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TITLE : Sustainable Management of Scarce Resources in the Coastal Zone - SMART

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Abstract

SMART, dedicated to Sustainable Management of Scarce Resources in the Coastal Zone, has successfully developed an innovative and participatory approach for integrated water resources and coastal zone management.

This approach was tested on the natural resources problems and issues in five case study areas around the Eastern and Southern Mediterranean (Turkey, Lebanon, Jordan, Egypt, Tunisia) which provide a diverse set of test cases with widely varying physiographical and socio-economic conditions. Problem analysis with the early involvement of stakeholders in each region identified the major issues: a set of simulation models was then applied to explore a range of common scenarios for each river basin and coastal region as the basis for sustainable management strategies.

Scenario analysis was based on the initial socio-economic data and local actor perceptions, using indicators of sustainable development in a DPSIR framework. The scenarios of water resources management, coastal water quality, and land use change, were designed to explore the range of possible futures: starting with a baseline to represent the status quo, scenarios with a time horizon of 25-30 years were designed for *business as usual*, and an *optimistic* as well as a *pessimistic* case for each location.

Scenarios were translated into model runs that generated estimates for basic indicators such as overall and sectoral demand/supply ratio for water, reliability of supply, and coastal water quality. Land use specific resource consumption aggregated from a Land Use Change model were used to cross-check the results of the water resources model.

Differences between the individual scenarios for the main indicators ranged from meeting the objectives of balanced, reliable and sustainable supplies to pronounced deficits of up to 50% with a reliability as low as 55% (based on daily supply targets). The basic pattern of conflicting demands between agriculture as the major water user, and the urban-industrial areas and increasingly infrastructure for tourism as well as environmental water demand such as the wetlands in the Gediz Delta or in the Abu Qir region in Egypt can be observed in all cases, even though in different proportions. Increased efficiency and alternative allocation patterns due to savings in agricultural water demands can contribute towards more sustainable resource use.

The final step of the analysis was a multi-criteria comparative analysis of the scenarios to identify common patterns and actor preferences. It clearly demonstrated the potential for sustainable solutions, given the range of possibilities between the different sets of assumptions on socio-economic driving forces, but also regulatory and economic measures. With the optimistic cases it can be shown that sustainable water resources management in the coastal zone is feasible with a well balanced set of regulatory and technological instruments. The results are being disseminated to the stakeholders that have contributed to the original problem formulation and scenario definition in each case. In addition, the test cases, case study results, and the on-line tools and data bases together with all project deliverables and related reports, papers, presentations, and scientific publications are available on-line for a wider audience at the project web site at http://www.ess.co.at/SMART.

Summary of final report

Consolidated scientific report

Objectives

SMART addresses a number of specific scientific objectives:

- To build, and test in a number of parallel comparative case studies, and consistent and well-integrated set of tools for the design, analysis, and effective communication of policies for integrated coastal zone management.
- To develop a generic approach to combine engineering analysis with socio-economic considerations in a unifying and consistent multiple-criteria framework.
- To link, through expert systems technology, quantitative simulation models water resources and hydrological models with policy oriented qualitative assessment.
- To integrate expert systems technology with complex simulation models to improve their applicability in data poor and data constrained application situations.
- To develop appropriate tools and methods for the communication of complex technical information to a broad range of participants and stakeholders in the policy making process, primarily based on Internet technology.
- To develop formal methods of rule-based aggregation and dis-aggregation of data and information to span the entire range from data to indicators or criteria, and issues.

Activities

The project was designed for a period of three years. It consisted of four overlapping main phases with their associated milestones.

During the first twelve months, SMART has been progressing as scheduled. Despite the withdrawal, for administrative reasons, of the University of Alexandria and its replacement by the new Egyptian partner, CEDARE, the delay in starting up the project was minimal. With the end of the first year, the expected Milestones have been reached, all Deliverables due were completed and submitted.

During the second project period, SMART has been progressing as scheduled.
With the end of the second year, the expected Milestones (M03 and M04) have been reached. Though no deliverable was due in this project year, draft versions of the next set of Deliverables (reports on WP 04 and the case studies) have been prepared and were attached to the Annual Report.

The third reporting period was dedicated to the completion of the case studies and reporting. A workshop, held in Venice close to the end of the project, was dedicated to the comparative-multi-criteria analysis of the scenarios generated in the case studies and the resulting Deliverable D10.1 and D10.2, summarizing the concluding analysis.

Results achieved: a summary presentation

The overall objective of the SMART project was to develop, implement and test a new, participatory but scientifically sound and rational approach to planning and management of the coastal zone that can help to reconcile conflicting demands on scarce water. In essence, the project is concerned with testing a strategy for solving water demand conflicts.

The development of this approach begins with the integration of three primary components, a socio-economic framework, and two quantitative analysis tools: WaterWare and TELEMAC. The resulting methodology was used to simulate scenarios for the assessment of water supply and water demand with reference to *Integrated Coastal Zone Management* methods. Together, these models have aimed to integrate environmental impacts, costs, access, and equity, in a systemic way. Their outputs will be assessed by a rule-based expert system and used to formulate recommendations for conflict resolution that favor sustainability over time. Participation of selected stakeholders from water management institutions was used in testing the approach and in identifying best water management practice. This 'SMART' methodology was applied to five case studies in the Mediterranean coastal zone in the countries of Turkey, Lebanon, Jordan, Egypt and Tunisia.

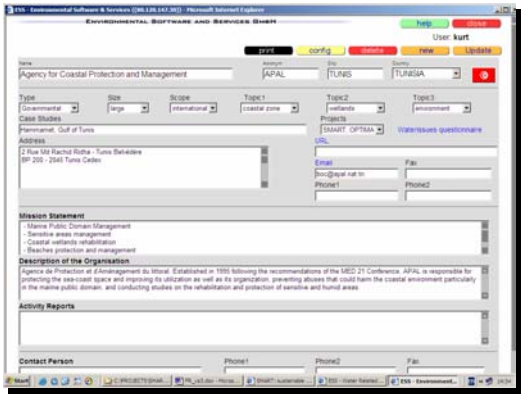
The SMART Case Studies

Country	***Turkey***	**Egypt**	***Lebanon***	***Jordan***	**Tunisia**
Case Study	*Gediz River Basin*	*Abu Kir Bay*	*Abou Ali River Basin*	*Gulf of Aqaba*	*Gulf of Hammamet*
Area (km^2)	*18.000*	*1.339*	*482*	*2.018*	*155*
Water Supply (MCM/yr)	*1.100*	*1.192*	*287*	*17*	*321*
Water Demand (MCM/yr)	*886*	*1.473*	*88*	*14*	*304*
Population	*1.700.000*	*2.000.000*	*400.000*	*84.000*	*68.710*
Price of Bottled Water (Euro/ Litre)	*1*	*0,15*	*0,58*	*0,39*	*0,20*

This requirements and constraints report presents a comprehensive list of issues, that are to be developed through the socio-economic analysis in WP02, provide the conceptual framework for the case studies and the scenarios explored in WP05 to 09, and applied in the comparative assessment in WP10. It lists the data requirements for the methods proposed in WP03, analyses what is known about local data availability, describes the resulting constraints and suggests alternative approaches where necessary.

Sustainability is an umbrella concept that is explored in the SMART project by calculating a daily water budget for a given area and studying water supply and water demand over time and space, from a multi-disciplinary perspective. Within this context, key water issues for each case study have been complemented with key issues of change that are likely to have an impact on the water system in the future.

Requirements and constraints



The first and leading work package was dedicated to a detailed compilation and analysis of requirements, issues, and constraints. The former was based on the early identification and involvement of stakeholders in each case, the latter primarily concentrated on data requirements of the modeling tools proposed and the data availability situation in each case study area.

Key Water Issues that have been identified across the case studies describe problems of *scarcity*, where demand is almost equal to or actually exceeds local supply, or where losses in the distribution system exceed 50%. The uncertain *quality* of available water due to the effects of human activities increases pressure on water resources. The amount of water suitable for domestic and agricultural uses is diminished by pollution in all cases, though primary sources vary. Outflows from urban, industrial and agricultural activities contribute to the pollution of coastal waters which in some cases may not be safe for bathing and fishing.

Key Issues of Change across the case studies have been identified as: *Demographic Change* which can affect the water budget through the growth and migration of the human population; *Land Use Change* which can affect the water budget through human activities; *Technological Change* which can affect the water budget through increasing capacity to access, transport and store water and through the quality of water in return flows; and *Institutional Change* which can affect the water budget through the regulation of water price, water allocation and water quality. Of these, through the preliminary assessment of the case study conducted for this report, *Land Use Change* has emerged as the phenomenon most evidently linked to water demand conflicts.

Policy Relevant Information associated with these key issues can be expressed in the form of indicators. These indicators are relevant to defining the scenarios studied, and have formed the basis for a conceptual framework for SMART's rule-based expert system. This conceptual framework is being structured with consideration for the DPSIR[1] understanding of interrelationships between human activities and the state of the water supply within the case study areas. Multi-criteria analyses was used in the comparative assessment of case study applications to judge the success of indicators' sustainability performance given a set of specific conditions defined in the scenarios. The final list of indicators was derived from the key issues identified with the stakeholders, and formed to basis of the development of scenarios specific for each case study.

[1] "Driver – Pressure – State – Impact – Response" A framework developed by the European Environmental Agency for environmental assessment, that illustrates cause and effect relationships within the nature-society system.

Stakeholders with an interest in sustainable water management have been identified in all of the case studies. The comprehensive list includes institutional stakeholders at three different levels, private stakeholders of various types and NGOs. The involvement of key stakeholders in the project activities is to be managed locally, on a case by case basis. Contacts for this purpose have been identified and compiled in an on-line data base (publicly accessible and still being extended) that lists now 60 institutional and personal contacts for the five case studies together with a chronological record of contacts and interactions: http://80.120.147.30/INSTITUTIONS

Data Requirements and Availability. The requirements for the socio-economic framework the WaterWare system, and the TELEMAC system were circulated to the project partners, after which a checklist was filled out with reference to the individual case studies. An iterative process within the consortium was exploring the limitations in each of the study areas. The results of this process have shown that in most cases some of the data are not immediately available, but the existing information gaps have not been clearly identified in all the cases. The compilation of information and data has been slowed by the bureaucratic process within some of the research institutions and public data suppliers, which was expected as one of the difficulties in the region.

The data requirements for the socio-economic framework requested a level of detail that is largely unavailable in most cases due to the frequency of census reporting and the lack of specific information at the municipality level. Queries about the data required to describe the river basin objects modeled by the WaterWare system, indicate a need for further clarification. Some of the data requirements for the TELEMAC modules were not clearly understood and this delayed the confirmation of availability and the selection of the module to be applied. In general, there is need for continued iteration to arrive at more precise description of essential data requirements and a conclusive inventory of the information that can be accessed for this study.

Constraints are grouped in three categories: the constraints to applying the three main components of the methodology resulting from lack of data and the feasibility of applying the proposed tools; the constraints to exchanging information due to the political, and cultural context within which the studies are conducted; and finally, the constraints to meeting the project deadlines with quality research products posed by the speed of communication that is possible with only limited face to face contact and relying primarily on electronic mail.

