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OPTIMA

Optimisation for Sustainable Water Resources Management

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D04.2 Data Compilation and Analysis Report: case study specific data

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PU	Public (will be posted on project web site)	X
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

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EXECUTIVE SUMMARY

The overall aim of OPTIMA is to develop, implement, test, critically evaluate, and exploit an innovative, scientifically rigorous yet practical approach to water resources management, in close cooperation with local and regional stakeholders, intended to increase efficiencies and to reconcile conflicting demands. Based on the European Water Framework Directive (2000/60/EC), the approach equally considers economic efficiency, environmental compatibility, and social equity as the pillars of sustainable development. The project realises both the importance of the socio-political and economic aspects, but also the importance of a reliable, consistent, and shared information basis for the policy and decision making process. Empowerment through scientifically based but policy relevant information is a key concept (AG21, Chapter 40).

Central elements of the OPTIMA project are

- The seven model-based case studies in Cyprus (Dhiarizos river), Turkey (Gediz river) , Lebanon (Lower Litani), Jordan (Zarqa river), Palestine and Israel (Wadi Zeimar/Alexander river), Tunisia (Melian river) and Morocco (Martil river);
- The data bases that have been developed to compile and analyse the underlying socio-economic and physical, hydrological data, as well as the model scenarios, including the profiles of stakeholder institutions and water issues as defined by the stakeholders.

Two major domains of the data bases have been described in separate dedicated Deliverables:

- D04.1: Data Compilation and Analysis: techno-economic data
- D05.1: Land use data report

The integration of the data and models has been described in

- D06.1: Systems Integration and Implementation Report

This Deliverable describes and summarizes the shared and case study specific data and their common data base implementations. This includes:

- **The Stakeholder and Institutions data base**
- **The River Basin object descriptions**
- The Water Issues data base and its on-line interactive questionnaire interface (D02.1)
- The GIS and land-use data (Deliverable D05.1)
- The Water Technologies (Deliverable D04.1)
- The model scenarios (Deliverable D06.1)

The emphasis of the description is on the Stakeholder data base and the overall River Basin Data, that have a common structure, but case study specific coverage and content and have not been covered in detail in the Deliverables listed above. The data compiled are consistent with the data requirements described in the Annexes to the DIRECTIVE 2000/60/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 October 2000, establishing a framework for Community action in the field of water policy.

Work Package 4: Objectives

Objectives:

The main objective is to compile and process the data required for the model system and the individual case study applications of the methods defined in WP 02 and the numerical tools described and configured in WP 03, subject to the constraints analysed in WP 01.

The main objectives are:

- Compilation of the common/generic techno-economic data (D04.1)
- **Compilation of the case -study specific information for all cases;**
- **Documentation of all data sets with a common set of meta-data, storage in a common data base including a web accessible map-server for the GIS data.**

A high degree of standardization in terms of the data to be used (defined by the model data requirements, see WP 03) as well as the meta data to be used in their description will be attempted to facilitate the efficient use of the started, common set of methods across case studies; and the comparative analysis across case studies.

Tasks:

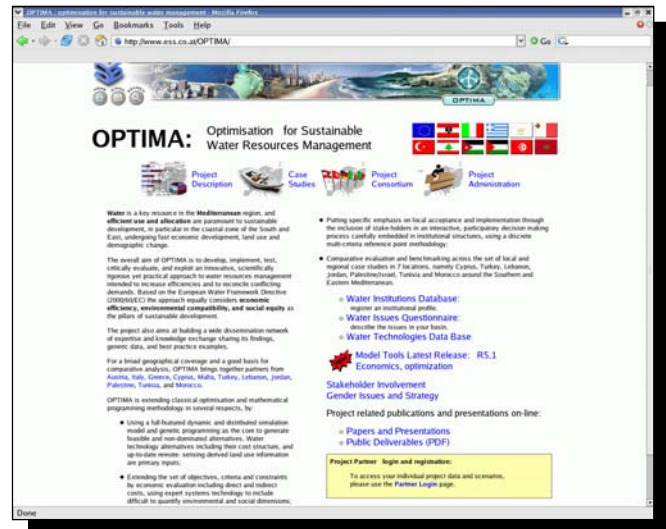
- Compilation, analysis, and processing techno-economic data including efficiencies, investment and operations costs, life times
- Water technologies (for agricultural, industrial and domestic) and infrastructure measures;
- Compilation, analysis, and processing of the case study specific physiographic, hydrological and institutional/economic background data (including water pricing, discount rates, regulatory elements like subsidies, or effluent taxes):
- GIS data: Land-use, base maps, DEM, population, infrastructure;
- Hydrographical data (climate, river flow, groundwater/pumping);
- Building of a consistent data base across case studies;
- Setting up a common map server (web accessible) for the GIS data;
- Comparative analysis of the data and preparation of the Data Reports.

Common data structure and implementation

To support the comparative analysis of the individual case studies, but also to have all the data necessary for the modelling tools available in a directly useable format, a common data structure definition and in fact a common data base implementation have been developed.

The following data bases are available on-line and from the project web server at <http://www.ess.co.at/OPTIMA>, all implemented with a web based user interface:

1. The Institutions and Stakeholder data base with currently more than 300 entries;
2. The Water Issues data base and Questionnaire (described and analysed in D02.1)
3. The Water Technology Data Base (described in D04.1)
4. The GIS and land use data (described in D05.1)
5. The model scenarios (Described in D06.1)
6. The River Basin Object data base



All data bases are implemented with Open Source tools under the Linux operating system, namely: MySQL RDBMS, PHP and C/C++ with the GD graphics library for the data base management and user interface, and the Apache web server supporting remote access through the http Internet protocol.

The use of standard HTML and data formats compatible with the http protocol makes it possible to use all multi-media formats supported by common browsers, including video and sound, that can be used as complements to standard static imagery or interactive slide shows. This can make the presentation and description of the river basins and their major problems more attractive for a broad audience and thus also data publishers.

Institutions and Stakeholder Data Base

The Institutions and Stakeholder data base holds more than 300 entries from the case study countries and a few external institutions that have demonstrated interest in the OPTIMA project.

The data base is accessible from the project homepage, and requires a user login for authentication. Visitors to the site are automatically logged in as user guest, which provides a read-only access to the existing entries but the possibility to generate a new entry.

As a general policy, only the owner (registered user) of an entry can edit or delete it.

