Felicita Scapini · Gabriele Ciampi *Editors*

Coastal Water Bodies

Nature and Culture Conflicts in the Mediterranean

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Edited by

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This book is dedicated to the memory of one of the participants in the WADI project, Dr. Fatiha Amar Bou-Salah, who suddenly passed away, leaving her friends in grief, however rich of her teachings, example of life and peaceful attitude towards women and men of all cultures.

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Chapter 1
Mediterranean Coastal Areas at Risk Between Conservation and Development

Felicita Scapini

Abstract The WADI project (INCO-CT2005-015226, sixth Framework Programme of the European Commission, 2006–2008) analysed a number of fresh and transitional water bodies in Mediterranean coastal areas suffering from scarcity and/or bad quality of water. Integrated multidisciplinary studies were made to highlight natural and human impacts on the ecological and socioeconomic systems depending on these water bodies. A study-site approach was adopted and the real contexts were analysed, in order to pay attention also to local details, thus not disregarding important elements of the systems. The ultimate goal of the project was to mitigate existing conflicts among stakeholders for water use, addressing the needs of the local people, particularly the weak or underrepresented part of the population. Efforts were made to facilitate communication among the various actors. The lessons learnt and difficulties encountered in the various contexts both in the northern and southern Mediterranean coasts are discussed in this introductory chapter. The challenge was faced by researchers of being at the same time 'objective scientists' and stakeholders.

Keywords Mediterranean coastal area • Water bodies • Study-site approach • Conflicts among stakeholders • Integrated water management

1.1 Issues of the Mediterranean Coastal Zone and the Challenge of Integration

The Mediterranean coastal zones are facing increasing challenges of development and integration. The tempos of socioeconomic development differ among countries, between the northern and southern coasts and between the inland and the littoral zones.

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So, a management suitable for a context may impact another connected, but far, context. A sustainable balance in case of trade-offs may be difficult to achieve and compromises are generally adopted between conflicting policies and actions, based more on the power of each stakeholder than on the real needs of the society. In environmental management, integration of different instances is a key issue and all possible efforts must be undertaken towards an integration of policies, countries, administrations and cultures.

In the Mediterranean region integrated water management mainly concerns fresh water demand for domestic, agricultural and industrial uses in contexts of water scarcity. Conflicts may also arise between the coastal and inland zones over the use of natural resources, causing pollution and/or depletion of water resources, with a consequent scarce supply of poor quality water to the end-users. In general, mismanagement of water may affect the coastal zones downstream of the source of pollution. This is particularly evident when long rivers flow across several countries and regions; however, in case of small rivers or 'wadis' (non-permanent flows of water in the arid regions, frequent in the southern Mediterranean region), issues of scarcity and bad quality of water can affect people on a smaller spatial scale (villages or local settlements) often not considered by regional and national authorities, which have their mandates for large populations.

River basins are often interconnected through systems of canalisation, constructed to prevent droughts and permit agriculture also in arid lands. Such systems may transfer pollution issues from one watershed to another. In particular, artificial water bodies maintained by dams and interconnected by canals, may favour the flourishing and spreading of plant and animal species that may be highly noxious to water ecosystems and to human health and activities. Ecologists are well aware of the issue of invasions of robust alien species that threaten the fragile local ones, well beyond the watershed scale (Gherardi 2007). However, the new water bodies created for economic purposes (storage of water to be sold for irrigation) may become new environmental resources, for example representing suitable areas for hibernating or breeding water fowls, and alien species, such as *Procambarus* or *Fragmites*, may be used by local people as alimentary resources or building material (see below the cases of Lake Maryut, Egypt, and El Hondo, Spain).

As a rule, changes (and problems in particular) are perceived as such when it is already too late for mitigation. It may be impossible to recover the systems at that point. So awareness of the possible impacts of water managements at various spatial and time scales is fundamental if we wish to develop efficacious long term strategies.

On the northern coast of the Mediterranean Sea, the semi-arid to sub-humid coastal zones suffer from irregular rainfall and polluted water supply from the rivers, which are often exploited by economically active inland regions. In south-eastern Spain, the Segura River flows to the Alicante Province from the Castile Region, where its water is used intensively to irrigate crops, leaving a scarce supply of bad quality water to the coastal zone (Martín-Cantarino, this volume). In central-western Italy, the Arno River flows down to the coast after having collected high levels of chemical pollution by the industrial activities in the plain.

The polluted water vapours of the coastal waters have caused the death of the pine trees lining the coast in the formerly Royal Reserve of San Rossore (now part of the Regional Natural Park Migliarino-San Rossore).

On the southern coast of the Mediterranean Sea, the water supply by rainfall to the coastal regions is irregular and gives origin to the typical wadis. This water is also trapped by dams to be used to develop agriculture in the arid inland areas. A network of dams and channels has been constructed to collect water and transport it from one place to another across the river basins. This may have high ecological and consequently socioeconomic impacts also on the coastal zone. As a matter of fact, the management of the rivers may reduce the sediment discharge and consequently facilitate the erosion of sandy beaches by the sea, indirectly affecting beach tourism that represents an important source of revenue to the countries (Oueslati 2004). The flow of sediments started from land erosion upstream far away from the coast contributes to create beautiful beaches; so what appears as a disaster upstream comes out as a benefit for the coastal environments. It is well known that the sediments accumulated in the dunes represent an important buffer or reservoir of sand, thus protecting coastlines against erosion (McLachlan and Brown 2006). Beach-dune ecosystems are currently under threat of disappearance all around the Mediterranean. The causes of this trend go from sea level rise to changes in marine currents, but management actions on rivers (blocking sediment flow) and constructions made on the dunes self are the main factors of erosion.

Increasing urbanisation is the most relevant issue in the Mediterranean coastal zone, as it is all over the world. Human population growth is the underlying force that drives a 'coastal squeeze' (Schlacher et al. 2006). Hence the coastal zones are trapped between burgeoning urbanisation from the terrestrial side and various marine stressors, also caused by climate change (Nordstrom 2000). These pressures are likely to increase at different tempos, with urbanisation expanding more rapidly than long-term climate changes and generating problems which can be immediately perceived. Climatic changes may affect water supply from rainfall in an unpredictable way, becoming a constraint for a rational distribution of freshwater resources, harshening the already existing problems. However, as in the case of beach erosion, the causes of the impacts on water resource are multiple.

Often water management measures undertaken to mitigate particular problems at one place may indirectly affect other compartments. In water management there is a tendency to implement measures that were already used somewhere else, without considering their possible impacts in the medium-long-term along the river basins or in neighbour zones nor the unique nature of the systems affected. Particularly, the socioeconomic contexts may be completely different from one locality to another and measures that have had positive impacts in one context may not be the best choice in a different one. Moreover, in decision making, rarely are past lessons taken into account. Despite the risks associated to uncontrolled deforestation or to dam construction in mountain areas have already been experienced in many localities, no measures are undertaken to prevent negative developments in other contexts. On the contrary, solutions for which the technology already exists are favoured. Models, generally used in engineering projects, rarely take into account the complexity

of the problems and tend to focus exclusively on particular sectors, for example crop irrigation, the distribution of drinking water or the conservation of wetlands as reservoirs of biodiversity, etc.

When decisions are taken centrally (at a national level) issues are generally oversimplified and the solutions proposed are those technically feasible, no matter if and how the local populations are affected by the management. On the other hand, when decisions are taken at a sub-political level, local authorities and managers are well aware of the complexity of the problems that receive due consideration, reducing possible risks (Beck 1986). At the local level, various indicators can be perceived by stakeholders and management can be adaptive.

As pointed out by Swallow et al. (2001) "For the purpose of research, it is usually important to be able to draw broadly applicable conclusions from impact assessment. This argues for selecting 'representative' sites. Yet in the case of watersheds, where site specificity may limit the ability to extrapolate results from one site to another, selection of research sites might better focus more on important or extreme circumstances whose results could provide insights into specific aspects of watershed management. A combination of methods, including quantitative and qualitative approaches, may be called for."

But the risk remains of subordinating the interests of many (the local communities) to those of few (those who take the decisions). Moreover, the scientific community is rarely consulted before political or management decisions are taken regarding the environment. It is well known that the tempos of the social impact of scientific results and decision making processes are different, the latter depending on the length of the mandates. Moreover, scientific outputs are generally adapted for and disseminated to the scientific community only and hardly understood by stakeholders and policy makers, mainly due to the specialised language used by scientists in their communications. On the other hand, no efforts are generally made by scientists to learn from the experience of local stakeholders, who may have a deep knowledge of the issues. There is an urgency to speed up the process of communication within the scientific community and to the public, but also there is a need to encourage a two-way communication of scientists with stakeholders at various levels, when necessary exploring different channels to communicate relevant messages. In the flow of communication, scientists may be considered as key players (stakeholders) at a supranational level, representing the interests of underrepresented social and environmental components.

1.2 The WADI Project Approach

The WADI project analysed the socioeconomic and ecological impacts of water management on natural and artificial water reservoirs in coastal areas around the Mediterranean, which sustain development and the highest level of urbanisation. Coastal areas also contain the most threatened water ecosystems, at highest risk of disruption, given their peculiar no-land/no-water status. The acronym of the project

WADI – WAter Demand Integration – suggests the temporary and unpredictable water flows common in the southern Mediterranean region and at the same time the need to integrate water management for the benefit of people. Fresh water is the most important natural resource for the local communities that have non-written rights on this good (Abdallaoui et al. 2009). This is recognised within the Millennium Development Goals (MDG), as the first priority, to provide good quality water for everybody. But fresh water is also a source of wealth for the countries, particularly those that base their economy on agriculture. A basic conflict may exist among those who have a primary right on water, those who own the resource and those who manage it. According to the MDG, the project WADI focused on fresh and transitional water bodies and the benefits the local population derives from the water bodies. The general objective of the project, to develop scenarios of equal water distribution to all stakeholders, including the less powerful components of the society, was ambitious for a three year project, but it has been a pertinent (categorical) guiding principle throughout the project and beyond.

In the framework of WADI project we have adopted a case-study approach and encouraged interactions between researchers and stakeholders at different levels, local, intermediate, national and international, and ultimately the communication between the scientific community and society. A dialogue with the stakeholders was initiated from the beginning of the project through focal meetings held at the study-sites. During these meetings, different stakeholders (national and regional authorities and managers; representative of the civil society, scientists, etc.) that in some cases had come together around the same table for the first time, were asked to explain their problems, hopes, plans and suggestions regarding water management. The outcomes of these meetings drove the subsequent ecological and socioeconomic research at the sites. So research was focused on real problems from the beginning of the project. The exchange of information among all parties involved was carried on during the field research and through events of presentation of the results. Contextualisation and adaptability were key concepts of this strategy (Beck 1997).

A systemic approach has proven very useful for an adaptive management of environmental resources, including fresh water. In this way we avoided staying blocked within a simplified ideal world, composed of only a few elements that can be easily managed, however with unpredictable outcomes (McNeill 2002).

1.3 Nature and Culture Conflicts at Study-Site Level

The study-sites chosen by the WADI project along the Mediterranean coasts cover a range of issues common in the region, and, at the same time, each site has a specificity derived from physical, climatic as well as socioeconomic conditions. A number of climatic, ecological and socioeconomic gradients can be drawn when comparing the case-studies analysed: North – South; East – West; developed – developing economy; intensively – sparsely urbanised; developed – recently discovered tourism. The study-sites were chosen in sub-humid (Italy), semi-arid to

Fig. 1.1 Location map: (1) Lake Maryut, Egypt; (2) Comacchio wetlands, Italy; (3) Ombrone River low plain, Italy; (4) Ghar El Melh Lagoon, Tunisia; (5) El Hondo, Spain; (6) Oued Laou, Morocco

sub-humid (Morocco and Tunisia) to arid areas (Spain and Egypt) (Fig. 1.1). Standards of living varied considerably among sites from a relative wealth at the European ones (varying according to stakeholders) to poverty in some contexts encountered in North Africa (Abdrabo 2006). The fragility of the systems and the unpredictability of ecological and socioeconomic changes were common traits of all WADI case-studies. At all sites, water was an issue regarding both quantity and quality of the water supply, as well as its management. Of the multiple gradients represented by the WADI study-sites, I'm presenting them according to an East–West gradient, to avoid an a-priori interpretation regarding development, implicit in the 'North–South' definition. As a matter of fact all the WADI case-sites shared issues of economic development and conservation of the natural and cultural heritage, all were complex systems, in which various factors interacted and influenced one-another. Complexity of the systems and more or less overt conflicts about the water bodies were the common issues of the WADI study-sites.

1.3.1 The Egyptian Case-Study

In Egypt, in the eastern part of the Nile Delta, the beautiful historical city of Alexandria is backed up by Lake Maryut, a coastal fresh water lake that belongs to a network of coastal lakes and collects water from the Nile River, in the past buffering the floods thereof (Fig. 1.1, location 1). The lake has a high landscape value for its geographical position. It is still recalled the story of foundation of the city by the young conqueror Alexander (e.g. at the City Museum of Alexandria). When he got to the sand ridge between the Mediterranean Sea and the lake, he immediately

recognised the strategic position suitable for the new capital of his kingdom, threw his mantel on the sand and said: 'Here I want my City'. And the city was founded, well protected from the attacks of enemies by the sea and the lake, and also sheltered from the floods, as it was built on the consolidated marine ridges. But, nowadays the urban area has enormously spread over the coastal area (Abdrabo and Hassaan, this volume), so that the risk of floods is real in case of sea level rise (El Raey et al. 1999; Torab and Azab 2007).

Moreover, water flow into the lake has decreased as a consequence of managements in the middle Nile Valley, namely the construction of the Aswan High Dam (McNeill 2002). From a holistic point of view, a further consequence of decreased fresh water supply from the Nile is an increased nutrient discharge from agriculture activities. Lake Maryut also collects discharge and waste waters from urban and industrial uses. Its pollution has been aggravated by the development of the city and has dramatically increased since the deviation of discharge channels from the Mediterranean Sea to the lake, so as to keep the coastal waters of tourist resorts clean. From that moment on, the situation of the lake has become worse with a sudden decline in fish catches (Abdrabo and Hassaan, this volume). The lake supports a numerous population of fishermen that live around the lake and in the lake self on pile-dwelling in the shallow zones (Fig. 1.2). This population is getting poorer and poorer as fish stocks in the lake decline. Income generating activities around the lake are also the sorting of solid urban wastes and the cutting of reeds (*Fragmites*) in the lake for several uses, for example building. Women and children participate in these activities.

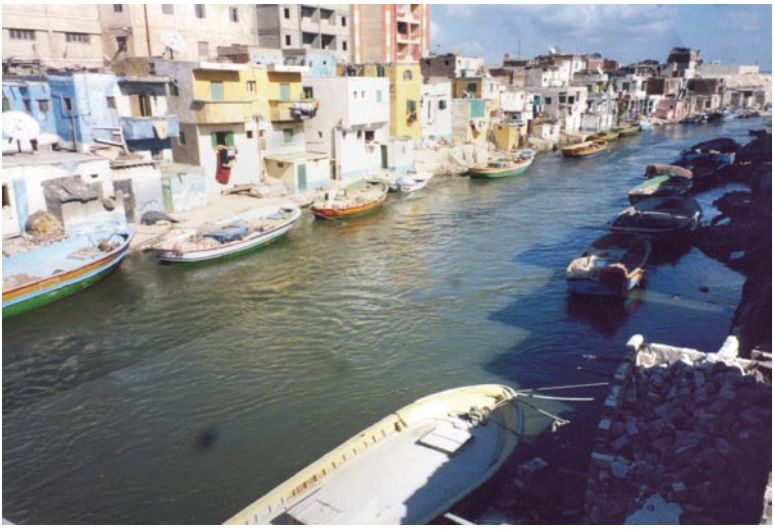

Fig. 1.2 Dwellings and boats of the Lake Maryut's fishermen. The channel was built for military aims at the end of the eighteenth century to connect the lake with the Mediterranean Sea. Currently it has become of paramount importance for fishery economy (Photo by Scapini)

The solutions proposed by the local administration include the filling up of the lake to gain ground for buildings and their infrastructures. Such measures will hardly favour the local population around the lake, the 'lagoon people'. A large amount of money from the World Bank has been earmarked to analyse the current situation, without showing a real willingness to improve it in favour of the local people. Overt conflicts exist between different stakeholders having different power and competence regarding the management of the lake, however the 'lagoon people' do not have official voice in the disputes and there is a risk for them of being disregarded as unimportant stakeholders.

We could remind here the historical experience elsewhere in the Mediterranean coastal area, for example the wetlands of Comacchio, south of Venice, in north-eastern Italy (Fig. 1.1, location 2; Fig. 1.3).

Still in the nineteenth century these wetlands were an unsuitable place for human settlements, subject to the threat of malaria disease (compare with the Maremma plain, Zanchi and Cecchi; Colombini and Chelazzi, this volume). A very poor 'lagoon people' lived there only seasonally in pile-dwelling to fish in the lagoons. Nowadays, the malaria disease was wiped out (also thanks to the DDT at the end of the Second World War and land filling). More recently, intensive aquaculture activities have been implemented in the remaining lagoons that have been maintained through a flow of salty water from the sea (Fig. 1.4).

It has become clear that aquaculture is much more rentable than cereal crop. Not only the ecological and landscape values have increased, but also the economic outcome of the land-filling has resulted negative in the places where land-filling

Fig. 1.3 Remaining coastal lagoon Valle di Comacchio (Ferrara, north-eastern Italy): a wood and reed house once used by fishermen and a "casone" (big brick house) used for aquaculture activities (Photo by Scapini)

Fig. 1.4 Remaining coastal lagoon Valle di Comacchio (Ferrara, north-eastern Italy): aquaculture landscape with the outlet to the sea in the foreground (Photo by Scapini)

was made. The trade-offs between different managements, land-filling versus aquaculture, agriculture versus urbanisation, biodiversity conservation versus agriculture, etc., are the subjects dealt with in this volume in different contexts, starting from the Lake Maryut case. The best solutions may differ among the contexts and considering different time and space scales.

1.3.2 The Italian Case-Study

In Italy we chose the lower Ombrone River valley in southern Tuscany as a case-study to analyse the issues related to water use and abuse (Fig. 1.1, location 3). As surface water becomes scarce during the dry Mediterranean summer and its quality consequently worsens, groundwater is increasingly used to irrigate crops. In this coastal zone the water table is near the surface and the exploitation of wells for domestic use and irrigation of small landholdings is easier and more economic than the management of a canalisation of water from the river (Fanini, this volume). The consequence of this practice by the local farmers is a lowering of the water table, which aggravates the effect of droughts on the water supply. In recent years the region had dry winters, during which the water table was not recharged and thus lowered. The intense use of fresh water from the wells for crop irrigation has also deteriorated the quality of groundwater and increased soil salinity with negative consequences on crops (Zanchi and Cecchi 2008, this volume). The lowering of the water table in the coastal zone has also caused an intrusion of marine water with a consequent increase in the salinity of groundwater (Grassi and Netti 2000).

This has had a dramatic impact on the viability and growth of pine trees and on biodiversity within the natural park, the Parco Regionale della Maremma, which is part of the area and represents an additional value for the region (Scapini and Nardi 2007; Colombini and Chelazzi, this volume).

There is a demand for new tools to monitor the impacts of climatic change and come to grips with the problems of increasing soil salinity as well as coastal erosion. However, as is usually the case when large amounts of money can be mobilised for infrastructures, projects have been planned and implemented that may cause undesirable impacts on fragile components of the ecosystems under concern. An equilibrium is difficult to reach, and disputes have arisen among stakeholders, including the researchers, on the best management strategies. It is difficult to stay neutral when the sustainability of relevant ecosystems is under question in a area of great natural and cultural value.

In this volume we analyse three compartments of the Ombrone River Low Plain relevant for water issues: crop irrigation (Zanchi and Cecchi), agritourism (hosting in farms) development (Fanini) and wetland biodiversity (Colombini and Chelazzi); we also discuss the respective, non-neutral roles of environmentalists and 'economicists' (a neologism to stress the tendency to make money from everything, including the environment) in proposing management and mitigating measures (Ciampi). Focusing on and highlighting conflicts about environmental issues, researchers may make things worse instead of playing a mitigating role. Environmental protection easily works when the area to protect is a small island, well separated from the context and not subject to discussion. But this is rarely the case. As a rule, protected areas are part of larger contexts, by no means pristine, influenced by and influencing surrounding areas.

1.3.3 The Tunisian Case-Study

In Tunisia the WADI project focused on an area located in the north-eastern coast of the country, including the low basin of Oued Majerda and Ghar El Melh - Sidi Ali El Mekki lagoons (Fig. 1.1, location 4). The river Majerda flows down from Algeria, but no major problems arise from the international sharing of the river, as water scarcity is apparently not an issue in the river upper basin. The low plain is of high economic, environmental, cultural (e.g. the archaeological remains of the Roman city of Utica) and landscape value, although threatened by floods and droughts, coastal erosion and silting up of the lagoon and its outlets. The risk of floods in the plain has been aggravated by the recent construction of a coastal highway that may block water discharge from the lakes on the hills backing the plain, in case of heavy rainfall. The relative abundant fresh water supply is threatened by the development of intensive agriculture and urbanisation in the low plain, as well as by the construction of dams in the hills to supply the arid central regions of irrigation water and the city of Tunis of drinking water. In this case, the management decisions have been taken on the national level for the benefit of the populations

living in other regions of the country. The water management activities are in most cases implemented by enterprises that act in a sectorial way, with scarce consideration of the local needs. Also, intervention in one sector (e.g. tourism) may have negative effects on another (e.g. agriculture).

Coastal management projects are being developed to enhance tourism activities in the region, while the needs of the community that lives near the Ghar El Melh lagoon and depends on fishing and traditional agriculture, are scarcely taken into account by the intermediate and national level decision makers. The research activities carried out in the frame of the WADI project have highlighted the ecological relevance of the area around the coastal lagoons, and a plan of protecting this area from intensive urbanisation has been developed by the national agency for coastal protection and management (the APAL, a participant in the WADI project). Landscape and biodiversity values as well traditional activities such as polder cultivation around the lagoons (Ramli technique, described by Fanini, this volume) have been declared worth of protection. The implementation of this protection plan has given rise to disputes between local and national stakeholders on land-use. The local representatives are in favour of a rapid development of infrastructures for coastal tourism that is rapidly increasing on national level with the developing economy of the country. On the other hand, the APAL is aware of the ecological and landscape value of this coastal sector, as well as the intrinsic risk of a mass tourism use, that is to erode the resources on which the tourism activity self is based (Caffyn 2002). So, the area was included within a larger plan of coastal protection. The implementation of such a protection plan will possibly enhance the international visibility of the Tunisian northern coast as a resort for Mediterranean eco-tourism.

Locally, the disputes on land-use mainly occur on the beach itself and the dune that separates the beach from the lagoon. Non-permanent wooden shelters are built by the owner of the ground and are gradually increased to become wooden houses, then illegally transformed in concrete buildings from inside (Fig. 1.5a, b). The national administration orders to destroy such constructions before they can be declared second houses; but more illegal houses are built elsewhere. On the back of the beach there is a bourgeoning of similar growing houses that can be reached by car driving on the sand and are consequently impacting also the fragile littoral ecosystem.

On the lagoon side of the beach, the solid and liquid wastes from the village and sparse houses pollute the brackish water. The lagoon has only a limited opening to the sea and is gradually silted up for a lack of proper management of the sediment inputs. Here, the affected stakeholders are the local fishermen who are gradually substituted by larger boats fishing in the sea. Powerful owners have built their villas on the hill backing the lagoon-beach system, thus directly impacting the Mediterranean forest growing up the hill. However, the declaration of a protected area also in this sector (scientific inputs were provided by the WADI researchers) has blocked further construction activities. Hopefully, this beautiful sector of the Mediterranean coast will not be ‘discovered’ by international tourism that will bring the demand of hotels and more impacting infrastructures, as has already happened elsewhere in the country.

Fig. 1.5 (**a**, **b**) Spontaneous building development on the dunes of Ghar El Melh lagoon: (**a**) A brick house is being built behind the wooden cabin; (**b**) a nice illegal villa has been made, while the wooden cabin apparently has become an out-building. In the background, a forest has been planted to stabilise the climbing aeolian dunes (Photos by Scapini)

A similar trade-off between tourism development versus landscape protection is observed in central-western Italy (see Section 1.3.2 and Colombini and Chelazzi, this volume). However, the existing management plans differ depending on the stakeholders, whether local or national. At difference with Tunisia, in Italy environmental protection is managed locally, and the disputes occur mainly between the local authorities and local owners of land.

1.3.4 The Spanish Case-Study

In Spain WADI has focused on El Hondo lagoon (Alicante Province), an artificial water reservoir for irrigation needs, recently developed into a natural reserve (Fig. 1.1, location 5). When water supply is scarce, as happens throughout most of the year and has been especially severe during the recent years of drought, the stakeholders' water demands come into conflict. The associations of irrigating farmers own the water, the farmers are the users and pay for the water, and the environment represented by the regional environmental agency needs protection (Martín-Cantarino, this volume). The economic, cultural and natural values of the area are unquestionable and all stakeholders claim their own part in the exploitation of the water body. The WADI participants organised joint meetings with the various stakeholders, including the least represented, rural women and school teachers, and set up discussion tables on El Hondo area. The local and regional press participated in this process of promoting awareness of the El Hondo problems along with its ecological and cultural values, as well as people's expectations from the project (Martín-Cantarino 2006). A conflict of interests has arisen between the farmers' associations and the regional authorities for the use of the area and the disputes on the water body have rapidly escalated to bitter water conflicts, eventually causing the closure of the natural reserve and the overexploitation of the water reserve (Martín-Cantarino, this volume).

According to their expertise and role in higher education, the WADI scientists have been asked to play a mitigating role in the dispute, defending the importance of water for the protection of biodiversity against economic uses. However, the holistic analysis of the case-study has highlighted the peculiar role of traditional agriculture in environmental protection. The risk is high of losing diversified traditional activities for ever in favour of industrial activities and infrastructures for an international tourism, which are surrounding the El Hondo area, that homogenises everything (Löfgren 2001). There is a need to 'protect farmers' as well as natural biodiversity. The squeezing of farmers due to mass tourism infrastructures seems to be counteracted by another trend: local young people are looking for new possibilities, related to organic farming and rescuing of traditional products. The unbalance among trends is still high, and the main challenge seems to be represented by the ability to create associations to give voice to the local civil society. The role of women associations at this study site is very important for the conservation of a contact with the local reality and its protection.

1.3.5 The Moroccan Case-Study

Oued Laou is a river flowing down the western Rif mountains to the Mediterranean sea, in northern Morocco (Fig. 1.1, location 6). Within a relatively small spatial scale of 930 km², the watershed offers an authentic case of contrasting and varied landscapes (cultivated plains, mountains, forests, etc.), variously impacted by human activities.

But these environments, the beach and the mountains, are interconnected by natural, cultural and economic links. Regarding water supply, the area includes arid zones suffering from water deficit to very humid zones at risk of floods. The geological substrates of prevailing limestone create a water reservoir of paramount importance for the hydrology of the area.

From a geographical point of view, this mosaic of ecosystems is integrated in a natural unit, the watershed. The presence and dynamics of water accomplish various functions that are both ecological and socioeconomic. Water (the river and its affluents) links the different compartments of the system.

The main land-uses (agriculture, animal husbandry, urban development, forestry, fishing, etc.) directly affect natural resources and the environment as a whole. The kind and characteristics of natural resources are strictly dependent on the quality and quantity of the water supply. If the latter are changed, irreversible impacts may be created that affect animals and plants, as well as human activities. Some of them may appear in the long-term, as the water merges several minor impacts and, in the long-term, some may cause major impacts on a larger scale, the entire watershed. The best way to understand such interactions would be to apply both a multidisciplinary and an integrative approach. The concept of integration at the level of watershed stresses the need to consider all the components of the water's cycle, as well as the interactions among the natural and human systems along the rivers.

The north-western Mediterranean coast of Morocco is currently developing tourism and linked infrastructures, such as the construction of the new harbour of Tangier and a highway along the northern coast. The village of Oued Laou is an urban area developed at the river mouth, representing a well-appreciated bathing resort visited every year by increasing numbers of national tourists. It is foreseen that the international tourism (conveyed by the highway) will soon discover this area. Such development is in apparent contrast with the rural mountain environment actually observed, where the settlements are mostly sparse 'douars' (a few households belonging to a family group) administered by rural municipalities, around the historical city of Chefchaouen. The high altitude natural forests host endemic arboreal species (*Abies maroccana*) as well as a rich diversity of fauna and flora (recently the mountain area was declared a natural reserve of world importance, the Talassemtane National Park). Both are threatened by an intense use of ground for traditional agricultural practices including the cultivation of *Cannabis* crop (Ater and Hmimsa 2006). The latter represents an important source of income for the resident rural population and land owners often choose to devote to *Cannabis* their lands as a whole, avoiding any other subsistence activity. This fact, paired with the absence of any other alternative rentable activity, makes people dependent on this only illegal source of income, increasing social instability. Despite the declaration of the site as a MAB (Man and Biosphere) reserve, people living in it are unaware of its self existence as a natural heritage. Only few schoolchildren contacted during our field work declared that they got the information on the Park from the television and not from their family (Fanini and Fahd 2009).

The site is therefore in an unstable balance between a traditional way of living and rapid socioeconomic development. Problems are perceived as such only when

they concern the short term, and the local people have apparently no interest in future development. Regarding water, there is a deterioration of water quality from upstream to the coast, caused by the absence of any regulation in wastewater discharge by urban settlements (El Alami et al. 2006). The WADI ecological and socioeconomic research focused on the relevant biodiversity and interesting marginal cultures, at risk of homogenisation and loss as a consequence of the rapid development. In this site we have analysed the actual issues linked to the use of natural goods, starting from the local men and women and their perception of changes (Fanini, this volume). The local population will ultimately be affected, both positively and negatively, by the ongoing socioeconomic development. Our analysis was carried out independently from any development plan or NGO (non-governmental organisation) project (as is usual the case in developing contexts) and this favoured the obtaining of an honest information and a better understanding of the trends of change in the socioeconomic context.

1.4 Shared Expertise and Policy Making

Having focused on the relevant issues about water bodies, the WADI project collected first hand information with particular emphasis on the gaps of available information, generally relative to sectors neglected by the powerful stakeholders. The neglected sectors were the poor fringes of the population (e.g. the Egyptian and Moroccan cases), the natural component of the ecosystems (e.g. the Italian case) or the traditional agriculture (e.g. the Tunisian and Spanish cases). For each of the case-studies analysed, the picture has become more complete, and in some cases, by observing the issues from different points of view, the focus changed. So, where environmental issues were apparently the most relevant, as in the Spanish case (Martín-Cantarino, this volume), the importance of the sociocultural context has been highlighted and, consequently, a compromise between the needs of biodiversity conservation and agriculture has to be negotiated. In the Italian case (Zanchi and Cecchi, this volume), the analysis of the climatic change in the local context, along with the study of the agricultural practices in the area, revealed that the latter have a major effect of desertification. So, new agricultural practices must be suggested to the farmers.

The issue of communicating scientific results in the appropriate way to the relevant stakeholders has become urgent. Often we want to communicate messages that are unwelcome to powerful stakeholders and this may represent a ‘political’ problem. This issue was particularly evident in the Italian case-study, where trade-offs and conflicts exist among various sectors: ecosystem protection, agriculture and tourism, each using the water resources (Colombini and Chelazzi; Fanini, this volume). As long as the discussions about environmental protection and the management of natural resources were kept within the meetings of managers and scientists, no problems arose. Local authorities and managers often ask researchers for scientific inputs to develop and monitor their management plans, regarding the

protection of natural resources, agricultural practices or land-uses. However, the main lesson learnt from the system approach of the WADI project was that a sectorial management may have negative impacts on other sectors. Below an example is presented that illustrates the difficulty of communicating undesired messages to stakeholders.

To enhance public awareness we decided to publish an illustrated book on the natural park (the Maremma Regional Park) to be sold in the bookshop of the park itself at a low cost (Scapini and Nardi 2007). The title and sub-title of the book 'The Maremma Regional Park and the Surrounding Area – a Guide to Know and Understand' stressed the system approach. We wanted to 'guide' the reader through the various compartments of the system, including the human dimension that has used and transformed it, as well as through the historical changes of the area. We also analysed the management of the natural park that has substantially contributed to the development of the area for the last 30 years. Eventually we illustrated future scenarios, in particular those resulting from engineering measures to stabilise the shoreline and nourish the beach in front of the park aiming at increasing the number of visitors of the park, thus its income.

This point of view, whereas scientifically justified (Scapini 2006; Speybroeck et al. 2006), generated a conflict with the local policy makers that had already obtained the financial support to implement the criticised management plans. Local policy makers and park managers considered the publication of the book 'politically dangerous' and asked us to remove the chapter on management from the book, thus concealing the threats of mismanagements from the lay public. Apparently, this was a tentative to block the flow of communication from science to society in this respect. According to this logic, science should stay in its world of 'universals', separated from political issues, and eventually communicate their contrasting results to policy makers only, without involving the public. The role of researchers as stakeholders has become here clear. Obviously, we decided to keep the chapter with its criticism and published the book in its complete version. So the book was not sold in the bookshop of the Park, but in the bookshops of the city of Grosseto and no public presentation of the book was organised in the concerned area, as had been planned. Likely, the book did not directly reach all the visitors of the park, the very target of the message conveyed, but a diversified local public bought the volume. We noticed an unexpected interest in the issues treated in the book in people living in the surrounding or working in the park itself. They felt themselves as stakeholders and were happy that researchers considered their problems related to the management of the park as relevant. For sure, this was a positive result of the dispute between researchers and local policy makers. After 1.5 year, in the second summer after its publication, the book is eventually sold in the bookshop of the park.

We may conclude that not only the importance of the message or the lack of similar publications determine whether a book is read or not by the target public, but an expectation must arise. The dispute with the policy makers had given rise to such an expectation in local stakeholders. As to the management decisions that we wanted to contrast, the general policy was obviously not changed, but the management

plan was partly revised and no beach nourishment will be made within the park. Moreover, a sector of the beach that we had described in the book as particularly rich in biodiversity, has been declared an integral reserve in the updated management plan of the park.

In a completely different context, the Moroccan study site, a volume has been published that collects the papers produced by participants in the project WADI on the watershed of the river Laou, the river mouth, the beach and coastal waters of the bay in front of the village named Oued Laou, highlighting the natural and cultural values of the area (Bayed and Ater 2009). This information is now put at the disposal of the scientific community, managers, decision-makers and students, to contribute to the local understanding of the area, and, in addition, offer an example of a multidisciplinary approach of international relevance. The results published in the volume represent a baseline necessary for the development and implementation of integrated management plans involving natural and cultural resources at the scale of the watershed. A scientific support to decision making is actually requested by policy makers and managers, and scientists have the duty to provide it.

1.5 Lessons Learnt from the WADI Experience

To achieve a sustainable development that guaranties an healthy world to the future generations, as well as the biodiversity that we have received from our ancestors (as stressed by the conclusions of the World Summits of Rio and Johannesburg) we need practical examples to illustrate the different situations encountered in the world, in order to share the knowledge and show the difficulty to reach the objectives of sustainability. In the Mediterranean context, water management and the share of water resources is one of the most important aspects of the present century, and this is stressed by the Water Initiative of the European Union towards the Millennium Development Goal regarding drinkable water. The objective of obtaining good quality water in the Mediterranean sea, currently at highest risk of an irreversible pollution being an almost closed sea, was also stressed by the Barcelona Convention and the Blue Plan.

In such a framework, the contribution of WADI was essentially practical and case-study oriented. If the objective of an integrated management of the water resource was achieved only at international and political levels, its implementation is likely to fail locally. The willingness of collaboration of all the stakeholders, particularly of the local population, is an essential prerequisite of an integrated management of the water resource. Starting from the stakeholder analysis, the complexity of each local system has become apparent, as well as the difficulty to solve disputes on the use and management of water. Perfect technical plans that take into account the needs of environmental protection for the future generations, may dramatically fail without the consideration of the social environment. In an integrated approach, social sciences must be definitely included in the scope of an ecological assessment. But the opposite is also true: society cannot survive and develop if not

in an healthy ecological environment. The interdisciplinary collaboration must not be unilateral, but reciprocal, if we do not want to make management mistakes, as unfortunately was done in the past.

So the first lesson learnt and take-home message can be derived from the analysis presented in Chapter 2, on wetland socioeconomy (Abdrabo and Hassan). The various compartments, both economic and ecologic, and stakeholders of different importance were analysed for the extremely interesting case of the Lake Maryut in Egypt, at risk of disappearance due to current mismanagements of the lake and fresh water resources. The power of each stakeholder and the economic outcome is likely to determine the fate of the lake. However, scientists can contribute in estimating the actual socioeconomic value of the ecological and landscape components of the system, as well as highlighting the needs of the poor social components that have no voice in decision making.

In Chapter 3, on gender integration in the socioeconomic analysis (Fanini), the dimension of the different roles of women and men regarding the use of water resources, was compared at three of the WADI study sites. The interest of such an approach resulted clearly, but also the difficulty to obtain gender disaggregated data through the usual socioeconomic analyses. The difficulty also resulted to separate the issues linked to water use and management from those regarding the use of other natural resources. Once again the importance of an ecosystem approach including the socioeconomic context, is the main outcome of the WADI approach and can be considered the second take-home message.

Chapter 4 (Martín-Cantarino) deals directly with the environmental conflicts and conflict management. The story telling method introduces the reader into the real case of disputes regarding water use escalating to water conflicts in southeastern Spain. The story starts from water, but ends up in the common conflict between economists (represented here by the local farmers) and ecologists (represented here by governmental authorities advised by ecologists' associations). The role of researchers appears here twofold: they have a knowledge on the importance of biodiversity and need of environmental protection, but at the same time are aware of the role of traditional agriculture in maintaining an healthy ecosystem.

Agriculture and uncontrolled irrigation of crops can have dramatic effects of increasing soil salinity and ultimately starting a process of desertification as was documented for the Grosseto Plain, central Italy, that suffers for unpredictable rainfall of an annual rate below the 500 mm/year (Chapter 5, Zanchi and Cecchi). The issue was analysed along with the recent climatic changes and the urgent stress of taking measures to prevent an irreversible transformation of agriculture soil. The main stakeholders in this case-study are local farmers that take day-to-day decisions over crops and irrigation techniques, and regional authorities that take political decisions over land-uses and the economic development of the area. They are not in conflict, but there is a need of shared awareness over the issue of soil deterioration as a consequence of water quality deterioration. Researchers become definitely key stakeholders with a duty of communication of the risk and possible solutions.

Chapter 6 (Colombini and Chelazzi) illustrates the same area of the previous chapter from the protection point of view. The subject of interest is here the 'Maremma wetlands complex', the remaining water bodies within the cultivated area. The biological value of the wetlands are highlighted and their importance stressed, starting from the geological origin and historical development. The existing conflicts on the uses of water in the area are described and explained considering the past events, the current managements are discussed and the future scenarios presented with a justified concern of the authors for this area of highest natural and cultural value.

To end up, the never-solved conflict is discussed in Chapter 7 (Ciampi) between the two contrasting views, of the 'environmentalists' (and animalists) and the 'economicists'. Both extremisms claim to be the most important stakeholders vis-à-vis of policy makers. Both claim to have the keys of the future. The author illustrates extreme outcomes (scenarios) when environmentalists or economicists prevail in convincing policy makers. Scientists, both the true ecologists and economists, should be made aware of the risks of extreme positions and collaborate for a scientifically sound integrated approach.

The issue remains of communicating messages to those powerful stakeholders who do not welcome them. We are well aware that most of the powerful stakeholders already have precise ideas on what they want to do using their power. We are also aware of the difficulty of intercultural and interdisciplinary communication. But we feel that scientists have a duty of openness with respect to the public that pays taxes to support scientific research and are the eventual receivers of the results obtained through scientific research at their site. This is the reason why we wrote this book. We thank all the stakeholders who participated in the WADI project with their ideas and different attitudes towards the natural and cultural environmental goods.

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Chapter 2
Wetland Socioeconomy: The Case of Lake Maryut (Egypt)

Mohamed A. Abdrabo and Mahmoud A. Hassaan

Abstract Any conflict affecting the wetland areas requires an overview of their regional socioeconomic structure. The search for objectivity involves the use of economic valuation techniques applied to the environmental goods and services the wetland area can supply. The use of such techniques in the case of Lake Maryut enables the authors to observe the following main issues: conflict of interests among the stakeholders; deterioration of water quality; declining area of the lake due to its transformation into crop fields or urban areas; declining fish production; vital function of the lake as a deterrent to the urban expansion of Alexandria City.

Keywords Socioeconomic analysis • Wetlands • Economic valuation • Stakeholder analysis • Environmental goods and services

2.1 Conceptual Framework

2.1.1 Socioeconomic Contexts

The universally known definition of the environment as 'it includes all surroundings, whether natural or man-made', cannot make sense without taking into account the human dimension. This means that socioeconomic environment represents an integral part of the environment, which interacts with other environmental compartments.

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Thus any management efforts of the environment, both physical and biological, cannot make sense without taking into account the human dimension. It seems unreasonable, therefore, to consider impacts only on flora and fauna and not the local population and economy, for socioeconomic conditions are usually affected by the natural environment, which provides a continuous supply of environmental goods and services.[1]

For instance, environmental deterioration could lead to alteration in the social orders including community attitudes and lifestyle. Moreover, unplanned tourism activities may, in this respect, destroy the cultural, natural and landscape values that could be fragile assets of human communities.

Socioeconomic structures may, meanwhile, affect, positively or negatively, the natural environment and its ecosystems through various human activities (Fig. 2.1). This means that the quality of the environment and community welfare are highly interconnected. This is especially important in developing countries, where people are dependent on the natural environment for their subsistence and livelihood. However, the very behaviour of those people often adversely affects the environment they depend upon for their living (Bunce et al. 2000). It is worth noting, nevertheless, that the interrelationships between natural and socioeconomic environments are generally poorly understood and have largely been ignored in project planning and decision making process.