Conclusions about alternative approaches have assumed successful application of the WaterWare system to be feasible in all of the case studies with the exception of Egypt where only water quality, but not availability as such (due to the massive flow of the local Rosetta Nile branch), are an issue. The TELEMAC modeling components were used for examining in some detail the distribution of pollutants in coastal waters that derive from the mainland drainage area, and land use changed was analyzed in more detail.

From the requirements analysis, it was recommended that the definition of the three principal scenarios take into consideration the importance of land use changes in defining water use conflict across the case studies. There is a need for a more detailed assessment of the key issues, particularly links between institutional arrangements and the interactions between the population and the hydrological system. Though at this time no *critical* information gaps have been identified, it is foreseeable that some currently unavailable data will need to be collected for the successful completion of the project.

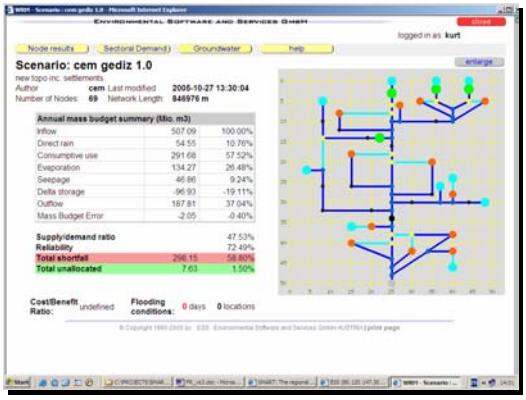
The tools, models and methods

Within this framework, SMART used two major and linked tools to analyze the scenarios defined for the case studies:

- WaterWare, a water resources management information system;
- TELEMAC, a 2D dynamic coastal flow and water quality model.

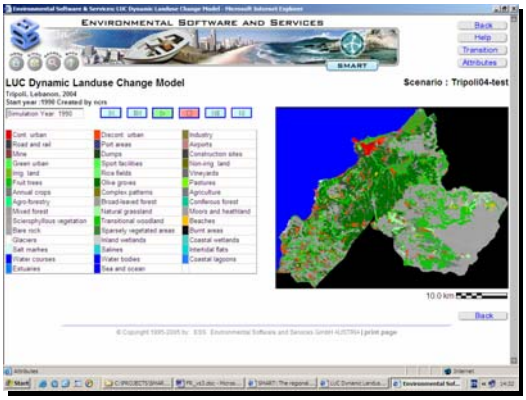
The two primary model systems were supported by several data bases and auxiliary tools available through the project web server at http://www.ess.co.at/SMART, such as s regional climate data base, on-line GIS server (both at ESS and at CEDARE, Egypt), as well as an on-line stakeholder data base, and an optional dynamic land use change model (http://80.120.147.30/LUC), based on the above conclusion.

WaterWare: A central tool for the scenario analysis that is the basis of the analytical approach of SMART is WaterWare, A river basin scale water resources information system and management model.



WaterWare combines several components and functions

1. An information system that includes:
    a. Time series analysis for hydro-meteorological variables which are used in the various simulation models;
    b. An embedded GIS (all objects represented in the system are geo-referenced) with an associated web-based MAP SERVER;
    c. A heterarchical object data base for river basin OBJECTS;
2. A simulation system that includes:
    a. A rainfall-runoff model
    b. An irrigation water demand model
    c. A statistical drought assessment model
    d. A water allocation (demand-supply balance model)
    e. A set of water quality models (STREAM, BLTM, XGW) for surface and groundwater, respectively;



    In addition, the system provides a set of interfaces for external models; in the case of SMART, this provides a link to the TELEMAC coastal water quality model.
3. A decision-support component based on a discrete multi-criteria assessment methodology (reference point optimization).

Within the framework of SMART, and to meet the requirements defined in WP 01 and WP02, the set of models is being extended to include

- A dynamic regional development model
- A dynamic land-use change model
- An embedded rule-based expert system for the assessment of socio-economic and environmental impacts based on the simulated demand-supply balance.

TELEMAC: coastal water quality

As a major element of the coastal zone, a resource for tourism, and at the same time directly affected by water and water management, coastal water quality was used as one of the main indicators in the scenarios.

To estimate the effects of different waste water generations in the different scenarios, the coastal water quality model system TELEMAC was used. The TELEMAC system is a powerful integrated modeling tool for use in the field of free-surface flows. Having been used in the context of very many studies throughout the world (several hundred to date), it has become one of the major standards in its field. The various simulation modules use high-capacity algorithms based on the finite-element method. Space is discretised in the form of an unstructured grid of triangular elements, which means that it can be refined particularly in areas of special interest. This avoids the need for systematic use of embedded models, as is the case with the finite-difference method. All the numerical algorithms are gathered into a single library (BIEF) that is shared by all the simulation modules. This makes for consistency throughout the TELEMAC system. The pre- and post-processing tools are particularly powerful and user-friendly. Most of them are based on the use of Ilog/Views libraries and offer a range of extremely sophisticated functions. The grid can be generated with the generator embedded in the TELEMAC system (MATISSE module) or by others, in which case the STBTEL module acts as interface. TELEMAC has numerous applications in both river and maritime hydraulics.

The system was developed by the Laboratoire National d'Hydraulique, a department of Electricité de France's Research and Development Division. It is distributed by Sogreah, which holds the exclusive rights for France.

The model system was successfully applied for all case studies.

The case studies

SMART used five case study areas with different geographical and socio-economic setting to test the approach developed in a concrete setting. They are located in Turkey, Lebanon, Jordan, Egypt, and Tunisia and thus span a major part of the South-Eastern Mediterranean. Please note that extensive maps, graphs, and imagery are available on-line for all of the cases as part of a multi-media on-line description of these cases, and can be found on the project web server at: http://www.ess.co.at/SMART/cases.html.

Turkey – Gediz river basin

The Turkish case study focuses on two major and closely related areas in western Anatolia, along the Aegean Sea: the first one is the **Gediz River Basin** while the second one is the neighboring city of **Izmir**.
In the basin, **water scarcity** is a significant problem, evidenced as water shortages due basically to competition for water among various uses. Main use is irrigation with a total command area of 110,000 ha followed by domestic and fast growing industrial demand in the coastal zone.
The second issue investigated is the **sustainable management of water resources** in the Izmir **urban** and **rural** area where coastal interactions are significant. This problem reflects not only a regional character but also national significance, as Izmir is the third largest city in the country and an important harbor along the Aegean. There are strong interactions between the basin and the Izmir rural area, as the Izmir metropolitan area consumes a significant portion of the **groundwater resources** of the Gediz Basin without feeding it back to the basin. There are also two important **industrial** areas in the Basin: the largest is in the Nif Valley immediately east of Izmir in Kemalpasa municipality while in the western edge of the city of Manisa is also growing an important industrial estate.
Moreover, the seaward fringe of the Gediz Delta is an **important nature reserve** and has recently been designated as a Ramsar site to protect rare bird species. Originally, the area received excess water from the Gediz River for much of the year, but since the '90s droughts, with restrictions on irrigation releases, the reserve suffers from water shortages.
This setting, coupled with difficulties to establish an appropriate and well coordinated control over the use of natural resources and pollution, brought in the region environmental degradation, resource depletion and pollution-related damages.

Egypt – Abou Kir bay

The Egyptian case study concerns the Abu Kir Bay Region, located at west of the Nile delta of Egypt where **Rosetta branch of the River Nile** delivers to the Mediterranean about 4-5 billion m3 of the Nile water yearly. The area also includes a large lake Idku (one of the less polluted lakes of the five northern lakes of Egypt) as well as important historic cities, including Rosetta city. This city populated by 200,000 people, mainly fishermen, is located at the north-eastern tip of Behaira Governorate, on the western bank of Rosetta branch.
The region is expected to experience soon a **strong economical growth**. The tourism activity should increase in the near future, especially after the discoveries of sunken cities in the bay and the recent official classification of Rosetta and Idku cities as potential tourist area. The government also declared Rosetta City among the group of monumental cities, covered by a plan of restoration of Egyptian cities. Lastly, the construction of an international coastal highway connecting Matruh and Alexandria cities (at the northwest of Egyptian Mediterranean coasts) to Sinai and Arish City to the east will facilitate the regional development and will link the city to the surrounding.
Rosetta region has been suffering from various aspects of **mismanagement**, neglect and deterioration in the past: coastal erosion, land based pollution to water resources and international water, urban encroachment in agricultural land, vulnerability to sea level rise, shortage of urban services and absence of planning. Losses of resources in

the region have caused moreover a large-scale deterioration of socio- economic conditions.
A significant loss of marine **biodiversity** due to increased load of dumped waste in the bay and of bird biodiversity due to deterioration of soil conditions and water quality in the region is also noticeable among the most important issues discussed in the case study.

Lebanon – Abou Ali river basin

The case study addresses an area stretching along the northern Lebanese coast covering **Tripoli** City to the north, the second largest in Lebanon, southward to the town of **Batroun**. The corresponding coastline length is about 30km while its width varies between 8-12km inland. The area typifies the Lebanese coast: it consists of a narrow plain followed inland by a series of foothills, plateau, then rising through steep slopes to the coastal mountain chain. It is crossed by a river (Abou Ali) passing in Tripoli and another minor one (like El-Jawz) near Batroun, with intermittent streams, dendrite drainage and dry wadis. The climate is hot sub- humid at the coast becoming milder inland.
The major urban complex is Tripoli, with about 300,000 people leaving in the city and 100,000 in the surroundings. It used to be a dominantly agricultural region, but the last three decades witnessed a rapid development of urban construction, including some industries, recreations and power plants at the expense of agriculture. The **urban/rural interface** around Tripoli has changed dramatically with great losses in prime land and resources: the immediate coastal foothills are highly urbanized close to cities but are cultivated outside. In the Chekka stretch and just north of Batroun there are **heavy industries**, phosphoric acid, asbestos tiles/pipes and cement. This is among the highest polluted areas in Lebanon, where quarrying, water, soil and air pollution is very noticeable.
Tourist pressure is a matter of concern in the area as it is typical of the Region, and there is a fairly dense road network for easy accessibility. There are many venues of significance, both in the cities, and scattered elsewhere including archaeological as well as scenic sites inland along the coastal valleys.
Precipitation essentially covers two ranges from coastline inward, 800- 950mm, and 900-1,000mm annually, though it falls within 3-4 months episodically and often torrential. Almost 50% of this water is lost through evaporation. Karst systems are rather well developed, and **water wells** are drilled abundantly and yet very loosely controlled: excessive water pumping resulted in salinisation of the ground and water that reflects on the secondary soil salinity and farmers income.
As there is neither a well-developed sewage network, nor wastewater control, nor proper solid waste collection and/or disposal, the major problem is the seepage of pollutants, leachates, and chemicals into the groundwater affecting its quality. Some major springs are treated and sparingly monitored, with clues that the treatment plant itself needs to be upgraded, as it happens in Tripoli.
The CS signals many problems for the area, which can be categorized as natural or human-made: the former include forest fires, strong erosion during heavy rains, droughts and some difficult inaccessible terrain with rock falls and landslides, as well as coastal floods and relative rise in sea level; human influence can be summarized as follows: chaotic urban sprawl, improper agricultural practices, and tourism.

