

REPORT

**THIRD INTERNATIONAL MEETING
PRESENTATION OF THE ITALIAN SITE
THE GROSSETO PLAIN**

**Villa Granducale Alberese, Grosseto
25-27 May 2006**

by

Isabella Colombini

PARTICIPANTS

Partners:

ISE - Institute of Ecosystems Study of Florence, National Research Council (Organising Committee)

Dr. Lorenzo Chelazzi
Dr. Isabella Colombini
Dr. Mario Fallaci
Mrs. Valmaira Pelli

University of Florence, Italy

Prof. Felicita Scapini
Dr. Mariella Nardi
Dr. Claudia Rossano
Dr. Simone Gambineri
Prof. Camillo Zanchi
Dr. Stefano Cecchi
Dr. Manuela Nelli
Mr. Riccardo Innocenti
Dr. Fatiha Bou-Salah (Algeria)

University of Alicante, Spain

Prof. Carlos Martin Cantarino

IMAR – Institute of Marine Research, University of Coimbra, Portugal

Dr. Joao Neto
Dr. Joana Patricio
Dr. Rute Pinto

IEI - International Environmental Institute Foundation of International Studies University of Malta

Dr. Louis Cassar
Dr. Elisabeth Conrad

Scientific Institute, University Mohammed V, Rabat, Morocco

Prof. Abdellatif Bayed

University El Manar, Tunisia

Prof. Faouzia Charfi-Cherhrouha
Prof. Ameer Oueslati

CEDARE - Centre for Environment and Development for the Arab Region and Europe, Cairo, Egypt

Prof. Mohamed Abdrabo

Invited speakers:

University of Siena

Dr. Giacomo Biserni

Prof. Carlo Citter

Stakeholders:

Azienda Regionale Agricola of Alberese

Dr. Marco Locatelli

Maremma Regional Park

Dr. Giampiero Sammuri

ARPAT - Regional Agency for Environmental Protection of Tuscany

Dr Fabrizio Martelli

Dr. Giancarlo Sbrilli

Dr. Dario Giannerini

Dr. Stefano Nocciolini

ARSIA - Regional Agency for the development and innovation in agriculture and forest of the Tuscan Region

Dr. Stefania Nuvoli

AATO 6 Ombrone Authority for the organisation of integrated water service

Dr. Paolo Quaranta

Water protection service, Tuscan Region

Dr. Roberto Calzolari

Interregional Basin Authority of the Fiora River

Eng. Francesco Pistone

Dr. Simone Rossi

Dr. Massimo Bellatalla

Department of Productive Activities, Labour and Society, Grosseto Province

Dr. Fabio Fabbri

Department of Territory, Environment and Sustainability Grosseto Province

Dr. Giorgio Nucci

Agriculture office, Grosseto Municipality

Dr. Elisabetta Corti

Dr. Daniela Vignali

Aquaculture farm "Il Padule" Castiglione della Pescaia

Mr. Argo Fornaciari

Mrs Nadia Fornaciari

Thursday 25 May

Opening session by Dr. Locatelli Director of the Azienda Regionale Agricola of Alberese that welcomes the WADI partners and stresses his enthusiasm to participate and interact with scientist of the project. He then explains that tomorrow his presentation will concern issues regarding water conflicts of the Regional Farm.

Prof. Felicita Scapini, coordinator of the WADI Project, presents the partners of the different Mediterranean countries to the stakeholders and briefly explains what are the main objectives of the project. In particular she explains that the meeting intends to pin point the main water issues that occur in the Italian site.

"Development of the Ombrone alluvial plain during the Holocene"

Dr. Giacomo Biserni, University of Siena

The presentation starts with the explanation of the study site: the Ombrone alluvial plain with its surrounding hills (Moscona, Istia, Grancia) and mounts (Uccellina). The aims of the research were the reconstruction of subsurface stratigraphy on the basis of borehole data; a detailed facies characterization based upon combined sedimentological, micropaleontological and micropaleobotanical analysis and an investigation of the relationships between facies architecture and glacio-eustatic fluctuation through the establishment of a sequence stratigraphic framework. The methods applied were: Aerial photographs investigation; data set of 96 continuously cored boreholes; a set of AMS dates from terrestrial macrofossils provided the basis for reliable geochronological framework. The geomorphological results showed: a beach-ridge delta plain parallel to the coastline; a narrow channel belt at 6-8 m above sea level and ~ 1 km wide; a Pleistocene terrace and a wide, fairly flat and depressed floodplain (0.5-1 m above sea level). Ten different facies associations, of Pleistocene and Holocene ages were identified from core analysis (sedimentological, peleontological and palinological analysis). Paleobotanical results showed that the local environmental conditions changed from marine to temporary fresh-water conditions shortly after 2800 BP. This was interpreted as a result of thermal contraction of ocean water caused by a cooling of the climate after the Subboreal-Subatlantic transition inducted by a decline of the solar activity. The detailed study of 96 boreholes from Ombrone alluvial plain allow to conclude that: avulsions did not take place in Ombrone alluvial plain during the Holocene; the close relationship between the cyclic stacking pattern of facies and pollen distribution suggest that sedimentary evolution was mostly controlled by the glacial/interglacial fluctuation; with a sea level rise stagnation occur during the Holocene (2850 yr cal BP), and its velocity was not constant.

Prof. Queslati asks for a clarification on the sedimentological process.

Mr. Fornaciari asks the reason why there has been an severe erosion process going on in the fifty years.

Dr. Biserni The main reason is that the Ombrone river has greatly decreased its discharge of sediments due to river bed quarrying and to reforestation of it banks. Also a change of global climate has had an influence: before rainfall was more distributed during autumn and spring seasons whereas now there is a tendency of having heavy rains concentrated in a few days.

"Rural landscapes, human settlements and exploitation of natural resources in the Grosseto plain: the historical-archaeological perspective"

