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SCENES

Water Scenarios for Europe and for Neighbouring States

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Thematic priority: Global change and ecosystems

DIA2.1
Descriptions of the Regions and the Pilot Areas

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DIA2.1
Region and Pilot Area Descriptions

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1. Objectives and Selection of Case Study Regions

The development, and above all application, of the SCENES scenarios needs evaluation and verification of methodologies and model results. Selected case study regions represent a large spectrum of natural and anthropogenic conditions that govern regional water use and availability now and in the future. The case study regions provide pilot areas for data consolidation, scenario evaluation, impact assessment and the analysis of pan-European to regional tele-connections. In addition this work package aims to facilitate information exchange, regional dissemination, as well as dialogue and partnerships between specialists working at the pan-European, regional and pilot area scales.

In line with the overall objective of SCENES to realise a multi-scale scenario study, the work in the case study regions is carried out at the regional and at the pilot basin level. It allows the integration of scenarios development from the pan-European to the regional and pilot area scale. The overall objective of this work package is to 1) Evaluate the pan-European scenarios and their impacts at the regional and pilot area level and 2) Enrich the pan-European scenarios with information and trends from the local and regional level.

More specifically the case study regions will in close collaboration with the other workpackages (WPs):

- consolidate data and information for regional and pan-European modelling (in collaboration with WP1)
- serve as test beds for evaluation of SCENES scenario building, in for example, regionalisation of pan-European scenarios and to feed pilot area observations into a pan-European analysis (in collaboration with WP2)
- provide key contribution to the development of a water resources & water scenario assessment modelling framework, which will be compatible between pan-European, regional and basin scales (in collaboration with WP3)
- participate in the impact assessment of the scenarios and their translation into regional and local level indicators (in collaboration with WP4)
- facilitate the dialogue and scenario dissemination amongst policymakers and stakeholders through the co-production of scenarios, support studies and training (in collaboration with WP5)

The SCENES regions have been selected to represent a broad range of climatic, hydrological, economical and political situations as well as the major drivers of Europe's water future. The regions selected were designed to cover different geo-political settings, which will have an important effect on water availability and use of these regions in the future. There is 15-fold difference in per capita income, and significant difference in water infrastructure and use, reflecting a wide range of impacts of changes in water availability. Examples of key drivers and European tele-connections that determined the selection of case study regions included

(i) changes in the EC Common Agriculture Policy (CAP), like reduction in agricultural subsidies, can have a major impact on water situation in the large region of EU Mediterranean countries,

(ii) a prospectus of Turkey and may be Ukraine to join the EU will impact water resources planning and management in the country, as a consequence of complying with water-related EU policies and directives, and with EU sectoral economic development strategies, and

(iii) an increased risk of a high level climate impacts in Southern Mediterranean and Northern Africa, such as persistent severe drought occurrence, may bring about large economic, migration and even social unrest changes in a large EU region.

(iv) size-enlargement, privatisation and globalisation of water-utility businesses, especially the drinking water sector:

These examples of key drivers and the selection criteria applied have resulted in the selection of four case study regions: The large Mediterranean region (including North Africa and Turkey), the Eastern Baltic region, the lower Danube region, and the Black Sea region with the River Don as its most Eastern boundary. Within each region at least two pilot areas have been identified to study key water issues and trends in more detail and to be specific enough to link to ongoing planning processes. In addition to the Pilot Areas for one case study (East-

ern Baltic Region) scenarios are developed also with a regional perspective. Figure1 illustrates the case study regions and their main scope. In Figure 2 the selected Pilot Areas are displayed on the pan-European map.

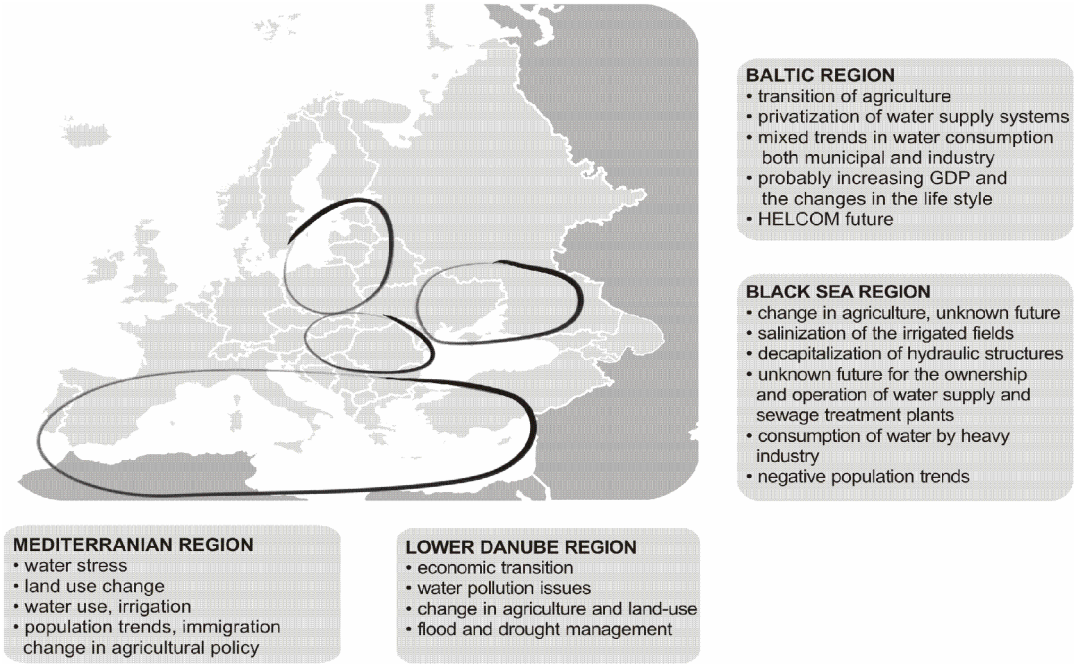

Figure 1: Case study regions and their scope within the SCENES project.

The work package IA2 is very challenging with respect to its coordination and management. With the four case study regions and 11 Pilot Areas the areas represent a great variety of issues and stakeholders. A considerable effort was devoted for planning and developing the management structure of the WP, as well as for harmonizing the activities across the regions and Pilot Areas. Due to the extent of the IA2 and its variability each case study has been assigned a case study coordinator, who is also a member of the Project Board (SCENES management body). Each Pilot Area has been assigned a contact person who oversees the work in the Pilot Area and serves as the contact to other WPs of SCENES. From the scenario team (responsible for the development of the scenarios) a support person has been nominated for each Pilot Area to provide necessary support to the participatory Pilot Area specific scenario development process.

This document provides a description of the Regions and their Pilot Areas, and the major challenges and issues to be tackled in those areas within the coming decades.

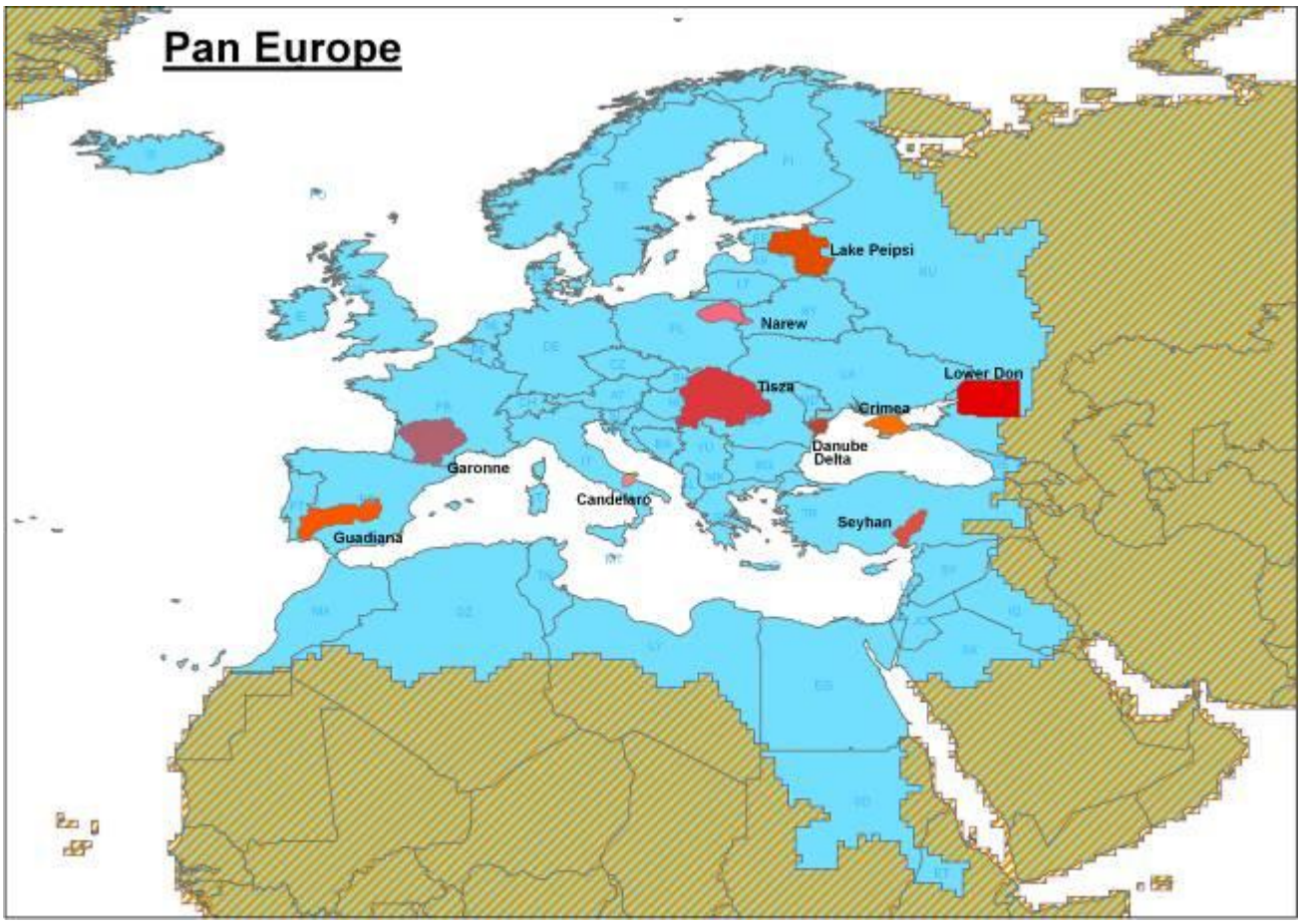

Figure 2: Phase I 'Fast-track' extension of pan-Europe and Pilot Areas identified (source: CESR).

2. Region and Pilot Area descriptions

A: Black Sea Region

A.I Geographical description region

Ukraine and southern Russia lie in a temperate climatic zone influenced by moderately warm climate. Winters in the west are considerably milder than those in the east. In summer, on the other hand, the east often experiences higher temperatures than the west. Precipitation is uneven, with two to three times as much falling in the warmer seasons as in the cold. Maximum precipitation generally occurs in June and July, while the minimum falls in February. Western Ukraine, notably the Carpathian Mountains area, receives the highest annual precipitation- more than 1,200 millimetres. The lowlands along the Black Sea, in the Crimea and in the eastern parts of the region, by contrast, receive less than 400 mm annually. The remaining areas of the region receive on the average 400-650 mm of precipitation annually.

A.II Institutional setting, including political and administrative setting

Taking into account the transition economy of countries, which are allocated within the region (Ukraine, Russia) the main driving forces for the future of water(s), will be reforms in water and land management. The processes of decentralization of water management, irrigation management transfer and privatization of water infrastructure together with land reforms and general social - economical transformation to the market economy will be a basic force for developments of water scenarios for this region. The mentioned transformations will call for institutional and legislation changes, which should be adopted, with respect to the European WFD and other EU

documents, to the cultural, economical and infrastructure particularities of the region. The investments in water infrastructure and management will depend from the way and duration of reform processes.

Regional transformation processes in water and land management should also be linked with general EU policy developments. The enhancement of the European Union will influence water and land management policy in the region. The development of EU nature resources policies - due to global climate changes and expected decline in agriculture subsides - will have an effect on new agricultural market developments and will increase investments. So, reforms in the region will be interrelated with EU developments. These interrelations are taken into account as a driving force on a higher level, which will link regional and Pan- European water scenarios.

A.III Socio economic situation

The southern part of the Black Sea catchment area is intensively used for agriculture including irrigation in all parts of Ukraine and Russia. Agriculture has to fight with regular droughts and therefore requires irrigation. Irrigation installations are however outdated, require much energy and investments leading to decreased incomes of the rural population. Main driving forces in both countries are industrial enterprises building the main potential financial source for the economy of Ukraine as a whole and Russia.

A.IV Key water related issues & trends

The transformation process in the NIS countries is driven by land privatization and new decentralized management of water resources. This requires completely new structures and investments. Both are calling for cooperation of farmers, water users and their associations and local administration entities. Sustainable new concepts have to look for possibilities of profitable investments. Considering the huge potential for energy and water consumption economy, it can be supposed that financing economy measures would have by far the best cost-use effect. Implementing new economy measures (techniques and management) should be a main challenge for the years to come.

A.V Selection of Pilot Areas

The two selected pilot areas are situated in the Ukrainian and Russian Eastern lowlands as defined as eco-regions in the Water Framework Directive (WFD). The Crimean peninsula and the Lower Don were selected as pilot area because the needs for the future are especially visible here. Water quality problems for example, but also air pollution and high energy consumption are obvious and known since decades. The financial circumstances must be considered as difficult. If the positive effects of sustainable measures can be demonstrated including profitability, this will have a signal function to many other regions not only in Ukraine/Russia but in the whole of East Europe.

Pilot Area A.1: Lower Don Basin in Russia

Selection criteria

The main reasons for choosing the Lower Don River basin as a pilot area (in the Black Sea Region) are:

- one of the great rivers of Azov-Black Sea basin;
- possibility to develop region scale scenario (and methodology) with consideration of socio-economic, management and institution peculiarities of former USSR country (it would be good example to disseminate within CIS);
- possibility to enrich pan-European scenarios within specific conditions;
- one of the main Russian industrial and agricultural regions with good development prospects (actual annual growth is about 8%);
- intense household, industry and agriculture impact on water bodies;
- scarcity and deterioration of water resources;
- importance of transboundary aspects (Russia-Ukraine: Seversky Donets and Kundruchya rivers);
- sufficiency of data and adequacy of experience with scenario development (Integrated Basin Resources Management and Protection Plans etc).

Description of Lower Don River basin

The Don River source lies in the northern edge of the Middle-Russia highland. The river flows for 1870 km and enters the Taganrog Bay of the Sea of Azov. The River Don catchment area is 422 thousand km^2. There are 18 administrative units ("Oblasts") that are fully or partially situated in this area, occupying 87.4% of the basin's territory. Further, the Kharkov, Lugansk and Donetsk oblasts of Ukraine occupy 12.6% of the basin area. This territory belongs to the most densely populated and economically developed regions of Russia. Here, the problem of water supply is one of the most important. The Don River basin features well developed industry, intensive agriculture and high number and density of population, totalling 20 million inhabitants, 13 million of which live within the Russian territory, accounting for a density of 35.3 per 1 km^2 - 4 times more than the country average. The river water volume at the lowermost point averages 27.7 km^3 (20.4 km^3 for medium low water years and 13.7 km^3 during low water years).