Socioeconomic environment refers to a wide range of interrelated and diverse aspects and variables relating to or involving social and/or economic variables, or a combination of both. These aspects and variables could, in general, be categorised into four groups including: (1) socio-cultural; (2) demographic; (3) economic;

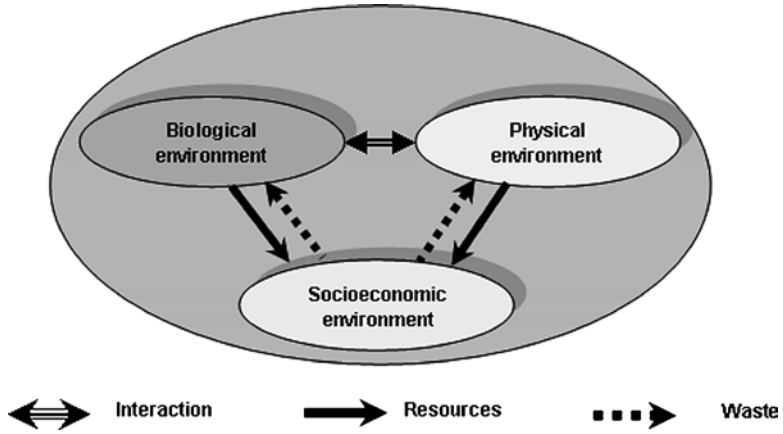

Fig. 2.1 Interrelationships between natural and socioeconomic environments

[1]Environmental goods may include any resources provided by the environment for instance minerals, construction materials, while environmental services are related to environmental ecosystem functions involving for example shoreline protection, biodiversity, recreation and tourism.

and (4) fiscal aspects. Socio-cultural aspects may, for instance, involve issues such as community life in terms of social and cultural attitude, traditions and values, community structure and coherence, cultural properties and archaeological sites. Social aspects may also involve 'housing and community services' such as education, health, police and fire protection facilities, and solid waste disposal. There is also the public infrastructure, including water, sanitation, electricity and roads. Demographic aspects may include population size, age/gender structures, distribution and density. There are also the migration patterns and population trends (for more details, see Intergovernmental Committee 1994).

Economic aspects may include general characteristics of the local economy in terms of structure, employment/unemployment patterns and income generation. There is also the local markets and production patterns (Murdock et al. 1986). Additionally, fiscal aspects are related to public revenues and expenditures including for example different forms of taxation, and spending on infrastructure and social services of local governmental bodies.

It should be kept in mind that better understanding of the socioeconomic context can support a knowledgeable and well informed decision making, with respect to:

- Ensuring efficient use of resources
- Enhancing social aspects
- Protecting human health and safety
- Incorporating environmental values in decision making
- Integrating sustainability perspectives and principles
- Accounting for views and values of community and
- Encouraging public participation in environmental management leading to enhanced feeling of ownership by the end-users

2.1.2 Socioeconomic Structure in Wetland Areas

Wetlands are considered to be amongst the Earth's most productive ecosystems through the various functions they perform; which could be grouped into four categories (de Groot 1992). They include regulation functions, which are associated with the ecological processes contributing to a healthy environment. There is also the carrier functions, as ecosystems provide space for various activities, like human settlement, cultivation and energy conversion. Production functions, meanwhile, through which ecosystems do provide different resources for humans, like fish, fuelwood, timber, rich sediments used for agriculture in the floodplains. Moreover, information functions involve ecosystems provision of scientific, aesthetic and spiritual information (Schuyt 2005).

Wetlands, through such functions, provide a variety of goods and services[2] that support, directly and indirectly, the livelihood of millions of people (Barbier et al. 1997).

[2]It is argued that ecosystem functions are ecosystem functions as long as there are human beneficiaries (Fisher and Turner 2008).

However, there still exists the view that wetlands are 'wastelands', resulting from ignorance or misunderstanding of the value of the goods and services available. This has led governments to see only wetland potentials, which require alteration to ecosystem, for intensive agriculture, industrial and/or residential uses. Furthermore, wetlands have been exposed to various forms of pressures including pollution, waste disposal and landfilling activities.

2.1.3 Economic Valuation of Wetland Functions

It is typically argued that a major reason for excessive depletion and conversion of wetland resources is often the failure to account adequately for their non-market environmental values in development decisions. This means undervaluing wetlands to be lost environmental values, which represents a serious problem when comparing it to land conversion schemes, which is usually associated with marketable outputs. Thus by providing a means for measuring and comparing the various benefits of wetlands, economic valuation can be a powerful tool to aid and improve wise use and management of global wetland resources. The following sub-sections discuss various concepts and techniques related to economic valuation of the environment in general and wetlands in particular.

2.1.3.1 Economic Value of the Environment

It is worth mentioning that, the total economic value of environmental goods and services is the sum of four sub-values including:

- Direct value: which is reflected in the market value of an environmental component (e.g. price of wood in the case of a forest)
- Indirect value: which reflects the functions performed by an environmental component and the indirect benefits that can be derived from it
- Optional value: which is the value of reserving an environmental component for possible use in the future
- Existence value: the value of retaining an environmental component without any possible use in the present or the future

The first three of the above values represent the use value of an environmental component, while the fourth represents the non-use value (Fig. 2.2).

Use values are grouped according to whether they are *direct* or *indirect*; the former could involve both commercial and noncommercial activities, with some of the latter activities often being important for the subsistence needs of local populations in developing countries. Regulatory ecological functions of wetlands may, meanwhile, have important indirect use values. For instance, storm protection may

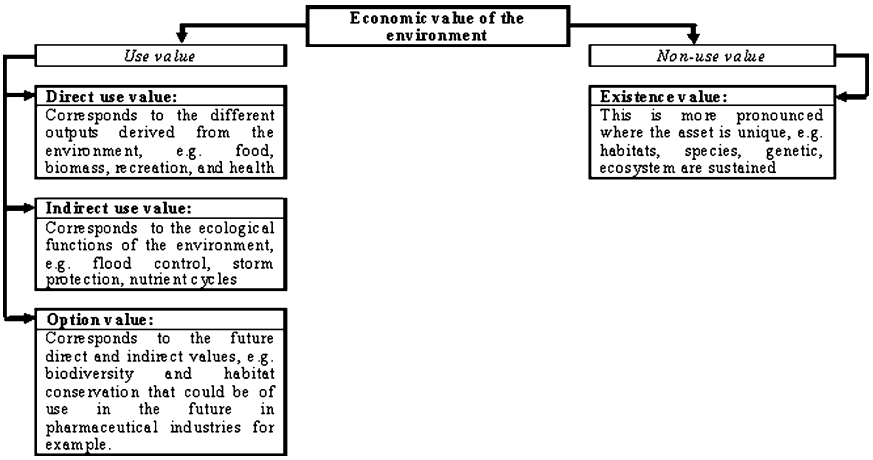

Fig. 2.2 Components of the total economic value of the environment

Table 2.1 Classification of wetland economic value (Cited in Barbier et al. 1997)

Total economic value			
Use values			Non-use value
Direct use value	Indirect use value	Option and quasi-option value	Existence value
• Fish • Agriculture • Fuel wood • Recreation • Wildlife harvesting • Peat/energy	• Nutrient retention • Flood control • Storm protection • Groundwater recharge • External ecosystem support • Micro-climatic stabilisation • Shoreline stabilisation	• Potential future uses (as per direct and indirect uses) • Future value of information	• Biodiversity • Culture/ heritage • Bequest values

have indirect use value either in the form of savings in not having to construct a man-made storm protection or through reducing property damages (Table 2.1).[3]

2.1.3.2 Economic Valuation Concept

Economic valuation means simply eliciting measures of human preferences for or against changes in environmental conditions. It represents an essential step in incorporating environmental considerations into environmental assessment and

[3]It should be borne in mind that the supply of ecosystem goods and services are not monotonous but could be changing overtime (Hein et al. 2006).

decision making, which can provide the potential for more cost-effective public choices, so that limited public funds can be spent to the community's best advantage.

There is a number of techniques available for economic valuation, but the most common is the income and employment multiplier. It works on the basis of an initial income injection into a local economy, that is provided by the wages of direct employees at a proposed installation and any expenditure on local goods and services required for construction and operation of the project[4] (Abaza et al. 2004).

Another aspect of the economic impacts, the secondary impacts, is related to possible impact on the environment and their effects on the environmental services and resources it provides. The difficulty with dealing with environmental goods and services, such as air and water, is that they are not traded in the marketplace and have no prices to reflect their economic value. Thus, it is important, in such cases, to find ways for estimating the economic value of these goods and services.

Economic valuation is of tremendous importance in different contexts, for instance, appraisal of projects or programmes cannot be comprehensive or adequate without economic valuation of their environmental impacts. Also, setting national priorities for environmental policy is better informed if economic values of environmental resources impacts are known with some degree of certainty. Moreover, the entire objective of sustainable development could not be interpreted without some idea of the value of various environmental assets (Fig. 2.3). This means that economic valuation can provide the potential for more cost-effective public choices, so that limited public funds can be spent to the community's best advantage.

2.1.3.3 Techniques of Economic Valuation

In order to estimate the economic value of different environmental goods and services, economists have developed a number of valuation techniques (Fig. 2.4). Each of these techniques has its advantages and disadvantages and cannot be employed generally to deal with every possible case (Pearce 1993). In this context, there are a number of approaches that can be employed for economic valuation purposes, which can be laid in one of four categories, namely, direct and indirect observed approaches, and direct and indirect hypothetical approaches. Observed approaches involve the direct or indirect estimation of value from observations of market behaviour, with the former including market valuation of physical effects, while the later including travel cost, hedonic pricing, avoidance expenditures. Hypothetical approaches base their direct or indirect estimation of value, meanwhile, on responses to hypothetical valuation questions.

- Market Valuation of Physical Effects (MVPE)

The most straightforward way of valuing environmental change is to observe physical changes in the environment and estimate what difference they will make to the

[4] In many economies, increased direct income is either saved or exported from the economy in remittances to family and other kin outside the local area. In this case, the value of the multiplier would be low.

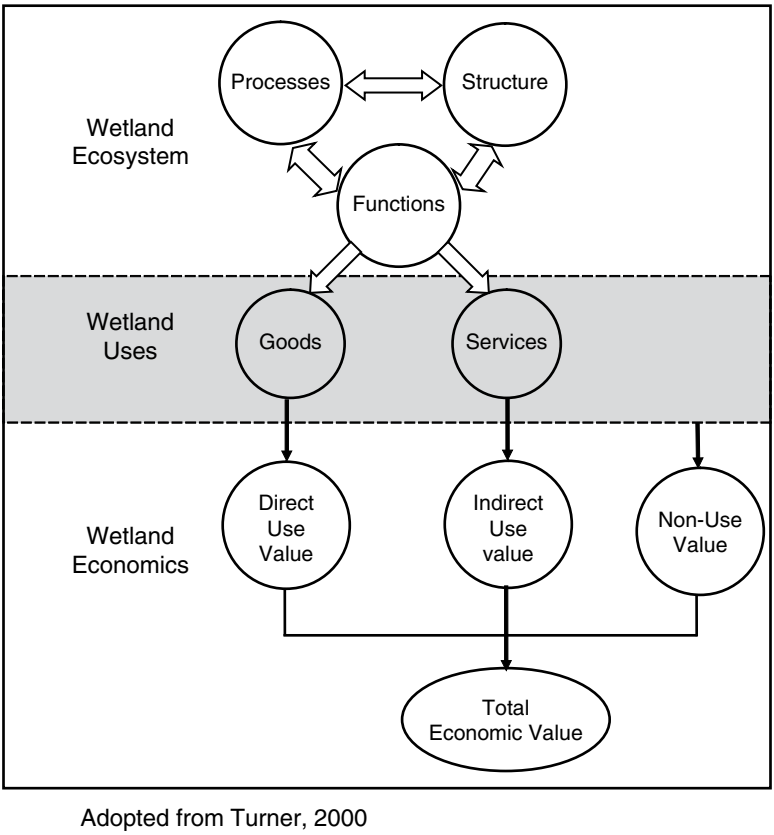

Fig. 2.3 Connections among wetland functions, uses and values (Source: Turner 2000)

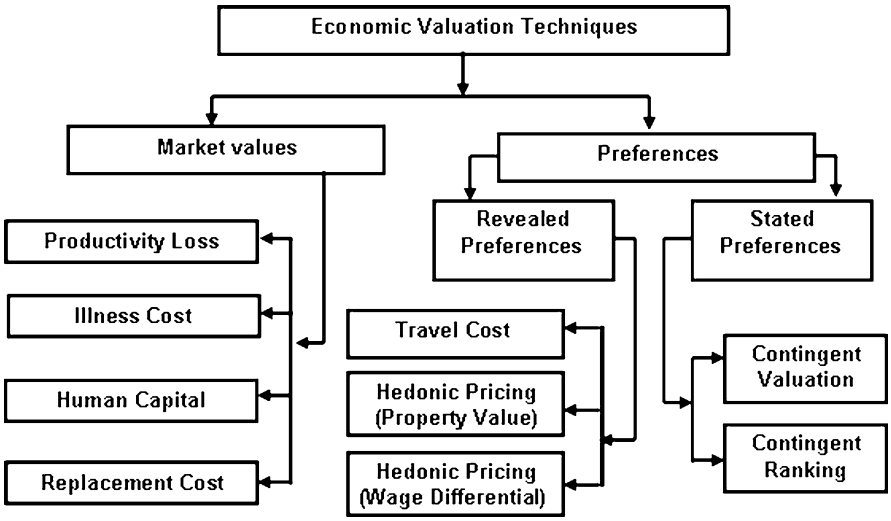

Fig. 2.4 Economic valuation techniques

value of goods and services. For instance, acid rain causes damage to trees and plants, which reduces their market value. Soil erosion reduces the yield of crops grown on site, and may cause downstream farmers and reservoir owners to spend more on removing silt from their property. Within the MVPE category, several techniques are available:

– Under the production function approach, environmental 'inputs' such as soil fertility and air and water quality can be related through econometrics techniques to output, showing how output varies with changes in the various kinds of input.
– Replacement cost method estimates the cost of environmental damage by using the costs which the injured parties incur in putting the harm right.

  Obviously, not all these methods should be pursued in each case; the choice should be made according to:

  • Which type of impacts are more prominent
  • What information is available and feasible and
  • Resources available to the analyst (EDIWB 1995)
  • Hedonic Methods

Hedonic pricing methods are based upon the assumption that goods and services are usually defined in terms of their attributes. This means that the values of these goods and services are the sum of the values of the attributes which they contain. For example, a suit is made up of a number of characteristics, including style or cut, size, fabric type (fibre, weight, and texture), print or pattern, and colour.

The market value of a suit would depend on the set of characteristics it contains, and consumer preference for these characteristics. The values consumer place on a particular characteristic, say fabric type, is inherent in the market value of the suit itself. Two suits would be perfect substitutes for each other, and would have the same market value, if they both possessed the exact same set of characteristics. Likewise, the fewer characteristics two suits contain in common, the more 'imperfect' they are as substitutes for each other, and the less likely they are to have the same market value. The difference in the characteristics that the suits contain, and consumer's preference for these characteristics, explain the difference in the market value of the suits.

When goods or services contain an environmental characteristic the same logic follows – the market value of the environmental characteristic is 'embedded' in the market price of the good or service which contains the characteristic.

The hedonic methods include two valuation techniques: property-value approach, and wage-differential approach.

– Property value and other land values: The property-or land-value approaches rely on real estate prices as an implicit measure of the indirect effects of changes in environmental quality. The theoretical grounds is that people tend, all other things being equal, to prefer homes in quiet, clean neighbourhoods to those in polluted, congested and noisy ones. Accordingly, they are typically willing to pay a premium for a home meeting their preferences.

As market prices for housing reflect the aggregate value that people place on all housing attributes, including environmental ones, the value of the environmental quality is implicit in the housing prices. Such value could be determined by controlling for other relevant housing characteristics, which influence housing prices.

The general approach is to regress housing or land prices on a group of explanatory variables, such as house age, size, design, type of construction, and a number of location variables, including one or more environmental variables such as air quality, or proximity to an environmental amenity. This approach meanwhile requires that there exist a free real estate market and that individual are well-informed about the market conditions in their area of search (Day 2001).

– Wage differential: The wage-differential approach is similar to the property-value approach, except that it attempts to place values on the incremental value of morbidity and mortality associated with certain risk-prone jobs. This information can then be combined with the dose-response functions to estimate the benefit of specific reductions in pollution levels. These functions, derived from epidemiological data, relate the level of pollution exposure to the degree of morbidity – mortality.

Similar to the property value technique, the use of this technique requires well functioning labour markets, with competition, mobility and access to information on job risks. If workers have incomplete information on job risks, this may cause them to misperceive the actual risks and thereby bias the subjective valuations implicit in their wage.

- Travel Cost Method (TCM)

The Travel Cost Method depends on information about the amount of money and time people spend getting to a site to infer a value for that site. Although TC can in theory be used to value almost any non-market good or service; in practice, however, it is only used for the valuation of recreational sites such as parks and beaches. It can also be used to value changes in environmental quality at recreational sites, such as changes in water and air quality.

The premise of TCM is that users travel from various places to spend time at a site. Although no fee is charged to access the site, there is a cost involved in travelling to and from the site. This cost, which is the amount of time and money individuals spend getting to and from a site, can be used to derive a demand function for the site. Once demand has been derived, it is possible to estimate the benefits (including consumer's surplus) associated with the site.

It should be stressed that the cost of travelling to a site is not directly used to value the site. The cost of travel is used to establish the relationship between the cost of travelling to the site and the number of visits to the site. This information is then used to derive a demand curve for the site, by assuming that visitors will respond to increases in admission costs in the same way as they do to increases in travel costs (Boardman and Weimer 1996).

TCM is best used for valuing a single recreational site. Although TCM techniques have improved considerably since the earliest studies were carried out, it has not gained wide acceptance because large data requirements make it a time consuming and expensive process.

Most TCM models take into account a number of variables in addition to travel cost, including, income, education, and alternative recreational opportunities (Dixon et al. 1994).

- Contingent Valuation Method (CVM)

Contingent Valuation Methods are used to obtain values for non-market goods or services. It is a survey technique that attempts to elicit information about individuals' (or households') preferences for a good or service by asking an individual a question or a series of questions about how much they value a good or service.

Using CVM involves three steps: (a) Designing and conducting a CV survey to elicit individuals' values for a good or service, (b) analysis of Willingness To Pay (WTP) responses, and (c) estimation of overall benefits or costs associated with existing conditions.

A CVM questionnaire typically has three parts: (a) a detailed description of the environmental situation being valued, (b) a series of questions about the socioeconomic and demographic characteristics of the respondent; and (c) one or more questions that determine how much the respondent is willing-to-pay for the good or service if confronted with the opportunity to obtain it under the specified terms.

The most important concern when employing CVM is the high risk of receiving biased answers. Such bias include: (a) strategic bias, (b) information bias, (c) starting point bias, and (d) hypothetical bias (Table 2.2).

2.1.4 Towards an Integrated Socioeconomic and Ecosystem Perspective

Wetlands management is considered to be an issue of great importance not only for environmental conservation sake, but also for the benefits and livelihood support they provide to population. Wetlands, meanwhile, are threatened by a variety of factors including poverty and economic inequality; pressure from population growth, immigration and mass tourism; and social and cultural conflicts (Kontogianni et al. 2001). Such conditions are compiled by ignorance or misunderstanding of the value of the goods and services supplied by wetland ecosystems.

Table 2.2 Values of environmental goods and services and their preferred valuation techniques (Moons 2003)

Value	Preferred valuation techniques
Direct use – recreation	Travel cost method Contingent valuation method
Direct use – hunting, timber	Market values (prices)
Indirect use – ecosystem functions	Production cost function Dose-response function Damage function Contingent valuation method
Option value	Contingent valuation method
Non-use value	Contingent valuation method

This means that economic valuation of these goods and services could contribute to more informed policy and decision making. However, the essence of overall socioeconomic valuation of wetland ecosystem functions is not only to quantifying such functions. Rather, the main issue of concern is to determine how society is affected by such functions. This means that economic analysis, as suggested by Turner et al. (1998), should take into account the influence and the range of relevant stakeholder interests.

2.2 The WADI Experience on Maryut Study Site

2.2.1 Socioeconomic Contexts: A Background

Lake Maryut is one of the northern Egyptian lakes, located in the north western coast of Egypt. The lake extends for 80 km along the north-western coast of Alexandria and 30 km south and is divided into a number of basins by highways and railroads. In contrast to other northern lakes in Egypt, Lake Maryut is a closed lake, not connected with the sea. The average depth of the lake ranges between 0.55 and 1.2 m. The level of water surface is −3 m compared to Average Sea Level.

The area of the lake extends for about 20 km between 31°01′48″ and 31°10′30″ North and 29°49′48″ and 29°57′00″ East. The lake is divided into four main basins; Main Basin, Southeast Basin, Southwest Basin, Aquaculture Basin (Fig. 2.5).

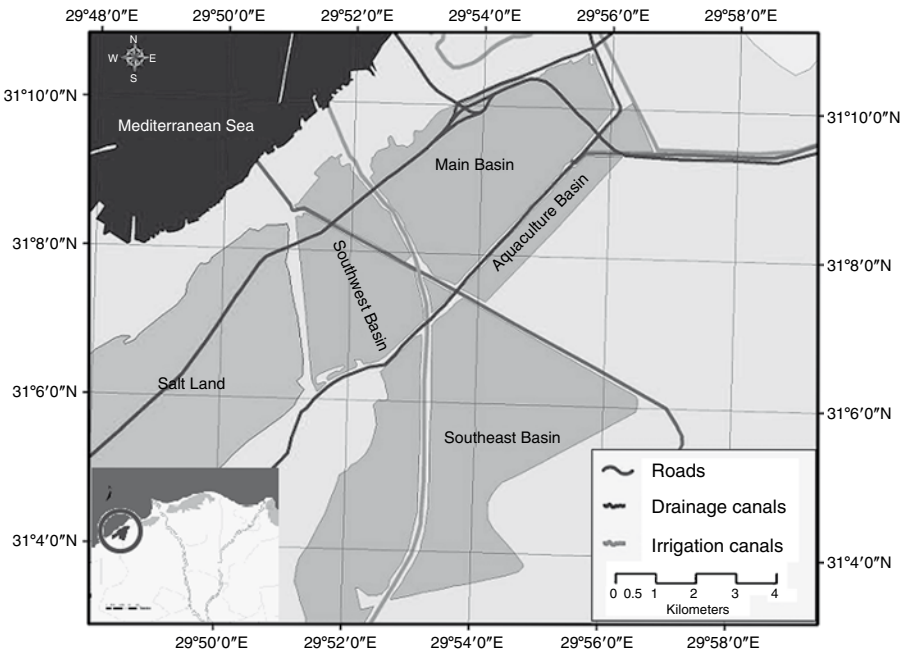

Fig. 2.5 Main basins of Lake Maryut

Nearby the lake there is a wide area of newly-reclaimed land which includes a number of human settlements, mainly rural. Most of these settlements discharge their domestic wastewater (sewage) into irrigation and drainage canals, which discharge their water ultimately into the Lake through El Qallah Drain. Also there is an industrial complex nearby the Lake (mainly petrochemical industries), these industries discharge industrial wastewater into the Lake after some sort of treatment.

2.2.2 Main Issues

The main issues in the case of Lake Maryut can be concluded in three issues including:

- Conflict of interest among stakeholders

The area of the Lake is supposed to be managed according to Law 124 of 1983, which states that the General Authority of Fisheries, Ministry of Agriculture, is the main agency responsible for managing water bodies (Article 2). The law also states that it is forbidden to discharge industrial waste water, pesticides or any similar toxic or radioactive compounds into the water (Article 15) and to fill up or drying any parts of the lake (Article 20). Law 4 of 1994 'Law of Environment', meanwhile, assigns the responsibility of protecting the environment and monitoring the discharges of various activities into the environment, including water bodies, to the Ministry of State for Environmental Affairs.

Lake Maryut involves a large number of stakeholders, at national and local levels with sometimes conflicting interests (Fig. 2.6). At the national level, four main stakeholders were identified including; the Ministry of Irrigation and Water Resources, which sees the lake as a contingency place for disposing of agricultural wastewater and thus interested in keeping the level of water in the lake as low as possible. There is also the Ministry of Agriculture, represented by General Authority of Fisheries, which attempts to attain effective use of Lake for fish production through proper management of the lake for instance in terms of higher water levels and quality, area preservation and vegetation cover control, etc. The Ministry of Housing and Reconstruction has been interested in development schemes in the Lake vicinity including for instance the construction of a number of new roads across the lake. This has led to further subdivision of the Lake into small basins; some of which are drying up as they are totally disconnected from the Lake area. The Ministry of State for the Environment is the main government agency responsible for protecting and improving the environment, including wetlands, in Egypt. However, the Ministry does not have enough power to effectively protect the Lake and improve its environmental quality. It could be argued accordingly, that each of these stakeholders, though all are government bodies, have different interests

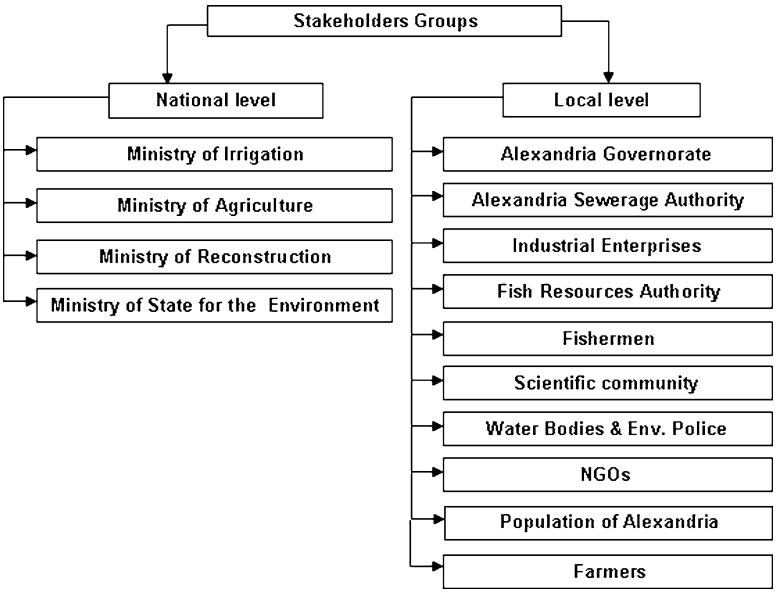

Fig. 2.6 List of stakeholders groups at both national and local levels

and visions, mostly conflicting, for the lake. Thus, large part of the problem lies with these governmental bodies and shed doubts on their ability to protect and manage the Lake. Moreover, such a trend is expected to continue as it was found that Alexandria Governorate adopted a development strategy that call for environmental rehabilitation of the lake (Alexandria Governorate 2007), while attempts to landfill parts of the lake, by government and private bodies, are still on-going.

The main stakeholders at local level, meanwhile, include a wider diversity of bodies, with Alexandria Governorate being interested in providing land for rapid urban expansion both for residential uses and creating investment opportunities. Despite the Governorate, as typically stated by local officials, large-scale land filling activities are actually carried out by governmental bodies, supposed to protect the Lake area from illegal land filling activities. There is also Alexandria Municipal Wastewater Authority, responsible for the collection and proper disposal of wastewater, which dumps more than 300,000 m^3 of municipal mostly untreated or primarily treated sewage water mixed with irrigation wastewater into the main basin of the Lake, through El Qallah Drain.

Such conflicting interests represent one of the main causes of environmental quality deterioration experienced in the Lake. There is also the Water Bodies and Environment Police, which is responsible for protecting the water body of the Lake and its vicinity through the enforcement of the Law 4 of 1994 'Law of Environment'. Despite their executive powers, this body is suffering from limited financial and human resources.

A number of nearby industrial firms are either discharging their untreated industrial wastewater into the Lake or using the Lake water for cooling purposes. Due to ineffective enforcement of environment law and the connections of these industries, this group has been away from the arms of the law but unfortunately has highly negative attitude towards the Lake. The fishermen and fish traders, meanwhile, have been on the losing end of the equation losing their livelihood due to deteriorating quality of water. Their voices are not well heard as they have been socially excluded and politically powerless.

The scientific community, represented by Alexandria University with its various academic institutions, have been involved in conducting diverse research work on the Lake. However, this group, despite of its positive interest and supportive attitude towards the Lake, has been largely interested in the Lake for scientific purposes. Local non governmental organisations (NGOs) are interested in protecting the environment and supporting the common causes of the population of Alexandria but have limited political, financial and human resources.

In addition to above-mentioned groups of stakeholders there are the farmers living and working in the area located to the south of the Lake. There is also, the population of Alexandria in general who have a stake in its natural resources, including the Lake, but are not aware of the potentials of such an ecosystem.

Based on the above analysis of the stakeholders and their interests in the case of Lake Maryut, it could be argued that the conflicting agendas of different government bodies are not helping the Lake case. Such conditions, is amplified by the fact that various stakeholders have different attitude and interests as well as have different levels of power and financial political and human resources. Furthermore, the absence of cooperative approach between various stakeholders leads to further deterioration of environmental quality of the Lake.

- Deteriorating physical conditions of the Lake
- Deteriorating water quality

The Lake has been receiving, since the mid-1980s, considerable quantities of untreated or partially treated industrial, agricultural and municipal wastewater. Thus, water quality of the Lake has declined considerably, despite partial treatment of some discharged industrial and municipal wastewater. This has been the case especially in the case of the Main Basin of the Lake, which is bordered by highways from three sides and by the Nubaria Navigation Canal and El-Umum Drain from the west side (Fig. 2.5). The basin receives heavy industrial and domestic untreated wastewater, primary treated domestic wastewater and agricultural wastewater (El-Bestawy et al. 1999). For instance, some 300,000 m^3 of untreated municipal and irrigation wastewater, through El Qallah Drain, is dumped daily into the Main Basin. This in addition to the uncontrolled dumping of industrial wastewater located to the north of the Lake (Table 2.3).

One of the main pollution problems in the Lake has been the high concentration of heavy metals, the most obvious of which is Lead, which was found to be considerably higher than recommended standards. This pollution problem has been highlighted by a number of research literature suggesting high degrees of bioaccumulation of this

Table 2.3 Pollution levels in Lake Maryut (Source: Field work conducted in March 2007 by Centro de Estudios Avanzados de Blanes, Spain, WADI project)

Pollutant	Maximum	Minimum
Oxygen (mg/L)	127.51	0.9
Oxygen (%)	16.8	0.05
pH	8.54	6.8
Ammonium (mg/L)	118.68	0.07
Nitrate (mg/L)	15.96	4
Nitrite (mg/L)	0.63	0.02
Chromium (mg/L)	0.17	0.012
Lead (mg/L)	9.72	1.2

dangerous pollutant in the fish of the Lake. It was suggested, in this respect, that the fish caught, mainly from the Main Basin, is usually contaminated with heavy metals and other pollutants affecting it suitability for human consumption. It is worth mentioning that the heavy metals pollution problem is also associated with the accumulated heavy metals accumulated over the past couple of decades into the Lake sediments.

As a result of deteriorating water quality of the Lake, fishing activities have been experiencing steady decline in quantity and quality of harvest.

- Declining area of the Lake

In spite of the existence of adequate legal framework and a number of implementing agencies (see Section 2.1 above), such legalisation has never been effectively implemented to control illegal land filling and polluted wastewater in the Lake. The area of the Lake has been declining over the past couple of decades due to filling in activities to acquire land for urban development of Alexandria City and the construction of the highway across the Lake. For instance, it was found that Lake Maryut has experienced a noteworthy decline, of about 3.24 km^2 representing about 4.63% of its area, during the period 1984–2002. This decline in the area of the Lake was found to be uneven between various basins of the Lake, with the Main and the Southeast Basins experiencing the largest decline in absolute terms compared to other basins. For instance, about half of the overall decline in the Lake area occurred in these two basins, which lost 1.59 and 1.13 km^2, respectively. This could be mainly due to that the location of Main Basin that is adjacent to built-up area of Alexandria City. Also, the Southeast and Southwest basins have declined by about 0.32 and 1.13 km^2, respectively.

It could be argued that, this reduction in Lake area, can be attributed to the land fill up activities for land acquisition purposes. For example, the area of the Lake adjacent the entrance of Alexandria City, was filled up by Alexandria Governorate and sold to private investors for the purpose of developing a commercial centre and upper class residential compound in addition to some other activities. Furthermore, other forms of encroachment on the Lake body, undertaken this time by the central government, took the form of the construction of a highway across the Lake body. This highway, called 'Mehwar El Taameer', was erected on the Lake body in

2002–2004 with a length of about 13.2 km of roads.[5] This, it could be suggested, shows that large-scale land filling activities are actually carried out by governmental bodies, supposed to protect the Lake area from illegal land filling activities. Thus, large part of the problem lies with these governmental bodies and shed doubts on their ability to manage and interest in protecting.

Moreover, such a trend is expected to continue as it was found that Alexandria Governorate adopted a development strategy that relies on more encroachment on the Lake body.

It could argued that such a decline in Lake area means not only loss of socio-economic and environmental goods and services, but also the viability of the Lake ecosystem itself. These services include preventing intrusion of salt water to the aquifers and agricultural fields surrounding the Lake. Also, the Lake has a role in adjusting the climate of Alexandria. Moreover, the Lake is considered as an ecosystem, which is a habitat for various species. The next sub-section represents economic valuation of one of the main functions of the Lake.

2.2.3 Economic Valuation of Lake Ecosystem

It is typically argued that a good starting point for an informed policy and/or decision making concerning an environmental resource is to identify the benefits associated with this resource. In the remaining part of this section, an attempt is made to identify different ecosystem goods and services being produced by Lake Maryut. Thereafter, an estimation of the economic value of the ecosystem goods category Lake, in an attempt to the show its real economic contribution, is made. For that purpose a complete list of different ecosystem functions as well as the goods and services of the Lake, was developed. The list included for example fish production and potentials for developing recreational and tourism activities in the Lake. Thereafter, the potentials for employing different economic valuation techniques were employed in an attempt to value such goods and services were assessed.

It was found, in this respect that the values of some of these services were quite difficult to estimate; for instance adjusting local climate of Alexandria City. Moreover, some valuation techniques were not applicable to the case of Lake Maryut, for instance, travel-cost approach, as it requires that the sites to be valued should be unique in that people would be travelling from different places to it so that a demand function for it could be derived, which is again not the case for Lake Maryut. Similarly, the Hedonic-pricing method requires the presence of a free functioning market of real estates and that either records of these real estate values before and after pollution or of similar areas that could be used as control cases are available.

[5] This is the length of roads only crossing the lake.

Yet, none of these conditions were found to exist in the case of Lake Maryut. It could be suggested, therefore, that this paper, in this context, could be seen as setting the bases for more comprehensive work on estimating the total economic value of the Lake.

2.2.3.1 Market Value of Fish from the Lake[6]

In general, fishing activities is one the most dominant economic activities in Lake Maryut, which made the Lake an enormous source of fish production in terms of quantity and quality. There is, also, the aquacultures, which occupy large areas of the Lake.

According to recent statistics, there are 2,073 fishing boats in the lake and 20,000 fishermen. Taking into consideration that the average family size is 4–5 persons, this means that about 100,000 inhabitants rely on fishing activities in the Lake to earn their livelihood.

Fish production from the lake, has experienced considerable decline over the past 2 decades (Fig. 2.7), that is since domestic wastewater, and thereafter, was accompanied with illegal industrial wastewater being disposed of directly in the Lake, was first dumped in it. This presented severe signs of environmental degradation including for instance: lack of oxygen, discolouration and algal blooms (EEA 2006).

Such production have seen, over this period, two peak quantities, the first in 1986, where fish was caught by the pollution and in its attempt to avoid pollution was easily caught by fishermen. The second was in 1999–2000, when some low

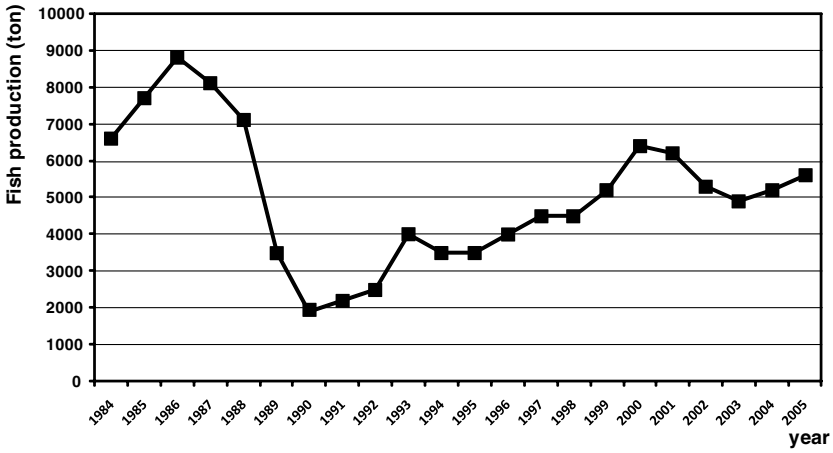

Fig. 2.7 Fish production (1984–2004) (Source: Fishery Resources Public Authority)

[6] This include both fish catch and aquaculture production.

cost measures were taken to divert domestic wastewater from coming into the main basin. However, these measures were half way abandoned due to conflicts between different governmental bodies and thus production started to decline again. In addition to the effects on quantities of fish caught, the quality of fish was also deteriorating as it became contaminated with various pollutants, the most serious of which is heavy metals (for more details see for example EEA 2006; Saad 2003).

According to the market price of fish in 2005, the average price for a tonne of fish was about L.E. (Egyptian Pounds) 7,500. The total market value of the fish production from Lake Maryut in 2005 was about L.E. 42,000,000. This means that the average annual value of fish production per Acre equals to L.E. 2,545.

- Market value of fish = *Average price* × *Quantity* = 7,500 × 5,600
- Total Market Value = L.E. 42,000,000
- Average annual value of fish production per Acre = L.E. 2,545

Concerning the decline in Lake area due to land filling activities that took place between 1984 and 2002, it was estimated to be about 800 acre. Additionally, some 1,176 acres are threatened to be dried up and lost as they are totally cut from the Lake system by the establishment of new roads crossing the lake body. This means a total loss of about 1,976 acres of the Lake and consequently the loss of annual fish production, due to area decline, is estimated to be about L.E. 5,028,920.

- Lost annual fish production due to area decline = $A \times B$

  Where:

  A = Average annual value of fish production per acre
  B = Lost area between 1984 and 2002

- Lost annual fish production due to area decline = L.E 2,545 × 1,976 Acre = L.E. 5,028,920

Such a decline in fish production was of concern to fishermen, in a survey conducted in 2007, who suggested that the average daily fish catch in the past the fish catch ranged between 10 and 30 kg. Average daily catch nowadays, again as stated by the fishermen, did not exceed 10 kg despite the extra efforts they had to put into fishing (Fig. 2.8).

The total economic value of fish production from the lake, based on above estimates, assuming 5%, 7.5% and 10% discount rates, equals to L.E. 84,000,000; 56,000,000; and 420,000,000, respectively. The present value of the foregone fish production due to land filling and drying activities, assuming again 5%, 7.5% and 10% discount rates, equals L.E. 100,580,000; 67,040,000 and 50,290,000, respectively. This means that the total economic value of returns on fish production, including lost production due to land filling and drying activities, range between L.E. 470,029,000 and 940,578,000. It is worth mentioning in this respect that these estimations undervalue the value of fish production from the Lake, which could have been higher if optimum conditions in the Lake, in terms of water quality and depth, were maintained.

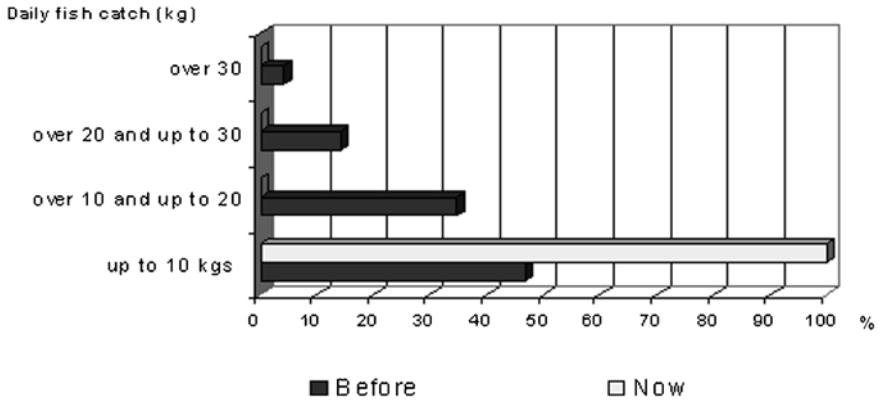

Fig. 2.8 Change in fish catch

The decline in fish production, as a primary impact to pollution and land filling, has had secondary impacts in the form of lost jobs either as fishermen or those working in the supporting sector, for example marketing and boat maintenance and consequently their households livelihood. In order to assess the socioeconomic conditions in Lake Maryut, a wide range of data was collected through a field survey. For that purpose a preliminary questionnaire form developed and used in conducting a pilot survey covering a relatively limited number of cases in the area of Lake Maryut and its surroundings.

Due to the fact that the Lake is supporting the livelihood of thousands of people in its vicinity the decline in fish catch does not only affect fishermen but also those working in supporting jobs, for example salesmen, transportation, etc. The fishermen and associated workers may be seen as vulnerable groups that have high illiteracy rate and low skills to be able to seek other jobs. They also have no social security[7] or health insurance. Such conditions have led, according to the socioeconomic survey conducted in 2007, to as many as half of the fishermen's children to drop-out from the education system as they did not afford schooling costs and/or support their by working in the informal sector.

2.2.3.2 Value of the Lake Function as a Deterrent to Urban Expansion

The urban expansion in Alexandria City amounted, during 1972–2002, to 29.76 km^2. Also, it is noticed that the various administrative sections of the study area did not expand equally in temporal and spatial scales. At spatial scale, the old inner

[7] It was suggested that fishermen receive the monthly retirement from the Fishermen Society was no more than 70 L.E.

