The WATER CoRe project is cofinanced by the ERDF and made possible by the INTERREG IVC programme.

The Interregional Cooperation Programme INTERREG IVC, financed by the European Union’s Regional Development Fund, helps Regions of Europe work together to share experience and good practice in the areas of innovation, the knowledge economy, the environment and risk prevention. EUR 302 million is available for project funding but, more than that, a wealth of knowledge and potential solutions are also on hand for regional policy-makers.
GOOD PRACTICES HANDBOOK
The INTERREG IVC project WATER CoRe (Water scarcity and droughts; coordinated actions in European regions) provides an exchange platform on water scarcity and drought issues. Due to climate change effects, water scarcity is foreseen to affect the European Union citizens on ecological, economic and social issues, at local and regional level. New and coordinated strategies and policies are required, to mitigate the climate change impact on our economy and our life. Thus, the main objective of the project is the exchange of experiences and the transfer of good practices between the regions partners in the project and the improvement of topic related management standards all around Europe.

WATER CoRe involves 14 partners from 7 EU Member States, shown in the map.

WATER CoRe leads to improve water scarcity and drought management policies and instruments in all the partners regions. Regional politicians have underlined their commitment to this project in a Memorandum of Understanding. Through the project homepage the results are accessible also to other European regions.
The best practices exchanged are collected in the Handbook, the knowledge core of the project. Achieved experiences are organised in 5 thematic sections covering all the WATER CoRe main topics. Project partners were involved in identifying and collecting regional experiences through the establishment of 5 working groups. Specific ‘selection criteria’ were identified: consistency; exchangeability; repeatability; effectiveness; involvement; measurability; sustainability; completeness; clearness and conclusions reached. The whole process led to select a total number of 103 good practices, here collected, subdivided into the following 5 areas:

### TECHNOCALICAL MEASURES

#### A1

**37 GOOD PRACTICES**  
Topics - Partners know-how concerning management plans, guidelines, software tools, research programmes oriented towards real and strong solutions to water demand-side management. Main topics approached: alternative sources to freshwaters; treated wastewaters recycling; efficiency in the distribution networks and leakage reduction; water-saving equipment; sustainable irrigation; metering and reuse.

### ECONOMIC AND FINANCIAL INSTRUMENTS

#### A2

**11 GOOD PRACTICES**  
Topics - Economic and financial instruments focused on water demand-side management through monetary mechanisms. Main drivers involved: 1. Taxing and pricing; 2. Return on investment.

### DROUGHT MANAGEMENT

#### B

**13 GOOD PRACTICES**  
Topics - Communication and information tools and strategies to cope with drought events: technological and infrastructural measures; planning, management and monitoring issues.

### CLIMATE CHANGE

#### C

**26 GOOD PRACTICES**  
Topics - Existing policy frameworks on different levels of governance relating to different fields for the implementation of adaptation and mitigation strategies. The factsheets selected deal with four different key concepts: forecasting; adaptation strategies; mitigation strategies; implementation and governance.

### COMMUNICATION AND PARTICIPATION

#### D

**16 GOOD PRACTICES**  
Topics - Awareness raising and education; information and dissemination as well as public participation programmes and stakeholders involvement tools.

Each good practice is here described in factsheets, which include reference to the partner responsible of collecting the main information and to the contact person, a short project description, the main results obtained, the indicators used, the total costs of the practice, the repeatability and applicability and further references.
Hereby the acronyms of the partners responsible of the good practices are collected:

**HMUELV**
Ministry of Environment, Energy, Agriculture and Consumer Protection of Hessen

**HLUG**
Agency of Environment and Geology of Hessen

**GdA**
Ministry of Agriculture, Livestock and Environment of Aragon

**AIW**
Aragonese Water Institute

**ERR**
Emilia-Romagna Region

**ARPA SIMC**
Environmental Agency of Emilia-Romagna – Hydro-Meteo-Climate Service

**Lower Tisza**
Directorate for Environmental Protection and Water Management of Lower Tisza District, Hungary

**REC**
Regional Environmental Center for Central and Eastern Europe (REC), Hungary

**MoE**
Ministry of Environment and Forests, Romania

**NMA**
National Meteorological Administration, Romania

**COVASNA**
Environmental Protection Agency Covasna, Romania

**Noord-Brabant**
Province of North-Brabant

**Hérault**
General Council of Hérault

*Have a good reading!*
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<td>Contact</td>
<td>Martina Bodem - <a href="mailto:martina.bodem@rpda.hessen.de">martina.bodem@rpda.hessen.de</a></td>
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**Project description**

Germany is a country with an abundance of water. Nevertheless, even here there are distinct conflicts over the utilization of groundwater.

The groundwater catchment area Hessian Reed (measuring more than one thousand square kilometers) is highly important for the supply of the Rhine-Main urban area. On the one hand there are granted rights for the withdrawal of groundwater of approximately 100 Mio m³/a. On the other hand woodlands and wetlands are experiencing draught damages and settlements cracks occur. Competing forms of utilization being carried out in close proximity to one another often make it nearly impossible to find a balance of interests.

The groundwater management plan Hessian Reed is a planning and steering instrument for a sustainable water management of the area Hessian Reed. Its purpose is to ensure the water supply of the Rhine-Main urban area and the South of Hesse and to avoid the formation of settlement cracks, the damage of forests and wetlands, and to prevent the drying up of irrigation wells.

The main contents are:

- Definition of target groundwater levels. At selected sampling reference points, the groundwater management plan provides target groundwater levels, which are aimed for. These guidelines are the result of balancing the user-specific requirements for the groundwater level with a view to pertaining to forestry, nature conservation, agriculture, settlement and water management issues;
- For the long term series of groundwater levels an individual range of fluctuation can be assigned to each reference value. The lower value of the fluctuation amplitude is referred to as the "lower threshold level limit";
- Construction of infiltration facilities for groundwater recharge. To ensure the public water supply in the Rhine-Main area and to maintain constant groundwater levels in environmentally sensitive areas purified Rhine water is infiltrated in some areas;
- Develop a package of measures. The groundwater management plan also provides for measurement readings to be taken in the groundwater management as an effective control and monitoring of groundwater management. The results of measuring the groundwater level are published via Internet (GW-online). Therefore, a rapid information exchange is provided for. Licensing authorities can promptly respond to any irregularities;
- The objectives of the plan will be implemented in the regulations of water right decisions.
Results obtained

- The groundwater level is not permitted to fall below the “lower threshold level limit” on a long-term basis.
- Rights for the abstraction of groundwater are linked to the maintenance of “lower threshold level limit”.
- The target groundwater levels is aspired with the help of the infiltration.

Success factors

- Low water tables are counteracted by installing infiltration plants. The groundwater is artificially recharged by purified surface water (autumn, winter, spring) depending on the weather conditions.
- In summer the purified surface water is used for irrigation.
- A three-dimensional groundwater model and a soil-water model were constructed in order to calculate the dimensions of the infiltration plants. That guarantees the maintenance of minimum groundwater levels over prolonged dry periods of several years.
- The main water supply companies have interconnected their distribution networks.
- An internet-based groundwater information system has been established (GW-online).

Indicators used

- The level of the groundwater table is constantly maintained above minimum threshold level.
- No reported further settlement cracks.

Repeatability and Applicability

It can be a model for other areas in Europe.

Total costs

Undeclared.

Further references

Websites:

- [www.rp-darmstadt.hessen.de/ir/8PDA_ Internet?cid=d06963-c9505c4032941bb28bcd5a3be](http://www.rp-darmstadt.hessen.de/ir/8PDA_ Internet?cid=d06963-c9505c4032941bb28bcd5a3be)
- [www.hmuelv.hessen.de/ir/8MULV_ Internet?cid=0c0c02c476d617cd5005815e34039755](http://www.hmuelv.hessen.de/ir/8MULV_ Internet?cid=0c0c02c476d617cd5005815e34039755)

Publications:

- Grundwasserbewirtschaftungsplan Hess. Ried;
- Sachstand Gesamtkonzept Vermeidung von Vernässungen im Hess. Ried (10 Punkte Programm);
- Maßnahmen zur Vorflutsicherung;
- Riedkarten zu Maßnahmen zur Vorflutsicherung;
- Infiltration im Hessischen Ried.
### Project description

The concept for the “Environmentally friendly groundwater abstraction in the Vogelsberg area” is a planning and steering instrument for a sustainable water management in that area. Its purpose is to preserve existing wetlands.

The Vogelsberg area is a volcanic region, which is highly important for the water supply of the Rhine-Main urban area. Due to its climatic and geological conditions the Vogelsberg area possesses a variety of nature protected wetlands, whose existence is closely linked to subsurface groundwater. Because of the increasing competition between abstraction of groundwater from the Vogelsberg area and requirements of environmental protection a strategic concept for environmentally friendly groundwater abstraction has been developed. This includes a “Guideline for a sustainable groundwater abstraction in the Vogelsberg area”. To ensure the water supply while protecting the wetlands, a management concept was developed based on a three pillar model.

The first pillar describes a predictive control of well water levels (the permitted groundwater abstractions are linked to minimum well water levels). The second pillar represents technical measures to increase the flooding frequency. With additional measures of water logging by the regional water works in extremely dry years, the preservation of wetlands can be guaranteed (pillar 3). A monitoring program accompanies the effectiveness of the measures.

### Results obtained

Precise steering of the groundwater abstraction based on ecologically determined groundwater levels on a long-term basis.

- Securing water supply by avoiding damages to the water balance of the wetlands.
- Protection and preservation of wetlands.
- Regeneration of damaged wetlands.

### Success factors

Three pillar model:

- The permitted groundwater abstractions are linked to minimum well water levels;
- Technical measures are implemented in order to increase flood events in affected wetlands;
- Additional water logging in extremely dry years is implemented by the water works.
**Indicators used**
Level of the well water and good state of the wetland.

**Repeatability and Applicability**
It can be a model for other areas in Europe.

**Total costs**
Ca. 500,000 €.

**Further references**
- Website HMULIV: Die umweltschonende Wassergewinnung im Vogelsberg 
  www.hmuelv.hessen.de/irj/HMULIV_InternetReport?cid=0c0c2c476d617c5005815e34039755
- “Grundwasser im Vogelsberg”;
- Gutachten “Übergreifende Bewertung der Grundwassergewinnung im Vogelsberg”.
Project description

Germany is a country with an abundance of water. Nevertheless, even here there are several regions where distinct conflicts over the utilisation of groundwater occur. One such area is the South of Hesse [the region between the rivers Rhine, Main and Neckar] and here especially the Hessian Reed.

Main sectors of competition for the limited groundwater resources are public water supply, industrial water demand and agricultural irrigation. The proportion of the last on the total water consumption is highly related to the annual weather conditions. In the Hessian Reed it amounts about 12% in normal years and 22% in drought years. But in opposite to the public and industrial sector were the water consumption is precisely known because of measuring by water meters there is a relatively large uncertainty about the exact amount used for agricultural irrigation. This depends on the fact that usually the groundwater consumption for irrigation - which are usually run by mobile pump units) - is not measured by water meters but other methods which are less precise and reliable. In the Hessian Reed exist nearly 2000 of such wells spread over the whole area.

Within this context there was for some years a discussion between the Regierungspräsidium Darmstadt as the granting and supervisory authority of the water rights and certain farmer-organisations about an objective, easy to verify, sufficiently accurate and easily accessible method for recording the amounts of extracted groundwater used for irrigation.

Result of these discussions was that besides water meters actually only one alternative recording method can potentially fulfil all these conditions: recording the water amounts by means of the operating-hours counters of the pump units which supply the irrigation devices.

On occasion of an information exchange between representatives of the Regierungspräsidium Darmstadt and the Hessische Bauernverband (a farmers association) in the autumn of 2007 one agreed in a pilot project to compare both methods in respect to the demands on a recording method listed above.

The pilot project was realised in the irrigation period 2007. The results obtained were discussed between the project partners in 2008 and finally published in a brochure by the Regierungspräsidium Darmstadt operating-hours counters. The publication (only available in German) consists of the following three parts: Part A (common aspects of agricultural irrigation in South Hesse), Part B (realisation and results of the pilot project); Part C (agricultural irrigation in Europe – a comparison of selected member counties). The publication can be downloaded from the Internet (address further below).
Results obtained

- Both methods fulfill in principle the required demands.
- The method by means of the operating-hours counters requires the definite registration of further parameters (especially nozzle size and pressure, but also number of installed sprinklers in case of irrigation by small sprinklers within a piped network) to obtain as good results as by water meters (this is in the range of 2 till 5% error in case of an metronomic class B instrument).
- Under practical conditions out in the field the error easily rises to 15% and above.
- Recording the irrigation parameters like installed nozzle size and actual pressure is a severe handicap of the operating-hours counter method against the method using water meters and it is to be assumed that under realistic conditions of irrigation - when time is limited - the recording of the exact parameters will often be forgotten.
- For the supervisory authority it needs a much greater effort to examine by hindsight the amount of groundwater a certain farmer has abstracted compared with the chance to secure right recordings by means of supervising the installation of water meters in advance.
- In view of these aspects the Regierungspräsidium Darmstadt decided that only water meters - like in other consumption sectors - can be accepted for the recording of the extracted groundwater.

Success factors

- When granting new water rights the Regierungspräsidium Darmstadt will usually formulate a regulatory requirement that the extracted groundwater has to be measured with water meters.
- In case of already granted rights the authority will reach an agreement with the farmers associations, that the farmers will provide themselves with water meters within the next 2 or 3 years.
- In case an agreement will not be achieved the authority will modify the existing rights in this intention unilaterally.

Indicators used

Amount of extracted groundwater for irrigation purposes which is measured by water meters.

Repeatability and Applicability

As it could be shown in Part C of the above mentioned publication there exist similar problems in other regions in Europe. In some areas the responsible authorities have already achieved the use of water meters for measuring the extracted groundwater.

Total costs

Undeclared.

Further references

- www.grundwasser-online.de/gwo_portal/modules.php?name=Content&pa=showpage&pid=54
- www.rp-darmstadt.hessen.de/itj/servlet/plt/portal/prtroot/slimp_CMReader/HWdl_15/RPDA_Internet/med/e14/e14246b7e135-21f012f31e2389e48185.2222222222-22222222222222222222
- www.rp-darmstadt.hessen.de/itj/servlet/plt/portal/prtroot/slimp_CMReader/HWdl_15/RPDA_Internet/med/22f/22f4246b7e13-521f012f31e2389e48185.2222222222-22222222222222222222
- www.rp-darmstadt.hessen.de/itj/servlet/plt/portal/prtroot/slimp_CMReader/HWdl_15/RPDA_Internet/med/d12/d125246b7e13-521f012f31e2389e48185.2222222222-22222222222222222222
**Project description**
The EMR software (environmental and agricultural evaluation of irrigation) runs daily water balances and quantifies pollutants in the drainage (salts, nitrates and major ions). Depending on these amounts, the EMR calculates a series of indices to assess the irrigation quality and its agri-environmental impact in the time period defined by the user.

The EMR evaluates the irrigable area included in a particular basin, dividing the territory from the land to the irrigation communities, thus adapting to different scales and data.

Via a simple water balance in the soil, EMR quantifies the water needs and evaluates the irrigation quality from efficiency and water deficit indicators, while the agri-environmental impact is quantified for all irrigation from water usage rates and salt and nitrate pollution.

The main inputs and outputs for the Bardenas-Arba irrigation system were measured over 4 hydrological years (2004-2007), which enabled the EMR to be used for the development of water, salt and nitrate balances, as well as for calculating irrigation and agri-environmental quality indices.

**Results obtained**
The results obtained from the Bardenas-Arba pilot scheme show a high use of water and little possibility of reducing pollution due to salts. This means that irrigation and fertilisation need to be managed in combination to minimise crop water stress and nitrate pollution.

**Success factors**
Adaptation to different scales, conducting daily water balance and quantification of crop water needs.

**Indicators used**
Irrigation quality assessment: indicators of efficiency and water deficit.

Agri-environmental impact assessment: indices to use water, salt contamination and pollution by nitrates.

**Repeatability and Applicability**
It is replicable in other contexts because it is a software tool, and therefore easy to be reproduced in other scenario, introducing the parameters and values of the new community of irrigators.

**Total costs**
Undeclared.

**Further references**
Undeclared.
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<td>Francisco Aranda - <a href="mailto:faranda@aragon.es">faranda@aragon.es</a></td>
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### Project description

The Aragon Water Commission is a collegiate, participative body, with consultative functions in dependency of the Water Institute of Aragon. It is a plural body in which government representatives are in minority and where social interests are represented broadly.

The Aragon Water Commission, that consists of 65 members, each with a right to vote, is integrated by the President and the Director of the Aragon Water Institute and 63 members from different collectives. These 63 members represent:

- Social organizations whose principal aim is to protect and preserve the environment, particularly water and its associated ecosystems: 4 representatives;
- Social organizations that aim to defend those affected by Public Works Regulations: 4 representatives;
- Associations representatives of local entities that aim to defend those affected by Public Works Regulations: 4 representatives;
- Social organizations devoted to the defence of consumers and users: 1 representative;
- University of Zaragoza: 2 representatives;
- Associations of Aragon from local entities designated on the basis of parity and representation of the local entities of the 3 provinces: 6 representatives;
- Representation of the municipalities of Huesca, Teruel and Zaragoza: 3 representatives;
- Neighborhood associations set up in the territory of Aragon: 2 representatives;
- Representation of the “Comarcas” of Aragon [counties]: 3 representatives;
- Representation of agricultural users: 6 representatives;
- Representation of industrial users, including hydroelectric schemes: 6 representatives;
- Representation of tourist, recreational, fish farming users or other users not included above: 2 representatives;
- Experts in water issues: 4 representatives;
- Representation of the Government of the Region of Aragon: 4 representatives;
- Representation of the Parliamentary Groups of the Regional Parliament of Aragon: 5 representatives;
- One representative each of the Hydrographic Confederations of the Ebro basin, Tajo and Júcar: 3 representatives;
- Community of irrigators of Aragon: 4 representatives.

The Aragon Water Commission operates in both plenary sessions and a permanent commission and elaborates specific papers for the study, report or reference of issues that due to its technical complexity, social impact or environmental repercussion or other reasons, require a specific treatment. Water Commission Plenum.
The plenary session consists of these 65 members, each with a right to vote. Its functions are:

- To debate matters pertaining to water and water works that are considered of interest to the Region, and try to bring divergent views to achieve maximum consensus on the matter.
- It is a duty of the Plenum to take acknowledge and inform about:
  - The Aragon Water Policy Principles prior to their approval by the Aragon Government and remission to the Aragon Parliament;
  - Plans of supply, sanitation and water treatment within the territory of Aragon or referred jointly to more than 4 counties;
  - Changes in the tariff structure of water treatment levy;
  - Issues concerning this matter deemed appropriate to be submitted for its consideration to the President, Vice-president, and Regional Ministers of the Region of Aragon.

Permanent Commission.
The Permanent Commission consists of the President of the Water Institute of Aragon, the Institute’s Director and 8 members representing the different social collectives, all of them with a right to vote. The functions of the Permanent Commission are:

- To prepare the issues that will be debated by the Plenum;
- To collaborate with the President to set the agenda of the Plenum;
- To propose to the Plenum the elaboration of specific white papers for presentation on relevant issues that require a more detailed study;
- To take acknowledge and inform about the Plans ruled by Act 6/2001 whose implementation does not exceed more than 4 “Comarcas”;
- To assist the President in the practice of his functions regarding the Water Commission;
- And any other functions commissioned by the President or the Plenum of the Commission and those which are legally assigned.

White papers.
The specific white papers will be scheduled by agreement of the Plenum. The Plenum will establish its subject and members. So far, 5 specific white papers were commissioned to elaborate reports on different issues. These white papers are the following:

- The Aragon Plan for Water Infrastructure;
- The Principles of Water Policy;
- Water quality;
- Projects within the Aragon Water Pact;
- Ruling of the Commission.

Results obtained
The Commission has approved 3 reports either unanimously or by a wide majority. These reports dealt with:

- The regrowth of Yesa’s reservoir to an intermediate level;
- The San Salvador’s reservoir;
- Santaliestra reservoir and the actions foreseen to regulate Esera River.

Success factors
Participation of all society sectors which are concerned about water issues and diversity of the following items: infrastructure, water quality, base of water policy, Water Agreement Works.

Indicators used
Agreements reached through the opinions of the presentations and participation of different groups in them.
Repeatability and Applicability
This experience could be repeated and implemented in other regions as in Aragon it has turned out to be a successful tool to reach consensus, achieve social participation and raise a social debate on water issues and hydraulic infrastructures.

Total costs
Undeclared.

Further references
portal.aragon.es/portal/page/portal/IAA/COMISION
### Project description

The “water saving project Bagnacavallo” started in 2003 as a pilot project to evaluate the effective reduction of domestic water consumption among the population involved. The Project Bagnacavallo foresaw, since autumn 2003, the free delivery, to each private household living in the Municipality involved (3,817 in total), of a domestic water saving kit composed of faucet aerators for house taps and showers. These are small devices which, by raising the percentage of oxygen present in the running water, reduce its flow, increasing at the same time the hygienic-sanitary return. There was also a communication campaign about the water saving in houses. Following the installation of the kits made directly by the citizens, there has been a monitoring on the consumptions for a year period. Furthermore a statistical analysis has been conducted on the values of the consumption aiming at establishing an eventual difference in the consumptions deriving from the use of the devices and the entity of such difference.

### Results obtained

At the end of the project it has been verified that the water saving was of about 10-12% per-capita.

Besides that, there has been an energy saving of about 44 TEP (equivalent tons of petrol).

The water saved [15 L/per-capita/day; 0,5 €/cubic meters] has reduced the costs by 13,000 € in a year.