Figure A.1: Pilot Area: Lower Don river basin boundaries.

The Rostov oblast in the lower basin is one of the largest in terms of economical potential: it is within the top ten industrial producers and the second in terms of agricultural production. The extent of water resources supply there is 33 thousand m^3 per km^2 of area.

The multipurpose use of water resources within the Don River basin has developed historically and consists of the following components:

- Water supply for the main branches: industry (including heating and nuclear power plants), drinking water for the population, agriculture including irrigation of pastures;
- Fisheries (natural and artificial reproduction of fish, commercial fish pond farming);
- transport;
- hydro-electric energy production;
- Ecological needs (provision of minimal sanitary/ecological flow conditions of the Don and Seversky Donets River and residual rivers inflow to the Sea of Azov).

The leading branches of the basin's economy are as follows: heat energy production (coal mining and natural gas industry), metallurgy, chemical industry, wood processing and pulp mill industries, production of consumer goods (light industry, processing of skins and shoe production), producing of building materials, food processing industry, agrarian-industrial complexes. The factories belonging to these branches are the largest water consumers and sources of solid, liquid and gaseous wastes.

Pressures

The lower Don basin provides the main water resource within the oblast. Recently, anthropogenic extraction of water from the riverine system exceeded 60% of natural water discharge and was almost 2 times higher than the reserves of surface water formed on the oblast territory. Recently, there an obvious shortage of local water resources came up. The main water consumers are industrial enterprises (about 47%) and irrigated agriculture (27%). The share of water consumption for municipal purposes is about 8%, for agricultural water supply it is about 3% and for all other purposes 15%.

The discharge of waste water into the lower Don water body totals about 1/3 of the natural water discharge during low water years. The main sources of pollution of surface waters in the low Don River basin are:

- Waste water of municipal and industrial origin;
- Drainage water from irrigated agricultural fields (pesticides and fertilizers)
- Storm-water run-off

- Non-point pollution sources;
- Toxic substances produced in the river and its reservoirs in consequence of water loads.

A summary of main pressures in the Pilot Area is given in Table A.1 and the most important stakeholders in Table A.2.

Table A.1: Main pressures for various water use types in the lower Don river basin.

Pressures	Water Use Types						
	Household	Irrigation	Fish-breeding	Industry	Shipping	Recreation	Ecological services
Water scarcity	+	+	+	+	+	+	+
Flooding						+	
Salinization	+	+		+			
Contaminant pollution	+	+	+	+		+	+
Eutrophication	+		+	+		+	+

Table A.2: Stakeholders within the Lower Don Pilot Area.

Actor	Identified organisations and people
Authorities involved in river basin management (note the representatives of different committees)	Don Basin Water Management Authority;
	North-Caucasus Hydromet;
	Rostov Oblast Administration, Env. Committee (Rostov)
Other relevant authorities and public officials (note different policy sectors at different policy levels)	Department for technological and environmental Supervision (Rostekhnadzor) for the RO;
	Department for Nature Use (Rosprirodnadzor) for the RO;
	Ministry for Energy, Industry and Natural Resources, RO
	Ministry for Agriculture, RO
Political decision-makers (local and regional)	Rostov Oblast Administration;
	Municipalities of the cities and towns within the Lower Don basin (Rostov, Azov, Taganrog, Novocherkassk)
Authorities involved in river basin management(note the representatives of different committees)	Fishery Committee
	Rostov Vodokanal
	Association of Rostov Oblast Vodokanals, incl. Don VK-Yug
	Local police office (responsible for fihery and natural resources)
Firms, business representatives	Energy companies (TGK-5; Rostovenergo, etc.)
Laymen	Many
Non Governmental Organisations and civil activists	Tsentr prirodopolzovaniya
	Rostov Oblast Ecological Centre
Journalists (note: are important in imagining and writing of scenarios)	Local newspaper “Gorod N”
	Local TV “Vesti-Don”
Researchers (fields as natural and social science, history)	Southern Russia Academy of Science
	AzNIIrKh (Fishery scientific research institute)
	North Caucasus Branch of Russian Scientific Research Institute of Integrated Use and Protection of Water Resources
Other (according to local specifics)	Southern State University (geography department)

Pilot Area A.2: Crimea in Ukraine

Selection criteria

Crimea can play an important role in the SCENES project. It can be a hot spot area, which depends from water withdraw from Dnieper and where water scenarios can be very important for people, local and national authorities to provide social-economical sustainability in the South region of Ukraine and also on in the Black sea region as a whole. The high potential of the pilot area in terms of agriculture, nature and recreation can be developed only when water quantity and quality will be sufficient. This prospective can convince policy makers to use scenarios for their decision making.

From another view, the Crimean case study can be used for other areas in the low Dnieper region of Ukraine where many similarities in nature and land use exist and where driving forces for scenarios can be the same (climate change, policy and institutional set-up, investments etc.). So for the Low Dnieper and then the Black sea region the Crimea case study can be up scaled to identify possible degrees of changes. After such up scaling the more global WATERGAP modelling results by can be improved and better involved in European scenarios development.

Description of the area

The Autonomic Republic of Crimea was selected for a Pilot Area in SCENES because problems of water scarcity must be expected for the future. Huge quantities of water are needed for irrigated agriculture, for drinking water supply and for industrial use. According to the climatic peculiarities that have been described above, the main need for additional water is during the vegetation period in summer. To satisfy the water needs water has to be pumped to Crimea through the big Northern Crimean Canal. It is the oldest still functioning system, constructed during the sixties and seventies to secure water delivery to Crimea. Its water comes from the Dnieper River and is used for agriculture (90%), fishery, industry and municipalities. The NCC irrigation system is located in the steep zone of Crimea, which borders in the North the Sivash Sea and wetlands. The Crimean Mountains form the Southern border of the NCC irrigation system.

The length of the canal system can reach several hundred, up to about 400 km. The canal network with its pumping stations has to be managed according to the various water needs. This included caring about the technical infrastructure, repair works etc. and has been a state duty during Soviet times.

New organization structures are developing slowly and state and private support (mainly investments) are needed to reactivate the whole system. Planning s for the future have to include all those aspects (and many more), discussion with all stakeholders, including the rural population, is necessary and the Scenes project will be a welcomed instrument to support the development into the right sustainable direction.

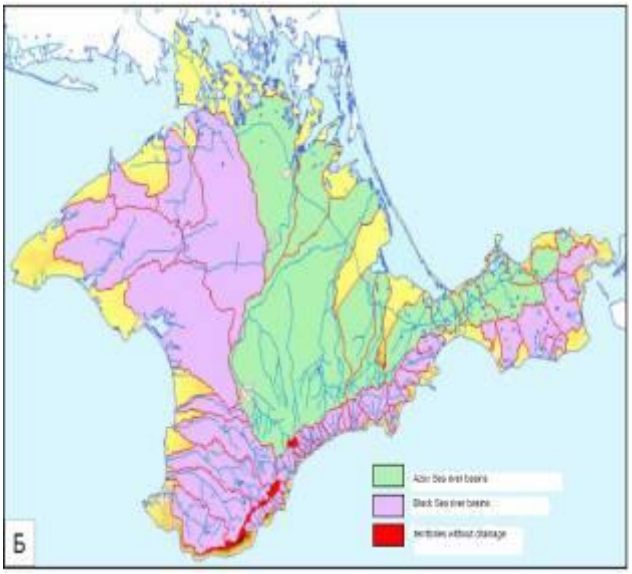

Figure A.2: Crimea river basins.

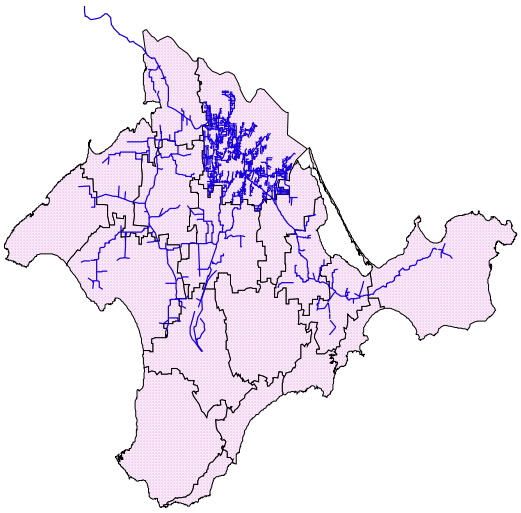

Figure A.3: Administrative regions of the AR Crimea and the irrigation network.

Pressures

After long-term irrigation action, environmental problems have occurred. They were connected to groundwater table rising, soils degradation, as well as to the pollution of soils and ground waters.

At the end of the 1980s and at the beginning of 1990s new problems related to resource deficits were observed. In this time, some disadvantages of large-scale irrigation system as high energy consumption and related high maintenance costs, absence of reliable water volume measurement systems started to influence irrigation efficiency. After independence of Ukraine in 1991, new problems appeared. They were related to the general social-economical situation during transition and reforms in agriculture, especially due to the mismatch between large scale irrigation infrastructures and small scale private farms.

Table A.3. Stakeholders within the Pilot Area.

Actor	Identified organisations
Authorities involved in river basin management (note the representatives of different committees)	SCWM (Kiev)
	Management of Northern Crimean canal
	SCWM – AR Crimea
	Ministry of Environmental Policy of AR Crimea
	Basin Water Management Department
Other relevant authorities and public officials (note different policy sectors at different policy levels)	Council of Ministers of AR Crimea
	Districts Water Management Departments
	Public utility company "Krimvodocanal", Gorvodocanal of Simferopol
	"Krimgeologiya"
	"GidrogeologomelioratExped."
Political decision-makers (local and regional)	Verkhovna Rada AR Crimea (Crimean Parliament)
	Rural population
	Municipalities
	Citizens
Firms, business representatives (e.g. energy production, tourism, farming, fishing…)	Agricultural enterprises
	Farmers
	Crimean farmers' association
Laymen (e.g. house wives, residents, young people)	Representatives of population from South costal areas
Non Governmental Organisations and civil activists	"Ecology and world"
	"Primavera"
	"Mendzhlys"
Journalists (note: are important in imagining and writing of scenarios)	Local newspaper "Krimskaya Pravda"
Researchers (fields as natural and social science, history)	Crimean Scientific and Research Centre of IHE&LR UAAS
	Tavrida Natioanl univercity
	Design Institute "Crimea Giprovodhoz"

B: Eastern Baltic Region

B.I Geographical description region

The Eastern Baltic region lies in the North- Eastern Europe, begins from the South East of the Baltic Sea and continues up to the Karpaty mountains in South. It covers about 500 thousand km^2, which is about of size of France or 4.6% of Europe. The relief is rather flat since the major part of area lies in the East European Plain. Mountains are found along southern border in Poland where also lies the highest point. In Latvia, Estonia and Lithuania the highest points are closed to 300 m.

Weather conditions are defined by maritime and continental climate, depending on the direction of air flows. The prevailing western winds with cyclones bring rainfalls and define comparatively moderate winters and summers. Average precipitation lies between 550 and 800mm per year. Arable land covers less than half of the region. A large part is covered by forests and wetlands (bogs, fens).

Table B.1: Basic characteristics of the region.

	Estonia	**Latvia**	**Lithuania**	**Poland**
Area, th. km^2	45.2	64.6	65.3	323.3
Highest point	Suur Munamägi, 318 m	Gaizins, 312 m	Juozapines, 294 m	Rysy, 2,499 m
Major rivers, (km)	Võhandu (162) Pärnu (144) Põltsamaa (135)	Gauja (452) Daugava (352) Venta (178)	Nemunas (475) Neris (234) Venta (161)	Vistuha (1047)
Arable land, %	25	30	45	45

B.II Institutional setting, including political and administrative setting

The Eastern Baltic region covers four states - Estonia, Latvia, Lithuania and Poland. The four countries have become members of the European Union on 1 May, 2004. This means that the legislative framework and goals for the water management policy is in line to the established ones on the level of the European Union. The Water Framework Directive (WFD) transposed in the national legislation (Water Act and subordinated legislative documents) is the key policy instrument for water management today and will drive the policy trends in future. The WFD has established a new approach for the water management in the region. Today, water quality objectives and all water management planning and implementation issues are achieved and coordinated based on natural geological and hydrological units - river basins.

The countries have designated competent bodies responsible for the implementation of the new water policy:
Estonia: water management is organised on eight river basin level (formally designated in three river basin districts), the responsibility lies on country environmental board where specialists have been employed to work on river basin level. Estonia shares its inland waters with Latvia and Russia.
Latvia: water management is organised on four river basin level, which are also assigned transboundary river districts. Latvia shares its inland waters with Estonia, Russia, Byelorussia and Lithuania. The national Environment, Geology and Meteorology Agency has been nominated as the competent body. It is envisaged that four river basin authorities will be established in future. Currently, due to constrains in resources the river basin management is organised centrally.
Lithuania: water management is organised on four river basin level, which similar to Latvia are also transboundary ones. Lithuania shares its waters with Latvia, Byelorussia and Russia.
Poland: has defined two transboundary river basin districts: Odra and Vistula. The management is organized by Regional Water Boards, three for each river basin and one located in upstream area of Vistula and Odra. Ministry of Environment is in charge of water management issue on the state level.

B.III Socio economic situation

The Eastern Baltic region is inhabited by about 45 million people (1.35 - Estonia; 2.31 - Latvia; 3.43 - Lithuania; 38.17 - Poland), which are about 6% of the Europe's population. The statistics on population show gradually decrease in the number population in this region. This is due to the fact that the growth rate (number of live births and the number of deaths) is negative in all four countries, as well as emigration from the countries to other regions of Europe.

The region is evaluated economically as fast growing region of the Europe. The growth rate of GDP of Estonia, Latvia and Lithuania indicates annual increase from 6-10%, while in Poland it is about 3-5%. This is certainly much higher than average in European Union (2-3% in the last decade). However, when looking at the actual GDP values per inhabitant then the countries have achieved just half of the level of the average in the European Union. National economy is also similar among the countries of the Baltic region. Sector of services contribute to gross value added close to 70% while agriculture about 4-5%, and industry about 17% in Latvia and up to 20-25% in Estonia and Poland.

B.IV Key water related issues and trends

The Eastern Baltic region does not generally have water shortage problems, as precipitation exceeds evaporation by approximately 50%. The average total volume of freshwater available per capita is medium to high, between approximately 7,000 m^3 in Lithuania and the northern part of Poland, and 14-17,000 m^3 in Latvia and Estonia. Nevertheless, certain regions in each country have relatively small water resources, as is the case, for example, in north and northeast Estonia, in northwest Latvia, western Poland. Seasonal and inter-seasonal variations have an impact on individual wells as well.

Water is abstracted for various purposes: public supply (including small scale commercial activities), industrial production, cooling water for energy generation, agricultural activities, etc. It is abstracted from different groundwater layers, from surface waters (rivers and lakes) and in Estonia, partly from the sea. Twenty to 30% of the population, mainly in rural areas, are not connected to centralised water supply systems. The centralised water supply systems in Lithuania depend mainly on groundwater. In Latvia, Estonia, and Poland approximately 30-35% of the population get their drinking water from surface waters.