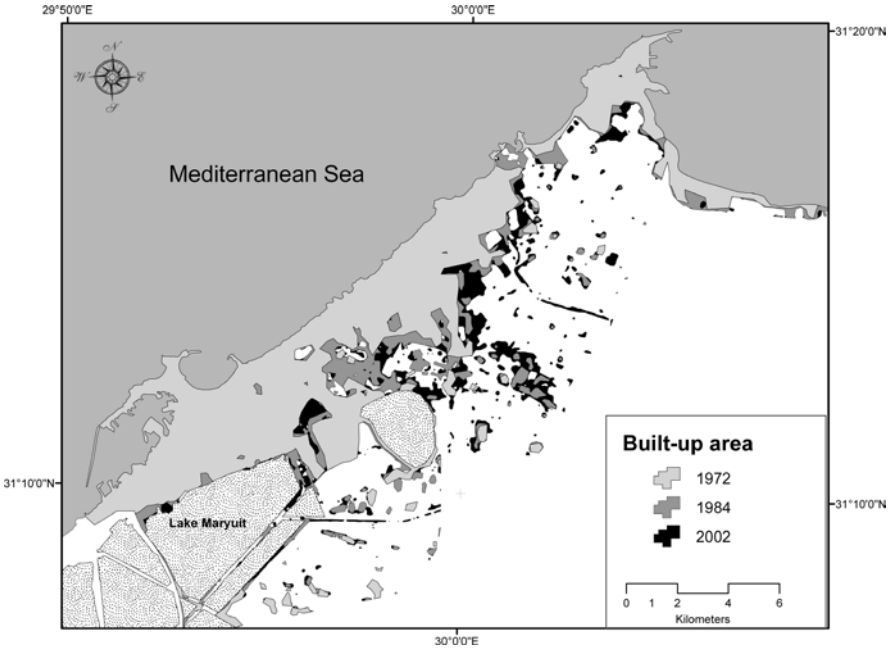

Fig. 2.9 Urban expansion in Alexandria over the period 1972, 1984 and 2002

section of the city such as El Attareen, El Laban, El Manshia and El Gomrok did not experience any expansion during the period between 1972 and 2002. Other sections, which have rural fringe, experienced considerable expansion at rates ranging between 2.12% and 49.89% during the period 1972–1984 and between 1% and 28.10% during the consequent period 1984–2002 (Fig. 2.9).

From a temporal perspective, the same sections which experienced varied expansion rates at different periods of time, for instance, the built-up area of Sedi Gaber section expanded rapidly during the period 1972–1984 (49.89%), thereafter, its expansion slowed down in the consequent period 1984–2002 (9.75%). Generally, this was the case in most sections that experienced expansion of its built-up area. The only exception was in the case of Montazah section which maintained high rate of expansion in the two consequent periods of time.

The derived size of the expanding areas in Alexandria City is then regressed against distance from city centre, area of adjacent section and population in adjacent section. Table 2.4 shows the results of the Ordinary Least Square (OLS) linear model statistical analysis of urban expansion in Alexandria City. It was found according to this analysis that the distance to the city centre and the area of adjacent section were of the right sign and significant at 5% and 1% significance levels. The population size in adjacent area was, meanwhile, found to be insignificant (Table 2.4).

Table 2.4 Statistical analysis of the OLS linear model of urban expansion in Alexandria City. Standard error is reported in parenthesis

R-Sq 68.8%	
R-Sq (adj.) 63.9%	
Variable:	
Intercept	1.6934 (0.7601)**
Distance to city centre (km)	–0.06436 (0.02714)**
Area of adjacent section (km^2)	0.10775 (0.03699)*
Population size of adjacent section	-832×10^{-8} (432×10^{-8})

* Significant at 1% significance level
** Significant at 5% significance level

The regression equation is:

$$E = 1.69 - 0.0644D + 0.108A - 0.000008P$$

Where:

E: represents the expanding area by section (m^2)
D: is the distance from that section to the city centre
A: area of the adjacent section
P: is the population size of that section

This represents a rough estimate of urban expansion experience in Alexandria, which is considered to be a reasonable means to assess urban expansion pressures in the Lake direction. Yet, further in-depth study of the, economic and socioeconomic factors influencing urban expansion in terms of magnitude, nature and directions is need to provide a more precise assessment.

The estimation regression equation is then utilised in projecting urban expansion in the vicinity of Lake Maryut, over the same duration, assuming that the Lake did not exist. According to this equation, the total area that could have encroached on in the Lake vicinity was found to be 7.3 km^2. It could be argued that such an impact is magnified by the fact that all parts if the Lake are located within a range of 3–19 km from city centre.

Yet, the valuation focuses on the potentials for urban encroachment on agricultural land located behind the Lake, which is located behind the 6 km distance from the city centre. This is because agricultural land starts to appear in the satellite images after that distance from the city centre. It is estimated, using the above mentioned equation for urban expansion that the area that could have been encroached on in that region, if the Lake was not present, equals to 6.44 km^2, which is about 1,465 Feddans (1,533 acres) (Fig. 2.10). The market value of this area, assuming a price per Feddan of L.E. 100,000, is estimated to be about L.E. 147,000,000. It is worth mentioning that this value does not include the value of the Lake area itself, but rather its function as a barrier to urban expansion.

It should be mentioned that such an economic valuation based upon a rough estimate of urban expansion experience in Alexandria, which is considered to be a reasonable means to assess urban expansion pressures in the Lake direction.

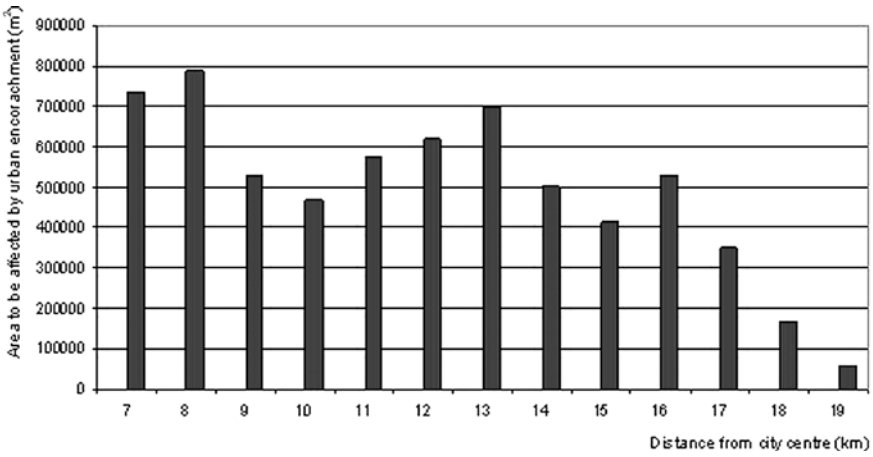

Fig. 2.10 Estimated urban expansion experienced in Alexandria City at different distances from the city centre (1972–2002)

Yet, further in-depth study of the, economic and socioeconomic factors influencing urban expansion in terms of magnitude, nature and directions is needed to provide a more precise assessment. Such an analysis would require the inclusion of other factors such as the improvement of infrastructure and city function, the promotion of industrial technology and the increase of service industry.

2.3 What Should Be Done?

In the shadow of various stakeholders' and conflict in their interests, Lake Maryut has been subject to a wide ranges of pressures. In such a situation there should be a twofold strategy to deal with the issues of concern in the Lake. A short term strategy needs to focus on preserving the Lake area and prevent further deterioration of its conditions. Such a strategy would require the establishment of a powerful institutional setup for the Lake involving main stakeholders. It is worth mentioning that this setup can only succeed in its mission with a clear and precise mission and executive powers. This setup need to have adequate human, political and financial resources to be able to manage the Lake and strike a balance between conflicting interests of various stakeholders.

The long term strategy, meanwhile, should aim at improving the environmental quality of the lake. Firstly, the initiated agency that will be responsible for the Lake has to develop a list of possible strategic scenarios for improving the environmental quality of the Lake. Economic, social, technical and environmental feasibility of each of the proposed scenarios should be assessed. It should be noted that such scenarios should be adopted through a comprehensive dialogue among various stakeholders, including the general public and beneficiaries, including fishermen. The adopted scenario should spill clearly the roles and responsibilities of all stakeholders involved.

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Chapter 3
Integration of the Gender Dimension into Socioeconomics Analysis

Lucia Fanini

Abstract Men and women carry out different and complementary activities, specially if we consider rural environments. The environmental resources are therefore differently used and perceived with respect to gender, and different needs may emerge. To achieve equality conditions, these features should be considered in a constructive way and in an integrated perspective, avoiding gender segregation also in the theoretical perspective. Women activities and duties are often related to the domestic sphere and, even if essential to the household, generally do not generate money flow, so they may escape the socioenomic approach. A tuning is needed, to give voice to all social components, also considering their different (in space, time, status, power, etc.) scales. This chapter synthetically illustrates how the challenge of gender integration in the socioeconomic analysis was faced throughout the WADI project.

Keywords Gender And Development (GAD) • Rural environments • Traditional activities • Empowerment

3.1 Introduction

In socioeconomic analysis, there is an emerging need of an integrated analysis and management of resources. The integration of gender aspects is a further step required to deal with the correct representation of complex environmental systems in their broad sense, that is including natural and human socio-cultural diversity. With the idea that diversity is richness, knowledge about gender issues should be

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used to identify intrinsic values of the contexts and should represent a background for potential development. This is true at multiple scales, but at the local scale (i.e. the community level) it is particularly important that different social components, such as men and women, are linked in different ways to environmental resources. Therefore, the different social components can be differently affected by management choices, current policies or trends of change. In agreement with the Gender And Development (GAD) approach, integration of the gender perspective is not intended merely as the collection of gender disaggregated data or the collection of 'data regarding women'; it involves a strategy for data collection and data analysis tuned to each study site, to achieve an overview of the situation of men, women, environment and their relationships.

Within the WADI project, aimed at building scenarios of sustainability, the final goal of the gender analysis was the identification of challenges towards empowerment (following Millennium Development Goal 3: Promote gender equality and empower women), keeping in mind that the empowerment of people is the consequence of a social, economic, political and legal balance between the different social components regardless of their ability to generate money flow. In particular, rural environments are strictly linked to the ecological framework, as people not only depend directly on agriculture and/or fishing but also on activities, such as rural tourism, based on the attractiveness of the landscape, which is shaped by the local inhabitants. In such a fragile equilibrium, the path to sustainable development can receive many inputs from the integration of gender issues by means of an identification of the key roles and the potential of empowerment.

The identification of needs is a key feature of the gender approach. Two kinds of needs can be identified when carrying out an analysis: practical needs and strategic needs. The first are immediate and easy to identify, and they often differ among women within the same context. The second are long-term, shared by the majority of the female component (as they are linked with subordination and vulnerability), and often difficult to identify, even by the women themselves. One practical example could be women's concerns on water sanitation (immediate need) and women's concerns on environmental sustainability (strategic need). Scenarios are based mainly on the satisfaction of strategic needs. Yet, no strategic needs can be satisfied without a sound background in which immediate needs are fulfilled. The interconnection between these two kinds of needs can be represented by the people's awareness and willingness to change. Therefore, in our analysis, we looked at education (both traditional and supplied by school and technical training of adults) and at sensitivity to water-related issues as a proxy of potential changes.

While the availability and use of services was easy to identify, the willingness to change towards empowerment remained the most critical issue. As the willingness to change is related to different sensitivity and concerns, we tuned the analysis tools to the different WADI study sites, looking to identify different (gendered) issues of sensitivity. By integrating this gender perspective, WADI aimed at building scenarios of sustainability.

3.1.1 The Water Issue and the WADI Contribution

Different roles of men and women, as well as gender-based activities, can be highlighted within each context. The differences become particularly evident if we take into account the water issues (UNDP 2006), the main WADI theme. Acting on immediate needs related to water does not ensure empowerment: different studies have shown that women who gain access to water do not automatically engage in activities that strengthen their empowerment (UNDP 2006; Ivens 2008). This gap can be filled if we consider that it is not access to water per se that drives changes in the network of men – women – environment relationships; equality of access and control over resources is the background for gender equality (mainly defined by empowerment of women). Information about imbalances (current or related to possible management choices) integrated in an overall scenario will be the WADI contribution to gender equality at the study site level, aimed at facilitating the shift from satisfaction of immediate needs to satisfaction of strategic needs.

We focused on transitional situations rather than static ones, as dynamic contexts often open possibilities of more profound changes. A common thread connecting the study sites is the rural context, in which agriculture is still the main influence on both the socio-cultural and ecological environment, connecting people, land and water. The sustainability of the local life-style, the maintenance of traditional cultural characteristics, the achievement of gender equality and protection of the environment are deeply interconnected in rural zones and cannot be considered separately.

In agriculture, water management is intended mainly as irrigation, for which both the water quantity and quality (affected by salinisation or pollution) may be an issue of concern. In the domestic sphere and related activities (typically female), water management ranges from water supply (with particular attention to quality) to wastewater discharge and treatment (Hamdy 2005). Each of these aspects may generate conflicts but also may contain solutions, in terms of everybody's right to equal representation, if the correct challenge is adequately faced.

3.1.2 Gender Approach: From an Overall Methodology to the WADI Case-Studies

The WADI project was based on a case-study approach, which implies consideration of intrinsic variety, reflecting the variety of traditions and cultural aspects in the Mediterranean area. Hence, the challenge was to match the socioeconomic gender approach with the peculiar aspects of each study site in order to represent a complex system starting from bottom-up information collection. The collected data had to go beyond gender-disaggregated data, as these latter approaches, albeit essential, are often biased due to the methodology and timing of data collection (an example in Box 3.1). This issue was faced throughout the Socio-Economic And Gender Analysis Programme (SEAGA) methodology developed by FAO in 1993

Box 3.1. An example of gender bias in data collection

Frequentation of the sandy beach of Oued Laou was studied by two researchers (a man and a woman) who evaluated the density of people in the different beach zones and asked visitors questions on their socio-economic profile, region of origin, fidelity to the site, satisfaction with the availability of services and willingness to pay for site quality. Visitors were found in groups (families or friends) with mainly six people per group. According to the protocol, one questionnaire was administered per group. As previous experience had indicated that many people frequented the beach in groups, many questions were fitted to the group size (e.g. including the requirement of specific details for the other group components). What was the profile of the person effectively responding to the questionnaire? Most of the answers were supplied by men (80%) on average 33.5 years old. However, since this profile does not reflect the variety of people spending their time on the beach, there is a need to pay attention to the proper fitting of questions, targets and methodologies to the context.

Khattabi et al. (2005)

(FAO 2009a), aimed at facilitating the representation of women's voices. Given the complexity of the issue, the scale of the analysis is important, so as to allow a proper understanding of the system at its multiple levels. Thus, SEAGA proposes a set of tools for three main levels: field, regional, macro.

The water issue (FAO 2009b) was the main driver of our analysis, which connected the different agro-ecosystems considered using the SEAGA methodology for the field level. The background for the integration of gender aspects was tested in the field to achieve a proper adaptation to each study site, while the socioeconomic background was used to establish the strata and the categories, such as urban versus rural population, the main sources of income, etc., to be represented in the surveys. Households were considered the sampling units, with a two-fold perspective towards the activities carried out inside the household and outside the household. Access to services, including education, was analysed and the perception of water-related problems was investigated as a proxy of willingness to change. This complex set of characteristics, fitted to the delicate local network of men – women – environment relationships, led us to use non-probabilistic methodologies for the data analysis.

Moreover, two peculiar main points were taken into account: (1) as major differences between genders play a role in the transmission of traditional activities (typically female) and the carrying out of rentable activities (typically male) (Howard 2003; Momsen 2007), we included one traditional rentable activity in each site considered; (2) the presence of a natural protected area often has, or is claimed to have, a positive influence on the whole issue, by assuring the quality of environmental resources, improving traditions and making such processes rentable. Thus, the effects of the vicinity to natural parks were considered.

The following case-studies were analysed:

3.1.2.1 Italy: the Ombrone River Low Plain and 'Agritourism' (In-Farm Vacations)

Consistent with European programmes on rural development, 'agritourism' is regulated by law (Italian law 96/2006) as the hosting of tourists by farmers (single individuals or associations). The aim is to increase external sources of income to supplement, but not substitute, farming activities. Agritourism can include cultural and culinary activities based on farm produce but must not subtract land from farming activities. In addition, the time devoted to the tourists should be less than the time devoted to agriculture. Such regulations are aimed at ensuring the complementarity of farming and small-medium enterprise activities. Hence, agritourism activities are related to the household that is a traditionally female sphere of action, but at the same time generate income. Historically, the study area was inhabited by families coming mainly from north-eastern Italy, displaced to Maremma during the land reclamation. In the last decade, the area has seen a shift of tourism from hotels to other structures, including agritourism facilities, with a consequent increase of both demand and offer. At the same time, the Region of Tuscany has supported small-medium enterprises run by women. In Tuscany, coastal areas, including Maremma (inside which the Ombrone low plain is located) are more affected by female unemployment and precarious work opportunities (IRPET 2005); in this context, the recent improvement of women-run enterprises has led to an increase in female enterprises, mainly in sectors such as tourism. On the other hand, female enterprises in agriculture are following the overall declining trend of the agricultural sector. The Maremma Regional Park, established in 1975, is an attractive destination for domestic and international tourism. Tourism with naturalistic aims is expected to be less affected by seasonality, leading to higher stability of the system with respect to areas exclusively devoted to seaside holiday making. A sample of households hosting tourists in the municipality of Grosseto was contacted and requested to participate in a survey. Of the 60 agritourism enterprises chosen for the analysis, only 16 agreed to answer the questionnaire. No households inside the Maremma Regional Park area were involved in the study, as their inclusion in the Park area implies different regulation from the law mentioned above (Fig. 3.1). The questionnaire included questions on household data, activity patterns and sharing of the work between genders, services offered to the public (both residents and visitors) and to women in particular. A section of the questionnaire was devoted to the perception of problems (including those regarding sustainability of water and environmental resources) and proposed solutions.

3.1.2.2 Morocco: the Oued Laou Valley and the Pottery of Fran Ali

The Oued Laou River basin, like the whole north-western area of Morocco, is experiencing a massive infrastructure expansion associated with increased tourism development. Indeed, tourism is proposed as a driving force for the development of rural areas. Toward this aim, rural tourism is increasing both the number and diversification of activities. Most of the inhabitants of the Oued Laou Valley (around 300,000) live in rural zones. Urban areas are Chefchaouen (the only historical

Fig. 3.1 A farm restored to host tourists within the Maremma regional park (Photo by L. Chelazzi)

urban settlement) and the new towns of Oued Laou (still expanding, mainly due to improved seaside tourism) and Bab Taza, for a total of 200,000 inhabitants in urban settlements. The Laou River flows through the valley and there are many springs at all altitudinal levels, ensuring water availability. The landscape in the valley is heterogeneous, and the human activities developed in this framework are varied, ranging from traditional fishing to agriculture. Traditional handicraft (e.g. 'taraza' hats, 'mendil' tissues, pottery) is highly characteristic of the zone. The Talassemtane National Park was established in the area in 2006, mainly to protect the endemic fir species *Abies maroccana* (included in the UNESCO Man and Biosphere Program launched in 1970) (UNESCO 2009) but indirectly protecting other endemic species of the area. The Park includes human settlements: villages, 'douars' and the 'young' urban zone of Bab Taza. Within the valley, the village of Fran Ali is characterised by the production (exclusively by women) of traditional pottery (Fig. 3.2). Clay reservoirs and working techniques are a family heritage, transmitted from mother to daughter through learning by experience. These activities are not organised, and the women's products are collected twice a week by external people to be sold at local and regional markets (the products are fragile and no effective way of shipping has been organised, so the diffusion cannot be wider). The complexity of the Oued Laou Valley framework was analysed by submitting a questionnaire to 52 households, among them 30 from rural zones and 22 from urban ones. To represent the set of issues considered, the sample included households from Fran Ali and from settlements in the National Park area. For each household, the leading man and the leading

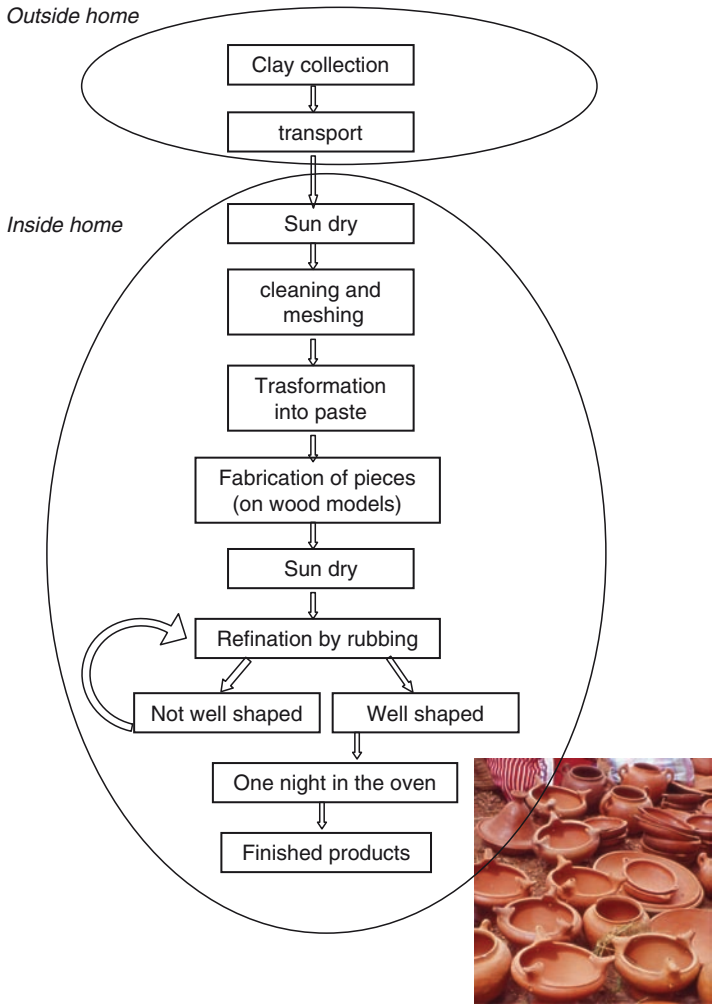

Fig. 3.2 The process of Fran Ali pottery making, based on A. Khattabi (2005, personal communication). The actions carried out inside and outside the domestic space are highlighted (Photo by G. Ciampi)

woman were interviewed separately at the same time to avoid mutual influences on the answers. The questionnaire included four main sections: the profile of the family (household number, educational level, main source of income); availability of services (school, other training, health, water, sewage, electricity, gas); the division of labour (related to the household and outside the household) between genders; the perception of trends (related to the changing landscape, water availability, traditions, concerns and solutions).

3.1.2.3 Tunisia: the Majerda River Low Plain and 'Ramli' Agriculture

Since independence, much effort has been devoted to the improvement of agriculture in the region, and water management for irrigation has been one of the main concerns. At present, the lagoon of Ghar el Mehl is surrounded by fields cultivated with the 'Ramli' technique (Oueslati and El Aroui 2009). This technique was developed to supply land for agriculture, under the pressure of increasing demand for land and produce. The technique is closely linked to the ecological characteristics of the lagoon, a water body connected to the sea: tides generate periodic variations of the level of the freshwater table. In fact, since the less dense fresh water floats on the salty sea water, this supplies natural irrigation of the crops (Fig. 3.3). To be successful with the 'Ramli' technique, one has to know the local environment and accumulate (or inherit) a long experience. Small plots of land are usually cultivated with annual crops, while larger fields associate horticulture and arboriculture (mainly olive trees). The products of this peculiar, strictly local type of agriculture are sold in the markets of nearby cities (Tunis and Bizerte). Many inhabitants of the area combine fishing with agriculture. In this framework, the main risk of bias in data collection was the non-correspondence between land owners and land workers. Therefore, questionnaires, containing specific questions on the sharing of work between genders and ages, were administered to people found working in fields. In addition, 81 farm households around the perimeter of the Ghar el Mehl lagoon were contacted, in cooperation with the Territorial Cells for Agricultural Information, and asked about the basic socioeconomic structure of the household, the details about field ownership and cultivation (disaggregated by gender and age), risks and trends of the perception of change.

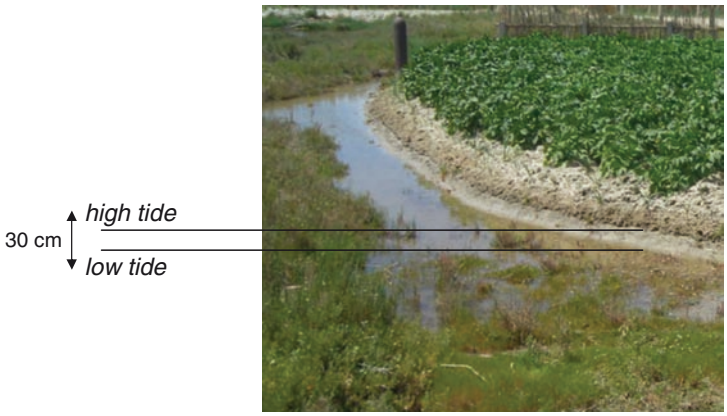

Fig. 3.3 An example of the 'Ramli' technique, in this case a potato field. The tide in the lagoon ranges from 20 to 30 cm (Based on a photo by A. Oueslati)

3.2 Results: From the Case-Studies to an Overall Perspective

The three study areas showed strong local characterisation, but the main patterns could be derived. Following a bottom-up approach in the data analysis, we found the following:

3.2.1 Ombrone River Low Plain

People showed low willingness to respond to the questionnaire. Of those who agreed, women running agritourisms were 56% (50% is the proportion for whole Tuscany, consistent with the regional increase of women-run small enterprises, reported by IRPET 2005). They divide their work between agriculture, hosting activities and care of the house, but they are often helped by other women of the family in the latter activity. There is an unbalanced age ratio in the management roles: most entrepreneurs are over 65 years old, and the proportion decreases with age, reaching the minimum value for entrepreneurs less than 36 years. Traditional food quality (only 6% of the agritourisms are certified as 'organic', but 60% are on the way to obtaining the certification according to EU rules) is attractive for visitors and is a stimulus to diversify what is offered to tourists. The market also has an important role in water management, in terms of swimming pools: 40% of the agritourisms have a swimming pool, which is highly requested by visitors despite the vicinity to the seaside, but in the end is little used. Local people are well aware that this is a costly and inefficient resource use: the water to fill the swimming pool has to be brought by a tank trunk and pool maintenance is expensive, but not having a swimming pool may compromise the success of the activity. The local perception is that, despite the vicinity to the Maremma Regional Park, visitors are still mainly attracted by seaside holiday making, which generates the same seasonal issues that affect other seaside localities. The agritourism managers feel that they cannot impose rules on the visitors, as they are paying for their vacation. Therefore, information on correct water use, to be given to visitors before or during their journey, should be supplied by the institutions.

In agriculture, there is a need of improved water management, especially regarding maintenance of the drainage structures established during the land reclamation (Zanchi and Cecchi, this volume), which are damaged by excessive water flow during the rainy seasons. A particular issue is that of alternative energy sources: the lack of financial support has a main role in the poor use of these resources. Wind pumps (small private wind engines to draw water from wells, see Fig. 3.1) are an historical landscape component of the region, but no funds for alternative energy sources or funds for the conservation of former agricultural structures are available. Thus, to maintain the old wind pumps and/or install new ones is a choice mainly left to individual initiatives. On the other hand, cheap and efficient systems, such as double discharge of toilets and water flow reducers, are widely used.

Other indicated problems, which the institutions are asked to solve, are the lack (at the municipal level) of differentiated garbage collection and poor control of the agritourism requirements (some agritourism enterprises merely host tourists without carrying out farming activities). Finally, the people can clearly identify the strengths and weaknesses of the local situation and have ideas on how to improve it. However, there are no local associations for agritourism, preventing local people from having a voice at higher management and institutional levels. At the same time, these levels are asked to solve the identified problems.

3.2.2 Oued Laou Valley

Water availability is not a problem, as private or public springs and wells are still supplying water for free to half of the rural zones. Most agriculture does not need irrigation ('Bour' cultures). Concerns start when the water supply has to be paid for after connection to the water service. The water management system is dramatically changing, from traditional regulation ('Jma'a', i.e. the village authority, which regulates agriculture and irrigation) to institutional regulation, and despite the ongoing deep changes, no information on water use is offered to the local people. After loss of the traditional management system, some related structures such as the 'saquías' (channels to spread water for irrigation and cattle) are no longer maintained. Probably due to the good water availability, no water issues are perceived by the population, with some exceptions in summer when the harsher climatic conditions may affect the drinkable water supply in some localities. At Fran Ali, the main ecological issues are the availability of clay (knowledge of places to collect clay are inherited by the family) and firewood for the traditional ovens. In particular, firewood collection is regulated at the overall level without consideration of traditional activities. Such issues are not perceived at all by the men, whose profiles are not very different from the other agricultural zones of the valley since they only sell the handicrafts and are not aware of the links between this activity and ecological constraints. Another important issue identified at the whole river basin level was the lack of wastewater treatment: only the urban centre of Chefchaouen has sewage sanitation services, and pollution problems are only perceived at the low plain level. Again, water quality conditions in the low basin are harsher during summer, due to the higher water demand and the higher sanitation demand during the season of tourism. Despite the water availability, rainwater is collected in tanks and used for washing clothes, both in rural and urban zones. This is probably made because washing clothes with rainwater is more efficient due to the lower calcium content, so the habit is preserved at an overall level in the valley. Another overall characteristic is the availability of technical training, supplied to people without a difference between rural and urban zones; however, only women devote some time to learning a new activity (mainly sewing), showing a trend towards female segregation of adult technical training activities.

No professional training or other activities to raise awareness are carried out with respect to traditional handicrafts. Schooling is on the increase, and many cases of illiterate parents with children attending school were found in our survey. The division of labour between genders highlighted the women's role in all the activities considered: not only do they take complete charge of the domestic sphere but almost all the external activities are based on the participation of women. At Fran Ali, where the inhabitants are also farmers, women carry out all the duties plus pottery. Traditionally, women cannot participate in the 'Jma'a' (where the 'Jma'a' still exists, including Fran Ali), so they can only express themselves through their husbands. Both the local men and women feel that they are not represented at all outside the traditional context, especially at upper institutional levels. The presence of the Talassemtane National Park is not perceived by the inhabitants: they feel that their activities are neither limited nor improved by the establishment of the Park, and some people are not even aware that they are living inside the Park area. A few proposals to solve problems were supplied by the interviewees, the most frequent being attention and intervention from institutions.

3.2.3 Oued Majerda Low Plain

Women have almost no role in 'Ramli' agriculture: despite the expected female role in well-defined agricultural activities, for example crop collection, cleaning and stocking produce, no specific kinds of participation were recorded (Oueslati et al. 2009). The main part of the work is carried out by local farmers and workers coming from other Tunisian regions to compensate the lack of local labour. When men own the land, they carry out most of the work. Even though women own 30% of the land, only 10% of the field work is carried out by women landowners, and the husband or brother takes charge of the 'Ramli'. There is also age-related segregation: young people, even sons of the landowner, usually do not work the land (and daughters, consistent with the gender segregation, even less so). The same pattern seems to be repeated when we consider fishing, identified as a complementary work activity in the area: no women were found working in the port or on fishing boats. However women were collecting molluscs in the lagoon (F. Scapini 2008, personal communication). The study area is a strategic zone for food production for the nearby urban areas, and this probably has a positive effect on the satisfaction of immediate needs: households have a high rate (around 95%) of electricity and water supply; 87% of the households are also connected to wastewater treatment. Schooling is on the increase, at a faster rate among females. On the other hand, the observed segregations (gender and age) in activities may also be related to the fact that this is a strategic zone, in which the economic value generated by productive activity makes women and young people marginal, even if they constitute around 50% and 30% of the Ghar el Mehl population, respectively. Age segregation is even harsher in 'Ramli' agriculture, as 70% of active

people are older than 40 years and 19% older than 60. Regarding the information services, a risk of bias was found in the fact that only landowners are allowed to attend courses, even though some of the farmers rent the land; thus, the information flow is not reaching all the potential final users. Occasional workers also receive no training except direct experience. The main concerns expressed by the interviewees regard crop production, especially for those farmers renting fields. Pesticides are widely used instead of crop rotation (even if crops are annual) to preserve crops from damage. Also in this case-study, risks arise from water quality rather than water availability. Another critical issue is the competition for land use between tourism (mainly domestic), agriculture and fishing. Although apparently not in conflict with agriculture, fishing is affecting the structure of the lagoon: the construction of a new harbour for fishing boats has initiated a process of change of the shape of the littoral zone and the influx of seawater into the lagoon, as can be detected from time-series of maps and pictures. Therefore, the effects of pesticide use and artificial structures may compromise the system on which the income of many people depends in such a finely tuned (and therefore fragile) manner.

From the local frameworks, we can derive an overall perspective at the level of the WADI project, including common issues and driving forces.

3.3 Common Issues

The ecological characteristics are changing at a very small scale, thus defining the scale of traditional activities and uses of ecological resources closely linked to the environment: the Fran Ali pottery cannot exist without local clay reservoirs, traditional ovens working with firewood, etc.; 'Ramli' agriculture cannot exist without the lagoon ecosystem; agritourism will not be successful without a beautiful landscape to attract tourists. The patchiness found at the case-study level, but consistent with the characteristics of the entire Mediterranean basin, represents a high diversity of content. This is a resource, but at the same time makes it difficult to manage the whole framework at a higher level. This becomes critical if we consider the issue of patchiness applied to the ability of local people to make their voices heard: the lack of communication between levels can be detected by indicators such as the absence of networking activities and organisation into associations. Moreover, the low willingness to respond to the questionnaires reinforces the idea of an 'island' behaviour, which implies poor self-organisation towards mainstreaming and empowerment. There are many possible reasons for this, from historical to ecological ones, but there is an emerging need of education in this sense. The achievement of representation at the decisional levels (often required for problem solving) was found to be a need that goes beyond the gender perspective, despite the twofold exclusion of women from decision-making, as in the Moroccan case: women are not represented at the 'Jma'a' but both men and women felt that they were not represented at higher levels of management and policy-making.

It emerged that land ownership does not automatically lead to control of the decision-making processes, even if property rights were pointed out as a key determinant of women's household management (Ivens 2008): in all cases, women were found to have property rights with respect to land and households, but often this was not enough to avoid their segregation from rentable activities. The market and policy-makers are driving the trends of change but the representation of women is low in these two frameworks, creating a loop and keeping the gender issues marginal. Often this phenomenon was paired with low willingness to be involved and general distrust.

Throughout the case-studies, male migration to urban areas was irrelevant, except for two households sampled at Oued Laou. Instead, a common problem was the ageing of the resident population in rural zones.

The paradigm of a female role in biodiversity conservation in agriculture was not applicable at our case-studies, since women carry out the whole set of duties and share agricultural field work with men (as in the cases of Morocco and Italy) or are segregated outside the agriculture context (as in the case of Tunisia). However, good practices are maintained by women within the domestic sphere when they are efficient or economically rentable, for example rainwater collection for washing clothes (less calcium content) or the application of methods to save water in agritourisms. Such reasonable choices are consistent with what usually occurs in the case of closely related ecological and human features (as in rural zones): when conditions change, the habits that are preserved are the most efficient ones, and there is no place for inefficient habits, even if they are traditional ones (Marten 2001).

3.4 Common Driving Forces

Market pressures drive some choices regarding the activities of local people, as in the case of swimming pools in the Ombrone River low plain study site (not needed by the inhabitants but required by the visitors). This point gives an indication of the need to assess the existing traditional knowledge, also through valuation of products obtained by an application of such knowledge. In all the case-studies analysed, we can see that women are maintaining traditional knowledge related to the domestic sphere and its connection to the external environment, as in the case of handicraft products and traditional food, and they are able to supplement the traditional uses of ecosystem resources with new good practices (such as tanks for rainwater collection and water flow reducers). Therefore, the promotion of traditions and good practices could favour the survival of the local people and be a sound tool for bottom-up empowerment of women, towards the achievement of an equality of conditions. Nevertheless, care should be taken to avoid romanticising nature and traditional knowledge, that is driving the demand and supply of a false tradition, far from the real systems and no longer matching the local ecological peculiarities: in a changing framework, the challenge is to appreciate traditional societies for what they really are (i.e. societies that have co-evolved with the environmental conditions to which

they are matched) and not what we want them to be (Marten 2001). In this respect, tourism is often seen, or claimed to be, a solution for the development of marginal zones and the alleviation of poverty (WTO 2002). However, before expectations are raised, a cautious analysis of the framework should be carried out, involving local women and men from the very beginning, to propose and develop activities in regard to the network of relationships between people and the environment. Integrated rural tourism, which was chosen for some of our case-studies, may represent a development strategy that takes into account and improves local cultural, social, environmental and economic resources (Cawley and Gillmor 2008). The role of natural protected areas could also be expanded, from the old-style model of 'areas without people' to a service for local empowerment through preservation of the environment that has shaped the local traditions and improvement of the quality of natural resources. This is particularly true in the case of 'young' protected natural areas, such as the Talassemtane National Park, in which links between the landscape and the inhabitants must be created, offering an intrinsic chance to reinforce the relationships and ensure sustainability of ecological management.

In this framework of sudden changes and dynamic equilibria, education may be identified as one of the main connections between practical and strategic needs and a promoter of profound changes in the long term. Education should play a main role at multiple levels: education of local women and men to organise themselves, counteract the lack of confidence and drive positive changes through a bottom-up approach; education of external users (tourists and visitors) to respect and enhance the value of the local resources; education of children to be citizens that will take charge of the sustainable and equal management of resources. The positive signals coming from the increase of primary school attendance (for both boys and girls) indicate that possible actions can be carried out in concert with the school programmes.

3.5 Lessons Learnt in a Wider Perspective

The peculiarities found in the local contexts are linked to the variety of attitudes and sensitivity of the people, with additional differences intrinsically related to gender. However, some common features can be highlighted, and the challenge is how to match a bottom-up and gendered contribution (in full respect of the diversity) with the overall dynamics, towards a shift in the rural zones from a critical issue to a resource.

Throughout the set of study sites, the satisfaction of practical needs is consistent with what has been reported at the macro level by the United Nations (2008): some conditions are approaching the Millennium Development Goals (MDG Goal 2: Achieve primary universal education), while others are still far from reaching the goals (MDG Goal 3: Promote gender equality and empower women). Strategic needs, which include empowerment and control over management choices and policy making, are still far from being fulfilled, as they are often not part of the sensitivity

of local people, perhaps because of an issue of scale, with wider phenomena not being perceived as issues of local concern. Consequently, some goals (such as MDG Goal 7: Ensure environmental sustainability) are still an open challenge.

However, the profound relationships (more or less perceived) between people and ecosystems focused our attention on two main concepts: (1) good environmental quality is the basis of equal division of resources, and (2) conservation sensu stricto of environmental resources cannot be separated from conservation sensu stricto of traditional activities (Momsen 2007), and vice versa. They have to be combined, as the continuous feed-back between the environment and its inhabitants is the key to sustainability. This may lead to the avoidance of conflicts and marginalisation, which often have a greater effect on the people with less power, usually women and young people. When considering a system as a whole, we need to take into account that systems are dynamic, so the gender perspective should be considered dynamic as well, and ongoing social changes could open empowerment possibilities. By acting on dynamic rather than static features, we could achieve scenarios in which women and men are equally represented, without losing their specific contributions to sustainability. External variables, such as tourism and the establishment of protected natural areas, can enhance the value of the local knowledge and ecosystem and generate willingness to preserve them.

Finally, a basic choice between actions and strategies seems to be required: successful actions can increase the effectiveness of some processes and lead to excellence in well-defined and isolated activities, while successful strategies can combine activities that fit and reinforce each other (Cawley and Gillmor 2008), leading to equality and improving the resilience of the systems.

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Chapter 4
Environmental Conflicts and Conflict Management: Some Lessons from the WADI Experience at El Hondo Nature Park (South-Eastern Spain)

Carlos Martín-Cantarino

Abstract The concept of conflict contains some ambiguity that clearly appears in the relationship between scientific objectivity and socioeconomic subjectivity – albeit objectivity and subjectivity can sometimes exchange their respective adjectives. The case of El Hondo ponds (Valencia Region, Spain) represents a meaningful example. The Regional Environmental Administration enacted water use laws aimed at assuring the survival of a rare population of ducks (*Oxyura leucocephala*). Unfortunately, the same laws were considered to jeopardise the survival of the local (human) Community of irrigating farmers, the Riegos de Levante. Another regional case concerns with the preservation of the plant species *Limonium*. The palliative remedy of this conflict consisted in separating as much as possible the areas and the resources linked to wildlife conservation from the ones essential to the regional economy. Separation implies neither debate nor mutual understanding: it is a remedy, not the desirable management of the conflict.

Keywords Conflict definitions • Water related conflicts • Water conflicts narratives • Irrigating farmers • Cultivation versus conservation

4.1 Introduction

Our objective in this paper is to remark the central role of the analysis of water-related conflicts in the WADI project rationale and to give an overview of some of the results and lessons obtained during these three-year long research. The aim of WADI was 'to enhance stakeholders benefits' by means of 'water demand integration',

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where 'integration' is understood as not only including the different demands of uses and services, but also the differing perceptions and values of each stakeholder. But any proposal or attempt of integration should be aware of the conflictive situations it will inevitably cause, specially (but not only, of course) in the Mediterranean area, where water is frequently a scarce and vital resource. Is really this conflictive scenario, where so many different interests try to prevail over the other ones in a day-to-day continuous strife, the proposal of WADI to 'enhance stakeholders benefits'?

We do believe that integration, the joint consideration of different aspects of water uses and values, even conflictive, is useful to 'enhance stakeholders benefits', but this requires new ways of understanding and managing conflicts around water use (Martín-Cantarino 1999). We think (and this idea will be the conducting-line of the present paper) that sustainability and a reasonable degree of stakeholders' benefit do not require a no-conflict, consensual quiet scenario (or even are incompatible with it), but rather a scenario in which conflicts exist but they are properly reframed and managed (sensu Greenhalgh and Russell 2005) in a non-destructive manner.

WADI, in fact, as other European Commission (EC) – funded research projects, was designed and proposed with the aim of furnishing some useful information and advice to the European Commission in relation to the challenges posed by the EC Water Framework Directive to environmental policy and also, since it affects the notion of sustainable development, to international cooperation policy. Moreover these challenges are important because the Water Framework Directive has introduced a new approach to water management, with serious consequences (Kaika 2003). To be precise, we think that the EC Water Framework Community has posed two enormous challenges to water managers, and specially to managers in charge of the Mediterranean water bodies: (1) it has imposed the need to guarantee the ecological quality of water bodies in an area where water scarcity is common and water demands for different human socioeconomic activities frequently collide; and (2) it has also imposed the need to manage water (and thus the need to obtain and maintain the ecological quality and the satisfaction of other water uses) through a participative approach, with a real, effective involvement of all stakeholders. If these two basic requirements are to be really accomplished, important social conflicts are to be expected, specially in the Mediterranean area.

Some authors have remarked the apparent contradiction among the 'technocratic' determination of what is 'ecological quality', which establishes a non-negotiable basic restriction for any other human use, and the social participative approach imposed by the Water Directive (Steyaert and Ollivier 2007). Do these two basic conditions of the European Directive form, to a certain extent, an oxymoron, as claimed by some authors? What is clear is that, since the approval of the Directive, these ecological constraints will be an unavoidable condition of water conflicts among stakeholders. In any case, we think that the policy endorsed by the Directive will require a deeper understanding of what are conflicts (specially, environmental and water conflicts) and their importance, not only from an applied point of view (e.g., for environmental management), but also from a comprehensive knowledge of the real structure and functioning of water ecosystems, as products of thousands of years of human modification and exploitation.