### Success factors

The key elements that made this pilot project successful and effective have been the “door-to-door” distribution of the kits for domestic water saving, together with informative documentation distributed to the public.

### Indicators used

Number of distributed water saving kit (1,961); number of distributed brochures (1,961); number of families involved (1,814); water consumption reduction (10 - 12% per-capita); energy consumption reduction (44 TEP).

### Repeatability and Applicability

Highly applicable and repeatable pilot project in all European Municipalities.

### Total costs

190,000 € (approx.).

### Further references

[www.racine.ra.it/risparmioidrico/progetto.htm](http://www.racine.ra.it/risparmioidrico/progetto.htm)
### Project description
This water saving project started in 2006 as a pilot project to evaluate the effective reduction of domestic water consumption among the population involved. The project foresaw the free delivery, to each private household living in the Municipality involved, of a domestic water saving kit composed of “last generation” faucet aerators for house taps and showers. There was also a communication campaign about the water saving in houses and gardens. Following the installation of the kits made directly by the citizens, there has been a monitoring on the consumptions for an year period, calculating also the water consumption in the gardens (which are very abundant in this Municipality). Furthermore a statistical analysis has been conducted on the values of the consumption aiming at establishing an eventual difference in the consumptions deriving from the use of the devices and the entity of such difference.

### Results obtained
Water saving was of about 18% per-capita (in July 34%).

### Success factors
The key elements that made this pilot project successful and effective have been the “door-to-door” distribution of the kits for domestic water saving, together with informative documentation distributed to the public.

### Indicators used
Number of distributed faucet aerators for house taps (14,000); number of distributed faucet aerators for showers (4,300); number of citizens involved (2,675); water consumption reduction (18% per-capita).

### Repeatability and Applicability
Highly applicable and repeatable pilot project in all European Municipalities.

### Total costs
80,000 €.

### Further references
www.provincia.bologna.it/ambiente/Engine/RAServePG.php/P/266411030300
### Project description

Ciba Speciality Chemicals S.p.A. (part of BASF since April 2009) is a leading global company dedicated to producing high-value effects for its customers’ products. The site of Sasso Marconi foresees five business areas: plastic additives, coating effects, water and paper treatment, textile effects, and home and personal care. The research line of plastic additives (organic fine chemicals) is the most important in strategic and productive terms. In 2005 a Programme Agreement has been signed among the National Minister for Environment and Defence of Territory and Sea, the Region Emilia-Romagna, the Province of Bologna, the Municipality of Sasso Marconi and Ciba Speciality Chemicals S.p.a., with the title “Integrated approach on water management, withdrawals reduction and emissions containment”. This program is dedicated to the substantial improvement of environmental impact of the Ciba site of Sasso Marconi, through the reduction of the water introduced and successively re-emitted in the surface water bodies, other than the reduction in quantities of wastewaters both organic and watery produced in the site. More in detail, one of the objectives of the project was the “reduction of the quantity of water withdrawal”.

### Results obtained


### Success factors


### Indicators used

Reduction of the quantity of water withdrawal (estimated: -30,500 ton/y).

### Repeatability and Applicability

Agreement among partners strongly interested in the achievement of the objectives. Modernisation of the productive chain. Detailed analysis of the enterprise water balance.

### Total costs

883,249,75 € (comprehensive of all the activities of the Agreement).

### Further references

Undeclared.
**Project description**

This water saving project, started in 2006, foresaw the free delivery of a domestic water saving kit composed of “last generation” faucet aerators for house taps and showers. There was also a communication campaign about the water saving in house and garden. The domestic water saving kit was free-distributed in 17 Municipalities of Province of Ravenna (Alfonsine, Bagnacavallo, Bagnara di Romagna, Brisighella, Casola Valsenio, Castel Bolognese, Cervia, Conselice, Cotignola, Faenza, Fosignano, Lugo, Massalombarda, Ravenna, Riolo Terme, Russi, Solarolo) for a total amount of 6,000.

**Results obtained**

High number of involved Municipalities (17/18); Free distribution of 6,000 faucet aerators.

**Success factors**

The key elements that made this project successful and effective have been the “door-to-door” distribution of the kits for domestic water saving, together with informative documentation distributed to the public. Very low cost project.

**Indicators used**

Number of involved Municipalities (17/18); number of free-distributed faucet aerators (6,000).

**Repeatability and Applicability**

Very low cost project. High applicability and repeatability in European Municipalities.

**Total costs**

20,000 €.

**Further references**

www.provincia.ra.it/
**Project description**

The aim of the project is water losses reduction by active leak control and pipes repair in Portomaggiore and Portoverrara water distribution systems, managed by Hera. The waste metering of this network is due to an increase of input water in 2005 (and in the begin of 2006) that led to an efficiency drop in erogation in Portomaggiore outskirts caused by pipes underdesign and increased water head loss. With the aim of knowing the boundary conditions and evaluating the losses amount in real time, 7 valves have been closed to make the district served only by a unique inlet. At the same time, the use of the hydraulic model gave a first degree of information about the maintaining of the service. The waste metering district has been divided in 8 sectors (each of them of 5-6 km of pipes monitored by 40-50 acoustic sensors) with the aim of concentrating the search in specific areas.

**Results obtained**

At the end of active search of losses nearly 1.100 m³/day of water saving, without decreasing user demand. Moreover, the pressure increase due to flows reduction improved the quality of service for high building without private pumps.

**Success factors**

The key factor has been to notice that the service worsening was due to an unjustified increase in water input. Hydraulic model of the network helped in finding the best solution to solve the problem without further compromising the service.

**Indicators used**

The operations of valves closure, losses location and following repair took place from 21/02/2006 to 27/03/2006 and brought a decrease of Minimum Night Flow (MNF) from 27,91 l/s to 7,49 l/s. The Minimum Night Rate MNR (rate between the minimum hourly flow and the mean hourly flow on daily base) has lowered from 0,68 to 0,38 (under threshold intervention of 0,40).

**Repeatability and Applicability**

The methodology is repeatable in water distribution systems with continuous monitoring of District Metered Areas. The consistency of results is specific to each particular context.

**Total costs**

50.000 €.

**Further references**

**Project description**

The X-Water Project aims to provide guidance on the support offered by Automatic Meter Reading systems in the control of water losses. With respect to water demand management, the AMR systems allow the application of incentives/disincentives to the water tariff based on knowledge of the actual bands of water consumption.

The proposed approach is based on the data collection on all the meters at the same time and involves a sector of the water distribution networks of Forlì municipality, with 211 property and two supply points. Each water meter is homologated in Class C and equipped with an optoelectronic impulse device. The AMR system installed collects synchronous data directly from water meters and delivers them to the Central Unit Control. Incoming data are redirected to the Concentrator, which makes the data compression.

**Results obtained**

The application over a sector of the water distribution network of Forlì has shown that the "real time" monitoring allows major improvements about water losses reduction. A substantial reduction of the awareness time could be achieved with an evident reduction of the water volume lost. It is worthwhile underlining that since the AMR system makes possible to distinguish between apparent losses and physical losses, it is also possible to choose immediately the more suitable procedure in order to fix the problem. Therefore, AMR systems could be seen as a real and feasible water distribution network monitoring tools.

**Success factors**

Remote monitoring systems are able to read users’ water meters and it is possible to use this feature for a dynamic water balance, and also it is an excellent starting point for a water losses dynamic control approach that links the benefits of active leakage control and the ones of passive leakage control. Using uncertainty analysis, useful information about water loss type (apparent or real) can be carried out. The project aims to provide indications regarding the applicability of distance reading for the identification of physical leaks in the network. Through continuous control of the district's water balance (synchronous detection of volumes introduced into the system and supplied to customers) it is possible to detect water losses in a timely manner and launch research and repair activity, thus reducing lost volume. The project has had some very interesting results with regard to the possibility of developing an evolved accounting system, offering post-meter services, and early detection of losses, even when concealed. The Utility now intends to continue with experimentation to evaluate systems to locate leaks punctually and automatically.

**Indicators used**

The AMR system has displayed the presence in the DMA of Forlì of water leakage that emerged a month later with a magnitude greater than other water losses that emerged in a shorter time, shown the real possibility and accuracy of the AMR system in the water loss control. The estimation of the recovered volume with the installation of AMR system on all the territory served by HERA Group has been estimated equal to 15.6 $10^6$ m$^3$/year.
Repeatability and Applicability

Pilot system. The application is repeatable and applicable without specific limitations because commercial devices were used.

Total costs

50,000 €.

Further references


www.gruppohera.it
Project description

The Aquasave Project is dealing with the consumption saving of potable water in the city, by means of a new experimental way of resource consumption management. The water management system had been installed in a residential building of eight flats (ca. 22 persons). The system maximizes reuse by a) Greywater Reuse System: it collects, treats and sends greywater (coming from showers, bathtubs and washbasins located in bathrooms) to toilet flushing; b) Rainwater Use System: it collects, treats and sends rainwater to dishwashers and washing machines. Moreover, the system minimizes the water consumption by installation in the flats of water saving components.

Greywater Reuse System: greywater coming from bathroom washbasins, bathtubs and showers is collected through an appropriate network, pre-filtered (a grid stops solids: about 500 μm) and sent to the collection tank in the plant room; then greywater is filtered and disinfected, and sent to the storage tank. Afterwards, through a dedicated distribution network, a loading system sends the treated greywater to the flats and then to the toilet flushing cisterns. The treatment plant works automatically.

Rainwater Use System: rainfall coming from the roof, collected through a dedicated network, flows to the plant room. Here first rainwater is separated and sent to the sewer; a pre-filter stops (through grid: about 500 μm) leaves, pieces of paper, birds’ feathers and faeces, and other solids; so pre-treated rainwater flows into the collecting tank. Afterwards, rainwater is filtered and disinfected, and sent to the storage tank to have a reserve of water to be used in periods of little rainfall. Afterwards, through a dedicated distribution network, a loading system sends the treated rainwater to the flats and then to dishwashers and washing machines. The appliances use rainwater at washing cycle beginning, and potable water at cycle end for final rinse. The treatment plant is automatic.

Consumption Reduction System: water saving components are implemented. i.e. (a) toilet flushing cisterns with dual discharge volume; (b) water taps with two possibilities of water flow rates, provided with faucets; (c) “last-generation” washing machines and dish washers.

Results obtained

Total water saving: 50% (30% components; 15% greywater reuse; 5% rainwater use), i.e. from 167 L/p/d to 74 L/p/d.

Success factors

Collaboration among partners. Appropriate technological choices. Constant monitoring of the activities.

Indicators used

Water consumption (L/p/d = Litres/person/day).
Repeatability and Applicability
Life Pilot project, i.e. innovative, demonstrative, repeatable in other contexts of Europe.

Total costs
1,285,094,96 €.

Further references
eboals.bologna.enea.it/ambtd/aquasave-doc/aquas-ing.htm
**Project description**

The aim of the project is water losses reduction by active leakage control, by which it is meant all the activities for monitoring and localization of leakage. In this specific case, this has been made by the setting up of District Metered Areas, i.e. the subdivision of big water distribution systems in smaller ones in which inlet pressures and flows are periodically or permanently measured. The setting up of DMAs in Reggio Emilia started in 1993 by Enìa Group and led to 232 DMAs, covering the 85% of the Province.

DMA setting up consists in permanent valves closure and in pressures and flows measures of inlet points; in some case the pressure at inlet point is controlled by means pressure reducing valve. These measures are recorded and elaborated with the aim of quantifying the amount of losses and their approximate positions. After the leakage localization and repair, water saving is verified. Besides measures, other information is required to apply IVWA methodology and Minimum Night Flow Analysis: network length, density of users connections, number and type of users, demand pattern of big users, annual revenue water volume.

**Results obtained**

The monitoring of the districts orient the active search of water losses to locate the broken. In 2007 this activity has been covering approximately 994 Km of network equivalent to 20% of total allowing to recover more than 5 million of m³ to which is associated with a saving of energy equal to about 2650 MWh.

**Success factors**

The key factor has been the involvement and training of staff that allowed for the application of the required methodology and technology.

**Indicators used**

ILI - Infrastructure Leakage Index; CARL - Current Annual Real Losses; UARL - Unavoidable Annual Real Losses; MNF - Minimum Night Flow.

The Infrastructure Leakage Index (ILI) value decreased from 3.92 in 2005 to 3.76 in 2006. Annual per capita water allocation decreased of 13% from 2001 to 2005 and the numbers of burst decreased of 28% in the same period.

**Repeatability and Applicability**

The experience is clearly repeatable and applicable. The detailed rules and the consistency of the results are specific to each particular context.

**Total costs**

The parametric cost is approximately equal to 13100 €/km of network. In urban area with high density of population, the parametric cost in relation to users is equal to 50 €/connection.
Further references
www.irenemilia.it
**WG A1 - water demand-side management (technological measures)**

<table>
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<tr>
<th>Partner</th>
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<tr>
<td>Project</td>
<td>14 - Pressure control</td>
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<tr>
<td>Type</td>
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<td>Contact</td>
<td>Emanuele Cimatti - <a href="mailto:ecimatti@regione.emilia-romagna.it">ecimatti@regione.emilia-romagna.it</a></td>
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</table>

**Project description**

This project concerns leakage reduction by pressure regulation in the area Bolognina of Bologna (managed by Her Group). This is a residential area of about 113 ha, mainly covered by high density housing. The average altitude of the district is equal to 43.35 m asl and the maximum geometric difference is around 6 m. The water distribution network consists of about 24 km of pipelines and feeds a population of about 19,500 inhabitants. The network is composed mainly of asbestos cement pipes whose diameters vary from DN 50 to DN 300, with a preponderance of DN 100. Due to the high water losses, nearly the 40% of the input water, and the numerous breaks, this portion of the network has been isolated and now is served by only two entrances, Battindarno and Repubblica, both equipped with pressure reducing valves. The DMA setting up required 13 interventions: while some of them required only the valve closure, other required pipe replacement or new pipes design. At the same time a monitoring campaign recorded inlet pressures and flows, pressure in a point inside the district and demand of a remarkable user. The initial average pressure of 8 bar, excessively high with respect to building height, was lowered to 6 bar.

**Results obtained**

Water and energy recovery and reduction of breaks in pipes and users connections.

**Success factors**

The key element of this project has been the identification and setting up of DMA and the correct evaluation of the fastest and cheapest solution to reduce water losses. The hydraulic model obviously played an important role in this decision.

**Indicators used**

Measures of pressures and flows at the inlet point of the district, measures of pressure inside the district and of user's demand. Water saving of about 189,000 m³/year and energy recovery of about 143 MWh/year, considering that the average energy intensity for water supply system of Bologna is equal to 0.76 kWh/m³.

**Repeatability and Applicability**

The experience is clearly repeatable and applicable. The detailed rules and the consistency of the results are specific to each particular context.

**Total costs**

80,000 €.

**Further references**


www.gruppohera.it
**Project description**

The water, gas and district heating “Regional Network and Plant Remote Control Centre” situated in Forlì will remotely oversee over 2,000 plants and 60,000 km of networks in real time in the six provinces of Emilia-Romagna Region that HERA Group serves with a population of 1.2 million of users and a water volume supplied of 257 $10^6$ m³ (2009) by means 319 treatment plants and 30,849 km of pipeline. The Regional Network and Plant Remote Control Centre is the largest centre in Italy in terms of number of services and remote controlled points, and one of the largest in Europe. The main features are constituted by a control room with a giant 60 m² screen, 100,000 points remotely controlled in real time, a 3D system to represent the main plants, 90 monitors, 30 stations. At the end of the project, a team of 60 operators will be employed, with 24-hour emergency technical call centre, double communication lines in optical fibre and an autonomous fire-fighting system. An expert system that provides operators with guidance and assistance in remote management activities and, taking advantage of its experience, helps prevent against the occurrence of serious problems. The centre will be connected with the Regional Hydro-Meteorological System station radar, ARPA rainfall stations, and the Regional Cartography Office. It also has a Crisis Unit room that can be used by the Civil Defence in emergency.

**Results obtained**

This project led to a unified vision of the water distribution system, both network and plants, managed by Hera S.p.A., allowing an optimal planning of operations and interventions. Earlier this was complicated by the fact that Hera remote control was a mixed and heterogeneous systems [analysis carried out in 2005].

The local SCADA systems, inherited from the former municipal, were characterized by logic, technologies and philosophies strongly differentiated between them: within the territory of an operating company there were more SCADA systems and the management data were stored in different databases with different logic of data capture.

**Success factors**

It represents a new frontier in remote control and is an excellent resource at the service of the local area and the general public with the emphasis on security.

**Indicators used**

Number of controlled plants, length of controlled network, size of scheduled team.
Repeatability and Applicability
The experience is clearly repeatable and applicable.

Total costs
Currently being updated.

Further references
www.gruppohera.it
**Project description**

Advanced water saving strategies for sustainable irrigation management are hard to manage by farmers. Furthermore, plant water use efficiency can not be maximised without a parallel, precise management of the plant mineral nutrition. It has become increasingly evident that an efficient integrated management of water and nutrients supplies requires adequate tools. Nowadays, even in the more developed countries, technicians and farmers computer skill are ranging widely, from “not at all” to a great cleverness. As a consequence, in the same area the diffusion of a decisional support has to face several skill levels. Moreover, the availability of reliable soil physical and chemical characteristics and meteorological data still is actually scattered.

To cope with these issues while assuring the largest diffusion of a sustainable water and nutrients management, a single crop, stand alone, multi target tool has been developed. The Fertirrigere DSS provides answers with increasing precision, from an optimised checkbook methods to a daily dynamic irrigation and fertigation management. The tool consists: (i) a pilot model, daily fed with precise plant, soil and climate inputs, that applies the more sophisticated and precise management criteria, (ii) a number of slave model which provides irrigation and nutrients balances at daily step calculated on statistical and forecast basis. An irrigation district (homogeneous macrozone) can be managed in a semi-dynamic way, only adjusting when needed the slave models on the basis of the pilot model. Corrections would be sent to the farmers as mobile phone text message.

**Results obtained**

Tests carried out in commercial farms show a water use efficiency more than double, higher production and better quality, water savings up to 1600 m³/ha/year (50%).

**Success factors**

A single crop model can be better calibrated and applies crop specific algorithms, thus it offers precise outputs. A stand alone model allows the user to “play” with, doing simulations and test. Technicians having acquired sufficient skill, can manage homogeneous cropping areas. The DSS can be used on the spot, even without internet connection, interacting with growers.

**Indicators used**

Water and nutrients use efficiency, yield, fruit quality, gross margin and irrigation/fertilisation costs.

**Repeatability and Applicability**

The model is available for processing tomato, potato and onion. Nearly all the vegetable crops can be implemented. The climate and soil water algorithms were tested in 9 EU countries and in a wide range of conditions. Notwithstanding, local calibration is suggested.
Total costs
The processing tomato and the potato DSS are freely available. The cost to implement a new crop can be roughly estimated around 40,000 €.

Further references
www.consorziocier.it
www.fertorganic.org
Project description

IRRINET is an expert system for Irrigation Scheduling, developed by the CER implementing the results of more than 50 years of research on plant/water relation and sustainable irrigation management. The IRRINET project was supported and co-funded by the Emilia-Romagna Region with the aim to progressively reduce water use for irrigation all over the region. IRRINET is among the tools provided to the farmers in the frame of Emilia-Romagna Regional Action Plan for Rural Development 2007-2013. The IRRINET service is freely available on Internet and provides an “irrigation advice” for the main water demanding crops, combining several data sources: meteorological data from ARPA-SMR (Regional Environment Protection Agency- Department of Agro-Meteorology); soil data from the regional “Hydro-Geologic and Seismic Service”; crop parameters as defined by the CER, including the application of the most effective irrigation strategy for every crop considered. The crop water balance is calculated at daily step and at field scale according to the geographical position (GIS) and to the crop characteristic, simulated or inputted by the farmer. The service provides the users with the optimal irrigation volume and timing, via web or mobile phone text message. The expert system has been setting to reach the highest production while saving water. Since 2009 IRRINET has evolved in IRRINET Plus which implements economic calculation of the irrigation profitability, providing farmers with further information other than optimal irrigation volume and time, assessing the economic benefit related to the next irrigation through a traffic light advisory system. The green light indicates that the added value obtained with irrigation overcomes the costs of the irrigation itself; the orange light indicates uncertain economic advantage; the red light signals that the irrigation costs are higher than the irrigation added value. Farmers, who are sometime sluggish in changing their habits just to save water, are stimulated by the economic approach to apply the most targeted and economical water supply so as to maximise profit while reducing water overuse.

Results obtained

In the period 2006 - 2009 IRRINET interested a regional irrigated land share of about 23%, bringing to a water saving of about 40 million m³ per year.

Success factors

The key element which made this initiative successful is the simple, user friendly, informative system that has been set up for farmers to decide how much to irrigate. This visual tool is accessible for free by whoever has interest in it and is tailored for a large number of crops.

Indicators used

User's feedbacks are utilised to evaluate the service effectiveness. Furthermore, IRRINET Plus requires specific feedback with respect to the cropping techniques, expected maximum production, expected market price, irrigation system and its characteristics as, e.g., the kind of pump (fuel or electric powered), operating pump pressure, labour cost, water cost (if accounted by volume).
Repeatability and Applicability

IRRINET can be easily transferred where the needed information to run the expert system are currently available. Crop parameters, set up for the Emilia-Romagna region, need to be locally validated, or substituted by a local set of parameters.

Total costs

Operating and maintenance costs: 55,000 € per year. The costs of the web service and of the implementation of the CER’s researches results were part of several projects carried out during the last decades. A rough estimation of the development costs sum approx. 300,000 €.