Prof. Carlo Citter, University of Siena

Contemporary landscape is a complex mosaic of historical ones, each erasing parts of the previous and sedimenting new features. Thanks to modern research methodology it is possible to read the sherds and imagine how the whole picture could have looked like. Despite contemporary "rumours", as yet we do know not much about Etruscan landscapes in the Grosseto plain. The Etruscans had a very weak impact on landscape, exploiting natural resources without much investment. Salt, fish, extensive agriculture, cattle-breeding seem the main features. Settlement pattern seems to be characterized by small scattered farms all around the salt lagoon and possibly some villages. Roselle was the real central place both in juridical and economic terms. Traces of a road system, though not in a roman style, have been found both north- and southwards. Around ca. 100 BC, the first roman villas were established and things changed. However there are no indications of a very market oriented economy. No amphora-kilns, no traces of extensive vineyards. The change is perhaps in terms of a better organization of estates and a more complex social, and therefore, settlement hierarchy. Both small and large farms, villas (great farms with mosaics and baths), villages, harbours, streets, water pipes were found. Salt, cattle-breeding, fishing, cereals again seem the main features of the rural economy. Between the second half of the 1st century BC and the 1st century AD the settlement pattern in the Grosseto plain reached its apex. From 1th to 6th century AD the plain was abandoned. Roman landscapes are dissolved and rural communities go back to a Bronze Age economy. In this context the town of Grosseto originates. Both S. Martino villa (the central place of the plain for about 7 centuries) and Via Adige street-inn at the end of 6th century are abandoned and a poor rural community of peasants is established at the beginning of the 7th century. After the roman breakdown it is not until the end of the 8th century that there is a change. Late lombard and carolingian age aristocracies become more interested in estate exploitation. The path from the so called "manor-system" to the "seigneurial system", or from curtis (manor) to castrum (castle) had impact on landscapes. In the 8th century Grosseto is still a small village and about 1100 AD the plain of Grosseto was fairly unsettled, while the neighbouring hilltops were filled with fortified villages (castles) founded to manage a better exploitation of traditional natural resources and especially the silver mines. The Aldobrandeschi family, lombard by origin, was now the major ruler of the plain. Salt revenues were one of the major incomes of high and later middle age Grosseto economy. Later on the powerful Comune of Siena succeeds in conquering Grosseto as well as in eliminating the former Aldobrandeschi rule. A period of strong environmental degradation about the first half of the 14th century are at the base of the major landscape changes. At the same time Ombrone's floods fill up the lagoon, decreasing its salt level. After Siena's breakdown in 1554, Florence became the ruler of the plain. For some decades at the end of 16th century Grosseto and its surroundings were at the core of Medici's family attentions. Literary sources and historical maps show a very dismantled landscape, severed by bad health conditions of the inhabitants.

Conclusions: Despite much research yet no evidence about amphora or pottery kilns or specialized agriculture have been produced. Especially during the Roman period, comparisons between the Grosseto plain and the nearby Albegna valley showed marked differences. From the late 10th century onward evidence of salt production is quite strong. It is probably because of the great importance of salt production in the economy of the plain that its end (end of 14th century) severed the economic recession. Siena turned much of the cultivated land into pastures, which produced less investment in agriculture. However salt production did not cease completely, but it continued far away from the town, close to the sea in a new system of relations between owners and peasant communities.

Eng BouSalah: Why was there a change in the health conditions of the population in the 14th century?

Prof. Citter: Because there was a decrease in the water salinity of the marshlands due to closure of the lagoon's connection with the sea. When water became stagnant this provided the condition for the establishment of the malaria disease.

Prof. Scapini This is one interpretation. Others think that the conditions for malaria already existed at the breakdown of the Roman empire. What do you think about it?

Prof. Citter It's a topic. The breakdown of the Roman empire doesn't mean the breakdown of humanity. This is a Mediterranean point of view. In fact the Anglo-Saxon do not talk about invasions but about "a period of people moving". From their point of view history started when they moved in the former boundaries of the Romans empire. It is generally thought that the barbarian invasion destroyed Roman monuments, basilicas etc. but recent excavations in Rome proved that monuments remained standing until the 9th century. So the end of the Roman empire doesn't mean the end of civilisation.

"Sustainable Management of Water Irrigation"

Prof. Camillo Zanchi University of Florence

General overview: Water for agriculture. At a world scale 70% of water available from rivers, lakes and ground water-tables is utilized for irrigation. The irrigated land is about 16% of the total utilized agricultural land, which produces 40 % of the total crop production. In the Mediterranean 70 % is used for agriculture, 17 % for industry and 13 % for domestic use. In Northern Mediterranean countries the percentages are: 49 % for agriculture, 38 % for industry and 13 % for domestic use whereas in Southern Mediterranean countries the percentages are: 79 % for agriculture, 13 % for industry and 8 % for domestic use. In the Mediterranean the total irrigated land is about 16 millions hectares, with an increase of about 3 millions hectares in the last 15 years. In Italy water use is subdivided as follows: 60 % for agriculture, 25 % for industry and 15 % for domestic use and in Tuscany the irrigated land is about 47.286 hectares, corresponding to 6% of the total utilized agricultural land, instead of 20% of the national average. The irrigation water uptakes are about 250 millions m³/year, corresponding to 30 % of the total water consumption, instead of 60 % of the national average. According to the General Circulation Models, by the year 2050 there will be a rise in temperature between 1,5 and 3,0 °C and a decrease of rainfall of about 25 %. Therefore there is an urgent need of using other water resources more than conventional ones (saline waters, wastewaters). Furthermore there will be severe increase of soil salinity or of the alkalinity regime. Naturally this leads to adverse effects such as: osmotic or total salt effects; specific-ion effects and specific ion effects of sodium.

This is why certain management practises need to be applied. These are: an improvement of irrigation water efficiency; the use of proper agronomical practices, monitoring the dynamics of salt in the soil and the use of non-conventional water for irrigation

According to the irrigation system water efficiency changes. With a surface irrigation there is a water efficiency of 50-60%, with sprinkler irrigation of 75% and with localized irrigation of 90-95%. Different agronomical practices can be applied to improve water uses. These are: leaching, drainage, selection of tolerant crops (needs of less water but more often), use of crops with high W.U.E.(water use efficiency), timing of irrigation (reduce time between two successive irrigations), placement of seed, mulching, land smoothing or grading, fertilization, changing methods of irrigation (drop irrigation), deficit irrigation. Important is also the Leaching Requirement (LR): the calculated fraction of water that must be passed through the plant root zone to maintain the soil salinity at or below a specified value. An experiment showed that using straw mulch wilting point was reach after 60-90 days according to the amount of mulch/m² whereas with bare soil this was reached after 30 days.

Prof. Scapini proposes to have questions and discussion at the end of the morning session because we are a bit behind schedule.

"Classification of surface freshwater of the Grosseto plain"

Dr. Fabrizio Martelli, ARPAT Grosseto

With the law D.Lgs 152/99 an engagement has been taken to review the existing monitoring network so as to obtain a complete picture of what is known on water quality through severe planned actions. According to this law and to the indications in the Water Framework Directive (2000/60/EC) the Tuscan Region has achieved the "Plan for water conservation in Tuscany" approved in January 2005.

Until today the criterion to define the Environmental state of a water course (SECA) has not been defined so the definition of environmental quality is based on the Ecological State of a water course (SECA), for which two other indices are needed. These are: the level of pollution by macro-descriptors (LIM) based on BODs (O₂ mg/L), COD (O₂ mg/L), NH₄(N mg/L), NO₃ (N mg/L), Total Phosphorus (P mg/L), *Escherichia coli* (UFC/100mL) and the extended biotic index (IBE). There are tables with indicating values and colours to classify water quality. According to SECA, LIM and IBE blue colour indicates excellent quality, green good, yellow sufficient, orange poor and red very poor water quality.