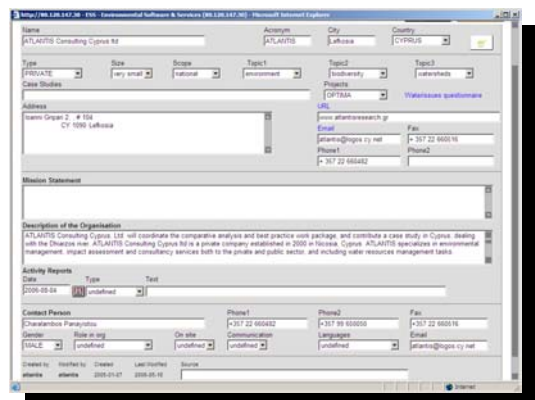


The access to the individual entries is through a listing of all available data entries. The entries are described by:

- Institution name
- An acronym
- An institutional type characterisation
- The country

Users can, at that level:

- Select an entry from the list for display
- Page forward or backwards for a multi-page list
- Re-arrange the list by selecting a column to sort by, ascending or descending
- Filter the entries by typing an arbitrary search string in the text fields above each column
- Create a new entry with the button: NEW
- Trigger the analysis of all entries
- Generate a printable listing of all entries
- Refresh the current list after some changes



Institutions data structure:

The description of a stakeholder institution includes:

- Basic identification and characterisation
- Institutional address, contact information
- Institutional profile (description, mission)
- Contact person and personal contact information
- List of chronological contact activities
- Meta data (owner of the record, creation and modification dates)

The case study specific data sets are:

Case study	country	stakeholders
Dhiarizos river	Cyprus	16
Gediz river	Turkey	67
Lower Litani river	Lebanon	67
Zarqa river	Jordan	39
Wadi Zeimar/Alexander	Palestine/Israel	42
Melian river	Tunisia	26
Martil river	Morocco	25

Graphical summary analysis of data contents



COUNTRY DATA BASE	TURKEY		LEBANON		PALESTINA		CYPRUS		JORDAN		MOROCCO		TUNISIA	
	yes	no	yes	no	yes	no	yes	no	yes	no	yes	no	yes	no
Name	66	1	67	0	42	0	16	0	38	1	22	1	23	0
Acronym	62	5	56	11	20	22	15	1	32	7	22	1	23	0
City	67	0	38	29	39	3	16	0	38	1	23	0	23	0
Country	67	0	67	0	42	0	16	0	39	0	23	0	23	0
Type	67	0	67	0	42	0	16	0	39	0	23	0	23	0
Size	61	6	54	13	19	23	11	5	37	2	21	2	22	1
Scope	67	0	59	8	14	28	12	4	37	2	20	3	23	0
Topic 1	66	1	39	28	14	28	12	4	37	2	23	0	22	1
Topic 2	50	17	33	34	8	34	12	4	37	2	22	1	22	1
Topic 3	49	18	30	37	3	39	10	6	35	4	20	3	22	1
Case Studies	67	0	59	8	40	2	13	3	38	1	20	3	22	1
Projects	67	0	56	11	40	2	14	2	38	1	21	2	22	1
Address	67	0	37	30	39	3	15	1	38	1	20	3	23	0
URL	50	17	16	51	16	26	8	8	29	10	8	15	14	9
Email	26	41	23	44	28	14	7	9	28	11	7	16	20	3
Fax	66	1	15	52	15	27	15	1	30	9	18	5	23	0
Phone 1	64	3	22	45	14	28	14	2	30	9	14	9	20	3
Phone 2	3	64	10	57	4	38	4	12	4	35	11	12	8	15
Mission	63	4	31	36	24	18	11	5	33	6	18	5	22	1
Description	52	15	21	46	11	31	6	10	31	8	3	20	23	0
Activity Reports	39	28	38	29	1	41	0	16	25	14	1	22	0	23
Contact Person	65	2	53	14	29	13	15	1	34	5	18	5	19	4
Phone 1	67	0	39	28	31	11	14	2	29	10	17	6	18	5
Phone 2	7	60	20	47	3	39	4	12	7	33	10	13	7	16
Fax	66	1	8	59	19	23	10	6	14	25	14	9	20	3
Gender	65	2	49	18	30	12	15	1	34	5	18	5	18	5
Role in org	65	2	46	21	26	16	11	5	34	5	17	6	18	5
On site	7	60	49	18	3	39	4	11	23	16	10	13	16	7
Communication	67	4	48	19	9	33	10	6	33	6	17	6	12	11
Languages	66	1	47	20	11	31	8	8	30	9	16	7	19	4
Email	37	30	15	52	8	34	4	11	22	17	2	21	14	9

Water Issues Data Base

This currently holds 121 questionnaires from the seven OPTIMA case studies.

The entry point is again a listing of all available data sets, described by:

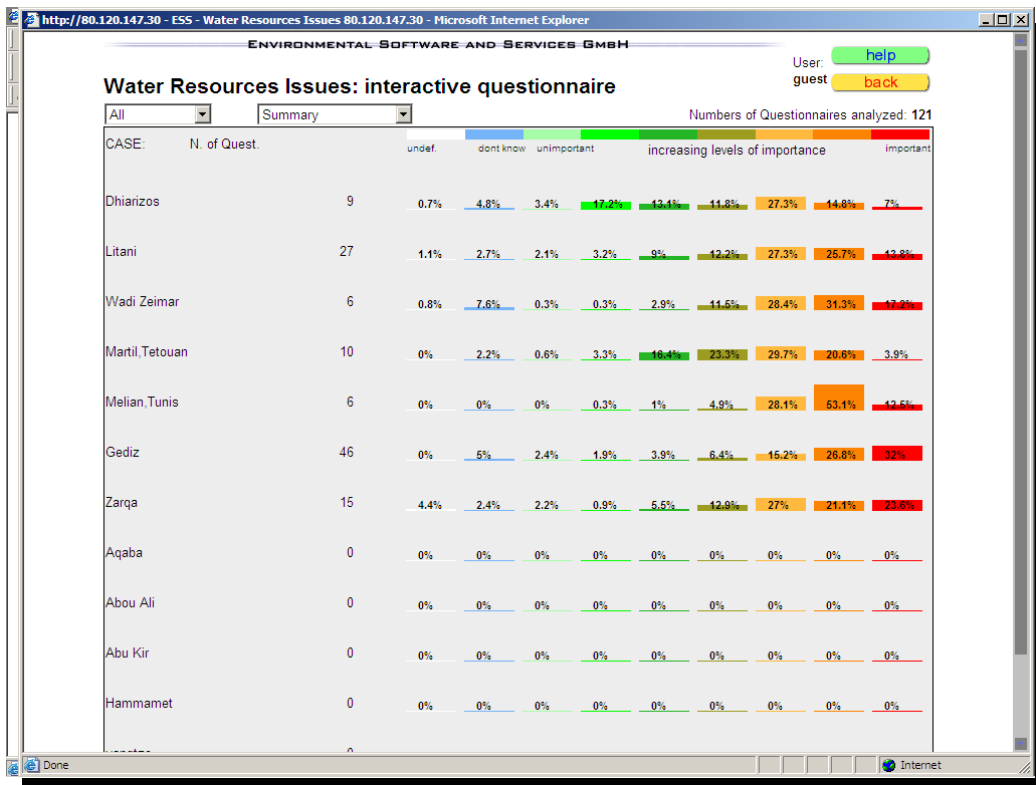
- The case study or basin
- The user contributing the entry
- The last modification date for the entry
- The institution/stakeholder that contributed the questionnaire
- Entry number within the case
- Total number of entries for the case



The case study specific data sets are:

Case study	country	questionnaires
Dhiarizos river	Cyprus	11
Gediz river	Turkey	46
Lower Litani river	Lebanon	27
Zarqa river	Jordan	15
Wadi Zeimar/Alexander	Palestine/Israel	6
Melian river	Tunisia	6
Martil river	Morocco	10

Summary evaluation (frequency of categorisations)



Water Technology Data Base

The Water Technology Data Base holds 50 entries on generic water technologies that are used for the optimization scenarios.