Further references

www.consorziocer.it/Irrinet/
<table>
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<tr>
<th>WG</th>
<th>A1 - water demand-side management (technological measures)</th>
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<td>Promoter</td>
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<tr>
<td>Project</td>
<td>18 - Novel Water reuse Technologies</td>
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<tr>
<td>Type</td>
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<td>Period</td>
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<td>Contact</td>
<td>Emanuele Cimatti - <a href="mailto:ecimatti@regione.emilia-romagna.it">ecimatti@regione.emilia-romagna.it</a></td>
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</table>

**Project description**

The EU Commission estimates that water reuse can contribute to reduce up to 13% of the irrigation ground and surface water withdrawal. Direct or indirect water reuse involves several aspects: contamination by faecal, inorganic and xenobiotic pollutants; high levels of suspended solids and salinity; rational use of the dissolved nutrients (particularly nitrogen). The challenge is to apply new strategies and technologies which allow to use the lowest irrigation water quality without harming food safety or yield and fruit or derivatives quality. The EU project SAFIR was aimed to help farmers solve problems with low quality water and decreased access to water. New water treatment devices, a membrane bioreactor (MBR, Grundfos A/G, patent pending) and a modular field treatment system (FTS), were developed to allow a safe use of waste water produced by small communities/industries (<10,000 EI) or of treated water discharged into irrigation canals. Water treatment technologies are coupled with irrigation strategies and technologies to obtain a flexible, easy to use, integrated management.

**Results obtained**

The innovative technologies were found able to produce safe, high quality water for irrigation treating primary waste water or tomato derivatives. Applying the proposed treatment pathways both faecal and heavy metal contamination can be controlled avoiding accumulation of pollutants in soils or along the food chain. The safe reuse of treated waste water produced, e.g., by a small plant (2,000 EI) secures, independently of climate, enough irrigation water to support the production of 1,100-1,500 tonnes of tomatoes, when directly delivered to the field. A storage capacity corresponding to 7 days production would increase the tomato yield supported by the treatment plant to 1,800-2,400 tonnes, while a 30 days storage capability can support 2,250-3,000 tonnes yield.

**Success factors**

Robust technologies. Production of safe water resources, filtered and disinfected.

**Indicators used**

Relative water reuse (Reused water volume/Total water volume).

**Repeatability and Applicability**

“Plug and play” technologies.

**Total costs**

Related to the needed level of water treatment.

**Further references**

www.safir4eu.org
WG A1 - water demand-side management (technological measures)

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<th>Partner</th>
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<tr>
<td>Project</td>
<td>19 - Research program on water saving in agriculture</td>
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<tr>
<td>Type</td>
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**Project description**

Since 1980 Emilia-Romagna Region, Department of Agriculture is encouraging and promoting research and studies on water saving in agriculture. The research programs on water saving in agriculture have been co-funding by regional laws (e.g. LR 28/98). CER has been carrying out researches on the sustainable use of water resources since 1959. CER is the point of reference for the Emilia-Romagna Government, Institutional Water Stakeholders (Water Authorities and National Association of Land and Water Reclamation Agencies) and Grower Associations for what concerns the sustainable use of water in agriculture, irrigation technologies and reuse of treated waste water.

The research on irrigation water saving have been devoting to crop response to irrigation, deficit irrigation, regulated deficit irrigation and partial rootzone drying, irrigation scheduling, sustainable irrigation management, assessment of the plant growth parameters, impact of irrigation regimes on product quality, development of models and Decision Support Systems, development of Crop Water Stress Index (infrared thermometry), studies on the sustainability of water reuse, test of irrigation technologies and design of irrigation systems, water treatments in constructed wetland at the farm scale.

These activities have brought to the identification and validation of the crucial parameters needed to calculate the optimal crop water requirements and to develop DSSs which are utilised at regional and national level. The results of the past and ongoing research programs are utilised by the Emilia-Romagna Region, and by the CER itself, to coordinate current irrigation management and to develop know-how for future irrigation scenarios as adaptation to climate change impact, also through participation in national and international projects.

**Results obtained**

A rough analysis of the research programs impact over the last 30 years revealed substantial changes in the farmer’s irrigation patterns which led to a reduction of the annual irrigation volume ranging from 30 to 50%.

**Success factors**

A continuous improvement of the know-how base, producing and implementing innovation through a diffuse system of communication and training for farmers.

**Indicators used**

Enhancement of the water use efficiency in agriculture and relative irrigation supply below the cumulated evapotranspiration, avoiding any plant’s luxury consumption.

**Repeatability and Applicability**

The existing knowledge and know-how can be adapted and calibrated to different cropping areas.
**Total costs**
The CER devoted to research projects 750,000 € per year in the 2007-2009 budget, cofunded by the Emilia-Romagna Region, Department of Agriculture, EU DG XII, Private Companies etc.

**Further references**
www.consorziocer.it
Project description
Capillary rise from shallow water table is an important input to the crop water balance. From October to late June, in a large part of the Po valley water table is ranging from - 0.5 to - 1.5 m depth, thus providing a significant contribution to the crop evapotranspiration. To assess the crop water requirement satisfied daily by capillary rise, a Shallow Water Table Monitoring Network has been set up. The network has been composed by 142 stations located in key areas, representative of an irrigation district, identified by means of pedologic studies and analysis. Every station counts 5 piezometers, each of them measuring the water table in a 0.5 m soil layer, from - 0.5 to - 3.0 m depth. The reading frequency is of about 10 days. The collected data are organised in a regional database, analysed, processed and provided daily to the Extension Services in order to calculate the capillary rise contribution to the crop water balance at field scale.

Results obtained
Up to 11.000 users benefit every day of the shallow water table assessment via the IRRINET irrigation webservice. Furthermore, the water table level is reported weekly by the Irrigation Bulletin diffused by the 9 Emilia-Romagna Provinces. A web GIS shape file is also available in the CER website. Water saving related to the water table measurement, for the 11.000 IRRINET users, is totalising up to 37.3 millions of m³ per year.

Success factors
The fast and effective use of the collected data, the wide diffusion and the strong link with the irrigation web services are the main success factors. Moreover, the pedologic and hydrologic analysis of the territories allowed the correct placement of the measurement stations securing data reliability and repeatability.

Indicators used
Data exploitation by the Extension Services and estimated water saving.

Repeatability and Applicability
The spatial distribution algorithm of measured water table depth and the link with web and GIS technologies are both applicable everywhere significant capillary rise from shallow water table is expected.

Total costs
Operating and maintenance costs are as follows: 10 € per measurement (manual) + 150 € per year for the stations maintenance. The installation cost is approx. 300 € per station.

Further references
www.gias.net/gias/falda/default.asp
irrigation.altavia.eu/servizi/cer/mappafaldacer.aspx
**Project description**
Automated drip irrigation is considered the most efficient way to maximise water saving. Nevertheless, time based computer automated irrigation is giving poor results due to the lack of flexibility of the irrigation scheduling. The challenge is to connect directly whether the water soil storage, the plant or the water demand by the atmosphere to the automated irrigation system in a dynamic way. Nowadays, automated drip irrigation driven by soil water content sensors is widely diffused as well as plant water status monitoring is already applied in greenhouse vegetables crops and the application on woody crops in the field is an ongoing process. The SOLARDRIP project has been aiming to drive the irrigation exploiting photovoltaic panel technologies in a double way: to power the irrigation system and to assess the amount of solar radiation the plant is receiving. The hourly plant water use is highly correlated with solar radiation as well as the amount of energy produced by the photovoltaic panel. A direct current electric pump is directly connected to the photovoltaic panel, avoiding the leakage caused by storage batteries or inverter DC/AC.

The irrigation system characteristics (drippers delivery capacity, dripline size and length, etc.), the pump discharge and the photovoltaic panel size were carefully balanced in order to secure the correct water supply to the crop.

**Results obtained**
The SOLARDRIP main results are: (i) very high water use efficiency due to the irrigation time lasting from sunrise to sunset with dynamic change of the irrigation volume driven in real time by the solar radiation; (ii) fast and effective adaptation to the evapotranspiration changes; (iii) high energy efficiency with zero emission; (iv) reduced environmental footprint of the agricultural product; (v) low cost automation of the irrigation system. The first SOLARDRIP pilot system is 7 years old and still running without problems. The water saving with pear and peach orchards range from 35 to 50%, of about 1.000 m³/ha/year in the Emilia-Romagna sub-humid climate. Three prototypes are now running by Agricultural High Schools and Demonstration Field located in the region.

**Success factors**
Robust technology, easy to use. The labour cost of irrigation is close to zero. Farmers can be unmindful of irrigation management, unless for the pump and dripline maintenance.

**Indicators used**
Water and energy use efficiency.

**Repeatability and Applicability**
SOLARDRIP can be adapted to other climatic conditions and to crops other than orchards.
Total costs
The cost of the pilot systems set up is still quite high, even floating with the photovoltaic panel market. The cost of the technology is expected to lower rapidly when applied on large areas and/or widely diffused.

Further references
www.consorziocer.it/ricerca_ambiente_solare.html
Project description
The correct design of the irrigation system is crucial to minimise water losses during the distribution phase. TECNIRRI is a decision support system helping the farmer choice of the better microirrigation system for its own crop, soil and climate (minisprinklers or drippers), i.e. improve irrigation system efficiency supporting the correct system design. The DSS calculates as well the optimal emitter distance on the lateral pipeline, the correct number of emitters per plant (woody crops), it helps as well sizing main and lateral pipelines, filtration station and single filters, or calculating the irrigation depth of each irrigation system. The TECNIRRI resident database implements the technological bench tests carried out by CER on the microirrigation materials available on the market. The database is updated every year. The data provided by CER are intended to be super partes and obtained from independent, non commercial, technological tests.

Results obtained
TECNIRRI is widely used by farmers, particularly for what concerns the selection of the emitter and of the filter. This allows to overcome water distribution problems related to the irrigation system design, making more effective the applied water saving irrigation techniques and strategies.

Success factors
Key factors are the step by step guidance choosing the irrigation system components and the simple, user friendly, interface.

Indicators used
85,231 TECNIRRI web pages were browsed in 2009, most of them directly selected by the user while about 20,000 through the major web browsers.

Repeatability and Applicability
TECNIRRI can be easily transferred only translating the web pages.

Total costs
Operating and maintenance costs: 32,000 € per year. Development cost about 150,000 €.

Further references
www.consorziocer.it/TecnirriNet/
Project description
Burana Land-Reclamation Syndicate has looked after the building of the “Bocchirolo” pilot system for the pressure irrigation among farms (surface waters for irrigation in farming rationalization and storing). To be precise, by the surface waters coming from the Torbido Canal – in the PDO “Protected Designation of Origin” of the Vignola plums and cherries in Savignano on the Panaro river (Modena)’s Municipality – Burana gave the opportunity to 10 farms specialised in cherries’ production to move from surface irrigation to microirrigation.

Results obtained
By using innovative irrigation techniques Burana Land-Reclamation Syndicate got a concrete saving of surface waters. Compared to the traditional irrigation methods the saving in surface waters for irrigation is of 60%.

Success factors
The works Burana Land-Reclamation Syndicate carried out, particularly the system for the microirrigation among farms, are the clear proof of the fact that the use of modern irrigation technologies allows both the reduction of water consumption in irrigation and the optimization of the surface water resources for “top grade specialization” farms gathered together.

Indicators used
It turns out to be particularly interesting for the farms that have practically replaced the traditional methods of surface irrigation – furrow irrigation and the use of well water – by the irrigation system implemented by Burana Land-Reclamation Syndicate. Moreover, “Bocchirolo” pilot system represents an optimal demonstration for all farmers who have the intention of adopting this changeover and giving their contribution to water saving.

Repeatability and Applicability
The project is repeatable in other territories devoted to fruit farming at high specialisation with the availability of qualitatively and quantitatively appropriate surface waters.

Total costs
Undeclared.

Further reference
www.consorzioburana.it
**Project description**

Burana Land-Reclamation Syndicate, in the field of the funds received from the Ministry, has carried out two different kinds of work addressed to different territorial and productive fields. In particular:

a. A micro-basin for storing water and facing drought problems, especially in summertime, has been built on the ‘San Pietro Canal’, in the Municipality of Castelnuovo Rangone (Mo), in an irrigation context particularly far away from the canal’s origin by taking advantage of the peculiar hydraulic morphology of the canal itself in San Lorenzo locality;

b. A pilot system for the pressure irrigation among farms on the ‘Diamante Canal’ in the PDO “Protected Designation of Origin” of the Vignola plums and cherries’ territory of irrigation, called “Basse di Vignola” (Vignola’s plain areas).

Vignola (Modena)’s Municipality.

13 farms involved for about 35 hectares of total terrains irrigated.

**Results obtained**

By using innovative irrigation techniques Burana Land-Reclamation Syndicate got a concrete saving of surface waters. Compared to the traditional irrigation methods the saving in surface waters for irrigation is of 60%.

The project is in line with the so called “Piano di tutela delle Acque” - Waters’ Protection Plan - of the Emilia-Romagna region and with the European guidelines about the water resources’ preservation, as basic elements for the environment and for the quality of life, both by the quantitative and the qualitative point of view.

**Success factors**

The works Burana Land-Reclamation Syndicate carried out, particularly the system for the microirrigation among farms, are the clear proof of the fact that the use of modern irrigation technologies allows both the reduction of water consumption in irrigation and the optimization of the surface water resources for ‘top grade specialization’ farms gathered together.

**Indicators used**

The farms that took part in the project have practically replaced the traditional methods of surface irrigation – furrow irrigation and the use of well water – by the micro-irrigation system implemented by Burana Land-Reclamation Syndicate.

Moreover, this pilot system represents an optimal demonstration for all farmers who have the intention of adopting this changeover and giving their contribution to water saving.
Repeatability and Applicability
The project is repeatable in other territories devoted to fruit farming at high specialisation with the availability of qualitatively and quantitatively appropriate surface waters.

Total costs
Undeclared.

Further reference
www.consorzioburana.it
**Project description**

The COLT project aims to save water amount for seasonal irrigation. The project supports Reclamation Consortia and Agriculture Department by using remote sensing images to classify crops and fruit orchards, acquired before the beginning of the irrigation season, and by applying a soil water balance modelling system.

The involved area is the whole plain of Emilia-Romagna region, the area is about 106 ha, but after masking manmade, forest and wetland features, the area remain around 650,000 ha.

**Results obtained**

The project established a successful pre-operational service for the real time monitoring of crop in order to define water need for agriculture by an extended water balance model application. The extracted data from satellite images are exploited in an operational chain as a decisional support for water distribution priority according to crop types operated by Reclamation Consortia.

The map on the left shows an example of the remote sensing classification result obtained by the programmed acquisitions, while the image on the right shows a model output related to irrigation needs for the agricultural season. Results are available as raster and vector files. The images refer to the Renana Reclamation Consortium located around the city of Bologna. Integrations of summer seasonal forecast and climate change prediction are able to predict water requirements for 3 months ahead and their trend in the next years. Efforts are also given to integrate COLT and cadastral vector data with EU agricultural compensation requests to build up a GIS able to assist all the Reclamation Consortia’s procedures at cadastre basis. This development should determine payments based on actual consumption.
Success factors
Real time crop monitoring, water balance model output (ETP, irrigation, water consumption, etc.), vector classification data for statistical (geographical location of crops) and administration purpose (water priority distribution, water contributions, etc.).

Indicators used
Saved water amount for irrigation, Reclamation Consortia and Agriculture Department’s requirements of information details fulfilled.

Repeatability and Applicability
The methodology can be applied to any location. It is important to exactly know the agricultural practices and phenological calendar of the area. Actually only DMCii can guarantee to cover wide area in one pass. This is fundamental because it permits to drastically reduce the pre-processing and classification procedures. DMCii can also provide images at affordable price.

Total costs
40,000 €/year.

Further references
www.arpa.emr.it/sim/?telerilevamento/colt
www.arpa.emr.it/dettaglio_documento.asp?id=708&idlivello=64
www.dmcii.com/
**Project description**

Establishment of a meteorological database for optimizing irrigation and plant protection for regional agriculture. A meteorological and agro-meteorological network has been implemented in Emilia-Romagna with more than 200 stations. ERG5, a database for optimizing irrigation and supporting regional integrated production in local agriculture systems, has been established basing on the regional monitoring network. Main properties of ERG 5 is providing Reclamation Consortia with meteo hourly and daily data on a grid of 5 km side, interpolating measured data from regional meteorological stations. Most of meteorological and agro-meteorological variables are considered. Automatic and manual quality controls are fulfilled. Similarly, 3 days forecast meteo data are available on the grid point from a meteorological limited area model (COSMO), soon with a 7 days step of forecast. The ERG5 grid is monitored by a data visualization and interpolation system (PRAGA) for supplying end users of continuous series of meteorological data essential for modelling application in irrigation, plant protection, fertilization and evaluation of climate hazards.

**Results obtained**

Uninterrupted series of principal agro-meteorological variables are available for regional application in saving water for irrigation in a sustainable agriculture. Data are used by Reclamation Consortia and Regional Service for plant protection daily.

**Success factors**

Daily delivering, effective interpolation and quality control. Continuous series of meteorological data on the whole regional territory.

**Indicators used**

Efficiency of services for water saving in irrigation offered by Reclamation Consortia based on EGR 5 data delivering.

**Repeatability and Applicability**

The ERG5 system can be applied to all geographical areas if time series of observed meteorological variables and digital elevation model are available. PRAGA basic version for data visualization and interpolation is available at ARPA-SIMC free.

**Total costs**

100,000 €/year.

**Further references**

Data quality: daily automatic and manual control

Interpolated data:

Erg-5 interpolation on a regular grid

Data interpolation over 5x5 km Erg-5 regular grid.

Interpolation map: example of precipitation

Automatic hourly radio download of weather data from:
- 282 rain gauges
- 188 temperature sensors
- 83 humidity sensors
etc.

Interpolated data:

Hourly data
- Temperature
- Precipitation
- Humidity
- Evapotranspiration
- Radiation
- Leaf wetness

Daily data
- Temperature [min, mean, max]
- Humidity [min, mean, max]
- Wind [speed, direction]
- Precipitation
- Evapotranspiration
- Global daily integrated Radiation

Daily delivery

LAWI model forecast output for next 3/7 days

End users
Project description

The good environmental status for the necessary water supply in the Hungarian-Serbian border region can characteristically be assured by extracting it from the subsurface, as the periodicity of surface water supply can not assure the demands. The exact revelation of the quantity and quality conditions of groundwater is determining in favour of further development of the area. It is essential to clearly work out the quantity and quality limits for meeting with the needs of the drinking water, and assuring the good ecological status concerning the water used by the economy and the surface ecosystem. The quantity and quality conditions of the subsurface water supply shall be analyzed on the whole territory. In favour of the development homogeneity of the border region on the Hungarian and Serbian side it is very important to execute the utilizable water supply quantities and their geographical distribution in a common way, according to equal principles.

Results obtained

According to the model results it can be stated that due to the water pull outs decrease of the surface of water by 2-6 meters can be expected in the shallow aquifer, though in the deeper aquifer a 5-15 meters decrease can take place. There is a meaningful difference between the Hungarian and Serbian areas in the feature that in Serbia there is greater depression, owing to the concentrated water pull outs and the shallower aquifers. There is a significant size of depression in Hungary only in the surroundings of Szeged.

Although it can be observed that in the region of Szeged and Subotica, mainly at the lower Pleistocene formations, the decrease of the surface of water (cone of depression) established by water production shows a cross border effect. At these areas the two-sided water pull outs should be harmonized, because the further increase of the water extraction can restrict the capacity of the other party.

The decrease according to the surface of water raises the speed of the water leaking down, thus the areas concerned by intensive water pull outs regard as endangered in a greater extent from the point of view of surface pollution.

Success factors

The two countries have different data frameworks. The first step was to build an integrated data set. The GIS analysis and the hydrofinamical model used this uniform data approved by both countries. Wide range of professionals were involved in the project implementation.

Indicators used

Hydrogeological database and expert studies collection.
Study on the revision of the existing monitoring network.
Study on the expected trends of groundwater resources and their likely territorial consequences.
Professional meetings.
Project reports on the website of KÖVIZIG-s.
Repeatability and Applicability
Generated similar projects and further development of this project.

Total costs
103,000 €.

Further references
www.atikovizig.hu/
### Project description
The status of the surface water on the areas of the border region between Hungary and Serbia being west of the River Tisza determines the environmental status of the catchment. In the last 15 years with drought periods the environmental status has been deteriorating. Due to the changes in the natural and social environment it became necessary to work out an action plan in favour of the good environmental status of the catchment. The general aim of the project is to work out such a precautionary package, which aims at the improvement of the environmental potential on one hand and on the other hand it lays emphasis on the sustainability by involving those interested (population, ATIKÖVIZIG, Kiskunsági Nemzeti Park, enterprises, civil organizations).

### Results obtained
The complex revelation of the environmental status of the catchment. IT background has been modernized by procuring IT equipments and evaluating programmes. The complex study meant an ecological survey of the area, the revelation of the terms of management of water-supplies according to the catchment.

### Success factors
Expert group, civil society’s opinion.

### Indicators used
Ground water level, Quantity and quality of surface runoff, Air temperature, Changing of area of excess water, Changing of area of wetlands.

### Repeatability and Applicability
The action plan includes the measures which are necessary to improve the environmental potential on the whole catchment area. The results help to solve similar problem.

### Total costs
384,832 €.

### Further references
www.atikovizig.hu
**Project description**
Water resources decreased according to the drought in the project affected Homokhát sub-region (underground water-levels sank down, surface outflow reduced), water supply of sodic habitat is inadequate. Within this the endangerment of the southeastern slope of the Homokhát sub-region is significantly increased, because traditionally high-quality agriculture got acclimatized there.

**Results obtained**
Building the water replacement system of Nagyszéksós-tó.
Reconstructing the internal area of the reservoir.
Rebuilding the elements belonging to the connecting drainage routes.