Jordan – Gulf of Aqaba

Jordan is located in the semi-arid to arid region where only about 10% of the total area (90,000 km3) receive above 350 mm of rainfall per year. The **only coastal area** in Jordan is the Gulf of Aqaba, populated by 150,000 people, where the shoreline amounts to about 45 km.
Aqaba area has been declared a **special zone** as a duty free area in order to attract new investors in trade and industry. This development will increase demand for water for the growing population and future industrial activities.
Water supply to Aqaba region are derived from the Red Sea Basin (5.0 MCM groundwater) and the adjacent Dissi aquifer system (20 MCM) plus a great part of **treated wastewater**.
The current water consumption in the region is estimated 25 MCM where about 10 MCM is used for industrial purposes and 10 MCM for municipal purposes. Agriculture, street trees and parks receive only 3 MCM from fresh water and about 4 MCM treated wastewater.
On the **water quality** side, seepage from irrigated areas resulting from excess irrigation near the coast of Aqaba is already present while the planned industrial activities will soon certainly affect the water discharging in the gulf of Aqaba.
The total area is comparatively small, leading to a high concentration of economic activities potentially contradictory (ie. tourism vs industry) along the coast and thus **competition** for space in addition to the competition for water

Tunisia – Gulf of Hammamet

The case study site is the Gulf of Hammamet with its large **tourist resorts**.
The Tunisian coastline spans 1,300 km. and over the last two decades, a major shift of population growth, urbanization, industrialization and tourism towards the coastal zone could be observed. The emerging problems are typical, and usually involve a combination of rapid land use change, population growth driven to a large degree by migration from inland agricultural areas, depletion of water resources often accompanied by overexploitation of groundwater resources and consequent salt water intrusion in the immediate coastal zone, and pollution from unchecked economic development and insufficient waste and waste water management. These developments conflict with the parallel development of tourism, which depends on the same resource basis but also on a clean and attractive environment, inland and coastal areas.

The analysis of scenarios:

For each case study, a set of scenarios was constructed from the results of the socio-economic analysis from WP 02. The scenarios were organized with the same interpretation in each case, including a baseline scenario for system calibration, a business as usual naively extrapolating current trends, as well as an optimistic and a pessimistic scenario. These base scenarios were further split in sub-scenario, explained in detail in D 02 and D10.

The example from the Gediz shown below summarizes the results of the model based scenario analysis and illustrates the structure of the information as well as the actual range of values found: with considerable simplification, the basic indicators between optimistic and pessimistic scenarios can vary by a factor of almost two. In all cases,

water use by agriculture is, not surprisingly, they key factor: savings through reallocations, changes in cropping patterns, and more efficient water supply and irrigation technologies can make the biggest potential difference in absolute terms.

SCENARIOS	Baseline		Current BAU		Current Optimistic		Current Pessimistic	
Summary of main scenario assumptions	Baseline scenario with observed values for 1991		Crop pattern change expected. The TS of the year of 1982 are used		Crop pattern change expected. The TS of the year of 1982 are used		Crop pattern change expected. The TS of the year of 1991 are used	
Supply/demand ratio (%)	95.41		98.51		99.78		52.67	
Reliability (%)	92.73		87.97		88.94		73.67	
Total Shortfall (%)	3.2		1.68		0.27		134.96	
Total Unallocated (%)	1.77		0.21		0.15		0.05	
Sectoral Water Budget Data	S/D ratio (%)	Reliability (%)	S/D ratio (%)	Reliability (%)	S/D ratio (%)	Reliability (%)	S/D ratio (%)	Reliability (%)
Domestic	0	0	0	0	0	0	0	0
Agricultural	94.66	87.5	97.96	71.16	99.16	71.37	52.03	54.73
Industrial	100	100	100	100	100	100	100	100
Generic	75.05	83.01	99	83.01	99	83.01	90	83.01
Total	99.95	90.25	98.27	79.36	99.34	79.5	58.6	68.4

Comparative analysis and conclusions:

The individual performance of the policy options under consideration were aggregated using **multiple-criteria approach** (MCA). The total performances yielded by applying the additive averaging method based on the VF and weights described earlier are shown in the Table below:

Final results of the Comparative Analysis

	Jordan		Lebanon		Turkey	
Options	**Score**	**Rank**	**Score**	**Rank**	Score	**Rank**
ABAU	**0,6653**	**1**	0,5496	10	0,8297	8
AOPT	0,5737	6	**0,7723**	**2**	**0,896**	**3**
APESS	0,5269	10	0,4262	13	0,6356	16
CRB	**0,6563**	**2**	0,5626	9	0,6873	15
CRBAU	0,617	4	0,5642	8	0,7846	9
CROPT	0,5362	9	0,7543	4	0,8704	4
CRPESS	0,4476	13	0,4258	14	0,7285	13
WDMBAU	**0,6466**	**3**	0,613	6	0,8363	5
WDMOPT	0,5636	7	0,753	5	**0,9092**	**2**
WDMPESS	0,5264	11	0,4279	12	0,7437	11
WQMBAU			0,5242	11	0,8308	7
WQMOPT			**0,8283**	**1**	**0,9169**	**1**
WQMPESS			0,42	15	0,7266	14
WSMBAU	0,6031	5	0,5802	7	0,771	10
WSMOPT	0,5511	8	**0,7678**	**3**	0,8356	6
WSMPESS	0,5025	12	0,4067	16	0,7326	12

For a detailed definition of the scenario types, please see deliverable D10.1, Comparative analysis, available on-line at http://www.ess.co.at/SMART.

The situation in each case study is unique, nevertheless the same preferences – internalized in the value functions applied to transform the expected outcomes of the policy options and the criteria weights were the same in all case studies. The correlations between the rankings obtained in each of the case study. Kendall's tau coefficients (ranged between 0.18 and 0.63) are generally smaller than the Spearman Rank Correlations (0.28 – 0.83). In the Lebanon and Turkey the results show higher similarity. This is also the only statistically significant correlation regardless which type of correlation coefficient was used. Both case studies share the **same policy option as the best preferred one** – WQMOPT. It should be noted that this option could not have been considered in Jordan case study and thus this comparison is limited to the common policy options. The second best option in Lebanon CS is AOPT whereas this option is ranked third in Turkey. The second best option in Turkey is WDMOPT which is on the position 5 in Lebanon. Likewise, the lowest ranking options are similar, the differences in their rank positions are rather low and in any case do not exceed 6 rank positions. This explains the high correlation between both case studies.
In the Jordan case, the most prefered option is ABAU which ranks very low in other case studies. Similarly, the second best option (CRB) is the second worst in Turkey. The low ranked options on the other hand yield equally poor results in the other cases. Interestingly, the best results in Jordan CS are related to the BAU scenario, followed by the scenario OPT.

The results of the analysis are constrained in some cases by the limited availability of data. To translate the findings into concrete and robust, reliable policy advise would require considerable more time and effort and quantitative data from the field in each case, going well beyond the scope of the SMART project.

Nevertheless, the **methodology** originally developed in the project and leading to the final Comparative Analysis demonstrated to be fully operational even in those cases with limited data availability being the main constraints. The conceptual framework used as well as the multi-criteria analysis adopted concretely shows how **participatory decision making** can be handle and understood by non experts users, representing an operational approach for **bridging scientific modeling and policy**.

Results achieved: a chronological view

Results achieved during the first reporting period:

- Work Package 01 on requirements and constraints was completed, the corresponding Deliverable submitted;
- Work Package two was nominally completed, the corresponding Deliverables submitted; remaining resources were used in direct and ongoing support of the individual case studies leading to the final multi-criteria comparative analysis.
- Work Package 03 has produced the two Deliverables as planned; the software systems were ready for implementation in the case studies; following the detailed requirements from WP 01, a new, additional set of models was prepared for the description of land use change. The remaining effort in WP 03 was used for fine tuning and any further development of the models based on feedback from the case studies;
- Work Package 04 started as planned; first results were the data made publicly available on the GIS/MAP Servers at ESS and CEDARE respectively.
- Work Package 11 (Exploitation) was running as scheduled, with the project web server (D11.1) and the Dissemination Plan (D11.2) as its central deliverables.

The major scientific achievement of the first year was the completion of the requirements and constraints analysis, and the socio-economic framework together with first work on indicators. In parallel, model data requirements were defined, and the first training course for the coastal water quality model was held in France. Data compilation was started, with first results available and published with continuous updates, on the project web server.

Deliverables finalized in the 1st project period:

- D01.1 Requirements and Constraints Analysis Report (FEEM, Italy).
- D02.1 Identification of Problem Issues (EIAPT, Portugal)
- D02.2 Guidelines for socio-economic Analysis (EIAPT, Portugal)
- D03.1 Water Resources Modeling Framework (ESS, Austria)
- D03.2 Hydrological Simulation Modeling System (SOGREAH, France)
- D11.1 Project Web Server, operational sine October 2003 (ESS, Austria)
- D11.2 Dissemination Plan (ESS, Austria)

Results achieved during the second reporting period:

- Work Package 00 continued with the project web server as a major tool serving as communication hub (together with the mailing list smart@ess.co.at, which has accumulated well above 1,000 messages at this point !).

  The web server has also been used as a shared data repository, and the central element in the dissemination strategy (WP 11), and has reached a considerable popularity for external visitors, too. The data volumes managed by the project web server (without the on-line data bases and interactive models) exceeds 270 MB of raw text and imagery data.

- Work Package 04 started as planned, with the structure and entity-relationship model for a common data base defined by SUMER, and ongoing data compilation by the case study partners; initial results were the data available on the GIS/MAP Servers at ESS and CEDARE respectively, the on-line monitoring time series data display at ESS, the data used for the first scenarios for the on-line models: http://www.ess.co.at/SMART/ including CORINE classified imagery for the new land use change model: http://aca.ess.co.at/LUC/
- Work Package 11 (Exploitation): Several publications were prepared and submitted to various Conferences and Journals. An up-to-date list is maintained on-line at http://www.ess.co.at/SMART/publications.html
- For the involvement of end-users and major actors in the individual case studies, contacts have been extended and several presentations were made. Where appropriate, representative end users have been invited, and have attended parts of the management board meetings in Izmir and Aqaba, with dedicated discussions sessions and presentation in connection with these meeting.

The major scientific achievement of the second year was the completion of the analytical tools, data bases and data compilation, and first results of model applications, based on the indicator framework and resulting scenario definitions defined in WP01 and WP02, following the work plan and meeting the Project Milestones as scheduled.

Deliverables submitted in the 2nd project period:

- D04.1 Data Compilation and Analysis Report (SUMER, Turkey) – draft version
- D05.1 Case Study Report Turkey (SUMER, Turkey) – draft version
- D06.1 Case Study Report Egypt (CEDARE, Egypt) – draft version
- D07.7 Case Study Report Lebanon (NCRS, Lebanon) draft version
- D08.1 Case Study Report Jordan (FOAJ, Jordan) – draft version
- D09.1 Case Study Report Tunisia (CNTD, Tunisia) – draft version

Results achieved during the third reporting period:

During the third and last reporting period the final versions of the Case Study Reports were completed, together with the Data Compilation and Analysis Report.
FEEM (Italy) compiled the Dissemination Report by collecting the summary of activities carried out during the whole project period by each partner. Moreover they finalized D10.2 in collaboration with EIAPT (Portugal), dividing WP10 Comparative Analysis into two parts.
The eTIP, including exploitation plans for the results achieved, was filled in electronically by each participant.