In 2001-2002 several water basin were monitored with these parameters. The Albegna River was evaluated excellent for its water quality according to IBE values and in 2002 good according to SECA and LIM values. The Bruna River was monitored in two localities one in its higher section and the other in its lower section. The first locality was classified green with a good water quality whereas its lower section in yellow indicating a lower water quality due to the presence of intensive agriculture and high irrigation. Both Cornia and Fiora rivers were classified green with a good water quality according to SECA, LIM and IBE values. Instead the Ombrone river flowing through the province of Siena and of Grosseto was under stress. Its water quality was classified yellow according to LIM and SECA values (with a high quantity of *E. coli* in the waste water coming from villages, towns and cities) and green according to IBE values. This river was monitored in several points including its three affluents (Gretano, Melacce and Trasubbie) that had good water quality. Also heavy metals and additional parameters were monitored and on a total of 400 samples monitored in 113 localities 33 sites presented critical values. Also Orbetello and Burano Lagoons have been continuously monitored in several points with high costs. In Diaccia Botrona only one monitoring point was chosen

Dr. Naida Fornaciari asks if it is foreseen to have an intensive monitoring programme by ARPAT in the Natural Reserve of the Diaccia Botrona.

Dr. Fabrizio Martelli it all depends on the amount of money at disposal and on the political interest in the area. At Orbetello there was an ecological crisis with the death of tons of fish for the anoxic conditions that occurred in the water. This produced an enormous impact on the local population and on the local tourism. Here there are several enterprises that live on the production of fish whereas in Diaccia there is only one aquaculture farm. The same can be said for the Burano Lagoon where there was a five year ecological crisis before a decision was taken.

Mr Fornaciari owner of the fish farm at the Diaccia answers in a very polemic way.

"Initiatives of ARSIA to rationalise water in agriculture"

Dr. Stefania Nuvoli, ARSIA, Tuscan Region

Introduction explaining what are the aims of ARSIA. One of the main objectives is the promotion of innovation in order to conserve the environment, save water and produce a high quality of agricultural products. In Tuscany plans to ameliorate irrigation have been proposed. First of all in Tuscany out of 857,698 of available agricultural surface only 6% is irrigated especially along coastal areas. In Tuscany a total of 757 million euros are obtained from cultures that need water. These are industrial crops (44 million €), vegetables (159 million €), corn (30 million €), fodder

plants (38 million €), flowers and ornamental plants (75 million €), orchards (29 million €), nurseries (382 million €). In the last few years there has been a trend to decrease cultures such as corn, vegetables, fodder, orchards that need more water and to increase olive trees and vineyards that need less quantities of water to grow.

In Tuscany 56% of water irrigation is taken by farms from underground water, 23% from surface water and 9% from small basins and lakes. Only 9% of this water is regulated by Consortiums the rest is taken autonomously by farmers. The difficulty of water supplies are mainly caused by the lowering of the water table, a decrease of water flow of rivers, the limited capacity of water basins and this leads to water conflicts.

The irrigation situation in Tuscany is critical even if the irrigated surface is limited. In Tuscany water supply is mainly obtained from ground water, there are a great number of conflicts and big difficulties in maintaining today's levels of production.

The main managing strategies should consider the problem both from a quantitatively and qualitatively. From a quantitative point of view water demand should be characterised, interventions should be rationalised, waterworks should be ameliorated, alternative water resources should be used and surface water should be considered a very valuable resource. From a qualitative point of view there should be a rationalisation of fertilizers.

Several experimental projects have been carried out by ARSIA:

"Istituzione di tre Centri dimostrativi per l'irrigazione nelle principali aree irrigue della regione"(1996-1998).

"Collaudo e trasferimento di innovazioni tecniche e tecnologie nel settore dell'irrigazione"(1999-2002).

"Attività sperimentale in pieno campo per la verifica dell'utilizzo dei reflui su colture ortive"(1998-2002).

"Indagini sulla potenzialità di utilizzo irriguo delle acque reflue depurate sul territorio toscano" (2002-2003)

"Razionalizzazione degli impieghi irrigui per la gestione sostenibile delle risorse idriche regionali" (2004-2007)

"Promozione e sviluppo di innovazioni tecnologiche e di modelli gestionali nel settore dell'irrigazione per la tutela delle risorse idriche"(2004 – 2005)

"Studio dell'impatto dell'attività agricola sull'inquinamento da nitrati in alcune aree della Toscana ai fini dell'applicazione della direttiva nitrati"(2006-2008)

Conclusion: saving water implicates a strict agreement between end users and local administrations. Extremely important is also technical assistance, innovation and planning.

Prof. Abdrabo You have shown that cultivated areas for certain type of crops decrease. Who decides: the local farmers or the local administrations?

Dr. Nuvoli No, it's the market and the policies of the European community.

Prof. Zanchi Also some cultures, such as strawberries, are not produced anymore because of the process of salinisation of the water table. Strawberries need a good water quality. Now there is a tendency of producing tomato in this area because it is more tolerant to salt.

Eng Bousalah Does the local population benefit from the new techniques and experiments that were carried out? Is there a link between science (Universities), innovation, local communities and industries?

Dr. Nuvoli Market and environmental conditions are changing so fast that it is almost impossible to keep up with its pace. These changes go too quick compared to the research. Also if we want innovation its cost is extremely high

Eng Bousalah Are farmers grouped in some sort of consortiums?

Dr. Nuvoli Yes but these are never enough to solve local problems.

"Drinking water: a resource at risk in the Grosseto plain"

Eng. Paolo Quaranta AATO 6 Tuscany

The Grosseto plain is part of three municipalities: Grosseto, Castiglione della Pescaia and Orbetello. It's an alluvial plain originated by the Ombrone, Albegna and Bruna Rivers and it is delimited by the coast, by the river mouths of the Bruna and Albegna rivers and by the hills towards land. The water table of the alluvial plain is imbedded in gravel and sand frequently separated by waterproof layers of clay. Its width is quite variable from a few meters to several tens, its depth rarely exceeds 100 m. The water table is used in several ways: with wells drilled with different techniques. Very often in the same well water is pumped from water tables at different depths. It is rare to find wells (except for those used for drinking water) that are cemented so as to isolate different water tables at different depths. Rarely the wells are controlled in their water flow and often extreme pumping produces lowering of the table and extraction of solid material together with the water. There are several sectors interested in the use of the water table: managing water services for drinking water, agriculture for irrigation, industry for productive aims, domestic wells (for cattle, gardens etc. that are very abundant as no authorisation for drilling is required. At the moment in the Grosseto plain the number of existing wells is unknown. Wells don't have water-meters so it is impossible to exactly know how much water is extracted. However, sure information is available only for wells extracting drinking water. We believe that the number of wells used for other purposes is ten times the size of those used for drinking. Each year 8 million m³ of drinking water is extracted. Extracted quantities for agricultural, industrial and domestic uses are unknown. There are no parameters indicating the correct extractable quantities. However considering the problems that have affected the water table in the last decade it is evident that there is a disequilibrium between water extraction and natural reload of the water table.

From a qualitative point of view the main problems regarding drinking water are:

- Wells around Grosseto: natural presence of iron and manganese. Presence of sulphates probably due to the interconnection with the thermal water table at Roselle.
- Wells of Barbaruta, Pian dei Sodi: natural presence of iron and manganese due to the water quality of the Bruna River that flows through the metalliferous hills. Chlorides values are increasing because of the increase in water irrigation of the area. Also sulphates are in increase because of thermal waters in the area.
- Wells of Castiglione della Pescaia: loc. Valle, Pian di Rocca and Pian d'Alma. Problems of salinisation of the water table due to excessive extraction: severe consequences on drinking and water irrigation. Furthermore these water tables are sand saturated and when water is extracted it can produce problems such as the lowering of the ground level.