**Success factors**
Suitably cleared grey water reuse.
Maintain water habitats.
Development wetland.
Decrease inland inundation.

**Indicators used**
Develop the water habitat and wetland.
Reconstructing the main channel.

**Repeatability and Applicability**
Complex development plan to solve the problem, with grey water reuse.

**Total costs**
607,287 €.

**Further references**
www.atikovizig.hu
<table>
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<th>WG</th>
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<tr>
<td>Partner</td>
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<td>Project</td>
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<td>Location</td>
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<td>Target</td>
<td>Municipalities Bugojno, Jajce, Gornji Vakuf and Donji Vakuf</td>
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<td>Level</td>
<td>National, regional, local</td>
</tr>
<tr>
<td>Contact</td>
<td>Andrea Bevanda - <a href="mailto:abevanda@rec.org.ba">abevanda@rec.org.ba</a></td>
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</table>

**Project description**

The main goal of the project was to reduce the pollution of the environment from untreated waste water polluting Vrbas River and to improve the quality of citizens life.

This goal was realised by means of support to institutional strengthening and capacity building of the Public Regional Communal Service Company, municipal communal service companies and Municipalities and through the preparation of a pre-feasibility study.

The Pre-feasibility study covers not only infrastructure development, but also needs for future institutional and capacity building and sustainable functioning of the Public Regional Communal Service Company and Municipalities. It provides sufficient information to justify acceptance, modification or rejection of the planned environmental investment and is based on international standards for assessment of environmental investment projects. In addition it covers all aspects of the proposed project: technical, environmental, financial and economic, social/stakeholder, and institutional.

Specific goals of the project:

- To assess the current situation in waste water services and to provide recommendations for changes needed in the Public Regional Communal Service Company, municipal communal service companies and Municipalities;
- To support the Public Regional Communal Service Company in assessing needs for investment projects development, preparation and management.

**Results obtained**

- Assessment of the current state in the field of water/waste water issues.
- Conceptual solution and the pre-feasibility study.
- Capacity building activities as trainings, workshops and study tour to Slovenia.
- Vrbas Forum established and functioning and used for public awareness sessions.
- Cooperation and communicating between stakeholders improved.
- Municipalities, Municipal communal service companies and Public Regional Communal Service Company are institutional strengthened and capacity built in water management.

**Success factors**

- Support provided by the Norway Government, Ministry of Foreign Affairs Norway.
- Political commitment and support by relevant public authorities and beneficiaries.
- Good cooperation and coordination of activities between the project team, focal points in ministries responsible for water management and external consultants.
**Indicators used**

- Number of training events, seminars, publications.
- Fulfillment of the tasks agreed between the donor, project team and beneficiary.

**Repeatability and Applicability**

This example is replicable in other public water services with similar institutional framework.

**Total costs**

App. 350,000 €.

**Further references**

REC’s website: [www.rec.org](http://www.rec.org) & [www.rec.org.ba](http://www.rec.org.ba)

Project description

The Danube River Basin Management Plan has been elaborated in the frame of the first River Basin Management Cycle according to the EU WFD lasting until 2015. The first RBM Cycle will be followed up by two more cycles that will be finalised by 2027 including updates on respective water management issues. According to the WFD the first RBM Cycle follows four phases with defined tasks:

PHASE I: Definition of river basin districts, definition of the institutional frame and mechanisms for coordination (until 2003);

PHASE II: Analyses of river basin characteristics, pressures and impacts and the economic analysis, establishment of the register of protected areas (until 2004);

PHASE III: Development of monitoring networks and programmes (until 2006);

PHASE IV: Development of the River Basin Management Plan including the Programme of Measures and Public Participation/Consultation (until 2009).

Aware of the basin-wide relevance of the flood and drought issues the chapter 8 deals with the water quantity issues and climate change.

The compilation of the DRBM Plan was a particular challenge due to many facts, which are different in comparison with other European river basins. The Danube River Basin is the “most international” river basin in the world covering territories of 19 countries. Those 14 countries with territories greater than 2,000 km² within the Danube River Basin are joined in the framework of the ICPDR. With an area of 801,463 km² the Danube River Basin is the second largest river basin of Europe. Including the coastal waters it covers an area of 807,827 km².

In view of the large differences and particularities in the basin it was necessary to develop a realistic perspective of how to develop the Danube River Basin Management Plan and how to coordinate this most efficiently. In general, there are three levels of coordination:

Part A: the international, basin-wide level;

Part B: the national level and/or internationally coordinated sub-basin level for selected sub-basins (Tisza, Sava, Prut, Danube Delta);

Part C: the subunit level, defined as management unit on the national territory.

The information increases in detail from the Part A to Part B and C.

The content of the DRBM Plan on the A level is strongly based on findings and actions on the national/sub-basin level. So far, the Danube countries agreed to develop sub-basin management plans for the Danube Delta, the Tisza, Sava and Prut basin, which are elaborated in a higher resolution than on the A-level. The Tisza RBM Plan will be finalised in parallel to the DRBM Plan and in close coordination with the activities in the DRBD. The International Sava River Basin Commission is developing a Sava Basin Analysis that should be finalised soon. RBM activities are currently initiated for the Danube Delta whereas for the Prut River Basin respective activities still need to be developed.

For each Significant Water Management Issue (see Chapter 2.3), the Joint Programme of Measures (JPM) is based on the defined visions and management objectives and includes - as a consequence - measures of basin-wide importance. The measures of basin-wide importance of the JPM are firmly based on the national programmes of measures. A feedback mechanism from the basin-wide discussions into the national
planning served the integration of the international JPM into the national RBM Plans/PoMs. This integration should guide the implementation of measures coordinated on the basin wide scale through the Danube countries and the achievement of the WFD objectives by 2015. With the DRPC and many bilateral/multilateral agreements between individual countries, appropriate coordination mechanisms are in place to enable transboundary cooperation and to ensure the development of the DRBM Plan on the basin wide level. Figure 2 describes the role of the ICPDR as facilitating and coordinating platform between the different Danube countries. Where the boundaries of the Danube River Basin District extend beyond the national borders of the countries cooperating under the DRPC (e.g. into Italy or Poland) it was the responsibility of the respective countries to find an appropriate form of coordination with the relevant neighbours.

**Results obtained**
- Danube River Basin Management Plan.
- Climate Change Conference.
- Flood Safety Project along the Tisa river in Hungary.
- Sustainable Water use in Europe – Floods and Droughts.
- ICPDR Stakeholder Conference.
- Accident Emergency Warning System.
- Summary of eventual main potential impacts on water due to climate change and list of selected projects on climate change relevant to the DRBDs.

**Success factors**
- Political commitment and support by all riparian countries.
- The European Community support.
- Good cooperation and coordination of activities.
- UNDP/GEF support by means of the Danube Regional Project (DRP).

**Indicators used**
- Number of training events, seminars, publications.
- Fulfilment of the EU WFD requirements at national level.
- Joint Program of measures, prepared and adopted by all members.

**Repeatability and Applicability**
Experience can be repeated and applied in any transboundary river basins taking into account the specific conditions.

**Total costs**
Undeclared.

**Further references**
ICPDR web-site: www.icpdr.org
Web-sites of all national competent authorities
Main Publications:
Basic documents, Technical papers, Annual reports, Danube Watch, Databases, Maps, Videos, etc.
## Project description

The project proposes a system that uses wind power energetic potential for regions with reduced average wind speed and high risk of plant water stress. Major research and engineering efforts are focused on designing systems that efficiently convert wind power in electricity or mechanical power in regions with high wind potential (constant high wind speeds, and constant directions). However, little was done for use of wind power where the above-mentioned conditions do not occur and where the wind-powered devices are not economically feasible. The wind-powered device proposed for implementation in this project was designed to take advantage of reduced wind power to pump water for irrigations in agricultural regions from depths up to 30 meters. Lower technical requirements of the new device and the particular field where it is intended for use (irrigation) can assure a successful implementation. The apparatus was invented by a research team from National Institute for Aerospace Research and was patented in Romania (no. 119966/2005).

The main objectives are:

- Delineation of regions with climatic conditions that comply with the technical requirements of the device for well functioning (wind potential) and elevated plant water requirements (hydric stress);
- Analysis of agro-climatic parameters in these regions for establishing the water (irrigation) needs for plants and the water availability for agriculture (i.e. water table not deeper than 30 meters);
- To test the feasibility of DEOL prototype for agricultural use and to describe the methodology of implementation;
- Conduct a study case for an optimal site positioning of the device;
- Assess the financial, environmental, and agricultural benefits from the implementation of the device in farms;
- Disseminate the results, potential benefits and guidelines to farmers.

### Table: Project Summary

<table>
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<tr>
<th>WG</th>
<th>A1 - water demand-side management (technological measures)</th>
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<tr>
<td><strong>Partner</strong></td>
<td>P11 - NMA</td>
</tr>
</tbody>
</table>
| **Promoter** | Number of partners: 7  
- National Institute for Aerospace Research “Elie Carafoli”- (INCAS), Bucharest, Romania/Coordinator.  
- National Meteorological Administration, Bucharest, Romania - P 4 |
| **Project** | Research and Development Station for Fruit Trees Growing Baneasa from Romania used the wind device for irrigation in the experimental fields. |
| **Type** | National Excellence Research Program (NERP)  
Module: Complex Research and Development Projects  
Programme: AGRAL  
Thematic Fields S/T: Alimentation, agriculture and biotechnology; Production and lasting management of soil, forest and aquatic environment biological resources; Preservation and lasting management of natural and artificial resources.  
Technological Platform: Clean energy  
| **Period** | 2006 - 2008 |
| **Location** | Romania |
| **Target** | The targeted users are farmers (agricultural, orchards, gardening) from regions with reduced average wind speed and high risk of plant water stress. |
| **Level** | National, regional, local |
| **Contact** | Organisation/Agency: National Institute for Aerospace Research (INCAS) Romania – project coordinator  
Project Manager: Eng. Ion Nila - inila@incas.ro  
Web Site: www.incas.ro  
Contact person of NMA: dr. Elena Mateescu - elena.mateescu@meteoromania.ro |
Agro-climatic records from the agricultural regions of South and South-Eastern Romania will be analyzed in order to characterize the potential for wind powered device implementation in small and medium farms.

In Romania irrigation has a complementary character and the farming in small parcels is the most frequent, thus large devices are not reliable for local needs, while simpler and smaller systems are not very expensive to implement and much easier to use. Irrigation systems have been installed on almost half of the drought affected areas, but currently only few of these systems are actually working. Economic efficiency, often low due to high-pumping requirements, is one of the original causes. Difficulties in adjusting to small-scale private farming are at present an additional drawback. Some calculations seem to show that under present socio-economic conditions, the efficiency of intensive agriculture, including irrigation, might by exceeded be the efficiency of extensive agriculture, but further research is needed in this respect.

Results obtained

The expected results are strongly related to life quality improvement in rural areas by increasing crop yields with a reduced costs and non-polluting irrigation technique.

The positive aspects of the results:

- Creating interdisciplinary partnership for comprehensive assessment of technical, scientific and socio-economical aspects of objectives and results;
- Improving communication, information exchange and enhancing scientific and technical experience sharing;
- Using long-term agro-climatic and hydrological observations for adapting the system to local conditions;
- Increasing the population awareness to encourage sustainable and environmental-friendly attitudes;
- Elaborating a coherent strategy for efficient dissemination of the socio-economical benefits;
- Complying with EU requirements for environmental protection regarding use of renewable and non-polluting energies.

At national level, adaptation strategies are needed to offer the policy support for local adaptation activities, and to ensure that such activities are pursued in a cost-effectiveness and sustainable manner. Climate change, increased greenhouse gas emissions, and depletion of fossil fuel reserves are strong arguments for development of new technologies based on renewable energy sources.

Success factors

- The novelty of this device consists in combining technical aspects of small turbines easy adaptable to wind direction change but rather inefficient, with elements from highly efficient large turbines but with the disadvantage of high production and maintenance costs.
- Small and medium farms, especially the ones with limited access to power lines or fuel supplies, are ideal end-users of the wind-powered irrigation system, if their agro-climatic conditions are suitable for such an investment.
- Fruitful implementation of the system is conditioned by the simultaneous presence of four agro-climatic criteria: high water deficit in the root zone, wind potential, water table and economical importance of the crop. In addition, the study will reveal the economical feasibility of the irrigation device by analyzing the cost/benefit in a pilot study case.
- Research on specific process of renewable energy device starts with the complete analysis of technical, scientific and socio-economical factors that are critical for the project success.
- Implementation of interdisciplinary projects for providing high quality advisory services and new technologies to end-users and decision-factors.

Indicators used

- Agro-climatic approach: time data series, thematic maps, identifying the regions with wind power energetic potential and high risk of plant water stress, for well functioning of DEOL.
- DEOL constructive aspects and performance:
  Constructive aspects:
  - The turbine has a “Savonius” type rotor, made from light materials and of reduced dimensions, thus able to function at low wind speeds (<3 m/s);
  - The vertical rotor takes advantage of wind power from any direction, thus using efficiently the energy of every wind gust.
DEOL can pump water from a depth of maximum 30 m.

At least 1 hectare can be irrigated with one device. The reservoir at the base of DEOL accumulates water and redistributes it as needed.

**Repeatibility and Applicability**

In the competition “Pilot project on development of prevention activities to halt desertification in Europe” funded by EC/DGE/Grant Application [Reference: Desertification 2009-2010 - Open Call for Proposals. Title: Halting desertification in Europe. Deadline for submission of proposals: 30 June 2010 17.00], NMA proposes a pilot project called “Preventing Desertification in the low land of the Mures river basin of Romania”. The project will involve three partners from Romania and one from Greece, and the experience gained will be developed in this new project. Also, a farmer from the Pecica area (from the Mures river basin) will benefit from the practical results of the project, including information on water resource and the wind device (is a condition of eligibility of the project).

**Total costs**

400,000 €.

The project was financed by the Romanian Government through Ministry of Education and Research in the frame of National Excellence Research Program (CEEX), and co-financed by 3 partners.

From the total budget of the project, 80% was covered by CEEX Program and 20% co-financed.

**Further references**


Scientific papers:

1. **AMERICAN INSTITUTE OF AERONAUTICS AND ASTRONAUTICS – April 2007**
   - Partner 3 ISMMA - Vladimir CARDOS and Horia DUMITRESCU
   - Subject: “Aerodynamic and aero-acoustic analysis of the wind turbines” as part of the Contract no.61/2006, CEEX Programme (the paper has been sent to AIAA)

2. **AIDAA - The 13th AIAA/CEAS AERO-AcouSTICS CONFERENCE**
   - Partner 3 ISMMA - Vladimir CARDOS and Horia DUMITRESCU
   - Subject: “Wind turbines performances” within the Contract No.61/2006, CEEX Programme

**Project description**

The Local Action Plan for Environment is a planning and steering instrument for sustainable development of Covasna County. LEAP involves evaluation of environmental issues, setting priorities, development of community vision, identification of the most appropriate strategy to solve the major problems and establishes measures and actions to improve the state of environment and public health at the county level. LEAP was one of the most important ways for public participation in decision-making process. It comprises 146 actions which are monitored by the Environmental Protection Agency Covasna. For each action that leads to solving an environmental problem, it contains the following elements: parties (institutions, organizations, groups) responsible for implementing actions; parties (groups, institutions, organizations or other entities) who performs the supervision and cooperation in implementing the actions; deadlines for actions; possible funding sources for implementation actions.

Main problems identified in LEAP:

1. Pollution of surface waters;
2. Soil and groundwater pollution;
3. Waste management;
4. Quantity and quality of drinking water;
5. Management of urban space;
6. Travel and Leisure;
7. Nature Protection and Biodiversity Conservation;
8. Environmental education;
9. Human health;
10. Atmospheric pollution;
11. Threats of major accidents, natural and anthropogenic phenomena.
General objectives of LEAP in water sector:

1. Reduction of surface water pollution due to the evacuation of waste water insufficiently cleaned and the insufficient or inexistent sewerage network (urban and rural surroundings);
2. Elimination of surface water pollution due to untreated industrial water evacuation;
3. Monitoring of the quality of surface water;
4. Reduction of nitrate pollution caused by agricultural and zoological activities;
5. Diminution of soil and underground water pollution because of use of fertilizers and pesticides in the agriculture;
6. Reduction of degradation/pollution of soil and underground water due to mining activities;
7. Improvement of access to water infrastructure;
8. Assurance of health state for the inhabitants improving the drinking water quality.

Results obtained
Since 2006, 21 actions were fulfilled in the area of water, waste, nature protection, education and public awareness such as extension and rehabilitation of water supply systems; rehabilitation/construction of urban and industrial sewage plants; improving waste management, reduced industrial pollution through forestation of areas affected by erosion, implementation of the legislative framework for the protection and conservation of local biodiversity; projects developed to promote sustainable development in tourist areas; extension of urban green space and rehabilitation of buildings; environmental education and awareness campaigns organized.

Success factors
- Increased number of water supply systems in rural areas.
- Sewage and waste water treatment plants constructed in rural areas.
- Increased number of water projects in implementation.

Indicators used
- Number of Municipalities with centralized water supplies systems and sewage system.
- Number of projects.
- Water quality parameters.

Repeatability and Applicability
LEAP is a vivid document which is revised when new problems are coming up or new priorities are identified.

Total costs
Undeclared.

Further references
Undeclared.
**WG A1 - water demand-side management (technological measures)**

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<tr>
<td></td>
<td>Frank van Lamoen - <a href="mailto:Fvlamoen@brabant.nl">Fvlamoen@brabant.nl</a></td>
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</tbody>
</table>

**Project description**

To prevent a growing use of groundwater for sprinkler irrigation there has been a stop on new irrigation permits in North-Brabant. Also the relocation of waterputs is not allowed anymore. In the existing permits it is prohibited to irrigate grassland before the 1st of June and in June and July between 11.00 and 17.00 hours.

At the same time a project was started called 'Agrarisch grondwaterbeheer' [Agricultural groundwater management]. Since the year 2000 the 8,400 farmers who have a permit for using groundwater for sprinkler irrigation, have to register how much groundwater they extract. A total of 2,850 farmers have joined the project Agricultural groundwater management. The participants are supported by measures such as:

- research into crop selection;
- improving natural water supply by water conservation;
- information on effective, efficient and prudential watering [advice based on satellite images].

They use 40 percent less groundwater than those who do not participate. From the revenues of the provincial groundwater charge part of these measures are supported financially.

**Results obtained**

Through the combination of regulation and stimulation the use of groundwater for sprinkler irrigation has stabilised. In North-Brabant, the average amount of groundwater used for sprinkler systems has declined (2000-2007).

**Success factors**

Financial stimulation: the participating farmers are exempted from paying the provincial groundwater charge. Participants benefit from the advises that can be directly used.

**Indicators used**

Decline in the use of groundwater for sprinkler irrigation.

**Repeatability and Applicability**

Undeclared.

**Total costs**

On the one hand farmers pay for the services they receive. On the other hand they are exempted from paying a groundwater charge.

**Further references**

www.zlto.nl
### Project description

At businesspark Vosdonk in Etten-Leur part of the cooling water of Alumet Etten BV (Alumet) is re-used as process water by Saint Goban Isover Benelux BV (Isover). In this way Isover can save on using groundwater. Both companies extract groundwater for their production processes. Also Alumet can save on the amount of cooling water that has to be discharged on surface water. To distribute the water from Alumet to Isover, an 800 meter long pipeline is build.

### Results obtained

The average amount of water delivered is 20 cubic meters per hour with a yearly delivery of about 80,000 cubic meters, which is the yearly saving on groundwater extraction by Isover.

### Success factors

The project shows that innovative combinations between factories can be made, in using the residuals (i.e. energy, water) of the other in a cost effective way. This project was subsidized by the Province of North-Brabant and the community of Etten-Leur.

### Indicators used

Amount of saved groundwater.

### Repeatability and Applicability

There are many businessparks where there are factories with processes in which the waste water (cooling water) of a neighbouring factory can be used, which can lead to savings in the use of groundwater.

### Total costs

Undeclared.

### Further references

[www.hydrobusiness.nl](http://www.hydrobusiness.nl)
<table>
<thead>
<tr>
<th><strong>WG</strong></th>
<th><strong>A1 - water demand-side management (technological measures)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Partner</strong></td>
<td>P14 - Hérault</td>
</tr>
<tr>
<td><strong>Promoter</strong></td>
<td>General Council of Hérault</td>
</tr>
<tr>
<td><strong>Project</strong></td>
<td>36 - Investigation program on opportunities for the recovering of rain water under the Mediterranean climate</td>
</tr>
<tr>
<td><strong>Type</strong></td>
<td>Survey (theoretical and practical studies) and work (experimental equipment)</td>
</tr>
<tr>
<td><strong>Period</strong></td>
<td>February 2008 - October 2009</td>
</tr>
<tr>
<td><strong>Location</strong></td>
<td>The survey concerns all the local territory and deals with an experimentation on individual social housing and public buildings</td>
</tr>
<tr>
<td><strong>Target</strong></td>
<td>Owners, individual, building stakeholders as architects, craftsmen in order to enhance practical knowledge and support local decision makings.</td>
</tr>
<tr>
<td><strong>Level</strong></td>
<td>Regional</td>
</tr>
</tbody>
</table>
| **Contact** | Caroline Muller - cmuller@cg34.fr  
Bernard de Gouvello - bernard.degouvello@leesu.enpc.fr |

### Project description

This investigation and action program takes place in two steps:

1. economic and technical survey: guidance advices designed to project managers, maintenance of equipments;
2. Capitalization of experiences, feedbacks related to the techniques employed, involvement of stakeholders, climate factors and launch of information campaigns (use of a guide for alternative water resources).

### Results obtained

The expected result consists in supplying operational and detailed information on rain water recovering under the Mediterranean climate. The information gives also explanations to resolve specific issues and about recovery equipments and storage devices.