4.2 Background on Conflict and Conflict Analysis

Conflict analysis is normally considered to be an intrinsically transversal, transdisciplinary branch of knowledge which has derived its conceptual and methodological basis from a diversity of scientific fields, ranging from social psychology, peace and war studies, diplomacy, policy and public affairs studies, business management, sociology, ecology, etc. However, as is frequently the case with such claims of disciplinary integration, the integrative approach of actual conflict and conflict resolution studies is normally rather incomplete or limited.

Probably, the weight that peace and diplomatic studies have had in the development of conflict and conflict resolution has determined a negative view of conflict as a disruption of the normal functioning of things, which should be solved. Conflict, associated to war, crime and disorder, is considered a threat to the wealth of the existing social, political and economic order. Also, psychology has tended to consider intrapersonal conflicts as a threat to the mental equilibrium of the individuals, thus as a problem to be solved as soon as possible (Redorta 2007).

On the other hand, conflict (struggle, strife, dispute) has been a seminal concept in the historical evolution of both ecological and social sciences, from the Darwinian 'struggle for existence' or the so-called social Darwinism, to the class struggle of Marx as the main motor of history. From these conceptual origins, conflicts tend to be seen as a factor of conforming the functionalism of ecological and social systems. For example, the economist Kenneth E. Boulding, much influenced by ecological ideas, tried a synthesis of different approaches in which conflicts are considered to be a universal phenomenon (Boulding 1963).

Although this kind of theories are more or less simplistic, specially when concepts from the biological sciences were directly applied to the complex circumstances of the social world, the important questions to be retained is that they consider conflict as a constituent part of reality, and thus of the functioning of social and ecological systems.

In this paper, our interest is not on interspecific conflicts, but on the social conflicts in relation to the use of natural resources. Since humans are an integral part of ecosystems and have modified them during centuries (Endter-Wada et al. 1998), social conflicts related to natural resources have also modelled actual ecosystems and thus conflicts should be considered as an integral part of ecosystems (or rather socio-eco-systems) (Bailey 1997).

4.3 The Importance of Defining 'Conflict'

There have been numerous attempts to find a comprehensive and/or workable definition of conflict. Many papers on conflict-related issues, from a variety of disciplinary approaches, begin with a discussion on previous definitions and their limitations, and an attempt to provide a more appropriate and efficient definition.

To give only an example, a review paper (Infante 1998) albeit having no aspiration of being exhaustive, was able to compile and analyse a total of 78 different published definitions of 'conflict'. This overabundance reflects of course the ambiguity of the theoretical approaches to this issue and the plurality of the involved disciplines (Entelman 2002).

However, not only from a theoretical point of view but also from an applied one, it is very important to discuss the conceptual consequences of the proposed definitions of conflict and to find a working, useful definition of conflict – in our case, a definition useful to WADI purposes. Perhaps it is not possible, nor even necessary, to find a universally satisfactory definition of conflict, but the acceptance of a limiting definition can have serious consequences on the way we conceptualise and analyse conflicts (Tjosvold 2006).

Traditional or simplest definitions are based on the idea that conflicts are the result of opposing interests involving resources, goal divergence and frustration. A typical 'rational' definition could be, for example, 'A situation in which two or more parties strive to acquire the same scarce resource at the same time'.

The limitations of these 'rational' definitions are obvious because the conflict is defined only in terms of violence (behaviour) or hostility (attitude) caused by this objective interest in the same unshareable resource. But a useful definition of conflict should also consider the differences in issue position as determinants of conflicts (Swanström and Weissmann 2005), for example, the role of historical animosity, the interference of other (frequently not confessed) aims (e.g., economic and political ones) or the subjective perception of the problem by each part.

It is revealing the insistence on the 'scarcity' of the disputed resource in many of these definitions. However, it is obvious that conflicts could arise even in cases where resources are abundant. But the most important question is the implicit perception of conflict as negative and destructive, or, as Tjosvold (2006) defined it, the confusion of conflict and competition.

Conflicts are not necessarily competitions in which there should be a winner and a loser, as in sports or games. Swanström and Weissmann (2005) strengthen the importance of considering not only competitive aspects, but also cooperative ones, because conflicts occur in mixed-motive relationships where the involved parties both have cooperative and competitive goals. As we shall see, this remark is very important in order to understand real environmental conflicts, because the definitions given above seem to imply that the goal of conflicts will be a win–lose result, or the destruction of of the loser party – which is not frequently the case. Rather, a more complex rationale is common in environmental disputes because in many cases the competitive elements create conflict, but the cooperative elements create incentives to negotiate an agreement.

So, there are two aspects that we consider of special relevance in any definition of conflict: an explicit mention of the importance of the subjective framing or perception of the problem (the importance of issue position, not only of behaviour and attitudes) and to the will to solve the problem, which implies that conflicts are not only competitive disputes among parties with incompatible goals, but can also be cooperative discussions around compatible goals.

4.4 The Central Role of Conflicts in the Rationale of WADI

As mentioned above, the aim of WADI was 'to enhance stakeholders benefits' by means of a realistic analysis of the possibilities of obtaining 'water demand integration'. In order to achieve this aim, WADI was based upon three main methodological approaches: case studies, participatory research, and future scenario planning. In fact, these three techniques are not independent. We want to outline the importance of these methodological options for our analysis of conflicts in the study sites.

First of all, WADI is a participatory research (Scapini, this volume). The final objective of integrating demands and enhancing stakeholders' benefits means in our case that WADI should produce some kind of learning (integrated learning) among stakeholders. An important part of this social learning should be related to the achievement of new capabilities for adequately managing conflicts, moving stakeholders to new and more cooperative dispute framings. Obviously, such 'social learning' is hardly attainable through top-down dissemination approaches, that is, conventional ex-post dissemination of results from the research. In order to promote an effective social learning, people should not only be 'consulted' but integrated in the very research process. Even issues studied should not be completely defined until having obtained substantial inputs from stakeholders, as we shall explain below.

WADI is a case-study approach, and specifically a study of conflictive cases. The case-study approach has been defined as 'a method for learning about a complex instance, based on a comprehensive understanding of that instance, obtained by extensive description and analysis of the instance, taken as a whole and in its context' (U.S. General Accounting Office 1990). WADI has tried to construct comprehensive pictures of a series of water systems around the Mediterranean. Unavoidably, any research trying to understand water socio-eco-systems in an integrative way, specially in the Mediterranean area, must scientifically cope with socio-political conflicts, due to the essentially 'contested' (and thus, political) nature of water (Mollinga 2008).

Case-study seems the best adapted methodology for promoting an effective understanding of real conflictive situations affecting natural resources (Kartez and Bowman 1993; Kyllönen et al. 2006). For example, the study by Keough and Blahna (2006) on the possibility of achieving integrated, collaborative environmental management, which in certain aspects resembles our present approach, is based on an analysis of four real cases. So, it is normal that a large proportion of the papers on conflict and conflict resolution make wide use of case-studies (for example, Homer-Dixon 1994; Castro and Nielson 2003; Bruckmeier 2005; Galaz 2005; Yasmi et al. 2006; Mikhledize and Pirozzi 2008; Swart and van Andel 2008; Matthew et al. 2009).

Moreover, case-studies are well suited to provoke discussion, to highlight issues and stimulate awareness of the problems. For Carson (1986), cases are occasions for teaching. Thus, case-studies are specially useful for promoting social awareness and learning in relation to environmental and water conflicts, the main objective of WADI.

WADI was also a scenario planning exercise. Scenarios are coherent pictures of possible future situations obtained by means of an integration of various sources and types of knowledge. Scenario planning is considered to be a useful technique for dealing with conflicts because, by refocusing debates from present concerns to future ones, they can help stakeholders identify commonly held long-term goals and generate consensus or cooperative behaviour (Neff 2007). This means that the construction of WADI cases should not simply provide a comprehensive understanding of the conflicts affecting the study sites, but also a projection into the future. This is evident also from the very title of the project: 'A socio-economic and environmental analysis of changes and trends'; in the same manner as cases, scenarios are intended to favour mutual learning among participants in the process of planning them.

4.5 Narratives as Necessary Results of WADI

Complexity has traditionally been an important issue in ecology, because ecology has to deal with complex systems. Recently, a certain amount of innovative and (more or less) controversial proposals have been generated related to the issue of complexity in ecology (Allen et al. 2001; Carpenter 2002; Zellmer et al. 2006). Of course, complexity is not a matter of what occurs in nature, but a function of the terms in which we wish to understand it (Allen and Roberts 2002). Complexity doesn't exist if we reduce our interest to a well-defined, isolated and simple problem. But we select our research subject not because its simplicity, but its social relevance. This is normally the case with environmental conflicts, and is certainly what happens with the kind of social-relevant questions WADI tried to address at the study sites. As remarked by Carpenter (2002), the success in dealing with complexity will determine the real social relevance of ecology during the next years.

The ultimate instrument for addressing complexity is narratives (Allen et al. 2001; Zellmer et al. 2006). Narratives are not irrelevant and inconsistent tales, but stories telling the meaning of acquired knowledge. Stories combine both quantitative and qualitative data and explain them. In fact, it is this term 'explanation' that characterises the narrative approach.

The objectives and methodological choice adopted by WADI required the production of consistent narratives. Indeed, the aim of case-study approach is to produce good, well-founded narratives (U.S. General Accounting Office 1990), specially if there is an interest in promoting effective learning among readers (Carson 1986) as happens in WADI. Scenario planning, the ultimate aim of WADI, is also a method to produce plausible narratives of possible futures (Carpenter 2002).

Narratives not only allow a meaningful treatment of complexity, they are also the necessary channel for communicating it to different readers, due to their capacity for promoting shared meanings of exposed facts. And this is so because stories, if properly built, generate commensurate experience amongst independent listeners (Zellmer et al. 2006). Independently of its scientific quality, a typical research

report does not help people to change their behaviour, as it normally does not reach them at a deep level of understanding. Since the final purpose of WADI was not to obtain information, but to enhance stakeholder benefits, our final written product should not be a document containing data, but a well-constructed narrative offering the reader access to the case at different levels, thus promoting social learning.

4.6 El Hondo as a Conflictive Site: Science and Integrated Science and the Reframing of Conflicts

4.6.1 The Study Site

El Hondo Natural Park is situated in the middle of the province of Alicante, in the South-East of Spain. The water system is of an enormous complexity, partly as a result of its long history of gradual human control of water fluxes in an area which was in ancient times a large swampy area in which two main rivers flowed: the Segura and the Vinalopò. Presently, the El Hondo water system is formed by two large ponds of fresh irrigation water pumped from the mouth of Segura River and five drainage canals, about ten smaller hunting/fishing ponds (with brackish water of different characteristics, since the provenance of these waters is very diverse), four ponds dedicated to ecological conservation (three owned by the environmental administration and the fourth by a conservationist non governmental organisation), the salines of Santa Pola (connected to the sea) and thousands of kilometres of drainage and irrigation canals, of very different water quality, connecting all above-mentioned ponds and water reservoirs (Fig. 4.1). The system is naturally and inextricably connected to another Natural Park (the Salines of Santa Pola), which is also very complex.

In relation to social aspects, the situation is no less complicated. Many different administrations, from the national (i.e. Water Administration) to the regional (i.e. Environmental Administration) and local levels (10 Town Councils directly involved) have some degree of responsibility on the system's management. Every level of management involves multiple actors. For instance, El Hondo falls within two national Water Administrations, that of the Segura River (Confederación Hidrográfica del Segura) and that of the Vinalopó River (corresponding to the Confederación Hidrográfica del Júcar). At the local level, 20 communities of irrigating farmers have the direct responsibility for the day-to-day operation of the water system. The large Community of Riegos de Levante is the owner of the two largest ponds. To the south of El Hondo, the irrigating farmers' communities most directly related to El Hondo water system are those of Catral, Dolores, San Felipe Neri, San Fulgencio and the Carrizales de Elche, which also use water directly or indirectly derived form the Segura River. To the north, other irrigating farmers' communities take their water traditionally from the Vinalopo River.

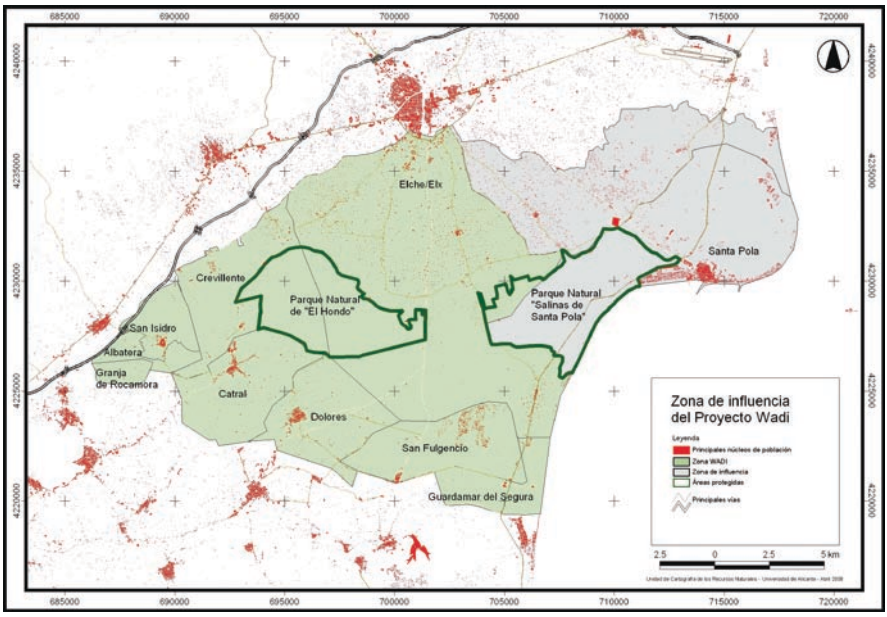

Fig. 4.1 The WADI study site of El Hondo and influencing zone (Valencia Region, Spain). The boundaries of two protected areas are marked. The other names refer to settlements

There are also many farmers associations, civic platforms and conservationist groups, cultural associations, etc., with relevant influence on the social system.

4.6.2 Methodological Issues

Different methods have been used in order to obtain the data needed for our analysis:

- Analysis of written documentation, both archival (in order to determine the importance of past conflicts in the present configuration of the water system) and recent documents (reports, administrative documentation, legal texts, etc.), including formal qualitative and quantitative content analysis
- Semi-structured interviews with key stakeholders
- Focus groups (group discussion)
- Participant observation

Participant observation (also named collaborative field work) is worth of a deeper explanation because of the special role this method has played in our research. Participant observation is based on a collaborative interaction between researchers and informants while jointly developing a given task. For this reason, it is a very

suitable technique for obtaining information not easily accessible by other means, neither by means of interviews. It provides also an opportunity of influencing in some way the social environment at the same time it is being studied. Participant observation can induce mutual learning between informants and researchers, specially if the research issues have been selected according to the informants needs or interests. According to the WADI rationale, we have tried to stimulate social learning during the research tasks, and so in a mutual manner, and not as a ex-post, top-down disseminative advice.

4.6.3 The 'Malvasia Case': The Risks of Objective Scientific Advice

In May 2005, a legal decree (Decree 93/2005 of the Regional Government of Valencia) was formally passed. Soon, it was popularly known as the "malvasia's Decree". The malvasia (White-headed Duck, *Oxyura leucocephala*) is a duck species internationally protected by the Bern Convention, Bonn Convention, Ramsar Convention and European Directive 79/409/ECC. El Hondo is an essential site for the conservation of the species in the Iberian Peninsula and the Western Mediterranean area. In 2002, for example, 70% of the Spanish population of White-headed Duck inhabited El Hondo. Also it is considered as an endangered and strictly protected species by Spanish national and Valencian regional legislation.

In a certain manner, the malvasia's Decree was the first legal disposition affecting El Hondo with a real scientifically-based environmental management content, because its dispositions were based on a specific and well-funded LIFE project carried out from 1 January 2001 to 1 January 2005.

The most transcendent disposition of the Decree is that no 'sudden' variation in the water level of the two larger ponds of El Hondo (built as irrigation water reservoirs in the first half of the twentieth century and owned by the irrigating farmers' Community of Riegos de Levante) is permitted during the breeding period of the White-headed Duck, from 1 February to the end of August. In fact rapid changes in water levels can cause the destruction of nests and broods. This implies the prohibition of any important discharge of water from the ponds or any introduction of water into them during this period. Additionally, hunting and fishing are prohibited or seriously limited because researchers demonstrated that these activities can cause the death of adult malvasia ducks.

In the very dry summer 2005, the executive assembly of Riegos de Levante decided to release water from the ponds to irrigate fields in order to save crops, despite the legal prohibition imposed by the malvasia's Decree. Green groups immediately denounced to court this transgression of the malvasia's Decree and the damages caused to the protected fauna of the Nature Park. As a consequence, the executive manager of Riegos de Levante was legally charged with environmental crime and a lawsuit was brought against him. An official report by the Environmental Administration, requested by the legal court, which documented the loss of malvasia's

broods, was used as the main incriminating evidence. The tension between Riegos de Levante and the Environmental Administration reached its peak during the formal start of WADI project (1 January 2006). The project, its approach, aims and especially its participatory characteristic had been extensively presented to all parties during the previous year; it was apparently felt as providing new possibilities for each party. In fact, in February 2006, despite the tension, all contacted parties attended the official presentation meeting of WADI and actively participated, offering their collaboration for the development of the project.

The situation remained stationary during the following months. To avoid legal consequences, Riegos de Levante did not release any more water from the ponds during the periods in which such discharges were prohibited by the malvasia's Decree. The feeling of grievance grew among irrigating farmers and generally among rural sectors of the area. Political aspects were also present, creating a quite explosive situation. During the last months of 2006, the Environmental Administration presented the drafts of new management plans for the Nature Park, which endorse a series of use limitations and barely contain any proactive or compensatory measure for affected sectors. This was another cause of resentment, angrily manifested during the WADI general meeting with stakeholders, held in February 2007. During the summer of 2007, after complaining several times that agricultural fields had not been irrigated due to the malvasia's Decree, Riegos de Levante also denounced that they could not even pump up to the ponds of El Hondo the much-needed and relatively good water that, thanks to some strong rains, was available in the Segura River at the end of summer; the exceeding water ended up running into the sea. In the context of the local traditional water culture, this loss of water was radically incomprehensible, and represented a very sensitive popular argument against the Administration's decisions.

In January 2008, as a result of this conflict, Riegos de Levante took the decision to close the entrance to their property and thus impede the access of the general public, environmental managers and researchers to the most important part of the Nature Park (the two large ponds owned by Riegos de Levante). Despite the importance of the decision taken by the farmers to show their feeling of grievance, no public declaration was made by the Environmental Administration and no measure was taken against this situation by any other institution. Moreover, no repercussion was noted in the social environment of the area, even after months had passed and the closing of the ponds was maintained.

In August 2008, Riegos de Levante denounced an outbreak of botulism and a massive mortality of waterfowl due to immobilisation of poor quality waters, and publicly demanded from the Environmental Administration the drainage of the two ponds for sanitary and environmental reasons. The extraction of water in spring and summer was precisely the cause of the conflict, due to its interdiction by the malvasia's Decree. After some reluctance, when the epizootic outbreak was confirmed by the technicians, the Environmental Administration finally authorised the drainage of the ponds. Once the ponds were dried out, Riegos de Levante publicly declared that they would not pump up new water into the ponds until the malvasia's Decree was abrogated or drastically changed, according to their demands.

Despite the fact that the most important part of the Nature Park was not only closed, but had also dried out, no public declaration was made during these months neither by the Environmental Administration nor by any other stakeholder, except, as usual, by Green groups. After months of inactivity, Riegos de Levante took up the initiative again. On 19 December 2008, a large public demonstration was organised by Riegos de Levante, in collaboration with other local farmers' associations, marched through the streets of Elche reclaiming irrigation rights in El Hondo and the abrogation of the malvasia's Decree. Riegos de Levante succeeded at mobilising not only farmers' associations, but also other Elche's civic organisations and even town authorities. Their capacity to stir up local forces was confirmed by the fact that all political parties represented in the Town Council, including the political party heading the Regional Administration (and thus the Environmental Administration), supported the demonstration more or less enthusiastically.

This demonstration was the final catalyst, which obliged the Environmental Administration to call for a dialogue. Apparently the success in mobilising such a range of local forces (except Green groups), including groups not normally sympathetic to the positions of Riegos de Levante, surprised and preoccupied the political decision makers, showing that they had lost the control of the situation. The way central administration normally ignores how things go at local levels, and specifically in the rural or agricultural world, that is, the emotional charge in discourses, the importance of informal relations, the more-or-less generalised sense of grievance (which acts always as a common ground against administration), etc., is a typical example of what sociologists have pointed out regarding similar environmental conflicts (Pedreño Cánovas and Cid Cid 1998).

During January 2009, the environmental regional Minister and the chiefs of Riegos de Levante formally initiated negotiations in order to put an end to the conflict. At this moment (March 2009) the final form of the agreement is not yet known, but it is clear that this story will not go on without serious consequences for El Hondo, affecting not only the ponds of Riegos de Levante, but potentially the whole system. The recent events have probably strengthened moves towards a sub-optimal future scenario.

4.6.4 When Scientific Advice Can Cause Conflicts and Unsustainability

In our opinion, the malvasia lesson is that even an ideal situation from a researcher point of view (where scientific findings have successfully influenced management decisions) can generate unexpected, dramatic consequences. In this case, scientific research was of good quality and gave a clear counsel to decision makers. This counsel was endorsed to the extent that a protection law was passed and a considerable economic effort was made, as recommended, through campaigns and environmental education activities to raise public awareness about the White-headed Duck and the soundness of protection decisions.

What has gone wrong then? One could simplistically think that the failure of the malvasia story cannot be attributed to scientific research, and that the complex mixture of social, political and cultural problems causing such a turbulent situation, has more strictly to do with managerial (or political) problems than with scientific questions. According to this, scientists have done their job giving decision makers clear recommendations, based on objective and scientifically sound argumentation. For the rest, we could argue, it is a question of the 'savoir-faire' of managers.

In our opinion the problem is more complex. In relation to the malvasia's case, it is probably appropriate to recall the well-known affirmation of Boehmer-Christiansen (1994): 'Science is often more comfortable in providing advice on what ought to be done and why, rather than practical advice on how it might be achieved'. In our case, it is obvious that researchers clearly said what ought to be done in order to conserve malvasia's populations and why. In fact, a considerable part of written reports, published materials and even legal documents was dedicated to explain the importance of the White-headed Duck and its conservation, thus maintaining certain water levels and ruling out traditional activities that might endanger malvasia's well-being. Given the objectivity of scientific evidence and measures proposed, the Administration simply adopted and legally ratified them integrally. At face value, this may constitute a perfect success story for scientific research and the rarely attained dream of environmental researchers.

In our opinion, this case perfectly illustrates what Herrick (2004) calls the futility of policies trying to ensure above all the 'objectivity' of data and information used for policy decisions, or even the consequences of 'excessive objectivity' denounced by Sarewitz (2000). The quest for objectivity in data usable in environmental management is not, of course, reprehensible. But the problem arises when the supposed 'objectivity' of facts obscures public and policy debate (Herrick and Jamieson 2001). Has the objectivity and the scientific excellence of research on malvasia's ecology obscured public debate? What is clear is that the malvasia case fits well with what Endter-Wada et al. (1998) consider the 'worst' possible implication of an isolated ecological research: considering that people are political obstacles for the implementation of what the natural scientists believe is necessary to meet ecological goals, and that the role of social science and managers is to 'educate' people so they become more supportive of those goals.

The Environmental Administration not only needs to know how the malvasia can be preserved, but also how the socio-ecosystem should be influenced or handled in order to guarantee the conservation of the malvasia. In other words, it is not so much a matter of managing the malvasia than a matter of working with stakeholders upon whom the survival of malvasia depends. And this kind of information has not been provided to managers by current scientific research because it needs a comprehensive approach encompassing rather than reducing complexity. Thus, a specific effort of integration of social and environmental, quantitative and qualitative, formal and informal information is absolutely needed.

For Walker et al. (2001), this activity of integration is distinctly different from the ones of managers, planners or researchers, and not the one that sits appropriately within the strict boundaries of any of these categories, but one that could

evolve from any of these starting points. The usual opinion that scientists should provide data and information, and managers must find the ways of implementing recommendations resulting from this information is too simplistic. Managers do not need pure scientific information, obtained within usual disciplinary constraints, but rather the integration of data into their real context, where they find practical sense. WADI project tried to put research as a starting point to advance towards the so strongly needed integration in the management of our systems. The case of the malvasia at El Hondo dramatically shows this need.

4.6.5 The Case of the 'Lemonium', or the Difference Between Competitive and Cooperative Conflicts in Environmental Management

'Lemonium' or 'Lemonio' are the approximate names that some local farmers of the area of El Hondo (and specifically Carrizales of Elche, the area towards the south-east of El Hondo ponds from which we have obtained the information for the present case) have given to a plant the Environmental Administration has said to them that is present in their lands. Few of them know exactly which plant it is, but this plant, even unknown, has become very important to them because the environmental authorities have said (or they have interpreted the Administration has said) that the 'Lemonium' is protected and they cannot plough and cultivate their lands if the 'Lemonium' is there. The 'Lemonium' has become one of the symbols of what 'Medioambiente' (Environment) means to them: an alien, bureaucratic and coercive force that tries to change their traditional way of life, on the base of incomprehensible arguments somehow related to what they qualify as the obsession of not harming wild animals and plants (Ciampi, this volume). 'Medioambiente', in this special sense, is a very important term for the understanding the local imaginary and local framing of environmental conflicts. During the Presentation meeting of El Hondo site in February 2006, which launched the project WADI, some speakers from the agricultural sector pronounced phrases like "These lands have nothing to do with the 'Environment', these lands are ours!". In this personified concept of 'Medioambiente' farmers include not only the Environmental Administration and its managers, but also Green groups and scientists. The WADI researchers were obliged to explain that they were not 'Environment' in this particular sense.

'Lemonium' is the local folk distortion of the name of the *Limonium* genus (Plumbaginaceae). The genus *Limonium* includes a great number of halophilous plants in Mediterranean coastal areas and in the province of Alicante in particular, many of them endemics to the area (see also Colombini and Chelazzi, this volume). The taxonomy of these plants is very complex (Crespo and Lledo 1998). Many species and forms, due to their restricted distribution, are included in the White Book of the endangered, endemic and rare species of the Valencia Region (Laguna 1998).

More importantly, *Limonium* species are associated with a Priority Habitat according to the European Council 92/43/EEC Directive on the conservation of

natural habitats and of wild fauna and flora (commonly known as the 'Habitats Directive'), specifically, the nº 1510 'Mediterranean salt steppes'. Due to the high salt content of soil and water, the unploughed fields are soon covered by salty scrub formations rich in *Limonium* species. Although from a strict phyto-sociological point of view, these colonising scrub formations should be labelled as 'Halo-nitrophilous Pegano-Salsoletea formations' (Habitat nº 1430, which is not a Priority Habitat according to the Habitats Directive). However, in the surroundings of El Hondo, all these formations are normally considered 'saladar' (halophilous scrub). In fact, the Management Plan of the Nature Park of El Hondo, in one of its most controversial dispositions, establishes that no 'saladar' formation can be broken up and put into cultivation. And this means that if a land has been left uncultivated during some years, it can not be cultivated again. For example, some farmers cannot cultivate the lands that had been cultivated by their parents. Obviously, this regulation has generated a very explosive situation, and even several farmers have been fined.

In 2006, during a field visit to the surroundings of El Hondo, the president of a community of irrigating farmers, while walking through a field where the Environmental Administration had prohibited cultivation because it was covered by a 'saladar formation', asked us: 'But which of all these plants is the famous Lemonium?'. Despite the value given to the plant and the conflictive regulation adopted for the protection of its habitat, no campaign had been made by the Environmental Administration to show local stakeholders why *Limonium* sp. were so important.

This is a typical case of apparently incompatible goals. 'Environment' and the farmers are perceived as incompatible parties, and the situation is a clear case of competitive conflict.

Some registered testimonies from the Environmental Administration staff certified that this perception of incompatibility is also shared by at least some influent members of the Administration. This perception has had serious consequences at a planning level, for example in the area delimited for the application of the Natural Resources Plan (Plan de Ordenación de los Recursos Naturales: PORN), one of the planning instruments established by the Spanish and Valencian Conservation Legislation for the protected areas. The delimitation of the area of application of the PORN should be defined according to scientific criteria, in order to guarantee the conservation of the natural resources and ecological processes on which the Nature Park depends. However, the consciousness of the perceived incompatibility between the environmental protection and traditional uses, and thus of the appearance of a possible case of competitive conflict in any area covered by the PORN, has led the decision makers to reduce the area to a minimum to avoid problems as much as possible. This area has been limited to an arbitrary periphery of 500 m around the Nature Park (Fig. 4.1).

The way in which the conflict has been perceived has led to a situation in which there is no guarantee of an adequate management of the (supposedly) protected natural heritage. As in the malvasia case, no solution was achieved, except the separation (to the maximum possible degree) of the conflictive (supposedly) incompatible goals. But it is important to note that this tendency to avoid conflicts goes in the detriment of sustainability and, in a sense, also in the detriment of stakeholders' true benefits.

4.7 WADI in the Boxing Ring of El Hondo: Testing the Role of Integrated Research in Re-Framing of Conflicts

Which role has WADI played in our conflictive cases? How has WADI research been perceived by each stakeholder? As a possible ally in the strife against other stakeholders? As a possible enemy to its aims? As a possible authorised mediator, acceptable by all parties? As a merely academic activity irrelevant for the 'really-important' questions?

As said before, the WADI team has carried out an important collaborative work in the area, with the aim of obtaining an integrated picture of the socio-ecosystem. This collaborative work has had, among other influences, the positive result of making local farmers conscious of the value of their activities, not only as a cultural heritage, but also as a driver of potential developments. For example, the WADI study on traditional fishing knowledge has been proposed by the irrigating farmers' Community of Carrizales and the Association of Private Owners of El Hondo to the Environmental Administration. Exhibitions on traditional fishing and in situ tasting of traditional fish cooking have been organised as a part of a formal strategic programme of eco-tourism and local development.

Also the WADI study on ethnobotany and traditional agriculture has had some influence. Among others, several agricultural and ethnobotanical products have been identified as capable of promoting socioeconomic benefits, including the local high-quality variety of melon, local traditional pomegranates, some vine varieties for the production of white wine, several textile plants grown in relation to irrigation infrastructures and used for handicrafts (mainly *Imperata cylindrica* and hemp, *Cannabis sativa*) and a series of spontaneous plants traditionally eaten in the area (*Sonchus tenerrimus*, *Cichoria intybus*, *Beta vulgaris*).

More importantly, through the organisation of a series of meetings, workshops, etc., the WADI project led some farmers, and specially the younger, to think that, perhaps, the 'Environment' and the well-being of local farmers as well as the maintenance of traditional activities of the local community were not completely incompatible. Moreover, the integration of these two aspects may offer them a better future scenario.

As a result of the WADI meeting of 15 November 2008, experiences from another WADI site (Parco Regionale della Maremma, Italy; Scapini, this volume; Colombini and Chelazzi, this volume) and from other Spanish protected areas were shown to El Hondo stakeholders. Taking advantage of the findings of the collaborative WADI work on local ethnobotanical and agricultural values, the irrigating farmers' Community of Carrizales has devised a strategic plan to promote agro-ecological potential enterprises. Although the initiative is yet embryonary, it has been officially supported by the Environmental and Agricultural Administration. It is important to note that the name selected by the farmers for this initiative: 'Agrarian Nature Park of Carrizales' (which has obtained support also from the Environmental and Land Planning Administration) aims to integrate both natural and agricultural values. Even some representatives of the Green groups have

been incorporated to the managing board of this Agrarian Nature Park with the aim of promoting Green initiatives.

A harsh, competitive conflict, of which the somehow mythical figure of the 'Lemonium' could be considered an appropriate symbol, is now being reframed, not in a situation of no-conflict, but in a cooperative conflict between conservationist goals and developmental goals. Of course, some strives or disagreements have already appeared between Green members of the new Management Board and some farmers, but the case is that many things have changed.

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Chapter 5
Soil Salinisation in the Grosseto Plain (Maremma, Italy): An Environmental and Socio-Economic Analysis of the Impact on the Agro-Ecosystem

Camillo Zanchi and Stefano Cecchi

Abstract Soil salinisation jeopardises economy and landscape formed in Grosseto Plain during the last two centuries. Observed evidences show that soil salinisation is not due to climate change and rain reduction, but predominantly to the agricultural techniques of the local farms, which require large water supplies for irrigation. Water is drawn heavily from brackish water bodies too. In turn, in this coastal zone the excessive exploitation of groundwater increases the entry of salt water from the sea into the groundwater table. This research indicates alternative agricultural techniques fit to avoid soil salinisation and aimed at maintaining agricultural profitability as well as the landscape in the Grosseto Plain.

Keywords Agricultural desertification • Soil salinisation • Agro-ecosystem • Saline water irrigation • Agronomic management

5.1 Introduction

Soil salinisation is one of the main soil degradation processes in the Mediterranean area. At the same time, it is a promoter and a consequence of desertification, that is the progressive degradation of fertility in the surface layer of the soil and of the production capacity of arid, semiarid and dry sub-humid lands, which can be attributed to stresses due to climate and to the unsustainable pressure of human activity on the environment (UNEP 1994).

In the Grosseto Plain (central Italy), where agriculture is the main economic activity, the agro-ecosystem is the main environmental feature and the rural landscape is an important determinant of the economic and social welfare of its inhabitants.

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Soil salinisation is the soil degradation process of major impact since it affects soil fertility and crop production. The causes of salt accumulation in the soils of the Grosseto Plain are the use of saline water for irrigation and the rise of salts from groundwater to soil surface by capillary action; this process is mainly due to the intrusion of sea water into the groundwater table because of the overexploitation of water resources for irrigation and domestic uses. Increasing salt concentration in the Grosseto Plain soils is usually not considered a serious risk because the salt–leaching action of the autumn–winter rainfalls is thought to be sufficient to prevent salt accumulation in the soil. However, the continuous decrease of cultivated hectares because of soil salinity, the continuous loss of irrigation water resources because of groundwater salinisation and the future climatic scenarios call for a review of this belief. Indeed, agronomic management of the salinisation process via proper cultivation techniques for the control of soil salt accumulation is very important for sustainability of this agro-ecosystem.

The aims of this paper are to describe the agricultural scenario and economic and environmental importance of the Grosseto Plain agro-ecosystem, and to present the research carried out within the WADI Project in regard to salinisation of cultivated land in the Grosseto Plain induced by irrigation practices.

5.2 The Grosseto Plain: A Recent Landscape with an Age-Old History

A broad plain dotted with houses, crossed by roads and furrowed by channels that define a myriad of cultivated fields (in most cases irrigated), with small patches of marshland preserved because of their historical and environmental value: this is the current image of the Grosseto Plain, the most intensely cultivated and anthropised part of Maremma, a coastal alluvial plain of about 390 km^2 south of the city of Grosseto between the Bruna River and the Ombrone River, mainly surrounded by low woody hills and separated from the sea by a band of coastal vegetation. Today's Grosseto Plain is a recent, evolving landscape, the result of exceptional human activity. Centuries of reclamation work have transformed and managed the water and soil, the basic elements that constitute and define the Maremma landscape (Caldelli 2003). Through the control and management of water-courses (hydraulic reclamation) and the drainage and permanent increase of soil depth (soil reclamation), man has continuously acted on the water and soil of Maremma to transform the landscape and improve the living conditions of its inhabitants.

Originally (6000 BC) the Grosseto Plain was an inland lagoon (Prile Lake) separated from the sea by a set of dunes where the present coastline is located. The dunes were created by the concomitant action of sea-erosion and soil-transport by rivers, the same water-courses that caused the progressive filling up of the lagoon and the formation of the alluvial plain by deposition of sediments.

The first human settlements in the territory surrounding the Prile Lake belong to the Etruscan-Roman period, when the economy of the populations was based on

fishing, agriculture and trade with neighbouring towns of the Tyrrhenian coast. In the Roman age, the water-courses were maintained to allow irrigation for the flourishing agriculture and to ensure their navigability. The end of the Roman Empire and the subsequent barbarian invasions put an end to the damming and cleaning of the water-courses, which resulted in recurrent overflowing of the rivers and expansion of marshland in the plain.

The first attempts of land reclamation were carried out by monks around AD 1000. But they resulted in vain because of the recurrent wars, which caused the abandonment of agriculture, the increase of the marshlands and the spread of malaria. The first real works of reclamation in Maremma were carried out under the Medici dynasty rule. They consisted in the excavation of ditches and channels to remove the water and drain the pools of the marshland. However, the incomplete reclamation (removal of water without filling the empty spaces caused by the drainage) and the uncertain economic policy of the Medici in Maremma (co-existence of agriculture, fishing and sheep-raising) resulted in a 'disorderly' landscape, where the fields cultivated for subsistence farming were under the permanent risk of flooding and of unsustainable hygienic-sanitary conditions.

In the eighteenth century, after the Medici period, Maremma was under the control of the Habsburg-Lothringen dynasty (1737–1860), which established innovative socio-economic policies (abolition of some feudal privileges, the centrality of agriculture in the economic development of Maremma, encouragement of farming) and began regular land reclamation based on the 'colmata' system, that is the artificial aggradation by deposition of river-borne sediments. In the period 1829–1832, two channels to transport the muddy water of the Ombrone River to the marshland were excavated; Leopold II enacted specific laws on land reclamation and many works were conducted for the control of rivers and to counter flooding of the plain.

In 1859, Maremma was annexed to the Kingdom of Italy and, for the next 60 years, reclamation followed the Habsburg-Lothringen dynasty pattern. Nevertheless, sediment filling up of the adductor channels of the water due to the 'colmata', the poor sanitary conditions of the area and the uncertain political climate of the time (dominated by revolutionary movements and internal wars) interfered with the reclamation of the plain and the work was often abandoned. At the end of World War I, the Maremma plain was still a very hostile environment for man and his activities. The variable topography (many areas were under permanent risk of submersion because of their low slope and/or elevation above sea level), the irregular hydrography (not all the ditches and channels of the drainage network had the same direction towards the sea) and the endemic presence of malaria made the plain a sparsely populated territory in which itinerant sheep-raising was carried out alongside subsistence agriculture based on wheat monoculture by seasonal and temporary labourers.

An important step towards the transformation of the Maremma landscape and socioeconomic development of the area was the establishment of the 'Consorzio di Bonifica' (Land Reclamation Consortium) of Grosseto in 1930, when several prominent landowners joined to manage the reclamation works of the plain. The aims of the Consortium, whose territorial bounds largely coincided with the present Grosseto Plain, were: to obtain and maintain thicknesses of soil free from stagnant

water in all fields of the plain; to develop highly productive and profitable agriculture; to favour permanent settlement of the rural population in Maremma. To achieve its objectives, the Consortium built channels to convey the water coming from the hills into the main water-courses and positioned four water-pumps to accelerate the 'colmata' process and remove the drainage waters. Instead of mass employment of seasonal day-labourers, the 'mezzadria' (sharecropping) system was adopted as the new socioeconomic pattern for the rural development of Maremma. The first agricultural machines and new cultivation techniques were introduced in the large landed estate (latifundium) farms: fallow and pasturage were gradually abandoned and the cereal yields increased thanks to the adoption of biennial or quadrennial crop rotations. As the reclamation process proceeded, new infrastructures (roads, aqueducts, irrigation channels) were created to support the economic development of Maremma and repopulation of the countryside.

The period of agricultural development of the plain and evolution of the Maremma landscape due to the initiative of the landowners continued till World War II, and the most evident signs of the socioeconomic transformation of the Grosseto Plain were the establishment of many new farms and the arrival of many rural families, also from other regions of Italy.

After World War II, the newborn Italian Republic declared Maremma a rural area of national interest for development of the country, and management of the transformation and development of the area was taken over by the Italian Government. Under public administration, the territorial, economic and social transformation of the Maremma plain greatly accelerated: the total land reclamation was completed, malaria was vanquished thanks to the massive use of pesticides, and the 'Riforma agraria' (rural property Act) was enacted in 1950.

The Land Reform was the fundamental legislative act that determined the present socioeconomic structure of the Grosseto Plain (Lucetti 2003). Its basic aim was the coincidence of land ownership and rural work: the farmer and the landowner had to be the same person. Before 1950, Maremma was organised in large estates (72% had more than 100 ha and estates larger than 1,000 ha occupied 45% of the total cultivated land) managed by rich landowners, and extensive agriculture and the 'mezzadria' system defined the agricultural scenario. Through the Land Reform, many people (more than 15,000) became landowners and the main consequence, other than the (virtual) disappearance of latifundia and mezzadria, was the birth of a new socioeconomic class consisting of farmers who carried out their own agricultural production on their own farm. Moreover, new houses, schools, churches, food shops and roads were built to support the work and daily life of the land assignees and their families; agriculture became increasingly intensive, transhumance disappeared completely and new crops, such as sugar beet, sunflower and vegetables, joined the traditional cereal crops. The rural property Act was the logical conclusion of the centuries-old reclamation process in Maremma, and its effects on the landscape and socioeconomic structure of the plain are well visible today.

The Grosseto Plain is now a highly impacted landscape, a large agro-ecosystem where the main economic activities are agriculture and tourism (also combined in recent decades). The agricultural activity is carried out in a dense network of highly productive farms spread over a total cultivated area of about 29,000 ha.

Agriculture also allows a flourishing and widespread activity of in-farm tourism (agritourism) and the production of forage crops supports an important cattle breeding industry. Therefore, the agro-ecosystem is the main environmental feature of the Grosseto Plain, and the rural landscape is important in determining the economic and social welfare of its inhabitants.

The Grosseto Plain is a dynamic, always evolving landscape, and its sustainability requires a balance between human activities and uses of environmental resources. For a long time, the continuous work of reclamation and the 'good' management of natural resources resulted in environmental sustainability of the agro-ecosystem. However, the economic and environmental balance of the rural landscape has become endangered in the last 10–15 years because of mismanagement of the resources (above all water and soil). The most evident and dangerous threat to sustainability of the agricultural activity in Maremma is the salinisation of groundwaters and cultivated fields.