Initiatives that should be adopted to render the water plants according to the laws: new water treatment systems are needed; a higher quality of water from Monte Amiata should be added to the water table; ground water extraction should be decreased. There should be a decrease of about 3 million m³ and the wells of Castiglione della Pescaia, closer to the sea, should be dismantled. A desalting plant should be made to substitute this resource.

Some solutions to favour a sustainable use of the water table: compilation of the hydrogeological budget, installation of flow gauges on each well, reconsider permits and water pricing policy (payment of water fees according to the different kind of usage), use of irrigation methods with low water consumption, favour water reuse, use of rainfall from small water basins.

Main constraints: the unknown number of wells make it very difficult to control and impose the installation of flow gauges and consequent payment of fees. The reuse of treated water has high costs that is unsustainable for agriculture. Use of rainfall from small water basins also is very costly and isn't applicable to coastal areas where evaporation is high and rainfall is low.

An intervention by governmental agencies is needed to cover costs of water management and to modernise networks. Only in this way it will be possible to recover existing water tables and to permit social and economic development.

Prof Bayed You have talked about the interconnection of the water tables, how independent are these from one another other?

Eng Quaranta We have seen that the Grosseto plain is of alluvial origins with clay, gravel and sand levels so in certain points a water table can be divided by waterproof levels by the under laying thermal water and perhaps at a distance of 1km there can be a connection between the two tables because of geological changes of the ground or because of excessive pumping that consequently changes the pressure. So water quality of the same water table can change according to the area.

Prof. Abdrabo You have show several solutions for the sustainable use of the water table: have you done an economic assessment?

Eng Quaranta For reuse of purified waste water costs are 0.50 € per m³; (including distribution). To build a small water basin (500.000 m³) costs are 3 million euros plus costs for its distribution and management. Often water must be pumped from great distances and this of course increases costs.

Prof. Abdrabo If the farmer knew that their excessive pumping produces problems of the salinisation of the wells their economic loss could be calculated and may be they would be more willing to pay a water fee.

Eng Quaranta Yes they might be more willing to pay but the farmers can't afford all costs. A farmer can pay 500.00 € /year but not 20000 € /year. A public intervention is needed.

Mrs Fornaciari Have you thought of reusing the drainage network?

Eng Quaranta There are several possibilities: it has been proposed the reuse of the old water network built by the Consorsio di Bonifica. The 10 million m³ of purified water produced by the water treatment plant of Grosseto has costs definitively higher than that of the same quantity extracted directly from the Ombrone River (that's why this system is preferred).

Eng Bousalah Why don't farmers organise themselves in some sort of consortiums?

Eng Quaranta It's not so easy because for example if a farmer has water in his well and pays 300 euros/year, he will not be willing to join a consortium in which costs are 10000 - 20000 euros to have the same amount of water. That why there should be a public intervention and costs should be base on the amount of water actually consumed.

"Water availability as limiting factor for the economic development of the Grosseto plain"

Dr. Fabio Fabbri, Grosseto Province

Let's start with some official data: during the summer in this area there are 5 million official presences plus 10 million daily presences. Tourism represents 25% of the product for this province. Agriculture represents about 250 million euros of plv (gross saleable product) and about 6 % of the pil (gross provincial product). Industry represents 15% of pil. All these three activities need water! Looking at data for rainfall in Tuscany on a surface of 22992 km² there is a mean of 1000 mm/year which means 25 billions m³, for evaporation 11.5 billions m³, underground flows 0.5 billions m³, surface flow 12.7 billions m³, potential surface resources 6 billions m³, total basin capacity 4.46 billions m³. In Grosseto on a surface of 3460 km² rainfall has a mean of 800 mm/year which means 2.8 billions m³, for evaporation 1.288 billions m³, underground flows 0.056 billions m³, surface flow 1.428 billions m³, potential surface resources 0.7 billions m³, total basin capacity 5.6 billions m³. In this province 5 million m³ are lost because of the inadequate water network. In the Grosseto province there are 80 water basins (surface < 3ha) with a capacity of 4.8 million m³ (considering a mean depth of 2 ml). Total water needs for agriculture are 7.7 million m³, for tourism 4 million m³ of water are consumed for 1 million persons with mean permanence of 5 days (official presence), 6.5 -8 million m³ of water is consumed for 2 million persons with mean permanence of 4/5 days (non official presence). Total water needs for industry and agri-industrial sector are 5 million m³. Water needs for local population are 6.3 million m³.

Final considerations: water deficit is compensated mainly from wells located along the coast and today this is not sustainable any more. Adequate policies for future scenarios still are missing but certain choices are urgent. We can not permit irrational water uses both directly and indirectly. In direct terms: the most important part of water irrigation for agriculture is still carried out with surface irrigation instead of using methods with lower consumptions (localised or drop irrigation). Furthermore, we should try to reduce water losses of the network (40% is lost). In indirect terms: a) reuse of waste water (purified water, etc) b) a different conception of the resource should be adopted: drinking water should be divided from that used for toilets. Furthermore, in cities and towns certain laws regarding reuse of rainfall (building of rain-water tanks) or reuse of white waters to irrigate public gardens should be adopted. If structural interventions are not made there is a real risk for the future development of the Grosseto province.

"Project to monitor groundwater in alluvial coastal deposits of the Ombrone Basin district"

Dr. Simone Rossi Basin Authority

The Ombrone Basin district has an area of 5.600 km² of which 3400 km² are in the Grosseto county (61%) and 2200 km² in Siena county (39 %). The study, planned by the Technical Department of Ombrone Basin District, involves portions of the territories of 11 municipalities (Capalbio, Castiglione della Pescaia, Gavorrano, Grosseto, Magliano in Toscana, Manciano, Monte Argentario, Orbetello, Roccastrada, Campagnatico e Scansano) for a total area of about 730 km². The study has required a series of activities that can be summarized: information gathering, georeferencing of bibliographical data relative to previous official studies (only studies commissioned by public agencies); analysis and computerization of stratigraphic data available in the archives of the Provincial Administration of Grosseto; creation of a GIS project for data management. Survey data were based on the following studies: preliminary studies for the Piano di Bacino (Prof. Pranzini 1991); DCR 338/94: general programme to accomplish and regulate financial facilitations in agriculture; Territorial Plan for Coordination (PTC) of Grosseto; Hydrogeological study of the salinity of the groundwater of the coastal area between Castiglione della Pescaia e Orbetello (Prof. Pranzini – 1995); Other studies. Dr Rossi explains from a geological and hydrogeological point of view how salt water intrusion functions (Ghyben-Herzberg rule) and how salinisation is measured (water levels and electrical conductivity). Measurements and maps are referred to June 2003, July 2004, April and September 2005 and show variation in conductivity, classes of conductivity, temperature and depth of water table, normalized conductivity, and calculated residual flux. Then several table used for the classification of the water are shown: type of water: fresh, brackish, marine, conductivity ($\mu\text{s}/\text{cm}$), total solids (mg/l), chlorides(mg/l), sulphates (mg/l), organoleptic and physical-chemical parameters. All these parameters are needed to quantify environmental quality. However there are limitations in the study based on the structure of the aquifers, the depth of wells, and scale.