### Success factors

A national specialized research centre has been commissioned to produce a survey that guarantees an efficient technical guide. Financial supports and incentives (by means of subsidizes) for equipments that allow long term return of investments.

### Indicators used

The implementations following the investigations and surveys are a first indicator of success factors. The efficiency of the water recovery devices measured in the framework of those experimentations represents another indicator.

### Repeatability and Applicability

The reiteration targeting specific users depends on: technical performances, economical and organisational conditions of implementation, maintenance.

### Total costs

Survey 49,974 € TTC.  
Implementations: 56,000 € TTC for 8 individual social housing.

### Further references

Website of the General Council of Hérault  
mag.herault.fr/
The research project titled ADOR (Decision Support on Irrigation Organization) is a freeware software application for integrated management of Irrigation Communities. It was created by the Aula Dei Experimental Station (National Research Council) and the Agrifood Research and Technology Centre (Government of Aragon). The use of this software application is aimed at the integrated management of irrigation water, which is the responsibility of the irrigation community, thus achieving a more effective control of water and its costs.

ADOR provides the following utilities:

- Inventory and management for all components of the irrigation community: users, land, irrigation networks and drainage, irrigation systems and water uses. This can all be seen in a summary outline and a geographical information system;
- Measuring the irrigation water delivered to each user, to enable charging according to volume consumed and the introduction of all types of tariffs;
- Assessment of the seasonal changes in variables, such as water use or the distribution of crops, and comparison of data with previous years;
- Availability of the billing database for the Irrigation Community.

This implies the centralisation of all Community activities. The central data-programme is run from the General Community headquarters, which receives daily requests for water from the communities via the Internet. The General Community compiles this information daily and sends it to the Ebro Hydrographic Confederation, so that the entire request process is faster and saves water.

Results obtained
Irrigation community’s sustainable management, which saves water.

Success factors
Irrigation community work’s centralization, minimizing the time of processing and accounting of water delivered to each user.

Indicators used
Community components inventory and Accounting of water delivered to each user.

Repeatability and Applicability
It is replicable in other contexts because it is a software tool and therefore easy to reproduce in another situation, introducing the parameters and values of the new irrigation community, that is, adapting the data to the new environment.

Total costs
It depends on the size covered by the irrigation community.

Further references
www.sirasa.net/arbol/pagina.asp?idArbol=47&idNodo=319
<table>
<thead>
<tr>
<th>WG</th>
<th>A2 - water demand-side management (economic and financial instruments)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Partner</td>
<td>LP - HMUELV</td>
</tr>
<tr>
<td>Promoter</td>
<td>HMUELV</td>
</tr>
<tr>
<td>Project</td>
<td>1 - Benchmarking of water supply and waste water companies in Hessen</td>
</tr>
<tr>
<td>Type</td>
<td>Economic</td>
</tr>
<tr>
<td>Period</td>
<td>Since 2000</td>
</tr>
<tr>
<td>Location</td>
<td>Hessen</td>
</tr>
<tr>
<td>Target</td>
<td>Increase economic efficiency of water supply and waste water companies in Hessen</td>
</tr>
<tr>
<td>Level</td>
<td>Regional and local</td>
</tr>
<tr>
<td>Contact</td>
<td>Werner Brill - <a href="mailto:werner.brill@hmuelv.hessen.de">werner.brill@hmuelv.hessen.de</a></td>
</tr>
</tbody>
</table>

**Project description**

The Ministry of Environment of Hessen, the Association of Municipalities and communities of Hessen and the Hessen branch of the German Association of water management, waste water and waste encourage all water supply and waste water companies in Hessen to a voluntarily participation in the benchmarking project.

As for a sustainable performance of benchmarking systems for water suppliers and waste water associations which are responsible on local level it will increase their economic efficiency.

**Results obtained**

Benchmarking is based on an inventory of technical and economic status quo of the company. A location decision in comparison to the industrial sector and to comparison groups takes place. Eventually, detailed individual evaluation and recommendation are provided to the companies, e.g. capability in energy saving measures, capability in reduction of water losses.

**Success factors**

Increase of economic efficiency of water supply companies and waste water companies in Hessen.

**Indicators used**

Number of participating companies.

**Repeatability and Applicability**

It can be a model for other areas in Europe.

**Total costs**

Approx. 30,000 € p.a.

**Further references**

Website:
www.hmuelv.hessen.de/ir/HMUELV
www.bkwasser.de/

Publications:
- Projektinformation 2009 - 2010;
- Präsentation des Vortrages im Rahmen der Informationsveranstaltung;
- Zwischenbericht BKWasser 2000;
- Abschlussbericht BKWasser 2002;
- Zwischenbericht BKWasser 2001;
- 5 Jahre BKWasser - Benchmarking für die hessische Wasserwirtschaft für den Zeitraum 2000 - 2004;
- Citizen Value Scorecard - Strategisches Controlling in Betrieben.
Project description

The taxes levied on water may be state (national level) or autonomous (regional level):

State taxes on water are regulated by the revised Water Law (Royal Legislative Decree, RLD, 1/2001). The Regulation tax and Water Use tax (article 114 of the RLD 1/2001) are among these state taxes.

The Regulation tax is intended to offset the costs of state investment management and meet operating expenses and maintenance costs for the works to regulate surface water and groundwater, which are wholly or partly financed by the State.

The Water Use tax must be met for the availability or use of water and is intended to offset the costs of state investment management and meet operating expenses and maintenance costs for other specific hydrological works, which are wholly or partly financed by the State, including correcting the deterioration of public water, due to its use.

Those obliged to pay both levies are the beneficiaries of those works, and are collected by the appropriate basin organisation for intercommunity basins.

In turn, the autonomous communities have established taxes levied on the various stages of the water cycle, without them being taxed by the State. For the Autonomous Community of Aragon, it is the Sanitation tax, which is an ecological tax, as enshrined by the Law 6/2000, 17 May, Water Management Planning and Participation in Aragon.

The aim of the Aragon Sanitation tax is to finance construction, operation and maintenance costs for sewerage and water treatment.

The taxable event is the production of wastewater, which is manifested through water consumption from any source (both that provided by suppliers as well as abstractions from surface water, groundwater or rainwater).

At the municipal level, it is referred to in paragraph 4 of article 20 in the RLD 2/2004, 5 March, approving the Revised Text of the Law Governing Local Taxes, by which local organisations can collect fees for sewerage and water distribution. In addition, local organisations may provide special contributions to carry out works or for the establishment or expansion of services related to water supply and sanitation.

Results obtained

- Recovery of investment costs in infrastructure and meet the costs of maintaining them.
- Funding of operating costs, maintenance and works’ construction of sanitation and water treatment.
- Increased efficiency and saving water.

Success factors

They are obligatory measures.

Indicators used

- Investment recovered and financing of new works.
- Efficiency and water saving.
Repeatability and Applicability
It is repeatable, because it is common to all European regions (taxes both at state, regional and municipal level).

Total costs
Undeclared.

Further references
Canon de Saneamiento (AIW) portal.aragon.es/portal/page/portal/IAA/CANON
**Project description**

The Regional Law 25/1999 has introduced the recognition of a new set of tools to determine the best water tariff applicable in order to reduce water consumption, to link the tariff to water quality and to foster environmental protection. RL 25/99 defines the Optimal Territorial Field (OTF) which correspond to the 9 Provinces of the Region Emilia-Romagna. For each OTF there is also an Agency which is competent for defining the level of demand for the public service, the water tariff in the OTF, the management and funding of the necessary interventions to ensure quality services. In 2004, the Region Emilia-Romagna introduced a new Regional Law (7/2004) which foresees the modification of the indicators and the introduction of new standards for the definition of the water tariff at regional level. The major innovation of this new tariff system consists in the introduction of a ‘performance’ indicator which can lead to the application of an incentive/disincentive to the tariff variable between −1% and +0.5%.

The key areas covered by the new indicator are the supply of the service (unexpected interruptions in the delivery, sewerage emergency services), customer service (call centre, answers to complaints, facilitation of the payment, services for disabled) and environmental impact (leakages). The core of the regional tariff consists in:
a) the promotion of quality for the service provided and of the saving and conservation of the resource through mechanisms of motivation/de-motivation;
b) the separation of the tariff for the aqueduct and for sewerage/depuration; c) update and redefinition of the tariff related to the wastewater industrial districts. Furthermore, the new tariff system aims at increasing the efficiency which is considered to be a key element for the regulation of the system. Therefore the new approach aims at defining an ‘efficiency frontier’ to be reached, rather than at applying a punctual factor.

**Results obtained**

Increase of efficiency and water saving of water supply/wastewater companies.

**Success factors**

Introduction of a ‘performance’ indicator; promotion of quality for the service provided and of the saving and conservation of the resource; separation of the tariff for the aqueduct and of that for sewerage/depuration; update and redefinition of the tariff related to the wastewater industrial districts; efficiency as key element for the system regulation.

**Indicators used**

Efficiency and water saving.

**Repeatability and Applicability**

It can be a model for other European contexts.

**Total costs**

Undeclared.

**Further references**

www.ermesambiente.it/osservatorio_sii_ru/
Project description
The Region Emilia-Romagna published a public call for the concession of regional contributions to the economic-productive sector of enterprises, approved with regional Decree n. 546/2003, carrying as object "Environmental Action Plan phase II: eco-incentives for the system of enterprises". The call has been subdivided in thematic types, one of which dedicated to water, in particular: “Realisation of plants, application of technologies and updating of techniques for the amelioration of the water balance, through the recycle of waters and reuse of wastewaters as well as reduction of the overall withdrawals and drainages, together with the realisation of industrial aqueduct networks.” The regional eco-incentives were equivalent to the 30% of the total cost of the intervention proposed to the enterprise included in the category “SME – Small Medium Enterprise”, and to the 20% in other cases. Thus contributions ("eco-incentives") have been provided in support of 41 private enterprises operating on the regional territory and belonging to different productive sectors (nursery, ceramic, building, agro-alimentary, colours and paints, textile, oenological, etc.). The interventions proposed which have obtained the eco-incentive were mainly based upon the modernization of the productive processes, on technical and technological innovations, recovery, reuse and recycle of water and wastewaters, applications of rain harvesting, etc., all addressed to the reduction of withdrawals from surface and groundwaters as well as of the consumption of the water resource.

Results obtained
Reduction of water consumption in enterprises comprised between 40% and 90%.

Success factors
The favouring of technological and technical updating of the regional system of enterprises in light of sustainable development and reduction of water consumption, supported by public economic contributions.

Indicators used
Conclusion of the intervention; achievement of the objective of saving indicated by the enterprise; measurement of the water consumption (water balance).

Repeatability and Applicability
The experience is repeatable and applicable. The detailed rules and the consistency of the results are specific to each particular context.

Total costs
3.000.000 € (approx.).

Further references
<table>
<thead>
<tr>
<th>WG</th>
<th>A2 - water demand-side management (economic and financial instruments)</th>
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<tbody>
<tr>
<td>Partner</td>
<td>P9 - REC</td>
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<tr>
<td>Promoter</td>
<td>REC</td>
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<tr>
<td>Project</td>
<td>5 - Priority Environmental Investment Programme (PEIP)</td>
</tr>
<tr>
<td>Type</td>
<td>Planning, infrastructural and economic</td>
</tr>
<tr>
<td>Location</td>
<td>West Balkans</td>
</tr>
<tr>
<td>Target</td>
<td>Albania, Bosnia and Herzegovina, Croatia, FYROM, Kosovo as defined under UNSCR 1244, Montenegro, and Serbia</td>
</tr>
<tr>
<td>Level</td>
<td>International</td>
</tr>
<tr>
<td>Contact</td>
<td>Dusan Sevic - <a href="mailto:dsevic@rec.org">dsevic@rec.org</a></td>
</tr>
</tbody>
</table>

**Project description**

Since its beginning in late 2001 the PEIP project was helping the competent ministries in the beneficiary countries in creating and updating national lists of priority environmental investment projects for each country. The first set of national PEIP lists was created in 2002 based on consultations with PEIP focal points coming from national ministries responsible for environmental protection and/or ministries responsible for waters. In each PEIP period (2001-2003, 2003-2005 and 2007-2009), these lists have been updated twice per year based on information from project proponents and national PEIP focal points. New priority projects have been added and some of the existing ones have been removed in each update, based on financing and construction developments in case of each project.

The projects have been classified in three sectors: Waste, Water and Air sector. During the entire period, the relative strategic importance of water sector projects increased, so that in 2009, on the national PEIP lists, there were 75% of water sector projects and 25% of air and waste sector projects in terms of total number of projects. The majority of water sector projects included rehabilitation and extension of water supply systems and waste water collection and treatment systems.

Apart from updating national PEIP lists, the project included regional knowledge exchange and national and local capacity building activities: regional meetings twice a year during the entire period 2001-2009; sectoral workshops and trainings in the 2003-2005 period; and national workshops and trainings directed at both national and local level in the 2007-2009 period. The regional meetings were targeted not only at regional knowledge and experience change, but also at presenting the national strategic financing needs to the EC, bilateral donors and IFIs.

**Results obtained (2001 - 2009)**

- 12 regional meetings.
- 3 sectoral workshops and trainings.
- 7 national workshops and trainings.
- 7 regularly updated national PEIP lists.
- 2 manuals (water and waste sector) for public utilities for organisational reform and investment project preparation.
- 1 guidebook on options for financing with donor profiles to assist project proponents seeking finance.
- 1 database on 143 critical project locations (hotspots).
- 1 strategic guidance for 29 hotspots.
- 2 studies on the status of environmental investment planning, which provides an overview for decision makers in the SEE region, and for donors on the process of transposing key investment-heavy EU directives.
**Success factors**
Active cooperation between the project team in REC head office, project officers in 7 country offices, and focal points in ministries responsible for environmental protection and/or water.

**Indicators used**
Number of training events and results from event satisfaction survey questionnaires.
Project dynamics on national PEIP lists.

**Repeatability and Applicability**
Undeclared.

**Total costs**
400,000 € (2007 - 2009).

**Further references**
Project Website:
archive.rec.org/REC/Programs/REREP/PEIP/Default.html
Main Publications:
Strategic Moves – Eight Years of Environmental Infrastructure Investment Planning in the SEE (2009)
web.rec.org/documents/peip/PEIP_Strategic_Moves_PDF_Final.pdf
A2 - water demand-side management (economic and financial instruments)

<table>
<thead>
<tr>
<th>Promoter</th>
<th>PP10 - MoE</th>
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<tbody>
<tr>
<td>Project</td>
<td>6 - WATMAN Project - Optimization of water allocation in case of drought and water scarcity component</td>
</tr>
<tr>
<td>Type</td>
<td>Economic</td>
</tr>
<tr>
<td>Period</td>
<td>2004 - 2007</td>
</tr>
<tr>
<td>Location</td>
<td>Romania-Arges Basin Water Administration</td>
</tr>
<tr>
<td>Target</td>
<td>Arges-Ialomita Water Basin Administrations and water users in the basins</td>
</tr>
<tr>
<td>Level</td>
<td>Regional</td>
</tr>
<tr>
<td>Contact</td>
<td>Mary-Jeanne Adler – <a href="mailto:mj.adler@mmediu.ro">mj.adler@mmediu.ro</a></td>
</tr>
</tbody>
</table>

Project description

Balancing the goal of retaining water in reservoirs with that of discharging water for meeting water demands is need in order to solve the short-term operation problem and is realized by fixing a proper system of costs attached to the corresponding arcs.

The problem of optimizing the WMS operation is formulated like a flow in networks problem as following: to find the flow that minimize the cost in the whole network while meeting the constraints of continuity in nodes and the constraints of non-exceeding lower and upper flow limits on arcs.

Conversion of WMS in the arcs-nodes network and the adequate choice of costs and limits on arcs are steps of a unitary process and depend on the goal of the respective model.

The economic concept of water use is the starting point of water demands modelling. According to this concept, a “utility/benefit function” or a “loss function” might be associated to each water user that represent the benefits obtained by using water or the damages produced due to the water shortage (1).

This way, depending on the specific character of each water user, its water demand might be considered as a single value, in which case the loss function has a single slope, or consisting in F trenches when the loss function is represented by F line segments of different slopes.

\[ Q_p = \sum_{f=1}^{F} Q_{pf} \]  \hspace{1cm} (1)

A unitary cost CF which expresses the unitary economic loss produced when the user missed one unit of necessary flow is attached to the single water demand or to each water demand trench F.

Weight or priority coefficients might be used instead of the real unitary costs when the “utility/benefit function” or the “loss function” is not available. The weight/priority coefficient values are conventionally established in such a way as to reflect the relative importance of meeting different water demands or water demand trenches within the whole WMS.

Weight coefficient attached to a water demand or water demand trench should be as higher in absolute value as that water demand or water demand trench is more important from the prospective of water shortage consequences. Thus it is possible to catch into the analysis a more refined way of meeting water demands for some important water users which, for instance, have the possibility to recycle water:

- Allocate water during drought periods only for the trench corresponding to the minimum necessary need;
- Cover the rest of water trenches too in periods with enough water, and so reduce the user operation costs.
Results obtained

- Simulation of WMS operation on monthly (or ten days) intervals and on a year series.
- Optimization of WMS operation in each time interval from the year series by the means of “out-of-kilter” algorithm.

The convenient processing of results obtained in each time interval of the year series analyzed gives the opportunity to calculate parameters of WMS that characterize its functioning and to get the best water distribution for different users, getting restriction constraints.

Success factors

Water users collaborate under the coordination of the Basin Water Administration to get the best constraints and the optimum needed discharges during droughty periods; water supply for Bucharest and Pitești, as well as the important industries in the basin and hydropower energy, get the best success indexes for economical production.

Indicators used

The main statistical parameters used as indicators of long-term WMS operation are the following:

- Long-term reservoir operation rules;
- Actual degree of meeting water demand expressed in terms of year, month and quantity percentage;
- Other indicators of WMS behaviour during drought periods such as: maximum, average and minimum values of actual water distributed to different users and number of months in which each of these values appears;
- Time variation of reservoir volumes and levels, number of months when reservoirs are empty and full respectively, yearly and monthly average level, and so on;
- Indicators of hydropower plants performance: time variation of monthly available power, monthly, seasonal and yearly average energy production, yearly number of HPP operation hours;
- Pumping energy consumption for irrigation;
- River flow hydrograph in different control points as resulting from calculations performed.

Repeatability and Applicability

The model can be built for different other basins, where water scarcity became an issue or for drought prevention.

Total costs

25,000 €.

Further references

WATMAN Project, Feasibility Study, Coordinator Mary-Jeanne Adler, PhD, Project manager.
ALOC Component of the DSS: Prof. Radu Drobot, PhD, Violeta Voisan, PhD.
### Project description

The economic concepts of Water Framework Directive 2000/60/EC were transposed in the Romanian legislation in 3 stages (in 2004, 2006 and 2010), by amendments to the Water Law no. 107/1996 and to the Governmental Ordinance no. 107/202 on the establishment of National Administration “Romanian Waters”.

As a result, in Romania, the economic mechanism in the water management field was modernized based on the following principles:

- Beneficiary pays;
- Polluter pays;
- Recovery of the costs for water management;
- Protection and sustainable use of water resources;
- Water saving and reuse by application of the economic incentives and penalties.

The National Administration “Romanian Waters” applies on behalf of Romanian State the economic mechanism concerning the public services carried out:

- Assuring the raw water at source according to the water authorizations;
- Qualitative and quantitative monitoring of surface and ground water resources;
- Research in the water field, operative hydrology and hydrological forecasting;
- Reception of treated waste waters into the water resources according to the water authorizations;
- Protection against hydrometeorological hazardous phenomena, including drought;
- Reporting on EU Water Directives.

In this respect, specific contribution for the use of water resources and for discharge of waste water are established. In order to stimulate water saving, the newest contribution system for the water intake is structured on categories of sources and users, as follows:

1. Surface Water - inland rivers, lakes and reservoirs:
   1.1. Economic operators (including regional water operators), public institutions, religious establishments, agrozootechnical, industrial and others;
   1.2. Electrical, nuclear and thermoelectrical power plants;
   1.3. Hydroelectrical power plants;
   1.4. Irrigations;
   1.5. Aquaculture.
2. Surface Water - Danube:
   2.1. Economic operators (including regional water operators), public institutions, religious establishments, agrozootechnical, industrial and others;
   2.2. Electrical, nuclear and thermoelectrical power plants;
   2.3. Nuclear power plants;
   2.4. Hydrotechnical power plants;
   2.5. Irrigations;
   2.6. Aquaculture.
3. Groundwater:
   3.1. Economic industrial operators;
   3.2. Economic operators which use water intended for human consumption (regional water operators, public institutions, religious establishments and others);
   3.3. Irrigations;
   3.4. Aquaculture;
   3.5. Agrozootechnical operators.

Groundwater is considered a strategic resource, preserved for the periods of water scarcity and drought protected. For this reason, the contribution for groundwater use is the highest of all (1.25 bigger than that for water from rivers and 10 times more than that for Danube water).

Drinking water supply and sewage are public services carried out by regional operators (public or private companies) based on a regulated taxation system, surveyed by the National Authority for the Regulation of Public Services. This taxation system assures:

- Recovery of the service costs;
- Efficiency and safety of the service, public health and environmental protection;
- Discouragement excessive water consumption of the households;
- Encouragement of new infrastructure investments;
- Continuity of the service.

Results obtained
Water consumption at national scale registered a descending trend, but detailed economic studies are needed to establish how much of this trend is generated by application of the economic mechanism and how much by the industrial decline.

Necessary funds for the maintenance and development of the water works were obtained.

Success factors
Good collaboration between the National Administration “Romanian Waters” and the water users. Stability of the legal framework.