Industrial activities have caused a continuous sinking of the groundwater level and the formation of depression funnels in a number of areas close to the largest cities in the Baltic States. In some cases, intrusions of seawater into groundwater layers have been noticed. Due to the poor state of water supply systems, leakage is relatively widespread. In many areas drinking water quality is also insufficient, due to higher concentration of some elements (e.g., iron, fluoride, sulphides).

Due to soil properties and climate approximately 70-80% of agriculture land has been improved by drainage. Thus there is no demand for irrigation systems, however, a number of grasslands is (or might be) improved by subsurface irrigation systems. The draining system was extensively established in 1970-1980's. Due to political and economical changes in the country the drainage system has not been properly maintained last 15-20 years which has resulted in damages and loss in functionality. Due to insufficiently maintained amelioration systems, the groundwater level rose in 1990s and the soil is maintained at saturated or almost saturated conditions for longer time periods leading to anaerobic environments in soils, possible increase in denitrification rate and higher selfpurification capacity of ditches and small streams. Now, due to economy growth and available funding for infrastructure drainage activities are getting attention which also leads to changes in water ecosystems and water balances.

Because of human activities and absence of proper waste water treatment, water quality is one of the key issues of the environmental policy of the Region. Nutrient (phosphorus and nitrogen) input into water bodies has increased substantially and eutrophication has accelerated all over Europe as well as in the Eastern Baltic Region. Eutrophication has become one of the main environmental problems in the Baltic region since last dec-

ades, affecting not only closed inland water ecosystems but also river waters and the Baltic Sea. Typical features of eutrophication are:

- Increase in biomass production, resulting in increased deposition and decomposition of organic matter in deep water areas. This leads to oxygen depletion and formation of hydrogen sulphide, which may cause the death of benthic fauna and fish in those areas;
- Shift in the algae community from dominance of diatoms to green and blue-green algae, expressed by so-called "algae blooms." It results in low transparency, odour problems, the occurrence of toxic substances, and change in species composition in the upper food chain;
- Reduction in the level of biodiversity due to an increasing dominance of highly productive species.

The project SCENES will address the water quality issues of the Eastern Baltic Region. The river Narew (Poland) will serve as pilot area how the nutrient input will develop and how it will influence the surface water quality (chemical and ecological) in future. The lake Peipsi (Estonia) will serve as pilot area for modelling the water quality scenarios with regard to change in consumption patters in the region, improved efficiency of waste water treatment in big cities accompanied by increased number of households connected to the waste water systems and probable future intensification of agricultural production.

Pilot Area B.1: Narew Basin in Poland

Selection of Pilot Area

The River Narew basin has been selected as it represents number of the water related problems characteristic for the region. The most important of them are:

Water Quality Problems

The water in the Narew River and its tributaries is of medium quality. The main pollutants are nitrates, phosphates, E.Coli (as in the most of the country) and additionally chlorophyll in the upper course due to the blue-algae bloom in the Siemianówka reservoir. A number of lakes in the lake district are fairly eutrophic.

Role of Wetlands

The basin is rich in wetlands of international significance. Two of three national parks located in the basin are devoted for wetland protection. The river basin management plan will be oriented on wetland protection, however there is no policy for recognition of wetlands as a service provider for water management.

Impact of Infrastructures

There are 5 weirs on the course of the Narew River, none of them equipped with the fish ladder. The Narew river was slightly trained in mid 70ties for the flood control and drainage reason. The Siemianówka Reservoir requires special attention, while an impact of existing infrastructure is taken into account. The reservoir and old infrastructure brings to water management issues many long time abandoned problems from the past.

Water Quantity Problems

There are no water quantity problems in the basin. In the few smaller rivers, the drainage irrigation systems cause the problems during the low flow periods. These problems may arise in the case of intensification of agriculture

Description pilot area (geography & typical socio economic situation)

The Narew River Basin is situated in the north-eastern part of Poland (Fig. B.1). The Narew River is the fifth largest in the country with regard to river length (484 km) and the size of the basin (ca. 28000 km^2 before joining the Bug river). The entire basin, except for the most upper part (ca. 1200 km^2), is located in Poland, but the head catchment is located in Belarus.

The basin is developed in the reach of two last glaciations periods: Riss and Wuerm. From north to south the basin includes the following sequence of glacial landscape types: moraine lake district, outwash plains, ice-marginal river valleys and moraine hills. Sandy soils of various types predominate. During the Holocene the main valleys have been filled up with mesotrophic-eutrophic peat layers which still are partly undrained at present.
The river network of the basin is fully developed and rich in tributaries, which mostly originate in the postglacial lakes located in the northern part of the

basin. In the lake district region there are more then 500 lakes greater then 1 ha. A few irrigation and navigation channels create interconnections between lakes and the river network. The flow regime is typical for the lowland rivers in this part of Europe with peak flows after snow melting and regularly appearing low flow periods in the fall of the summer. The yearly average flow recorded in the most downstream gauging station - Zambski Kościelne (before confluence of the Bug and Narew rivers in the artificial reservoir) equals to 147 $m^3 \cdot s^{-1}$, when the average yearly minimum is 55 $m^3 \cdot s^{-1}$.

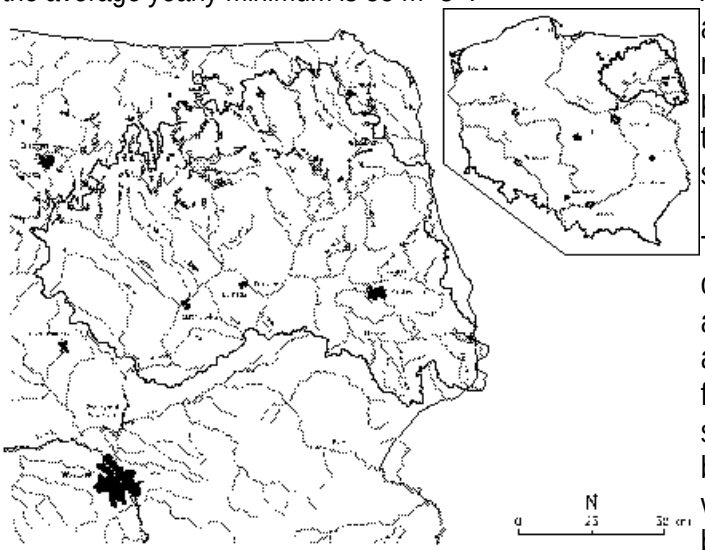

Figure B.1: Location of the Narew River Basin.

The area of Narew River Basin belongs to poorly populated in the scale of the country. The estimated number of inhabitants of the region is about 1,5 million. More than half of the population (60%) lives in the urban area (cities and towns). The biggest city on the analyzed area is Białystok, the capital city of Podlaskie voivodeship, with 295.000 (2006) inhabitants. The other cities are decidedly smaller and none of them exceeds 70.000 inhabitants.

The Narew River basin is an agricultural region, with a small degree of industrialization and no heavy industry. Existing production is connected with agriculture and forestry, and is based on local raw materials, which are mainly: milk, meat, cereals, vegetables, fruits and wood. The developing industries are mainly: agriculture, food and timber processing, and recently tourism. Wastewater from enterprises located in the cities, in most cases, discharge through the municipal main sewerage system and thence to wastewater treatment plants. Enterprises that are dispersed through the basin area have their own effluent treatment.

Agricultural land dominates the basin, covering almost 55% of its area. The upland of basin area is mainly used for arable land, the valleys are used as pastures and grasslands. The forestation ratio of the Narew River Basin is slightly over 32%, which somewhat exceeds the entire country average.

The Narew and the Biebrza river (the main tributary of the Narew river) valleys are among Europe's last active, regularly flooded riverine valleys. Until now, a considerable part of this area had been utilized for the purposes of extensive (environmentally sound) agricultural practices, thanks to which it still boasts wet meadows of a significant biodiversity value. Additionally in the south-eastern part of the basin, there are number of alder carrs which are groundwater fed. All those habitats are protected in the form of national parks.

Key actors to be involved in the pilot area

The key actors to be involved in the study (scenario development process) are: representatives of the Regional Water Board, representatives of the authorities (both of the state administration and self-government structure) of the three voivdeships covering the basin: Podlaskie, Warmińsko-Mazurskie and Mazowieckie, two main NGOs active in the region, National Parks authorities, Voivdeship Land Reclamation Boards, representatives of communities and municipalities associations, farmers organisations, water works professionals and scientists - in total about 20 people

Table B.2: Stakeholders within the River Narew Pilot Area.

Actor	Identified organisations and people
Authorities involved in river basin management (note the representatives of different committees)	Regional Water Board Warsaw
Other relevant authorities and public officials (note different policy sectors at different policy levels)	Union of Municipalities,
	Ministry of Environment
	Boards of Mazowieckie, Podlaskie and Warmisko-Mazurskie voivodeships,
	National Parks
	Institute of Meteorology and Water Management
Political decision-makers (local and regional)	Members of the local parliaments
Interest groups (different sectors. e.g. farmer's union)	State Forest Enterprise,
	Institute of Meteorology and Water Management, Environmental Protection Inspectorates
	Polish Angling Association
Firms, business representatives (e.g. energy production, tourism, farming, fishing)	Economic Chambers Polish Waterworks,
	Stora Enso Poland Ostrołęka,
	Waste Water Treatment Plant companies of Bialystok, Lomza, Warsaw
	Power Plant Ostrołęka,
	Regional Agricultural Chambers,
	Regional Offices of Polish Tourism Chamber
Non Governmental Organisations and civil activists	Polish Society of Bird Protection,
	Green Lungs of Poland Foundation,
	Save Wetlands Association
	Global Water Partnership Poland
	WWF Poland,
Journalists (note: are important in imagining and writing of scenarios)	Local newspapers
Researchers (fields as natural and social science, history)	Warsaw Agricultural University, Warsaw University of Technology, University of Warmia and Mazury in Olsztyn, Bialystok Technical University, Warsaw University

Pilot Area B.2: Lake Peipsi Basin in Estonia

Selection of Pilot Area

The main environmental problem in the area is eutrophication of surface waters including the lake. It is quite surprising because the overall load of both phosphorus and especially nitrogen to the water bodies decreased during the last 15 years. The decrease of nitrogen load was caused mainly by the depression in agriculture accompanied by drastically decreased amounts of used inorganic fertilisers and number of cattle in the area. The number of households and industries connected to the sewerage systems in larger municipalities has grown, which has increased the amount of wastewater delivered to the treatment plants.

At the same time rises in the price of drinking water and wastewater treatment have led to a substantial drop in the overall consumption of potable water by the general population, especially in Estonia, which has resulted in increased concentrations of nutrients in both the wastewaters delivered to WWTPs and the effluents released from those facilities. Similar tendencies are foreseen in Russian side of the catchment area. These processes have led to a decline in the N:P ratios at many rivers in the area and more intensive cyanobacteria blooms in Lake Peipsi that has been particularly pronounced during the last years. The economic recovery will probably intensify agriculture both in Estonia and in Russia and the proportion of cultivated land as well as the rate of fertilizer application increases that consequently could lead to higher losses of nutrients to surface and ground waters, especially with respect to nitrogen.

Description river basin (geography & typical socio economic situation) + map

The Lake Peipsi catchment, including the surface of the lake itself (3 555 km^2), has an area of 47,800 km^2, of which 16,323 km^2 is in Estonia and the rest in Russia and Latvia. The Velikaya River (Russia) and Emajogi River (Estonia) basins occupy 25 200 km^2 (57%) and 9 740 km^2 (22%) of the total drainage basin area. Lake Peipsi is connected with the basin of the Gulf of Finland and the Baltic Sea via the Narva River. Agricultural land and forests cover 42% and 40% of the total drainage basin, respectively. The northern part of this drainage basin has a sedimentary cover consisting of Ordovician and Silurian limestones; the southern part is characterised by sandy-silty and clayey Devonian deposits, which are overlaid by quaternary deposits that are usually less than 5 meters thick, and are thickest (often > 100 m) in the uplands. The topography of the catchment is relatively flat, with maximum elevations of about 30-100 m above sea level. The mean air temperature in the Peipsi catchment is 14-15 ^{o}C in June and -4 to 4.5 ^{o}C in December, and the mean annual precipitation is 600-650 mm. The biggest towns of the region are Tartu (95,000) in Estonia and Pskov (201,000 people) and Ostrov (72,000) in Russia.

Key actors to be involved in the pilot area

The key actors to be involved in the study are: representatives of the Regional Environmental Board, farmers organisation representatives, fishermen (the lake Peipsi is rich with fish resource) water works professionals NGOs, especially Peipsi Transboundary Cooperation Centre, is very active in involving local inhabitants in various actions for improving water management in the Peipsi lake (see Table .

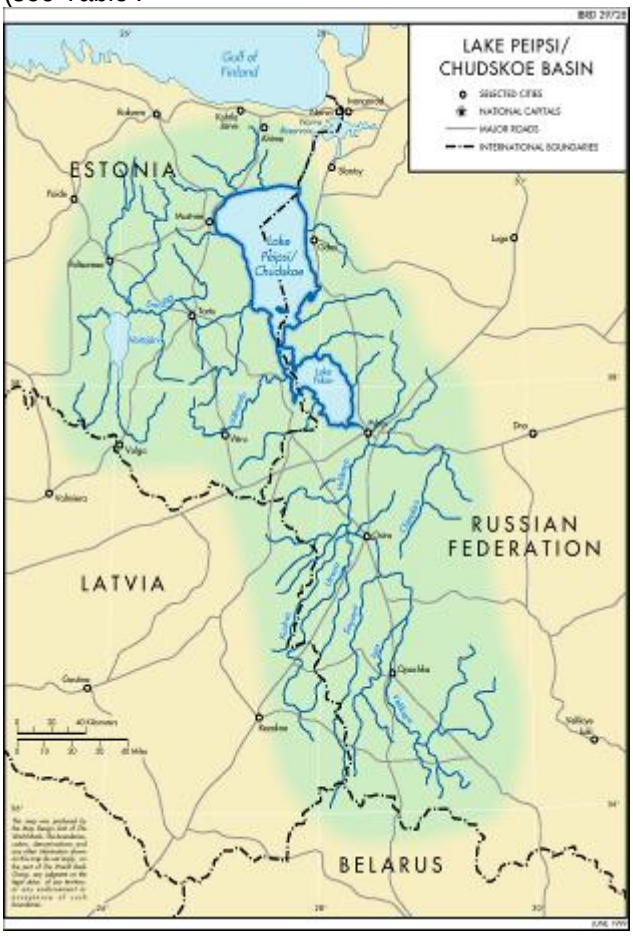

Figure B.2: Lake Peipsi Pilot Area.

Table B.3: Stakeholders within the Lake Peipsi Pilot Area.