The problems due to water and soil salinisation in the Grosseto Plain have been known for a long time: for example, the wells drilled near the coast by the 'Consorzio di Bonifica' of Grosseto around 1935 to provide fresh water for the population and for agricultural activities proved unsuitable for humans and animals because of the high salt content of the water. The first important studies of soil salinisation were carried out by the University of Florence in the second half of the past century. At the time, however, salinisation processes were limited to circumscribed areas near the coast, while soil and water salinisation have become increasingly dangerous and widespread in the last decade: each year, the distance from the coast of wells unusable because of their water salinity increases, and there is an increase every new crop season of the number of hectares no longer suitable for intensive, specialised and highly productive agriculture on account of the rising soil salt content.

The increased salt concentration in the cultivated fields of Maremma is a very dangerous soil degradation process because it affects overall soil fertility (physical, chemical, biological) and thus has a harmful effect on the productivity and economic sustainability of agriculture in the Grosseto Plain. Moreover, total reclamation of salt affected soils is not generally possible, and the agronomic control of salinity is very complicated because of the many aspects (soil, climate, hydrology, irrigation, cultivation techniques) involved in the soil salinisation process.

Knowledge of the territory and the mechanisms that determine soil salinisation are essential to define proper agronomic management of soils threatened by salinity and to preserve their fertility, so that agriculture will continue to be an opportunity for socioeconomic development of the Grosseto Plain and the agro-ecosystem will remain the major feature of its landscape.

5.3 The Agricultural Structure of the Grosseto Plain

The Grosseto Plain is an important agro-ecosystem of the Mediterranean area, where agriculture is carried out on more than 2,000 farms covering about 29,000 ha. Most of the farms are small (average farm 14 ha) and almost all of the agricultural

labour is carried out by the farmers and their families (Camera di Commercio Grosseto 2006, 2007).

Almost all the agricultural production of the Grosseto Plain is due to the cultivation of herbaceous crops, and only 9% of the total agricultural land is devoted to woody crops (Fig. 5.1). Because of the climatic features of the Grosseto Plain, characterised by a coastal Mediterranean climate with a strong, permanent hydro-climatic deficit during the spring–summer cultivation season (Regione Toscana 1984), the agricultural production of the spring–summer months requires irrigation. In 2000, about 35% of the cultivated area of the Grosseto Plain was under irrigation, and the most important irrigated crop (in terms of hectares) was tomato, followed by forage crops, vegetables and cereals (Fig. 5.2). Although livestock breeding in the Grosseto Plain has decreased in recent years, the production of forage (mainly alfalfa and maize for silage) is important for the many cattle farms in the Province of Grosseto. Another important aspect of the agricultural activity of the Grosseto Plain is the continuous increase of agritourism activities on the farms of the area (Regione Toscana 2007).

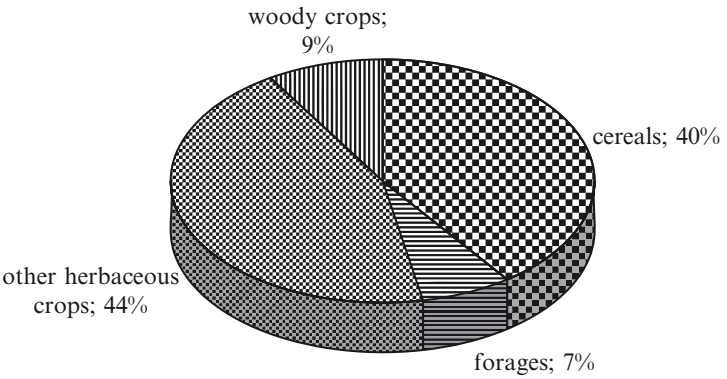

Fig. 5.1 Percentage division of the 'total cultivated land' of the Grosseto Plain agro-ecosystem

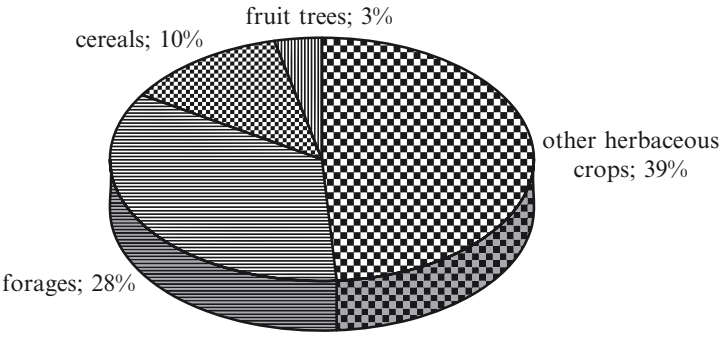

Fig. 5.2 Percentage division of the 'irrigated land' of the Grosseto Plain agro-ecosystem

In summary, in the Grosseto Plain the agricultural activity is carried out by a network of small farms, where most of the labour is carried out by the farmers and their families; the massive input in terms of labour, mechanisation, fertilisers and irrigation results in high productivity (crop yields), and agriculture provides the main or only kind of income for many people. Moreover, the number of tourists coming to Maremma because of the environmental quality of its agro-ecosystem has increased yearly in the last decade, and the rural landscape appears to be the most important product of Grosseto Plain agriculture within the context of the environmental and economic sustainability of the Maremma territorial system.

5.4 Salinity Hazard in the Grosseto Plain

Soil salinisation is one of the main soil degradation processes in the Grosseto Plain and in the irrigated areas of the Mediterranean Basin: when considered in relation to persistence and permanence, the sustainability of irrigated agriculture is limited mainly by salinity and salinisation of the irrigated soils. All irrigation water contains soluble salts, and when the irrigation water is used, the water (which acts as a solvent) is largely removed from the soil or the plant by evapotranspiration, while the salt (the solute) remains in the soil. Thus, salt accumulation occurs after repeated applications and it is only a matter of time until a salinity regime is established, unless measures are taken to prevent it.

Problems due to soil salinity in the Grosseto Plain are well known. Several studies have demonstrated severe salinisation of the soils at several sites in the plain, especially in clayey areas with poor drainage (Breteler 1983; Zanchi and Cecchi 1995; Falciai 1996). Until 10–15 years ago, saline soils were limited to areas near the coast and water bodies (Sevink et al. 1986). The main mechanism of soil salinisation was identified as the entry of sea water along water-courses and reclamation channels during sea storms, and the consequence was the salinisation of soils because of the diffusion of saline water (Ungaro 1995; Pranzini 1996).

In the last decade, however, another soil salinisation process has become increasingly important and diffuse. Because of the overexploitation of water resources for human needs (agricultural, industrial and domestic uses), the natural equilibrium between fresh and saline groundwater has been disrupted, with the intrusion (and diffusion) of salt water from the sea into the groundwater table, the main source of water for irrigation (Beemster 1987). The consequence is salinisation of the irrigated soils (Fig. 5.3).

In the Grosseto Plain agro-ecosystem, many important crops (maize, tomato, vegetables, soybean, watermelon and alfalfa) are cultivated during the dry spring–summer season. The water deficit during the irrigation season is higher than 400 mm and more than 70% of the irrigation water is drawn from the groundwater table by hundreds of wells scattered across the plain. Therefore, we can understand the potential impact of such severe, rapid and widespread soil degradation on the economic and environmental context of the Grosseto Plain.

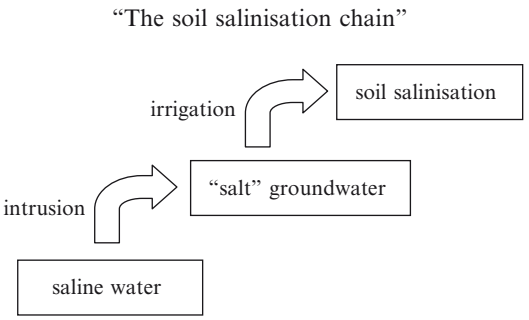

Fig. 5.3 Soil salinisation in the Grosseto plain: movement of salt from sea water to groundwater to soil

Another important aspect to be considered in evaluating the potential risk of soil salinisation is climate (van der Molen 1984). Saline soils are formed where the amount of salt that accumulates is greater than the amount removed. Since the migration of salts in soils occurs mainly through salt solutions, the main condition of salt accumulation in soil is the preponderance of evaporation over drainage. As a consequence, the processes of salt accumulation are governed first and foremost by the water balance of each particular area. Both the water balance of the area and the ratio of evaporation to drainage depend on climatic conditions.

The present Mediterranean climate is characterised by hot dry summers and mild wet winters. The region frequently has years of scant rainfall, and many areas are afflicted by severe drought. The alternation of a wet and dry season results in two critical periods related to the potential risk of soil salinisation: the first is the autumn–spring period when the often abundant rainfall may cause water stagnation; the second is the summer period because of the high evapotranspiration demand that causes salts to rise from the groundwater to the soil surface (Monteleone 2006).

Climatic analyses of the Mediterranean area show that the central and southern countries of the region are not at risk of water stagnation during the wet season; however, rainfall-induced leaching of the salts brought to the soil by irrigation is almost negligible. Moreover, scenarios developed with the most recent General Circulation Models for assessment of the hydrological impacts of climate changes predict that rainfall will decrease over much of the Mediterranean by the year 2050, especially in the southern parts where it could diminish by up to 25% with respect to the mean values of the period 1961–1990; the decreased precipitation should be accompanied by a rise in temperature of between 1°C and 3°C (De Wrachien et al. 2002a, b). Reduced precipitation will have a major impact on irrigation demands and the potential leaching action of rain (De Wrachien and Ragab 2003; Döll 2002; Seckler et al. 1997).

The climatic risk of soil salinisation in the Grosseto Plain has been investigated by an analysis of the climatological data for a 50-year period (1956–2005) at the meteorological station of Grosseto (Zanchi and Cecchi 2008). Three climatological parameters were considered: evapotranspiration, rainfall and the Climatic Water Balance (CWB), that is the difference over a defined length of time between cumulative rainfall and evapotranspiration requirements; CWB summarises the relative

importance of rainfall and evapotranspiration for the assessment of the climatic risk of soil salinisation (Fig. 5.4). The most important result of the climatological analysis was the persistent and progressive contraction of the Climatic Water Balance of the Grosseto area. The spring and summer seasons were characterised by a permanent lack of water surplus, and the arid period was prolonged to the autumnal months, with an average CWB around zero. The CWB of the winter season was positive on average

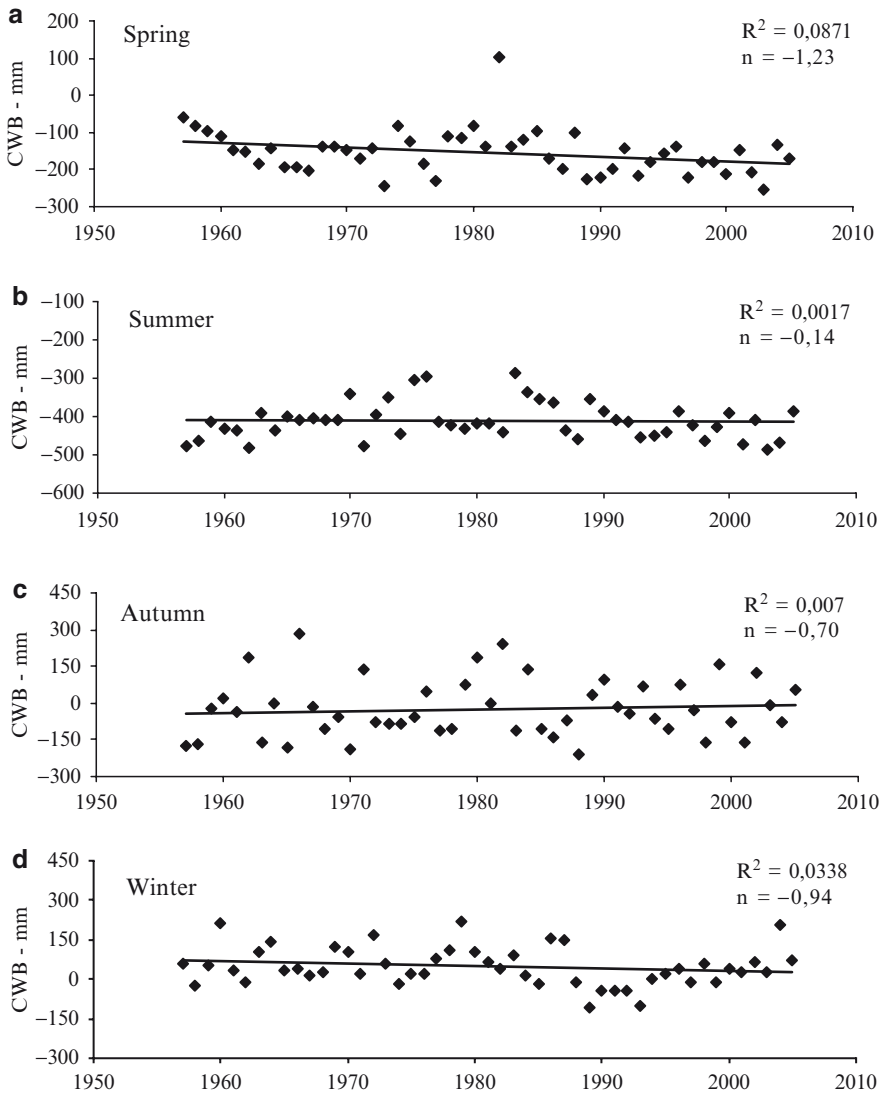

Fig. 5.4 Linear regression of the seasonal Climatic Water Balance (CWB, mm) during the 50-year period 1956–2005 at the meteorological station of Grosseto

(there was a surplus of rainfall for salt leaching) but not in every year; above all, it showed a trend towards values close to zero, indicating the risk of a chronic water deficit extended also to the winter months. Such a trend could reduce the autumn–winter rainfall-induced leaching of the salt accumulated in the soil due to irrigation during the spring–summer cultivation season. In the long run, this set of climatic conditions could prejudice the sustainability of irrigated farming systems in the Grosseto Plain.

5.5 Soil Salinisation and Agronomic Management of the Irrigated Land of Maremma

In recent years, the Grosseto Plain agro-ecosystem has experienced secondary salinisation of the irrigated soils due to the use of poor-quality irrigation water. The main consequence of this soil degradation process is reduced soil fertility, and from year to year the signs of 'suffering' by the agro-ecosystem are increasingly evident from both the economic and environmental point of view. In the decade 1990–2000, about 1,880 ha could no longer be irrigated because of the salinity of the water and a large number of wells became useless for irrigation purposes (ISTAT 2000). In the last 9 years (2000–2008), very remunerative crops such as onion became less important because they are saline-sensitive, while salt-tolerant crops (tomato and squash) spread on the irrigated land of Maremma (Regione Toscana 2008).

As a rule, total reclamation of salt-affected soils is not possible because supplies of good-quality water are not sufficient. The alternative for continued crop production appears to be the development of specialised management practices that lessen the damaging effects of salt and maintain as high a production level as feasible.

In irrigated areas affected by secondary soil salinisation, the agricultural limitations due to salinity become complicated because of manifold and complex soil-water interactions which depend on soil texture, soil structure, cultivation techniques, irrigation methods, water quality and water dynamics. In addition, the quality of irrigation water is expected to decrease because of strong competition for different uses of the water resources, and scenarios developed to assess the hydrological impact of expected climate changes, predict a major impact on irrigation water demand and the potential leaching action of climate over much of the Mediterranean (Alcamo et al. 2000). Therefore, soil salinisation of the irrigated land of the Grosseto Plain is predicted to get worse and the sustainability of agriculture activities will be compromised unless proper agronomic measures are taken to prevent it.

At present, the irrigated farms of the Grosseto Plain carry out highly specialised, intensive agriculture, and their farming systems are too rigid and inflexible for a timely response to the severe, rapid and widespread soil degradation induced by the use of saline irrigation water. As a consequence, in comparison with the secondary soil salinisation scenario, the farmers follow two main strategies: either they accept lower crop yields and continue with saline water irrigation or they change crop and cultivate more salt-tolerant plants and continue with saline water irrigation.

However, the end result of this behaviour is 'agricultural desertification': from irrigation season to irrigation season, the farmers promote salinisation of the soil, and it is only a matter of time before the soil salt content reaches a level incompatible with agriculture.

To avoid soil salinisation of the irrigated fields in the Grosseto Plain, the irrigation strategy must introduce the lowest possible amount of salt into the soil. The starting points are: to know the salt content of the irrigation water; on the basis of the specific soil characteristics, to carry out crop rotations that reduce the amount of irrigation water applied to the soil during the crop season; above all, to ensure sufficient salt leaching during the rainy season (rotation of irrigated and non-irrigated crops, autumn–winter and spring–summer crops, leafy and grain crops, etc.).

For continued crop production, the irrigated farms of the Grosseto Plain require agronomic management practices involving the farming systems as a whole rather than a focusing on single crops and/or single cultivation techniques.

> Soil is one of humanity's most precious assets
> It allows plants, animals and man to live on the earth's surface
> Soil is a limited resource which is easily destroyed
> Farmers and foresters must apply methods that preserve the quality of the soil
> – European Soil Charter, Council of Europe, 1972

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Chapter 6
Evolution, Impacts and Management of the Wetlands of the Grosseto Plain, Italy

Isabella Colombini and Lorenzo Chelazzi

Abstract This chapter analyses the wetland areas of the Grosseto Plain on the central west coast of Italy starting from a general description of the multiple roles of wetland ecosystems and their value to humanity at a national and an international level. A brief description of their geological origin and of their evolution though history is given taking into account human interventions ever since the Etruscan-Roman period. In particular the wetlands of two main areas, the Diaccia Botrona Provincial Nature Reserve and the Maremma Regional Park, are described from a geomorphological, botanical and faunal point of view and are considered intrinsically connected to other water bodies of the region making up the 'Maremma wetland complex'. In the last section conflicts among stakeholders on the main environmental issues are highlighted and focus is made on the ongoing management plans and actions that are now taking place.

Keywords Evolution of environment • Natural and human impacts • Management • Wetlands

6.1 Introduction

According to the Ramsar convention (1971) wetlands are defined as: 'areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed 6 m'. These particular ecosystems host specialised flora and fauna that are highly valuable both from an ecological and biogeographical point of view. The destruction of these environments has taken

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place and still occurs throughout the world. Wetlands are globally distributed so it is not surprising that the first modern intergovernmental treaty on the conservation of nature resources had the aim of protecting these particularly complex environments. For this reason only a few decades ago, international laws and a detailed guidance on the development of National Wetland Policies and on management planning for individual wetland sites were adopted and included in the Italian legislation (Galletti 1995). In the past, it was generally recognised that wetlands were unhealthy environments with little value, which could be exploited advantageously only through land reclamation strategies. However, this concept was based on scanty information on the uniqueness of the environmental characteristics of wetland areas and on the tendency to privilege the enhancement of a territory only through land reclamation strategies (Galletti 1995).

The multiple roles of wetland ecosystems (productive environments providing tremendous economic benefits, cradles of biological diversity, storehouses of plant genetic material, etc.) and of their value to humanity have been increasingly understood and documented in the last century. However, today, knowledge is still lacking in some cases and if present, it is incomplete and/or non-homogeneous. The absence of information is thus a limiting factor not only for science but also for the key role that it plays in the correct management of wetland areas. In fact, inadequate management strategies generally lead to irreversible environmental changes of wetland areas with enormous costs to human welfare.

Due to the particular morphology of its coast, Tuscany has always been characterised by a very rich and diverse number of wetlands and by extensive floodplain woodlands with hydrophilic characteristics. In northern Tuscany marshes could be found at the deltas of the Serchio and Arno rivers, in the Bientina basin (Pisa and Lucca provinces), in the Valdinievole (Pistoia and Florence provinces) and along the Leghorn coast. To the south extensive wetland areas occurred at the deltas of the Bruna, Ombrone and Fiora rivers. Furthermore, in inland Tuscany marshes once covered the areas located in the Arno Plain to the south of Florence and in the Val di Chiana (Siena and Arezzo provinces).

When Italy was unified in 1861, in Tuscany there existed about 57,000 ha of marshlands, equal to 2.4% of its territory. Nowadays, these areas have decreased to about 11,500 ha corresponding to 0.5% of the entire territory. These remaining wetlands differ in typology according to the different altitude at which they occur (plains, hills, mountains) and according to their different origins (coastal, fluvial, glacial and karst) and water quality (from hyper-saline to freshwater).

The protection of the natural environment and of the landscape is one of the major issues in economical regional planning and must thus avail itself of an interdisciplinary kind of territorial planning. Nature conservation is therefore a very challenging topic, as it involves all environmental compartments and an array of different expertises (Doccioli 1970).

In an over-populated country like Italy, today's landscape is the result of a series of slow but profound modifications that have occurred through time and that are the result of changes in human conditions and needs (housing typologies, food demand, farming, leisure activities, tourism, etc.). However, these environmental changes

have varied greatly from one region to another resulting in a great variety of different situations, ranging from almost pristine to totally impacted ecosystems (Barsanti and Rombai 1986; Maniglio Calcagno 2006).

In the Mediterranean, the alluvial plains, formed by nearby rivers, represent one of the environments that have been best able to cope with human impacts. This has mainly occurred on account of the unfavourable life conditions (risks of malaria) that in the past were present in those areas and also because of the absence of adequate technological means. This has been the case for the Grosseto Plain, in which the presence of large private estates, characterised by an enduring ultra-conservatism and of politically strong local hunting associations (with a long tradition in water fowl hunting) have contributed to the conservation of the marshlands. For these reasons a consistent part of the wetlands have reached our days almost in their original state and have been preserved from important historical interventions such as land reclamation.

6.2 Origins and Evolution of the Grosseto Plain

6.2.1 Geomorphologic Characteristics

The Ombrone River basin is subdivided in four sub-basins: the Ombrone, Albegna, Bruna rivers and the Osa stream, covering a total of 4,768 km^2. All systems are included within the territory of the Tuscany Region.

The main river of the basin, from which it takes its name, is the Ombrone River that is also the largest in southern Tuscany, with a catchment area of approximately 3,500 km^2. Flowing on Pliocene loamy-sandy sediments, this river has the greatest suspended sediment load as compared to other rivers in Tuscany. Its fluvial regime is influenced by seasonal rainfall and during the period of highest precipitations, it causes abundant erosion throughout the landscape (Matina et al. 2005).

During the last glacial interval, the Ombrone and Bruna rivers cut two valleys into the Late Pleistocene deposits on opposite sides of the present alluvial plain, leaving in the middle a ridge protruding towards sea. Due to post-glacial warming and the consequent rise in sea-level, the sea invaded the coastal valleys and formed a large gulf with two inlets. Later these inlets were filled up by the sediments carried by the two rivers, the southern of the two inlets filling more rapidly because of the higher loads of clastic material carried by the Ombrone. During the first post-glacial phase mainly coarse sediments were deposited and formed the gravel layers of groundwaters. Subsequently, as the temperature increased, finer alluvial sediments were carried, forming silt and clay deposits. In the southern part of the plain, formed by the Ombrone, gravels and sandy layers are thicker and more abundant, whereas in the northern area of the Bruna silt and clay deposits are mainly to be found (Innocenti and Pranzini 1993; Carboni et al. 2002; Bellotti et al. 2004; Biserni and van Geel 2005).

The Ombrone River originates from the south-eastern Chianti hills near San Gusmè (Siena). After a relatively complex course of about 165 km through narrow and steep valleys, it runs out into the Tyrrhenian Sea in an area south-west the city of Grosseto. The final section of the river has a meandering course and has a typical lentic environment characterised by very slow water flow.

The Grosseto Plain is thus an alluvial plain formed by the progressive build up of sediments, especially by the Ombrone River (Bellotti and Davoli 2001). In the sixth century BC, during the Etruscan period, dune formations along the coast created a vast lagoon that gradually was transformed into a large lake, the so called Prile Lake, that received waters from the Bruna River. In more recent times, the progressive and gradual input of sediments carried by the Bruna or deposited during floods by the Ombrone rivers filled up the lake and formed extensive marshlands.

6.2.2 Erosion and Salinisation

Nowadays, the delta of the Ombrone River is undergoing a strong erosion process that began during the second half of the nineteenth century after a long period of accretion that occurred more or less rapidly according to the different climatic conditions and the historical events (Pranzini 2001; Ciampi 2007) (Fig. 6.1). The relatively recent change in this trend was triggered by the beginning

Fig. 6.1 The Ombrone River mouth (Photo L. Chelazzi)

of the land reclamation process, through artificial aggradation (filling up technique, the 'Colmata', Zanchi and Cecchi, this volume). This process continued until the fifties of the last century and resulted in a great decrease of fluvial sediments to the sea. However, the phenomenon of erosion continued even after the end of the land reclamation processes and today, it is still affecting wider and wider areas of the delta. The sedimentary deficit of the littoral can be attributed to the low quantity of sediments that are now carried by the Ombrone River caused by human interventions on the river banks and bed. In fact, river bed quarrying is an important activity still going on in several locations along the river.

As a result of the strong erosion, the advancing sea has caused marine water intrusion into coastal groundwater and has invaded the surface of vast bordering areas.

In the Grosseto Plain, the salinisation of the water table is a complex phenomenon (Bencini and Pranzini 1992; Pranzini 1996; Grassi and Netti 2000). In fact, marine water intrusion is seasonal (proceeding in summer and receding in winter) and progressive, as it tends to advance towards land through time. Also pumping groundwater for crop irrigation worsens the situation and attracts marine water to wells. Furthermore, in some areas mineral water of deep layers naturally reaches the surface and mixes with sea water. Another phenomenon contributing to ground water salinisation is the extraction of salt water from clay layers of marine and lagoon origin.

6.2.3 Land Reclamation and the Rural Property Act

The alluvial origin of the Grosseto Plain has determined the presence of extensive marshlands, a characteristics that distinguishes the area. These marshes were once fed by the waters from the Bruna River and by the floods from the Ombrone River. Ever since the Etruscan-Roman period, the first attempts to reclaim land for agricultural purposes were made and interventions were carried out to favour water outflow. However, it was not until the Medicean period, during the seventeenth century, that the first water infrastructures were built. These aimed to ameliorate the water quality of the Prile Lake exploited, at the time, for fishing activities. When important cities arose in the area, several navigable channels were built. These fostered trade and thus merchandise could be easily transported to the port of Castiglione della Pescaia. It should be recalled that only during this period land reclamation interventions started to be successful. In fact, besides the construction of channels, it was necessary to raise the river banks of the Ombrone to prevent water from invading the newly reclaimed lands during river floods (Barsanti and Rombai 1986). However, the territory on the left hand side of the Ombrone did not receive the same attention as the one on the right. In fact, given the presence of important centres on the river's right bank, the first interventions to contain the river waters and the building of channels occurred on this side. Interventions (river embankment and the construction of channels) on the other side of the river were

carried out only later in time and it was not before the first decade of the twentieth century that some real results were achieved.

Besides the channels built to drain the plain, during the nineteenth century another series of channels were constructed to convoy the waters to the plain during flooding of the Ombrone River. This technique of aggradation, namely the filling up of the lands with fluvial sediments for their reclamation, when used systematically, gave important results similar to the ones that had originated the plain itself. This technique, used until the beginning of the 1950s, aimed at reclaiming land for agriculture and at solving the plague of malaria. Once the disease was wiped out, also thanks to DDT, both the end of the land reclamation process and the pressures on behalf of the local hunting associations led to the conservation of some wetlands of the Grosseto Plain. In fact, ever since the mid-seventies of the last century, the Diaccia Botrona Provincial Nature Reserve and the Maremma Regional Park were declared protected areas by the Grosseto Province and Tuscany Region respectively. In the Maremma Regional Park several levels of protection were established with some areas declared as 'integrally protected'.

From the period of the Habsburg-Lothringen dynasty, in 1737, to the first decades of the last century, the image of the Maremma has always been associated with a fertile and rich farming area thanks to the choices in cultivations and to the reorganisation of its lands. After the rural property Act of (Riforma agraria) dating back to the first years of the 1950s, owners of small properties transformed traditional farming into intensive and specialised farming and in a very short period of time were able to obtain the best results both from a social and economic point of view.

Today, the Grosseto Plain is heavily impacted by a network of highly productive farms. Here, standards of living are quite high and all kinds of problems regarding the social disequilibrium between city and countryside have been solved. Farming, today, is seeking larger markets also thanks to the processing and enhancement of typical local products. Furthermore, it may also be stated that besides farming, tourism has also become a highly competitive activity that can take advantage not only of sea-side tourism (sun bathing, swimming, sailing, tracking, etc.) but also of cultural activities that can be carried out along the coast and in the more inland areas of the territory.

6.3 Diaccia Botrona Provincial Nature Reserve

6.3.1 Ecosystem Description: General Features and Water Quality

Near the town of Castiglione della Pescaia, on the western part of the Grosseto Plain, lies a wetland area that includes the Padule of Castiglione, a portion of the Padule Aperto, the pinewoods and the coastal dunes (Fig. 6.2). The entire area (about 3,000 ha, 0–5 m above sea level) is considered an IBA (Important Bird Area)

Fig. 6.2 Diaccia Botrona Provincial Nature Reserve: map of the area (Modified from Google Maps)

and it is delimited by the Bruna River to the north-west, by the Affacciato bank and San Leopoldo Emissary channel to the east and by the coast to the south-west. Within the area lies the Diaccia Botrona Provincial Nature Reserve of about 1,000 ha that was declared a SPA (Special Protection Area, EC Directive) by a national law. The Reserve is subdivided in two main wetlands from which it takes its name: the Serrata of the Diaccia and that of the Botrona.

Furthermore, about 80% of the IBA is made up of reclaimed land for farming and a fish farm.

Within the area there is a system of channels interconnected by a complex network of secondary channels that spread out into the wetlands collecting and draining freshwater run-outs originating from rain (Fig. 6.3). The wetlands receive fresh water from the Molla drainage channel to the north and from the Cernaia pumping infrastructure to the east. With the tides, sea water reaches the wetlands, passing through the Castiglione della Pescaia Port channel that is connected to the Molla channel through the Bruna River. From here, sea water passes on to the Tanaro ditch, to the Bilogio channel and to the Antico Navigabile channel and then into the wetlands with a rich system of smaller channels.

The Diaccia Botrona Provincial Nature Reserve, declared as a nature reserve in 1991, encompasses four different landscapes: a dune with wood vegetation and the nearby relict areas of hygrophilous woodlands; the Serrata of the Diaccia and Botrona (salt marshes, salt pastures e salt steppes) that make up almost 70% of the

Fig. 6.3 Network of channels and wetlands of the Diaccia Botrona Provincial Nature Reserve (Photo L. Chelazzi)

entire Reserve; the channels built to reclaim land together with the section of the Bruna River within the Reserve; the grounds of the 'border' areas.

In the Reserve, landscape features and ecological characteristics have rapidly changed within a decade. In particular these changes occurred when the area was protected from waterfowl hunting and when management by the hunting associations suddenly ended. Once the new local administration (the Grosseto Province) took charge, the Reserve was subjected to endless legal procedures that determined a long period in which all kinds of interventions in the wetlands were rendered impossible. This led to a decisive change in the functioning of the entire ecosystem. As a matter of fact, from a typical stable freshwater environment there was a rapid change towards a brackish, unstable one, as demonstrated by previous studies on the flora and the fauna.

As to the chemical and physical characteristics of the waters of the Reserve, today, there are two different situations according to the season: during the winter-spring period there is a freshwater tendency whereas during the summer the water becomes saline or hypersaline. In the first case, the abundant rainfall on the entire basin to the north of the Reserve causes a consistent decrease in water salinity values that may reach oligohaline conditions. In the second case the scarce precipitations and the increase in temperature together with marine water intrusion, due to the tides, cause an increase in salinity values that, sometimes, may reach hyperhaline conditions. This phenomenon appears particularly evident in the so-called 'chiari', located at the centre of the wetlands. In fact, these areas are not subjected to abundant water exchanges with external sources and receive fresh water from rain during the winter season and salt water during the summer. Furthermore, the ground surface of the

marshes is saturated with salt so it is clear that when evaporation takes place in the hottest period of the year there is a consistent increase in water salinity (even over 60‰). When hyperhaline conditions occur in association with anaerobiosis massive deaths of aquatic organisms take place, changing chemical characteristics including the ones in wetland border areas. In the last decades, scarce water exchange in the channels, due to their filling up because of floods, to natural biological sedimentation and to the absence of routine maintenance, have played a key role in favouring the above cited phenomenon.

6.3.2 Botanical Features

During the winter season macroalgal biomass is not particularly developed in the waters of the Reserve, except for a scarce presence of *Enteromopha linza*. Contrarily, during the summer, blooms of macroalgae can appear along the channels and in the larger basins near Ponti di Badia.

From a botanical point of view in the Diaccia Botrona Provincial Nature Reserve eight units can be distinguished according to their physiognomy: flooded areas and water-courses; riparian formations; 'lamineti' with succulent halophytes; halophytes with *Halimione*, *Suaeda* and *Limonium*; Juncetum associations; hygrophilous woodland; pinewoods; cultivated lands (Tomei et al. 1991; Tomei and Guazzi 1993).

1. Flooded areas and water-courses. Along the watercourses and in the permanent water pools, especially in the southern section, *Ruppia spiralis* occurs together with algae of the *Enteromorpha* and *Chaetomorpha* genus. The presence of these species is related to the high levels of salinity and to the eutrophication processes that characterise the waters of the Reserve.
2. Riparian formations. Generally these areas host hygrophilous species not adapted to salt water conditions. These entities, not particularly rare in freshwater wetlands, were once widely distributed also in the Reserve. Today these species are restricted to small elevated areas that can not be reached by salt water inundation. For this reason, these areas of the Reserve are considered particularly relevant for their flora.
3. 'Lamineti' with succulent halophytes. These are halophytes inhabiting the salt pans that remain submerged from autumn to spring.
4. Halophytes with *Halimione*, *Suaeda* and *Limonium*. These formations develop in areas slightly more elevated compared to those of the 'lamineti' with succulent halophytes and are subject to periodical salt water inundation.
5. Juncetum associations. In the Reserve several species of the genus *Juncus* are widely represented. *J. maritimus* is generally located on less salty grounds, while *J. acutus* can be found in the more halophilous formations together with *Salicornia*. In a section to the north of the Reserve a vast and continuous vegetation cover of *J. subulatus* occurs. This species is typical of brackish bogs and is important from a phytogeographic point of view.

6. Hygrophilous woodland (Fig. 6.2). In the southern section of the Reserve, to the south of the Tanaro ditch, there is a remnant hygrophilous woodland mainly composed by *Ulmus minor* and *Fraxinus oxycarpa*.
7. Pinewoods. The 'Pineta Granducale' (Fig. 6.2) is a pinewood on the consolidated dune extending from the town of Castiglione della Pescaia to that of Principina a Mare. This pinewood was originally planted between 1831 and 1848 by the Lorena Family when interventions were made to reclaim land along the coast. The pinewood is mainly composed by the stone pine tree (*Pinus pinea*) and in a smaller percentage by the maritime pine tree (*P. pinaster*) in areas closer to the sea. The pinewood plantation, that today hosts pines of different ages, is quite valuable from a landscape point of view. In the large sunny openings of the forest many Mediterranean maquis shrub species appear.
8. Cultivated lands. Cultivated lands are mainly located to the east of the Arginone and in some areas of the Botrona. These lands, fit to be sown, are sometimes left unplanted and are thus invaded by spontaneous species and consequently grazed.

It must be noted that some plant species of the Diaccia Botrona Provincial Nature Reserve have been included in the 'red list' of Tuscany's regional plants because they have been declared as 'endangered plants'. These are *Althenia filiformis* found in flooded areas and water-courses, *Aeluropus litoralis* of the 'lamineti' with succulent halophytes, *Halimione portulacoides* and *Oenanthe acquatica* of the halophytes formations and *Eryngium maritimum, Euphorbia paralias* and *Medicago marina* of the psammophilous formations.

The existence of many plant species present in previous studies has not been recently confirmed. These are mainly freshwater plant species that were present in the Diaccia Botrona until 1993 and that today have disappeared because of the environmental changes that have occurred in the water salinity of the wetland (from freshwater to brackish).

Today the Diaccia-Botrona's landscape is almost entirely composed by brackish water plants. The non-halophilous plant formations (riparian formations, including reed thickets of *Phragmites australis*) are extremely rare, limited in extension and are found in the more elevated areas of the wetlands. However, these formations seem to maintain a good capacity in invading new grounds when the salinity values decrease, as was demonstrated by the recent colonisation of some pools near the Ponti di Badia. Hence, the presence and distribution of the plant formations in the marshes is strongly determined by the quality of circulating water that causes the withdrawal of the freshwater formations in favour of the 'lamineti' with succulent halophytes and/or other halophilous formations.

6.3.3 Faunal Features

The community structure of the vertebrates of the Diaccia Botrona Provincial Nature Reserve has been well studied (Aminti et al. 1995; Puglisi et al. 1995a, b). The same can not be said for the invertebrate community for which studies are poor

and episodic (Cognetti and Maltagliati 2000; Cognetti 2002). There is, however, an unpublished work by Cognetti et al. (1998) on the aquatic fauna, that today could be useful as a comparison for new studies. The work showed that in the inner channels and especially in the 'chiari' invertebrates were quite scarce and mainly represented by some oligochaetes, chironomid larval flies, gastropod and by crustacean species.

In the waters of the entire area of the Reserve the fish community is subdivided in two clear sub-communities: a freshwater and a marine-brackish water community. In fact, in the waters of the larger channels the fish community is similar to that of the Bruna River and is characterised by the presence of euryhaline species. However, there is also a rich number of freshwater species surviving in the channels thanks to a surface freshwater current. Furthermore, it should be noted that some freshwater species of the larger channels, such as *Gasterosteus aculeatus*, appear seasonally and are related to winter floods and thus to changes in the water salinity. On the other hand, when there is marine water intrusion, due to particular tidal conditions, freshwater species are pushed to the north outside the boundaries of the Reserve. These species do not directly come from an upstream migration of the Bruna River but have probably originated from the internal network of channels.

Instead, the waters of the Serrata of the Diaccia are inhabited by a restricted number of fish species. Here, except for eels (*Anguilla anguilla*), other freshwater entities are totally absent even during periods of heavy rains.

Near the mouth of the Molla channel a typical marine-brackish fish community occurs and, when proceeding inland towards the Serrata of the Diaccia, the community remains more or less the same, except for some marine species (Blennidae) typical of ports and other rocky areas.

In the most internal areas of the Reserve there is a constant composition of species namely *A. anguilla*, *Aphanius fasciatus*, *Gambusia affinis*, together with mullets and *Pomatoschistus canestrini*. The presence of *Dicentrarcus labrax* in this habitat is probably related to individuals coming from the nearby fish farm. In terms of diversity, two species must be mentioned: *A. fasciatus* an important species because quite rare and *G. affinis* a very competitive and allochthonous species that was introduced during the middle of the last century to contrast malaria.

The fish population of the Serrata of the Botrona is quite poor and is composed almost exclusively by very dynamic populations of *G. affinis*. In fact this is the only species capable of a seasonal re-colonisation of the environment after the summer droughts.

As to amphibians the Reserve does not have a particularly rich array of species and probably the populations have been negatively impacted by the general increase in water salinity of the area. Ditches, channels of farming areas and low lands occurring along the northern margins of the coastal woods are the most favourable areas for the amphibians.

Contrarily, the Reserve has several reptiles some of which occurring in very small populations or rapidly declining if not already locally extinct (European pond turtle *Emys orbicularis*).

Even if limited in space, the Diaccia Botrona Provincial Nature Reserve has a considerable number of heterogeneous habitats making it a suitable environment for a great number of bird species. It has been estimated that more than 250 species exploit the environment during spring and autumn migrations and over 30 species use it as wintering and nesting grounds.

The Reserve, together with the entire 'Maremma wetland complex' of Tuscany's littoral wetlands (Baccetti et al. 1996), is one of the best studied sites regarding birds (Rome' et al. 1981; Arcamone et al. 1994; Aminti et al. 1995; Corsi and Giovacchini 1995; Puglisi et al. 1995a, b; Puglisi and Baldaccini 1997; Baccetti et al. 2002).

The recent modifications that have occurred in the Reserve have completely changed the quality of the habitat and have determined different spaces available to birds. In this respect, the waterfowl community has had the greatest benefits. These birds, in fact, have very much increased in the Reserve thanks to the large ponds that have been recently created at the Serrata of the Diaccia and that are ideal areas for birds to rest during daytime hours. However, if the entire 'Maremma wetland complex' is considered, it is clear that the zone has not increased its reception capacity but has simply redistributed the species over the wetland areas along the coast of southern Tuscany (Diaccia Botrona, Ombrone River mouth, Orbetello Lagoon).

Similar considerations can be made for the Greater Flamingo (*Phoenicopterus ruber*). This species has had an exponential increased in the Reserve due to two interconnected factors. The first depends on the geographical distribution of the species that has expanded greatly in the entire Tyrrhenian area, while the second is related to the modifications that have occurred in the habitat. Here, an abundant number of low water pools, with high salinity values and rich zooplankton have been created and have attracted birds. The recent modifications that have occurred in the Reserve have completely changed the quality of the habitat and have determined different spaces available to birds. In this respect, the waterfowl community has had the greatest benefits. These birds, in fact, have very much increased in the Reserve thanks to the large ponds that have been recently created at the Serrata of the Diaccia and that are ideal areas for birds to rest during daytime hours. Now the Greater Flamingo stably inhabits the Reserve with seasonal fluctuations tied to migratory or simple dispersal movements, with a mean annual presence of several hundreds of individuals (more than 600 in January 2002).

Another important nesting species that has benefited from the ecological transformation of the habitat is the Black-winged Stilt (*Himatopus himatopus*). At the beginning of the 1990s, this wader was already present in the Reserve with about 80 nesting pairs. Today its number has doubled. Two areas are colonised by this species and are located in sections to the north of the Diaccia and between the Bilogio and Diversivo channels.

Today, the 'Maremma wetland complex', including the Diaccia Botrona Provincial Nature Reserve, has reached international renown because during the winter season it receives a great number of water bird populations.

If changes towards brackish or salty habitats have favoured a certain number of aquatic birds, the changes in vegetation type with the drastic decrease of areas with *Phragmites australis*, *Bolboschoenus maritimus* and *Juncus* spp have caused the sudden decrease of some bird species such as the Marsh Harrier (*Circus aeruginosus*).

In other cases, the progressive loss of habitat has led to the extinction of species such as the Moustashed Warbler (*Acrocephalus melanopogon*) and the Great Bittern (*Botaurus stellaris*) with the first species becoming extinct more rapidly as compared to the second.