The entry point is a list selector similar to all other OBJECT CLASSES.

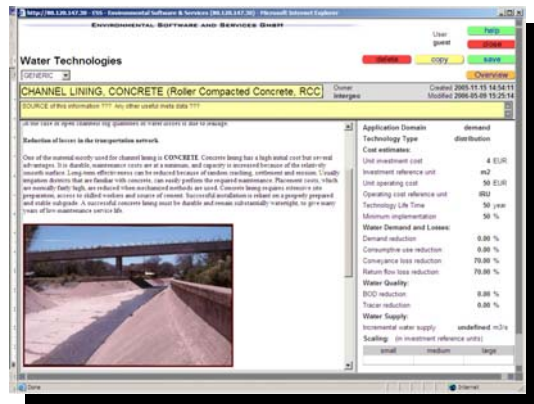
The listing shows the

- Name of the technology
- The last modification date
- An application domain



The individual technologies are described in terms of:

- Technology name
- Meta data describing the source of the information
- User, creation and modification dates
- A hypertext description with imagery
- Technology specific parameters:



Application Domain

Technology Type

Cost estimates:

Unit investment cost

Investment reference unit

Unit operating cost

Operating cost reference unit

Technology Life Time

Minimum implementation

Water Demand and Losses:

Demand reduction:

Consumptive use reduction:

Conveyance loss reduction:

Return flow loss reduction:

Water Quality:

BOD reduction:

Tracer reduction:

Water Supply:

Incremental water supply

Scaling: (in investment reference units)

GIS data and MapCatalog

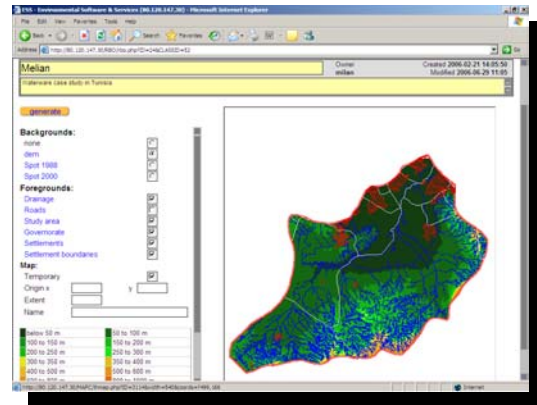
A separate instance of the

- MapServer,
- MapCatalog and
- MapComposer

has been implemented for each of the OPTIMA case studies.

The GIS and land use data are described and summarised in Deliverable D5.1.

The main map layers included for all case studies include:



MAPSERVER EMBEDDED GIS (Line features)	DESCRIPTION
Drainage	drainage system (all channels)
Roads	Road networks
Fault	Fault and fractures
Contours	The contour interval of 50 m
River	Major Water courses
Coast line	
MAPSERVER EMBEDDED GIS (Polygon features)	DESCRIPTION
Catchments	Watershed area
Governorate	Administrative boundaries
Subbasins	Sub basins in the Watershed
Study area	Limits of the study area
Soil	Soil type
Geology	Geology
Hydrogeology	Hydrogeological formations
Phereatic_WT	Pheratic water table depth
Vegetation types	Vegetation types
LU_2002	Land use 2002 (reference year)
LUC	Land cover ???
MAPSERVER EMBEDDED GIS (Raster data)	DESCRIPTION
Landsat TM	Thematic Mapper
Ikonos	Pan_Sharpended
SPOT	Panchromatic satellite imagery
DEM	Min. 1 km resolution, 1m vertical

Model Scenarios

Each of the case studies has built and run at least one baseline scenario of the WRM water resources model as the starting point of the optimisation experiments.

The WRM water resources model scenarios, grouped by location and sorted by modification dates that are currently on-line include:

WRM water resources model scenarios	
Dhiarizos, Cyprus	19
Gediz, Turkey	23
Litani, Lebanon	1
Zarqa, Jordan	20
Wadi Zeimar/Alexander, Palestine/Israel	5
Melian, Tunisia	4
Martil, Morocco	8
GENERIC and demos	7

NAME	OWNER	DESCRIPTION	START	MODIFIED	LOCATION
19 test scenarios	houlis	new data study test scenarios	2005-01-01	2006-09-11 08:32:27	GENERIC
wrb-zarqa	ipon	for the year of 2005	2005-01-01	2006-07-29 10:47:36	Wadi Zeimar
TEST ECONOMY	luis	simple test case for CBA	2005-08-01	2006-07-23 11:17:30	GENERIC
WRM Ghazal City	u2m	the topological model of the Martil basin	2001-08-01	2006-07-23 06:10:09	Martil
WRM of Martil Basin basal	u2m	the topological model of the Martil basin	2001-09-01	2006-07-23 02:06:41	Martil
wrb-zarqa - alexander	ipon	for the year of 1995	1995-01-01	2006-07-20 11:02:02	Wadi Zeimar
New topologic model of mel	col	the topologic model of the melian basin	2000-09-01	2006-07-19 11:52:24	Melian
200 Baseline WQ	ipon	Zarqa River Basin Baseline 10/2001 - 9/20	2001-10-01	2006-07-12 08:41:31	Zarqa
200 Baseline water quality	ipon	Zarqa River Basin Baseline 10/2001 - 9/20	2001-10-01	2006-07-06 09:03:34	Zarqa
Litani Lower Basin (LLB)	luis	Litani River Lower Basin (LLB) in Lebanon	2003-09-01	2006-07-05 10:13:00	Litani
200 Baseline-RR	ipon	Zarqa River Basin Baseline 10/2001 - 9/20	2001-10-01	2006-07-04 16:47:47	Zarqa
200 Baseline-R	ipon	Zarqa River Basin Baseline 10/2001 - 9/20	2001-10-01	2006-07-03 13:37:42	Zarqa
Chanzira baseline scenar	atlanta	incorporates year 2005 data	2005-01-01	2006-07-03 11:07:46	Chanzira
Chanzira Desalination Sca	atlanta	incorporates year 2005 data	2005-01-01	2006-06-30 14:02:29	Chanzira
wrb-zarqa - WadiZeim	ipon	for the year of 1995 test for WadiZeim	1995-01-01	2006-06-29 16:12:20	Wadi Zeimar
200 Baseline-CCFRAB	ipon	Zarqa River Basin Baseline 10/2001 - 9/20	2001-10-01	2006-06-27 09:16:20	Zarqa
2001 Chanzira Opt Design	atlanta	incorporates year 2005 data	2005-01-01	2006-06-26 08:36:41	Chanzira
200 Baseline-CCFRAB	ipon	Zarqa River Basin Baseline 10/2001 - 9/20	2001-10-01	2006-06-21 13:00:42	Zarqa
TEST CASE BIA	luis	just to test with access by CBA	2006-01-01	2006-06-21 09:17:24	GENERIC
200 Baseline-CCFRAB	ipon	Zarqa River Basin Baseline 10/2001 - 9/20	2001-10-01	2006-06-20 11:25:02	Zarqa

