fisheries and Aquaculture for Food Security and Nutrition 2014*, Rome, CSA.
- IEA (2014), *World Energy Outlook*, Paris, OECD-International Energy Agency (IEA).
- IRIN (2009), "Syria: Drought Driving Farmers to the Cities", *IRIN News*, 2 September.
- Millennium Ecosystem Assessment (2005), *Ecosystems and Human Well-being: Synthesis Report*, Washington (D.C.), Island Press.
- OECD (ed.) (2012), *OECD Environmental Outlook to 2050: The Consequences of Inaction*, Paris, OECD.
- Perthuis (C. de) (2009), *Et pour quelques degrés de plus... Nos choix économiques face au risque climatique*, Paris, Pearson.
- Pintus (F.) (2009), "Préserver les ressources naturelles", in CIHEAM and Plan Bleu (eds), *Mediterra 2009. Repenser le développement rural en méditerranée*, Paris, Presses de Sciences Po-CIHEAM, pp. 27-64.
- UNEP (ed.) (2009), *From Conflict to Peacebuilding: The Role of Natural Resources and the Environment*, Nairobi, UNEP.
- UNESCO (2015), *Water for a Sustainable World*, Paris, UNESCO.
- Werrell (C.) and Femia (F.) (2013), *The Arab Spring and Climate Change*, Washington (D.C.), The Centre for Climate and Security.
- Wilkinson (C.) (2004), *Status of Coral Reefs of the World*, Townsville, Australian Institute of Marine Science.
- WWAP (2015), *The United Nations World Water Development Report 2015: Water for a Sustainable World*, Paris, UNESCO, World Water Assessment Programme (WWAP).