Deliverables submitted in the 3rd project period:
D10.1 Comparative Analysis of Case Studies, (FEEM, Italy; EIAPT, Portugal)
D11.3 Dissemination Report – User Feedback (FEEM, Italy)
D11.4 Exploitation Plan - Technology Implementation Plan (electronic version)

All Project Deliverables are available on-line, through the administrative page http://www.ess.co.at/SMART/ADMIN/deliverables.html (restricted access).

The documents are initially placed there for internal distribution and review, then after submission to the Commission, they are kept on-line as reference copies, for possible updates, and for public access as part of the dissemination activities.

Problems encountered

No major problems encountered. Delays in the start-up were due to the change in partners (from the University of Alexandria to CEDARE, both Egypt) and the subsequent delays due to the necessary project amendment, and thus late payment of the advance to the new partner.

Delays in data availability (mainly related to WP04) were expected, several fall-back mechanisms were foreseen such as the use of more generic data to start the model activities on schedule.

For the final comparative analysis, only three out of the five case studies (Turkey, Lebanon, Jordan) could supply all the data and model scenario runs for the water resources model. The cases in Tunisia and Egypt could use only part of the tools, due to either limitations in data availability or the physiographic nature of the case study area, but supplied alternative results from the land use change model and the coastal water quality model that were more appropriate in these cases.

Technology implementation plan

The main data are compiled in the on-line TIP.

Tools and methods develop in SMART are being used as the basis for an ongoing follow up project in FW6, OPTIMA.

In parallel, in all case study areas the consortium is seeking opportunities for further applications of the tool and methodology with the local stakeholders identified and on a commercial basis. This is implementing the dissemination plan and continuing cooperation of the partners and joint activities beyond the lifetime of the initial project.

Among them are the continuing support of all on-line tools as demo systems accessible to visitors to the web site, and the gradual conversion of all project Deliverables and results into an innovative on-line format as an eBook including the interactive model and data bases in addition to more traditional reports and presentations.

Publications and papers

SOGREAH (1st Septembre 2004 – 31st August 2005): Article in the network newsletter of the INBO – International network of basin organizations (in English, Spanish and French) “Mediterranean basin - SMART” Dec 2004 – Jan 2005, n°13

Shatanawi, M., Naber G., and Naber, S. (2005): Management of Future Water Supply and Demand for Aqaba City in Jordan . Submitted to WATMED 2, November 2005, Marrakesh.

Fedra, K. & Harmancioglu, N. (2005): A web-based water resource simulation and optimization system. In: Savic, D., Walters, G., King, R., and Khu, S.T. [eds.], CCWI 2005, Water management for the 21st Century, 167-172, University of Exeter.

Fedra, K. (2004): Water Resources Management in the Coastal Zone: issues of sustainability. In: Harmancioglu, N.B., Fistikoglu, O., Dalkilic, Y, and Gul, A. [eds.]: Water Resources Management: Risks and Challenges for the 21st Century. Proceedings of the EWRA Symposium, September 2-4, 2004, Izmir, Turkey, Volume I, 23-38 pp.

Fedra, K. (2004): Coastal Zone Resource Management: tools for a participatory planning and decision mkaing process. In: Green, D.R. et al. [eds.]: Delivering Sustainable Coasts: Connecting Science and Policy. Proceedings of Littoral 2004, September 2004, Aberdeen, Scotland, UK., Volume 1, 281-286 pp.

Shatanawi, M., Al-houri, Z., Freissinet, C., Mensencal, Y., Badran, M. and Manasrah, R. (2004): Tidal Force and Wind Effect on the Hydrodynamics of the Gulf of Aqaba Using TELEMAC-2D . Presented at the INCO-MED Conference, Amman, June 14.

Gul, A. (2004): SMART Sustainable Management of Scarce Resources in the Coastal Zone. Poster presentation at the ECO-IMAGINE OPENING CONFERENCE GI & GIS FOR INTEGRATED COASTAL MANAGEMENT 13th - 15th May 2004, Seville, Spain

El Raey, M.; S. Nasr; O. Frihy; Y. Fouda; M. Elhattab; O. Elbadawy and A. Shalaby (2004): Remote Sensing And GIS For Sustainable Development of The Coastal Area of Abo Qir Bay, Egypt; Submitted to EARSEL Symposium at Dubrovnik, May 2004

Nasr, S., El-Raey, M., El-Shenawy, M., Okbah, M., Absulsoeud, A.,El-Hattab, M., Abdel Khalik, M. (2004): Assessment of Water Quality of Abu-Qir Bay along the Mediterranean Coast of Egypt. Submitted to: EARSEL Symposium at Dubrovnik, May 2004.

Fedra, K. and Abdel-Rehim, A. (2003): SPATIAL ANALYSIS FOR COASTAL ZONE MANAGEMENT: Beyond GIS. Accepted at: CoastGIS'03, Genoa, October 2003.

Khawlie, M. (2004): Remote Sensing in Studying Stress Increase of Land Use Change for Water Resource Management. Presented at the UNOOSA-ESA-Sudan Regional Workshop on the Use of Space Technology for Natural Resource Management, Environmental Monitoring & Disaster Management, Khartoum April, 2004

Papers used at presentations and conferences:

CNTD: « Projet SMART - Sustainable Management of Scarce Resources in the Coastal Zone », poster presented at the Annual days of the Environmental and hydrologic Laboratory of the Tunisian National school of engineers ,June 18th and 19th 2004

Fedra, K. and Abdel-Rehim, A. (2003): SPATIAL ANALYSIS FOR COASTAL ZONE MANAGEMENT: Beyond GIS. Accepted at: CoastGIS'03, Genoa, October 2003.

Freissinet, C. , al-Houri, Z., Mensencal, Y., Shatanawi, M.: Gestion Durable des ressources en Eau en zone Cotier – SMART. Paper presented at the 6th Cannes Water Symposium, Cannes, June 2004

Number of MSc and PhD degrees resulting from work:

1 MSc and 7 PhDs have been trained during the project period.

Conclusion

The SMART project has reached its objectives as originally formulated in the proposal and Technical Annex to the contract.

The results include the direct and immediate contributions to sustainable resources management in the coastal zone in the five case study areas;
But more importantly the development and testing of a methodology was successfully applied in five cases, and thus holds promise for further applications.

At the level of the five case studies, the results met the expectations in general even though there were some surprises like dramatic land use changes in the Abu Kir area. The main result, however, is that the method and tools provided a structured framework to think about scenario of development and alternative strategies for coastal zone and water resources management in a large setting, involving local interest groups, stakeholders and actors beyond the primary research teams. In this awareness building and demonstration of the feasibility of a rational and scientifically based approach using advanced tools of information technology, we see a major outcome.

Even though the use of quantitative tools did create problems and required a difficult learning period in most teams, the project could demonstrate that it is feasible after all, that missing data are not an insurmountable obstacle, and that methods of applied systems analysis as well as the close integration of socio-economic approaches and natural and engineering sciences can work in multi disciplinary teams. In this respect, the experience holds great promise.

Management report

Organization of the collaboration

The project collaboration was implemented as foreseen in the Technical Annex.
A project Management Board with one voting member per partner has been established as foreseen.
The primary format for communication to organize collaboration was through

- The project web site http://www.ess.co.at/SMART/
- The SMART on-line discussion forum
- The smart mailing list (smart@wss.co.at)
- The bi-annual project (management board) meetings.

In addition, a number of bilateral meetings and a training course on coastal water quality modeling were held.
In general, collaboration was smooth and effective, with all partners contributing actively and according to the work plan. Minor communication problems due to technical reasons were easily solved through the redundant communication channels used. Despite national and regional differences in reliability, the electronic media and in particular the project web server have turned out to be very efficient for project coordination and communication.

Meetings

Meeting	Location	Host	Dates
Kick-off meeting	Cairo, Egypt	CEDARE	2003 01 05 - 2003 01 06
1. Board meeting	Beirut, Lebanon	NCRS	2003 06 13 - 2003 06 15
TELEMAC modeling workshop	Grenoble, France	SOGREAH	2003 08 19 - 2003 08 28
2. Board meeting	Izmir, Turkey	SUMER	2003 09 18 - 2003 09 21
3. Board meeting	Aqaba, Jordan	UJO	2004 02 10 - 2004 02 14
4. Board meeting	Tunis, Tunisia	CNT	2004 09 12 - 2004 09 14
WRM/RRM Modeling workshop	Izmir, Turkey	SUMER	2004 12 09 - 2004 12 10

TELEMAC modeling workshop	Grenoble, France	SOGREAH	2005 01 12 - 2005 01 14
5. Board meeting	Grenoble, France	SOGREAH	2005 01 17 - 2005 01 18
WP 10 workshop	Venice, Italy	FEEM	2005 06 23 - 2005 06 24
FINAL meeting	Venice, Italy	FEEM	2005 06 23 - 2005 06 24

Exchanges

No long-term staff exchanges were foreseen in the project.

Individual partner final reports

ESS, Austria

Project Team:

Name	Qualifications
Kurt Fedra	Systems analyst, project manager
Milan Kubat	Computer scientist, senior analyst
Franz Karrer	Analyst, software developer
Farayi Nyamadzawo	System administrator
Ernst Fastl	Software developer
Gustav Grusell	Software developer
Lena Widl	Financial administration
Gabriela Heimhilcher	Project administration

Activities

Meetings attended:.

Meeting	**Date**	**Participants**
Kick-off meeting, Cairo, Egypt	5-6 January 2003	Kurt Fedra
1st Board meeting, Beirut, Lebanon	13-15 June 2003	Kurt Fedra
2nd Board meeting, Izmir, Turkey	15-22 September 2003	Kurt Fedra
3rd Board meeting, Aqaba, Jordan	10-14 February 2004	Kurt Fedra
4th Board meeting, Tunis, Tunisia	12-14 September 2004	Kurt Fedra
DSI Meeting, Ankara	18-21 October 2004	Kurt Fedra
WRM/RRM Modeling workshop, Izmir, Turkey	9-10 December 2004	Kurt Fedra
TELEMAC modeling workshop, Grenoble, France	12-14 January 2005	Kurt Fedra
5th Board meeting, Grenoble, France	17-18 January 2005	Kurt Fedra
WP10 workshop, Venice, Italy	23-24 June 2005	Kurt Fedra

Bilateral working meetings:

Meeting	**Date**	**Participants**
Working session in Venice Developing a common understanding WP 01	31 March - 1 April 2003	Valerie Cogan Roberta Camera Kurt Fedra
Working session in Gumpoldskirchen	8 July 2003	Valerie Cogan Gretel Gambarelli

Review D01 and develop work plan for WP10		Kurt Fedra Sandra Mink
Bilateral Meeting between ESS and UOJ to discuss WATERWARE and other activities	Nov 30- Dec 02, 2003	K.Fedra, M. Shatanawi M. Badran, G. al-Naber, S. al-Naber, Z.al-Houri
Venice coordination meeting	January/February 2004	Kurt Fedra
Amman (with UJO)	19-20 February 2004	Kurt Fedra
Gumpoldskirchen, with UOJ (model training)	14-21 August 2004	K. Fedra, M. Kubat, F. Karrer, M. Shatanawi, S. Al-Naber
Stakeholder Meeting	8 December 2004	Kurt Fedra SUMER Project Team Stakeholders

Other meetings, dissemination:

ESS participated in a bilateral meeting with FEEM in Venice for discussions on WP 01.
ESS hosted a meeting with FEEM staff for discussion or indicators, related to work packages 1,2 and 10.
ESS, in collaboration with CEDARE, has submitted a paper for the international COASTGIS '03 conference, held in Genoa, October 2003.