Main conclusions: The coastal water table of Ombrone Basin Regional District is affected by the phenomenon of water table salinisation documented in several studies. The monitoring performed to date by the Technical Department of Ombrone Basin has yielded a preliminary picture of the "degree" of salinisation in the water table. The subsequent phases of the study (monitoring, geometrical reconstruction of the water table and the cross-referencing with specific studies) will allow to define a model and to analysis the evolution of this phenomenon.

Prof Bayed Are there other methods, a part from conductivity, to measure salinity and to study the water table?

Dr. Rossi Another method is the study of the ground water levels and the analysis of other ions such as chloride, sodium, etc. and isotopic analysis in order to understand if the phenomenon of salinisation is produced by thermal water. All other methods are base on chemical analysis.

Eng Bousalah and *Prof Abdrabo* both stress the needs to have further information on the social-economical aspects and on the managing strategies.

Prof. Scapini proposes a forum on the subject so as to ask these question directly to the stakeholders.

Prof. Charfi Asks information on tourism.

Prof. Scapini Dr. Fabbri showed this in his presentation. We will pass this information with a disk with all the presentatiions at the end of the conference

Prof Charfi: Are there important industries in the region and what are the regulations?

Dr. Rossi In this area the industry is not very developed (water use is mainly used for domestic and agricultural usage) and the rules are those of the european community.

Prof. Charfi Is the water coming from industries purified and those coming from the city are they checked from a bacteriological point of view?

Dr. Rossi ARSIA is in charge of this and but yes, I think most reused water is checked both for contaminants and bacteria

Dr. Patricio Are there studies on the ecological quality of ground waters?

Dr. Rossi These are the studies of ARPAT for the environmental quality (DL 152/99).

Prof. Oueslati Here we have talked about risks for the absence a good quality water, but what about the risks in floods.

Dr. Rossi As Basin authority we have done, both for the Ombrone and Fiora Rivers, the plans for the hydrogeological structure in which we have pointed out, through maps, areas at hydrgeological risks (floods but also landslides). These maps are available on the web.

Prof. Charfi: Can we make a summary of what we have heard in these presentation?

Prof. Scapini Now this is not possible, but we will share the information giving the presentations to each partner and we will have a summary of the presentations and the notes of the discussion. We will also have a forum where we will discuss the topics that were not here considered.

Friday 26 May

"Role of ecological indicators in environmental coastal assessment"

Dr. Joana Patricio, IMAR, Coimbra

General overview of the global and European water situation. Information on the WFD – Water Framework Directive (2000/60/EC) which has as main objectives to prevent further deterioration of water resources; to promote sustainable water use based on long-term protection of water resources; to enhance protection and improvement of the aquatic environment using specific measures; to ensure the progressive reduction and prevent further pollution of groundwater; to contribute to mitigate the effects of floods and droughts. Integration is a key concept underlying the Water Framework Directive. Innovative aspects are: an ecological status assessment based in all system components. Water-pricing policies where all users - agricultural, industrial and households - contribute in an adequate way. Water management with the natural river basin district as a unit. Implementation of the WFD: description of the biological quality elements that exist in pristine or low anthropogenic disturbance conditions (equivalent to high status)

Ecological status assessment for rivers and estuaries/coast is based on physico-chemical, biological and hydromorphological aspects The Ecological status must be assessed relatively to the reference conditions. From the comparison between the observed values and the reference values an “Ecological Quality Ratio” is derived. The final classification of the water body is thus based on the ecological and chemical status (priority substances concentrations not in excess of the standards set) Applying the concept of ecological status requires methods capable of distinguishing different levels of ecological quality to classify all water types. An output of the Medcore project was to produce a user friendly guide for practitioners based on ecological indicators. When indicators are used effectively, they are expected to reveal conditions and trends that help in development planning and decision making and become useful in environmental management. Monitoring levels can be from a general level to a more specific one (Ecosystem -community - population - individual - cell - molecular) with an increasing relevance from molecular to ecosystem levels. To be good indicators they should have a biological, methodological and social relevance. In the process of selecting an ecological indicator several variables must be accounted for: type of disturbance/pollution, of community, data requirements and data availability. Example of Mar Menor Lagoon. Environmental quality assessment is a complex task, therefore indicators must be utilised following the right criteria; the use of a single ecological indicator is not recommendable; the complementary use of different indicators or methods, is highly recommendable in determining the environmental quality status of an ecosystem. Ecosystem Goods are material products obtained from systems for human use, while Ecosystem Services are conditions and processes through which natural ecosystems sustain and fulfil human life. They are useful to assess ecosystems conditions and trends; to allow the evaluation of each study-site and the decision-making about possible strategies to harmonise socio-economic and environmental issues; to allow the definition of sustainability scenarios for ecosystems; to serve as a base for future work, indicating which ecosystem goods and services should be more carefully treated and investigated. Example of possible applications for Lake Maryut and El Hondo.

"Protected area management in the coastal zone: a landscape approach"

Dr. Louis F. Cassar, Dr. Elisabeth Conrad, IEI, University of Malta

Introduction: More than half world’s population lives within 60 km of the coast. This zone provides multitude of resources and benefits for human populations and has rich and diverse ecosystems. However, this environment is environmentally vulnerable, subject to increasing pressures, e.g.

population growth, tourism, urbanisation, resource exploitation, industrial development, pollution etc. and is undergoing intense land-use conflicts. There are few successful cross-sectoral management initiatives. All these factors may eventually outpace the system's ability to recuperate and there could be repercussions on the future economic growth and on human development. The Mediterranean is unique for its geomorphological history and setting. It is one of 25 "biodiversity hotspots" worldwide and has a long history of exploitation of the coast. It has different social and political regimes in different countries however, the basin is unified by natural aspects. The Mediterranean is a region under threat because of its numerous pressures (population growth, tourism, agriculture, fishing and aquaculture activities, industry, energy, maritime traffic, sewage, river discharges etc.) which produce numerous impacts (overexploitation of water resources, biodiversity and ecosystem changes, eutrophication, oil pollution, microbiological contamination, heavy metal pollution, coastal erosion, landscape degradation, health risks). The question is: has the response been sufficient? Protected areas are areas of land or sea especially dedicated to the protection and maintenance of biological diversity; of natural and associated cultural resources and managed through legal or other effective means. They represent one form of management response. They cover approximately 7.5% of the original vegetation surface but situations vary greatly from country to country, with varying levels of knowledge, resources and commitment. When planning a protected area we must: select the areas (centres of biodiversity, wilderness areas, landscapes), use certain techniques (gap analysis, identification of hotspots) and evaluate the value of system-wide planning. When designing protected areas we must: design principles; social and political constraints. Important is also the understanding of pressures (What are they? How can they be dealt with by effective management?) Furthermore we must define management objectives and prepare the management plan. This is a formal document for specified period that provides explicit mandate; it serves as blueprint for routine operational tasks; it needs to be based on sound scientific data, zonation, it must specify short-term targets and long-term goals; it is imperative that goals are attainable. Plan formulation should be through a participatory and interdisciplinary process. In the day-to-day management it is important to have an adequate and trained staff, an adequate and timely funding, an good quality equipment and infrastructure. Furthermore the process should be facilitated through the support and active involvement of locals. Achievement of objectives ultimately depends on an effective management. In Mediterranean protected areas there are specific issues: first protected areas are small and many are only terrestrial. There is a lack of staff and training, a permanent shortage of equipment and funding, a need for better enforcement, institutional coordination is very weak, need for more public awareness, significant problems with the social environment, particularly with resource users and a lack of broad system approach.