Indicators used
Variation of the contributions.

Repeatability and Applicability
Undeclared.

Total costs
No available date on the costs of the legal and organizational measures for adapting the economic mechanism in the water management field to the EU requirements.

Further references
Water Law no. 107/1996 as later amended;
Governmental Ordinance no. 107/202 on the establishment of National Administration “Romanian Waters” as later amended;
National Management Plan of the Romanian Territory belonging to the Danube River Basin- Synthese.
**Project description**

**The water paradox**

It is a strange paradox that water is crucial for life while it comes at a price next to nothing. In the Netherlands the use of groundwater resources for industry and agriculture—although limited by legislation—is virtually for free. A cubic metre of drinking water in the Dutch province of Noord-Brabant costs less than 1 €. This means there is no real incentive for water saving or optimising the use of resources.

On the other hand there is a gap between water demand and water supply in the area of Brabant. During dry summer periods agriculture and nature have to cope with water scarcity. Due to climate change, this disrupted balance is expected to grow.

**Changing attitudes**

In recent years, water as an issue has moved from pure hydrological management to an LQWHJUDWHGSDUWRIODQGXVHSODQQLQJ,WKDVDOVRGHYHORSHGIURPDWKUHDWêOLNHpRRGLQJêRUD\LQWHJUDWHGSDUWRIODQGXVHSODQQLQJ,WKDVDOVRGHYHORSHGIURPDWKUHDW supported by new tools and instruments. Monothematic and defensive approaches make way for integrated views and sustainable development. New ways of water management are needed, powered by new drivers.

**Adding value to water:**

The main challenge in this new approach is how to create incentives for change. The key solution seems to be adding economic value to water. This economic approach to water management was addressed in a joint project of water managers and land users in Brabant.

**Results obtained**

After an inventory of business opportunities and availability of resources (Sankey graph/Water Balance tool; survey of water supply and demand in Brabant), the project focused on selected regions in which stakeholders and entrepreneurs cooperated in creating plans for new water driven activities. This is the so-called New Markets approach.

Economic drivers are:

- Brackish cultures and regional produce;
- Water and energy production;
- Water in agro-food complexes and chains;
- ‘Water farming’—cooperative water retention;
- Water for housing and recreation.

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**WG A2 – water demand side management (economic and financial instruments)**

<table>
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<tr>
<th>Partner</th>
<th>P13 - Noord-Brabant</th>
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<tr>
<td>Promoter</td>
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<td>Telos – Brabant Centre for Sustainable Development, University of Tilburg</td>
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<td>Project</td>
<td>8 - Water as an economic driver; A ‘New Markets’ approach to sustainable water management (Waardecreatie met Water)</td>
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<td>Type</td>
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<td>Period</td>
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<td>Location</td>
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<td>Target</td>
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</tr>
<tr>
<td>Level</td>
<td>Regional</td>
</tr>
</tbody>
</table>
| Contact | Frank van Lamoen - fvlamoen@brabant.nl  
|         | Jules Hinssen - j.p.p.hinssen@uvt.nl  
|         | Hans Mommaas - j.t.mommaas@uvt.nl |

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**Source:** Telos/Urban Unlimited
In the second stage of the project, focus will be on creating real businesses based on the business plans made. With these pilots the feasibility of an economic approach to sustainable water management will be tested.

**Success factors**
- Engagement and cooperation of stakeholders (form both the public and private sector).
- An entrepreneurial approach.
- Flexibility in policy and regulations in order to optimise business opportunities.
- Adding economic value to water, increasing incentives for water saving and awareness.

**Indicators used**
- Number of business ideas and plans.
- Number of stakeholders and entrepreneurs involved.
- Balance between water supply and demand.

**Repeatability and Applicability**
Both the “New Markets” approach and the Sankey Graph (Water Balance tool) are applicable – and have been applied - in other regions and settings. New Markets approaches have been applied to e.g. tourism in the province of Limburg and rural development in Friesland.

**Total costs**
100,000 €.

**Further references**
**Project description**

In the Netherlands there is an abundance of water (precipitation) in winter time, but often a shortage during summer. New ways have been explored to store this surplus on farmland and sell it as a product in times of demand. This in short is the principle of the water farm; a concept in which a multifunctional land use concept; water must be seen as a product with a certain value in order to let the water farm perform as an economical feasible enterprise; 4. There must be customers, in search of water within the region. Supply and demand can also be linked in a regional cooperative; 5. There must be funding for initial investments.

**Results obtained**

A feasibility study has been carried out. The Waterboard Aa en Maas is starting a pilot project.

**Success factors**

Key factor of success are regional cooperation and the acceptance of water as an economic good.

**Indicators used**

- Number of farmers interested in the concept.
- Number of (pilot)business cases.

**Repeatability and Applicability**

The concept can be applied wherever the 5 requirements are met.

**Total costs**

The concept should be self-sufficient or profitable. Some initial funding is required.

**Further references**

www.innovatienetwerk.org/en
www.aequator.nl/english
### Project description

In order to prevent an unlimited use of groundwater, the province of North-Brabant charges the use of groundwater. If someone withdraws more than 10 cubic meters of groundwater, and the purpose of the withdrawal is to use the groundwater, a provincial groundwater charge of €0.019/m$^3$ has to be paid.

The revenues are used for research and financing our groundwater monitoring network.

No groundwater charge is required for:

- Energy storage;
- Soil and groundwater remediation;
- For pumps with a capacity less than 10 m$^3$ per hour;
- Activities that don’t have the use of water as a purpose such as drainage and emergency services.

### Results obtained

The amount of extracted groundwater is stabilised and meets the target for North-Brabant of less than 270 M. m$^3$ per year.

### Success factors

It is an obligatory measure.

### Indicators used

Stabilisation of the amount of extracted groundwater in North-Brabant (yearly less than 270 M. m$^3$).

### Repeatability and Applicability

Undeclared.

### Total costs

Undeclared.

### Further references

[www.brabant.nl](http://www.brabant.nl)
**Project description**
The study program is based on improving the general knowledge on water consumptions and the definition of an action plan. The program is conceived to carry on an economic analysis of this action plan and secondly to assess the commitment and approval of citizens by applying a governance process.

**Results obtained**
The program study implemented on the central territory called “Heart of Hérault” concerns 77 Municipalities and according to the last census in 2009, 67,567 inhabitants. The administrative boundaries include the water catchment basin of the Hérault river.
The content of this program is:
- A statistical analysis of water consumptions, factors of variability;
- Water consumption ratios of public facilities;
- Modelization of evolution phases accordingly with three hypothesis of urban growth (natural trend versus active urban planning);
- Analyse the users approval for water savings policy;
- Analyse of rain water recovery devices in 8 social accommodations (sanitation water use).

**Success factors**
The stakeholder involvement in regional and suburban planning as well as local authorities, over the complete process of water management.

**Indicators used**
- Set of references (ratios) for each category of uses.
- Impact of factors as housing density, water prices and consumptions.
- Level of governance.
- Shifts in the decision-making based on the acknowledgement of the report conclusions.

**Repeatability and Applicability**
The method can easily get repeated on larger scale than the river basin perimeter (also an administrative one) even on the whole Hérault’s territory, in particular regarding the consumption figures, the governance process and the optimization of quantity water demand.

**Total costs**
104,000 €.

**Further references**
www.waterandterritories.eu
Project description

The National Drought Monitoring Centre is an initiative from the Ministry of the Environment and Rural and Marine Affairs, intended to bring together all the Spanish water authorities to form a centre for learning, forecasting, mitigating and monitoring drought in Spain.

It is formed by the 8 inter-community basin organisations dependent on the national government, the 7 intra-community water boards, the autonomous cities of Ceuta and Melilla and the 17 Autonomous Communities and local corporations.

Each party must provide appropriate information to be able to anticipate the effects of drought and mitigate its environmental, social and economic impact.

This initiative is part of the new policy to strengthen public control of water use and quality and enhance the participation and responsibility of citizens to combat waste, speculation, shortages and pollution of water.

There is a section dedicated to the National Drought Monitoring Centre on the Ministry of Environment website (www.mma.es) where the following information can be found:

- Hydrological information on rainfall, surface water, groundwater, circulating flows, surface water quality, non-conventional resources and snow and wetland reserves;
- Drought monitoring reports prepared by the Ministry of the Environment;
- Legislative and management measures implemented by regional and local governments;
- Educational information for the public on the environment;
- Direct link to the Civil Protection Directorate General website (risk information);
- Measures to mitigate the effects of drought on agriculture.

Results obtained

Monitoring by Administration and civil society:

- Drought monitoring reports;
- Updated hydrological information on rainfall, river discharge, etc;
- Measures to mitigate drought.

Success factors

Frequent content and data updating.

Indicators used

Increasing number of users.
Repeatability and Applicability
It is repeatable in other contexts, since it is a knowledge center, monitoring, anticipation and mitigation of drought made up of all water administrations of the country. Therefore, it could be applied in any other region with the appropriate changes by country.

Total costs
Unquantifiable.

Further references
www.mma.es/portal/secciones/aguas_continent_zonas_asoc/ons/
### Project description

The emergency supply plans for population centres over 20,000 are intended to guarantee supplies if there is a drought. The plan is based on the following:

- A risk assessment and system to control shortages;
- Implementation of actions depending on the status of certain indicators;
- Demand management;
- Actions regarding the supply.

The emergency measures are for unexpected circumstances, when there is a severe or long-lasting drought. Measures include the construction of emergency wells, establishing supply restrictions, prohibiting use, temporarily modifying use, etc.

The Hydrographic Confederation in Aragon has established a number of reserve requirements in the reservoirs to supply the main water supplies in the basin, as follows:

- Selection of minimum contributions recorded in historical periods of 3, 6 and 12 consecutive months for the indicator considered;
- Estimate of the reserves required to meet any shortfall in contributions (Contributions - Demand + Reserve).

A series of status indicators for the main supplies and thresholds is established from the reserve requirements, giving the following alert classification:

- Pre-alert: 12 months guaranteed supply;
- Alert: 6 months guaranteed supply;
- State of emergency: 3 months guaranteed supply.

**Zaragoza supply:**

- Minimum reserve: 25-30 Hm³. However, due to the distance from the reservoir to the supply output, a minimum of 50 Hm³, extended to 100 to maintain environmental flows, is established for the Ebro reservoir;
- Indicator: Volume of water stored in the Ebro reservoir.

**Huesca supply:**

- Minimum reserve: 6 Hm³;
- Indicator: Volume of water stored in the Vadiello reservoir.

### Results obtained

To ensure water supply during drought periods.
Success factors
- A system for evaluating and controlling shortages risk.
- Actions implementation depending on indicators state.
- Demand management.
- Actions on offer.

Indicators used
Stored water volumes in reservoirs based on population.

Repeatability and Applicability
It can be repeated in other contexts, since the plan’s goal is to manage the drought in order to ensure water supply to the population, a key objective in any country. It is necessary to adapt the plan to the conditions characteristic of each population.

Total costs
The cost depends on population size.

Further references
Undeclared.
Project description
The Action Plan for alert situations and possible drought in the Ebro Hydrographic Confederation Basin was approved by Ministerial Order in March 2007. Previously the plan was subjected to a Strategic Environmental Assessment process including a period of consultation.

The Drought Plan is a reference document and an effective tool for managing resources in times of drought. The methods of operation and implementation of measures were agreed by all parties involved (society, government, scientific community, NGOs, etc).

The specific objectives of the Plan are:

- To ensure the availability of water required to guarantee the health and lives of the population;
- To prevent or minimise the negative effects of droughts on the ecological status of water bodies;
- To minimise adverse effects on supplies to population centres;
- To minimise the adverse effects on business, according to the usage prioritisation established in the water legislation and river basin management plan.

This plan identifies the mitigation measures considered most appropriate as they go beyond the various developmental stages of a drought situation, with monthly drought monitoring information recorded in map form. In normal circumstances, the measures will be derived from ordinary planning, before successively moving on to monitoring and control measures, conservation measures then restriction measures.

The Plan consists of a diagnosis of the drought, a programme of measures and a system for managing and monitoring:

- The diagnosis includes the identification and characterisation of territorial and environmental parameters, by analysing and characterising historical droughts. It also includes the definition of indicators, thresholds and stages of the drought. Basic indicators are: volume stored in surface reservoirs, piezometric levels in aquifers, flows into storage areas or reservoirs, rainfall at representative stations and estimated accumulated snow volumes.
- The programme defines and describes the type of measures that can be applied to each zone at each stage of a drought.
- The management and monitoring system allows for analysis of the measures implemented as well as corrective actions if goals are not achieved, and describes the methodology for preparing monitoring reports analysing the evolution of the drought.

Results obtained
To guarantee the availability of required water to ensure population health and to minimize the effects of drought both environmentally and economically.

Success factors
Definition of indicators, thresholds and drought stages.
### Indicators used
- Volume of water stored in surface reservoirs.
- Groundwater levels in aquifers.
- Fluvial gauging in stations and reservoirs.
- Representative rainfall stations.
- Estimated values of snow volumes.

### Repeatability and Applicability
It isrepeatable in other contexts, since the plan’s objectives are common to all regions of Europe, but it would be adapted to the conditions of each region.

### Total costs
Unquantifiable.

### Further references
www.mma.es/portal/secciones/acm/aguas continent zonas_asoc/ons/planes_sequia_isas/ch_ebro.htm
**Project description**

The Special Wastewater Treatment Plan of Aragon (PED), set in motion by the Government of Aragon, is an unprecedented action taken in Spain, meant to achieve the adjustment of the urban wastewater discharge to the European Directives and to the Spanish regional and national legislation, and to assure quality water during droughts. The objective of the Plan is to purify all urban wastewater from Municipalities and entities of more than 1.000 equivalent inhabitants through secondary treatments. This Plan operates in 176 Municipalities and involves the building of 136 waste water plants and more than 500 Kms of collectors, with a final total investment of more than a billion euro. The Plan is developed under a concession system, which includes the construction work and the operation of the installations. A population of 200.191 inhabitants will benefit from this Plan. This corresponds to an equivalent of 594.930 equivalent inhabitants, which means that 21% of Aragon’s wastewater has to be treated. Adding up the wastewater treatment plants [EDARs] already running, this will result in a treatment of 90% of the wastewater. The Water Institute of Aragon [Regional Ministry for the Environment] will provide the technical management of the Plan and the implementation will be carried out by SODEMASA, a public company of the Government of Aragon. One of the essential aspects of the Plan is the involvement of the affected town/village councils, as they will transfer their competences in the field of water treatment to the autonomous administration and undertake to obtain the land, right of way and temporary occupation needed to carry out the construction work. The Water Institute of Aragon will meet the cost of construction and operation of the infrastructure included in the Plan. The cost associated with wastewater treatment will be recovered through a sanitation tax (ecological tax), within the 20 years of the duration of the concessions.

**Results obtained**

At this moment, the project has been finished in 92 out of 176 Municipalities. This means that 17% of Aragon’s wastewater has been treated.

**Success factors**

- Inter-administrative collaboration: Town/Village Councils - Water Institute of Aragon.
- Public works concession system: Obligations – Income from concessions. Sanitation tax.

**Indicators used**

Percentage of treated wastewater.

**Repeatability and Applicability**

It can be repeated in other context, because it is an essential tool for assuring quality water, although its repeatability will depend on the ambition level of the mentioned plans.

**Total costs**

Undeclared.

**Further references**

portal.aragon.es/portal/page/portal/IAA/DEPURACION/RESUMEN
**Project description**

The ‘Local Action Program to cope with drought and desertification’ of the Region Emilia-Romagna (LAP E-R) has focused on the improper use of the land and of the water resource in areas characterised by climatic fragility with growing drought phenomena. Through meteorological and agro-meteorological indicators it was possible to identify the regional areas more subject to climate change, with the highest anomalies in precipitations and in the temperature regimes: the crest elevations, the low and medium hill areas, in particular of Romagna. The sample area has therefore been identified in the Lamone Valley for the critical water balance of its basin. The summer waterway flow does not allow for the satisfaction of the water demand for the cultivations during the irrigational season and the area has consequently been subject to an extensive phenomenon of excavation of over 460 water storage basins. The adaptation measure (water storage basins) results insufficient because it does not intervene on the water demand, which grows faster than water storage. The impact on the river remains negative and unchanged. In the mitigation measure simultaneous to the adaptation, the maximum available resources (except for the Minimum Vital Flow - MVF) are examined and there is agreement on measures to contain demand. For example: adoption of correct water balances, less water consuming species and varieties, limitations to withdrawals, payment of the water, limitations to the installation of new cultivations of Actinidia.

The solutions foresee the reasoned integration of the following groups:

- **WG B - drought management**

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<tr>
<th>Partner</th>
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<tr>
<td>Project</td>
<td>5 - Local Action Program to cope with drought and desertification</td>
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<td>Emanuele Cimatti - <a href="mailto:ecimatti@regione.emilia-romagna.it">ecimatti@regione.emilia-romagna.it</a></td>
</tr>
</tbody>
</table>

| Regione Emilia-Romagna |

- **Results obtained**
  - The communication and informative actions, through seminars, meetings and conferences, have directly involved over 300 people.
  - The results of the LAP E-R have been presented in two national scientific congresses (AIAM 2008 and AIAM 2009); the methodology and the project data have been published on regional and national reviews (ARPA Rivista, Rivista Agricoltura).
  - The raising awareness actions on the issues of drought and desertification, water resources and climate change have reached numerous users of the INFEA network through web informative channels and the centres Faenza CEA 21 and Coop Atlantide.

**European Union**

European Regional Development Fund
The program goals have attracted the interest of the administrations directly involved in similar processes, but in different environmental conditions, such as the Authority of the Reno basin and other land reclamation authorities of Romagna. Following the LAP E-R, the Authority of the Reno basin has concluded a study on the drought phenomena in its competence areas, providing territorial and hydrologic data to highlight the equal vulnerability to drought and desertification, due to the presence of cultivations and irrigation techniques that are not sustainable anymore given the current environmental resources.

The instruments adopted in the program, such as the territorial water balance model Criteria Geo and the data of the forecast-climatic bank ERGS, have been made available in some agencies composing the technical table (CER, CNR-Ibimet, CBRO).

The activities undertaken and the results obtained by the project Interreg III ERE (Espace Riviere Europeenne) have been valorised by the LAP E-R at regional level. This allowed for the launch of a post-project scientific collaboration on the common issues.

The concepts at the basis of the technical solution suggested by the LAP E-R in the field of internationalisation of the water cost have become part of the local planning instruments (PTCP Forlì-Cesena), thanks to the awareness of the involved administrators.

The LAP E-R has interacted positively with the Health Check 2009 of the Rural Development Program, through which the European Commission has underlined the priority on 4 transversal themes: climate change, renewable energy, water resource management and biodiversity.

Success factors
The identification of a sample area is probably the first factor of success because it spotted a critical situation which is more subject to climate change. However the major element that led to the success of this program is the fact that the intervention is tailored on many levels at once: identification of adaptive measures, re-equilibration of the cultivations and attention to the social and environmental value of water.

Indicators used
Number of participants to the conference/workshop/seminar (over 300 people); publications and articles; video clip production; large number of stakeholders “reached”.

Repeatability and Applicability
The experience is repeatable and applicable. The detailed rules and the consistency of the results are specific to each particular context.

Total costs
30.000 €.

Further references
www.ermesambiente.it/wcm/acque/sezioni_home/in_evidenza/PAL_EmiliaRomagna.htm
www.arpa.emr.it/pubblicazioni/siccita/generale_1096.asp
Project description

The study conducted in the mountainous basin of the Senio Torrent (270 km²) has focused its attention in particular on the relationship between the water balance and the irrigational requests at the level of morpho-functional units (micro-basins), as well as on the realisation of thematic cartographic instruments finalised to the planning, capable to identify the potentiality and limits of the water resource destined to irrigational use.

The result thus aims at the diagnosis of the current situation of the studied territory with reference to the planning of possible solutions to be adopted for a sustainable development, in a territory subject to an intensive antrophic exploitation.

The work is articulated in 4 main phases:

1. Collection and insertion of administrative data in the files relative to derivations of superficial waters;
2. Elaboration of a distribution map of intensive cultivations of the basin through photo-interpretation of the satellite orto-pictures Quickbird year 2003 and consequent precision surveys on the field;
3. Realisation of the water balance of the single cultivations according to the scheme Thornthwaite-Mather with the identification of the monthly water deficit;

The planning directions are also meant to orientate the public investments in consortial works of accumulation estimating the dimensioning and evaluating the priority, to value the more balanced territorial spheres and to limit the agricultural activities where there are not the preconditions of sustainability.

Results obtained

A cartography has been elaborated to highlight the level of criticality of each morpho-functional unit, with the relative planning addresses and the intervention priorities.

The maximum levels of criticality are identified in the analysis units of pede-collina, along the terraces of first level of the Torrents Senio and Sintria, its main affluent, and on the accumulations sides nearby the water body in high hill.

At the basin level the overall yearly water deficit is of about 4 million m³ of which 89% can be measured in the months of July and August.

Success factors

The analysis of the distribution of the intensive cultivations and the relative water balance identified the criticality elements in the single morpho-functional units.
Furthermore the study has been in support to the planning activity relative to the editing both of the “Piano Stralcio for the Senio Torrent basin – general revision” conducted by the Reno River Basin Authority and of the “Variation to the Territorial Plan of Provincial Coordination of the Province of Ravenna in actuation of the Water Protection Plan of the Region Emilia-Romagna”.

**Indicators used**
The combination of the territorial data (climatic, pedologic, farming) necessary to the calculation of the water balance allowed to identify the overall necessary classes to characterise the diverse productive contexts present in the basin.

**Repeatability and Applicability**
This study is adaptable to all those areas characterised by a strong criticality in finding the water resource, an excessive request of which could have repercussions on the qual-quantitative characteristics of the waters.