Among mammals, all species that typically occur along the central Tyrrhenian coast can be found in the Reserve. Generally, no relevant species inhabit these wetlands except for the extinct European otter (*Lutra lutra*) that during the 1970s used to live in its waters.

6.3.4 Aquaculture

To the south of the Diaccia Botrona Provincial Nature Reserve there is the so called 'Azienda ittica Il Padule', a fish farm that is directly connected to the waters of the Reserve (Fig. 6.2). Today, this farm has a high annual production of about 400 tonnes of Sea bass (*Dicentrarchus labrax*). The farm arose in the 1950s to produce *Gambusia affinis* to contrast malaria and was maintained for 10 years; later the farm was converted to the production of eels (*Anguilla anguilla*) and then to that of Sea bass. The farm has an area of 65 ha of which 80% is made up of water basins. Of these, about 15 ha are occupied by basins in which the water pumped from the Tanaro channel undergoes a purification treatment. A similar area, subdivided into 15 water basins, is used for intensive aquaculture, whereas the remaining 35 ha are used to convey waste waters into other basins where processes of natural sedimentation and phytopurification occur (Saroglia et al. 2002). After the phytopurification process, the water is let into the Antico Navigabile channel and then into the channels connected with the marshes of the Reserve. With this system a good circulation in the waters is guaranteed in the entire area. The breeding basins are covered with nets to protect them from fish-eating birds, whereas the other basins are free and are colonised by natural fish populations. Many water birds take advantage of the situation feeding on the zooplankton, zoobenthos and on natural fish populations according to their trophic niche (Dell'Angelo 1999). In the breeding ponds, fish density is always kept lower than 1 kg/m^2. Feed is of high quality and its supply is interrupted when fish are still actively searching for food items (Saroglia et al. 2002). This best management practice minimises the risks of accumulation of nitrogen and phosphorus in the ponds and guarantees a high quality of the exiting waters. Furthermore, high standards in fish production are also obtained with this method. Liquid oxygen is added to the waters of the breeding basins when particular conditions occur so as to obtain concentrations never lower than 70% of the saturation, even in out flowing waters.

6.4 The Maremma Regional Park

6.4.1 Ecosystem Description: General Features, Water Quality and Coastal Erosion

The Maremma Regional Park was established by the Region of Tuscany in 1975, fostered by the convictions and studies of respected scientists of the University of Florence. Its territory is administrated by the Province of Grosseto is to be found in the municipalities of Grosseto, Orbetello and Magliano in Toscana. The Park includes 8,902 ha of 'Protected Area' and 9,097 ha of 'Border Area'. The area includes a coastal plain (0–15 m above sea level) and the hills of the so called Monti dell'Uccellina (Poggio Lecci 414 m above sea level). The Ombrone River and many other the channels built during the land reclamation flow, in the sandy plain to the north. The agricultural plain, delimited to the east by a chain of hills, is made up of the lands that were once reclaimed from the freshwater lake of Alberese and the wetlands of Talamone. The coast is low and sandy to the north and high and rocky to the south. The Ombrone River flows out into the sandy plain and in the past its sediments have caused progradation of the coast towards the west (Ciampi 2007). Recently there has been an inversion in trend and an erosion process of about 11 months/year is now taking place at the river mouth. Instead, to the south there has been an accretion of the coastline (Colombini et al. 2007), due to sediments eroded at the river mouth and transported southwards by the dominant sea currents.

Both to the north and east of the mount ridge, the plains are under the influence of salt water intrusion. Between 1984 and 1995 studies (Matina et al. 2005) on groundwater salinity were conducted in the northern section of the Park. These revealed that salt water intrusion had reached Spergolaia, a locality at about 5 km from the sea. A different situation appeared in the plain located to the east of the Monti dell'Uccellina where in 1984 no salt water intrusion had been recorded in the water table. Instead, in 1995 this phenomenon was widely distributed on the entire area. In this case, the salinity of the water table is probably not associated to marine water intrusion but to the salt water trapped between the sediments or to the exchange of ions with clay sediments.

The plain within the Park has an array of different levels of wetland environments including: a sandy coast with a retrodunal pinewood, the Ombrone River with its areas between the river and its flood banks, the channels built to reclaim lands, the marshlands, the pastures and lands reclaimed for agriculture close to the sea.

Between Principina a Mare, on the right hand side of the Ombrone River, and Collelungo the sandy coast is undergoing a strong process of erosion that has reached its highest level in the area immediately to the south of the Ombrone River mouth (Fig. 6.4). In this area, up to a distance of 3 km from the river mouth, the dune, that once reached 4–5 m above sea level, has been completely destroyed. The destruction of the dune not only has had a negative effect on the retrodunal pinewood because of the salt spray reaching the pine trees but also because sea water reaches the interdunal depressions of the 'Pineta Granducale' storms. At about 4 km from

Fig. 6.4 Wetlands of the Maremma Regional Park: map of the area (Modified from Google Maps)

the river mouth there is an area in which the phenomenon of erosion and accretion of the beach is in equilibrium. From here onwards, and especially after Collelungo, there is a slow but progressive accretion of the beach. About 200 years ago this area was a marine gulf as testified by the topographical names (Porto Vecchio – Cala Francese – Cala Rossa). Now the area presents a very low dune belt (1–1.5 m above sea level) due to the positive sedimentation process still in progress (Colombini et al. 2007).

At about 500 m to the south of Collelungo, in an area where the process of aggradation reaches its highest level, there is a retrodunal shallow depression where a dune slack occurs. In fact this area, only about 50 m in width, can be periodically flooded by heavy rain or can be invaded by marine water during violent sea storms.

Within the Park there are several water-courses (the final section of the Ombrone River and many channels built to reclaim land) that are important for their environmental and landscape features.

The Ombrone River flows into the Park's territory for less than 10 km, starting from the 'Pian di Barca' meandering to its river mouth. Here the river environment is typically lentic, characterised by a very slow water flow. Furthermore, in this section sea water tends to mix more or less with fresh water of the river according to the river flow rate and to the conditions of the sea. Consequently, there is a progressive increase in salinity values as the waters reach the mouth of the river.

In the Maremma Regional Park a great number of channels were constructed to reclaim land. These are located in the plains to the north of the Ombrone River course and to the east of the Uccellina hills. Some of the larger channels and those receiving water from the network of secondary channels bear water all year long. Of these in the Trappola plain, on the right hand side of the Ombrone River, there is the Collettore Morelle channel that runs into the Ombrone itself whereas, on the left hand side, there are the Essiccatore of Alberese and Scoglietto-Collelungo channels.

In the plain to the east of the Uccellina hills there are three main channels: Piscina Statua, constructed to dry up the Alberese Lake and the Collettori Orientale and Occidentale channels, that flow in the Talamone plain and are connected to the sea through a pumping system. Except for the Scoglietto-Collelungo channel, all these channels are subject to periodical and frequent cleaning operations that permit the constant outflow of the water. For this reason their banks are exclusively covered by herbaceous plants.

6.4.2 Botanical Features

On the first dune belt, the vegetation (Arrigoni 2007) is dominated by species characteristic of sand dune systems (*Ammophila arenaria*). In the retrodune *Juniperus oxycedrus macrocarpa* and *Juniperus phoenicea* can also be found.

The retrodunal depression, dune slack, located in the southern section of the beach, has a typical marshland vegetation due to its particular conditions. Here the main plants include *Juncus acutus*, *Schoenus nigricans* and *Limonium etruscum*. *L. etruscum* was described as a new endemic plant by Arrigoni and Rizzotto (1985) and at the time this plant also occurred in the nearby wetland areas of the Trappola and Talamone. Today, this species has become extinct in these two localities because of habitat loss or misguided management strategies. In fact, at the Trappola an erosion process has wiped out the population whereas at Talamone a parking lot for summer tourists has been built directly over its environment.

The marshlands close to the Ombrone River are what remains of the larger wetlands that were once to be found in the Grosseto plain. Thus what results today is a system that has been constantly transformed by variations of the coastline, interventions for land reclamation, water canalisation, reforestation, exploitation for pasture and agriculture. The low valley of the Ombrone is thus made up of a seminatural environment with a complex system of continuously changing freshwater and brackish wetlands and by an artificial agricultural landscape.

The Trappola, an area to the north of the Ombrone River mouth, is characterised by pools with marshland vegetation (Figs. 6.5 and 6.6), by interdunal areas with *Salicornia* or *Juncus* formations and by woodlands with stone pines (*Pinus pinea*) and junipers (Fig. 6.7). To the south of the river mouth on the Marina di Alberese plain, pinewood (*P. pinea* and *P. pinaster*) formations prevail but in areas closer to the river mouth saline meadows and uncultivated lands also are conspicuous (Fig. 6.8).

Fig. 6.5 Wetlands of the Trappola: aerial view of the Porciatti marshes (Photo L. Chelazzi)

Fig. 6.6 Wetlands of the Trappola: pools with typical marshland vegetation (Photo L. Chelazzi)

The marshland vegetation of the Maremma Regional Park is a complex mosaic of plants due to variations in water quality (fresh or salty), duration of submersion and to substrate type (sand, mud and clay). The marshland vegetation mainly occurs in areas of the Trappola, in those close to the Ombrone River mouth and at the 'Paduletto' at Collelungo. In wetland areas, tree formations are scarce and limited

Fig. 6.7 Wetlands of the Trappola: aerial view of the interdunal wetland area (Photo L. Chelazzi)

Fig. 6.8 Wetlands to the south of the Ombrone River mouth (Photo L. Chelazzi)

to some populations of *Fraxinus oxycarpa* and *Ulmus minor*. Other formations including *Phragmitetum communis* and *Cladietum marisci* have limited distributions in relation to winter submersion and water salinity, while Juncetum and Salicornietum formations are largely dominant in the Park.

The Salicornietum formation is the halophilous marshland vegetation that is best represented at the Trappola and at the mouth of the river. The species that compose the formation appear very similar morphologically speaking because of their succulent aspect but in phytosociological terms three almost monospecific associations occur: *Salicornietum radicantis* species with the widest distribution that inhabits areas subjected to prolonged winter submersion, *Arthrocnemetum glauci* occupying areas with shorter hydroperiods and *Halocnemetum strobilacei* in particularly saline areas.

The 'lamineti' are located in low-lying land with depressions containing permanent water and are colonised by *Scirpus maritimus* and *Salicornia litoralis* together with *Ruppia maritima* and algae of the *Chara* genus.

The Juncetum formation is the most evident and abundant helophytic vegetation of the Park and includes *Juncus maritimus* and *J. subulatus* in more or less saline water and *J. acutus* in freshwater pools.

The marsh grasslands are characterised by grasses and hygrophilous or hygro-halophilous shrubs subjected to seasonal submersion. *Carici extensae–Schoenetum nigricantis* is the dominant association in the marsh grasslands of the Park.

Along the river banks there is a riparian woods with hygrophilous tree species such as *Populus alba* and *Fraxinus oxycarpa*. Instead, in areas closer to the river mouth xerophilous or halo-resistant species such as *Tamarix gallica* are dominant.

From late-spring throughout the entire summer period, large sections of the Scoglietto-Collelungo channel are covered by stems of *Myriophyllum spicatum*, whereas the muddy river banks are characterised by *Juncus acutus*, *Phragmites australis* and *Spartium junceum*.

6.4.3 Faunal Features

In the entire territory of the Maremma Regional Park the faunal component has been accurately studied especially for birds and mammals (Arcamone et al. 1994; Baccetti et al. 1996, 2002). Instead, for invertebrate species and in particular for those of wetland environments, studies are scarce and in some cases totally absent. Only recently, within the WADI Project, more accurate studies were carried out on the diversity of arthropod populations of the beach-dune area and dune slacks of a section of the beach to the south of Collelungo and of the meadows that from the river run up to the embankments and which are subject to temporary submersions.

As to amphipod species, besides the talitrid *Talitrus saltator*, typical of sandy littoral environments, there are also populations of *Orchestia gammarellus* along the Ombrone River banks. This talitrid is very common also inland, in the wetland areas of the Paduletto and of the Serrata dei Cavalleggeri that are not necessarily

and/or permanently submerged. This amphipod during the dry period takes shelter at the base of the vegetation (*Juncus acutus*), where high levels of moisture are found. In the marshes near the Ombrone River mouth, there is a small array of lepidopteran species typical of these environments (Fabiano et al. 2007).

In the dune slack to the south of Collelungo the diversity values calculated for invertebrate species are quite high if compared to the bordering beach-dune system or to other similar wetland areas. This makes it an ecotone rich in species (over 200) belonging to both wetland and Mediterranean maquis areas. This is mainly due to the peculiar characteristics of the environment that permit the existence of a marshland vegetation strictly in between the dune belt and the retrodunal Mediterranean maquis (Colombini et al. 2007).

In the Maremma Regional Park many other invertebrate species are known but rarely do these strictly belong to wetland habitats.

As previously mentioned, the Ombrone River has lentic features in the section flowing within the Park. Thus, the fish inhabiting this section belong to some species that are strictly fluvial and others that are euryhaline, marine and brackish. The first group includes typical fluvial species and many other fish introduced for fishing practices at the beginning of the last century.

In the Scoglietto-Collelungo channel, but also in other channels with permanent water, there are a great number of fish species, this also thanks to the connection with the Ombrone River that generally occurs during the periods of greater outflow.

In the Park certain amphibian species are quite common in freshwater wetland areas, but these are to be found especially in those areas where water occurs during their reproductive phase.

Because of the great variety of habitats that are present within the Park, reptiles are generally very abundant both in species and in numbers. The European pond turtle *Emys orbicularis* inhabits the channels where mechanical cleaning is not carried out as in the case of the Scoglietto-Collelungo channel. In fact, the cleaning of channels and banks can severely damage this species especially during the earlier life stages.

As already mentioned, when speaking about the Diaccia Botrona Provincial Nature Reserve, the wetland areas of the Maremma Regional Park are included in the 'Maremma wetland complex' of Tuscany, making it one of the best studied sites for birds (Aminti et al. 1995; Arcamone et al. 1994; Baccetti et al. 1996, 2002; Puglisi et al. 1995a, b). In the low-lying lands of the Park more than 200 different bird species have been recorded. Of these, almost half are considered 'emergent fauna' at a regional, national and international level.

The wetlands of the Maremma Regional Park are not undergoing radical changes in their environmental characteristic (from freshwater to brackish) like those of the Diaccia Botrona, however, important changes have occurred in the areas close to the river mouth. Coastal erosion has determined salt water intrusion especially in the older interdunes and nearby channels. However, the local names ('Saline' on the right side of the Ombrone River; 'Campo Salino' and 'Saline di S. Paolo' in on the left) and the presence of a typical halophilous marshland vegetation (*Salicornietum radicantis, Arthrocnemetum glauci* and *Halocnemetum strobilacei*) indicate an older condition with typical saline characteristics.

Thanks to the lentic characteristics of the Ombrone River, all areas closer to the sea together with those of meadows and farmlands within and outside the Ombrone embankments, make up the most important wintering site in Tuscany for geese (the Greylag Goose, *Anser anser* and the Greater White-fronted Goose, *Anser albifrons*) and ducks.

From 1975 when the area was first protected, the colonisation of this site by the Greylag Goose has been gradual (Baccetti 2007). Vast areas of pastures and fields, where hunting was suddenly prohibited, became available to the geese. The 'Macchiozze' was the first area to attract the birds. Successively, the number of individuals increased to almost 700 units indicating that habitat conditions permitted longer stopovers. In 1991 when the Diaccia Botrona was declared as a Reserve, the potential foraging areas was doubled. This led to a splitting up of the bird flock into two groups that initially were divided only during the daytime but then, later on, became two distinct flocks. In 2004, more than 2,000 Greylag goose individuals were recorded between the Maremma Regional Park and the Diaccia Botrona Provincial Nature Reserve making the area an internationally important one according to the Ramsar convention (Baccetti et al. 2002). Furthermore, the presence of such a large flock attracted other birds such as the Greater White-fronted Goose and the Common Crane (*Grus grus*).

The entire area, including the coastal sandy zone, has become important also for the overwintering and the nesting of several wader species.

The wetlands of the Park also host a conspicuous number of resident or overwintering birds of prey. Today an Interreg III project of the European Regional Development Fund (ERDF) is aiming at reintroducing the Osprey, *Pandion haliaetus*, in the Maremma Regional Park. It's been 80 years, since the last couple was seen nesting in the area of the Tuscan Archipelago. Now, this project wants to be an attempt at fostering the nesting of this species within the Park itself. Two strategies have been adopted: the use of artificial nests and bird models on the one hand and the translocation of hatchlings from donator countries (Corsica Regional Park) using the locking method on the other.

Given the heterogeneity of habitats and its state of protection, the Maremma Regional Park also represents an extremely favourable environment for mammal species and in recent years it has even been recolonised by the wolf (*Canis lupus*). This species that had become extinct in the area before the establishment of the Park, has now reached a small population of seven resident individuals. It has been suggested that the species has probably used the woodlands of the Ombrone River banks as a corridor to reach the Park. These, in fact, connect the inland wild Chianti hills of Tuscany to the Park without directly crossing important towns or cities.

Besides being an important water source for most mammal species, the channels and river of the Park have become a favourite site for the coypu (*Myocastor coypus*), a typical invasive species. Instead, many herbivorous species have been attracted to the Juncetum and Salicornietum formations and to the saline meadows for their trophic needs. Here, wildlife species such as boars (*Sus scrofa*) and fallow deers (*Dama dama*) feed together with the typical local cattle species ('vacca maremmana')

which is commonly bred in the wild. Furthermore, the Lesser white-toothed shrew (*Crocidura suaveolens*) has been recently recorded in the periodically submerged Juncetum formations and nearby areas.

6.4.4 Management Plan

Most of the 'Protected Area' of the Maremma Regional Park is considered a Special Protection Area (SPA) and is subdivided into four levels of protection: Integral Reserves, Oriented Reserves, Protected Zones and Promotional Areas. Integral Reserves are areas with highly valuable environmental and landscape characteristics due to the presence of significantly important plant and animal species and to the presence of particularly fragile ecosystems. Oriented Reserves are areas with valuable environmental and landscape features that host important plant and animal species that have been characterised by man-made ecosystems or areas that throughout history have been impacted by human intervention. Protected zones are man-made areas characterised by landscape and environmental values connected to traditional cultivations and breeding practices. These are important also on account of the presence of historical sites and architecture. Finally, Promotional Areas are man-made areas characterised by landscape and environmental values connected to local farming and towns (e.g. Alberese).

The wetlands classified as Integral Reserves are: the 'Marshes of the Trappola and of the mouth of the Ombrone', the 'Paduletto at Collelungo' and the 'Coastal Area of Porto Vecchio-Cala Francese-Cala Rossa'.

From a morphological point of view, the 'Marshes of the Trappola and of the mouth of the Ombrone' consist in flat, low-lying areas (at sea level or in some cases even below) occupying the delta of the Ombrone River. These are characterised by a sandy-muddy substrate originating from wetlands and consolidated dunes, which, at the moment, are experiencing a strong process of erosion on the side of the sea. These include the last section of the Ombrone River that in this part has a meandering course and quite a large width.

To the south of the Collelungo promontory, the 'Paduletto at Collelungo' is a plain more or less all at sea level, located between the coastal dune and the Uccellina hills. Water levels and abundance vary greatly according to the season, and the area represents an important ecological continuum with the 'Coastal Area of Porto Vecchio – Cala Francese – Cala Rossa'.

The 'Coastal Area of Porto Vecchio-Cala Francese-Cala Rossa' is an area with a well preserved dune and a retrodunal wetland area that hosts interesting plant and animal species.

The following areas belong to the Oriented Reserves: pastures and farming areas of the Trappola on the right hand side of the Ombrone River, the Ombrone River itself and the marshlands on the left hand side of the river located at the San Paolo pumping station, at Campo al Pino and the wetlands and pastures at the Macchiozze.

The pastures and farming areas of the Trappola are flatland areas where, in the past, human intervention has been very strong. Here, ground surface is slightly higher in level as compared to the sea because of several strategies that were implemented in the past such as land reclamation and water management. Pasture lands are, at intervals, mixed with pinewoods and marshlands and together with the neighbouring farming areas make up a very important habitat for birds and a buffer zone between the Integral Reserves and more external areas.

The Ombrone River itself and its river mouth, is an extremely important element of the landscape not only on account of the botanical and faunal communities it hosts but also because it constitutes an ecological corridor between the wetland areas of the coast and those of the inland.

The Saline di S. Paolo are plains to the left of the Ombrone River occurring at the same or, in some cases, beneath the level of the sea. These areas are characterised by a helophytic marshland vegetation and by a great number of bird species, especially of migratory species.

Proceeding inland, the areas of Campo al Pino and of the Macchiozze are the other two wetlands found close to the Saline di San Paolo. These areas are located on a plain of alluvial origin at a few meters above sea level and are part of the meadows and farmlands included within the Ombrone embankments. In the past, these lands have been reclaimed as clearly shown by the presence of water channels built during the implementation of the rural property Act. The entire zone, apart from the temporarily submerged areas, is mainly exploited for pasture and is characterises by the presence of both wild and domestic ungulate species. Because if its vicinity to the river and to the marshes, the zone is important for conservation purposes. The Macchiozze is an internal wetland area, which is interesting for its fauna and which has recently been undergoing a process of environmental rehabilitation.

Finally the reclaimed low-lands at Talamone are considered Protected zones. All these lands are subject to submersion and are undergoing salt water intrusion. Especially during the winter season, the area has the potential to host important aquatic migratory birds species and thus is considered relevant for its faunal components.

6.5 The Other Coastal Wetlands of the ‘Maremma Wetland Complex’

In the past, the entire southern coast of Tuscany, from Castiglione della Pescaia to Capalbio (at the border with Latium Region) was once occupied by large marshlands, small freshwater lakes and extensive floodplain woodlands characterised by a hydrophilous vegetation. After land reclamation interventions and the increase in agricultural activities during the first half of the last century, today some vestiges of the original wetland areas still remain. Besides the large Orbetello lagoon, important for its natural environment and the economic role of its fishing activities, other areas testifying previous situations are Campo Regio, Burano Lake and San Floriano Lake.

Campo Regio lies on the coastal plain delimited to the north by the Osa River and to the south by the Albegna River. This area, located in the municipality of Orbetello, at about 20 km south of the city of Grosseto and at 1.5 km from the coast, has a surface of about 20 ha. This area is what remains of a formerly much larger wetland area in which small nuclei of thermo-hygrophilous floodplain woodlands still occur. These represent the spontaneous vegetation of the Maremma coastal plain in which the water table is close to the surface. Even if today this area is not that extensive and has encroaching farmlands all round, it has maintained wetland plant species that have progressively become quite rare elsewhere.

The entire Orbetello Lagoon is considered a Wetland of International Importance and was declared a Ramsar site in 1977 essentially to protect the rich and important bird species of the area (Fig. 6.9). The Provincial Nature Reserve of the Orbetello Lagoon (1,522 ha) is located in the western part of the lagoon itself and called Laguna di Ponente. In this Reserve there is a very small National Nature Reserve covering about 30 ha, and the WWF 'Oasis' which includes land alongside the lagoon. The Laguna di Ponente is separated from the sea by a sandbar, Tombolo della Giannella, linking the mainland to the Monte Argentario, whereas in the centre of the lagoon the town of Orbetello, lying on an incomplete sandbar linked to the mainland by a causeway, divides it from the Laguna di Levante.

The area encompasses a variety of different coastal habitats including the sandy littoral, sandbar formations, the brackish lagoon, small temporary freshwater pools, Mediterranean maquis shrubs, farmlands and an artificial pinewood plantation.

Its geographic position together with the presence of brackish wetlands are of crucial importance for resting and nesting of many endangered bird species.

Fig. 6.9 The Orbetello Lagoon with resident Greater Flamingos (Photo L. Chelazzi)

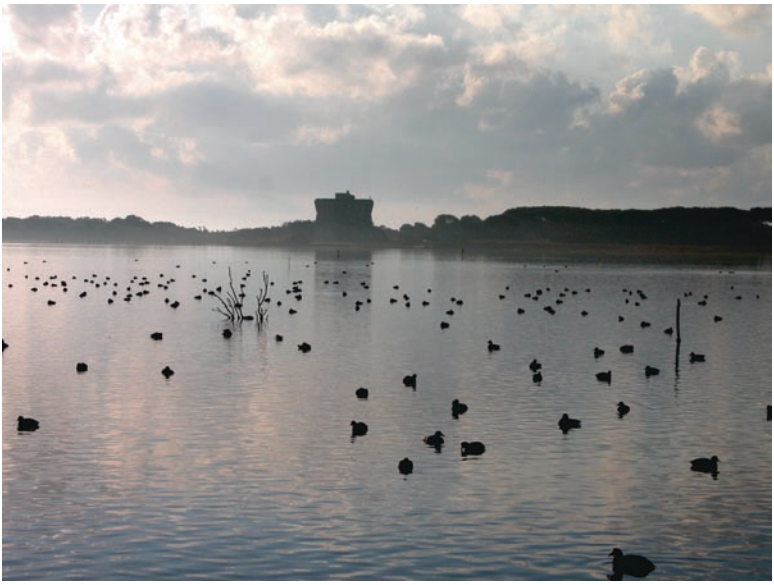

Fig. 6.10 The Burano Lake with over wintering Eurasian Coots (Photo L. Chelazzi)

From a botanical point of view the brackish water displays a rich population of blue, red, brown, and green algae that in the past (1992–1993) bloomed extensively on account of excessive nutrient accumulation in underwater sediments and lack of oxygen in the water.

The National Nature Reserve of the Burano Lake was declared in 1980 (Fig. 6.10). The Reserve is located in the southern section of the Grosseto Province in the Capalbio Municipality. The area includes 410 ha of private land and has been managed by WWF-Italia for many years. According to the Ramsar convention, the Reserve was designated Wetland of International Importance and is included among the 'Sites of Community Importance' and in the 'Special Protection Areas'

The National Nature Reserve of the Burano Lake lies along the Maremma coast between the promontory of Ansedonia to the north and the Chiarone ditch to the south, which represents the border line between Tuscany and Latium regions.

The Burano Lake is what remains of an extensive lagoon that once occupied the area. In the past this has progressively dried up and filled in with sediments coming from small water courses. Later on the land reclamation processes further reduced its size. Today it is a brackish lake of 140 ha (about 1.5 m in depth), separated from the sea by two sand dune belts. An artificial channel connecting the lake to the sea is filled up at its mouth but can be periodically opened for the management of fishing activities. The Reserve includes a variety of habitats of ecological value characteristic of the Maremma area such as the coastal dune, the retrodune with a Mediterrenean maquis, remnant hygrophilous woodlands, a water-fringe cane bed, a brackish lake and temporarily submerged meadows.

Today, on the plain at the foot of the hills behind the Burano Lake, there are still some perennial freshwater pools that have survived land reclamation, thanks to their importance as water reservoirs for agricultural requirements. These areas have become important resting grounds for waterfowl species. Of these the San Floriano Lake is the most relevant and it has been considered a Site of Community Importance (SCI). The lake, of about 7.5 ha, occupies a lowland of a karst valley. Although most of its banks are artificial and the area is surrounded by farmland, this lake is considered highly valuable for its plant and animal community.

6.6 General Considerations on Management Strategies and Conclusions

Before the European directives on wetlands, issued in the last decades of the last century which provided for the protection of particular environments, a small group of scientists had become aware of the enormous environmental value still existing in the low Grosseto Plain. The group was able to convince a more or less uninterested management community to make plans and take actions for the protection and conservation of this particular habitat. However, this decision by the local administration to enact conservation measures probably arose from an opportunistic idea that envisaged future economic benefits rather than from a real belief in a conservation strategy. In fact, today the environment is considered a good economic investment in the long-term as it attracts tourism for both leisure and educational activities. After the agricultural crisis of the 1970s, an environmental awareness was starting to emerge and more and more people were becoming attracted by the exclusiveness and quality of that particular environment that had long been forgotten and which at that time was exclusively exploited by rich landlords (Doccioli 1970). At the beginning, the wilderness of this area became an attraction for an élite of cultured individuals and in particular for people with a major influence over the masses. In fact, the whole Province of Grosseto became a hot spot for politicians, entrepreneurs, actors and learned people that frequently visited and spent their summer holidays in this area. As a consequence this led to great economic benefits for the locals, who were literally invaded by tourists and also to a great boom in ‘agritourism’. Today, this activity is not only restricted to the summer but extends over a longer period of time, bringing additional revenues to local farming families. However, the massive invasion of summer tourist has strongly impacted the environment as it has led to landscape changes through the construction of visitor centres, parking lots and other residential settlements.

As already mentioned, along the southern coast of Tuscany there is a system of protected wetlands, all included in the Grosseto Province, ranging from the Diaccia Botrona Provincial Nature Reserve to the north, to the National Nature Reserve of the Burano Lake to the south. These wetlands, to which the Maremma Regional Park and the Provincial Nature Reserve of the Orbetello Lagoon also belong, occupy

almost two thirds of the entire territory, with a coastline of 60 km. However, the 'Maremma wetland complex', as indicated by some ornithologists (Baccetti et al. 1996), should not be considered a mosaic of wetlands, important only for birds (sometimes ornithologists are somewhat fundamentalists) or for plant species but its importance should be based on the contemporary existence of both abiotic and biotic components. Furthermore, the Maremma wetland complex is best considered as a whole rather than as a series of different sites and thus should be managed as one. Centralised management should be carried out by experienced personnel (and not simply by architects who frequently have no expertise on ecological matter) and local managers should take into account and respect the opinion of experts such as biologists, ecologists, engineers, economists, geographers, etc. Also local stakeholders (farmers and tourist operators) should be informed and involved in decision making processes and their needs should be considered by managers, without involving destructive political conditioning. A centralised management of the wetland complex, besides aiding in protecting the environment, could also guarantee the sustainable use of natural resources, by redistributing tourist loads in space and time and it could address tourists to cultural and natural sites as an alternative to leisure activities (sunbathing and swimming).

In the Grosseto Plain the management of protected areas and of wetland areas in particular, presents an array of many other different problems ranging from foreseen interventions to contrast coastal erosion, to project management for conservation purposes, to conflicts among local authorities and for achieving the correct use of the natural resources.

Today, the erosion process that the mouth of the Ombrone River is undergoing, is undoubtedly a fact. This phenomenon, occurring entirely within the Maremma Regional Park, has been mainly caused by human activities further inland that have drastically reduced sediment transportation. The foreseen actions to contrast or slow down the process are, in our opinion, inadequate and can severely damage the natural environment. These actions are targeted to contrast surface marine water intrusion in areas where soils have already saline characteristics, as demonstrated by the place-names (Campo Salino, Saline di San Paolo) and by the presence of an halophilous vegetation and where, nowadays, pasturelands are only partially exploited. In northern Europe, when similar problems occur, local authorities buy the lands undergoing erosion and interventions are made only in the case that cities, towns or important roads are directly threatened (Speybroeck et al. 2006). In the case of the Maremma Regional Park the land involved in erosion is already a regional property (Region of Tuscany) so it appears clear that the choice of certain actions is governed by a totally different political strategy.

In the Park the proposal of beach nourishment to rebuild a beach and improve the site for tourist has not been approved because of the severe impacts that sand withdrawal from the marine deposits or, worse, from the areas close to the promontory of Collelungo would have caused on the entire coastal ecosystem. However, the foreseen construction of a revetment parallel to the sealine will in any case severely modify the wetland area at the mouth of the Ombrone River. This embankment will prevent sea water from reaching the saline low-lying grounds during the occasional

storms and the areas will soon be transformed into a freshwater environment or, in the worse of cases, will dry up. In fact recently, with the authorisation of the Park, the Consorzio di Bonifica (Consortium for Land Reclamation) has started new works to reactivate the mobile sluice-gates of the Chiavica bridge at the mouth of the Essiccatore di Alberese channel (built the last century as a draining channel). This will prevent marine water intrusion in the channel during sea storms and the reactivation of the pumping system at Idrovora San Paolo will favour saline water outflowing towards the sea. Among the foreseen interventions, there is a plan for the desalination of the marshland near the mouth of the Ombrone River (Integral Reserve according to the Park's legislation and proposed as a Ramsar site by the Region of Tuscany) by introducing freshwater in the existing channels. According to the Consortium this operation will probably recharge the water table with freshwater and lower the salt water in the water table. All these interventions will cause a severe modification of the wetland habitat and will lead to the loss of another wetland area of international importance going against EU directives. Furthermore, for the construction of the revetment the existing roads will be enlarged and consolidated. These will permit trucks to bring into the Park the necessary material coming from inland area mines and the whole ecosystem will be further impacted by the construction of the construction yard itself. Perhaps in order to stop or at least slow down the erosion process, it might have been sufficient to forbid river bed quarrying from the Ombrone, which today represents one of the main factors causing the decrease in sediment loads. An off-shore breakwater, parallel to the shore, to dissipate part of the incident wave energy before it reaches the shore, might also have slowed down the erosion process. For the moment only several submerged concrete groynes perpendicular to the shoreline will be installed with the hope of giving rise to a local beach reconstruction process. Another action that might limit the sedimentary deficit could be the stocking of earthy excavation materials in certain areas along the course of the Ombrone River (160 km, 3,494 km^2, Provinces of Siena and of Grosseto, 44 municipalities) that could be thrown into it when the strongest floods occur. Furthermore, in order to limit the damaging effects on the 'Pineta Granducale' of surface sea water intrusion in the old interdunal areas, it would be necessary to maintain operational or to strengthen the pumping system at the Idrovora San Paolo that has not been working for many years.

The cited interventions are in some way in contrast with other projects of the Park. For example, there is an ongoing project in which an attempt for the reintroduction of the Osprey in the area is being made. In fact, some individuals actually visit the areas close to the mouth of the Ombrone River and the Diaccia Botrona Provincial Nature Reserve indicating that the two areas are adequate at least as feeding grounds for the birds. When 80 years ago the nesting population of Osprey disappeared from the islands of the Tuscan Archipelago, changes in the environment or habitat loss had been considered as the main causes of its disappearance. Also poaching of adult individuals and of their eggs for trophies or collections had also contributed to the drastic decrease in its population. Today, the absence of a nesting population in the Maremma Regional Park that is directly protected is, in our opinion, probably due to other factors such as the disturbance of the encroaching

city of Grosseto and to the heavily impacted surrounding areas. The foreseen interventions at the river mouth will cause further disturbance to the birds and only worsen the situation. Furthermore, reintroduction projects have recently been criticised and discussed (Frankham et al. 2004) and alternative strategies such as environmental rehabilitation should be considered as a better strategy. Generally, these lead to a spontaneous choice on the part of the natural populations to select the area as breeding grounds. Something very similar has occurred for the wolf that recently has spontaneously recolonised the woodlands of the Park.

In the last few years there have been many projects, also supported by the European Community, that have had wetland areas as a target. Unfortunately, in many cases, once the project has ended all structures (pathways, information panels, sheds for visual protection, island for bird reproduction, etc.) built during the course of the project are abandoned without receiving further attention by the local authorities that sometimes have also actively participated in these projects.

The absence of centralised management of the wetlands that are still to be found today along the coastal littoral of the Grosseto Plain (also including those of the southern part of the Grosseto Province and bordering on the Latium Region) can bring to dangerous conflicts among local authorities and stakeholders (Region, Province, Municipalities, Land Reclamation Consortium, River Basin Authorities, Environmental Associations, Non Governmental Organisations, Ownerships). These conflicts lead to a total absence of actions or to disorganised and sometimes contrasting initiatives. For example, in the case of the Maremma Regional Park, the Region of Tuscany is both owner of the local farm (Azienda Regionale Agricola di Alberese) and manager of the Park itself and frequently the actions planned by the Farm do not have nature maintenance or biodiversity protection as a priority. On the other hand, actions undertaken by the Park to reach its objectives do not always coincide with the interests of the Farm. Furthermore, conflicts among local administrations for the jurisdiction over wetland areas often lead to compromises that are in favour of local interests such as the removal of hunting and fishing restrictions in sites declared as SCI (Site of Community Importance).

As to the problem of the water salinisation occurring at the Diaccia Botrona the local fish farm has been unjustly (Saroglia et al. 2002) accused to be its main cause. In our opinion this problem could be partially solved by the reactivation of the mobile sluice-gates of the Giorgini bridge located at the mouth of the Bruna River at Castiglione della Pescaia. As a matter of fact, these gates had been constructed to permit the outflow of freshwater toward the sea but at the same time to prevent sea water intrusion in inland areas through the drainage channels. However it should be recalled that the wetlands of Diaccia Botrona are continuously in evolution and from a primitive situation with saline characteristics (relict of the ancient marine gulf) the area has evolved towards freshwater conditions. However, this trend has started to reverse when at the beginning of the last century the last section of the Bruna River was deviated from the wetlands directly into the sea. Today the salinisation process can only worsen because of the construction of a mobile barrier on the Molla channel that is being built by the Consorzio di Bonifica. This barrier can be inflated to prevent surface salt water from reaching the Idrovora Cernaia from

which local farmers pump water for irrigation. This will bring to a decrease of freshwater into the marshes of the Diaccia Botrona and will exacerbate the problem of the salinisation process.

Another quite important problem regarding the management of wetland areas that is to be considered in our opinion is the way in which these protected areas are to be exploited. This becomes particularly relevant especially when these are naturally or artificially small in size as in the case of sandy littorals and their bordering wetland areas.

The wetlands of the Grosseto Plain have always been of economic importance even when these areas were not protected. In fact, until the end of the eighteenth century the pools for the production of salt were located in these coastal wetlands and their location changed in relation to the evolution of the plain. The production of salt was the major local income before the land reclamation process. Furthermore, in the past, these wetland areas were used as pasture grounds during the winter and plant species were collected for the construction of roofs and the production of mats. Also the use of aromatic plants and medical herbs was widely disseminated among the local population (Bencivenni 2007). Before the land reclamation process and the implementation of the rural property Act the economy of the low Grosseto Plain was quite poor and the main source of proteins was guaranteed by fishing and hunting activities within the wetlands. The importance of fishing goes all the way back to the Etruscan-Roman period when in the area there was the Prile Lake. This activity reached its peak during the period of the Medici dynasty when fishing became a monopoly of the landowners. This activity was developed on the lake as it was safer and more profitable compared to fishing at sea. For this reason all hydrological actions made during that period had the intent of ameliorating the water quality of the lake more than that of reclaiming the land. After the gradual filling up of the lake and the formation of the wetlands, the area was still used as a trophic resource and snails and frogs were also gathered. Successively, the new marshlands attracted a great number of water birds and hunting became an important source of food and of income for the local population. This occurred especially during the Second World War when also the residents of the town of Grosseto exploited the wetlands. When standards of living improved after the land reclamation process and the implementation of the rural property Act, traditional hunting and fishing in the marshlands lost its original nutritional value and became an important recreational activity. This attracted fishermen and hunters also from other parts of the country and continued more or less until protection measures were taken. Today these areas have a twofold value, one regarding conservation and the other having an economic function in attracting tourists:

Environmental protection should simply mean bestowing particular attention on an environment, so that its landscape, its high biodiversity levels, the presence of species or of their peculiar association are not damaged by external factors that might alter their state. Problems in environmental conservation emerge when, in the name of false populism, the concept of conservation is confused with an economic investment that may yield a rapid return. This occurs when the real reasons for which an environment is protected (small and fragile ecosystems in particular) are forgotten.

In fact, in the name of everyone's fundamental right to freely enjoy Nature (Doccioli 1970), today's trend goes in the direction of fostering recreational tourism in these protected environmental areas (including school trips), which is often of very low level, not very educational and enriching. In parks a very different type of tourism should be aimed for, based upon truly educational purposes and on an understanding of the real value of conservation.

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Chapter 7
The Ombrone Delta and the Two Chief Systems of the World Today: Environmentalist and Economicist

Gabriele Ciampi

Abstract The author takes inspiration from a limited geographical research on a coastal protected area in Italy, the Maremma Regional Park, to launch a criticism of two opposing approaches that have negatively influenced today's culture and politics. This criticism draws from different points of view to converge in an affirmation of the irrationality of both approaches, environmentalist and economicist. The former is fed by the aesthetic attitude of the urbanised population which has aroused in the last decades neo-animistic and neo-arcadian beliefs. The latter appears paradoxically linked to the former through the public opinion which demands for artificial renaturalisation of the environment, implying expensive engineering works as well as strained biological interventions.

Keywords Environmentalism • Economicism • Animalism • Park • Environmental engineering

7.1 The Occasion: How Geographers Have Studied the Ombrone Delta

The subject of this article is the delta of the Ombrone River, located in the geographical region of Maremma (Central Italy). In the text that appears in the guide to the Maremma Regional Park (Ciampi 2007; Scapini, this volume, paragraphe 1.4), I attempted to document and, where possible, to interpret the various changes of the delta over the brief arc of time represented by the last two centuries. We may say 'brief' because the beginning of the processes that created the

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Ombrone River Delta dates to approximately the early Iron Age – that is, to the transitional period, some 3,000 years ago, between the Villanovan and the Etruscan civilisations. In addition, that date corresponds with a significant demographic threshold marked by an acceleration in population growth in the western Mediterranean area. Geographical evidence for such growth lies in the settlement synoecism, of which Rome is the most notable example: Seven villages became a single city. In the case of the Ombrone Delta, the formation of dune sand-ridges – the 'bricks' with which the delta was constructed – constitutes the terminal event in a logical, chronological, and factual sequence that might be reduced to the following formula:

population → deforestation → agriculture → erosion → delta sedimentation.

In my view, this in no way detracts from the fact that absolute dating of the dune fields is partly speculative and is, in any case, less reliable than relative dating, given that differences of a few decades are unlikely to be discernible with physical and palynological methods.

The Ombrone Delta, then, had a beginning and perhaps it will also have an ending; indeed, even today, it is no longer the cuspate-type delta, marked by a prominent apex, as it was during the preceding 350 years. The intensity of the delta's dynamic has been neither constant nor even unidirectional. Indeed, periods of growth have frequently alternated with periods of shrinkage (respectively, progradation and retrogradation, as from the terminology of geomorphology).

What this means is that the Ombrone Delta is an unstable object and, as such, may be defined as a phenomenon. Its oscillations do not, however, represent a regular pendulum motion, but are more akin to irregular pulsations. The reason for these pulsations has been the subject of empirical studies which, as so frequently happens notwithstanding the employment of rigorous methods, have nonetheless managed to fall into subtle epistemological traps. In specific, these involve the relationships between causation and synchronicity and between causation and location, whose opposite is chance. Such a discussion, however, goes far beyond the nature and limits of this article.