At the Maremma Regional Park a management audit was carried out through a Systemic Sustainability Analysis (SSA) exercise. Themes that were approached were: biodiversity, recreation, agriculture, landscape, research and environmental education and management. For biodiversity issues identified were: displacement of floral species on dunes and maquis; introduction of alien species; dependence of certain fauna on humans (domestication: foxes); disturbance of fauna by park users; accelerated erosion (impinges on dune vegetation); re-introduction of indigenous species. Tasks required were: introduce a programme to control invasive species; gradual thinning of pines; ensure adequate controls concerning movement of visitors across park (trampling on dunes); more information to create awareness and more surveillance is needed; take measures to halt erosion even beyond park precincts; encourage re-introduction of native species (to be coupled by research). For recreation issues identified were: reduction of beach area by erosion; seasonal pressure by beach users; increasing volume of motor vehicles; revenue accrued from visitors; level of information for interpretation within park. Tasks required were: an holistic study to replenish sediment loads; a study to understand visitor carrying capacity and possibility of limited access to certain areas; car park location needs to be addressed; it is necessary to explore possibilities of other sources of income for park; better sign-posting and more information is needed. For agriculture issues identified were: use of pesticides and fertilizers on cultivated areas within park; competition between agriculture and natural areas leading to land fragmentation;

economic contributions of agriculture and agro-tourism. Tasks required were: raise awareness on potential dangers; no new land take-up should be encouraged for agriculture; diversification of agricultural land: encourage organic farming & agro-tourism. For landscape issues identified were: man-made/natural landscape elements; dynamic landscape: changes with seasons; transformation of landscape by agriculture, other infrastructure, erosion and pine plantation. Tasks required were identification of conservation zones; identify activities that are compatible with different seasons; setting up of biodiversity corridors within the park. For research and environmental education issues identified were: staff training; co-ordination of research initiatives and keeping of records; presence of interesting biotopes; monitoring. Tasks required were: training of staff by experienced personnel in different areas of research and conservation; set up database of research and findings; encourage research and streamline efforts by various entities; maximize on the potential the park offers as a result of different biotopes; encourage the setting up of a monitoring programme. For management issues identified were: stakeholders/key actors; information and interpretation; finance; relationship between part staff and management committee; staffing; base-line studies and monitoring; management model. Tasks required were: stakeholders/key actors; information and interpretation; finance; relationship between part staff and management committee; staffing; base-line studies and monitoring; management model.

"Management of the Maremma Regional Park"

Dr. Giampiero Sammuri, President of the Maremma Regional Park

The main question is: Conservation or development: are they possible together or does conservation exclude for definition development? Since nineteen-sixties up to a few years ago, in Italy, the public opinion was subdivided in two points of view: complete conservation (protected areas as nature sanctuaries and humans tolerated only for scientific reasons) or complete opposition (protected area seen as limiting factor to development). Today positions have changed and protected areas are viewed as areas where a) conservation is compatible with sustainable development and b) this has an effect on the promotion of the territory.

Conservation compatible with sustainable development: site selection based on scientific criteria starting from habitats undergoing environmental emergencies; species or habitats belonging to community directives, red lists, international conventions or Italian directives; conservation through special regulations as starting point for sustainable development; agriculture based on biological and typical products; agro-tourism; eco-tourism and high quality tourism; associated handicrafts, environmental education; scientific research.

Effects on the territory: use of the word "park" to promote economical activities; absence of special rules and constraints; environmental values are an optional; possibility of creating the so called "protected area" anywhere.

Generally parks attract a lot of tourists but they also produce many constraints. A possible solution could be: selection of a certain area, called "park" but no rules are applied and tourist come to visit it anyway. Nevertheless a study conducted by IRPET (2002) demonstrated that the visitor awareness changes accordingly. In the Maremma Regional Park 99% of the interviewed people were aware to be in a park, in the Casentino Park awareness was 87,6 % whereas in a "false" park this decreased to 48%.

Maremma Regional Park, created in 1976, is the second Italian Regional Park. In 1992 it received the European Diploma and other awards from WWF, LIPU and Lega Ambiente. It has carried out several conservation projects: Project for the conservation of the Roller (from 1996 to 2003 in the park breeding couples have increased from 9 to 18), Project for the conservation of the marine turtle, Project for the conservation of the osprey; Project for the conservation of the greylag goose (from 1997 to 2002 near the Ombrone River mouth over-wintering individuals have increased from 320 to 715). From 1997 to 2002 visitors have increased from 59504 to 80327. April (23.77%) -

May (20.81%) and August (13.3%) are the months with the highest numbers of visitors. In 10 years paying visitors have increased from 49.000 to 80.000 with a total increase of 61% and a yearly increase of 4.8%. The Grosseto plain has a peak of visitors during summer months (June -August) consequently the park is an important element for tourist sustainability both from a socio-economic and an environmental point of view. In a study it was shown that park tourists are in average from 36 to 50 years old, have a higher education and economic level. Park tourists are interested in local culture and 93% declare to have eaten in a typical local restaurant while only 54% beach tourist use local restaurants. Furthermore 94% park tourists buy biological or local products against 37% beach tourist and the average amount of money spent by park tourist was higher. Park tourist are more willing to pay for a higher quality in park services compared to beach tourists.

There are certain rules and regulations that hotels, agro-tourisms, camping and hostels near the Maremma Regional Park must follow before they can be included in the list of recommended structures. First, certain standards are requested: food quality, waste recycling, natural resource use, air quality, contribution to the reduction of traffic, information on Park facilities and selling of local products. Furthermore, the structures must satisfy certain environmental requisites: reduction in use of plastic plates and forks, use of recycled paper, use of low energy consuming lamps, subdivision of wastes, rooms for smokers and non-smokers, preparation of local dishes, provide information on transportation and park initiatives, provide a questionnaire asking information on quality of offered services. If the structure reaches these standards it is automatically inserted in the Parks web page. Advertisement of the structure is assured and promotion is made through specialised journals. Each structure receives products and brochures on local attractions. The Park organises professional courses for tour operators.

Conclusion: Analysing a 4 year time-lag (1999-2002) to an increase of the number of visitors (from 55846 to 80327) there has been an increase in the number of days present in the park of the osprey (from 23 to 303) and an increase number of greylag geese (from 385 to 686 inds.). This demonstrates that there can be sustainable development associated to a correct conservation.