Actor	Identified organisations and people
Authorities involved in river basin management (note the representatives of different committees)	Estonian -Russian Joint commission on transboundary water bodies
Other relevant authorities and public officials (note different policy sectors at different policy levels)	County environmental departments
Political decision-makers (local and regional)	Minsitry of Environment, Estonian Environment Information Centre, Ministry of Agriculture, Municipalities within the catchment
Interest groups (different sectors. e.g. farmer's union)	Farmers Union, Central Union of Estonian Farmers, Fisheries union, Estonian Waterworks Association
Firms, business representatives (e.g. energy production, tourism, farming, fishing…)	Agricultural companies, small farms, transport agencies arranging boat trips to L. Peipsi.
Laymen	Local residents through local municipalities
Non Governmental Organisations and civil activists	Peipsi Centre for Transboundary Cooperation, Living Lakes - The international Network, Estonian Society for Nature Conservation, Water Association
Journalists (note: are important in imagining and writing of scenarios)	Weekly newspaper Maaleht, county newspapers
Researchers (fields as natural and social science, history)	Tallinn University of Technology, Estonian University of Life Sciences, Tartu University, Maves Ltd.

C: Lower Danube Region

C.I Area description

The Danube River Basin is the second largest river basin of Europe, covering 801 463 km² and territories of 18 countries (see Table C.1). The Danube flows 2780 km from west to east. Its catchment area stretches from 8° 09` at the source of the rivers Breg and Brigach in the Black Forest up to 29° 45` eastern longitude in the Danube delta at the Black Sea. Its southernmost point is at 42° 05` northern latitude in the source area of Iskar river in the Rila mountain and its northernmost point at 50° 15` in the Morava/March source area. The Danube has an average discharge of 6550 m³/sec at its mouth in the Danube delta. Natural floodplains, protected wetlands and Ramsar sites such as Gemenc, Upper-Tisza Valey, Tisza-lake in Hungary, the Kopački Rit in Croatia and Danube delta have certain importance in all kinds of ecological services. Beside big industrial developments, agricultural area and large settlements have a great influence on the water quality and qualnity.
In the project we focus on the Lower Danube section of the Danube, including the entire Tisza basin and the Danube section till it reaches the Black Sea. Majority of the Lower Danube countries - Hungary, Slovakia, Romania, Serbia-Montenegro - has a large part of the country in the Danube catchment (Hungary is 100%, see table C.1. and Figure C.1), which means importance of cooperation need in cross border water management. At some of the tributaries - like Tisza river - large embarkments and flood control systems had been developed with drainage and irrigation canals, pumping stations and flood reservoirs (polders) completing the system.

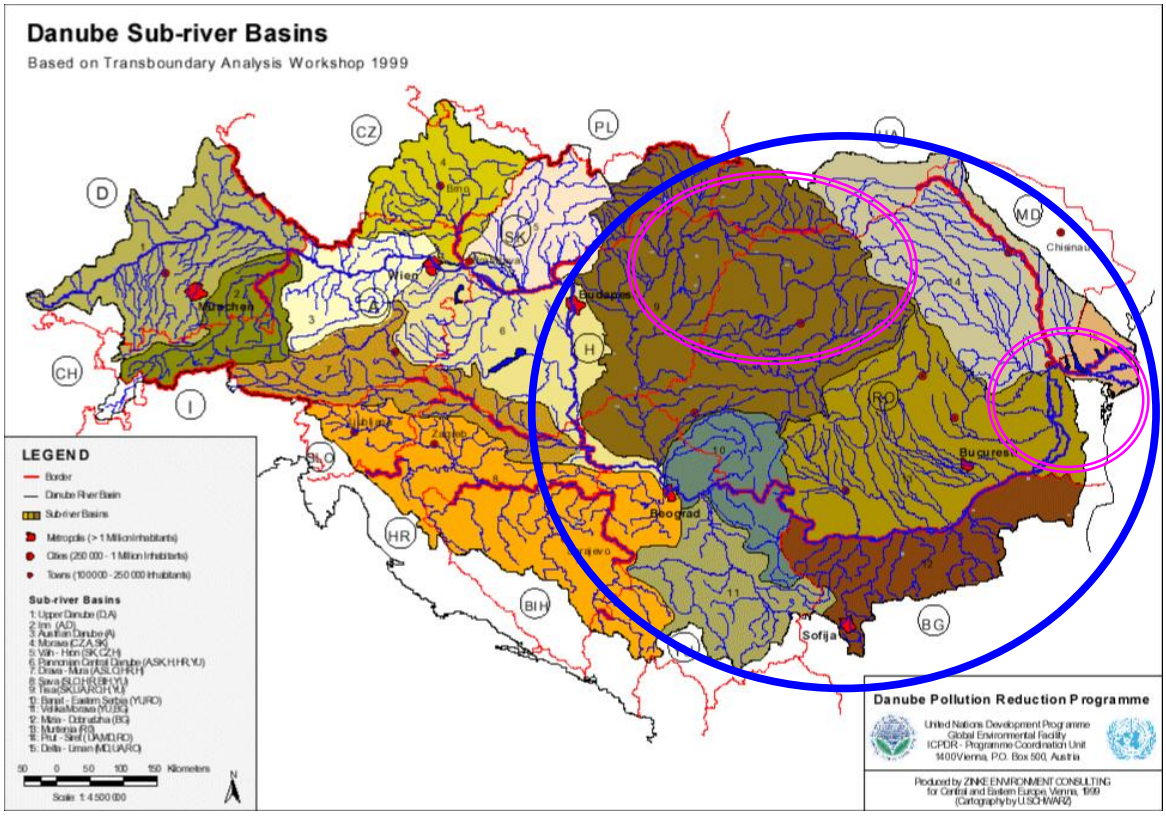

Figure C.1: The Danube river basin - and the selected Pilot Areas (map source: ICPDR, 2003).

Table C.1: Coverage of the states in the Danube River Basin (DRB) and estimated population.

State	Code	Official coverage in DRB [km²]	Digitally deter-mined coverage in DRB [km²]	Percentage of DRB [%]	Percentage of DRB in state [%]	Population in DRB [Mio.]	Percent of population in DRB [%]
Albania	AL		126	< 0.1	0.01	< 0.01	< 0.01
Austria	AT		80,423	10.0	96.1	7.7	9.51
Bosnia and Herze-govina	BA		36,636	4.6	74.9	2.9	3.58
Bulgaria	BG		47,413	5.9	43.0	3.5	4.32
Croatia	HR		34,965	4.4	62.5	3.1	3.83
Czech Republic	CZ	21,688		2.9	27.5	2.8	3.46
Germany	DE		56,184	7.0	16.8	9.4	11.60
Hungary	HU	93,030		11.6	100.0	10.1	12.47
Italy	IT	565		< 0.1	0.2	0.02	0.02
Macedonia	MK		109	< 0.1	0.2	< 0.01	< 0.01
Moldova	MD		12,834	1.6	35.6	1.1	1.36
Poland	PL		430	< 0.1	0.1	0.04	0.05
Romania	RO	232,193		29.0	97.4	21.7	26.79
Serbia and Monte-negro	CS		88,635	11.1	90.0	9.0	11.11
Slovak Republic	SK	47,084		5.9	96.0	5.2	6.42
Slovenia	SI	16,422		2.0	81.0	1.7	2.10
Switzerland	CH		1,809	0.2	4.3	0.02	0.02
Ukraine	UA		30,520	3.8	5.4	2.7	3.33
Total			(801,463)	100		81.00	100

C.II Institutional setting and socio economic situation

Principles of exercise of water policy and management in countries in the Tisza basin have particular differences in present time. In all countries several institutes are dealing with water policy related issues - water authorities, water basin councils, municipalities have role in regional management supervised by one (like in Hungary) or several ministries (Ukraine). All countries are faced with rapid change of ownership (privatisation, re-privatisation) which has an impact on the management of smaller water distribution structures, mainly causing decline of quality of water management capacities at specific locations.

EU harmonised legal framework is set for the new member states since 2004 (e.g. WFD, Natura 2000) as well as for Romania (in accession). Ukraine has expressed the interest to test the implementation possibility of WFD and gain lessons from pilot projects. In Hungary the so called Vásárhelyi Plan was accepted in 2003 which focuses on integrated flood protection measures and introduces multifunctional flood polders along the Tisza river (6 emergency water reservoir will be created in 4 years time). The project addresses new tasks in the field of institutional settings and measures of water management.

Realizing the need for cooperation for integrated water basin management countries of the Danube river basin formed a International Commission for the Protection of the Danube River (ICPDR). A secretariat was set up and several international project was initiated to control nutrient pollution, implement effective flood control measures and harmonize data gathering and national research. The platform initiated in 2002 long-term Action Programme for Sustainable Flood Prevention in the Danube River Basin to achieve a long term and sustainable

approach for managing the risks of floods to protect human life and property, while encouraging conservation and improvement of water related ecosystems.

The ICPDR has set up its own monitoring network, which is available. The inter-calibration process of WFD reference sites will assist the international comparison of regional and local processes in the DPSIR framework and support the economic assessment and methodology development at long run. There is an information gap concerning the pressure data and landuse /land utilization data, which should be in the focus of the case study assessment.

C.III Key water related issues & trends

a) Relevant pressures identified for the last four decades:
   - Uncertainty of precipitation, higher variability of extreme meteorological events due to regional impact of climate change, increase of flood risk.
   - Change of land use on an uncontrolled way, conversion of wetlands into arable land for intensive agriculture practice at a very (multifunctional ecosystems converted in mono-functional and intensive fuelled systems) extensive scale;
   - Increasing urbanisation without proper sewage treatment;
   - Infrastructural development (power plants, water dams);
   - Intensification of production at different economic sectors (increase water demand and pollution load);

b) Relevant impacts (damages)
   - Eutrofication of rivers, oxbows and wetlands, including the Coastal Delta and North-Western Black Sea;
   - Changes in the hydrology of the River and its tributaries;
   - Changes in the trophic structure and biodiversity of freshwater ecosystems;
   - Damaging the regulatory and cultural functions of ecosystems;
   - Damaging quality and quantity of natural resources (in particular dramatic decline of fisheries), decrease of biodiversity;
   - Pollution and decline of groundwater;
   - Problems with freshwater supply (As, nitrate, etc. pollution).

c) Most relevant policy questions
   - Rehabilitation of trophic state of the Danube river basin and its tributaries
   - Rehabilitation of the fishery sector, based on productivity of natural and semi-natural aquatic ecosystems;
   - Conservation of biodiversity;
   - Rehabilitation of the regulatory function of wetlands;
   - Mitigation of Coastal erosion;
   - Economically feasible flood control and water management policies and measures, including cross border water management.

Pilot Area C.1 Upper Tisza Basin of the Danube river basin

Selection of the Pilot Area

In the Danube Region two pilot areas were selected for participatory scenario development and support the process of enrichment of the pan-European scenarios and assessment.

The criteria for area selection were:

- Provide an opportunity for detailed assessment of region specific issues, such as transboundary pollution, flood and draught and coping with WFD requirements
- Having ongoing process to build on (data sets, models, interested stakeholders, preliminary results on the driving forces and impact assessment from previous projects)
- Create common understanding of long term driving forces and impacts
- Contribute to the implementation of the Danube basin Pollution Reduction Program, and
- Contribute to the pan-European policy discussion on water issues.

Issues at the Upper Tisza

Extreme water distribution (Flood and draught): The Upper Tisza (especially the Hungarian territory) is the most exposed to the danger of floods among all European countries. Increasing Highest Water Levels of flood waves and decreasing time periods of returns were observed in the last decades.
Reasons of these symptoms can be: land use changes (with special regard to deforestation in Ukraine), silting up of the flood plain, overgrowth of the flood channel by vegetation, and climate changes. Besides of that draught appears and aridity cause loss of yields in agriculture.

Pollution (accidental and permanent): Water quality problems can be partly accidental pollution (spill) events and partly long term quality problems as well. The danger of accidental pollution events has increased because of the industrial development of upstream countries (e.g. catastrophic cyanide pollution of the rivers Szamos and Tisza in 2000, caused by Aurul, Australian company in Romania). Long term quality problems can be caused by low ratio of dwellings connected to the public sewerage network (38 % in Northern Hungary Region /2000/). The probably highest water quality problem in the Hungarian Tisza basin is caused by excessive loads of plant nutrients causing eutrophic-hypertrophic water quality in the Tisza and its reservoirs and endangering the unique wetlands (oxbow lakes) of the Tisza flood-plain (avg. total phosphorus concentration of all Tisza tributaries exceeds 100 µg/l, thus the rivers are in hypertrophic range when arriving to Hungary). This problem is even larger owing to the fact that the known point source load data (www.tiszariver.com) explain only a small fraction of the observed loads.

Figure C.2: Upper Tisza basin.

Table C.2: Stakeholders within the Upper Tisza Pilot Area.

Actor	**Identified organisations and people**
Authorities involved in river basin management (note the representatives of different committees)	High level Water and Environmental Authority (Ministry)
	Local water directorates
	Waterboards Association,
	Local water boards
Other relevant authorities and public officials (note different policy sectors at different policy levels)	Local governments
	Waterworks for drinking water and sewage
	Associations
Political decision-makers (local and regional)	Governmental
	Regions
Firms, business representatives (e.g. energy production, tourism, farming, fishing..)	Chemical plant
	paper plant
	Agriculture
	Hydropower plant?
	tourism
	Fishing
Researchers (fields as natural and social science, history)	Universities (Debrecen, Miskolc)
	Budapest research groups, universities
	Godollo University

Pilot Area C.2 Danube Delta in Romania

Selection of the Pilot Area

The Danube delta is recognized as a wetland area with high importance (appointed as World Heritage). The area is the largest and best preserved wetland area of Europe's deltas. The Danube delta hosts over 300 species of birds as well as 45 freshwater fish species in its numerous lakes and marshes. This are was selected as one Pilot Area due to its great value a natural reserve and source of natural resources. The major aims of the Pilot Area are to:
The criteria for area selection were:

- Provide an opportunity for detailed assessment of region specific issues, such as transboundary pollution, and coping with WFD requirements
- Create common understanding of long term driving forces, pressures and impacts
- Contribute to the implementation of the Management Plan for the Danube Delta.
- Contribute to the pan-European policy discussion on water biodiversity issues.

Brief presentation of the area

At the end of a course of over 2840 km, collecting the water from a vast hydrological basin that exceeds 8% of the are of Europe, the Danube River, the second largest river of the Continent, has during the last 16,000 years built at its mouth with he Black Sea one of the most beautiful delta in Europe, perhaps in the whole world.

The Danube Delta, as one of the greatest wetlands of the earth, offers good conditions for an impressive number of plants and animals. Among these, reed beds form one of the largest single expanses in the world, and Letea and Caraorman forest represents the northern limit for two rare species of oak, that are more frequently met in the south of the Italian and Balkan peninsulas.