For the STREAM water quality model, the corresponding number of scenarios reflects the relative importance of water quality in the individual case studies:

STREAM water quality model scenarios	
Dhiarizos, Cyprus	-
Gediz, Turkey	1
Litani, Lebanon	2
Zarqa, Jordan	6
Wadi Zeimar/Alexander, Palestine/Israel	9
Melian, Tunisia	1
Martil, Morocco	2
GENERIC and demos	7

In addition, several scenarios have been created for the

- RRM rainfall-runoff model (126 scenarios) and the
- IWD Irrigation water demand model (11 scenarios)

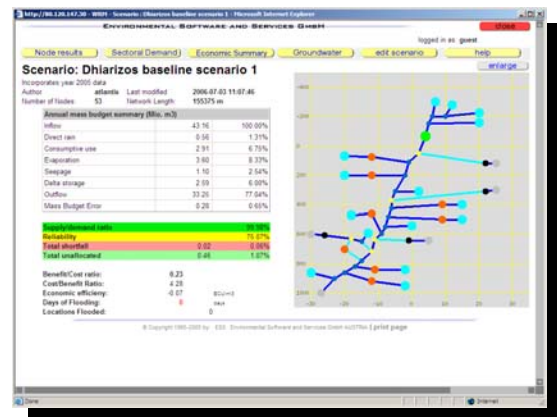
The models calculate outflow from ungaged basins, or supplementary irrigation water demand, respectively, and thus can be used to provide input data estimates (time series of water flow or demand) for the WRM model scenarios.

WRM baseline scenarios

The baseline scenarios including the economic assessment of the status quo represented are the basis for the optimisation scenarios. The models are based on the stakeholder perceptions as defined in the water issues questionnaires, and their feedback in the stakeholder workshops. The following baseline scenarios have been generated:

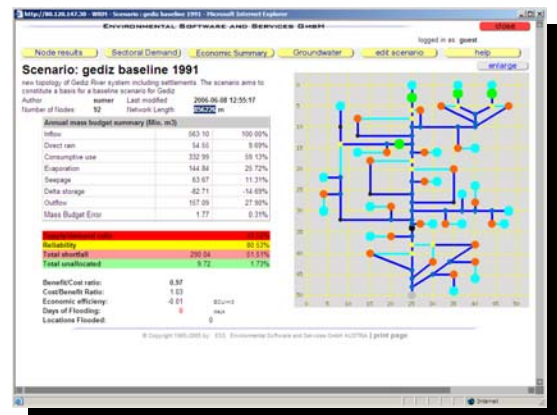
Dhiarizos, Cyprus:

Baseline scenario	
Basin area (km ²)	260
Network length (m)	155,375
Number of nodes	53
Supply/demand ratio (%)	99.98
Reliability (%)	75.07
Shortfall (%)	0.06
Unallocated (%)	1.07
Benefit/cost ratio	0.23
Economic efficiency (€/m ³)	-0.07



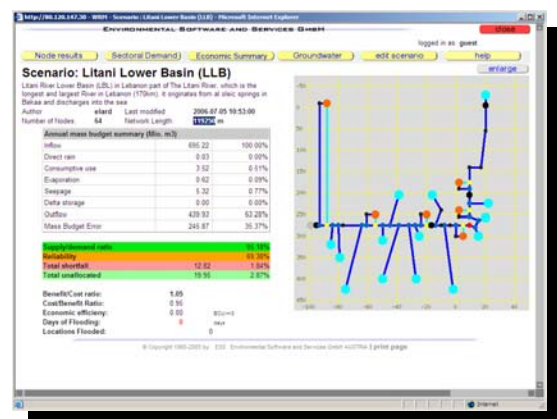
Gediz, Turkey

Baseline scenario	
Basin area (km ²)	18,000
Network length (m)	856,226
Number of nodes	92
Supply/demand ratio (%)	49.52
Reliability (%)	80.53
Shortfall (%)	51.51
Unallocated (%)	1.73
Benefit/cost ratio	0.97
Economic efficiency (€/m ³)	-0.01



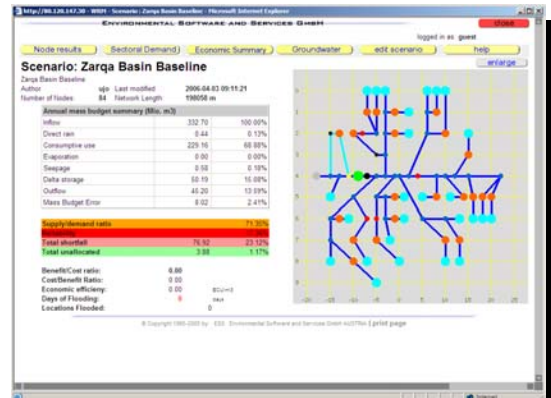
Lower Litani, Lebanon

Baseline scenario	
Basin area (km ²)	600
Network length (m)	119,250
Number of nodes	64
Supply/demand ratio (%)	95.18
Reliability (%)	69.38
Shortfall (%)	1.84
Unallocated (%)	2.87
Benefit/cost ratio	1.05
Economic efficiency (€/m ³)	0.00



Zarqa, Jordan

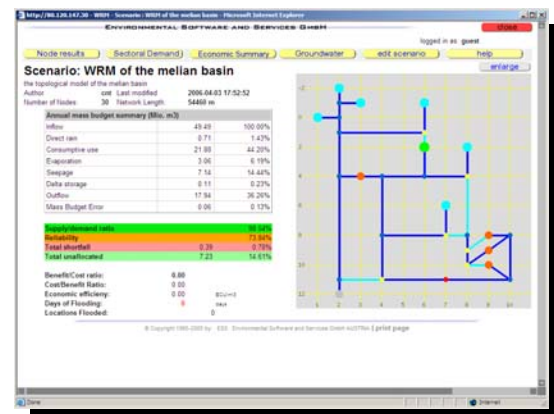
Baseline scenario	
Basin area (km ²)	4,120
Network length (m)	198,058
Number of nodes	84
Supply/demand ratio (%)	71.35
Reliability (%)	17.36
Shortfall (%)	23.12
Unallocated (%)	1.17
Benefit/cost ratio	-
Economic efficiency (€/m ³)	-

**Wadi Zeimar/Alexander, Palestine/Israel**

Baseline scenario (2005)	
Basin area (km ²)	500
Network length (m)	70,386
Number of nodes	57
Supply/demand ratio (%)	96.82
Reliability (%)	99.79
Shortfall (%)	1.78
Unallocated (%)	57.00
Benefit/cost ratio	-
Economic efficiency (€/m ³)	-0.24