"The Azienda Regionale Agricola of Alberese: water conflicts"

Dr. Marco Locatelli, Director of the Azienda Regionale Agricola di Alberese

Introduction: In the past, water sources of the Uccellina Mounts were wisely managed by man: water, particularly rich in iron, was decanted through a series of small basins, it was stocked in a larger basin and then was transported to the Villa Granduca by a system of channels. This water was also used to fill up the troughs scattered along the way down towards the valley. Furthermore, near the "serrata dei cavalleggeri" there was a water spring, very close to the sea, that was utilised to fill up the cattle troughs with a manual water pump. Another system to extract surface water was a pump powered by a windmill. This method was generally used for cattle troughs.

From summer 2003, when a terrible drought occurred, all new vineyards have been provided with modern techniques of water irrigation and small lakes of hilly areas are utilised to guarantee additional water in case of emergency. In some areas of the Azienda methods to consume minor quantities of water have been developed. However, there are still some marshlands within the Azienda (some have also been reconstructed in a Life-Project). Due to salt water intrusion, an ever growing number of agricultural soils are becoming inadequate for farming (lower production) and unfortunately this phenomenon is in expansion. In many cases the Ombrone river is used for water irrigation but, already at the end of July, at several km from the mouth of the river, some areas reach high values of salinity that render soils totally inadequate for cultivation (not even tomatoes that are highly salt resistant can be cultivated). Also wells have been undergoing salt water intrusion and are now of no use. Recently, near the river mouth, there has been a landward marine water intrusion due to the rupture of a breakwater. This has caused the death of the pinewoods and great economical and environmental damages. Furthermore, this intrusion has destroyed an enormous

amount of grasslands consequently damaging cattle breeding. In November 2005 hail and a flood have destroyed structures and hay stockages. In the Azienda during the summer there is a strong competition for the water resource between wildlife and cattle. Wildlife is attracted to cattle troughs and regularly drinks in them. Water is also necessary in case of fires and the Azienda has a helicopter in the areas during summer season.

The Azienda has several proposals that could mitigate all these problems:

To construct a lake in an area where there was once a quarry using the water of the Ombrone River during floods.

To build new water fountains for wildlife to reduce competition for the resource.

To permit soil drainage so as to maintain soils fertile.

To propose a better water management in the hillsides (lakes) and in the underground compartment

"Aquaculture in equilibrium with the surrounding environment: an experience of the first years of the eighties and its evolution today"

Mr. Argo Fornaciari and Mrs. Naida Fornaciari, Azienda Ittica "Il Padule" Castiglione della Pescaia

Mrs. Naida Fornaciari reads a paper presented at an interregional symposium in 1981 by Dr B. Rosselli Del Turco. She explains how the system of channels feed the aqua-culture pools and their different functions. She then goes on and shows how wastewaters and other non treated public water bodies can damage and have severe consequences on their private enterprise. She shows maps and promises that she will hand out all the available documents for those who are interested.

Mr. Fornaciari explains that while the private enterprises try to mitigate the problems coming from the environment such as pollution, risks of anoxia, bad water management etc. they are not helped by the public administrations who just control and don't do their job to prevent water pollution of the channels that are then used by the private enterprises. As example he explains that about a month and a half ago because of an illegal dumping into the channels to the north of his enterprise tons of fish have died with an enormous economic damage (years of hard work destroyed in one night).

"Bioindicators of water quality: open problems in the operative applications of the water framework directive (2000/60 CE)"

Dr. Roberto Calzolari, Tuscan Region

Planning of water protection actions is strictly linked to the assessment of the ecological state of sea and freshwater. The ecological state is defined from a scientific point of view as the composition and abundance of different flora and fauna species, which are linked to the chemio-physical characteristics of the water. Surface water quality assessment, based on biological indices, started more than a century ago, with the observation that organisms occurring in polluted water are different from organisms that occur in clean water. Hundreds of methods for biological water quality assessment have been developed since then. The basic principles of the saprobity system (*Saprobien system*) were originally proposed by the Germans before the second world war who introduced the concepts of 'Biological Self Purification' with distinct zones of decreasing pollution. Each saprobic zone affords optimal conditions for certain species and the communities of the organisms in turn behave as 'biological indicators of organic pollution'.

The Trent biotic index is the origin of standard table based biotic indices. All other indices such as, Graham's index, Indices Biotiques, Biotic Index, Danish Biotic Index are modifications of the Trent biotic index. Later, the Trent Biotic Index was extended to provide a range of 0-15 in

place of 0-10 as the Extended biotic index. The Spanish and Italian modifications are based on this Extended Trent biotic index. The score methods were originally differentiated from index methods for involving abundance in calculation. Although this differentiation is no more valid, the calculation procedure of score and index methods are quite different. The origin of all score methods is the Chandler's Biotic Score.

From a legal point of view, since year 2000, monitoring plans required only the monitoring of the chemio-physical parameter as issued by the Italian rules. The same approach was presented in the European Community water related directive: the most impressive example of this situation was the freshwaters for fish life directive (78/659/CEE) where the presence or absence of fish is not of relevance for the compliance to the requirement of directive.

After year 2000, with the Water Framework Directive (FWD), the Community water policy had the following aims: 1) expanding the scope of water protection to all waters, surface waters and groundwater 2) achieving "good status" for all waters by a set deadline 3) water management based on river basins 3) combined approach" of emission limit values and quality standards

The main choice of the F. W. D. 2000/60 ce were:

- Flexibility of the possible solution (no fixed scheme or patterns)
- Best ratio between financial cost and environmental benefits
- The catchment - basin is the natural dimension for the water protection plan
- Monitoring is the basic tool for the management and verification of the water quality status (ecological status)
- The water protection plan is the coordination tool between the protection policy and operative actions

The water bodies are mainly ecosystems with their own operational rules and these do not change according the socio - economic drivers. The socio - economic development must be sustainable.

Water is: a) a public commodity b) an important economic player c) an important industrial sector d) an economic resource that is strictly connected with local benefits

Water must be considered as an economic benefit: It must have a price that is linked to the effective "cost of production". Therefore "the consumer" uses only the necessary quantity of water and discharges a lesser quantity of polluted water because he is also paying the effective cost of sewage services and treatment.

Water quality protection: Ecologically correct management of the water bodies is necessary in order to have reasonably priced water services (supply, sewer, and treatment) for citizens, industries, and agriculture. However financial resources are scarce.

For the Water Framework Directive there are a number of objectives through which the quality of water is protected. The key ones at European level are:

Significant water bodies: Sub-set of the hydrografic net (defined by the regional government) where the following quality objective must be assured: sufficient ecological status by 2008 and good ecological status by 2016

Ecological protection of whole waters ecosystems: Specific uses of the waters; Abstraction of drinking water (75/440/cee, 79/869/cee); bathing water (76/160/cee); shellfish waters (79/923/cee); freshwaters for fish life (78/659/cee)

Quality level strictly linked to the requirements for these uses

For this reason, a general requirement for ecological protection, and a general minimum chemical standard, was introduced to cover all surface waters. The two elements are: "good ecological status" and "good chemical status".

If the minimum legal objectives are obtained by 2008 and 2016 and if limits of emission for each significant water body are respected water monitoring is not only a tool for awareness but it has a legal value and it becomes a tool for water quality management.