The main characteristics of the Pilot Area are

- The total surface of the Danube Delta = 4178 km^2 (82% on the Romanian territory)
- The Danube Delta reserve of Biosphere (5800 km^2 on the Romanian territory):
    - ecological restoration areas 1142 km^2
    - strictly protected areas: 506 km^2
    - economic zones: 3061 km^2;
    - buffer zones: 2233 km^2 which includes:
        - Delta buffer zones: 1203 km^2
        - Marine buffer zones: 1030 km^2
- Biological diversity: total number of flora and fauna species is 5149 which includes:
    - the greatest population of pelicans from Europe 8000 individuals, as well as for
    - the Dalmatian pelican 200 individuals.
    - 60% from the world wide population of pygmy cormorant 6000 individuals;
    - 50% for the entire population of Red - breasted goose (winter time) 40,000 individuals.

Together with a great number of aquatic and terrestrial plants, here are also many important colonies of pelicans and cormorants, which are characteristics for the Danube Delta, as well as a variety of other water birds which reside in or visit the delta for breeding or wintering. The large number of fish is also notable, with species of both high economic and ecological value.

Without doubt, the impressive range of habitats and species which occupy a relatively small area makes the Danube Delta a vital centre of biodiversity in Europe, and a natural genetic bank with incalculable value for global natural heritage.

Many of the plant and animal species found in the delta are also important natural resources for economic use as food, building materials and medicines; they have attracted people to the area since ancient times. The human dwellings were mainly based on the use of these natural resources, so, traditional activities, characteristic cultural and social habits have been developed

Figure C.3: Satellite image of the Danube Delta Pilot Area.

Because the cumulative negative effects of the activity in the delta, together with those occurring around the delta itself, there was an increasing danger that the natural ecological balance would become irreparably harmers if appropriate measures were not taken to reduce these impacts, to restore already damaged areas, to protect the extending unaffected area, and to harness local and regional support for these measures.

The factors briefly described above provided arguments for the designation of the Danube Delta Biosphere Reserve (D.D.B.R.) by the Romanian Government in 1990, a decision then confirmed by the Romanian Parliament through law 82 of 1993. The DDBR possesses all the main features of a biosphere reserve, namely:

- conserves examples of characteristic ecosystems of one of the world's natural areas and contains:
    - strictly protected care areas;
    - traditional use areas, e.g. for fishing, reed harvesting;

- buffer areas to reduce external impacts;
- land and coastal / marine area in which people are an integral component and which is managed for objectives ranging from complete protection to intensive yet sustainable production;
- regional centre for monitoring, research, education and training on natural and managed ecosystems;
- place where government decision makers, scientists, managers and local people cooperate in developing a model programme for managing land and water to meet human needs while conserving natural processes and biological resources;
- a symbol of voluntary cooperation to conserve and use resource for the well being of people everywhere.

Because the complexity and the position of the DDBR a special programme with specific objectives and projects, for the management of the area is needed. The Danube Delta Biosphere Reserve Authority (DDBRA) was involved in publishing this specific Management Plan for the Danube Delta.

The universal value of the reserve was recognized by the Man and Biosphere (MaB) Programme of UNESCO in August 1990, through its inclusion in the international network of biosphere reserves. This specific UNESCO Programme was launched in August 1970.

The DDBR was recognized as internationally important humid zones, mostly in their capacity of a habitat for the aquatic birds, in September 1990, when Romania has become a Party in the Ramsar Convention. The international value of the DDBR was recognized in December 1990, when it became Party of the Cultural and Natural World Patrimony.

Pressures

Point pollution sources:

- Urban sources - Tulcea city;
- Industrial sources: Alum Tulcea: Aker SA Tulcea
- Agricultural sources: Carniprod Tulcea: Pigcom Satu Nou

Diffuse pollution sources:

Diffuse pollution sources from Dobrogea hydrogeografic area, including Danube Delta are represented by (2006):

- chemical fertilizers used in agriculture: 10.15 kg P/ha; 3.04 kg N/ha
- pesticides used in agriculture - 0.35 kg/ha
- domestic animals: density of 0.16 animal unit/ha.

Hydromorphological pressures

Significant hydromorphological pressures are represented by:

- 60 important canals;
- embankment works - the total surface affected by dykes was of 103,000 ha, out which 15% being re-connected to the natural cycle in period 1994 - 2003;
- agricultural, fish farming and forestry works (ex: Popina, Sireasa, Pardina polders etc.).

Overexploitation of natural resources.

- Increasing pressure on some natural resources, especially fish and grasslands,

As an overall conclusion of a preliminary semi-quantitative analysis of present pressures the following remarks could be derived:

- the most relevant pressure to the Danube Delta environmental functions are caused by the Danube River quality inflow;
- the specific local pressures, but with a lower weight, are induced by the hydromorphological alteration, particularly the canals for navigation.

D: Mediterranean Region

D.I Geographical description

A region of contrast where water abundance and water scarcity coexist:
The Mediterranean region extends over 25 countries bordering the Mediterranean Sea and is one of the rare sites in the world that separates two adjacent areas with opposite demographic characteristics, distinctive socio-economic development and varied pressure on water resources. The common feature of this region is the 'Mediterranean climate' characterized by mild winters and dry long summers.

However, water abundant countries co-exist with intensely water scarce countries and regions as natural supplies of renewable water resources are shared very unequally among countries and populations (Table D.2). The northern water-abundant sub-region accounts for 72% of all renewable water resources and is characterised by low population growth, stable water demand and moderate pressure on water resources. In contrast, the Eastern region supplies 23% of all water resources in the region as the southern region and south-eastern coast adjacent to dry and desert areas, has only 5% of all water supplies that alongside a high demographic pressure results in increasing demand for water and a strong strain on water resources.

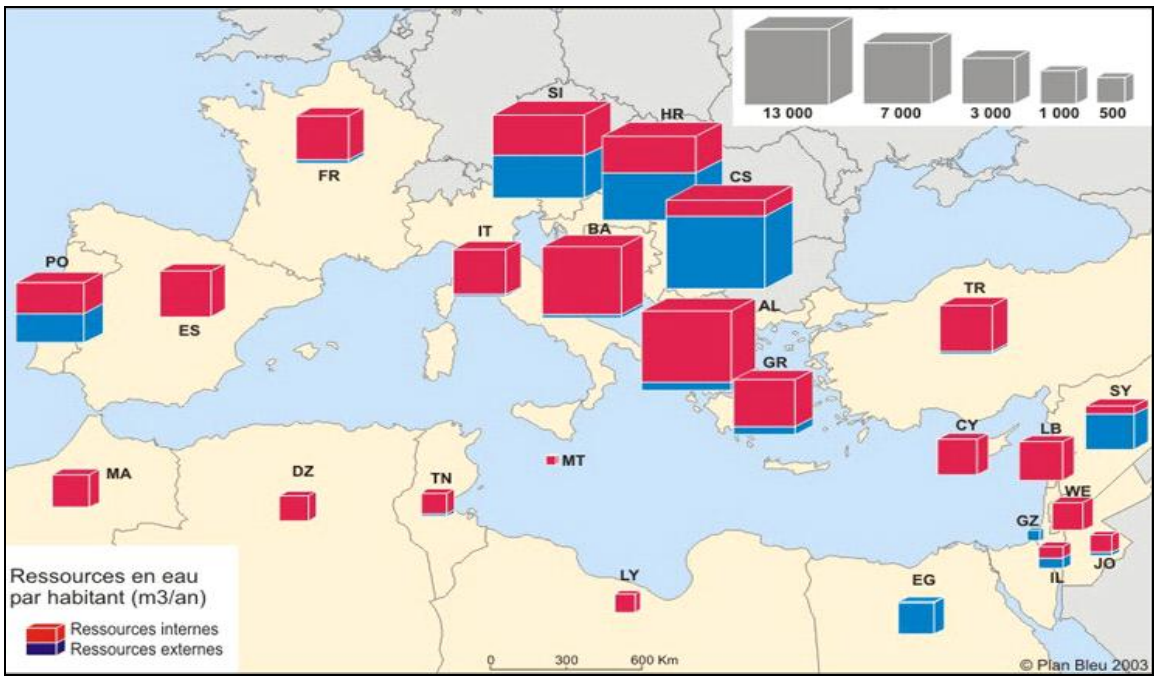

Figure D.1: Per Capita Water resources in the Mediterranean region. Source: Plan Bleu (2003).

Irrigation agriculture is a key sector in the Mediterranean region
Overall the Mediterranean region has a threatened fragile environment with a high seasonal variation of rainfall, frequent droughts and an increasing dependence upon irrigation agriculture. These factors have resulted in severe water depletion problems, salinity from marine intrusion and water contamination. Alongside, frequent torrential rains produce soil erosion, uncontrolled run-off and irregular water flows

As irrigation agriculture is a key sector for food production and economic development in the Mediterranean region, it consumes a large proportion of all available water resources, 70% on average and up to 90% in the water-scarce countries or regions. Structural shortages of water are foreseen in this area where resources are already saturated and expected to aggravate. Irrigation agriculture in the Mediterranean region, as in any other

arid and semi-arid regions in the world, relies greatly on the exploitation of groundwater sources that constitutes a strategic source of water. Therefore, the use of groundwater for irrigation has been increasing due to easy access, low investment costs of irrigation development and high profitability, causing over-exploitation of aquifers and the progressive degradation of associated wetland ecosystems of high ecological value.

In this context, one of the major challenges in the Mediterranean region is the development of an appropriate context of agricultural, environmental and water policies in a more integrated approach that will meet the objectives of economic, social and environmental sustainability. Economic, social and institutional solutions are foreseen to develop effective water management, promote modern agriculture, food production, and economic development and secure the environmental sustainability of the water resource base.

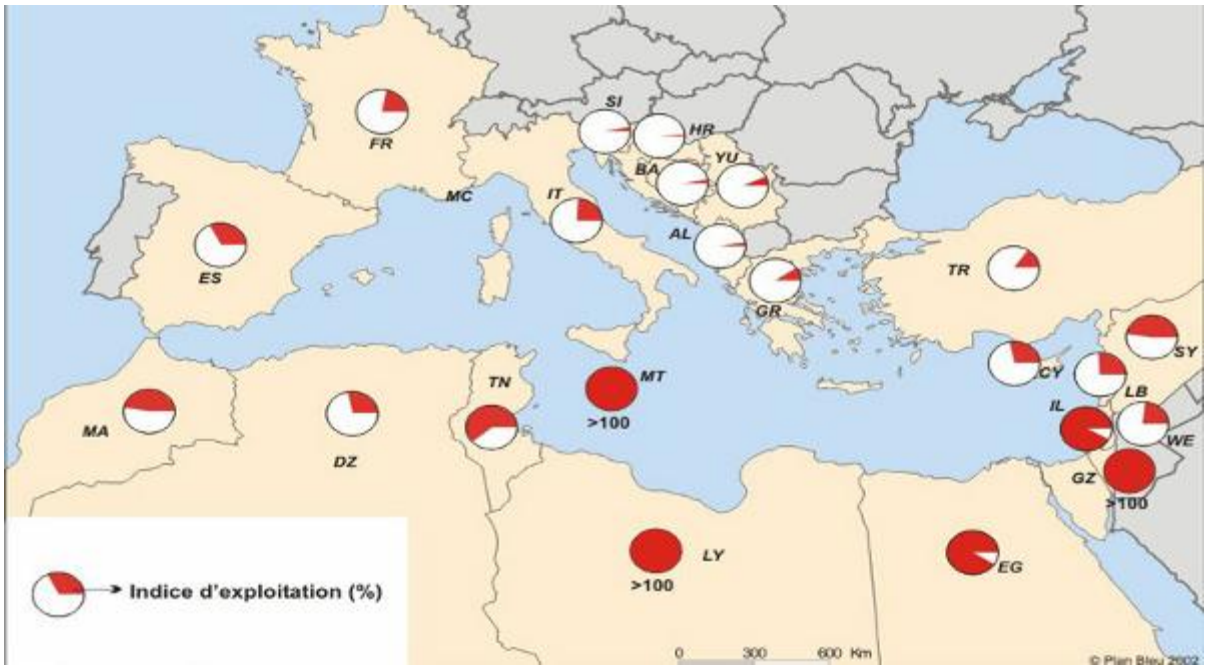

Figure D.2: Renewable water resource exploitation index. Source: Plan Bleu (2003)

D.II Institutional setting and socio-economic situation

The socio-economic situation of the different countries in the Mediterranean region (table D.2) is largely varied and pressure on water resources is a result of demographic dynamic, social and economic factors and technological development. Although population growth has decreased in the region since the 1990's, it continues to be high in world average in the southern Mediterranean countries where it was above 1.5% in several counties (e.g. Algeria, Morocco, Libya) and added around 2 million inhabitants per year.

The pressures to achieve a sustainable development of water resources in the Mediterranean region emanate from the diverse situation across countries and region in relation to water scarcity and the uneven and inequitable distribution of resources among economic sectors and social groups. The major driving forces determining theses pressures are the following: (i) Population growth and social instability, (ii) Globalisation and increasing integration into the world's economy, (iii) Increasing influence of international agreements, such as the Euro-Mediterranean agreements, (iv) Water supply increase and the resulting growing pressure on water resources for economic development, (v) Water management trends, (vi) Growth of water use conflicts and water demand control.

D.III Key water related issues & trends

- Water management that will include social and environmental elements to ensure a sustainable development of water resources.
- Increasing participation of local agencies and stakeholders in water management and development of integrated basin management of water resources.
- Increasing profitability of low water-intensive crops.
- Development of water conservation policies that will include cost-share instruments among competing users (agriculture, environment) and income compensation mechanisms for agricultural production.
- Increasing use of recycled and desalinated water and eco-technologies.
- Decrease in total water demands (-12 per cent in the region), reduction in irrigation area in the north Mediterranean and large increase in irrigation efficiency.
- Priority to water conservation and water quality policies.

Table D.1: Socio-economic indicators in selected Mediterranean countries. Source: FAO 2005, World Bank 2005.

	Total population (mill. inhab)		Agricultural population (mill. inhab)		Urban population (% total)		Pop. density (pop/ crop land)	GNI per capita (2006 US $ /person)		Agricultural value added / GDP (%)		Energy use (kg oil equiv. per capita)	Electric power per capita (kWh/ pers)
YEAR	1980	2006	1980	2004	1980	2005	2003	2003	2005	2000	2006	2005	2005
Algeria	19	33,4	35	23	44	19,7	13,79	170	3,03	11,5	8	1058	899
Egypt	44	74,2	61	35	44	31,29	73,93	1306	1,36	17,3	14	841	1245
France	54	61,3	8	3	73	46,39	109,7	48	36,56	3	2	4534	7938
Greece	10	11,1	26	12	58	68,27	84,27	154	27,39	8,2	3	2790	5242
Israel	4	7	6	2	89	61,68	304,71	n.a.	20,17	2,7	n.a.	2816	6759
Italy	56	58,8	13	5	67	39,22	192,78	232	31,99	3,1	2	3160	5669
Libya	3	6	25	5	69	50,87	3,33	36	7,29	n.a.	n.a.	3218	3299
Morocco	19	30,5	56	34	41	18,5	70,5	146	2,16	15,3	16	458	644
Spain	38	44,1	18	6	73	33,01	85,2	69	27,34	3,9	3	3346	6147
Syrian Arab Rep.	9	19,4	39	27	47	9,57	103	176	1,56	24	18	948	1411
Tunisia	6	10,1	39	24	52	6,5	61,7	118	2,97	13	11	843	1194
Turkey	46	73	44	29	44	49,24	93,4	97	5,4	13	10	1182	1898

Table D.2: Effects of long term water policy-related issues.