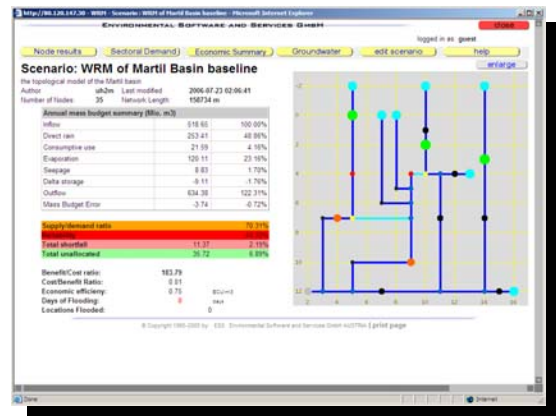
**Melian, Tunisia**

Baseline scenario (2005)	
Basin area (km ²)	553
Network length (m)	54,460
Number of nodes	30
Supply/demand ratio (%)	98.54
Reliability (%)	73.84
Shortfall (%)	0.78
Unallocated (%)	14.61
Benefit/cost ratio	-
Economic efficiency (€/m ³)	-



Martil, Morocco

Baseline scenario (2005)	
Basin area (km ²)	1,129
Network length (m)	158,734
Number of nodes	35
Supply/demand ratio (%)	70.31
Reliability (%)	49.39
Shortfall (%)	2.19
Unallocated (%)	6.89
Benefit/cost ratio	183.79
Economic efficiency (€/m ³)	0.75



Please note that in total, there are currently about 90 WRM water resources model scenarios (with about 400 distinct NODES defined in total over the individual case studies) together with 28 STREAM water quality model scenarios defined and operational on-line at the OPTIMA project web server. They represent various structural alternatives or development stages of the model building process, or planned basin structures in some cases.

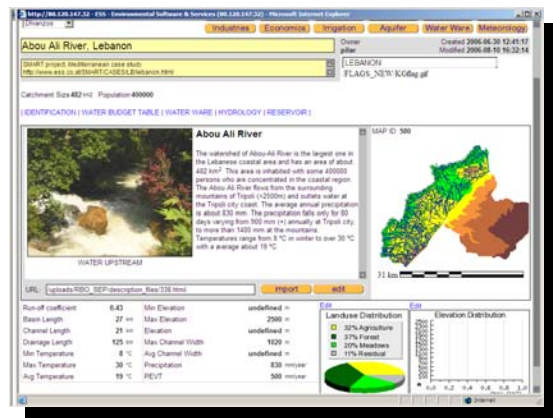
RIVER BASIN OBJECTS: data base structure

The central repository of all case study related data is an object based, hypertext structured data base for the description of a **river basin**.

The data base is implemented with a relational data base engine (RDBMS) such as MySQL, ORACLE or PostgreSQL and a graphical user interface in HTML for distributed web access with any industry standard browser.

The basic data types used include:

- Text (symbols, short descriptions, text blocks and entire HTML pages as well as optional PDF documents)
- Scalar variables, defined both numerically as well as in a parallel symbolic labelling to support the integration of qualitative and semi-quantitative information
- Vectors (time series of scalar data)
- Matrices and tensors (two and more dimensional scalar data sets)
- GIS data (vector and raster coverages)



The data structure includes the following major topics or embedded elements in the hyperlinked structure, defined in some details below:

1. **Identification**/Description including external hypertext pages covering topics such as physical and economic geography, history, regulatory framework, etc.
2. **Economics** (separate summary page)
3. **Demography** (separate summary page)
4. **Physiography**, elevation distribution, tabular summary, also available as DEM in the GIS/MapCatalog
5. **Lands use** distribution; tabular summary, the data are also available as part of the GIS data and MapCatalog
6. **GIS/RS** data, MapCatalog
7. **Hydrology** and water budget, including hypertext links for the (optional) description of floods and droughts, time series of monthly hydrological variables.

The following topics correspond to NODES in WaterWare water resources model system (WRM and STREAM models sharing the same node/reach structure) and can in fact be used to inherit basic data for the model scenarios:

8. **Monitoring** stations and time series data, including the reference climate station(s)
9. **Water Supply:**
 - a. Sub-catchments, basins (hierarchically structured)
 - b. Wells, well fields, springs
 - c. Interbasin transfer
 - d. Desalination plants
10. **Water Demand:**
 - a. Major settlements
 - b. Irrigation districts
 - c. Large farms, agrobusiness
 - d. Major industries
11. **Structures:**
 - a. Reservoirs and dams, lakes
 - b. Aquifers
 - c. Waste water treatment plants
12. Stakeholder data base link
13. Water Issues data base link
14. WaterWare application and model scenarios

Each of the topics is covered by a separate (pop-up) hypertext page, several of which lead on to further, additional pages in a hierarchical structure for further detail and the possibility to edit the data (subject to access rights defined by the case study owner and user name).

The individual topics and their basic, first level data content are described below.

The Descriptor types used include: V (variable, free text); S (symbolic, list of predefined symbols) H (hybrid, numerical data and symbolic range labels).

RIVER BASIN OBJECTS: attributes and data elements

1 IDENTIFICATION/DESCRIPTION	
Name	Descriptor, V
Description 1	embedded HTML and images
Description 2	URL, pop-up page, links
Country	Descriptor, S
Flag	GIF, derived from country
Province	Descriptor, V
Sub Region	Descriptor, S
Climate Zone	Descriptor, S
Major Settlement/City	Name (link to OBJECT)
2 LOCATION (can also be found at the MapServer page)	
Reference point LATITUDE	Descriptor, H
Reference point LONGITUDE	Descriptor, H
Map/GIS data	Embedded map, Map ID
3 PHYSIOGRAPHY	
Catchment area	Descriptor, H

Minimum elevation	Descriptor, H
Maximum elevation	Descriptor, H
Elevation difference	Descriptor, RO (computed)
Area elevation table, WIDGET/editor link	Table/ graphic, GIS data (DEM)
River length (main stream)	Descriptor (RRM scenario ?)
Drainage length (all perennial channels)	Descriptor (RRM scenario ?)
4 LAND USE/LAND COVER	
Table: area - % (simplified classification)	Table (CORINE level 2 ?)
5 DEMOGRAPHY	
BUTTON to a linked TABLE	
Total population	Descriptor, H
Rural	Descriptor, H
Urban	Descriptor, H
Growth rate (total)	Descriptor, H
Growth rate (urban)	Descriptor, H
Growth rate (rural)	Descriptor, H
% < 15 year old	Descriptor, H
% 16-65 (working population)	Descriptor, H
% > 65 (retired)	Descriptor, H
Age/sex distribution	TABLE, population pyramid ?
6 ECONOMICS	
BUTTON to an ECONOMICS TABLE pop-up	
Total Gross Regional Product (GRP)	Descriptor, H
GRP per capita	Descriptor, H
GRP by sector (agriculture, industry, services)	TABLE, Pie chart (editor)
Employment (sectoral)	TABLE, Pie chart (editor)
Growth rates (sectoral)	TABLE, Pie chart (editor)
Water price (domestic),	Descriptor, H
Water price (industry)	Descriptor, H
Water price (agriculture)	Descriptor, H
7 METEOROLOGY	
BUTTON	
CLIMATE STATION(s)	Selector or OBJECT
Annual Average: Total Precipitation	Descriptor, RO (derived ?)
Annual Average: Air Temperature	Descriptor, RO (derived ?)
Daily values Temperature (one o more year)	Monitoring TS link
Daily values Precipitation (one o more year)	Monitoring TS link
Daily values Run off (one o more year)	Monitoring TS link
8 HYDROLOGY	
Average annual runoff	Descriptor H
Maximum (daily) flow	Descriptor H
Minimum (daily) flow	Descriptor H
ANNUAL WATER BUDGET	LINK to a pop-up TABLE (RRM)
Daily values Run off (one or more year)	Monitoring TS link
Flood- drought conditions	URL, HTML (pop-up) link
9 MODEL SCENARIOS	
WaterWare application link	BUTTON