The necessity, by the competent Authorities, to achieve the qual-quantitative objectives in the sphere of environmental protection of the fluvial ecosystems and of sustainability in the use of the water resource indicated by the sector legislation, is opposed to the necessity of the agricultural sector to dispose of a sufficient water quantity so as to guarantee the technical and economic sustainability of the specialised productions which characterise the agricultural territory.

**Total costs**
6,000 € gross.

**Further references**
Website where it is possible to read and/or download the entire study (in Italian):
www.regione.emilia-romagna.it/bacinoxeno/Bilancio_Idrico_Senio/bilancio_idrico_Senio.htm


**Project description**

Monitoring drought and its effects to support decision makers on prevention and mitigation.

An integrated drought information system based also on a website has been developed after ARPA participation to Desertnet and Sedemed Interreg III projects. The website contains information to support the application of the regional plan for water protection for drought management. The drought observatory is the core of the website; it provides tools and data to study drought and desertification within the region, gathers updated documentation and informs institutions and citizens properly. Bulletins are produced weekly during critical seasons, monthly during the year, with measured data and forecasting. Indicators and benchmarks for meteorological, agricultural and hydrological droughts are available; in particular, two new indicators for assessing agricultural drought, which consider the transpiration deficit (Dtx) and the water available content in the soil (AD) are original.

**Results obtained**

Integrated bulletins on drought are used by administration and technical bodies. Official regional site for drought monitoring.

**Success factors**

Frequently refreshing with up to date contents and issues.

User friendly drought bulletins.

**Indicators used**

Increasing rate of web contacts and users numbers.

**Repeatability and Applicability**

The observatory web project is easily repeatable and is an example of gathering information and data from hydrological and meteorological monitoring networks, applying both common and new indicators. Bulletins web editing is an easy way for data dissemination on drought.

**Total costs**

25.000 €/year.

**Further references**

www.arpa.emr.it/siccita/
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<td>Period</td>
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<td>Location</td>
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<tr>
<td>Contact</td>
<td>Lucio Botarelli - <a href="mailto:lbotarelli@arpa.emr.it">lbotarelli@arpa.emr.it</a></td>
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</table>

**Project description**

The project mainly consists in providing, through the website of the Reno River Basin Authority, the knowledge on the course of water levels corresponding to the flows in drought periods relative to the situations monitored on the main water bodies of the Reno River basin. For this reason, periodically between May and November summarising reports are produced to show the trend of the levels.

From 2005 the more suitable and representative stations (around twenty) have been selected all over the Reno River basin (thus also in the territory of Tuscany), once evaluated the more opportune frequency to the scope of the observations, verified the reliability of the system and planned the relative activity necessary to the maintenance of the regional monitoring network.

Along the year, during the low water periods, measures of capacity are made by ARPA Hydrometeo-climate in collaboration with the Reno River Basin Authority, periodically and in function of specific situations to be monitored (intense and sudden rainfalls, persistence of drought periods, withdrawals and release of water volumes, etc.). The aim is to verify the flow of water bodies, together with the maintenance and update of the flow scales of the tele-hydrometric instruments present in the basin, with particular attention to the description of low water conditions with reduced capacity.

The frequency of the necessary field measurements varies in function of the “stability” of the sections and of the necessity to update, revise and modify the flow scales, consequently to floods and changes in the hydromorphologic conditions of reference.

Such activities are necessary conditions so as to ensure the reliability of the direct verification system of the hydrometric values, especially in function of very low and close to zero capacity values whose reliability and confirmation requires frequent direct field measurements.

The utilisation and optimisation of the existing regional hydrometric network managed by ARPA-SIMC is fundamental in order to dispose, once defined the flow scales, a real-time control.

**Results obtained**

Periodically, usually from May to November, summarising bulletins are produced to show the trend of the levels. Such trend consists mainly in the observation of the water quantity which flows in the section under monitoring, for which a “critical level” has been defined corresponding to the water MVF determined by the Water Protection Plan (WPP) of the Region Emilia-Romagna and an “alert level” with a doubled value.

The choice of defining an “alert” value is motivated by the will to pair the finality of control with a short and medium term management approach especially in periods of minor flow and in temporal and spatial concomitance with the needs.

The Reno River basin shows to be deeply influenced by the rain regime, highlighting a particular sensibility caused by prolonging of drought periods; the criticalities generally take place since the beginning of the summer season, while the time of response to significant meteoric events and more favourable climatic situations is slow, so that the recover takes place only in the period of autumn rains.
Success factors
The choice to determine the “critical level” and the “alert level”, especially in the most critical periods in temporal and spatial concomitance with the needs, is motivated by the will to pair the finality of control with a short and medium term management approach.

Indicators used
The “critical level” refers to a height corresponding to the water MVF and the “alert level” is equal to a doubled height. Monitoring of the capacities and Minimum Vital Flow (MVF).

Repeatability and Applicability
This experience is repeatable in all those areas characterised by periods of low water in relation to the sensibility of the system to the prolonging of drought periods, to the appearance of criticalities since the beginning of the summer season and to the recovery achieved only with the consistent supply of the autumn rains. Furthermore, the whole of the collected data, put in relation with the levels measured, can allow to define the balance between the ingoing and the outgoing volumes in the section of measurement, permitting an adequate live management of eventual derivations placed in the surroundings.

Total costs
Undeclared.

Further references
- Website: www.regione.emiliaromagna.it/bacinoreno/sito_abr/varie/portate_2009.htm
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<td>NMA is the national authority in the meteorological field in Romania, and is subordinated to the Ministry of Environment and Forest, functioning on the basis of Law 216/2004.</td>
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<td>9 - Agromonitoring network – integrated system for water resources management in Romania</td>
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<td>Target</td>
<td>1. Decision factors – Ministry of Environment and Forest, Ministry of Agriculture and Rural Development</td>
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<td></td>
<td>2. Scientific community – experts from Academy of Agricultural and Forestry Sciences “Gheorghe Ionescu-Sisesti”, University of Agronomic Sciences and Veterinary Medicine of Bucharest, Faculty of Agriculture</td>
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<td>3. Farmers - Romanian Agricultural Procedures Associations League (non-governmental Association)</td>
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<td>4. Insurance companies – Groupama, FATA-ASIGURARI, OMNIASIG</td>
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<td>Level</td>
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<tr>
<td>Contact</td>
<td>NMA: Dr. Elena Mateescu - Head of Agrometricological Laboratory - <a href="mailto:elena.mateescu@meteoromania.ro">elena.mateescu@meteoromania.ro</a></td>
</tr>
<tr>
<td></td>
<td>Daniel Alexandru: Expert in soil moisture field - <a href="mailto:daniel.alexandru@meteoromania.ro">daniel.alexandru@meteoromania.ro</a></td>
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</tbody>
</table>

### Project description

The negative effects of meteorological extreme events on crop production require specific monitoring methods in order to forecast the evolution of risk factors. As weather, climate, and soil are highly variable across a region or sub-region, the density of agro-meteorological stations becomes important. Moreover, integration of the stations in a unique network that allows centralized collection of data, analysis, and interpretation is critical to provide accurate information for decision factors.

The agro-meteorological activity undergoing within NMA, which integrates complex issues concerning the current and future evolution of crops vegetation state and soils water supply with respect to the meteorological parameters evolution, is a particularly important activity, with final aim to elaborate/edit the agro-meteorological bulletins and disseminate information at the level of the decision factors in agriculture and private farmers. The agrometeorological measurement program includes 55 weather stations, and the agrometeorological information are classified according to reference agricultural regions and types of crops, validated and managed based on specific programmes organized into data structures modules, which represent the entire agrometeorological monitoring system.

The main purpose of Agromonitoring Network is continuous surveillance of the agrometeorological phenomena (thermal, hydric and mechanic stress/risk) in order to identify in real time the most vulnerable areas and the dissemination of information towards the users aiming at making the right decision to prevent and mitigate the effects upon the crop efficiency.

Specific objectives are:
- To monitor daily agrometeorological parameters and changes in the soil moisture content at the crop level;
- To identify periods and agricultural areas seriously affected by extreme events;
- To carry out long-term agrometeorological forecasts upon plant growth, development and efficiency;
- To project and diversify the agrometeorological products in order to improve the quality of the specialized agrometeorological services and the scientific-based assistance of the decision-making factors in the agricultural domain;
- To improve the capacity of dissemination and turn to good account the specialized agrometeorological information at national, regional and local level through state-of-the-art technological transmission and transfer equipment.

### Results obtained

Weather information, including agro-meteorological forecast is extremely important for many tactical (day-to-day) and strategic (long-term) agricultural decisions. There are growing demands for timely and effective agricultural weather information for a wide variety of agricultural management decisions, ranging from crop’s response to daily weather to the crop’s adaptation to changing climate. The continuous monitoring of atmospheric parameters and recording of precipitation amounts provides real-time information regarding the weather phenomena with high impact.

European Union European Regional Development Fund
on agriculture. This information is corroborated with in-situ measurements of soil moisture and field observations of crop development stage and apparition of water stress to plants. After the information is collected and transmitted to NMA Centre in Bucharest, soil water balance is computed the crops water requirements and water stress are analyzed in order to assess the available water resources for crops. Modelling and GIS techniques are used to monitor the spatial extent of extreme weather phenomena and to assess most vulnerable areas. Information provided covers agricultural areas ranging from regional, sub-regional and national level, depending on specific needs of the end-users.

The main product within the operative agrometeorological activity is the Agrometeorological Bulletin containing diagnosis and forecasts of meteorological conditions and their impact upon the vegetation state of field crops.

The agrometeorological products can be found on-line at web page of NMA (www.meteoromania.ro) for informational and decisional purpose. For the general public the information is disseminated through mass-media. Periodical broadcasts (i.e. “Village Life”) are made at the public radio and television having nationwide coverage, and targeting rural audience. Articles for specialized publications and magazines are disseminated bi-monthly and monthly in electronic format (www.magazinagricol.ro; www.lumeasatului.ro; www.gazetafermierului.ro; www.profitaagricol.ro; www.revista-ferma.ro).

Success factors

The Agrometeorological forecasts includes the specific information (air temperature, rainfall, ETP, soil moisture, crop water requirement) needed for assessment of extreme events (drought or excess moisture). This data collected from the National Observation Network is analyzed and compared with the critical thresholds in order to evaluate the threat and make recommendations to decision-makers and farmers. The meteorological data (from synoptic meteorological database/ORACLE) processing and interpretation are made using specific applications, such as AGRO-SYNOP, AGROSERV and AGRO-TEMPSOL. The agrometeorological data represent specialized information coming from the network’s weather stations with agrometeorological programme, representative for areas of agricultural interest in Romania. The soil moisture dynamic during the crops’ active vegetation period (March-November) is monitored using specialized equipment such as 55 portable soil moisture measuring systems (DELTA-T). The quantity of available water in soil is directly determined using sensors in different observation points (agrometeorological platforms) representative for agriculture. The data collection is made every 10 days at the level of the Meteorological Services, by the agrometeorological specialists in the network, then transmitted electronically via computer to the NMA’s laboratory of Agrometeorology in order to produce maps of the soil moisture reserve (m3/ha) accessible to plants (winter wheat and maize), at calendar dates of agricultural interest and at different depths (0-20 cm, 0-50 cm and 0-100 cm).

The entire agromonitoring system is supported by development and improvement of the application regarding the collection and transmission of agrometeorological data in fast flow, and achieving statistic data series - data banks and computation of agrometeorological indices. Possibilities offered by the remote sensing and GIS techniques (software products for the space plotting of the main agrometeorological parameters/precipitation, drought indices, etc.) increased the accuracy of the spatial coverage by using the vegetation index NDVI obtained from satellite imagery of the SPOT VEGETATION.
**Indicators used**

- Acquisition of reliable agrometeorological data.
- Processing and extracting information, storage of data in specialized databases.
- Integration of the agrometeorological stations in a unique network that allows centralized collection of data, analysis, and interpretation.
- Upgrade of methodology of data collection and processing procedures (methodologies, data collection and storage, accuracy and quality control of observations, calibrate instrument, etc.).
- The specialized information is delivered to end-users interested in particular agricultural areas (i.e. regional, local) and crops (winter wheat, maize, etc).
- Specific drought indices:
  1. Agrometeorological indices/operationally activity;
     - Soil moisture.
     - Rainfall regime.
     - Heat waves.
  2. Drought related-indices derived from remote sensing data/operationally activity;
     - NDVI/Normalized difference vegetation index.
  3. Climatological indices/research activity;
     - Aridity Index/UNEP.
     - SPI/Standardized Precipitation Index.
     - De Martonne’s aridity index.
     - PDSI/Palmer Drought Severity Index.
- Periodical training of the agrometeorologists.
- Internet technologies/webpage: www.meteoromania.ro

**Repeatability and Applicability**

- NMA is one of the three institutions that operate the Technical Secretariat of the National Committee to Combat Drought, Land Degradation and Desertification, according to the Rules of Procedure of the National Committee (approved by the Ministry of Agriculture and Rural Development by No. 27528/VI/04.10.2005) and is member of the Executive Bureau of the same Committee. National Committee to Combat Drought, Land Degradation and Desertification that was established by Governmental Decision 474/2004 and its composition was formalized by Ministerial Order 503/2005.

**Total costs**

The activities of meteorology, fundamental research, systematic and complete weather monitoring, international data exchange and integration in the World Meteorological Monitoring System are funded from the state budget, via the MEF budget. Additional funding comes from providing specific services in the field of meteorology, according to the contracts signed with third parties. The costs for basic activity (network operation and maintenance) are approximately 150.000 €/year, from which 80% covered by MEF budget and 20% co-financed by the contracts signed with third parties (insurance companies, private farmers, specialized publications, etc.).

**Further references**

- The agrometeorological products posted on the website, of the project promoter;
- Maps of soil moisture for winter wheat and corn crops updated at the beginning and end of each week;
- Weekly agrometeorological forecast developed farming of the entire agricultural territory of the country, including specific recommendations depending on the weather evolution.

Publications:

- Elena Mateescu, Elena Antipova (2009) - Chapter 5, “To promote more active collaboration with farming community in Europe for improved applications of agrometeorology at the farm level including Internet technologies”, Reports to WMO RA VI 2009, pp. 175-189;
# B - drought management

**Partner**
P13 - Noord-Brabant

**Promoter**
Waterschap Aa en Maas, Waterschap De Dommel, Waterschap Brabantse Delta (regional water authorities)

**Project**
**10 - Restoration of brook systems (Beekherstel)**

**Type**
Spatial planning, water policy

**Period**
Many projects 2000 - onwards

**Location**
Brabant

**Target**
Water authority, regional government, farmers, NGO’s

**Level**
Regional

**Contact**
- Frank van Lamoen - fvlamoen@brabant.nl
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## Project description

Due to urbanisation and intensification of rural land use since the middle of the 20th century, flooding and high groundwater levels on farmland were no longer economically acceptable in Brabant. New measures focused on canalisation of brooks, resulting in straight waterways and secured fast discharge. This however had severe drawbacks on landscape and nature (more drought in summer time). It also created new problems in urban areas downstream (more flooding in winter time). Meandering brooks made room for a rational landscape, designed for large-scale farming.

In recent years, opinion has changed and more emphasis was laid on sustainable water management. In this new approach all functions (agriculture, nature, housing etc.) should be able to benefit from resources like water without negatively influencing each other’s needs.

A solution, widely used in Brabant and the rest of the Netherlands, was the restoration of brook systems. Sometimes this was aimed at bringing back the historical brook systems, in other cases a new landscape with new nature was created.

Looking at water scarcity – an upcoming issue due to climate change and competition for water – brook restoration helps to increase the buffering capacity of the water system (reduction of discharge) and water conservation in surrounding land.

By replacing technological measures and control by more natural – less regulated – systems it helps to convert the water system to a state of greater self sufficiency. This means less investments for constructions and management and thus also profit in an economic sense.

## Results obtained

Many projects on brook restoration have been carried out in Brabant and elsewhere in the Netherlands. This has led to:

- More natural values in the brooks and on adjacent land;
- Less rapid discharge and thus better water conservation in the brook systems;
- A lower amplitude of seasonal shifts in ground water levels and thus less drought related problems.

## Success factors

- Cooperation between water authorities, regional government and third parties.
- Transformation of land use, agriculture alone is not the leading sector anymore.
- Policy push through the implementation of the Water Framework Directive.
- Availability of funding.
Indicators used
- Amount of length of restored brooks.
- Quality of the new brooksystem (WFD indicators).

Repeatability and Applicability
Restoration of brooks systems could be done in any region with highly regulated waterways. Planning and execution should always be tailored to regional needs.

Part of the restoration work has been carried within the Interreg IIIB project ‘Nature Orientated Flood Damage Prevention’.

Total costs
N.A. (depending on regional needs and situation).

Further references
www.nofdp.net (in English and German).
www.aamicaas.nl (in Dutch, partly in English).
www.dommel.nl (in Dutch, partly in English).
www.brabantsedelta.nl (in Dutch, partly in English).
WG B - drought management

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<tr>
<th>Partner</th>
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<tr>
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<td>Project</td>
<td>11 - Flexible drainage and irrigation systems</td>
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</table>
| Contact      | Johan Elshof - johan.elshof@zlto.nl  
Frank van Lamoen - fvlamoen@brabant.nl  
Kees Peerdenman - k.peerdenman@brabantsdelta.nl  
Jacques Peerboom - jac.peerboom@wpm.nl |

**Project description**

Farmers in Brabant tend to prefer low groundwater levels to allow longer periods of access to land. This drainage is controlled by the water authorities. In some regions there have been experiments in allowing farmers to steer drainage in a more flexible way, either by letting them set the drainage basis in groundwater drainage systems or setting the weir level in waterways. These experiments show that by allowing more influence, farmers tend to accept higher water levels. This is beneficial for surrounding natural areas that formerly tended to be drained because of the low groundwater levels on farm land. It also diminished dependency on irrigation from groundwater sources during dry periods.

Part of the work (flexible weirs) has been carried out within the Interreg IIIA programme ‘Waterbeheer Benelux Middengebied’

**Results obtained**

A large number of farmers in the dry rural areas of Brabant have been involved with one of the measures.

**Success factors**

- Applicability within existing farming systems.
- Cooperation between water authority and farmers (organisation).
- Farmers are left in charge (within certain limits).

**Indicators used**

- Number of farms and farmers involved.

**Repeatability and Applicability**

The measures can be applied in regions in which there is a distinct wet and dry season and where problems with a seasonal water surplus/shortage are affecting farming practice.

**Total costs**

N.A. (depending on situation, only initial costs for weirs and drainage systems).
Further references
www.frontpage.zfno.nl/watermanagement (in English).
www.brabantsedelta.nl (flexible weirs).
www.peelenmaasvallei.nl (flexible drainage).
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<td>12 - Regional List of Priorities under normal circumstances in using water for agriculture and other economic interests</td>
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<td><strong>Type</strong></td>
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</table>
| **Contact** | Felix Helmich - Fhelmich@brabant.nl  
René Klerks - Rklerks@brabant.nl |

### Project description

In order to increase regional self-reliance and more reliability for agricultural water-use and other economic interests, four preferences (in order of priority), can be distinguished:

- Reducing water demand: by stimulating the creation and improvement of water balances, sample projects and communication. Stimulating the use of other types of water such as purified effluent instead of tap water;
- Better use of local water: water is retained and stored by laying it up during wet periods and retaining (ground)water and not letting it drain away as quickly;
- External water supply;
- Extracting ground water.

### Results obtained

The list of priorities has been taken over as adaption-strategies in the ‘Deltaplan hoge zandgronden’, a plan of the waterauthorities in agricultural organisations to make the higher parts of North-Brabant climate-proof.

### Success factors

This policy has been applied in other plans and has to be taken into account when new water demands are addressed. One of the first successes is the appliance in the ‘Deltaplan for the high sandy areas’.

### Indicators used

Reduced losses for the several water users owing to occasional water shortages.

### Repeatability and Applicability

The policy guideline and the cooperation process are both applicable in other regions. Some tailoring of priorities might be necessary.

### Total costs

Undeclared.

### Further references

[www.aaenmaas.nl](http://www.aaenmaas.nl)
**Project description**

In general, there is sufficient freshwater available in the Netherlands. A large proportion of the available freshwater is brought in from outside by the Rhine and Meuse rivers. Limburg and Noord-Brabant are partially supplied with water via the canal system leading from the Meuse. Some of the higher parts of the Netherlands where water extraction from surface water is not possible are dependent on local groundwater supplies during dry periods.

Sometimes water shortages occur during longer periods of drought in summer, resulting in damage to sectors such as agriculture, industry and shipping and to nature. In the case of exceptional circumstances, such as the dry summer of 2003, the National List of Priorities (Nationale Verdringingsreeks) comes into operation. This list regulates the priorities for the distribution of freshwater based on the criteria of safety, sustainability and social and economic damage.

Priority 1 - Safety and prevention of irreversible damage:
2. Subsidence and settlement (peat soil and upland moors).

Priority 2 - Public facilities:
1. Drinking water supply.
2. Energy supply.

Priority 3 - Small-scale, high-grade use:
- Temporary sprinkler irrigation of capital-intensive crops.
- Process water.

Priority 4 - Other interests (economic considerations, also in relation to nature):
- Shipping.
- Agriculture.
- Nature (provided no irreversible damage occurs).
- Industry.
- Water recreation.
- Inland fishing.
Results obtained
The List of Priorities is used by all water management authorities.

Success factors
Cooperation between water authorities both in space and hierarchy.

Indicators used
Safety and prevention of irreversible damage.

Repeatability and Applicability
The policy guideline and the cooperation process are both applicable in other regions. Some tailoring of priorities might be necessary.

Total costs
Policy measure, no costs.