Sector	Issues
Nature	• Preservation of ecosystems. • Preservation of natural wetlands. • Pollution control of surface and ground waters. • Protection of aquatic flora and fauna.
Private sector	• Adoption of economic instruments for inducing water conservation • High participation of stakeholders in decision making. • Large private-public partnership in integrated basin management of irrigation systems. • Compliance to tight environmental constraints. • Income-loss is foreseeable in the new policy context
Public sector	• Water demand management approach reinforced. • Public sector will regulate and control water management. With increasing stakeholder participation and public transparency • High increase in expenditure for water resources conservation and nature protection • Increase in social equity.

Pilot Area D.1: Guadiana Basin in Spain

The Guadiana basin extends over an area of 60.361 km^2 of which about 50.000 km^2 correspond to the Spanish territory and 11.000 km^2 to Portugal. The Guadiana basin can be divided into three distinct areas as shown in Figure D.3 below. The upper Guadiana in the Spanish territory, the mid Guadiana covering Spain's western segment of the basin down to the Portuguese border, that relates to specific national and trans-boundary issues, and the lower Guadiana in the Portuguese territory.

Specific details of the Guadiana basin can be found in the River Basin Authority web page: http://www.chguadiana.es/ including the recent report related to the application of Article 5 of the WFD.

The most important economic activity in Guadiana River Basin is agriculture, followed by commercial and administrative activities. In the last decades, there has been an increase of the industry, as well as the tourism in coastal areas, and an intensification of agriculture. Regarding the soil uses, most are devoted to rain fed agriculture, especially in the upper part of the basin, while meadows are more represented in the middle and southern part. Regarding irrigated crops, they are distributed all along the river basin, but more concentrated on the north-western sector. The most important cities are located in the areas adjoining irrigated lands.

Within the Guadiana basin, we will consider in SCENES the Spanish part of the basin, which comprises two sub-basins: the Upper Guadiana and the Mid-Guadiana.

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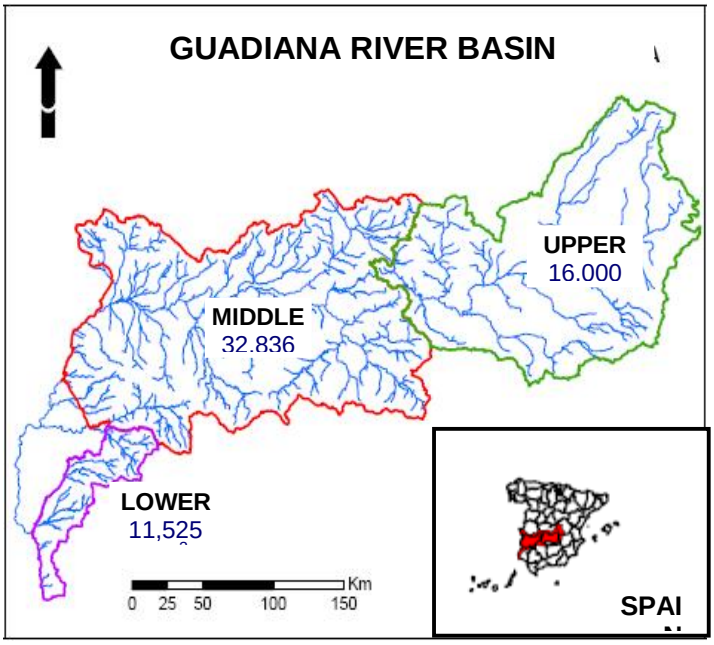

Figure D.3: The Guadiana Basin (Total surface: 60,361 Km^2 - 84% Spain; 16% Portugal). Source: CHG - Ambisat (2008).

Main Physical Characteristics of the basin:

- Annual water supply 6168 Hm3
- Total capacity 9114 Hm3
- Number of reservoirs and dams (>1 Hm3) 86
- Secondary rivers and streams 186
- Natural Parks and Special Protected areas 215527 ha
- Others reservoirs dams (<1 Hm3) more than 200
- Number of hydrogeology's units: 14
- Water Balance -304 Hm3; Water in-flow: 824 Hm3; Water out-flow: 1.128 Hm3
- Number of wells 60.847

Main pressures

In the Upper Guadiana, the following main issues can be underlined (based partly on Llamas and Martinez Santos, 2005):

- Irrigation agriculture is the main water user consuming up to 90-95% of total available water covering around 200,000 ha that are almost totally dependent on groundwater (Western Mancha aquifer)
- Intensive groundwater development over the last 30 years has exceeded the management capacity of the RBA to control further mining of illegal wells that currently exist.
- Expansion of irrigation has produced positive socio-economic effects in the area contributing to economic development, labour creation and social stability. Groundwater has proven to have a high resilience to drought impacts, and therefore has played an important role as crop production risk shelter, thus mitigating extensively farm income loss.
- Expansion of irrigation has produced negative environmental effects due to the overexploitation of the aquifer and the degradation of the associated wetlands and aquatic ecosystems.
- The Western Mancha aquifer was declared overexploited by law in 1989 and 1990 and water abstractions were subject to specific restrictions to the irrigators. Enforcement of this legal provision has proven to be inefficient due to the strong legal and practical opposition form the irrigators and the consequent high transaction costs involved for control and administration.
- Water is perceived as a very scarce resource and a basic input for farming activity and income gains. Therefore water use has led to long-lasting social and political conflicts.
- Water use conflicts arise al all levels: between regional and national governments, between basins (Guadiana vs. Segura over the Tajo-Segura transfer), between the RBA and the farmers (over closing of illegal wells), between farmers and environmental interests (agricultural development vs. environmental value of wetlands such as the Tablas de Daimiel National Park wetlands), between farmers (small vs. large land owners, legal vs. illegal well owners)

It is worth noting that one of the most remarkable examples of wetland deterioration has been the case of the wetlands in the "Tablas de Daimiel" National Park situated in the western La Mancha aquifer. This fragile ecosystem was progressively degraded as a result of overexploitation of the aquifer by the intensively irrigated adjacent farms (Llamas, 2001). This valuable wetland had gained a considerable international reputation for its great ecological value as a habitat of European and African aquatic birds and hibernating waterfowl. Catalogued in the Wet Areas

of Europe, UNESCO Biosphere reserve, RAMSAR agreement, EU Birds Directive and Habitats Directive, the area has attracted much international attention (Baldock et al., 2000). Recovering these lost wetlands requires effective policies aimed at promoting environmental sustainability by eliminating excessive ground water use.

In the Mid-Guadiana sub-basin presents the following features:

- Large surface-waters irrigation transformations were developed with considerable public funds under state-managed development plans in the 1960´s and 1970's. These irrigation development plans directed towards agricultural production achieved considerable socio-economic development in the area, labour creation and population stabilization.
- Vulnerability to climate driven impacts, such as drought spells, is high in this area. Drastic decreases in crop yields have been experienced in the area during drought periods resulting in great overall economic losses and negative social impact to the rural population.
- Resilience to climate-driven impacts is much lower in this surface-water irrigated area in comparison to the ground-water irrigated area of the upper Guadiana basin. As a consequence drought spells have distinct socio-economic impacts as well as environmental impacts in both parts of the basin.
- The present challenges in the area are: (i) technical challenges: modernization of the large irrigation schemes, adoption of water-saving irrigation techniques, increase water use efficiency (technical and economic) and improvement of crop production techniques. (ii) policy-driven challenges: response to the requirements of the EU WFD, such as the cost-recovery of irrigation services and the derived impacts of water tariffs increase on farm income and land use. Respond to the requirements of the new CAP by developing market-oriented crop diversification, socio-economic feasibility of farming systems and environmental sustainability (reduction in agro-chemical contamination).

Table D.3: Main issues related to water use in the Guadiana Pilot Area

Water uses	Main uses	Main problems caused by these water uses	Future trends of the water uses
Water for food	Cash crops	Agriculture is the main water consumer in the area: high water demand in he area	New CAP and water policies will possibly lead to extensification
	Fodder	High water consumption of fodder (in Mid-Guadiana)	
	Vegetables	Increasing importance because of their high added value; they are high water demanding crops, so they are highly contributing to over-use of water.	New CAP seems to encourage vegetable crops; if agricultural policies do not change, vegetables will even grow in importance.
	Wine production	The most traditional and most extended crop in the area	
Water for utilities	Domestic water supply and sanitation	Although there are not important problems of quality in domestic water, the descent on the aquifer level has been accompanied by its quality wors-	Arising quality problems are forcing to seek alternative sources for domestic water supply.
	Industry	Bad quality of spills	
	Energy	Low availability of water prevents the development of its use for energy production	It does not seem to change in the future
	Transport		
	Recreation	Consumptive uses are the most problematic: golf.	
	Tourism	None	Tourism is being very much encouraged by regional policies in Extremadura region (Mid-Guadiana). It will probably suffer an important increase in the following years.
Water for nature	Ecosystems	In Upper Guadiana: wetlands of 'Tablas de Daimiel' are a menaced ecosystem due to the aquifer depletion. It is a high value protected area (included in Ramsar)	If the evolution of the current situation does not change, the wetland area will decrease until its disappearance. In Mid-Guadiana, the surface of 'dehesa' traditional exploitation system (natural equilibrium between extensive cattle farming and natural ecosystem) is likely to grow.
	Species (also fish)	Water level withdrawal leads to lose in biodiversity in the Upper Guadiana basin.	Number of species will decrease. It is especially important for birds.

Table D.4: Stakeholders within the River Guadiana Pilot Area.

Actor	Identified organisations and people
Authorities involved in river basin management(note the representatives of different committees)	Guadiana River Basin Authority (Confederación Hidrográfica del G.)
	SEIASA (infrastructure office for modernization or maintenance works on the irrigation system).
	Hidroguadiana (depends on the Ministry of the Environment)
Other relevant authorities and public officials (note different policy sectors at different policy levels)	Consejo Regional del Agua (REG)
	'Centro del Agua' of Daimiel (LOC)
	Municipal courts: about 500
	Provincial governments: 8
Political decision-makers (national, regional and local)	Ministry of Environment · Council of Environment (REG)
	Ministry of Industry
	Council of Agriculture (REG)
	Regional governments
Interest groups (different sectors. e.g. farmer's union)	Agrarian Organizations (ASAJA, COAG, UPA)
	Rural Development Associations
	Irrigators associations and communities: 76
	Spanish Association of Groundwater Users (AEUAS)
	Groundwater Users' Federation (22 irrigators communities)
	Groundwater Users' Federation (22 CCRR)
	General Irrigators' Community of Groundwater (Ac. 23)
	Groundwater Privater Users' Community (Ac 24)
Firms, business representatives (e.g. energy production, tourism, farming, fishing..)	Electricity and energy organisations and companies: 3 (Iberdrola, UNESA, ENDESA)
	Consumers associations (at national and regional level) (10)
	Companies and Associations involved in water supply and water depuration (8)
	Sport and Golf associations (4)
	Local Commerce Chambers (8)
	Spanish and regional Fishing Federations (4)
	Cooperativa de Regantes de Extremadura (horticultural coop. firm, 89 partners)
	Entrepreneurs associations (5)
Non Governmental Organisations and civil activists	WWF/Adena
	Asociación Salvar el Guadiana
	Ecologistas en Acción (confederation)
	Ojos del Guadiana Vivos
	ADENEX.org
	SEO/Birdlife
	Ecologistas en Acción
	AEMS - Rios con Vida
Journalists (note: are important in imagining and writing of scenarios)	Environmental Forum of Badajoz (private members)
	Environmental websites and networks
	Local newspapers and magazines
Researchers (fields as natural and social science, history)	Polytechnic University of Madrid, (NeWater)
	Complutense University de Madrid, (NeWater)
	IGME (Geological and Mining Institute) (NeWater)
	University of Osnabrück, Germany (NeWater)
	CEMAGREF, Montpellier, France (NeWater)
	SEI - Oxford, UK (NeWater)
	Castilla la Mancha University
	CSIC (Scientific Research Council)
	CREA (Regional Centre for Water Studies)
Other (according to local specifics)	Nueva Cultura del Agua Foundation
	Lawyers Ariño & Asociados
	International Institute of environmental law
	Professional bodies: 26

Pilot Area D.2: Garonne Basin in France

Description of the area

The Garonne watershed extends over an area of 55 000 Km2. The Garonne source, in the Pyrenees, is located in Spain (*Valle de Aran*) and the Spanish share of the Garonne watershed corresponds to an area of 620 km2. The rest of the Garonne watershed is located in France.

The Garonne main tributaries are:

- on the left bank: the Gascogne rivers and,
- on the right bank : the Ariège, Tarn and the Lot rivers.

The Garonne watershed can be divided into two main distinct areas according to their hydrological regime: (1) the Upper- mid Garonne (*pluvio-nival regime*) and (2) the lower Garonne (*pluvio regime*) (see figure D.3). The lowest river flows are observed between July and October.

Two main cities are Garonne riverside: Toulouse (Mid Garonne) and Bordeaux (Lower Garonne), they also are the main cities of the entire Garonne watershed.

The pilot area proposed corresponds to the upper-mid Garonne watershed (including the Gascogne, Ariège and Tarn tributaries).

More information on the Garonne watershed can be found in the following web sites:

- Smeag (*Syndicat mixte d'études et d'aménagement de la Garonne*): http://www.eptb-garonne.fr/
- Agence de l'eau Adour-Garonne: http://www.eau-adour-garonne.fr/

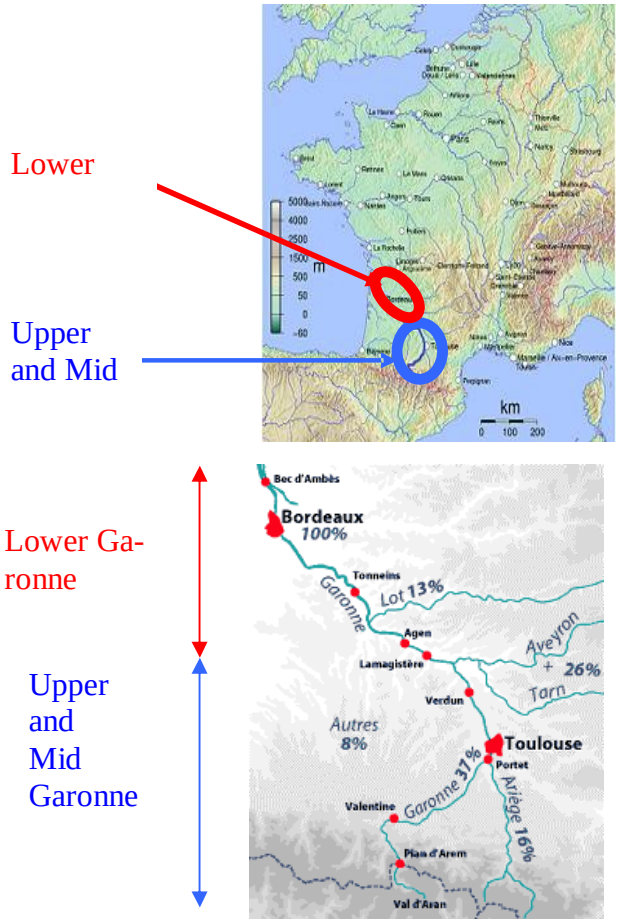

Figure D.4: The Garonne watershed and Pilot Area location.