Tasks and Results achieved

WP00 – Project coordination and administration:
included the setting up of the necessary communication structure with e-mailing list and project web server. Throughout the whole project period communication with the project officer at the Commission and with the project partners was maintained through various media. In light of the projects distributed geographical nature, this primarily relied on electronic communication.
Progress monitoring was based on the coordinators project tracking system, developed with the experience of more than ten projects as coordinator, including previous INCO projects.
Project meetings were organized, starting with a kick-off meeting and the preparation of review meetings. The project meetings were synchronized with the work plan and with major milestones and due dates of deliverables, and rotated among participants locations as much as possible, under the financial constraints of overseas travel expenditures.
All regular reports and deliverables were compiled and submitted to the Commission's project officer as scheduled.

D03 – Analytical tools, models:
A central tool for the scenario analysis that is the basis of the analytical approach of SMART is WaterWare, a river basin scale water resources information system and management model. WaterWare organizes the data describing a river basin in terms of spatial objects. The system provides a set of fully integrated tools or management information system around a core component: WRM. The Water Resources Model is a dynamic mass budget model for water demand and supply that keeps track on a daily basis of water through a set of river basin objects linked in the river network. The model

calculates both a water budget as well as a parallel economic summary, based on the costs of water supply, and the benefits of demands met as well as the costs of not satisfying demands.
In SMART, the primary and in any case initial implementation of the WaterWare system is at a central ASP server, accessible through the web. This would greatly simplify the hardware requirements for the partners, but also make the continuing updates and user support during the development phase easier than a distributed implementation.
In addition to the preparation and documentation of the WaterWare system, two additional model systems for land use change and dynamic socio-economic development in the coastal zone were used. Theory, implementation and data requirements for the land use change model LUC have been placed on the project web server in the technical document section for comments from the case study partners.

D11.1, D11.2 – Dissemination and Exploitation:
The corresponding work package was lead by ESS (Austria), who set up the Web Server and continuously updated the exploitation plans per partner and country.
The SMART project web server is operational since the very beginning of the project, accessible under: http://www.ess.co.at/SMART/
The server area is structured in three domains:

1. Publicly accessible pages that are primarily aimed at dissemination; a description of the project, its objectives, milestones, the on-line accessible or downloadable public Deliverables, and a user interest registration page to help build up a common address data base are examples; direct access to data and rich imagery are designed to make the site more attractive.
2. Publicly accessible pages that contain useful technical background material for the project partners that is deemed of more generic interest and thus open to any and all visitors – detailed descriptions of the case studies, modelling results, GIS data, and an image gallery are examples;
3. Restricted (user name and password) pages that are primarily geared towards the project participants and contain projects internal and administrative material.

The SMART discussion forum is a web-based interactive forum. This is a parallel mechanism to the web site and the mailing group, designed to also involve end-users and any interested outside institution or person.
Going beyond the local networks of major actors and stakeholders, SMART attempts to reach a larger regional and in fact all Mediterranean group.

For this purpose, the following activities have been started:

- Compilation of an address data base, starting with experts and officials in the domain;
- Implementation of a user interest registration page on the project web server that invited on-line registration; people registering the interest in the project are included in a secondary, wide mailing list for specific dissemination activities in the form of an ad-hoc Newsletter.
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In addition, the project planned a much wider, regional and in fact international dissemination through a number of complementary channels such as international conferences, publications, a user group and dedicated newsletters and direct contacts to institutions and initiatives concerned with the Mediterranean environment and coastal zone management.

The Dissemination Plan was continuously updated, and eventually lead to the Dissemination Report (D11.3, lead: FEEM) towards the end of the project, which also includes a summary of the end user feedback to measure the effectiveness of the project's Dissemination activities.

All publications relating to SMART are also published, within the copyright restrictions of the respective publisher, on the SMART web site, as abstract or complete text, on-line and/or for download in PDF format.

A separate Deliverable (D11.4) detailed the exploitation plan and strategies for the project in the Technology Implementation Plan (TIP) which was submitted on-line.

SOGREAH, France

Project Team:

Name	Qualifications
Dr. Catherine FREISSINET	Specialist in hydrology and water pollution Sogreah SMART project manager
Dr. Patrick SAUVAGET	Specialist in hydraulics modeling Sogreah-LHF (modeling division) Manager
René BALLESTER	TELEMAC administration system specialist
Martine MONTEIL	EU project assistant
Géraldine CARA	TELEMAC technician
Yvon MENSENCAL	TELEMAC specialist
Dr. Claude GUILBAUD	TELEMAC specialist
Pierre LANG	TELEMAC training specialist
Laure VINCI and Amandine MUTET	Sogreah- LHF Secretary
Chantal PIOT PILOT	EU administrative and financial assistant
Dr. Jean-Marc USSEGLIO	Vice-President Consulting Branch of Sogreah
Patrick-Yann DARTOUT	International Business Development Manager in charge of the Mediterranean countries

Team members that have partly contributed:

Name	Qualifications
Maurice BOLZE	Water quality expert
Dominique COMBE	Coastal watershed expert
François LUTHEREAU	Socio-economist expert
Bernard YON	Environmental expert
Marc BOISSON	Hydrogeologist specialist
Emmanuelle BERTHELLIER	TELEMAC specialist
Agnès CABAL	SIG and database specialist

Activities

Meetings attended:.

Meeting	**Date**	**Participants**
1st Board meeting, Beirut, Lebanon	13-15 June 2003	Catherine FREISSINET Patrick SAUVAGET
TELEMAC training, Grenoble, France	19-28 August 2003	Catherine FREISSINET Martine MONTEIL Géraldine CARA Pierre LANG Yvon MENSENCAL Claude GUILBAUD
2nd Board meeting, Izmir, Turkey	19-21 September 2003	Catherine FREISSINET Yvon MENSENCAL
3rd Board meeting, Aqaba, Jordan	11-13 February 2004	Catherine FREISSINET Yvon MENSENCAL
4th Board meeting, Tunis, Tunisia	11-16 September 2004	Catherine FREISSINET

	12-16 September 2004	Yvon MENSENCAL
TELEMAC modeling workshop, Grenoble, France	12-14 January 2005	Catherine FREISSINET Yvon MENSENCAL Martine MONTEIL René BALLESTER
5th Board meeting, Grenoble,	17-18 January 2005	Catherine FREISSINET Yvon MENSENCAL Jean-Marc USSEGLIO Patrick SAUVAGET Martine MONTEIL Amandine MUTET

Bilateral working meetings:

Meeting	Date	Participants
AMMAN TELEMAC session with Jordan partners	9 February 2004	Catherine FREISSINET Yvon MENSENCAL

Other meetings, dissemination:

Lebanon from 5th to 7th of August 2003: Mr. Patrick-Yann DARTOUT
Meeting with the Lebanon Water Secretary (Ministry): presentation of the SMART project and discussion on the environmental issues in Lebanon

Meeting with Mr. Jalal Halwani, Manager of the NGO of Tripoli already visited during the 2nd SMART meeting: definition of the pollution issues in the watershed of Tripoli and along the coast (SMART study site)

Meeting in France
Meeting with FFEM (Fonds Français pour l'Environnement mondial) in Paris (French GEF) September 2003: presentation of the SMART project (Catherine Freissinet – Patrick-Yann Dartout).

International Water Symposium – Cannes (France), 28 June –1st July 2004 (Catherine Freissinet)

Project description (French and English) for internal uses

Article in the SOGREAH international letter: sent by e-mail to +1000 governmental and private institutes around the world - July 2004
International Water Symposium in Cannes (France) 28th June – 2nd July 2004" Gestion Durable des Ressources en Eau en zone Côtière – SMART Sustainable management of scarce resources in the coastal zone" Catherine FREISSINET, Zain al-HOURI, Yvon MENSENCAL, Muhammad SHATANAWI
(Oral presentation + paper in the Symposium book)

Article in the network newsletter of the INBO – International network of basin organizations (in English, Spanish and French) “Mediterranean basin - SMART” Dec 2004 – Jan 2005, n°13

Tasks and Results achieved

WP01 – Requirements and constraints analysis:
Tasks within the corresponding work package included:

- Organization of the TELEMAC meeting (12-14th January 2005)
- Organization of the SMART meeting (17-18th January 2004)
- Coordination of the TELEMAC activities for the 5 case studies
- Contribution for different WPs’ reports and EU activity report

WP05 – 09 Case Studies:
SOGREAH implemented the TELEMAC software with the required data, built the modeling grids with each partner and ran a first hydrodynamic and water quality model (with TELEMAC-2D and SUBIEF-2D software) for each case studies.
SOGREAH worked with the different teams in order to help them in the construction and the calibration of their TELEMAC and SUBIEF models. Many e-mails and telephone calls were exchanged in order to help the partners in the TELEMAC model construction and calibration. And SOGREAH organized after (or before) each official meeting a special meeting (one full day) with the host partner in order to work with them on their own TELEMAC / SUBIEF models. A special 3 days TELEMAC session has been organized at SOGREAH-Grenoble from 12 to14 January 2005 in order to help all the TELEMAC modelers who joined with their scenarios’ analysis.
For each team a draft TELEMAC report has been sent to SOGREAH before the Venice meeting (June 2005), the SOGREAH experts sent back their comments on the results in order to allow the partners to elaborate their final TELEMAC report.

WP10 – Comparative Analysis:
Sogreah worked on the definition of the indicators with special emphasis on:

1. Identify the relationship between indicators and models (TELEMAC).
2. Evaluate the indicators suitability according to the models results and scenarios.
3. Development of specific program (FORTRAN) to extract TELEMAC/SUBIEF results and to transform them into environmental indicator.
4. This Fortran program with an explanation report has been given to each case study team in order to apply it to their TELEMAC scenarios.
5. Assistance to the five case study’s team to run the TELEMAC/SUBIEF based indicator and to analyze their results.

WP11 – Dissemination and Exploitation:
SOGREAH worked in close collaboration with FEEM in charge of this WP in order to give them all the information dealing with the dissemination activities of SOGREAH during the 3 years of the SMART project.

D03.2 – Analytical tools, models: Hydrological simulation modeling system:
Basic data sets from the case studies were adapted and installed, accompanied by user training for the TELEMAC system (hydrodynamic and water quality models).

FEEM, Italy

Project Team:

Name	Qualifications
Carlo Giupponi	Agronomist / Co-ordinator
Guido Santini	Agronomist /Project Manager
Roberta Camera	Political Scientist
Gretel Gamberelli	Economist
Valerie Cogan	Geographer /Project Manager
Silvia Bertolin	Administrative
Jacopo Crimi	Environmental scientist
Dora Castiglione	Jurist
Valeria Papponetti	Project administration and Financial reporting
Jaroslav Mysiak	Environmental economist
Camilla Facheris	Environmental scientist

Activities

Meetings attended:.