Embedded OBJECTS

Can be linked, depending on layout/space, from:

- A BUTTON
- A (summary, read-only) DESCRIPTOR (like number of objects), derived, aggregated or averaged over the set of child objects

The link leads to:

- A SELECTOR if there is more than OBJECT in the set
- The OBJECT directly if there is only ONE instance

10 EMBEDDED OBJECTS: WATER SUPPLY	
Subcatchments: hierarchical structure, same as the basic BASIN OBJECT	BUTTON to selector
Wells and well fields	Included in subcatchment selector
11 EMBEDDED OBJECTS: WATER DEMAND	
Major Cities	BUTTON to selector
Number of cities	Descriptor, RO (computed)
Total Urban population	(see above)
Irrigation Districts	BUTTON to selector
Number of districts	Descriptor, H
Total area irrigated	Descriptor, H, RO, computed
Major Industries	BUTTON to selector
12 EMBEDDED OBJECTS: STRUCTURES	
RESERVOIRS	
Number of reservoirs	Descriptor, RO (computed)
Total storage capacity/volume	Descriptor, RO, computed
Treatment Plants	BUTTON to selector
Number of plants	Descriptor, RO (computed)
Total capacity (PE)	Descriptor, RO (computed)

13 OTHER RELATED DATA BASES (access filtered by basin name)	
Stakeholders Data Base	Number, link data base
Issues Questionnaire	Number ,link data base

EMBEDDED OBJECTS: data tables

RESERVOIRS	
Type	Descriptor, S
Operator	Link (contacts DB table)
Aquifer	Link (OBJECT)
Storage Total (10^6 m^3)	Descriptor H
Dead Storage (10^6 m^3)	Descriptor H
Dam Height (m)	Descriptor H
Spill Capacity (m^3/s)?	Descriptor H
Surface Area (km^2)	Descriptor H
Depth / Area/ Volume Curve	Widget and editor, pop-up
Release Time Series	Link (Time Series)

AQUIFERS	
Type (confined, unconfined)	Descriptor, S
Layers	Descriptor, H
Geology (dominant)	Descriptor, S
Area (km^2)	Descriptor, H
Volume (average)	Descriptor, H
Average depth (m)	Descriptor, H
Porosity	Descriptor, H
Conductivity	Descriptor, H
Monitoring data: head	Link (Monitoring Station)
Monitoring data: quality (NO_3)	Link (Monitoring Station)
Number of wells	Descriptor (RO, computed)
Total annual average pumping	Descriptor Mm^3 (RO, computed)
Wells and well fields	Link (object list)

MAJOR CITIES	
Area	Descriptor, H
Description 1	Embedded hypertext
Population	Descriptor
Economic Activities	Pie chart/editor
Water use/consumption per capita	Descriptor, H
Description 2	HYPertext reference/URL

TREATMENT PLANTS	
Operator	CONTACT DB Link
Size (person equivalent)	Descriptor, H
Treatment technology	Descriptor, S
Sewer system type	Descriptor, S
Treatment Technologies	LINK to water technology data base
Hydraulic Capacity	Descriptor, H
Sewage composition	Pie Chart/editor widget

IRRIGATION DISTRICT	
Description 1	Embedded hypertext
Location/map	MapServer link
Operator	CONTACT DB Link
Size/area	Descriptor, H
Annual water demand	Descriptor, H
Irrigation technology	Descriptor, S
Crop distribution	TABLE, Pie chart (editor)
Water demand time series	LINK to TS/station OBJECT

MAJOR INDUSTRY	
Description	(embedded hypertext)
MAP	Local map server
Operator	CONTACT DB Link
Size (employees)	Descriptor, H
Industrial classification	Descriptor, S (NASCE, NOS-P, ISIC)
Water use m ³ /s	Descriptor, H
WasteWare m ³ /s	Descriptor, H
Treatment Technologies	LINK to water technology data base
BOD load	Descriptor, S

Implementation

Access through an OBJECT SELECTOR/NAVIGATOR with parallel map showing locations as DOMAIN boxes), attributes of the (sortable) selector columns are:

- Basin name
- Country
- Size
- Population
- (last modified date, space permitting)



**GIS: LINK to a MapServer/MapCatalog for the basin.
ALL georeferenced OBJECTS can be displayed as topical maps)**

MAPSERVER EMBEDDED GIS (Line features)	DESCRIPTION
Drainage	drainage system (all channels)
Roads	Road networks
Fault	Fault and fractures
Contours	The contour interval of 50 m
River	Major Water courses
Coast line	
MAPSERVER EMBEDDED GIS (Polygon features)	DESCRIPTION
Catchments	Watershed area
Governorate	Administrative boundaries
Subbasins	Sub basins in the Watershed
Study area	Limits of the study area
Soil	Soil type
Geology	Geology
Hydrogeology	Hydrogeological formations
Phereatic_WT	Pheratic water table depth
Vegetation types	Vegetation types
LU_2002	Land use 2002 (reference year)
MAPSERVER EMBEDDED GIS (Raster data)	DESCRIPTION
Landsat TM	
Ikonos	Pan_Sharpended
SPOT	
DEM	Min. 1 km resolution, 1m vertical

Case Study specific data availability

Against this superset of (largely optional) basin data, the case study specific data availability (status of August 15, 2006) is summarised below;

Case Study River basin	% data availability
Dhiarizos, Cyprus	55
Gediz, Turkey	73
Zarqa, Jordan	58
Litani, Lebanon	52
Wadi Zeimar/Alexander, Palestine/Israel	58
Melian, Tunisia	68
Martil, Morocco	61

1 IDENTIFICATION	B 1	B 2	B 3	B 4	B 5	B 6	B 7
Description 1	X	X	X	X	X	X	X
Description 2	X	X	X	X	X	X	X
Country	X	X	X	X	X	X	X
Flag	X	X	X	X	X	X	X
Province	X	-	-	-	-	-	-
Sub Region	X	X	X	X	X	X	X
Climate Zone	X	X	X	X	X	X	X
Major Settlement/City	X	-	X	X	X	X	X
2 LOCATION							
LATITUDE	X	X	X	-	X	-	X
LONGITUDE	X	X	X	-	X	-	X
Map/GIS data	X	X	X	X	X	X	X
3 PHYSIOGRAPHY							
Catchment area (km ²)	X	X	X	X	X	X	X
Minimum elevation (m)	X	X	X	X	X	X	X
Maximum elevation (m)	X	X	X	X	X	X	X
Elevation difference (m)	X	X	X	X	X	X	X
Area elevation table, WIDGET/editor link	X	X	-	X	X	X	X
River length (main stream) (km)	X	X	-	X	X	X	-
Drainage length (all perennial channels)	-	-	-	X	X	-	-
4 LAND USE/LAND COVER							
Table: area - %	X	X	X	X	X	X	X
5 DEMOGRAPHY							
Total population (inhabitants)	X	X	X	X	X	X	X
Rural	-	-	-	-	-	-	-
Urban	-	-	-	-	-	-	-
Growth rate (% total)	X	-	-	-	-	-	X
Growth rate (% urban)	X	-	-	-	-	-	-
Growth rate (% rural)	X	-	-	-	-	-	-
% < 15 year old	-	-	-	X	-	-	-
% 16-65 (working population)	-	-	-	X	-	-	-
% > 65 (retired)	-	-	-	X	-	-	-
Age/sex distribution	-	-	-	-	-	-	-