Table D.5: Upper-mid Garonne watershed water withdrawals and consumption.

Water use	Percentage of total water withdrawals	Percentage of water withdrawn that is consumed
Domestic water use (including parks irrigation in cities)	25 %	30 %
Industrial water use[1]	46 %	Less than 10 %
Agriculture "blue" water use	29 %	75 %

[1] Excluding nuclear water withdrawal and consumption

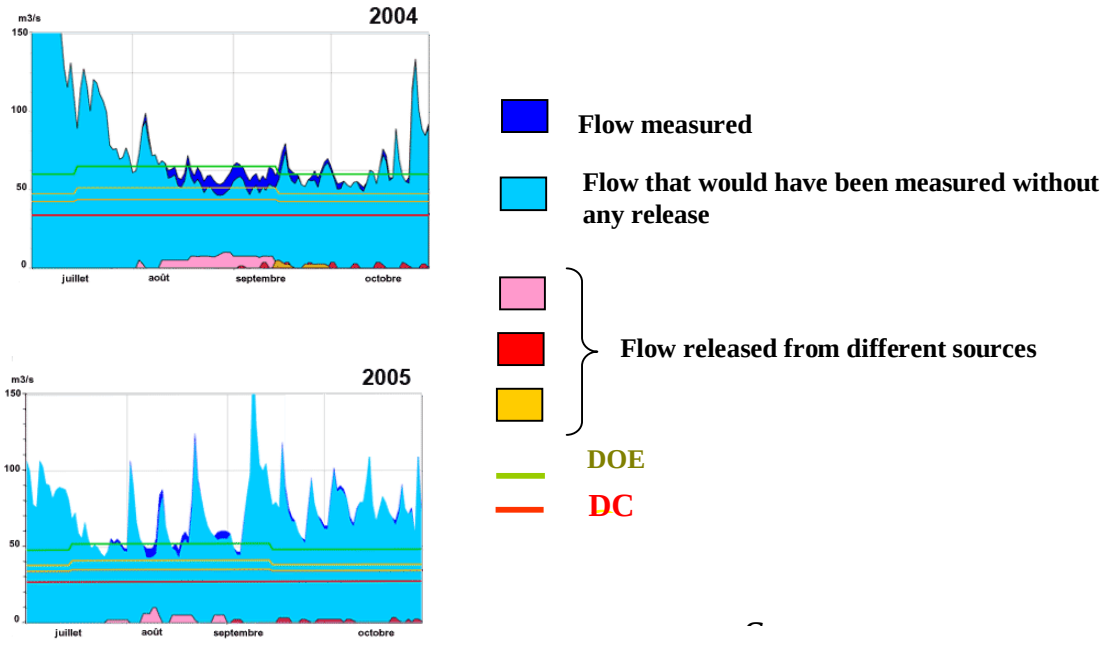

Figure D.5: Flow management and dams releases.

The SDAGE[2] approved in 1996 by the Adour-Garonne watershed council (*comité de bassin*), defined minimum flows to be maintained, in order to "allow ecosystem functioning and water needs fulfilment". There are intensive debates on how to reach the minimum flows objectives and on the objectives definition themselves particularly within the implementation of the water framework directive (WFD). These minimum flow have been translated into negotiated management indicators such as:

- *Débit d'objectif d'étiage :* flow supposed to allow anthropic demand fullfilment and good functionning of the hydrosystem.
- *Débit de crise :* flow levels under which drinking water and aquatic species lives are compromised
- *Débit de gestion d'étiage :* flow levels under which action starts to be taken (defined following a strategic model of destocking, variable each year) (see figure 2).

Debates and conflicts between water uses are driven by different stakeholders' representations of water demands characteristics, environmental needs, land use planning and power relations in decision making processes. They are also highly influenced by the perceived impacts of (i) changes in the CAP on the agricultural sector and on global agricultural water demand, (ii) climate change and renewable energy production.
Within the Garonne watershed, the co-ordination of energy, agriculture and environmental policies and their impacts on water management, uses and allocation at different scales is a key issue.

Main water uses characteristics:

Agriculture: Irrigation withdrawals are concentrated during the summer (June-August). Irrigation highly developed since the 70's associated to irrigation networks and dams building. In 2000, the irrigated area corresponds for the entire upper-mid Garonne watershed to 220 000 hectares (10 % of the total cultivated area). Today, more than 60 % of the irrigated area is covered by maize. Agriculture water withdrawals are subject to high inter-annual variability due to conjuncture climatic and economic factors. During the 2003 and 2005 summers, deficits led to administrative prohibition of withdrawing water of irrigation, affecting agricultural production. Agriculture is also responsible of important part of diffuse pollution in the watershed, particularly on the Garonne left bank.

[2] Schéma directeur d'aménagement et de gestion des eaux

Hydropower and nuclear production: During the XXth century, dams were built on the Garonne and its tributaries for hydropower production that highly influence river flows. In the Upper-mid Garonne basin, the average annual hydropower production (from dams and run-of-the river plants) represents around 5 000 GWh Two nuclear plants were also later built on the Garonne riverside, on being located in the pilot area and representing an annual electric production of around 18 000 GWh. Since the early 90's, contracts have been negotiated in order to insure water releases from hydropower dams and contribute to maintaining minimum flow in the main watershed rivers.

Industrial water use: industrial point pollution treatment and financing is mainly dealt with regulations and co-financing mechanisms for treatment through the water agency.

Domestic water use: the main issues are (i) ensuring water quality to allow affordable drinking water production, (ii) dealing with costs related to directives implementation and (iii) costs related to infrastructure renewal.

Water management

In France, water planning combines representative and participatory democracy mechanisms. Water resources and networks management involves public entities, "public-public" and "public-private" partnerships, mainly with:

- The involved ministries co-ordinated by the Ministry of environment (agriculture, industry, health) and they regional and departmental administrations, the "watershed prefect" (representing the State)
- The watershed parliament at large watershed levels,
- Territorial committees, EPTB (groups of departmental and regional councils organised according to watershed boundaries) at main rivers watershed levels,
- River committees and CLE at rivers and parts of watershed levels,
- Public entities, public-public partnerships and public-private partnerships for water networks and dams management.

Water policies implementation rely on laws and regulations, financial incentives and participation mechanisms (SDAGE, SAGE[3] and PGE[4], financial mechanisms through water agencies based on "reciprocity"[5], etc.).

Main issues for the near future:

They deal with:

- Irrigated area evolution under CAP reform
- Re-negociating the management objectives due to the WFD?
- Re-negociation of dams releases agreements
- Climate change and impacts on the Garonne river resources

These issue are related to the questions of :

- Future constraints for equilibrating water demand and supply,
- Future costs of different options for Improving water supply,
- Cost-Benefit analysis of ensuring a minimum flow in the river ? Of limiting agriculture water demand.

[3] SAGE: Schéma d'aménagement et de gestion des eaux
[4] PGE : Plan de Gestion des Etiages
[5] Mutualisation in French

Table D.6: Stakeholders within the River Garonne Pilot Area.

Actor	Identified organizations
Authorities involved in river basin management	Agence de l'eau Adour-Garonne
	EPTB (Smeag)
Other relevant authorities and public officials	MISE
	DIREN
	CSP
	Préfet
Political decision-makers	Comité de basin
	Conseil d'Administration de l'agence de l'eau
Interest groups	Environmental associations (UMINATE)
Firms, business representatives (e.g. energy production, tourism, farming, fishing…)	Chambres d' agriculture
	EDF
	CACG
Journalists	Depeche du midi
Researchers	G. Gleizes (UMR G-Eau)
	P. Vervier (ECOBAG)

Pilot Area D.3: Candelaro Basin in Italy

Description of the area

The Candelaro river basin is located in the Northern part of Apulia region (19.362 km2) (South-East of Italy) and covers an area of approximately 1780 km2. The area is characterized by an intensive agriculture, which is the main economic activity. Industry is not diffused, and tourism is acquiring more importance in some cities and on the coast, but remains a secondary activity. Concerning water resources, the basin is distinguished by a scarce river flow that explains its external and main surface water supply by Occhito dam (Fortore River), placed outside of the Candelaro basin boundaries delivering water for domestic, intensive agriculture and industrial sectors.

Regarding to land use, the predominant crop is durum wheat, a rain fed crop, occupying about 65% of the total land, followed by high-income crops like vegetables, sugar beet, orchards, olive trees and vineyards, mainly found in the Alto Tavoliere and Basso Tavoliere areas. In the Apennines of Candelaro, where the topography is much more irregular, pastures and forests predominate.

When assessing the annual trend of rainfall and potential evapotranspiration, it becomes clear that is not possible to cultivate spring and summer crops without resorting to irrigation. Actually agriculture is the main water consuming sector, using up to 60% of the total amount of water available. More than two thirds of the water used in agriculture is needed for irrigation, while the remaining one third is used by the agro-food industry and livestock.

Pressures

Candelaro is under a “water emergency” condition, worsen by a decrease of 30% in precipitations in the last 40 years, producing a progressive raise of the areas prone to drought and desertification, and by the conversion from traditional extensive grain to highly water demanding horticultural farming. The area suffers a chronic and substantial gap between demand and supply, and a continuous pressure on underground water and on soils as a consequence, through the intrusion of sea water, especially on coastal zones.

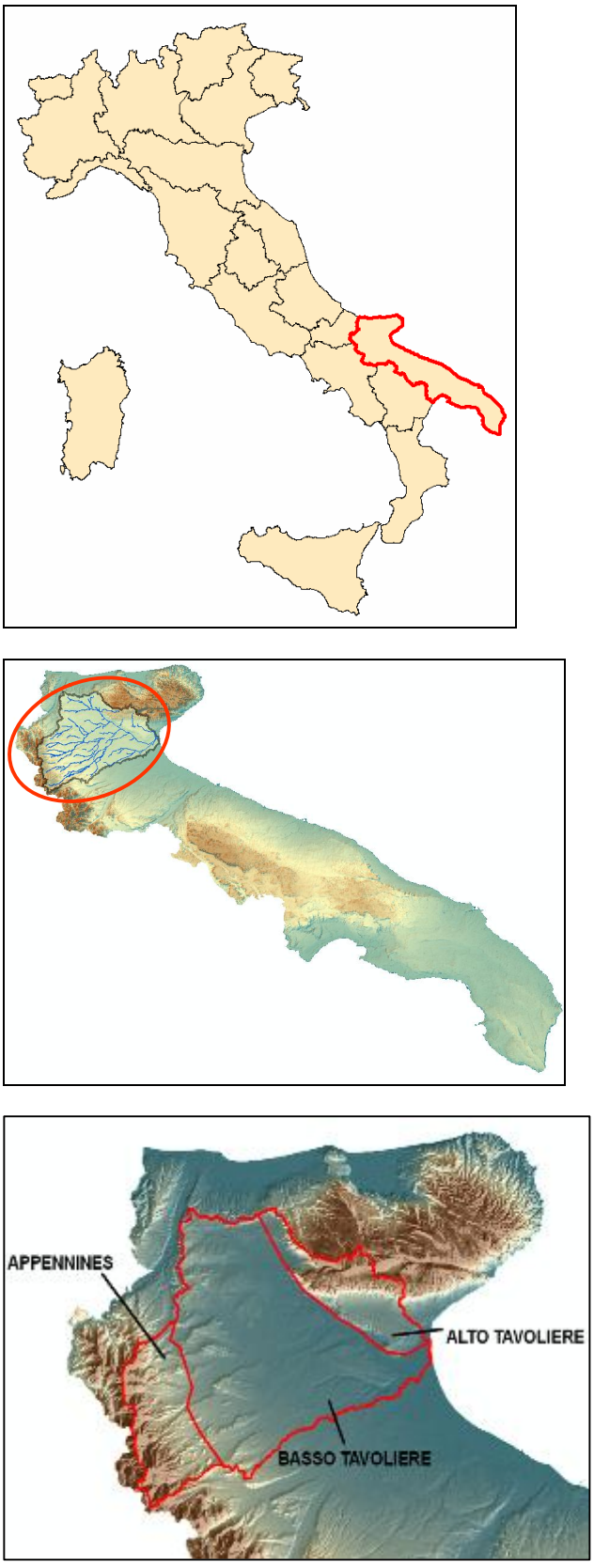

Figure D.6: Location and river network of the Candelaro river basin.

Actually, the hydrology is characterized by a torrential regime, with very small discharges flowing during summer season and episodic flood events in the raining season; particularly, the progressive decrease in surface water resources has caused in the last twenty years a massive groundwater overexploitation mainly by the agriculture sector for irrigation use; private wells lead to a progressive impoverishment of the aquifer reservoirs, in several zones, to a total absence of shallow groundwater.

The imbalanced demand and supply remains an important problem, caused in part by the incomplete execution of supply works, the continuous reductions in unit discharge due to an increasing municipal demand, and the change in the cropping pattern. Thus, conflict for water uses arises among farmers and domestic users in the scarcity period.
A debate regarding the construction of new infrastructures, as new dams, has been another relevant source of conflicts: between the regional administration and the consortium, regarding the raising of funds for new investments; and between the Consortium and the environmentalists together with the Cultural Heritage Service, for the negative impacts that new infrastructures might have on the environment and on the archaeological heritage of the area.

In addition, Candelaro is facing a water quality problem, mainly caused by agricultural practices (agrochemicals) and urban settlements, contributing to the water crisis, and to the irreversible deterioration of the natural ecosystem. The wetlands and the natural park are threatened by the pressures exerted on the quality and quantity of water resources.

The chronic water shortage as well as the water quality deterioration, are undermining agriculture sustainability and subsequently affecting the sociological, economic and ecological state of the region.

Management of water resources

The River Basin Authority (RBA) is a regional organization, which controls all Apulian basins and consequently the Candelaro basin. The "Consorzio di bonifica della Capitanata" is the local institution in charge of Operation, Management & Maintenance activities.

Participatory water management in irrigated agriculture is of long history and great relevance in many parts of Italy. It is of particular significance in Apulia where agricultural production, together with tourism, represent one of the major wheels of economy.

Most of agricultural production is based on irrigation although water availability is very limited, and highly depends on the water inflow from the surrounding regions (primarily from Basilicata) and water extraction from groundwater aquifers.

Apulia counts six land reclamation and irrigation consortia, covering an administrative area of 1,743,591 hectares, representing 90% of the total region surface. The most important Consortium in the Apulia Region is the Consortium of Capitanata, covering a surface area of 441,579 ha. The Consortium irrigable surface is equal to 146,000 ha and is organized in two main separate irrigation schemes, the Fortore scheme (Figure D.7) in the North of the province and the Sinistra Ofanto scheme in the South of the province, with differences in crop characteristics and in the land tenure.