Interpretation of the 'Delta phenomenon' has thus been oriented toward the search for a correlation between, on the one hand, the delta's formation and transformation and, on the other, the human population regime in the Ombrone River catchment area. The correlation was derived from the response times analysis. Ancient maps and data, synoptically compared to military and topographic reports, attest to the near-simultaneity that exists between periods of population increase in the Ombrone River catchment area and progradation of the Delta (formation of new dune sand-ridges) – true at least until the beginning of the nineteenth century. The connection between population decreases and stasis at the coastline (or its retrogradation) – once again up to the nineteenth century – has been shown to be as much clear. From these observations came the link drawn between the two phenomena – the delta changes and the population regime. It is understood, nonetheless, that population is not the only factor implicated in this morphogenesis, and the delta's 'regime' does not precisely mirror that of the population. Other factors, unrelated to human use and

habitation, may have intervened in ways that augmented or conflicted with factors related to human presence.

In other words, at the river mouth – that is, at the end of the catchment area – the delta 'dynamics' results from the balance created between a weight and a force or, in other words, between the 'input' provided by river sediments ('input' from the sea point of view, 'output' from the perspective of the river) and the marine erosion. This latter, obviously, is also mutable, but over a much longer arc of time; it is linked to prevailing winds, sea level, long-shore drift, unusual meteorological phenomena, and to ceaseless but erratic climate change.

As long as agriculture, including sheep farming, has been essentially the only productive activity within the Ombrone watershed (and, thus, the activity destined to absorb demographic increases); as long as every increase in farming production has been the result not of increases in productivity per unit of agricultural land but via the reclamation and extension of cultivated land even to areas of higher gradient (where erosion is more likely); as long as such kind of phenomena occurred, every population growth has necessarily meant progradation of the delta protrusion and every population decrease, inversely, has meant retrogradation of the delta protrusion (or, at least, its stasis).

In any event, in the absence of the erosion caused by human activity (or hyperactivity), the trend would likely have been negative in all areas, and deltas would likely never have formed at the mouth of any river. The rule holds no less true for the Nile River Delta (if I may be forgiven for a comparison of such a magnitude).

Things began to change after the eighteenth century – not gradually, in time or scale, but in a series of successive stages. We will not, in any case, attempt to summarise the dynamics of change in the Ombrone Delta from the nineteenth century to today, but interested readers may learn more about them in the guide mentioned at the beginning of this article (Ciampi 2007). The reasons for such a silence are twofold. The first has to do with the difficulty of describing, in brief terms, the changes that are currently underway in this area, even if we were to make use of the elegant metaphors that have thus far aided us in providing a brief overview of the 'tragedy' of the Delta.

The second is that the discussion of a geographical topic has, to this point, actually served as a sort of a pretext: once our research came to a close, in fact, that precise issue became the springboard for a series of broader cultural and political considerations, which are the subject of the discussion that follows.

7.2 The Construction: How the 'Park' Has Formed

Most of the Ombrone Delta is found within the Maremma Regional Park. In order to place this area in a spatial context, we must first locate it temporally. The transformations that have taken place in the concept of the 'park' – an invention that dates to the end of the nineteenth century – must be taken into consideration (although, in fact, credit for the invention of the 'park' belongs to the ancients who, before the

birth of Christ, had already identified sacred groves – 'lucus' and 'nemus' – as forests intended to preserve the springs that fed the aqueducts). One may observe in a general way that the 'park', as a concrete reality and as a construct, has undergone a profound material and semantic shift: The signifier has changed its signified. In the 1900s, the term alluded vaguely to an area characterised by the absence of human activity and, very nearly, of all human presence; an utopian, proto-human Eden, but an Eden that was enclosed within fences, nearly a concentration-camp for Paradise. Over time, the park began to permit the presence of humans as passive spectators or else to the extent that they engaged in minimal traditional activities (the Maremma Regional Park was one of the first to adopt this model at its founding in 1975). Subsequently, the model adopted by this park permitted an active human presence, recreational and naturist (which is to say, sometimes, 'nudist'). Later, the park authority promoted additional activities aimed at the economic development and the profitability of the park itself.

In the case of the Maremma Regional Park, today we can at last imagine a park that could be partially disassembled and rebuilt as a product manufactured by environmental engineers. These craftsmen conceive projects, that is – on the basis of uninhibited structural and hydraulic interventions – whose goal is to halt or reverse the geomorphologic and biological processes already underway, which processes are demonstrated by retrogradation in the proximal stretches of the delta and progradation in the distal ones. These changes might be defined as 'spontaneous' to the extent that they are the remote result of interactions and retroactions in which human activities and natural impulses frequently switch roles as the subjects and objects of change.

The material and semantic metamorphosis of the 'park' can be represented in a circular graph in which the value of the centre angle varies from 0° to 360°, moving from a minimum of human presence (and, thus, a maximum of naturalness or spontaneity) to its exact opposite, that is 360° of artificiality and 0° of naturalness (or wilderness). In this case, angular variations measure a phenomenon that constitutes a kind of palingenesis on the part of the park authority: The park becomes self-generating through the 'park-ification' of man-made structures, which, in turn, are miraculously transubstantiated into natural objects and landscapes.

The explanation for this story (just as with history in general) demands that we analyse at least two elements: interests and ideology. The first, by its very nature, is a paltry and often spatially circumscribed consideration. The second attempts to soar above specific circumstances. Today, nonetheless, having adapted to changing times, ideology wears two masks (in the Latin sense of the term) and plays, on today's stages, conflicting but also complementary roles: environmentalism and economicism.

7.3 The Alienation: How Society Has Reformed Nature

Before attempting to interpret environmentalism and diagnose its origins, it may be appropriate to trace a superficial outline of some of its symptoms, working backwards in the effort to identify an aetiology.

Environmentalism generates the demand for primordial purity, for a pre-human fairy-tale, and continually risks veering off into the anti-human. In addition, environmentalism sometimes takes on connotations that are substantially anti-ecological – when, for example, it digs its heels in regarding individual components of the environment in the style of the animalism collecting animal species, which are then extolled as an intrinsic value rather than interpreted as environmental indicators whose presence or absence is merely a sign of the condition of the ecosystem, where certain species can or can not live. In such a way, biodiversity is reduced to a biocensus of the creatures present in a given area, and what should be a useful tool for the measurement of environmental conditions becomes the environment itself in its perfect state.

At such stage, a first link between environmentalism and economicism can be already observed. The reintroduction of native species into environments from time immemorial modified by man, needs heavy economic investments. But their meaning is fully economic and not at all environmental. Indeed the investments are aimed at arousing the illusion of the wilderness as well as at attracting crowds of tourists, excited by the expectation of a conjunction of wild and beautiful.

Continuing its descent, environmentalism moves toward anthropomorphism and has the tendency to clothe itself in spirituality. Thus, the deviation from environmentalism's loudly proclaimed ecological premises is great enough to require something more than a simple description.

Consequently, the march across the mental desert of the environmentalism cannot help but reach the confines of philosophy. From Marxist thought comes a concept that concerns the relationship between structure and superstructure, generally paraphrased thus: The ruling culture is the culture of the ruling class. If we apply this interpretive framework to the here-and-now of environmentalism, we may observe the following.

Like other European countries and the United States, Italy today is a predominantly industrial or even post-industrial country, in which nearly the entire population earns a living from activities that are utterly divorced from any direct physical contact with or manipulation of the animal and vegetable world (in which I would include the fight to the death with carnivorous predators and seed-eating pests). From a geographic perspective, the production of the food consumed by Italy's resident population requires an area of 0.8 ha per capita, while actual cultivated land (or land which could potentially be cultivated using economically viable techniques) is only 0.3 ha per capita (0.2 crop fields; 0.1 forage and pasture areas). The number of hectares available to every Italian, meanwhile, is 0.5 (the inverse of density), counting the nation's entire surface area, including glaciers, soccer fields, freeways, dance halls, the roofs of houses, and so forth. What this means is that Italians must import 63% of their food from abroad and that food producers in Italy are a small minority (about 6% of the working population as opposed to 60% a 100 years ago). From an economic point of view, the framework is even clearer: today the income generated from agriculture and forestry amounts to 3% of GNP (gross national product). One century ago, it reached 50% (personal observations, 2009).

We hardly need to turn to cultural anthropology to understand the chain of physical–cultural events that were triggered following the economic shifts of the

last century (with a threshold in the 1960s). The physical detachment from nature and from the need to deploy one's own energies and intellect in the manipulation of flora and fauna gives inevitable rise to an emotional (and, finally, cultural) shift. Those who neither 'manufacture' their food with their own hands (nor witness the manufacturing process), but at most engage in its later transformation, can neither know, understand, or feel the reality of nature and its utterly pitiless dialectic. What results is a pervasive mass ignorance that provides fertile ground for visionary visions of nature (and, in particular, of certain of its floral and faunal elements) that are idealist, tender, artificially sweetened, and idyllic. Over time, such emotions become internalised; they take root deeply within the unconscious and create modes of perception and of evaluation that ultimately become models of behaviour. A new culture is born in which, given the economic and demographic impact of its members, has today become dominant. We might speculate whether environmentalist ideology was formed before, during, or after the gestation of this new culture. In any case, the initiates begin to emerge at a certain point, the born-again who announce the good news and whose behaviour gradually shifts from the sentimental to the threatening. At first, they offer a knowledge, then they proclaim a truth, and in the end they impose a commandment, to whose greater glory liturgies and worship services are dedicated (such as, for example, Earth Day held every April 22). If it were Paganism, it might be intriguing. Instead, it is the result of naivety on the part of many and naked ambition on the part of a few.

Beginning with their disgust and moral condemnation for any act that involves the manipulation of living creatures, especially animals, for purposes of productivity or hygiene, for scientific or medical research, or for recreation, environmentalists proceed to other means: physically aggressive, legislative, and judicial. At a human level, those few (whether they be researchers, farmers, foresters, breeders, city health officials, amateur or professional fishermen and hunters) who persist in their exploitation of nature, are – eco-comically – accused of ignorance. Thereafter, they encounter a growing lack of understanding, hostility, humiliation, and harassment whose result may even be serious economic consequences for the individuals involved and the community. When, in a single night, wild boars consume an entire season's chestnut crop; or when, in organic semi-open-range farms, terrified calves die of heart failure when they so much as smell a wolf, or else are eaten alive, in small bites, as they emerge from their mothers' wombs; or when sheep stop producing milk; or when required age distributions can no longer be maintained within a flock because of predators – none of these is perceived as a problem. The wolf's freedom is of greater importance than the breeders' survival. Let the farmers apply for a job in town and stop interfering with the lyrical howling of the wolf (or, at least, with the thrill of hearing one on television). The implication is: We will buy our food from other countries where we won't be forced to witness either the inevitable elimination of predators and pests or the more harrowing phases of the food-production process.

To enlarge the discussion: History books, as we know, contain a long list of the products of human culture that have proven to be self-destructive for the very communities that brought them into being. Environmentalism will likely be filed as yet another example, in a long series of self-destructive behaviours, in which humankind

inflicts behaviour upon itself that is opposed to its natural, essential needs, and in which those needs are undervalued in favour of fashionable aesthetic or ethical gratifications. Such gratifications, in turn, may be conceived solely within a social environment that is the victim of a partial and deformed knowledge of the natural and economic realities in which our survival as biological organisms (and not solely as artistic types) is materially possible. As we have already made clear, such ignorance is induced by the material conditions of existence that prevail in today's developed and 'affluent' urban societies, which imply a total professional detachment from and physical distance between consumers and primary producers. The demographic and economic disequilibrium that has developed between these two sectors has thrown the second into a state of cultural and political subordination.

7.4 The Infatuation: How the Sentimental Animalism Has Asserted Itself

No longer an actor in the dialectic between humankind and other beings, nor even a spectator, the 'tertiary-urbanised' consumer thus develops a psychological attitude of tenderness toward all living creatures, which ultimately reaches a level of anthropomorphism. From this, what follows is an ideology of universal brotherhood that extends to all living creatures, but which is severe, confrontational, and nearly persecutory with regard to human beings who have not consented to or who are not adapted to the prescribed behavioural model – a model that stands in contradiction both to the normal natural dialectic among the various species and to the social nature of the human species. The process that follows then branches into a variety of directions, one of which is legislative. Here, recognition is demanded for animals, and even for plants, of a moral and legal status that is not greatly different from that enjoyed by human citizens. The outcome is not innocuous. In the context of agricultural production, the laws that have been created are biased in favour of 'harmful animals' and are, as a result, socially unjust and economically injurious.

One inconsistency – among many – concerns the fact that such protections are valid for some animals but not for others: A solicitous eye watches out for predators but less for their prey; it is more attentive to certain elegant wild animals than it is to their domesticated variety, industrially reared. The result is that environmentalism lets fall one of its many scientific guises, demonstrating a part of its intellectual barrenness and revealing a superstitious belief system that approaches animism. This belief system finds expression in a kind of discrimination (classist or racist as the case may be) among the various species, privileging some to the detriment of others (those implicitly viewed as less noble). This sort of human behaviour is, of course, nothing new. The cat, for example, has generally merited less consideration than the lion, despite the cat's vital role in defending granaries from rats starting with the Neolithic agricultural revolution and in spite of the fact that the lion has been a competitor with human beings for the same resources. Notwithstanding its crucial role in the development of humankind, the cat is depicted much less frequently in

heraldry than is the lion. The moderns may have permitted themselves a similar lack of gratitude, but the Egyptians, 5,000 years ago, certainly did not.

Today, the latest development in this visceral trend (more than a school of thought) is its tendency to be transformed into militant fundamentalism, pathetic and arrogant at the same time, inclined to impose its predilections without discussion or to translate them into binding laws and regulations enforced 'erga omnes'.

The public, already in the throes of eco-emotion, arrives at this stage and is very unlikely to be able to see reason once again, at least not unless it is forced to endure some enormous shock such as, for example, when a child falls victim to predators or when a halt is called in food imports (a phenomenon that would hardly be surprising in the middle term as a result of population increases in exporting countries). In and of itself, a simple increase in the price of meat (or fish, thanks to seagulls and sharks) is of no particular consequence to the consumer numbed before the television screen. Indeed, the increase is not apparent from the price tag, but is rather hidden in the intricacies of tax and import laws, which attempt to obtain the financial resources needed to compensate (wholly inadequately) fish and livestock breeders. The subliminal message of this skilful proselytism, disguised as 'environmental awareness campaigns', is this: Shark fins and the calls of seagulls are so beautiful that they are well worth the price of a protein deficiency among poverty-stricken children.

An anthropomorphic attitude is shown by the animal rights movements, who deny the existence of dog breeds more aggressive than others, blaming only the training factor for their behaviour. This opinion clearly ignores the biological history of animal domestication (dogs, chickens, cows, etc.), aimed at selecting the breeds as a function of the various tasks they are destined. Unfortunately it is an opinion heralding criminal effects.

But it is only with the activities of the anti-vivisectionist lobbies that the environmentalist-believer attains the heights of the tragicomic (if not the pathological), when the health and safety of laboratory rats is placed above the search for cures for human suffering.[1] Recently, anti-vivisectionist demands have even been given consideration by the European Union, which is preparing to issue legislation to

[1]It is worth calling attention to an unusual case that is nonetheless relevant from a humanitarian perspective. In northern Australia, large marine and terrestrial reserves have been created. The last remaining communities of Aborigines are confined in these areas, where they live according to their ancient practices. Within the marine areas of these reserves, large saltwater crocodiles, protected by strict legislation, navigate the waterways. Occasionally, the Aborigines who venture out in their pirogues in search of food for their families are themselves eaten by the crocodiles. Generally speaking, however, no outsider hears anything about such events, unlike the case of shark attacks on surfers. The natives experience these tragedies with heathen 'ataraxia'. The indifference on the part of non-natives, on the other hand, does nothing more than reproduce the attitude of the early colonists who placed Aborigines in the same category as the local fauna. At the time, the hunting of Aborigines was aimed at the conquest of their lands; today, it is the modest price that must be paid for the conservation of wilderness areas, whose aesthetic enjoyment is experienced by urban dwellers – descendents of the conquerors – as an implacable need. Closer to home, the first massacres committed by wolves in Tuscany a few years ago aroused the protests of area cattle farmers. The regional authorities responded by saying that the breeders would have to learn to live with the predators. What remained

update a law that was in force in the fifteenth century – the very one that forbade Leonardo da Vinci's anatomical studies. In other cases, faced with the need to take defensive measures against pest animals, environmentalists insist that efforts be limited to the use of natural predators and oppose the use of mechanical and chemical means, once again disclosing the aesthetic bases of their demands.

If logic and justice were to prevail, however, these infantile guerrillas – who secretly introduced wolf and lynx specimens into Italy from eastern Europe in order to treat low fertility rates among local populations, which are largely endogamous – would be held legally responsible for the human and economic damage to private citizens and to the community that their illegal actions provoked and will provoke in years to come.[2] The result of their unlawful activities, however, is – incoherently – protected

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unanswered, however, was the farmers' follow-up question: Where and when in history (natural or cultural) have humans ever lived peacefully alongside wolves? The breeders next offered the constructive proposal of limiting the presence of wolf packs to large areas where they would find sufficient food resources, but would be prevented from invading the semi-open grazing areas where food animals were being raised. The cattle farmers even offered to furnish meat for the wolves in the event sufficient prey wild species were not present. The authoritarian but Green-inflected response to the proposal was: Absolutely not. You farmers need to pen your animals; wolves must be free to wander where they will. As a result, thanks to the power of environmentalists, some sheep farmers closed up shop, further reducing the production of organic food. As of this writing, yet another situation is unfolding. Cattle raised for the production of meat in semi-open-range organic farm systems can no longer complete their pasture season because – as we have mentioned previously – wolves single out the cows that are about to give birth and devour the calves even as they are being born, pulling them directly from their defenceless mothers' wombs. As a result, the animals who are about to deliver are now enclosed in stables. There, however, in conditions infinitely less hygienic than those in open pastureland, infections are the norm for both cows and calves, whereas they were non-existent on the range. The use of antibiotics thus becomes indispensable. Here, then, is another anti-ecological and anti-economic consequence of environmentalism (personal observations, 1996–2009).

[2]Here, the memory wanders to a casual meeting, in February 2008, with an elderly shepherd in Padule di Fucecchio (Fucecchio Swamps, Tuscany). This gentleman manifested the evident bitterness of someone deeply attached to his work but defeated by difficulties; indeed, he was on the verge of abandoning his profession. As he described the situation, his decision was the result of three related events: the massacres of his animals by wolves in the summer pastures of the Garfagnana region (Apennines); the charity he was forced to beg from the Green functionaries whose job was to dispense insufficient compensation for his losses; and the punishment of Tantalus he was forced to undergo, following each massacre, as he once again reorganised his flock into the precisely balanced age categories necessary to ensure that his animals would reproduce. An historical oddity of which few are aware has to do with the disappearance of the wolf in the Po River Valley, where it was widely present even to the middle of the nineteenth century. Population increase (prior to the beginning of emigration abroad) had caused farmers to increase their herds, and the animals were normally entrusted to children who guided the flocks to pasture while the adults were engaged in heavier work. The greater presence of livestock attracted increasing numbers of predators and they, as a question of economy, abandoned the hunt for the refractory ruminants and turned their attention to the more vulnerable young shepherds. The royal-imperial Austro-Hungarian government (at the time ruling power on Northern Italy), touched by the human question and efficient in its administration, mobilised the army which, in a series of pincer movements across the wild areas of the plains where the wolves hid, effectuated a careful zoological cleansing of these predators on children. Who can say whether Italy's current politicians (both national and regional) would demonstrate, in similar circumstances, the same sensitivity and efficiency of the Austro-Hungarian oppressor?

by law: Someone who kills a wolf serves time in jail just as does someone who kills a human being. Spontaneous and 'naturally' necessary, what results includes forms of civil disobedience based on natural law.

Historical confirmation of the interpretation of environmentalism that I have proposed here comes from England, the country where environmentalist-animalist sensibility first appeared and also the country in which the Industrial Revolution began before all the other countries (contemporaneously with a decline in agricultural production). Today, such emotional trend appears to be on the increase everywhere, but Italy is bravely maintaining its position at the top of worldwide rankings.

7.5 The Discrimination: How the Antithesis Between Protected and Not Protected Areas Has Been Imposed

Halfway between our grandparents, who were forced to strain the entire animal and vegetable kingdom with their own hands, and the new prophets of a nature cleansed of human presence, we find an intermediate sensibility, linked to urbanism and industrialisation but still positively influenced by science. Such a sensibility deserves the credit (or the blame, depending upon one's point of view) for the setting up of parks, a phenomenon which began even in Italy in the early twentieth century but which has exploded in the last 40 years.

In geographic terms, it should be emphasised that the locations chosen for the establishment of parks have always been strictly scrutinised by the political power. The reason is the need to ensure that the impact of such choices falls on areas inhabited by tiny fractions of the electorate, weak in both demographic and economic terms. The result is that the preferred sites for parks are either sparsely populated mountains or undeveloped plains areas, precisely because placing parks there avoids the risk of negative electoral consequences (caused, in turn, by resentment on the part of the locals for the constraints that the presence of a park place upon them even as it favours city dwellers). This geo-political management of parks can be called 'the war of the cities on the rural classes'.

In recent years, counter-urbanisation and the phenomenon of second-home ownership in the countryside have fanned the flames of this 'clash of civilizations'. Outside of the parks themselves, the reflux of urban dwellers fleeing 'false' urban reality in search of a 'true' extra-urban reality has run up against a certain amount of disappointment, provoking a series of rash reactions on the part of these urban refugees. In fact, when they have found themselves face to face with the realities of agricultural life, they discovered, to their dismay, that countryside does not mean nature – at least not in the sense of the word as it is filtered through fiction and the (dis)informative efforts of the environmentalist media.

Urban dwellers, in addition, fortified by the convictions they have acquired, have generally behaved in ways that are far from urbane in their roles as idle guests, which is essentially what they are with respect to those who live in and, in particular, from/by the countryside. In fact, the farmer's or rancher's manipulation of living things

is observed by these weekend farmers through a lens of affectionate ignorance of nature's realities and mechanisms, which leads, in turn, to their genteel distaste for the agricultural 'forcings' that the 'mise en valeur' of natural resources requires. What follows is a flood of specious quarrelling, and even litigation, for trivialities of every kind, from the offensive smells coming from the stables to protests over the eradication of the pigeons who pillage the fields for just-planted seeds. Those who are called upon to judge these grievances, however, generally belong to the same social category as the complainants, and the outcome can almost always be taken for granted. This is true for another reason: The laws that today govern the material existence of rural dwellers have not been made by them, but by their counterpart.

7.6 The Mystification: How Scientific Data on Climate Have Become a Trendy Bias

At this point, as we attempt to return to the intrinsic from the extrinsic, let us attempt a quick sociological analysis of environmentalism, which is partly implicit in what has come before.

We can identify at least five actors that exist simultaneously in the phenomenon of environmentalism: two belong to the culture of the educated, one belongs to the culture of anthropology, one to politics, and one to economics.

The first component includes the 'élite' – the scientists, naturalists and, in particular, the climatologists who provide the initial 'green' input, which is to say the scientific information that should serve as the rational justification for the mobilisation of the masses. The information provided by such scientists, however, is not always and not necessarily irreproachable when it comes to its authenticity and thoroughness (a factor that may also be the result of the uncertain professional ethics of some of the luminaries in the field, which is not higher than the average of the common people). We have a plethora of illustrative cases to choose among. Some examples could be plucked from the air, in both the literal and figurative sense of the word,[3] while others are more serious and immediately damaging.[4]

[3]The anathema against the CO_2 emissions on which global warming is blamed, on the other hand, is itself becoming a cause of warming – in the form of progressively accelerating masses of publications, public-service announcements, and anxiety. What is manifested in this phenomenon is the sort of forgetfulness typical of ritual prayers repeated without rational thought. No one, however, cites the human body among the sources of CO_2, though the human being is the only large mammal whose population has reached impressive numbers and which, simply by exhaling, produces large volumes of carbon dioxide; this does not even take into account the carbon-methane emissions of the human intestinal tract, which would increase out of all proportion if human beings (obeying the strict vegetarian admonishments), were to give up milk and meat and eat an exclusive diet of legumes (further ahead, see the heading 'eco-economists').

[4]One example that is genuinely dangerous for human health came in the form of a sort of sermon transmitted on a recent radio program in Italy. The guests in the discussion were a medical doctor (an allergist) and a media zoologist. The allergist advised caution in allowing domestic animals

Rummaging among these, we might point to the data supplied by astrophysicists regarding the temperature increases that are currently affecting all the planets in our solar system, even Pluto, to a degree proportional to their distance from the Sun (Ravilious 2007). The response to such data – within scientific circles as well as in the media machine – has been utter indifference, an indifference that is hardly justifiable, not least because it seems doubtful that earthlings, semi-divine though they may be, have the means to make and unmake the Universe (starting with the roasting of more than a half-dozen planets).

But even the shadow of a doubt regarding the climate is to be considered subversive, as such shadows always are. From now on, as a consequence, anyone who attempts to spread news intended to dampen environmentalist enthusiasm (even if his name should happen to be Milankovitch), may be guilty of a new category of crime that has recently been proposed by a court in the United States: 'climate change denial'. But time is short, and before long, even if the weather gets cold, it will still be hot as far as the law is concerned and thermometers will be censured as if they were obscene photos.

At this point, however, these 'emergencies' follow one another in dizzying succession and, as a result, the word emergency is losing its original semantic meaning of 'exceptional', becoming instead an indication of normality. And yet, to avoid letting ourselves be unduly influenced, it would be sufficient to keep in mind the distinction between climate and weather (in the 'olden' days, before the victory of the revolutionary geographers, this fact was well known even to literature students who had successfully completed their geography exams). These 'emergencies' and the 'climate gone mad' are subsumed into (and this is comprehensible to anyone) the classic concept of climatic regime, by which is meant the multiyear average of seasonal weather variations over the long-term in a given location. In other words, exceptions are covered by the rule and contribute to its definition.

Perception next provides its misleading contribution to the error and is willingly accommodated by the climatology-show. Thus, the residents of a region in which striking meteorological conditions occur become convinced that the climate is rapidly changing. What they are not told is that another part of the world is, at the same moment, experiencing weather conditions that are no less dramatic but which are

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into our homes, because children whose parents have a history of allergies are much more likely to develop, later in life, serious allergies of their own as the result of allergens contained in the saliva of animals and deposited on their hair or fur when they clean themselves. The eminent radio zoologist had no intention of listening to what the allergist had to say and began to speak ex cathedra about ethological studies regarding the importance of licks and hugs. The allergist responded with statistical data drawn from highly regarded international journals, but the moderator (irritated by the insinuation that nature was not always kind and good) cut the discussion short, telling listeners that there was no reason to worry. They could sleep peacefully with a dog or a cat in bed because, when he was a child and his grandmother was still alive, people lived in communion with animals and everyone grew up just fine. No one had a chance to object that, when his grandmother was alive, infant mortality in Italy was 30 per 1,000, in contrast to the 4 per 1,000 of today. The idea didn't fall on deaf ears, however. Recently, the Emilia-Romagna Region authorised elderly patients admitted to the hospital to bring their dogs with them for company.

the exact opposite. And a few years later, the opposite occurs. Emotions run high between the fear of global warming and the terror of a new glaciation: Just like the hysteria of the apocalyptic year 1000, this is no more than fear of the future (quite clearly justified, but for other reasons): a boon to some few (eco-terrorists) and damaging to many others (eco-terrorised).

Today, in addition, and for something on the order of the last 20,000 years, we find ourselves in an interglacial period. Because, over the last 1 billion, 700 million years, interglacial periods have always been followed by glaciations, it is impossible to exclude the hypothesis that the Earth may be on the verge of a new period of glaciation. If that is true, we ought to be hurrying to release as much greenhouse gas into the atmosphere as possible if we want to save our lives.

From a geographic perspective, in any event, potential climatic variations are not significant if they do not lead to changes in the physical landscape. In the temperate belts, for the moment, such changes appear to be minimal: The upper limit of the forest has ascended the Alps by some 100 m, but that fact seems due to the abandonment of high pasturelands. In Canada, the northwards extension of cereal cultivations by over 100 linear kilometres is due to the cereal price increase by 65% in the last 7 years. In the tropics the changes are more significant, but there, too, the causes are primarily related to human activity or population growth. What is important is their dimension. The entirety of the threatened changes might well be a question of the movement of climate-landscape belts toward the poles of no more than a few dozens of linear kilometres.

The issue of the rising sea level has been the subject of another hype. If we like, we can enclose the significant pre-historical sea rising between parenthesis. Archaeology itself, however, with its tangible physical evidence (and not only science, with its numbers) demonstrates the following: Even in historic times, from Augustus to the present day, sea levels have done nothing other than rise – some 1.35 m since then, independent of subsidence. Maybe Roman Empire has been responsible for having started such rise? There is no question that it would be convenient to be able to regulate the level of the seas to our maximum advantage, but to do so would involve a clearly unnatural pretence – promoted (who would have guessed?) – by nature's most out-of-control fans.

A similar argument involves glaciers, which are nonetheless more subject to fluctuation. Glaciers, unlike the seas, are bound not only to global changes, but also to regional variations in climate. The anxious might find it useful to read Emmanuel Le Roy Ladurie's "Histoire du climat depuis l'an mil" (1967) and might be additionally reassured by recalling that, during the Middle Ages, wine grapes ripened nicely under the English sun and 'Anglo-Wines' were even exported. The Little Ice Age (mid-1300 to mid-1800) forced viticulturists to convert their businesses into breweries. Later, a few of those who could not adapt to the change took refuge in Chianti; today, however, they are considering replanting vineyards on the Pennines, having made a first stop in the Apennines.[5]

[5] I would not, however, include Greenland in evidence regarding the warm Middle Ages. There on the Inlandsis, even at the time, there can't have been much green to see, and it is more likely that the Vikings called it Weissland. The place name error may be due to the carelessness of a mapmaker

Surely it is not polite to insist, but some rants demand to be corrected. One, frequently repeated, is that global warming is linked to desertification. In truth, they are related, but in the sense that any heat increase automatically leads to evaporation, to greater humidity in the atmosphere, and to increased precipitation (or, at least, mist). Deserts might run the risk perhaps of shrinking, if not of disappearing entirely, at least in the proximity of the seas.

In short, 'climate change' is a tautology. More misleading still is the use of the expression 'natural equilibrium'. In rhetoric, locutions of this type are called 'oximorons'. Equilibrium comes from the Latin words 'libra' (scales) and 'aequus' (equal). If we want to be sure that both sides of the scales hang equally, the scale must be motionless. But nature has never been motionless. Stasis is characteristic solely of still lives, a painting style that was popular some decades past. It is true that the concept of dynamic equilibrium exists in physics, according to which variations alternate cyclically within specified limits. The concept cannot be applied to ecological history as we know it, however. Macroscopic proof of this is to be found in the Pleistocene, during which glaciations and interglacial periods alternated cyclically, though none of these periods was identical to any other. The notion of dynamic equilibrium, then, is foreign to known ecological cycles.

An objection to such a conclusion might well call to the fore a consideration of the scale of the cycle involved, attributing it to infinitely longer spans of time (those linked, for example, in the birth and death of planets). The Earth was once a ball of fire and to that state it will one day return. At that level, however, the cycle assumes dimensions that are no longer those of ecology but rather of astrophysics. On that scale, we have no idea what role the human species may play, at least not in a biological sense.

But the error committed by the mass media as they raise alarms based on short-term observations is, above all, a methodological one (in addition to being incredibly naive). At one time, even high school students knew that the diagram of any phenomenon characterised by alternation appears very differently according to the graphic scale employed. The individual sections of a curve, whatever its pattern, may appear straight and uniform if the scale is small. Increasing the scale, the individual sections may appear more or less sinusoidal and much more densely curvilinear as the scale increases. In short, small climatic fluctuations do not necessarily indicate a reversal of a trend. Continuing to trace a path along a scale of increasingly minute detail, one moves from climate to the weather that changes from day to day.

An additional example of the misuse of scientific information involves admonishments to consume less water, which appear side-by-side with cautions about the need to consume less gasoline. Although the same verb is used, no warning is given that their objects are hopelessly heterogeneous. Water, once it is consumed, enters

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who took the name by which the Vikings presumably knew Canada and he applied it to Greenland. As regards the Mediterranean countries, should the climate really warm again in the future, they could get a comfortable remedy by an artificial lowering of the Gibraltar threshold that hinders the access of the deep, cold waters from the Atlantic Ocean into the Mediterranean Sea.

the water cycle and returns to us as rain over a span of time that may range from less than a day to some tenths of thousands of years. Hydrocarbons, once they are burned, require hundreds of millions of years to make their way beneath the earth once again (assuming that things proceed as they have during previous geologic eras). Direct object 'water', then, retroacts on the verb 'to consume' and renders it inappropriate: Under normal circumstances, water can only be 'used'. Indeed, the difference between use and consumption in this case has to do with the fact that the consumption of gasoline implies not solely a 'state' change (from liquid to gas), but also a complete change in 'nature' (chemical and physical). The chemical and physical phenomena that involve water (the formation of calcium carbonate, for example) require a minimum quantity of the water involved and are normally reversible. If anything, the problem lies in the role that water may play as a vehicle for pollutants. The essential fact, however, is that water remains, in the main, unaltered as to quantity; gasoline, in contrast, disappears and becomes something else.

What is more, domestic use represents less than 10% of all water use, the remainder of which is absorbed almost entirely by industry and agriculture. The admonishments against taking showers or flushing the toilet, therefore, are penitential in nature. In fact, the use of more water (if possible) might even have a positive impact on the environment, because it would reduce the concentration of pollutants in waste water and in the water bodies fed by such waste (see also Zanchi and Cecchi, this volume).

On the contrary, a negative impact on the hydrological cycle results just from high stand forests and woody plant encroachment which reduce – through the increased evapotranspiration – groundwaters, soil water availability and streamflow. The damage due to the artificial or spontaneous forestation is ecological as well as economical: The average water loss for the cultivated lands reaches 52%; 13% of the brooks dries up (Farley et al. 2005; Jackson et al. 2005; Huxman et al. 2005).

However, today the concept of equilibrium is normally misused, even when referred to sustainability. This requires frequent adaptation to the changes that occur according to the periods and the locations. Thus sustainability is linked to time and space in becoming, both remote from the concept of equilibrium, richer in artistic charm than in scientific contents.

7.7 The Subornation: How Scientific Data on the Environment Have Become a Political Passkey

The second sociologically relevant component of environmentalism concerns the masses, that behave according to specific anthropological models. This component, which necessarily depends upon what is fed to it by the scientific 'élite', is not in a position to scrutinise the messages broadcast via the mass media by scientific celebrities and bodies, who are, in turn, viewed as sacred messengers. As is generally the case in the priestly castes, the messengers certainly do not turn up their noses at the possibility of the personal, professional, and socio-economic return assured to them by such messages. In this case, the role of paymaster is played by politicians

(the third component), called upon to indulge the demands for salvation that arise from the catechised and fanaticised masses. When the moment arrives to attend to electoral matters, these politicians boast to potential voters of the funding they have ladled out to the more alarmist of the self-publicising publicist scientists.

The messages, in the meantime, experienced in a state of religious subjugation, take root in the consciousness and even in the unconscious of their passive recipients, eventually transforming themselves into models. With the passing of time, such models tend to constitute the new culture of anthropology that we alluded to earlier. As is well known, models characterised by emotionality or fanaticism are capable of creating reassuring social environments, but they clearly inhibit the critical faculties, triggering default a priori convictions and diverting logical thought into aberrant directions. Then masses and mass media bounce back and forth the emotional messages, which produce a resonance effect clearly audible by politicians. In turn, the political intrusion of mass culture acts through the powerful environmentalist-animalist groups, that have proliferated in the last decades. Therefore politicians are ready to deal with ecological issues not on the basis of their real importance but according to the political consent that such groups are able to carry. In other words the observed relationship between scientists, media discourse, public opinion and politicians creates a self-breeding vicious circle.

7.8 The Falsification: How Scientific Data on the Environment Have Become an Economical Deceit

This brings us, then, to the fourth component. Environmentalism is in no way harmless, not even economically. Representatives of the various sectors as well as political staff employees are well aware of its potential to subvert and destroy the economic and geopolitical balance of power. Foremost among these is the energy sector, whose control over resources, technologies, transport routes, and distribution and marketing networks is obviously of vital importance in the management of domestic and international power relationships. Indeed, government of the World and possession of the Earth are not synonymous, but they are mutually necessary.

But even more important than these aspects is the control of knowledge and its dissemination. Data regarding oil reserves from the petroleum industry's 'Seven Sisters' describe quantities that will, at current rates of consumption, be exhausted within approximately 35 years. Of course they don't explain that 'reserves' means one thing and 'deposits' means another. Deep deposits, tapped via the use of new technologies, could quickly become reserves – that is, those deposits that could be reached in ways that are both practical and economically advantageous. In that case, the duration of reserves would be measured in hundreds of years at the very least, and no longer in decades. If this information were to begin to circulate freely, however, the only thing that would fall deep down would be the price of oil (G. Battisti, personal communication, 2008).

Environmentalism is therefore a hotbed of eco-politically correct (and corrupt) projects. The search for alternatives to production methods that are currently in use (but which have been condemned by the eco-political court) has become the task of the research and development departments of the world's largest industries in the last few decades. But engineers and scientists are not the only ones at work here. The Princes of 'advertising', 'marketing', and 'promotion' – that is, the global circumvention of incapables – are likewise on duty. What is at stake – still and always – is the neutralisation of the negative effects of environmentalism on economic and political balances of power. The issue is – and this is surely no easy task – to find alternative solutions for industrial and agro-industrial production, which are capable of being perceived positively by the average end-user. Whether such solutions are actually and not solely stylistically alternative is a technicality. In any event, the managers of these so-called innovations can remain confident that the mass media will fulfil their educational role with supreme professionalism.

In the case of politicians, a few of the more uninhibited have chosen to ride, with a prophetic posture, the bandwagon of deceptions that the public so guilelessly accepts. Indeed, faced with such a public, it is simple work to invent a series of reductive but effective code phrases. The prototype for this sort of abuse of popular credulousness is an eloquent U.S. politician, a personality who has managed to embody a winning synthesis of environmentalism's diverse elements. His lectures are highly appreciated and still more highly paid (about 110,000 euros per hour). Alerted to the advent of any tropical hurricane, he assumes a Moses-like posture to admonish the neglected people, assuring them that they are being punished for their misdeeds in ways similar to the plagues of Egypt. If that were so, it would mean that, although people in temperate belts commit the most misdeeds, nevertheless the Lord appears to call to account solely those who live in the tropical belts. Does the prophet realise the seriousness of his insinuation?

In any case, if we believe in Divine Justice, we may hope that the 'false prophet' will be made to pay when the Climatic Judgment Day comes, even as his victims are saved. Which leads one to wonder: Who knows what grades the vice-president-to-be received in geography when he was a student? Perhaps he did better in the history of religions. Sooner or later, it may occur to him that a typical feature of primitive cultures is the attempt to explain natural disasters as divine punishments for offences committed. It is no accident that the concept of sin and the idea of a divinity employed in the punishment of sin took root in the Near East around 3100 BC, following the rapid drying up of areas that had previously been fertile. The Scriptures likewise lay the blame for the Flood (retrospectively) at the feet of humanity, adding that a similar punishment would never again be imposed. In the United States groups exist who, basing their position on a literal interpretation of the Scriptures, assert the incompatibility of their faith with a belief in global warming.

Another group of professionals implicated in these unseemly deeds are the science-journalists. One of these, who writes for a popular women's magazine, found herself at a loss when confronted with the objections of a reader who argued against her climatic alarmism. Taking desperate refuge in the strategy of the 'ipse

dixit', she cited the unquestionable authority of a highly respected international team of climatologists. Or, to speak in metaphors: A hired killer calls his client as a witness for the defence. That client, indeed, might well be a group that administers a fund of public good faith that can be converted into cash and which is establishing the careers of (and making a fortune for) a growing multitude of climatologists. Yet they deserve our understanding because, like everyone else, they have got families, too.

But in recent years, eco-journalists have found themselves facing some tough competitors, particularly fearsome on the battleground of opportunism. Ignorant regarding the environment, but eager to jump on a lucrative bandwagon, a number of pompous economists (more or less manqué) have also climbed on board. Their studies may have been more or less a failure, and they may never have opened a physical geography text in their lives, but they are sharp as tacks when it came to communications: They solemnly christened the entire argument 'environmental politics'. The name, however, is imprecise: not 'environmental politics' but rather 'political environment' or perhaps 'political politics'. Their stentorian voices resound in a zone cleared of scientific clutter. Listening to them, one may well rediscover the concept that seventeenth-century physicists called the 'horror vacui'.

When they have the opportunity to appear before the media, it is customary for these pseudo-environmentalist political scientists to show off a triumphant escort of scientists, chemists, or other scholarly figures, all of whom carefully ignore the systemic traits that characterise ecology. Often, these individuals delight in demonstrating laboratory experiments in which, for example, light is made to pass through samples of air mixed with various concentrations of carbon dioxide. In so doing, they traumatise spectators by revealing that, whenever the CO_2 concentration is higher, heat dispersion will be slower. The doubt never crosses their mind that, in the natural environment, higher concentrations of CO_2 can trigger multiple reactions, interactions, and retroactions, in contrast to the effects that may be observed in the laboratory. To describe one of these retroactions at random from among endless examples, it has been well known for centuries that a higher concentration of carbon dioxide speeds up photosynthesis by increasing the surface area of a plant's leaves. This, in turn, increases the plant's absorption of CO_2.[6] But not content with this success, these stage-scientists give themselves over to simplistic predictions of future global warming that chill the hearts of faithful listeners already stricken with guilt for their consumerist sins. The calculations performed by these prophets of doom are generally based upon no more than two or three elements, as if the Earth were a glass beaker whose content had been prepared by an alchemist.

According to some authors, however, the crux of the question must be sought elsewhere. They hint that the category of eco-economists (in theory even belonging

[6]The effect of deforestation is contradictory, too. Fewer forests mean less CO_2 absorption and more air heat retention. Nevertheless, especially in the warm-temperate and inter-tropical belts, the deforested areas have a lighter colour than the forests. As a consequence, the albedo increases, that is the amount of reflected sun light (i.e., the light not absorbed by the earth surface). It is obviously necessary to measure such an increase in comparison with its reduction, due to the glaciers' shrinkage and, above all, the huge increase of asphalt roads, that are dark in colour.

to the educated culture) is subject to an ironclad law (natural?) according to which the quality of professional output is inversely proportional to the author's fame. The standard-bearer of this breed in the U.S. is no longer a simple movie star, but has become a major producer in 'environmentalism show business', with production budgets commensurate with his audience share. As a means to reduce greenhouse-gas emissions, the eco-chef has proposed in recent a years a return to the recipes of the 'vieille cuisine', which recall the penitential regimens of certain monastic orders.