6 ECONOMICS							
Gross Regional Product (GRP)	-	-	-	-	-	-	-
GRP per capita	-	-	-	-	-	-	-
GRP by sector	-	-	-	-	-	-	-
Employment (sectoral)	-	-	-	-	-	-	-
Growth rates (sectoral)	-	-	-	-	-	-	-
Water price (domestic)	X	X	X	X	X	-	-
Water price (industry)	X	X	-	X	X	-	-
Water price (agric.)	X	X	-	X	X	-	-

7 METEOROLOGY							
CLIMATE STATION(s)	X	-	-	X	X	-	-
Annual Precipitation (mm)	X	X	X	X	-	X	X
Annual Average: Air Temperature	-	-	-	X	-	-	-
Daily Temperature (one or more year)	X	X	X	X	X	X	X
Daily Precipitation (one or more year)	X	X	X	X	X	X	X

8 HYDROLOGY							
Average annual runoff	X	X	X	X	X	X	X
Maximum (daily) flow	X	X	X	X	X	X	X
Minimum (daily) flow	X	X	X	X	X	X	X
ANNUAL WATER BUDGET	X	X	X	X	X	X	X
Daily Run off (one or more year)	X	X	X	X	X	X	X
Floods & droughts	X	X	-	X	-	-	X

9 MODEL SCENARIOS							
WaterWare link	X	X	X	X	X	X	X

10 EMBEDDED OBJECTS							
Major Cities							
Number of cities	X	-	X	X	X	X	X
Total Urban population	-	-	-	-	-	-	-
Treatment Plants							
Number of plants	-	-	-	X	X	X	X
Total capacity (PE)	-	-	-	-	-	-	-
Irrigation Districts							
Number of districts	X	-	X	X	X	-	-
Total area irrigated	X	-	-	-	-	-	-
RESERVOIRS							
Number of reservoirs	X	-	-	X	-	X	X
Total storage capacity (MCM)	X	-	-	-	-	-	X
Major Industries	x	-	-	-	-	X	-
WATER BUDGET TABLE	X	X	X	X	X	X	X
ECONOMICS TABLE	-	-	-	-	-	-	-
DEMOGRAPHY TABLE	-	-	-	-	-	-	-
GIS Map Catalog	X	X	X	X	X	X	X
WaterWare Application	X	X	X	X	X	X	X

11 OTHER TOOLS							
Stakeholders	X	X	X	X	X	X	X
Issues Questionnaire	X	X	X	X	X	X	X

River Basin Data Base: interface examples

River Basin

Gediz

Gediz Basin

OPTIMA and SMART project, Mediterranean region
<http://www.ess.co.at/OPTIMA/CASES/TR/turkey.html>
<http://www.ess.co.at/OPTIMA/PUBS/D01.pdf>

S-Region: Southeastern Europe
 Population: 1700000 persons
 Climate Zone: Mediterranean
 Province: Izmir

Owner: pilar
 Created: 2006-04-20 14:57:00
 Modified: 2006-08-21 11:34:29

MAP ID: 526

GEDIZ RIVER BASIN

The Gediz River in western Turkey has a length of about 275 km, drains an area of 17,600 km² and flows from east to west into the Aegean Sea just north of Izmir. Mean annual precipitation in the basin ranges from almost 800 mm in the 2,300 m high mountains to below 500 mm near the Aegean coast. Temperatures range from -24 °C at high elevations in winter to over 40 °C in the interior plains in summer. The natural vegetation of the basin is mainly shrubland, maki (bay, myrtle, scrub oak and juniper trees, amongst others) and coniferous forest with large outcrops of barren limestone mountain.

Downstream view

URL:

Total Growth Rate	undefined %	GRP Per Capita (€)	undefined €
Catchment Size	18000 km ²	Annual Precipitation	700 mm/ year
Minimum elevation	1 m	Annual Average Temperature	undefined °C
Maximum elevation	2206 m	Average Annual Runoff	undefined m ³ /seg
Elevation_difference	2205 m	Maximum Flow (daily)	undefined m ³ /seg
River Length	275 km	Minimum Flow	undefined m ³ /seg

Landuse Distribution

- 33% Agriculture
- 28% Forest
- 28% Meadows
- 11% Residual

Elevation Distribution

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River Basin

Zarqa River Jordan

S-Region: undefined
 Population: 250000 persons
 Climate Zone: undefined
 Province: JORDAN

Owner: pilar
 Created: 2006-06-29 10:40:38
 Modified: 2006-08-11 17:40:44

Editing Annual Average Temperature

temperature annual average

What is the annual average temperature in a region? It is the average value of the air temperatures registered on meteorological stations within and/or in close proximity of the case study area during a year.

air high: 40.000 °C
 air low: 40.000 °C

Temperature: °C

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Total Growth Rate	undefined	Average Annual Runoff	undefined <div>
Catchment Size	473	Maximum Flow (daily)	undefined <div>
Minimum elevation	undefined	Minimum Flow	undefined <div>
Maximum elevation	undefined		
Elevation_difference	undefined		
River Length	undefined		