Meeting	**Date**	**Participants**
Kick-off meeting, Cairo, Egypt	5-6 January 2003	Valerie Cogan Roberta Camera
1st Board meeting, Beirut, Lebanon	13-15 June 2003	Valerie Cogan
2nd Board meeting, Izmir, Turkey	18-21 September 2003	Gretel Gambarelli
4th board meeting (CNT) Tunisia, Tunis	12-14 September 2004	Gretel Gambarelli
5th board meeting (SOGREAH) Grenoble, France	12-14 January 2005	Carlo Giupponi
TELEMAC modeling Workshop (SOGREAH) Grenoble, France	17-18 January 2005	Carlo Giupponi
WP10 Workshop (FEEM) Venice, Italy	22-24 June 2005	Roberta Camera Dora Castiglione Silvia Bertolin

Bilateral working meetings:.

Meeting	**Date**	**Participants**
Working session in Venice Developing a common understanding WP 01, 04 &10	24 - 25 March 2003	Valerie Cogan Roberta Camera Nilgün Harmancioglu Okan Fistikoglu
Working session in Venice Developing a common understanding WP 01	31 March - 1 April 2003	Valerie Cogan Roberta Camera Kurt Fedra

Working session in Gumpoldskirchen Review D01 and develop work plan for WP10	8 July 2003	Valerie Cogan Gretel Gambarelli Kurt Fedra Sandra Mink
Working session in Venice Scenarios development and conceptual framework for the comparative analysis	4. February 2004	Carlo Giupponi Kurt Fedra Nelson Lourenço

Tasks and Results achieved

WP04 – Data compilation and analysis:
FEEM met with partners from SUMER (work package leader) to discuss the data compilation procedures and provide them with guidelines for the compilation of D04 according to the WP10 requirements.

D01.1 – Requirements and constraints analysis:
This report prepared the field for the overall project implementation and appeared to be particularly relevant for the Comparative Analysis scheduled in WP10. In fact, the two case studies with limited data availability pointed out in D01 are the same which made it difficult to compile the complete list of indicators needed for the final Comparative Analysis.

D10.1 - Comparative Analysis:
The activities within this work package have been implemented throughout the whole project duration in collaboration with EIAPT (Portugal). Tasks were:

- To organize the individual case study results in a common conceptual framework of common indicators of sustainable coastal zone development and resource management;
- To analyze the individual case studies within this framework;
- To identify and report common trends and best practice examples.

D11.3 - Dissemination Report – user feedback:
The activities within WP11 (Dissemination and Exploitation) carried out throughout the whole project duration, started with the Project Web Server and the Dissemination Plan prepared by ESS and were completed with the Dissemination Report – user feedback (D11.3) under FEEM responsibility.

EIAPT, Portugal

Project Team:

Name	Qualifications
Nelson Lourenço	Sociologist - Coordinator
Luís Rodrigues	Geographer
Maria do Rosário Jorge	Sociologist
Carlos Russo Machado	Geographer
Patricia Melo	Technician

Activities

Meetings attended:.

Meeting	**Date**	**Participants**
Kick-off meeting, Cairo, Egypt	5-6 January 2003	Luís Rodrigues
2nd Board meeting, Izmir, Turkey	18 – 20 September 2003	Luis Rodrigues
4th Board meeting, Tunis, Tunisia	11-15 September 2004	Luis Rodrigues
5th Board meeting., Grenoble, France	16-18 January 2005	Luis Rodrigues

Bilateral working meetings:.

Meeting	**Date**	**Participants**
Working meeting, Venice	1 April 2003	FEEM
Venice coordination meeting	4 February 2004	Nelson Lourenço
WP 10 workshop (Venice, Italy)	22-26 June 2005	Nelson Lourenço Carlos Russo Machado

Other meetings, dissemination:

May 2003 - (Brussels): Scientific meeting/networking inside European Union

Tasks and Results achieved

D02.1+2 – Socio-economic framework and guidelines:

All the tasks of the WP2 were carried out during these first twelve months of the SMART project. The corresponding deliverable D02.1 (Identification of problem issues) resulted from the problems found by the case study teams to collect data for the socioeconomic analysis, and the issues faced by the partners to apply the methodology.

D02.2 (Guidelines for the socio-economic analysis) was first presented in April 2003, after the kick-off meeting in Cairo. Based on the methodological procedures and lists of data inputs the deliverable was finalized as planned in the Technical Annex.

D10.1 – Comparative Analysis:

The analysis of the case study results were developed in close collaboration with the FEEM team. A list of indicators was discussed during the meeting in Venice (February 2004) and implemented on the results of all case study partners (WP05-09), including both socioeconomic as well as biophysical dimensions of the project.

SUMER, Turkey

Project Team:

Name	Qualifications
Dr. Nilgun Harmancioglu	Specialist in Hydrology and Water Resources Management SUMER SMART Project Coordinator
Dr. Okan Fistikoglu	Specialist in Hydrology, Watershed Modelling and GIS SMART Project Manager
Dr. Sevinc Ozkul	Specialist in Water Resources Management SMART Project Manager
Dr. Yalcin Arısoy	Specialist in Coastal Zone Management and GIS SMART Project Technician
Dr. Filiz Barbaros	Specialist in Water Quality SMART Project Technician
Dr. Esin Ucuncuoglu	Specialist in Marine Environment and Modelling SMART Project Technician
MSc. Ali Gul	Specialist in GIS and Hydrology SMART Project Technician
MSc. Gulay Onusluel	Specialist in Flood Studies and Modelling SMART Project Technician
MSc. Cem P. Cetinkaya	Specialist in Water Quality Monitoring Networks SMART Project Technician

Activities

Meetings attended:.

Meeting	**Date**	**Participants**
Kick-off Meeting, Cairo, Egypt	5-6 January 2002	Nilgun Harmancioglu Sevinc Ozkul Okan Fistikoglu
1st Board meeting, Beirut, Lebanon	13-15 June 2003	Nilgun Harmancioglu Sevinc Ozkul Okan Fistikoglu
Telemac modeling workshop, Grenoble, France	19-28 August 2003	Okan Fistikoglu Ali Gul
2nd Board meeting, Izmir, Turkey	18.-21. September 2003	Nilgun Harmancioglu Yalçın Arısoy Okan Fıstıkoğlu Sevinç Özkul Filiz Barbaros Ali Gül Cem Polat Cetinkaya Gulay Onusluel
3rd Board meeting, Aqaba, Jordan	10.-14.February 2004	Nilgun Harmancioglu Filiz Barbaros

4th Board meeting, Tunis, Tunisia	12-14 September 2004	Dr. Nilgun Harmancioglu Dr. Okan Fistikoglu Dr. Filiz Barbaros MSc. Ali Gul
DSI Meeting, Ankara	18-21 October 2004	Dr. Nilgun Harmancioglu Dr. Okan Fistikoglu
EnviroInfo Conference, Geneva	2004	Dr. Nilgun Harmancioglu MSc. Cem P. Cetinkaya
5th Board meeting, Grenoble, France	17-18 January 2005	Dr. Nilgun Harmancioglu Dr. Okan Fistikoglu Cansen Akkaya (end-user from DSI)
Final Meeting, Venice, Italy	23-24 June 2006	Dr. Nilgun Harmancioglu MSc. Cem P. Cetinkaya

Bilateral working meetings:.

Meeting	Date	Participants
Italy Meeting, (FEEM) Venice, Italy	22-26 March 2003	Nilgun Harmancioglu Okan Fistikoglu
Stakeholder Meeting	8 December 2004	Kurt Fedra SUMER Project Team Stakeholders
WRM modeling workshop, Izmir, Turkey	9-10 December 2004	Dr. Okan Fistikoglu MSc. Cem P. Cetinkaya MSc. Gulay Onusluel Dr. Filiz Barbaros

Other meetings, dissemination:

- Presentation of the project to the Local Agenda 21 partners at the Metropolitan Municipality of Izmir (July 2003).
- Presentation of the coastal modeling issues to the İzmir Municipality Consultant Mr. Mehmet Gulay and discussion on the modeling of the Izmir Bay (August 2003).
- Presentation of the SMART framework to the State Hydraulic Works (DSI) authorities at the DSI regional office in Izmir (April 2003).
- Presentation of the SMART framework to the State Hydraulic Works (DSI) authorities at the DSI General Directorate in Ankara and involvement of a higher degree DSI officer as an observer for project developments (May 2003).
- Poster presentation on "SMART Sustainable Management of Scarce Resources in the Coastal Zone" by Ali Gul (SUMER, TURKEY) at the ECO-IMAGINE OPENING CONFERENCE GI & GIS FOR INTEGRATED COASTAL MANAGEMENT 13th - 15th May 2004, Seville, Spain.
- Invited paper by Nilgun B. Harmancioglu on "Sustainability Criteria in Water Resources Management" presented at the 4th National Hydrology Congress, Istanbul, 23-25 June 2004 (Proceedings, pp.9-18).
- Paper by Cem P. Cetinkaya, Filiz Barbaros and Huseyin Gundogdu on "Determination of Social and Economical Indicators for Future Water Use

Scenarios in Gediz River Basin" presented at the EWRA Symposium on Water Resources Management: Risks and Challenges for the 21st Century, Izmir, Turkey, September 2-4, 2004 (Proceedings, pp.375-384)

- Meeting with the primary end-user of the project in Turkey, i.e., the General Directorate of State Hydraulic Works, in Ankara, May 11-12, 2004 and presentation of the project and the case study on Gediz River Basin in Turkey (the presentation made by Kurt Fedra, Nilgun B. Harmancioglu, Okan Fistikoglu, Sevinc Ozkul, Cem Cetinkaya and Gulay Onusluel).
- A meeting was held at the Water Supply and Sewerage Administration (IZSU) of the Metropolitan Municipality of Izmir on TELEMAC and WaterWare Modeling, which were demonstrated to IZSU authorities upon their request (January 2005). As a result of this meeting, IZSU indicated the intent to develop specific projects on Izmir Bay and the Gediz river basin.
- The major event at the regional level was the organization of a Stakeholder Meeting on December 8, 2004, which brought together local municipalities, NGOs, DSI Regional Office in Izmir and the Provincial Directorate of the Ministry of Environment and all other public and private water agencies. About 120 stakeholders in the case study region (Izmir and the Gediz river basin) participated in this meeting through invitation by SUMER. Problems and management policies relevant to the case study area were discussed in depth by the contribution of all stakeholders.
- The Stakeholder Meeting of December 2004 resulted in the development of a stakeholder database, which is currently available on SMART website held by the coordinator.
- Again at the Stakeholder Meeting of December 2004, SMART Project coordinator, DDr. Kurt Fedra gave a lecture on "Water Resources and Coastal Zone Management: Methods, Tools and Experiences from EU Projects", which initiated interesting discussions among the audience.
- Brochures were prepared for the project in English and Turkish and distributed not only to all the stakeholders at the above meeting, but also to national authorities and agencies (December 2004).
- Questionnaires on water issues were prepared in Turkish and submitted to all stakeholders in the database (January 2005). The results of these questionnaires are also available on SMART website and can be reached online.
- Information on the project is also provided to the Ministry of Environment and Forestry in December 2004 by sending SMART brochures to various departments of the Ministry. A project on the management of the Gediz river basin is also initiated by the Ministry in 2005; and within this context, the Ministry has included the SMART project in its agenda as one of the projects on Gediz, that needs to be closely followed and observed. The Ministry has requested that SUMER provides the results of the Gediz case study
- The Ministry of Environment and Forestry held a workshop in Izmir in July 2005 on the Gediz delta and wetland region. SMART project was also presented at this workshop, as a result of which 6 new projects were identified on Gediz management and SUMER is declared to be one of the major institutions to develop these projects.
- In May 2005, DSI, SUMER and ESS jointly submitted a project proposal to TUBITAK (the Scientific and Technical research Council of Turkey), which will

implement SMART methodology in the Euphrates-Tigris Basin, which is the largest river basin in Turkey.