The directive, explicitly defines the quality elements that must be used for the assessment of ecological status. These include: biological elements, hydromorphological and physico-chemical elements. The ecological status is an expression of the quality of the structure and functioning of aquatic ecosystems associated with surface waters and is defined as high, good and sufficient.

The chemical status is defined in terms of compliance with all the quality standards established for chemical substances at European level. The ecological status (SECA) is given by the biological and chemio-physical indices and this together with the chemical status give the environmental status. The ratio shall be expressed as a numerical value between zero and one, with high ecological status represented by values close to one whereas bad ecological status by values close to zero. Methods used for monitoring of standard parameters shall conform to international standards (ISO, CEN) or other national (UNI-IRSA-DIN-ASTM) which ensure the provision of data of an equivalent scientific quality and comparability. However, there are few biological indexes already standardized like physio-chemical analysis. Regarding the biological indexes some problems must be solved. Public bodies, involved in the water protection and in the management of water resources, need these indices that must have: clear and simple methods of application and elaboration of results, a multi level scale of classification (five levels), a numeric and discrete output, and they must be cheap because they must be used on a large scale (over ten years, in many sampling points -150 only in Tuscany).

In the next years it will not be necessary to find a new biodiversity index but it will be more useful to have a good methodological approach: choice (among already tested indices), of the most reliable index on the basis of previous experience; to carry out a procedure that joins, for each type of water body, the different biological indices (invertebrate fauna, fish, phytobenthos, macrophytes, phytoplankton, structure of riparian zone) in a unique assessment that gives the ecological state; field testing of these methodologies for the different type of water body .

General discussion

Eng Bousalah My first question is can agriculture and conservation coexist? I also would like to know, if it is possible, the number of visitors and the kind of visitors that come to the park. Are they foreigners or Italians? Are they children or adults? My second question is related to the problem of the drought: what was the consequence on the population and on the family income?

Dr. Cassar In the Mediterranean humans, agriculture and nature have coexisted for ages and there has always been a balance among these factors.

Prof. Scapini To the first question we have the figures that we will provide with a CD.

Dr. Colombini The kind of visitors change according to the season. During spring and autumn months there are mostly school children and foreigners from Northern Europe (Germans, Swedish, Dutch etc) visiting the park while during summer months visitors are mostly Italian and most come for sun bathing activities.

Dr. Locatelli Yes there are socio-economic consequences. As a matter of fact the Azienda has 52 families living on what the farm produces and if the production decreases these families will get a lower incomes.

Mr. Fornaciari In the concept of this Park there is more an idea of tourism than that of maintaining biodiversity. A real conservation strategy does not exist here.

Prof. Abdrabo Aqua-culture and agriculture have a certain income and thus are important for the population.

Dr. Locatelli It's a matter of choices: if we want that Azienda to be productive then we must work in that direction but obviously there will be consequence on the natural environment! However we must remember that this particular areas has been man-made

Eng Bousalah How are the 52 families motivated to maintain biodiversity and the environment since it is a regional farm?

Dr. Locatelli People, here, are very proud of their environment and an indication is that there hasn't been a real fire for quite a long time. This is a good indicator of environmental concern of people living in the area.

Mr. Fornaciari It's about 30 years that this area hasn't been undergoing arsons.

Prof. Scapini Both Mr. Fornaciari and Dr. Locatelli stress the same concept: agriculture and the Azienda try to maintain the environment in equilibrium. So both agriculture and aqua-culture activities are agents to maintain high quality of the habitat and of the water.

Dr. Cassar Everything is linked together. Aridity induces more water extraction and salt water intrusion in the water table. This produces a lower quality of grazing areas and cattle is compelled to occupy inland areas. As to aquaculture Malta has had a negative experience with this practice. In fact we first had aquaculture in the sea close to the coast but this has been a disaster. It has produced pollution and has had a negative impact on tourism. The choice was or aquaculture or tourism. Now it has been moved more towards open waters.

Mr. Fornaciari In Finland aquaculture was in the fiords but now they have had to move it because of the water pollution. Aquaculture done on land has higher costs but it's safer because it can be better controlled. Of course there are higher risks for the enterprise because there are temperature and salinity excursion higher than in marine and riverine conditions.

Dr. Neto What is the production of your enterprise?

Mr. Fornaciari I have a production of 6 kg/m³ that equals to 450 tons/y. The aquaculture farm has is 70 ha.

Dr. Patricio How many years ago did you start your enterprise?

Mr. Fornaciari My father started after the world war and first we were breeding mullets, then eels and now we rear bass.

Prof. Bayed How important is cattle-breeding for the Grosseto plain?

Dr. Locatelli In the Grosseto plain there are about 8000 individuals of the so called "Vacca Maremmana" which is a special race and about 80% is reared in Regional or State farms. The Azienda has 550 individuals. This cattle is reared in the wild all year long because it is very resistant to climate changes and eats almost anything it can find. So it has many advantages (its meat is low in fat) but also disadvantages because it has its anterior parts are more developed than the posterior ones that are sold better on the market. Before killing the animals they are fed for two months with biological fodder.

Prof. Charfi What about fishing activities? We have never talked about this activity.

Mr. Fornaciari There are small fishing ports in Talomone and Castiglione della Pescaia but the more important fishing ports are Porto St Stefano on the Argentario and Livorno. In Alberese there isn't the tradition of fish

Dr. Chelazzi From a cultural point of view the Grosseto plain doesn't have sea food in its tradition. Fish in the diet was imported by the Venitians when Mussolini brought down the families from Veneto to populate the reclaimed lands between the two World Wars. But this was fresh water fish.

Prof. Oueslati How do you rear cattle in the wild?

Dr. Locatelli You have to prevent inbreeding so the butteri have a very complicated job to keep the groups separated. And then there are regulations that all animals must be ear-marked. In the wild these are easily lost so they are also marked with fire.

Prof. Scapini Do you have questions on the talks about bioindicators of water quality? Does anybody have any remarks?

Prof. Scapini Now we must talk about the next steps for the Wadi Project.

Programme for the next meetings

Prof. Bayed Next meeting in Marocco will take place at the end of October - beginning of November (29th October to 5th November departure) but I will confirm the dates. There are two study areas so I must ask Prof Ater when will be most convenient for him.

Prof. Charfi The meeting in Tunisia with the local stakeholders will be held in the first week of December.

Prof. Scapini Now let's talk about the results of the three meetings we have had with the local stakeholders in Alicante, Egypt and the Grosseto plain. The outputs of the meetings will be handed out to the partners within a week for the Alicante meeting, within two weeks for the Egyptian meeting and within the end of June beginning of July for the Italian site.

Before the end of July we can start a forum where everyone can contribute with their ideas and open a discussion. During the summer we will have all the information for these three sites so that we can have a lot of time to think about it

September 2006 beginning of the field activities.

Prof. Bayed Proposes to candidate the Portuguese and Maltese groups for the interim and final WADI meetings respectively.

Dr. Neto In 2007 a general interim meeting could take place in Portugal (probably in September-October 2007) to discuss the results obtained and develop alternatives and guidelines for the stakeholders. Dates should be confirmed by Prof. Marques.

Dr. Cassar agrees to have the final WADI meeting at the end of 2008 in Malta.

18:30 Closure of the meeting.