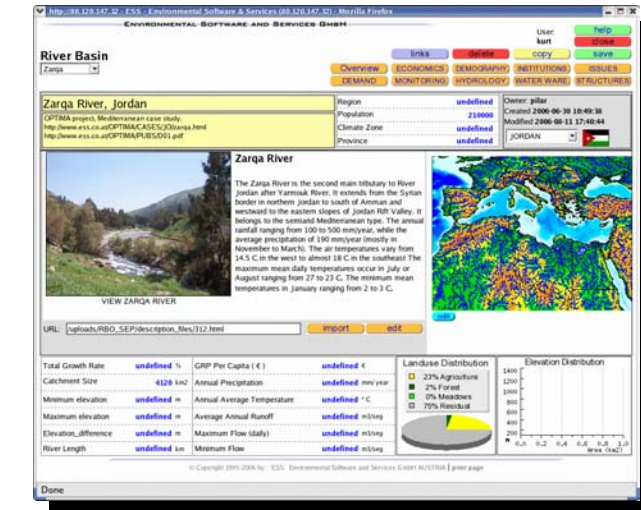
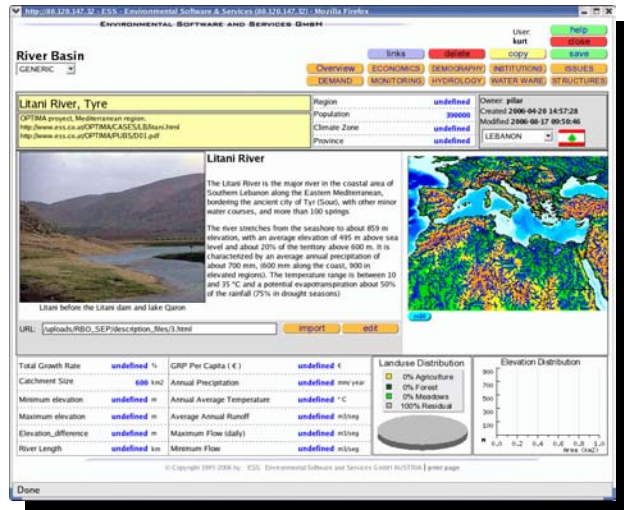
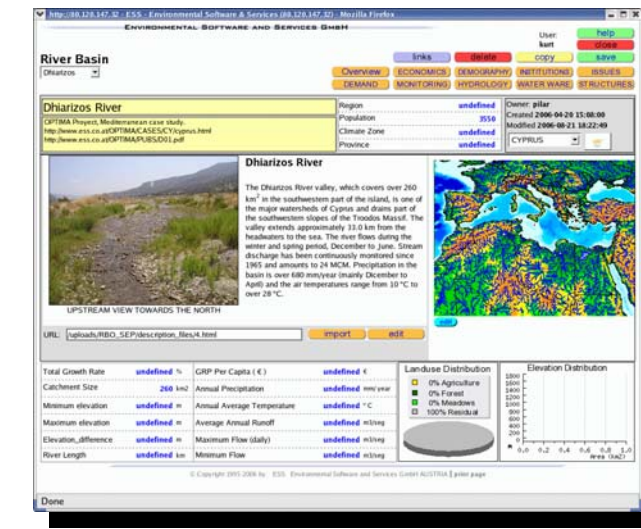
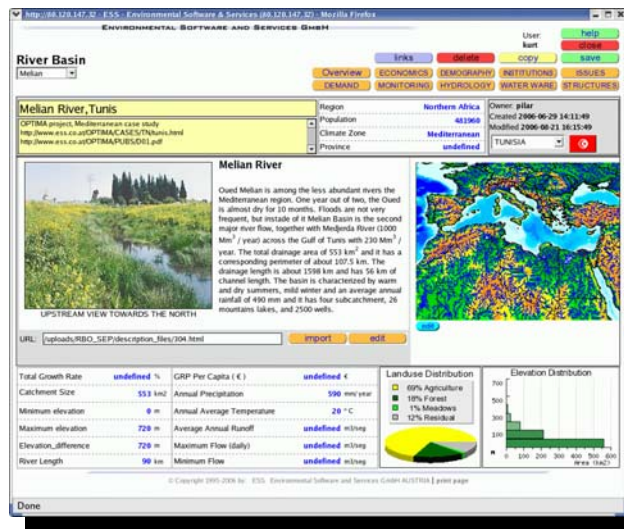
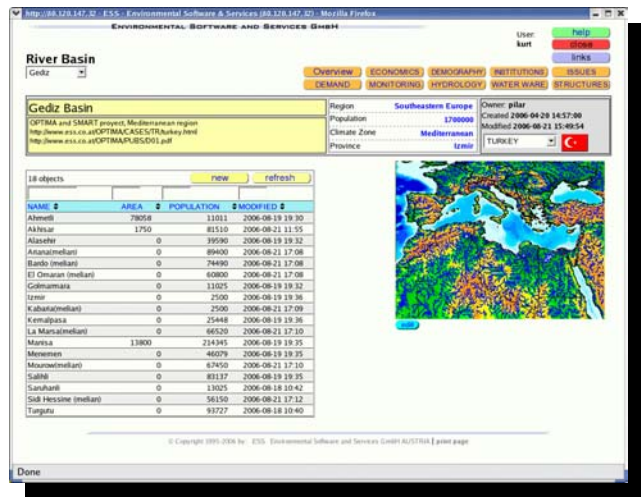
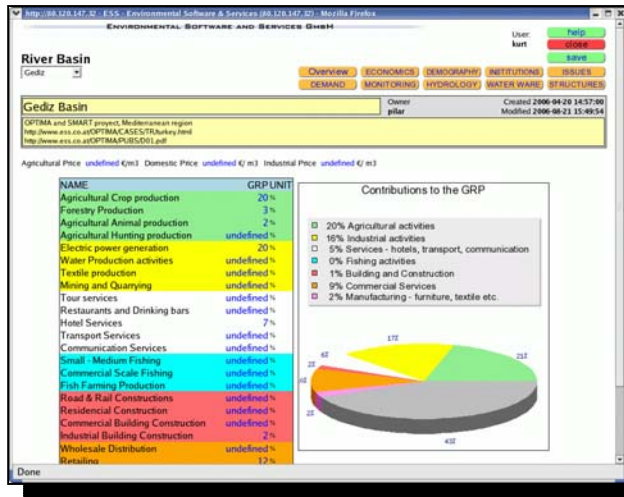
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STAKEHOLDERS: Mediterranean water resources management

Number of entries: 67 Last Modified: 2006-08-10

NAME	ACRONYM	TYPE	COUNTRY
2nd Regional Directorate of State Hydraulic Works (DS)	DS2	Governmental	TURKEY
Ministry of Environment and Forestry	M&E	Governmental	TURKEY
Water Supply and Sewerage Administration of Izmir Metropolitan Municipality	IZSU	Governmental	TURKEY
Manaman Left Bank Irrigation Assoc.	IAs	Public Authority	TURKEY
Turkish Erosion Control, Rehabilitation, and Environment Foundation YEMSA		NGO	TURKEY
Manaman Right Bank Irrigation Assoc.	IAs	Public Authority	TURKEY
Ahemeth Irrigation Assoc.	IAs	Public Authority	TURKEY
Uzum Irrigation Association	IAs	Public Authority	TURKEY
Gediz Irrigation Association_I	IAs GSB_I	Public Authority	TURKEY
Masar Irrigation Assoc.	IAs	Public Authority	TURKEY
Sakinc Right Bank Irrigation Assoc.	IAs	Public Authority	TURKEY
Sakinc Left Bank Irrigation Assoc.	IAs	Public Authority	TURKEY
Bag Irrigation Assoc.	IAs	Public Authority	TURKEY
Sargol Irrigation Assoc.	IAs	Public Authority	TURKEY
Sarhic Irrigation Assoc.	IAs	Public Authority	TURKEY
Turgutlu Irrigation Assoc.	IAs	Public Authority	TURKEY
Gokkaya Irrigation Assoc.	IAs	Public Authority	TURKEY
The Governorship of the Province of Manisa		Governmental	TURKEY
Regional Directorate of Bank of Provinces	BuP	Governmental	TURKEY
Manaman Research Institute of Rural Services		Education	TURKEY

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http://www.cgisnur.org/article.php3?id_article=43

River Drainage Database

<http://128.146.250.72:591/Rivers/>

USEPA

Virtual Field Reference Data Base:

<http://www.epa.gov/nerlesd1/land-sci/lcb/nrb/VFRDB/VFRDBmain.htm>

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