- Another stakeholder meeting was held at the General Directorate of State Hydraulic Works (DSI), in Ankara with the contribution of DDr. Kurt Fedra, Dr. Nilgun B. Harmancioglu and Dr. Okan Fistikoglu in October 2004. The major issues discussed at this meeting were the possibilities of developing joint projects with DSI on Gediz management and database development, based on experiences in the SMART project.
- Two students are preparing their Ph.D. theses on subjects that use the SMART methodology: the first one deals with multi-criteria analysis for sustainability in the B. Menderes basin in Turkey; the second one particularly focuses on the DPSIR approach.

Tasks and Results achieved

WP03 – Analytical tools, models:
SUMER contributed to the development of the analytical tools and models and participated in training courses of the TELEMAC model

D04.1 – Data compilation and analysis:
The deliverable was finally completed during the last project period as scheduled, whereas a draft version has already been submitted to the Commission's project officer at the end of the second project year

D05.1 - Case Study Report (Turkey):
The objectives of the corresponding work package were to implement and test the common and jointly developed methodology of SMART, and provide specific feedback from the local experience and know-how in the selected case study area, which covers the Gediz River Basin and the Izmir Bay along the Aegean coast of Turkey. This builds in particular on the extensive experience of DEU SUMER in a number of regional water resources management studies of the coastal zone around the City of Izmir and the neighboring Gediz Basin.
The tasks undertaken in WP 05 covered:

- Implementation of the tools (WP 03) with the data compiled in WP 04;
- Setting up the end-user institutions network
- Definition of coastal zone and river basin scenarios and policy instruments
- Scenario analysis (design, simulation, analysis and assessment)
- Dissemination to and through the user group network, analysis of feedback.

NCRS, Lebanon

Project Team:

M. Khawlie, G. Faour, M. Awad, A. Shaban, T. Haddad, M. Basbous, C. Abdallah & assistance from 3 technicians.

Activities

Meetings attended:.

Meeting	Date	Participants
Kick-off Meeting, Cairo, Egypt	5-6 January 2002	M. Khawlie
1st Board meeting, Beirut, Lebanon	13-15 June 2003	6 staff from NCRS & several administrative assistants
2nd Board meeting, Izmir, Turkey	18.-21. September 2003	M. Khawlie
3rd Board meeting, Aqaba, Jordan	10.-14.February 2004	M. Khawlie
4th Board meeting, Tunis	12.-14.09.2004	M. Khawlie, M. Awad
WRM/RRM Modelling workshop, Izmir	9./10.12.2004	A. Shaban
Telemac modelling workshop, Grenoble	12.-14-01-2005	M. Awad
5th Board meeting, Grenoble	17./18.01.2005	M. Awad
Final Meeting, Venice	June 2005	M. Khawlie

Bilateral working meetings:.

Meeting	Date	Participants
Telemac training, (SOGREAH) Grenoble, France	19-28 August 2003	M. Awad, M. Basbous

Other meetings, dissemination:

A public meeting was organized with the Municipality of Tripoli on September 2 in the presence of the North Water Authority & representatives from NGOs, universities, syndicates, & CSOs. The main purpose was to expose the outcome & progress of SMART work in the area, through open discussions & dialogue rather than a formal presentation (at the request of the Municipality Council). Major theme focused on environmental management and improving water availability.

M. Khawlie participated in a UNOOSA Workshop at Khartoum, Sudan, on April 4-7, focusing on the Use of Space Technology for Natural Resource Management, Environmental Monitoring & Disaster Management where he gave a presentation titled "Remote sensing in studying stress increase of land use change for water resource management - Lebanon" that depended on data/work for the Lebanese case study SMART that is duly acknowledged.

Tasks and Results achieved

WP00 - Project coordination and administration:
NCRS maintained on-going communication with project partners & coordinator, as conditions required, in view of information demand, monitoring of its quality & exchange for project implementation, as well as secured all necessary organizational arrangements including compilation, case study reporting, completing application of modeling, & supplying cost statements and progress reports.

WP01 - Requirements and Constraints Analysis:
Tasks were completed as follows:

- Lists: issues, problems, policy-relevant information
- Documenting data requirements of required methods
- Help in data analysis
- Help in explaining constraints & alternatives

WP02 – Socio-economic framework and guidelines:
Work carried our within this package:

- Supplied data on population, demography …
- Supplied data to help analyze policies and economic options for water use
- Supplied data to help analyze water demand, the urban-rural interface plus sectoral projections
- Supplied data to help analyze water economics vis-à-vis water resources, water pricing & sectoral coping with change

WP03 – Analytical tools, models:
This includes both the WaterWare Modeling (on water resources) and Telemac modeling (on river-sea physical & pollution conditions). Runs were completed for both and included in the Final Report on Case Study, and were presented during the last Management Meeting in Venice. For Telemac, all input data from Business As Usual, Optimistic, and Pessimistic scenarios were run.
For WaterWare, the three Model modules: Water Resources Model, Rainfall Runoff Model, and the Land Use Change model were run and completed taking some examples of change and the different scenarios values as above.

WP11 – Dissemination and Exploitation:

Dissemination	Exploitation
1. At National Level - contribute data to general scheme on land use planning, i.e. DTM, Drainage, Soil, Land use/cover, Change detection, Hazards Data are given to “Council for Development & Reconstruction” (Dr. W. Charafeddine) through contribution to the Comprehensive Land use Planning Project in Lebanon, subcontracted by “Dar Al-Handasa” Consultants (Dr. S. Srour), & IAURIF (Dr. F. Awada) e-mail: iaurif.fa@dargroup.com	The planning authorities are using that for analysis of requirements for comprehensive land use plan
2. At Municipal Level - contribute all maps and attribute data	The authorities put data in their GIS server, & use them for

The GIS Center – Environmental Observatory of the Union of Municipalities of the North (Mr. A. Abdulwahab, Head) e-mail: tripoli@tripoli.gov.lb	service, i.e. – other purposes
3. Environment - supply Ministry of Environment, especially coastal area people, with relevant data: several sectors of different interests, general coordinator M. L. Chamas, e-mail: lchamas@moe.gov.lb	They will use them to supply their coastal programs
4. Water authority - supply Regional water authorities with relevant data as available Dr. J. Krayim, General Director, North Lebanon Water Authority, Fax (961.6) 430075	They are useful for several administrative & water balance purposes
5. Scientific A PhD student is part of our staff (Mr. Basbous) carrying on his research focusing on themes & approaches of SMART project Mr. Basbous is carrying on work for his PhD (at Marne la Vallée University – France), his e-mail is: basbous_mo@hotmail.com	For scientific purpose
supply local researchers with needed data Dr. J. Halwani: Lebanese University, e-mail: jhalwani@cyberia.net.lb Mr. K. Nabbout, another student doing his PhD at Dresden University of Technology (Germany), his e-mail: khalednabbout@hotmail.com - NGO: Environment Protection Committee, Mr. Amer Haddad, President, e-mail: pipoo98@hotmail.com	They put them on their databases &/or GIS servers as part of their Regional information system
- contribute to thematic networks of relevance The Euro-Mediterranean project MEDCOASTLAND net Another similar network: MedWaterLand net The Mediterranean network MERSI web	Good spread of knowledge, exchange & networking
Public seminar with the North Municipalities & water authorities plus others (July, 2004) Another public seminar to expose the results is planned for Sept. or Nov. 2005	Knowledge community spread & supply of information
contribute to scientific workshops or conferences as they emerge (when convenient) & we are aware of them: - Remote sensing in studying stress increase of land use change for water resource management – Lebanon. UN/ESA Sudan Regional Workshop on the Use of Space Technology for Natural Resource Management, Environmental Monitoring & Disaster	Spread of scientific knowledge

Management. Khartoum – Sudan, April 4-8, 2004 - Environmental water management through clustering to improve water availability in coastal Mediterranean areas, Tripoli – Lebanon. Scientific paper sent to the Water Resources Management Journal for publication. - This research paper is going to be presented also at the WaterMed 2 Conference to be held in Morocco (Nov. 2005) - Modeling Lebanese sea coast water quality using TELEMAC and GIS. This research paper is going to be presented at the 6th Arab GIS Conference - Cairo, 12-13 September 2005.	

D07 – Case Study Report (Lebanon):

The study area comprised Tripoli, the second largest city in Lebanon along the eastern Mediterranean with a population of around 400000. It is the end journey of the Abou Ali river which drains about 482 km^2 of watershed (Fig. 1). The city lies in a small plain at the foot of a plateau with three tributaries of Abou Ali. The plateau, and the three tributaries, grade quickly up the steep slopes into Mount Lebanon chain to heights exceeding 1500 m where their major springs occur. Thus, within a short distance one is going from humid warm to dry and temperate. This nature, with sudden changes in topography as well as climate, induces socio-economic stresses on the community, which is scattered in lots of rural settlements, related to land exploitation and resource management.

UJ FOA, Jordan

Project team:

Name	Qualifications
Dr. Muhammad Shatanawi	Specialist in Hydrology and water resources
Dr. Mostafa Qrunfleh	Horticulture Specialist
Dr. Mohammed Badran	Aquatic Ecosystem and Environmental Specialist
Ms. Zain al-Houri	Hydraulic Engineer (M.Sc.)
Ms. Ghada al-Naber	Ph. D. student in Resources Management
Mr. Thair al-Momani	Hydrologist (M.Sc.)
Ms. Sawsan al-Naber	Irrigated Agriculture Specialist
Mr. Sami Shoubaki	Casual Labor

Activities

Meetings attended:.

Meeting	Date	Participants
Kick-off meeting, Cairo, Egypt	5-6 January 2003	Mostafa Qrunfleh
1st Board meeting, Beirut, Lebanon	13-15 June 2003	Muhammad Shatanawi Zain al-Houri Ghada al-Naber
TELEMAC modeling workshop, Grenoble, France	19-28 August 2003	Zain al-Houri Thair al-Momani
2nd Board Meeting, Izmir, Turkey	18-21 September 2003	Dr. Shatanawi & Dr. Badran
3rd Board meeting, Aqaba, Jordan	10-14 February 2004	M. Shatanawi, M. Qrunfleh, M. Badran, Z. al-Houri, G. al-Naber, T. al-Momani, S. al-Naber
4th Board meeting, Tunis, Tunisia	12-14 September 2004	Muhammad Shatanawi
Comparative analysis workshop	22-25 June, 2005	Muhammad Shatanawi Sawsan al Naber

Bilateral working meetings:.

Meeting	Date	Participants
Bilateral Meeting between ESS and UOJ to discuss WATERWARE and other activities	Nov 30- Dec 02, 2003	K.Fedra, M. Shatanawi M. Badran, G. al-Naber, S. al-Naber, Z.al-Houri
Bilateral Meeting between SOGREAH and UOJ to discuss TELEMAC model	Feb 08-10, 2004	C.Freissinet, Y.Mensencal M. Shatanawi, Z. al-Houri
Gumpoldskirchen, with ESS (model training)	14-21 August 2004	M.Shatanawi, S. Al-Naber
WRM modeling workshop, Izmir, Turkey	7-11 Dec. 2004	Sawsan alNaber Ghada alNaber

Other meetings, dissemination:

- Visit Aqaba Governorate (three times) to meet with main stakeholders, namely; General Director of ASEZA, Mayor of Aqaba, Governor of Aqaba District, Managers of Industrial Firms, Water Resources Department... etc.
- Prepare with the Royal Geographic Center, a digital elevation model.
- Plan for an awareness campaign with Jordan Environmental Society (JES)-Aqaba Branch regarding environmental issues in Aqaba.