There is no question that human intestinal emissions would increase out of all proportion if we were to follow the path indicated by the Master, take vows, and renounce milk and meat in favour of legumes. The math is simple. Today, cattle on farms and ranches across the world number 1,300,000,000; human beings number nearly seven billion. This means that 5.3 humans exist for every cow, except that the cow weighs as much as 5.5 human beings. If humans, then, in order to compensate for having renounced animal protein, began to eat beans alone, their fire power would quickly equal that of the livestock artillery. The greenhouse-gas emissions produced during ruminant digestion are identical to those produced by the single-stomach human, with differences due solely to variations in their relative size. In humans, these emissions contain less CO_2 and more methane than do those of cattle.

But such objections are wasted breath. In this sector, the jeremiads are perhaps more closely related to the development projects of the major players in 'environmentalism show business' than they are to intestinal currents. What is more, the recommended diet may be holy, but it is not healthy. The real problem isn't whether or not to consume meat and milk, but how to make everyone consume them. Meat-eating is evolutionarily required of the human species as it is of the other great apes, the result of our greater mass and of the increased functioning of our brains (a major energy consumer). In fact, the consumption of meat optimises, in biological and economic terms, the cost-benefit difference between quantity of food and nutritional benefit. Of course, it is advisable not to overdo things, because our brains have become larger but the human intestinal apparatus has remained the size of a vegetarian animal – an excellent example of the imperfection of evolution and of a not-entirely-benevolent Nature.

7.9 The Suggestion: How to Appreciate the Historical and Literary Antecedents of Environmentalism

We can extend this attempt to interpret environmentalism beyond the socio-political sphere to the literary one.

The physical and mental distance that exists today between our bodies and the living bodies of the animals and plants destined to become our food is nothing new in human history. In the past, Europe experienced the same alienation, the same psychological removal from the human–environment dialectic (albeit with a limited social group, though the results were similar) that is required for us to extract our

daily bread and butter from Nature. This alienation is accompanied by a sense of being deprived of contact with Nature and thus by an attraction to an image of its ideal rehabilitation, a longing, which sometimes descends into delirium, for a nature that is good as well as beautiful.

This is what the aristocrats did, for example, between the end of the seventeenth century and the eighteenth, along with the scholars who gravitated toward that seemingly frivolous world: Arcadia. In my opinion, the best symbolic representation of this is the shepherd's village that can still be visited today in the park of Versailles, where Marie Antoinette, along with her ladies in waiting and their beaux, sweated blood as they played at being shepherds, milking the sheep and almost managing to produce cheese; but not, however, lamb chops (that would have required the plebeian sequence of slaughtering-dismembering-butchering). Nevertheless, according to a dismal economic logic, lamb chops should have been the result of the exhausting activity of animal husbandry so joyously carried out by those dandies and ladies in waiting. Nonetheless, thanks to considerable state incentives, the farm at Versailles was not shut down until it became technically obsolete following the invention of the guillotine.

The 'pastoral' aspect of the Arcadians and the issue of sheep farming continued to be separate and reciprocally invisible productive sectors – at least until the environmentalists appeared upon the Earth. What we think of as the 'pastoral' might perhaps be defined as the aesthetic side of sheep-rearing. As often happens, the aesthetic was also anaesthetic; it suppressed and repressed reality along with the need for the unaesthetics, which is essential to human survival. Naturally, one must be able to afford aesthetics, as Marie Antoinette could and as today's urbanised-tertiarised environmentalists can. The hands and the handling that bring succulent dishes to our tables and effective medicines to our pharmacies have to do with other people: We don't even want to know to whom those rough hands belong. We, in our sanitised realities, find them disgusting.

Nonetheless, a doubt remains. The Arcadians – those poets so full of sensitivity toward nature and refined to the point of frivolity – accomplished an unexpected political exploit. In Italy they created a network among themselves, and from that network a movement began to develop. From the headquarters of the Accademia dell'Arcadia on the Gianicolo hill in Rome, they established a link with all the other centres of Italian Arcadia. They set up what they called the 'Italian Republic of Letters' in which intellectualism was stressed, defended, and translated into a moral imperative. The most important among them, Ludovico Antonio Muratori and Giuseppe Parini (who wrote the ode to 'The salubrious air'), were almost an inkling of the Risorgimento, long before revolutionary France provided the ideology, the law, and the military institution.

I asked myself why. Why did they shift from sentimental cosmopolitan pastorals to ethics and to Nation-building? I asked literary historians and they replied: That's a good question. Even with all due caution, I am tempted to conjecture that the reason concerns the enthusiasm with which they animated their profession as poets of Nature. To say as much is to concede no reduction in the sentences that today's environmentalists deserve to serve; they are enthusiasts, but also daydreamers. Of course, as Gramsci said, enthusiasm is a resource. In the present context, enthusiasm

can also constitute a positive factor for tackling real ecological problems (not the fantastic ones). But enthusiasm is a weapon and it's easy to get hurt, especially if honesty is paired with ingenuity rather than with knowledge. After all, the world is full of people who, hoping to escape their personal frustrations and lack of affection, cannot wait to find a mission that needs to be accomplished. Such a mission fills the voids in their existence and allows them to feel important to themselves and to others. What results are those waves of collective hysteria that have so often been observed in history, that therapeutic sense that 'we are all in this together'.

This suggestive conversation is an attempt to illustrate the fifth component of environmentalism. I'm sorry to admit it, but humanistic culture today seems incapable of accessing an awareness of the present. The baton is now being carried by educated scientific culture, while humanistic culture falls behind, or indeed acts as a brake between indignation and ignorance, advancing distinctions between humans and other living beings that are as clearly incontrovertible as they are beside the point. Evolution and environmental determinism are no longer acceptable, and very dated or very simplified controversies from late-nineteenth-century scientific thought are held out as a pretext. A terror exists of any contact between the natural and the socio-political, a subject that was not unknown to Marxism. Of course, the legacy of the Renaissance plays a negative role here, a disagreeable admission. Classicism rehabilitated the classical spirit but only selectively, favouring emotion and literature at the expense of reason and science. Often it ended up describing celestial harmonies, passing them off as terrestrial ones. In the magnificent elegies 'Sylvae' by Poliziano (1482–86), for example, we glimpse a rural world that is too good to be true, impossible in a real woodland environment, vaguely similar to that of Ermanno Olmi's film 'The Tree of Wooden Clogs' (1978).

I may be mistaken, but all of this appears to me to be a deficit that the humanistic culture has not yet made up. In Italy, the rhetorical-erudite tradition accentuates that insufficiency, which is no less present in countries with rationalist or empiricist cultural traditions.

Obviously this discussion is part of a far broader argument. In recent decades, European culture – and Italian culture especially – has been shaken by winds of subjectivity, personified by the glorious ranks of socio-humanists who pontificate against positivism and who sink, without even realising it, into neo-idealism. Theirs is a mock-heroic battle fought under left-wing flags in defence of arguments already found in the romanticism of the Nibelungs. Not having the means to go beyond positivist scientific conquests, the neo-idealists overtook them, but in reverse. Politically, they cause damage of all kinds and provoke consequences even at the expense of the environment itself. As one example, town planning today is very much based on perceptions of the landscape, ignoring a scientific analysis of it.

Now, however, we must pluck up our courage. This component exists and we must reckon with it, because it influences common sentiment, depresses thinking, stimulates mistrust, and levels accusations against science, for all of which we – who are blameless – are required to pay. We should then object that science is not to blame. The blame, instead, lies with many of today's scientists – simplifiers and, perhaps, even fawners.

But the emotional climate that this generates is favourably disposed to superstition. We recognise traces of this, for example, in the psychological element that peeps out in environmentalism: Whatever pessimistic news militant environmentalists bear regarding the environment, the information is welcomed with the inmost complacency. The discussion is a complicated one that risks taking us off course; obviously, other, more subtle interpretations of this 'catastrophist' unconscious may well exist. One involves the idea that humankind – because of the 'insufficient' development of its neocortex – is 'inadequate compared to its tools' and is nostalgic for Nature simplicity; according to another, such discomfort is due to today's exaggerated demographic dimension, which increases the pressure of technology everywhere, inside and outside of us, transforming it into what is experienced as oppression.

7.10 The Conversion: How Suggestive the Philosophical Roots of Environmentalism Are

The subject of enthusiasm mentioned above gives me the courage to attempt an assault on the last Bastille of environmentalism: a bold undertaking, because this prison of intelligence is protected by a slippery philosophical magma. The only possible route seems to be the one mapped out, I presume involuntarily, by one of the greatest thinkers of the twentieth century, Eric Voegelin. Having escaped from Nazism to the United States before the war, Voegelin was a critic of modernity, from science to enlightenment, and from positivism to national-socialism and Marxism. His "J'accuse" can be summed up in one word: Gnosticism. Gnosticism was one of the great schools of thought of Hellenism and the Late Antiquity. Gnostics and Christians had a love-hate relationship and, in the end, Christians did away with the Gnostics and their books. Gnosticism is based on the concept of 'gnõsis', literally, knowledge. There are various definitions of Gnosticism. One that suits our purpose, and that corresponds more or less to Voegelin's, explains it as the offer of knowledge that promises salvation. It is, however, a knowledge that begins from a rational, almost empirical base, only to develop quickly into a knowledge that stems from intuition and expands propulsively and enthusiastically into a universal and mystical knowledge. Only a few may fully possess such knowledge, but it is offered to all – provided they are willing to believe in the few. By following 'gnõsis' we can save ourselves. From what? From the disorder of the world, which is the essence of evil, injustice and unhappiness. This is also, at least in part, the promise of Christianity. But modern thinking presents Gnosticism – according to Voegelin – as a fulfillment that is no longer transcendental, but immanent. Thus, it employs other means – political, scientific, technical and economic; they will perhaps not result in salvation but, thanks to our faith in their attainment, they bestow happiness, which remains exactly what it is: an illusion (Voegelin 1968).

Now, I certainly do not apply Voegelin's accusation to all modern thinking, but I do think that today environmentalism could be included in that genre of promises of salvation that Voegelin judged to be guilty. In environmentalism we find the same

rigid apocalyptic dualism which, instead of opening up to ontological reality, blocks it out and invents a Gnostic one. Environmentalism, for example, also indulges the oxymoron of 'natural equilibrium', just as Gnostics talked about the 'dark light' and alchemists about the 'black sun'. In the environmentalist's contemplative vision of Nature, disorder arises from the use of technology and the economy; and evil, the malevolent being with horns, may be dressed as a geneticist, an aficionado of the blood-rare steak, an astronaut, or a Sunday-morning hunter.[7]

Environmentalism promises: Don't touch anything, leave everything to Nature and you will be saved. Its ministers are easily recognisable from the sound they

[7] The whining against hunting has long been a classic of environmentalist comedy. But these sentimentalists, incapable of experiencing pity, have never been touched by the doubt that the animal that dies during the hunt suffers far less psychologically than the one that dies at the slaughterhouse. If the similarity is not too crude, during the hunt the animal is like a soldier who dies in battle, but hopes to survive until the end, so he fights and has no time to think. The animal that is led to slaughter, instead, understands from the smell of blood that it is about to die, and it lives out its last hours like a convict condemned to death. Environmentalists also talk of 'animal well-being'… For those who may have forgotten, I should remind them that, until the 1960s, poaching on the part of peasants was a source of undeclared income that was essential to make up for the frequent lack of food for the croppers, farmhands, and farmers themselves. Today the 'élite minds' are up in arms because they see hunting as a pastime, such as it was most definitely for the lord of the manor, who, unlike his peasants, hunted legally. European society today, which has momentarily overcome the food crisis, could nevertheless decide to hunt again sometime in the future. In some countries of northern Europe, poorer immigrants illegally catch the large fish that live in the most polluted rivers and eat city pigeons, as did inhabitants of the inner-city projects of our own urban areas till 50 years ago. Yet today – much more so than previously – hunting plays a vital role for small-scale horticulture and organic farming and ranching. Based on the observations of farmers in central Italy, where the wolf has been reintroduced, it is estimated that wild boar and deer populations have been reduced by approximately 50% over the last 6 or 7 years. This is certainly beneficial to the vegetable and chestnut growers, as we have mentioned previously. And here there might well be a conflict of interests between farmers and hunters. But the question is this: Why should this huge reserve of high quality meat (as an indirect result of rural depopulation and of cultivated land reduction) be unavailable to the people and especially to the lower income groups? On the market, such meat is very expensive because it is scarce, given that it is almost all eaten by another creature, man's enemy since the beginning of time. Furthermore, the choice not to control predators like foxes and the weasel-like marten – in addition to having almost annihilated the hare – is making it impossible for families to keep chickens, since hen houses are pillaged in a manner more horrifying than the enemies of the hunt could ever imagine. This means that those who could do without still go to the supermarket, thus increasing the demand for chickens and rabbits bred in cruel, unnatural, noxious and anti-ecological conditions. Hunting can contribute to the reduction of this self-destructive trend and should thus be promoted and encouraged among young people and not inanely condemned. The public needs to be reassured: The taking of wild animals that are not at risk of extinction does not reduce the animal population, but frees up resources for those that survive and accelerates the generational turnover (a concept that, by analogy, may be assimilated into Parade's model, which I describe later on). In this matter, many other aspects could be examined. At present seven millions dogs and eight millions cats live in Italy. We don't know the business volume and the economic burden for both private and public budget. Certainly it amounts to many millions euros, which might have a more philanthropic goal. But, according a well-known rule, the love for the animals is inversely proportional to the one for the humans.

emit at short, regular intervals: 'Save the Earth!'… 'Save the Earth! … 'Save the Earth!' They know how.

It would thus appear that, on 'au pair' with Gnosticism, environmentalism bleeds shamelessly from rational knowledge into esoteric and mystical knowledge and exalts itself catalytically in this dimension of fideistic hope, regressing fatally into ante- and anti-modern spiritualism and animism.

Indeed, a revealed knowledge (Gnosticism) and a redeeming promise (millenarianism) are precisely the two ingredients present in the majority of religions. In environmentalism, Nature (contemplated above all in its decorative facies) becomes both the means and the end, which merge together to constitute 'Good'.

Unfortunately, however, in empirical reality, Nature appears good only to those who contemplate it under the effects of hallucinogens or in a mystical trance. In such a state of altered consciousness, the least harmful result is the shattering against the principle of non-contradiction: 'A' is not 'non-A'. Even environmentalists know that, in Nature, physical and/or mental superiority entails transforming the weakest into food or into another means of subsistence for the strongest. The respectful observation of predators tearing apart their prey produces moments of unparalleled ecstasy and enchantment: 'That's Nature', is the usual comment made in an inspired tone, intended to express a fusion of scientific knowledge and sublime wisdom. On the contrary, the 'natural' need on the part of the most numerous omnivorous mammal on earth to use the physical and intellectual means that natural evolution itself has provided provokes scandal and condemnation. In other words: When a predator is tearing its prey limb from limb, it is a natural act that arouses no pity for the prey; the breeding and butchering carried out by the human predator to feed seven billion fellow men and women, is, on the other hand, an inadmissible cruelty. For example: pity on the Easter lambs, no pity on the roe cubs, still living devoured.

Thus, the environmentalist is merciful to all natural predators, but 'unnaturally' non-collaborative with his own species. How can this contradiction be explained?

One possible interpretation is the following. Considering that very little of what is scientific survives for long in environmentalism, perhaps its unmentionable assumption is – paradoxically – precisely that separateness, that 'irreducibleness', or even the human being's non-belonging to Nature. From this, of course, originates the super-natural idea of the human being and his presence among 'natural' beings – they may be idealised, idolised, but they are irremediably different from and inferior to him. Thus Nature is reduced to a theatrical performance, decorative but distant, which the environmentalists, parasites in evening dress, watch from the comfort of the stalls, enjoying the plot without any economic worries, pangs of conscience, or desire for knowledge. The height of ridiculousness is reached, however, by the anarchic-capitalistic animalists. They propitiate the fiercest competition among other human beings, pushed as far as slave-driving subservience but, at the same time, rise up infuriated at the slightest opposition to Bambi's foraging in the vineyards that supply one of the emerging sectors of international trade.

In any case, the costs of the constraints imposed by environmental protection are known and quantifiable. In theory, they are certainly not a luxury. In practice, however, to some extent they are. What we pay for is the picturesque. We pay, just to

give one amusing example, to maintain six forest rangers in the Giudicarie Valleys of the Alps where bears from the Adamello Park willingly come down to enjoy a picnic in the apple-orchards. But the rangers that guard the area in shifts are not watching the apple trees. There are houses nearby; children walk to school alone, and the bears could put two and two together and, in 5 min, stockpile food worth 5 h of effort in the orchard. As if the rangers were not enough, in northern Italy a special legal-aid service has been set to oppose citizens who dare to defend themselves and their livelihoods from the 'awesome plantigrades'.

Our neighbouring Alpine countries, instead, do things the opposite way round and it is a criminal offence for anyone to attempt to introduce bears, just as it would be if he introduced an illegal immigrant.

In lyrical crescendo, it would appear that the Italian authorities (according to non verifiable sources) has finally engaged the secret services in the search for those responsible for the killing of bears in the Abruzzo countryside. On the scale of national values, D'Annunzio's shepherds (Picchione and Smith 1993) have perhaps become a threat to the Nation, comparable to Al-Qaeda.

From a financial perspective, however, no less onerous are the frequent rescues of large ungulates in difficulty, wounded or trapped in the snow, to whose aid even helicopters are called out (though they are perhaps not available to transport humans whose lives are in danger). The average tax-payer applauds misty-eyed, having acquired his ecological conscience from Walt Disney cartoons (which nevertheless do not include a chapter on natural selection and evolution). This gap is responsible for the void that hides behind severe admonitions to respect natural laws, equilibriums, and rhythms. If we want to split hairs, the same can be said for feeding urban cats which, at the very least have forgotten how to be cats.

The rule is hackneyed and cruel: The repeated application of the noble sentiment of compassion to individual animals produces, over time, a degenerative effect on the species. From our point of view, the phenomenon is paradoxical: The worst damage to nature is committed mostly by its fiercest champions.

Earlier I mentioned animism. This was not a rhetorical accusation. New trends in Philosophy and Anthropology (Serres 2008; Schama 1995) state the existence of 'rights of the trees', as well as of the animals. Logical premise of such rights is the existence of a soul in each living being (not yet in the inorganic objects). The 'rights of the trees' are a mere passage in the philosophic discourse which explains the 'Contrat naturel' as opposed to the 'Contrat social', human society as opposed to Nature. Traditionally, human sciences have uncertain scientific statutes, which grant large space to the conjectures: but often these ones are and keep on being only suggestive statements without any practical implementation. Unluckily, in this case the daring neo-animistic theories concerning the plant/animal souls are spreading into the pop culture and are reaching through it even the agricultural technicians and the academic world. Consequently, in western countries, students can often meet – during their curriculum – two conflicting approaches: anthropo-centric and eco-centric. According to the former, they shall learn the techniques of measuring, planting and cutting the trees, aimed at timber production, slope protection from erosion, scientific and aesthetic-recreational use: All to the good of man! According to the latter, the

utmost emphasis will be put on the forest as a value independent of any cost-effective function as well as any use in behalf of man. In this case, the future foresters will be acquainted that the forest possess a soul, which the students would have to learn to perceive – if they want to become the good professionals of tomorrow. Normally, jubilation ensues in the lecture hall. But no one becomes aware that they are all sitting at a desk made of wood which, strictly speaking, constituted the corpse of one of the animated beings of the forest (lasciviously populated by nymphs and satyrs rather than by woodcutters), a being that had been barbarically struck down – notwithstanding the tender sentiments that living trees may have aroused in the hearts of the eco-educated people sitting behind or in front of the desks. In the evening, to unwind from the fatigue of their studies, they will go to a pizzeria and order a 'calzone' that must absolutely be cooked in a wood-fired oven. Later, when they have graduated, they will compete for a place in some rangers corps, whose cultural initiatives are notable, even now, for their exquisite environmental sentimentalism, which only a malicious mind could interpret as a 'captatio benevolentiae' of public opinion – frivolous because it is unaware, unaware because it is satiated. And to think that it was actually a forester, Adolphe Parade, who, 172 years ago, used the two verbs that, when combined, provide a descriptive model of sustainable management of natural resources: 'imiter la nature, hâter son oeuvre' (imitate nature, hasten its work) (Parade 1937). Instead today, at the expense of the school of thought based on direct observation of the objective environment, a powerful new one is emerging whose basis is the self-thinking subject: a concept rich in anti-positivistic and neo-idealistic nuances.

One very concrete problem, directly caused by the aberrations mentioned, is that of new forestry legislation, in which the caprices of the new eco-fanatics are translated into laws (with no resistance from the 'powers that be'). This includes strict silvicultural norms: for growing crops: Despite the fact that it is a simple matter to make a small and involuntary mistake in the cutting of plants, this kind of error has become a penal offence (it was once simply an administrative offence), and public officials are now obliged to press charges. The judges, who cannot possibly be experts on the subject and are not capable of evaluating the microscopic triviality of the violation, are expected to hand down severe punishments. These punishments, in turn, discourage farmers from cultivating the woods, which become then derelict, with negative ecological consequences at least in the medium-term. The result achieved, therefore, is the exact opposite of what the zealous defenders of forests and the promoters of Draconian laws intended. According to a more subtle interpretation, however, the (conscious or unconscious) objective of the Neo-Arcadian environmentalists is what is actually being achieved: the expulsion of human beings from the natural environment, even at the price of serious imbalances, in order to create an idyll, a decorative design that can be contemplated at a distance and that excludes vulgar contact with the foul-smelling bodies of those that work the land all day long, day in day out, without holidays. Logically, such a perspective also presupposes (consciously or subconsciously) a condition of personal privilege which makes it possible to avoid responsibility for the resulting economic and human damage.

Moreover this undeserved privilege allows a double illusion. In fact, not only 'Nature' is not 'good', but it is not even 'beautiful' – as Winckelmann explained 250

years ago: The 'beautiful' in Nature is uncertain and the real beautiful is the ideal beautiful, not the natural one; that is to say that the real beautiful is a man-made work, achieved by a subjective selection of single elements chosen between different natural objects and assembled in a new artificial and artistic body (Winckelmann 2001).

Historically, the sentimental environmentalism of the urbanised people started from the publication of Rachel Carson's 1962 book, 'Silent Spring'. It can be recognised as the seed of the environmentalism destined to become a major component of the today's pop culture, at present intellectually fomented by the neo-animistic and neo-arcadian primitivism. The Carson's work, touching from its title onwards, spawned a literary vein and an anthology of expressions, slogans, and metaphors that are evocative and potentially useful to a new dramaturgy, but, alas, are irreparably misleading from a scientific point of view. One of the most common and well-known is the 'green lung', which aspires to be a metaphor for the forest. Unfortunately, the lung is green only in those who are dying; it is red as long as it is absorbing oxygen and releasing carbon dioxide – the opposite, that is, of what a forest largely does.

Yet the supposed scientific objectivity of these new trends in environmental policy is non-existent. For a long time, reforestation was the main objective and the consolidated practice of that policy. But since the collective fantasy has been populated by Disneyesque models, sections of woodlands have been chopped down to make clearings and give those big-eyed fawns some space, transferring them directly from cartoons to the land whose reforestation required so much effort. There's nothing wrong in that, of course. So far it has been a case of subjective choices, which have very little to do with scientific objectivity. Afterwards, however, Bambi does his job: eating and growing, eating and growing. In the end, as happened in the Migliarino-San Rossore (Tuscany) pine forest, grass alone is not enough and he chews the bark off the trees and threatens to destroy the forest and – in a certain perspective – to commit suicide along with it. At this point, according to this famous objectivity, Bambi would be pensioned off. Heaven forbid! Desperate shouts and threats and aldermen from the Green Party launching bellicose claims from the balcony of Palazzo Venezia, in Rome. Here, however, we must stop. This subject is beyond our jurisdiction. Time to call in the psychoanalyst.

7.11 The Confusion: How Environmentalism and Economicism Eventually Merge

Coming down, cautiously, from the pinnacles of philosophy and literature, down, down into the swamps of the 'politique politicienne', I anguish over whether environmentalism is right-wing or left-wing.

In his 'Critique of the Gotha Program', Marx wrote: 'Labour is not the source of all wealth. Nature is just as much the source of use values (and it is surely of such that material wealth consists!) as labour, which itself is only the manifestation of a force of nature, human labour power.' In another passage he reproaches the bourgeois economist Adam Smith for 'completely forgetting about the natural element

of production'; and further on: 'The worker cannot produce anything without nature, without the sensitive outside world' (Marx 1960).

Ergo, it is difficult to relate environmentalism (which worships the virginity and intangibility of Nature) to Marxist philosophy (Le Goff 1980). Rather than scientific socialism, perhaps an indication of the roots of the environmentalist movement could be found in the Utopian socialism of Charles Fourier and its appeal for universal harmony that denies natural and social dialectics (Fourier 1903; Schérer 2001).

But a clearer resemblance, perhaps even a partial continuity, could be located in the Late-Romantic German 'Naturismus', which, accompanying models borrowed from the Far East, sought a holistic, deep, almost mystical, relationship (that was simultaneously also sensory and carnal) between man (in his physical sense as well) and all the other physical bodies of the organic and inorganic world – expressed in the 'Blut-und-Boden' formula. This was the reason for the revaluation of bodily nudity, or nudism. This current, in which pagan reminiscences surfaced alive and kicking, played its role in the Nazi culture. However, this does not appear to be its worst component.

Unfortunately, neither can we grant environmentalism a birthright to the notion of sustainability (perhaps better said in French: 'durabilité'). In the Book of Genesis, in three very different verses (1:28, 2:15, and 3:19), God tells Adam to take over the Earth, but also to take care of it as if he were His lieutenant; and the references are to both the Earth with a capital 'E' ('*aretz* in ancient Hebrew) and the earth with a small 'e', the dirt in the pedological sense ('*adama*, hence Adam, formed from earth[8]). The fact still remains, however, that the two realities cannot coincide, although environmentalists often gloss over this, overestimating human power, whose use they so abhor.

What's more, in ancient Hebrew the word nature does not exist; there is only Creation (*beria*'), which stands for the same physical object, but implies a hierarchical order. This is exactly what is denied by 'Naturismus', in which man is on 'au pair' with all other beings. The Creation that man must look after belongs to Someone else, not him; man is not 'au pair' with Creation, but over-ordinate to it, although he is also subordinate to the Creator. Certainly, in the past 2,000 years we have been more deeply 'imprinted' by the biblical concept, with respect to which 'economicism' (in principle the opposite of environmentalism) represents a degeneration and a sinful misrepresentation. But perhaps the question we should ask ourselves is another: Up to what point is it our fault if we use too much earth, given that, in obeying Him, we have multiplied at breakneck speed? Perhaps even He can make a mistake? Or does He want to lead us into temptation via self-destructive behaviour, to make us suffer and pay for the sin from which, and with which, we were born?

[8]Adam means also reddish. Probably a link exists between the two meanings: earth and reddish. In the Near East the soils are often reddish due to the content of sesquioxide of iron. It depends on the process of mineralisation and oxidation which normally occurs in warm humid climates – formerly present in this area. Even in Latin, *Homo* comes from humus, soil.

In today's topical context, the response of environmentalism to the population growth and related economic needs of the environment exploitation, is contradictory as well as hypocritical. It allows, by a tacit agreement, the partition of the environment in two not-interconnecting domains: an artificially rebuilt primeval-joyful Eden, and an industrialised agriculture where plants and animals manipulation reaches the most unnatural level – with the understanding that it shall remain strictly invisible to the urban environmentalists. The resulting dichotomy is spatial as well as ideal, revealing, in this case, a possible link between manichaeic attitude and hypocritical behaviour.

7.12 The Camouflage: How to Go Back to the Story of the Delta and the Park

Prosaically speaking, at this point in the discussion we find ourselves literally back on the same ground from which we started: the alluvial deposits of the Ombrone River Delta. These deposits, until not many decades ago, were produced in enormous quantities by the erosion of the soil caused by the expansion of agriculture, which was, in turn, the result as well as the cause of demographic growth.

Today things have changed completely. Near the river mouth, the delta (and with it, the Park) is 'devoured' by marine erosion at a rate of almost 10 m/year; and the engineers (glorified from the beginning of this text) have been summoned with the probable ambition of livening up the delta, re-creating the park and also, indirectly, recreating its users (in the sense of increasing the opportunities available for recreational activities on the beach). All of this is to be done via great works which, compared to the erosive capacity of the sea, remind one of those ephemeral buildings, of the mortal works or, in the best case scenario, of generous experiments (that is, not inexpensive).

But there is something that doesn't make sense. What river are we talking about? We are not talking about the Rhine or the Thames, surrounded by tens of millions of residents and with a density of thousands per square kilometre. We are talking, and have been for a while, about the Ombrone; or better still, the 'parked' Ombrone, with a population density of zero point something. Without being ironic, 'parking' comes from 'park'. To 'park' something means to leave it immobile in one location, not move it around from one place to another. Even when motionless, whatever we 'parked' (typically a car) does not escape the becoming: After a while things like oxidation, flaking, cracks, etc., change their appearance. If, on the other hand, we take our car to the body shop, we don't say we parked it; we say it is being repaired or remodelled.

Today, the Ombrone Delta seems to be at risk of being subjected to a surgical operation, one that is not aesthetic, or even ethical, but in any case decidedly invasive. What's more, the Ombrone won't be in the hospital, but – as it were – in a body shop run by too self-confident repairmen. The ideas that had been bandied about (but fortunately for the moment have not been implemented) involve the

artificial fill or 'nourishment' of the coastal area near the mouth. Pumps would take up water and sand, which would then be transported to the mouth of the Delta through large pipes placed on the beach. In other words, it's a question of moving entire beaches, hauling them (fauna and flora included) from the water's edge at the distal stretches of the Delta's wings in order to redeposit them in its proximal stretches – that is, where they were about 50 years ago.

Indeed, an interested apologist attempted to justify these bold undertakings by saying that the removal of sand from the distal stretches of the Delta's wings, where it has progressively accumulated over the last century, constituted 'renaturalisation'. It's the kind of joke that only an established politician should try: renaturalisation as the artificial restoration of an environment modified by littoral dynamics. When are we going to flood central Italy and restore the Pliocene Sea? Or better still, when are we going to demolish the Apennines and cancel the secondary Alpine-Himalayan orogeny? Technically speaking, it is feasible; the expense, if worse comes to worst, can be covered by general taxes.

In order to guard against such 'renatured processes' (sic!) in future and to prevent them from taking off in directions that the Park authorities would not welcome, perhaps could be erected (making use of the original plans) a sort of Maginot Line: a stone barrier, like a dam, positioned on the beach, parallel to the shoreline and 150 m distant from it, plus (possibly) a series of perpendicular groynes, partly submerged, intended to deviate the long-shore drift.

At this point, according to the latest information available, it appears that this bold undertaking may actually start from the end, that is from the wall; as for the rest, we'll see.

It was calculated that, in order to erect the so-called Engineer's Wall, 1.2 km long and about 3 m high, the volume of materials necessary would require 3,000 truckloads (L. Chelazzi, personal communication, 2009). Pressure and mechanical movement of the trucks will further reduce the stability of the sandy and muddy soil, which is already unstable by definition; plant life, which contributes to the stability of the ground, will be pensioned off and animal life will be interred without a send-off. If the purpose of these works is to stop erosion, one can only expect that erosion will stop the work, and not the other way around.

The technical and economic criticisms of these possible initiatives is even more severe when the initiatives are linked to a lack of maintenance of the water management works that are part of normal reclamation management in the Maremma Plain (Colombini and Chelazzi, this volume). Paradoxically, while we are thinking about such invasive and costly interventions, the San Paolo water-scooping machine for the 'Canale Colletore del Tombolo' (main sewer channel), near the mouth of the delta, has been dismantled. As a result, seawater backs up into the 'Canale Collettore' and its tributary 'Canali Colatori' (lesser sewer ditches) which, instead of acting as drainage channels, function as irrigation channels for the grasslands and pine forests, flooding them with seawater when there are storms. The volume of seawater is such that, if the plants do not die because of the salt, they will drown under the water. At this point the concatenation, starting from the geological and colliding with the biological, reverses direction to move from the biological to the geological.

The disappearance of vegetation further reduces the stability of the ground, and the effects of marine erosion are added to those of normal continental erosion. Both, working as allies, can thus operate more effectively in demolition synergy, opening the way to definitive marine ingression. Goodbye Delta! With tearful eyes, we'll look at our photos with you in the background and keep you in our hearts forever.

This is what current operational plans have in store. If the more baleful ideas – such as artificial beach nourishment – should then be rekindled, two kinds of effect can occur: the direct biological damage and the indirect one. The drawing of sand from the coast plain near Collelungo, adjacent to the steep cliff (which long ago bordered the shoreline), can easily harm the groundwater fed by the overtopping limestone relief. Hence a negative impact on the pinewoods would result. In a word, the hydraulic damage would probably change into the biological one. But the rebuilding of the ancient shore close to the mouth would represent – theoretically speaking – something worse. We won't need to be professors of ecology to wonder what the consequences of such an intervention might be, an intervention that is not a question of remodelling but of moving the beach en bloc, upsetting the beach environment in all its systemic complexity and in all its organic and inorganic components. Such a possible petrifaction of the ecosystem would, logically, signify its end, because the 'processes' would first become 'facts' and in the end 'static objects', while the main distinguishing features of the ecosystem are its 'dynamics'.[9]

After all, even climax theory was abandoned in ecology nearly 40 years ago. But perhaps it was merely an oversight. The sandy beach, in the eyes of the authorities, might have been mistaken for a simple inorganic gap, a dump for sundry inert items, a sort of screen between marine and terrestrial ecosystems. Thus it is imperative that we inform authorities that it is not a gap, but an ecotone, that is an intersection or, better still, an interface between two ecosystems, a medium passable and inhabitable by biological organisms, richer in biodiversity than the adjacent ecological communities.

It is true that we tame Nature and we do not contemplate it, but 'est modus in rebus'!

In other words, if such an idea were realised in a place where people come and pay, naively believing to go back to uncontaminated nature, this would be called illusionism, which, in turn, would be an euphemism.

In summary, what if those responsible were to forget that one of the Park's institutional aims was to offer scientific research the opportunity to analyse biological

[9] The relentless change in the landscape pushes us to take account of its new features. For this reason we should mention the change that we have glimpsed in recent months. The marine erosion of proximal stretches continues head-on; but in the last 300 m of the river bed before reaching the sea, it would appear that fluvial erosion is also eating away laterally at the river banks. In other words, we appear to have a paradox: the mouth of an estuary superimposed upon the mouth of the delta. If this were the case, it would nevertheless not be an authentic estuary, which is determined by tides (like those of the Rio de la Plata or the Thames, shaped by the powerful ocean tides). Our beloved Delta is for the moment still dominated by the wave motion, but the slightest sediment discharge, just where the river should be richer in sediment, upsets the balance of fluvial morphogenesis in favour of erosion, almost eliminating sedimentation. See what happens in the next episode.

phenomena and ecological processes in conditions that suffer the least possible disturbance from human activities (producing valuable basic research)? What if they also persisted in the amnesia that includes the park only in the terrestrial ecosystems, but obliterates and excludes the interconnected marine and beach ecosystems? What if, lastly, they constructed the beaches ex novo to create larger bathing areas, attract increasing flows of tourists, and maximise profits? If they were to do all this, we would have to ask ourselves who the real company champion were: them or the Knight of (other people's) industry?

Lesser, but not negligible economic investments have been recently made by the Park also in order to reintroduce animal species (Osprey, *Pandion haliaetus*) which were long time ago disappeared. The disappearance was normally due to the environmental changes intentionally carried out during the land-reclamation of the Ombrone plain, performed in the past centuries (see also Colombini and Chelazzi, this volume). The artificial, difficult as well as expensive reintroduction belongs to the same economicist bias of the hard engineering works.

Anyway, at this point we must once again try to explain in abstract terms what could happen concretely. What occurs, as a matter of fact, is that the mistakes of environmentalism turn into the horrors of economicism, more in the sense of a standard procedure than as a doctrine. But this comes as no surprise. On the contrary, this link appears more and more frequent in the theatre of the world today and it gets us suspect it is a necessary link. In historical terms, development begot the demand for 'Nature' by the urbanised people and the birth of the natural parks. But development, by definition, cannot stop. And even 'Nature' must cooperate to development. In theoretical terms, the foundations of environmentalism and economicism have likewise something in common. Indeed, the total denial of anthropocentrism exalted by environmentalism, and its opposite, economicism's uncritical and boorish anthropocentrism, have the same result: the self-destruction of any society that espouses them. As we have mentioned, a significant dose of visceral emotion, whether prophetic or ravenous, lies at the basis of both. Moreover, we can observe an intellectual self-castration, a sort of automatic blockage of the logical-discursive chain, which stops without reaching any conclusion that is intuitively perceived to be contrary to the preconceptions and/or self-interests of either creed. Emotion aroused by the budget needs helps to follow the seeming syllogism: Business as usual → Nature as usual → Nature as Business.

But the authorities of the Maremma Regional Park didn't even have the excuse of a shortage of scientific expertise (as has happened in other contexts); instead, scientific consulting in the fields of geomorphology, biology and forestry was of a highly qualified and international calibre.

Let's get things straight: the Maremma case is not an isolated one. Elsewhere we also find certain contradictions innocently bandied about – such as officially naming the same area both a Park and a Business. In fact, on the map, the area of the Maremma Regional Park coincides to a great extent with the Maremma Region Commercial Farm. Originally, as we have repeatedly said, a park was a park to the extent that it was an area excluded from business activities. But the radical overturning of this notion, so much so that it becomes a tautological synonym of business, shows the malicious use of the term 'park' as a sort of a fig leaf. Everywhere the creators

of the camouflage know full well that users' perception of the word 'park' is completely different. And the temptation to carry out certain massive, pretextual projects is the warning light that identifies such malice.

The logic of engineering (like that of contemporary architecture) tends to be self-referential, fuelling itself with what appears to be progressively accelerated growth, but which often risks becoming an autocatalytic reaction. This urge to repeat projects, this obsessive-compulsive building, should be controlled rationally, if not totally suppressed throughout the country, just as environmentalists maintain.

There is a story by the Japanese writer Eiji Yoshikawa that seems to have been written for us. Once upon a time there was an aspiring samurai who was moved by the suffering of peasants who lived in a village near a river. He created new geometric fields along the river. But the river overflowed its banks, destroying fields and crops. Then the samurai built embankments parallel to the river bed. It does not say so in the story, but geomorphology teaches us that, if flooding is stopped in a stretch of river characterised by a prevalence of sedimentation over erosion, sedimentation will increase, progressively raising the level of the river bed. The result is that, in the future, worse flooding could occur. The story continues by saying exactly that: Later, an even greater river flood overcame and destroyed the defences built by the samurai. The samurai thought about this and then, instead of rebuilding the mammoth walls at exorbitant cost or abandoning completely all the plain, leaving the peasants' land to nature's whims, he moved the fields to a slightly higher elevation and changed their form according to the landform. He then built small embankments to defend the fields which were sufficient to save them from future floods because, even in the worst cases, very little water would reach the higher ground anyway. Finally he said: I must learn to be servant of the water and preserver of the land.

The parable is obviously more pertinent to land that is not restricted than it is to our 'parked' Ombrone, which deserves to be left in peace as far as possible. Geographically speaking, in Tyrrhenian Italy there are very few coastal plains that have not been compromised as concerns their environment. The plains of our beloved Delta are therefore a rarity that allow for scientific studies that would otherwise not be possible. Is the temptation to lay one's rough hands on them really so irresistible?

This rhetorical question is based on an overview that transcends the local problem, which tends to take on a national value and a general theoretical structure. The environmentalist message is unfounded if it is understood as an ubiquitous rule that must be applied indiscriminately to the management of the entire country. It has a meaning and an important function, however, if it is applied selectively to circumscribed areas where an exception to the rule of normal land management is based primarily upon natural and historical–anthropological scientific documentation. Such rigorous documentation, in turn, authorises us to make a subjective comparison of land values. At that point, we can decide whether or not protection is required, but the choice will be based on knowledge and not on preconceptions.

Once the choice is made, however – as it was just a few decades ago for the Ombrone Delta – and if that choice should ever be seriously contradicted, at that point there would be no elegance in continuing to adorn oneself with symbols

Superimposed on the image of the mosaic is the issue's theme: 'La natura come rivelazione' (Nature as Revelation). In the monotheistic religions of Abraham, the subject-object of the Revelation is the Word of God, and in Christianity it is also His Incarnation. Nature is not revealed, it is given. In the mosaic, the Revelation is the Cross that rises above Nature and reveals itself to it, not the other way round.

Probably in good faith, the intention of the cover's designers was to exploit Christianity as a vehicle of environmentalism, though they didn't realise they were committing a blasphemous heresy. Anyway, if, instead of referring to a monotheistic religious vision, the authors intended to imply a connection to Spinoza's immanentistic pantheism (expressed in his formula 'Deus sive Natura'), the combination of Nature and Revelation is even more illogical and equally inconceivable. By definition, Pantheism totally excludes any form of Revelation. It is true that 'revelation' is written with a small 'r' in the title of the magazine; perhaps this is a mitigating circumstance. But, in its own small way, the cover manages to slap both Faith and Science in the face with a single blow. The title, however, indicates a conceptualisation of Nature that is not even a distant cousin of the scientific one. The relationship between the environmentalist and the ecologist, similarly, is no less remote.

7.14 The Resignation: How Not to Deceive Oneself

"Tous les cerveaux de la Terre sont impuissants face au genre de stupidité qui soit à la mode".

(Jean de La Fontaine).

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that have become ambiguous and vacuous, with trinkets whose only justification is their seductive appeal for the tourist market. Or can parks be in competition with tour operators?

7.13 The Revelation: How Environmentalism Can Exploit Religion Too

It is worth examining the cover of this magazine, which enjoys worldwide distribution (Fig. 7.1). It shows the mosaic in the apse of the Basilica of Sant'Apollinare in Classe, in Ravenna. It depicts the Cross, the Angels, the Saint, the sheep, and the plants.

Fig. 7.1 Cover of the magazine *L'Ecologist Italiano* (*The Ecologist – Italian version*), 2007 (With permission)