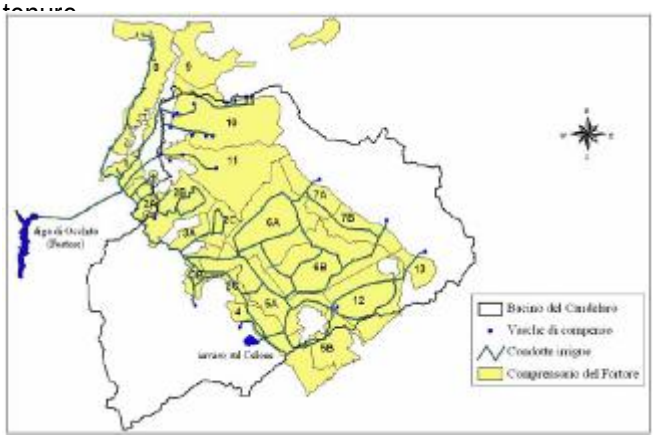

Figure D.7: Distribution network and irrigation districts of the Fortore irrigation scheme in the Candelaro basin.

In the Candelaro basin, most of the crops are irrigated by the Fortore irrigation scheme: 40% of the total area is occupied by tomato, 25% by sugar beet and 15 % by vine yards; these three crops represent the 80% of the total irrigated area, while both, tomato and sugar beet, represent the 65%. Other irrigated crops are olive trees and horticultural crops-fruit trees which represent the 10% of the whole irrigated surface each.

Table D.7: Stakeholders within the River Candelaro Pilot Area.

Actor	**Identified organisations and people**
Authorities involved in river basin management (note the representatives of different committees)	River Basin Authority
	Irrigation 'Consorzio di Bonifica della Capitanata'
Other relevant authorities and public officials (note different policy sectors at different policy levels)	Regional Authority
	Province Authority
	Ministry of Public Works
	Ministry of Agriculture
	Ministry of Environment
Interest groups (different sectors. e.g. farmer's union)	Park Authority
	WWF
	Environment Association
	LIPU (Italian association for birds protection)
	Farmers' Associations
Firms, business	COOP
Journalists	La gazzetta del Mezzogiorno
Researchers (fields as natural and social science, history)	Polytechnics of Bari
	National Council for Research-Bari
	University of Foggia
	University of Bari
	IAM Bari

Pilot Area D.4: Seyhan Basin in Turkey

Description of the area

The Seyhan River (formerly written Seihan, Sihun) is a 560 km long river in Adana Province, Turkey. The river basin has the surface area of 20.731 km². Seyhan river flows southwest from its headwaters in the Tahtalı-Mountains (provinces Sivas and Kayseri) in Anti-Taurus Mountains to the Mediterranean Sea via a broad delta.

In ancient times, it was called the Sarus, and its plain was called the Cilician plain. The major Seyhan River Dam upstream of Adana serves for irrigation, hydroelectric power, and flood control

The selected pilot area consists of Adana Province. It is located in the Southeast Anatolia. The area is situated between 34-36 eastern latitudes and 35-38 northern latitudes. Adana Province is in the Mediterranean climate zone, which is characterized by hot and dry summers and cool and rainy winters. Average precipitation is 625mm per year. The temperature varies between -10 and 50° C. Low levels of precipitation in the summer makes irrigation crucial for agricultural production.

Turkey is divided into 26 main hydrological areas, which are determined by river basins, and Adana is fed by two river basins: Seyhan and Ceyhan.

The total area of the Adana province is 14 000 km², with an agricultural area of 5 000 km² which constitutes about 2.5 % of the total agricultural area in Turkey. Pastures and meadows occupy around 500 km², while 5000 km² is forest-brushwood and shrubbery.

The Province's total population is 1.8 million, one of the most crowded in Turkey, with 25% living in villages. The population growth rate per annum is about 1.7 percent, which is lower than Turkey's average of 1.9 percent. About 20% of the population is illiterate. The population density is high (178/km²) compared to Turkey's average (88/km²). Agriculture constitutes an important part of GDP of the province, along with minor industrial production. The shares of the sectors in GDP are: Agriculture 43%, services 48%, and industry 14%.
Around 85 percent of the cultivated area is allocated to field crops. Fruits and vegetables occupy 8% and 7% of the cultivated area respectively. Main crops are cereals, cotton, maze, pistachio, soy bean, and sun flower. About 60% of the field crop land is allocated to cereals, 23% to maze, and 7% to cotton. 15% of cotton production and 40% of maze production of Turkey is provided from Adana. The region is also rich in terms of flora and fauna.

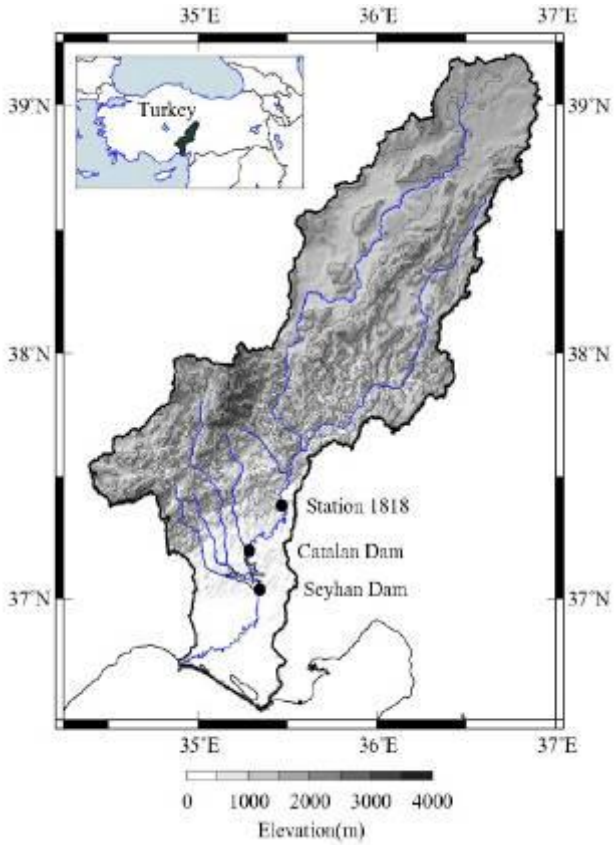

Figure D.8: Location of the Pilot Area.

3750 km² of land is suitable for irrigation. Around 1850 km² of land are irrigated. 1330 km² of land are irrigated by irrigation associations. 96% of irrigated land is irrigated by canal irrigation, while around 4%

of the irrigated land is irrigated by pipe system. 9% of the irrigation is done using groundwater.

The total water potential of the Region is 26,404 hm^3/year. 95% of this potential is from surface water. The irrigation water is provided from mainly from Seyhan, Kozan, Kesiksuyu and Aslantas Dams.

The pricing of the water is based on hectares of crops to be irrigated. There are slight differences in water charges with respect to crops. The volumetric price does not exist.

The institutional set-up in water pricing is similar to rest of Turkey. The urban delivery of water is under the auspices of the municipalities, whereas the management and operation responsibility of the irrigation water are given to irrigation associations (IA) formed by farmers, since 1994. At the tertiary level, the participatory management of irrigation is operational.
To sum up, the Region constitutes one of the most fertile areas in the country and is relatively rich. Agriculture is an important source of employment. Per hectare based O&M charges cause overuse of water which causes salinization and desertification in the agricultural areas. Loss of fertile soil due to erosion of land is also an important problem in the region. Maintenance of drainage infrastructure has become a problem after DSI has transferred O&M of drainage systems to IAs, which also contributes to the salinization problem in the region. Agricultural land is dispersed, which makes irrigation harder. There are also problems arising from legal arrangements over the use of water in the region.

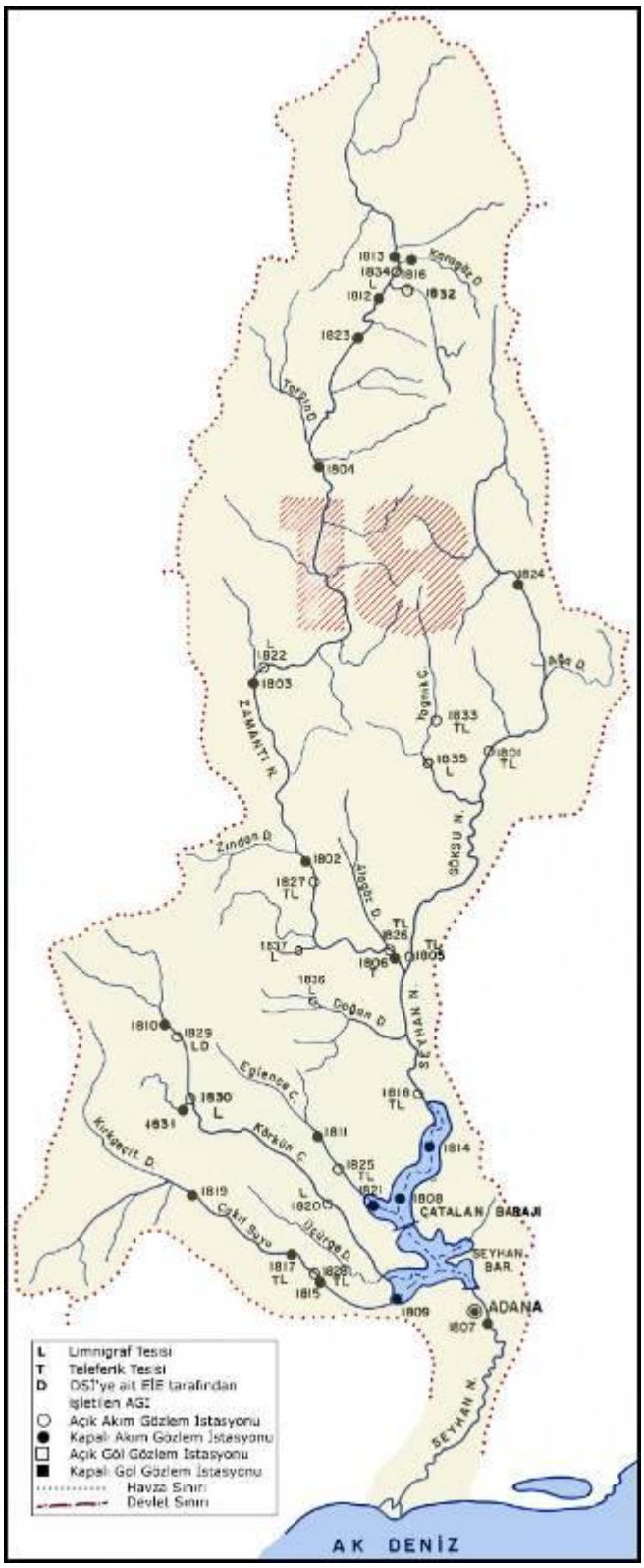

Figure D.9: Seyhan River Basin.

Main issues

The water related issues to be addressed:

- Pricing: Irrigation water charge covers only the cost of management and operations. Refer to the EU water directives about the possible changes and implications.
- Change in basic irrigation technology: volumetric vs canal irrigation, and implications for pricing.
- Environmental: Due to the over-irrigation and/or crop selection, soil salinization is expanding. Interactions with the management practices and pricing rules.
- Regional development: Implications of the changes in management practices and pricing for the contribution of water towards the development of the Region.

River Basin Management

State Hydraulic Works (DSI) has the sole responsibility for river basin management. It is headquarter is located in Ankara and has 26 regional directorates. The regional directorates are not organized according to the river basins. They are based on the grouping of provinces. However, each regional directorate covers at least major portion of a river basin. Water for domestic use is under the responsibility of the municipalities. They work closely with the DSI and Bank of Provinces (responsible for the infrastructure of the provinces). Any claim of water resources officially requires a permit from DSI.

A number of governmental and non-governmental organizations have direct and indirect interest in the development and conversation of water resources in Turkey. Institutional structure consists of three levels; decision making, executive and users level. In the decision making level, there are Prime Ministry, State Planning Organization and various ministries. Governmental organizations under the ministries are at the executive level. There are both governmental and non-governmental organizations at the water users level for the operation and maintenance of the projects (municipalities, utility agencies, irrigation cooperative etc.) Main executive level organizations responsible for development of water resources are General Directorate of State Hydraulic Works (DSI), General Directorate of Bank of Provinces, and urban water and sewage administrations.

DSI, attached to the Ministry of Environment and Forestry, is the major organization responsible for the development, management and preservation of water resources in Turkey. Development management and conservation of groundwater resources are also exclusively under the responsibility of DSI. Any claim of water resources officially requires a permit from DSI.

Bank of Provinces' responsibilities include developing urban plans, supplying municipal water, constructing sewerage systems and treatment plans, and providing loans to municipalities for the financing of such projects.

There are a number of monitoring-supervising organizations performing under various legislative arrangements. The Ministry of Environment and Forestry is responsible, among other things, for setting policies, principles and rules, inspecting activities, coordinating studies, and enhancing public awareness on environmental aspects of water resources.

Water users' associations, especially irrigation unions are perfect examples of participatory management in Turkey. The O&M of almost all state developed and previously state managed schemes are transferred to the stakeholders. About 350 irrigation unions currently and maintain 2 million hectares of 2.5 million hectares developed by DSI. Farmers using groundwater should form irrigation cooperatives. IUs are free to determine the fee subject to the approval of DSI and are responsible for fee collection. They should also provide annual reports about water parameters and financial situation of the Union to the DSI.

Concerning participation issue in the pilot area, there are 17 IUs in the Region managing about 1,330 km2. Some training and financial support for acquiring machinery have been provided at the start. They seem to be self-sustaining. The public authorities are in close contacts with the stakeholders at least through the associations. Hence they should be in close contact with at least regional public authorities. The control of water at the primary and secondary level remains with the state authority.

The public authorities are in close contacts with the stakeholders at least through the associations. Hence they should be in close contact with at least regional public authorities. The control of water at the head remains with the state authority. IU managers should meet with regional DSI to discuss about the scheduling of water delivery. The IUs are quite active, since they should be self-sustaining.

The communication links between the regional management authorities and stakeholders are open. The central and regional public authorities are flexible as long as the wishes of the stakeholders comply with the existing rules and regulations mentioned in the transfer contract.

Environmental policy making is rather new in Turkey. EU integration process started to have an impact in the policy formulation. Major interests groups are asked to voice their opinion during the development of laws and regulations. The voice of environmental NGOs started to be heard more loudly. Currently regulation and control ability of the Ministry of Environment and Forestry is weak.

Table D.8: Stakeholders within the Seyhan Basin Pilot Area.

Actor	Identified organizations
Authorities involved in river basin management	DSI representatives from Ankara and the Regional Directorate
Other relevant authorities and public officials	Provincial representative of Adana
	Regional representatives of Ministry of Agriculture and Rural Affairs, Ministry of Environment and Forestry and Municipality
Political decision-makers	Ministry and Agriculture and Rural Affairs
	Ministry of Energy and Natural resources
	Ministry of Environment
Firms, business representatives (e.g. energy production, tourism, farming, fishing…)	Irrigation Associations (about 25)
	Chamber of Commerce
	Farmers
	Irrigation coops (13)
Laymen (different water users)	Farmers
Journalists	Local journalists
Researchers	Representatives from the local Cukurova University