Tasks and Results achieved

Inputs for WP03 (TELEMAC, WRM, and the LUC model were completed), WP04 (Jordan data were compiled and sent to SUMER) and WP11 (data completed and included in the final report).

D08 - Case Study Report (Jordan):

Jordan is a semi-arid country situated near the southern coast of the Mediterranean and is located between latitudes of 29^{o} N to 32^{o} N and longitudes of 25^{o} E to 39^{o} E. The country is bordered by Syria to the North, Saudi Arabia and the Gulf of Aqaba to the south, Israel and Palestine to the west and Iraq and Saudi Arabia to the East. The total area of Jordan is about 89,342 km^{2}; out of which 560 Km^{2} as inland water mainly the Dead Sea and the Gulf of Aqaba.

According to the Water Stress Index (WSI), Jordan is classified in the category of “Absolute Water Scarcity”. The water problem is not only limited to shortage of water but the quality issue is rising. These problems are most pronounced in the south eastern part of the country where the Gulf of Aqaba is located. To solve the problem of water, non-renewable groundwater from nearby Dissi Aquifer is being transported to Aqaba.

CEDARE, Egypt

Project Team:

1. Prof. Mohamed El Raey - Team Leader
2. Prof. Samir Nasr
3. Prof. Omran Frihy
4. Prof. Yasser Fouda
5. Dr. Mamdouh El Hattab
6. Dr. Omar Elbadawy
7. Dr. Ahmed Shalaby
8. Eng. Wesam Ahmed

Activities

Meetings attended:.

Meeting	Date	Participants
Kick-off meeting, Cairo, Egypt	5-6 January 2003	Prof. El Raey, Prof. Samir Nasr, Omran Frihy
1st Board meeting, Beirut, Lebanon	13-15 June 2003	Prof. El Raey
Telemac modeling workshop, Grenoble, France	19-28 August 2003	Dr Omar Elbadawy
Board meeting, Aqaba, Jordan	8-10 February 2004	Prof. El Raey
Board meeting, Hammamet, Tunis	11 – 13 September 2004	Prof. El Raey, Dr. Omar Elbadawy
Board meeting, Venice, Italy	23 – 24 June 2005	Prof. El Raey, Dr. Omar Elbadawy

Bilateral working meetings:.

N/A

Tasks and Results achieved

D06 – Case Study Report (Egypt):

Abu Qir Bay region of the Mediterranean coast of Egypt includes Abu Qir Bay, Rosetta branch of the River Nile, Lake Edku and adjacent region bounded from the south by Mahmoudia Canal. The canal supplies the region and Alexandria City with fresh water

from the Rosetta branch of the River Nile. A number of historic cities and large areas fertile agricultural land are included and are undergoing large unplanned changes.

Extensive industrial, agricultural and domestic pollution in the area is an important factor contributing to deterioration of environmental conditions. The region is considered an important underutilized resource of agriculture, tourism and industrial production in Egypt. However, the shortage of institutional capabilities for planning, monitoring, assessment and pollution control in addition to lack of awareness among stakeholders, have rendered this region into a highly degraded and deteriorating environment.

CNTD, Tunisia

Project Team:

Name	Qualifications
BEN AMOR Salah	Geology specialist
AMRI Mohamed Ali	GIS and Remote sensing specialist
KOCHLEF Monia	Marine ecosystems and environment specialist
CHOUAYA Ali	Geology specialist He is preparing his Master in the frame of SMART project Subject: Environment and hydrologic modeling Institution: Tunisian National school of engineers.
RIAHI Mounir *	Remote sensing specialist
EZZINE Ahmed *	Geosciences specialist
Najeh SAYAH **	Geo-resources and environment specialist He prepares his Master in the frame of SMART project Subject: Lineamentary study of Sahel region using GIS & remote sensing Institution: University of SFAX Tunisia.
M. Ben MOUSSA	Technician

* new member (joined the SMART team in June 2003)

** new member (joined the SMART team in January 2004)

Activities

Meetings attended:.

Meeting	Date	Participants
Kick-off meeting, Cairo, Egypt	5-6 January 2003	BEN AMOR Salah AMRI Mohamed Ali KOCHLEF Monia CHOUAYA Ali
1st Board meeting, Beirut, Lebanon	13-15 June 2003	AMRI Mohamed Ali KOCHLEF Monia
TELEMAC modeling workshop, Grenoble, France	19-28 August 2003	CHOUAYA Ali
Water Ware Training, Turkey	Dec. 2004	N. SAYAH A. EZZINE, A. CHOUAYA
4th Board Meeting, Hammamet, Tunis	Sept. 2004	N. SAYA, A. EZZINE, M.B. MOUSSA

Bilateral working meetings:.

N/A

Other meetings, dissemination:

- Tunisian kick-off meeting: December 18th, 2002: Project's presentation to different specialists (scientists, bureaucrats) and persons in charge of the regional administrative units (commissariats) of agricultural development.
- Presentation of SMART objectives, methodology, and expected results during the scientific council* May 19th 2004
  *: CNTD + external scientists (universities, public institutions, ministries)
- Annual days of the Environmental and hydrologic Laboratory of the Tunisian National school of engineers : Presentation of SMART project + poster, June 18th and 19th 2004 (CHOUAYA Ali, EZZINE Ahmed, Najeh SAYAH)

Tasks and Results achieved

D09 - Case Study Report (Tunisia):

During the last decade, the Mediterranean basin and specially the costal zones faced several kinds of environment degradation. The coastal zones of Hammamet were dominated by the urban and touristic infrastructure extension. We can also notice an increase in the agriculture and industry development that involves an overexploitation of water resources. Then, this development affects and aggravates the sensitiveness and the vulnerability of this fragile ecosystem.
Thus, the management of the coastal ecosystem environment needs a global comprehension of the relationship between coastal resources, their employment and their evolution.

The increase of tourism and industrial activity involve conflicts in the consumption of water resources and area. This pressure affects the natural environment by hydrous rejects, hazardous substances, atmospheric pollution, land uses and surface and ground water consumption and supply. This is more and more emphasizing by the agriculture, industry, tourism and social activities.

This overexploitation could affect the biological and chemical water quality.

Annexes

Other relevant information

All project results, Deliverables, reports and publications, meeting agenda and presentations, data bases, model tools and auxiliary data bases and communication tools such as the discussion forum are available on-line linked from the project home page under **http://www.ess.co.at/SMART**.

Meeting reports

All meeting reports for the project meetings (kick-off meeting, Board meetings, workshops) together with the corresponding presentations are available on-line at http://www.ess.co.at/SMART/

Completed catalogue page

Summary:

SMART, dedicated to Sustainable Management of Scarce Resources in the Coastal Zone, has successfully developed and tested an integrated approach to natural resources management in the Mediterranean coastal zone.

Starting with the analysis of problems and issues in five case study areas around the Eastern and Southern Mediterranean (Turkey, Lebanon, Jordan, Egypt, Tunisia) which provided a rich and diverse set of test cases with widely varying physiographical and socio-economic conditions. Problem analysis in each case included the direct and early involvement of stakeholders and major actors in each region. Based on the major problems identified, the project applied a set of simulation models to explore a range of scenarios for each river basin and coastal region.

Scenario analysis was based on the initial socio-economic data and local actor perceptions, using indicators of sustainable development organized in a DPSIR framework. The scenarios, concentrating on water resources, coastal water quality, and land use change, were designed to explore the range of possible futures: starting with a baseline to represent the status quo and calibrate the common tools, scenarios with a time horizon of 25-30 years were designed for business as usual, and an optimistic as well as a pessimistic case for each location.

Scenarios were based on consistent sets of assumptions of socio-economic development, and translated into model runs that generated estimates for basic indicators such as overall and sectoral demand/supply ratio for water, reliability of supply, and coastal water quality. Land use specific resource consumption aggregated from the parallel Land Use Change model runs were used to cross-check the results of the water resources model.

Differences between the individual scenarios for the main indicators ranged from meeting the objectives of balanced, reliable and sustainable supplies to pronounced deficits of more than 50% with a reliability of supply as low as 55% (based on daily supply targets). The basic pattern of conflicting demands between agriculture as the major water user, and the urban-industrial areas and increasingly infrastructure for tourism as well as environmental water demand such as the wetlands in the Gediz Delta or in the Abu Qir region can be observed in all cases, even though in different proportions. Increased efficiency and alternative allocation patterns due to savings in agricultural water demands can contribute towards more sustainable resource use.

The final step of the analysis was a multi-criteria comparative analysis of the scenarios.
It clearly demonstrated the potential for sustainable solutions, given the range of possibilities between the different sets of assumptions on socio-economic driving forces, but also regulatory and economic measures. With the optimistic cases it can be demonstrated that sustainable water resources management in the coastal zone is feasible with a well balanced set of regulatory and technological instruments. The results are being disseminated to the stakeholders that have contributed to the original problem formulation and scenario definition in each case. In addition, the test cases, case study results, and the on-line tools and data bases together with all project deliverables and

related reports, papers, presentations, and scientific publications are available on-line for a wider audience at the project web site at http://www.ess.co.at/SMART.

Results achieved:

The project has produced direct contributions in the five case study areas, where the results of the scenario analysis are being disseminated to the local stakeholders and actors according to the dissemination plan. A major achievement in all cases is the awareness for modern scientifically based planning methodology that was raised among the local actors and stakeholders through their continuing involvement in various phases of the project and local meetings.

In addition, the tools and methods developed and tested successfully in the five case studies are being made available together with the underlying data bases and all reports and Deliverables produced as interactive demos and on-line documents on the project web server, maintained beyond the project duration. Through this dissemination activities, a follow up project in China with the Yangtze Water Resources Commission that is now applying selected tools developed in SMART has been initiated. Several other follow up projects with different groups of partners are under discussion or in preparation.

Finally, the project has led to the establishment of a network of institutions and individuals involved in natural resources management and integrated coastal zone management that goes well beyond the initial research teams.

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Data sheet for final report

(to be completed by the co-ordinator for the whole project)

1. Dissemination activities	Published	Submitted
Number of communications in conferences		29
Number of communications in other media (internet, video,…)		7
Number of publications in refereed journals	5	
Number of articles/books	2	
Number of other publications	3	

2. Training	
Number of PhDs	7
Number of MScs	1
Number of visiting scientists	
Number of exchanges of scientists (stay longer than 3 months)	

3. Achieved results	
Number of patent applications	
Number of patents granted	
Number of companies created	
Number of new prototypes/products developed	
Number of new tests/methods developed	4
Number of new norms/standards developed	
Number of new software/codes developed	7
Number of production processes	
Number of new services	
Number of licenses issued	

4. Industrial aspects

Industrial contacts	yes	☒	no	☐
Financial contribution by industry	yes	☐	no	☒
Industrial partners : - Large	yes	☐	no	☒
- SME	yes	☒	no	☐

5. Comments

N/A