Further references
### Project description

North Hessen is a model region for climate change adaptation. The KLIMZUG network in North Hessen consists of research institutions and representatives of the North Hessian business, administrative and educational sectors. These partners jointly develop and implement measures and strategies for adapting the region to climate change in the following fields: scenarios, resources, energy, transport, tourism, health and society.

As a next step, successful solutions and measures will be transferred to other regions and federal states. The project of the Department of Hydraulic Engineering and Water Resources Management at the University of Kassel is part of the field “Resources”. This field is subdivided into three sub-projects, in which agricultural, water management and forestry issues are investigated against the background of climate change. The aim of the research project is to quantify the impact of climate change on water resources management and to develop adaptation strategies. Variables that are taken into account are changes in land-use, limited use of protected areas of rivers and flood plains and adapted operation of hydraulic constructions to a more effective use of water resources. The project area includes the Eder lake and the downstream reaches of Eder and Fulda. Simulations and investigations are carried out with the help of hydrological and hydrodynamic-numerical models as well as geographical information system (GIS).

Co-operation partners: Science (CESR, Department of Grassland Science and Renewable Plant Resources, etc.). Administration (Regional Council of Kassel, district offices). Operator of dams (e.on Wasserkraft GmbH, WSA Hann. Münden).

Key words: Climate change, floods, low water, hydropower.

### Results obtained

The project is still in progress, but the successful implementation of the adaption strategies should be obtained by the participation of stakeholders and the governance-innovations of the KLIMZUG Nordhessen network.

### Success factors

Innovation aspects:

Informative level:

- Governance-innovation: climate change adaptation officers (KAB), climate change adaptation managers (KAM), climate change adaptation academy (KAA);
- Networking.
Professional - technical level:

- Detection and evaluation of the impacts of climate change;
- Continuation of the model chain (HN-Modelling following the climate- and rainfall-runoff-modelling, supply of GIS-Tools and DSS).

**Indicators used**

Technical indicators:

- Hydraulic parameters (water levels, flow velocities, flood areas, etc.).

**Repeatability and Applicability**

At first also in other regions it is necessary to know the impact of climate change on the water resources management and to work out corresponding adaption strategies. For this challenge the project can give the following input:

Informative level:

- The experience of the governance-innovations could be interesting for other regions in the process of climate adaption. Therefore the Regional, National and International network of the Klimzug-project could be useful;

Professional - technical level:

- The application of the international approved HN-model, the supply of GIS-Tools and the DSS in other regions facilitate the detection and evaluation of the respective impacts of climate change;
- Also the adaption strategies which will be designed in the sub-project could be a rough guideline for other river basins. Therefore the deliverables will be available for interested groups and the climate change adaptation academy offers advanced training within the framework of seminars, workshops and excursions.

**Total costs**

Subproject: 336,000 €.

**Further references**

www.klimzug-nordhessen.de
**Project description**

The Hessian Ministry of the Environment, Rural Areas and Consumer Protection (HMULV) launched the Integrated Climate Protection Programme of Hessen 2012 (INKLIM 2012) in spring 2004. The research programme was set up in order to identify pragmatic aims for the Hessian contribution to the reduction of greenhouse gases after ratification of the Kyoto Protocol by the German parliament.

The main objectives of INKLIM 2012 were the updating of CO2-emission data and the calculation of technical/economic scenarios, the analysis of climate change and impacts on a regional scale as well as the development of instruments and measures for effective climate protection together with an assessment of related costs. Specific to the programme was the integrated consideration of both greenhouse gas reduction measures and adaptation measures to climate change.

INKLIM 2012 consisted of three modules:

- Module I: Basics and technical/economic scenarios 2005/2012;
- Modules II and II plus: Climate change and impacts of climate change in Hessen;
- Module III: Instruments, costs and measures for implementation;

Modules I and III were coordinated by the Center for European Economic Research (ZEW). Modules II and II plus were implemented by the Hessian Agency for Environment and Geology (HLUG).

Within the framework of module II climate change in Hessen since 1900 was analysed and documented on a scientifically and statistically confirmed basis. In addition, the possible climate development in Hessen until 2100 was projected using a suitable model.

For the sectors water management (flows of Hessian river systems and groundwater recharge), agriculture and forestry, the expected climate change impacts could be deduced from the climate projection until 2050 (respectively 2100). Moreover, possible effects on nature conservation and species diversity as well as on human health were examined.

Within the framework of module II plus in addition to a preliminary study on possible CO2-storage in deep geological formations, the impacts of climate change were investigated in the following fields/sectors:

- Forestry and agriculture;
- Viticulture and fruit growing;
- Plant phenology;
- Soil (carbon content);
- Flow behaviour of Hessian river systems;
- Additional water demand for agriculture.
INKUM 2012 was the scientific basis for the Climate Protection Strategy of Hessen 2012 (Klimaschutzkonzept Hessen 2012) that was presented by the Hessian Minister of the Environment in March 2007. The strategy is based on the three pillars adaptation to climate change, CO2-reduction through innovation and international emissions trading.

The Hessian Ministry of the Environment was then commissioned to elaborate the Climate Protection Action Plan (Aktionsplan Klimaschutz) on the basis of the climate protection strategy. The plan was adopted by the Hessian Cabinet in November 2007.

The results of INKUM 2012 will be also considered for the Hessian Adaptation Strategy which is currently under development.

**Results obtained**
- Updated CO2-emission data.
- Quantification of technical/economic scenarios.
- Impacts of climate change on various sectors and assessment of related costs.
- Instruments and measures for effective climate protection.

**Success factors**
- The integrated consideration of both greenhouse gas reduction (mitigation) measures and adaptation measures to climate change.
- The integrated approach of investigating the effects of climate change on various inter-related sectors.

**Indicators used**
- CO2-emission data.
- Climate change induced costs.
- Various sector-specific indicators.
- Number of sub-projects.
- Number of stakeholders involved.

**Repeatability and Applicability**
The integrated approach of investigating the effects of climate change on various inter-related sectors and the subsequent utilisation of the results for policy development may prove an example for other regions.

**Total costs**
- Module II: 160,000 €.
- Module II plus: 155,000 €.

**Further references**
Website: [klimawandel.hluc.de/english-information/inklim-2012.html](klimawandel.hluc.de/english-information/inklim-2012.html)
**WG C - adaptation to climate change**

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| Target | - Water authorities  
- Environmental administration  
- Water management/supply  
- Agriculture  
- Forestry  
- Human settlements  
- Municipalities |
| Level | Regional, local |
| Contact | Mario Hergesell - mario.hergesell@hlug.hessen.de |

**Project description**

The research project “AnKliG” was set up in cooperation of the Hessian Agency for Environment and Geology, a major water supplier (Hessenwasser) and an engineering company (BGS Umwelt). The project started end of 2006 and finished in 2010. The project is funded by the Federal Ministry of Education and Research (BMBF) and belongs to the national research programme “Klimazwei”. Research activities focus on a large porous aquifer in South Hessen (Hessian Reed) and the adjacent fractured aquifer of the Odenwald. The two regions differ considerably in their hydrological regime and water supply infrastructure. The overall aim of the project is to develop adaptation measures and strategies for a sustainable groundwater management. One major objective of the project is to assess the implications of climate change on the various sectors which need to be addressed by an integrated groundwater management approach. Spatially distributed groundwater modelling is carried out to quantify the changes in groundwater recharge and groundwater levels for different emission scenarios (A1B, A2, B1). The used climate projection data are based on the general circulation model ECHAM5 and different regional climate models (WETTREG, STAR, CLM).

Further objectives of the project are:
- To quantify the future water demand for drinking water and irrigation;
- To evaluate the supply guarantee of local facilities for public water use (e.g. springs in the Odenwald region);
- To assess the extent of conflicts of groundwater utilization with other kind of land use;
- To reveal capabilities and limitations of groundwater management to counterbalance the impact of climate change on groundwater resources.

**Results obtained**

In the area under investigation, the annual precipitation levels will remain largely unchanged and relatively independent of the climate scenarios, although there will be a seasonal shift to drier summers and to winters with greater levels of precipitation. Mean annual recharge will remain unchanged until 2050 and fluctuate within the bandwidth of observed recharge rates of the past decades. During the second half of the century mean annual recharge tend to increase moderately.

In the case of the drinking water supply, in future warmer summers with lower levels of precipitation, the peak water demand will increase. As a consequence of declining discharge of springs during summer months decentralised water supply will be threatened and additional supply routes may be needed. Nonetheless, the mean water demand will be affected more by demographic development than by climate change.

In agricultural irrigation, the additional water demand will tend to rise as a result of drier summers and prolonged vegetation periods. However, the significant dependence of the market on agricultural products must be taken into consideration in the demand trend.

Overall, it is shown that, as a result of climate change, there will be no decline in the usage conflicts associated with groundwater. Due to the
predicted climate trends (dry summers and wet winters) periodical changes of extreme groundwater levels are likely to continue and intensify in future. A clear trend towards higher or lower groundwater levels is insignificant; rather, the trend of groundwater levels will always be dependent on the local constraints of groundwater management.

Potential impacts of projected climate change on water management and arising conflicts of interest between competing groundwater related fields are illustrated in the following figure:

Exemplary adaptation measures are:

- Stabilisation of groundwater levels by artificial recharge (infiltration);
- Optimising water-saving irrigation techniques (irrigation intensity and duration);
- Cultivation of heat resistant crops with less irrigation demand;
- Redistributing and dynamic steering of abstraction rates by means of the regional water supply network (groundwater level orientated);
- Adapting (dimensioning) and expanding the regional water supply network;
- Local installation of wells in residential areas in order to confine rising groundwater levels during wet periods.

Success factors

- Multi level approach: cooperation between an environmental agency (HUG), a regional water supply company (Hessenwasser) and an engineering company (BGS Umwelt).
- Integrated research approach (cross-sectoral).

Indicators used

Groundwater recharge rates, groundwater-levels, drinking water demand, irrigation demand.

Repeatability and Applicability

- Methodology of hydrologic impact modelling.
  The spatially distributed water balance model may be applicable to other regions in order to investigate the potential impacts of climate change on groundwater recharge and other water balance components.
- Dealing with uncertainties of modelling results.
  A major problem in assessing the potential impact of a changing climate on water resources are the uncertainties inherent in regional climate projections. The implementation of multi model ensembles produces bandwidths of modelling results. For developing adaptation strategies one has to take these uncertainties and bandwidths into consideration.
  The experience of assessing and handling uncertainties associated with regional hydrologic impact modelling can be transferred and exchanged.

Total costs

1 million €.

Further references

Project Website: www.anklig.de
WG C - adaptation to climate change

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<tr>
<th>Partner</th>
<th>P2 - Hlug</th>
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<td>Ministry of Environment of Hessen (HMUELV)</td>
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<tr>
<td>Project</td>
<td>4 - Integrated Climate Protection Programme of Hessen (INKLIM 2012) - Module II Sub-project: Spatially distributed investigations on potential consequences of climate change for groundwater recharge in Hessen</td>
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<tr>
<td>Contact</td>
<td>Mario Hergesell - <a href="mailto:mario.hergesell@hlug.hessen.de">mario.hergesell@hlug.hessen.de</a></td>
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Project description

Within the scope of the Integrated Climate Protection Programme of Hessen (INKLIM 2012) (Module II) the Hessian Agency for Environment and Geology has investigated the effects of climate change on groundwater recharge in Hessen. Regional climate projections based on the general circulation model ECHAM4, the IPCC emission scenario B2 and the statistical downscaling method WETREG (ENKE, 2003) have been used for spatially distributed water balance modelling (HERGESELL and BERTHOLD, 2005) until the year 2050.

Results obtained

Groundwater accounts for 95% of public drinking water supply in Hessen. The projected changes in climate have a significant impact on the groundwater resources in Hessen. The modelling results reveal that groundwater recharge increases by about 25% until 2050, compared to the reference period 1971-2000. This remarkable increase is due to the seasonal shift of rainfall occurrences from the summer to the winter season. In future, the mean groundwater recharge rates will correspond to high recharge rates which have occurred during wet periods in the past. However, low groundwater recharge rates may be still possible during longer periods of drought.

Based on the mentioned climate projections Hessen is unlikely to face any fundamental problems with regard to water supplies, even under changed climatic conditions. However, the possibility of regional shortfalls cannot be excluded, particularly during longer periods of drought. The projected alterations in the groundwater balance do not only affect the water supply sector. High or low groundwater levels cause problems in residential areas, agriculture, forestry and biotopes.

Due to rising groundwater levels roads may be flooded and cellars of buildings in urban areas may be damaged by flooding or moisture. Extremely high groundwater levels cause waterlogging in agricultural and forested areas. As a consequence agriculturally used areas can not be cultivated and forests are damaged. Higher groundwater recharge rates may affect the quality of groundwater due to intensified nitrate leaching in agricultural areas.

The extreme weather conditions (dry, hot summers and rainy winters) cause stress on plants. In the Hessian Reed, where agriculture plays a dominant role, the demand for irrigation water will significantly rise.

Low groundwater levels during periods of drought may be harmful to groundwater-dependent biotopes and forests. Buildings and traffic infrastructure can be damaged by settlement cracks as a consequence of falling groundwater levels during periods of drought. Decentralised water supply in the mountainous regions may be threatened by running dry of springs during the summer season.
In order to cope with the described impacts of climate change on the groundwater balance it is necessary to develop adaptation measures and strategies for a sustainable groundwater management. However, the modelling results are based on only one single emission scenario (B2) so that they cannot be regarded as forecasts. Therefore, further investigations are needed considering other climate projections in order to better reflect the entire bandwidth of possible future climate scenarios.

**Success factors**
Cross-sectoral approach (as sub-project of the Integrated Climate Protection Programme of Hessen, INKLIM 2012).

**Indicators used**
Groundwater recharge rates.

**Repeatability and Applicability**
Methodology of hydrologic impact modelling.
The spatially distributed water balance model may be applicable to other regions in order to investigate the potential impacts of climate change on groundwater recharge and other water balance components.

**Total costs**
Internal administrative costs.

**Further references**
Website of INKLIM 2012 – Module II final reports:
klimawandel.hluh.de/english-information/inklim-2012/module-ii-plus/module-ii-reports.html
Partner: P2 - HLUG
Promoter: Ministry of Environment of Hessen (HMUELV)
Project: 5 - Integrated Climate Protection Programme of Hessen (INKLIM 2012) - Module II plus Sub-project: Securing the agricultural production with additional water demand under altered climate conditions – measures for a sustainable groundwater management as well as recommendations for the agricultural cultivation in the Hessian Ried

Type: Technological, economic
Period: 2007 - 2009
Location: Hessian Reed (South Hessen)
Target:
- Water authorities
- Environmental administration
- Water management/supply
- Agriculture
- Forestry
- Human settlements
- Municipalities

Level: Regional, local
Contact: Dr. Georg Berthold - georg.berthold@hlug.hessen.de

Project description:
The climate change projected for Hessen will have a great influence on all hydrological parameters. Until 2050 a significant increase in the average annual temperature is predicted. Likewise distinctive increases in wintery precipitation as well as a marked decrease in summerly precipitation are expected. Thus the climate change will have effects particularly on land intensively used for agricultural and horticultural purposes in South Hessen. Under the present climatic conditions in the Hessian Reed an economical plant production is already only possible through additional irrigation.

It is assumed that the demand for additional water in grown cultures during the summer half-year will increase due to the prognosticated climate change. Such a development would involve a pronounced increase in additional water demand in plant production.

The investigation of alterations relating to additional water demand in agricultural cultures requires the registration of the present irrigation methods. Therefore, the current situation of agricultural irrigation in the Hessian Reed was recorded by a survey.

Results obtained:
Relating to the entire agriculturally used area (34 437 hectares) in the Hessian Reed the percentage of accessible irrigation area is 96%.

The survey revealed also that the cultivation of vegetables, strawberries and other garden crops comprises about a fourth of the agricultural area in the Hessian Reed and lies herewith far above the average (3-5%) of such cultures in the county.

Referring to the irrigation quantities the inquiry revealed that the demand for additional water in “wet years” has increased from 3.5 million m³ to 10 million m³ during the last 15 years. This is equivalent with an increase of additional water demand by about 12 l/m² within a decade.

On the basis of a continuous time series of the regional climate model WETTREG founded on the A1B scenario the expected developments of temperature, precipitation as well as evaporation from 1960 to 2050 were simulated. These data were taken as a basis for the expected development of additional irrigation.

From available climate data such as precipitation and potential evaporation first the daily water balances were determined by calculating the difference, and then aggregated on a monthly basis. The evaluation revealed that for the months of January, February and March a continuously increasing positive water balance is to be expected. For the months of April, May, June, July and August the water balances will become more and more negative towards the middle of the century.
Referring to the irrigation period (last week in March to the beginning of October) there will be an excess demand for water for agriculture due to the water balances becoming increasingly negative in the future. This deficit raises the additional water demand per decade by about 10 l/m².

As in the Hessian Reed the necessary infrastructure for irrigation is available, a growth of „intensive cultures“ (e. g. asparagus, other vegetables and berries) is to be expected with further rising water demand, caused by the climate change.

**Success factors**
Cross-sectoral approach (as sub-project of the Integrated Climate Protection Programme of Hessen, INKILM 2012).

**Indicators used**
Climatic water balance.

**Repeatability and Applicability**
The methodology of estimating the irrigation demand under climate change conditions might be applicable to other regions.

**Total costs**
Internal administrative costs.

**Further references**
Website of INKILM 2012 - Module II plus final reports: [klimawandel.hlug.de/english-information/inklim-2012/moduleii-ii-plus/module-ii-plus-reports.html](klimawandel.hlug.de/english-information/inklim-2012/moduleii-ii-plus/module-ii-plus-reports.html)
### Project description

A study of 7 catchments in Hessen with catchment sizes varying between 500 km² and 27 000 km² was carried out to quantify the possible impacts of climate change on the hydrological behaviour. Climate data based on the general circulation model ECHAM5 were downscaled by the statistical downscaling method WETTREG (SPEKAT et al., 2006) in order to generate daily point values corresponding to meteorological stations of Germany’s national meteorological service [Deutscher Wetterdienst]. The resulting regional climate projections were provided by the German environmental protection agency [Umweltbundesamt]. These data were used to force the conceptual water balance model LARSIM (LUDWIG and BREMICKER, 2006) to simulate present (1961-1990) and future (2001-2100) streamflow for the area of the river Rhine catchment. To the period 2001-2100 three different IPCC emission scenarios (A1B, A2 and B1) were applied. LARSIM allows a process-based and spatially distributed simulation of the medium-scale mainland water cycle.

The model was validated comparing measured streamflow with streamflow resulting from simulation with observed hydrometeorological data. Climate change impacts were related to the differences between simulated streamflow driven by the WETTREG data for the reference period 1961-1990 and streamflow driven by WETTREG data for the period 2001-2100 based on the three different emission scenarios. Each simulation consists of ten statistical realisations with a time series of 20 years per decade. In the following, mean monthly values of mean discharge, low flow and flood values were calculated and compared. Extreme values on peak discharge result from a percentile statistics of 600 annual flood values for different 30 year periods.

### Results obtained

**Synoptic view over all examined catchments.**

Annual precipitation amounts do not increase towards the middle of the century, whereas a clear disproportion towards increasing precipitation (+10%) during the hydrological winter half year [i.e. November – April] and a corresponding decrease during the hydrological summer half year (−5%) have been observed. By the end of the century the climate projections reveal winterly increases in precipitation of about +20% and summerly decreases of about 10%. Rising mean annual temperatures of about + 0.9 K towards the middle of the century and about +2 K by the end of the century indicate also decreasing influence of snow cover on hydrological processes.

Mean monthly discharge changes to higher values during December to February whereas lower discharge is expected from June to November. This means an intensification of the existing hydrological regime with winterly high streamflow and summerly low flows. Corresponding to the decrease of discharge in summer the mean low flow value which is a common design value concerning surface water regulations decreases by about 10% towards the middle of the century and 15% up to the end of the century for all scenarios.
The mean monthly flood values are expected to increase by about +10% during December to February up to the middle of the century and about +30% by the end of the century. Behaviours of extreme floods differ significantly between the three IPCC emission scenarios. Highest changes are observed for the A1B scenario, starting with an increase in flood values in the middle of the century with an amount of +20%. Lower increased flood values are obtained for the B1 scenario but starting 30 years earlier than in case of the A1B scenario.

In order to provide “climate change factors” for design flood values for the period from now to the year 2050 it seems to be appropriate to consider also results from the period from 2050 to 2080 because of the high variability in floods caused by various possible emission scenarios. It should be pointed out that changes in peak flow are quite unsure because of multiple causes [modelled daily values, uncertain extreme rainfall data from the climate model and downscaling method, high influence of the highest (uncertain) peak flow value of the time series].

**Success factors**
Cross-sectoral approach [as subproject of the Integrated Climate Protection Programme of Hessen, INKLIM 2012].

**Indicators used**
Mean monthly values of mean discharge, low flow and flood values, and extreme values on peak discharge.

**Repeatability and Applicability**
Using a process chain with results of a global atmospheric model to run a regional atmospheric model and using this hydrometeorological scenario input to drive a regional hydrological model to analyse the consequences for changes in streamflow and water budget.
Methodology is replicable in other regions as well as for other or refined atmospheric scenarios.

**Total costs**
Internal administrative costs.

**Further references**
Website of INKLIM 2012 - Module II plus final reports:
klimawandel.huq.de/english-information/inklim-2012/module-ii-plus/module-ii-plus-reports.html


**Project description**

A study of 9 catchments in Hessen with catchment sizes varying between 1200 km² and 5300 km² was carried out to quantify the possible impacts of climate change on the hydrological behaviour. Climate data based on the general circulation model ECHAM4-OPYC3 were downscaled by the statistical downscaling method WETTREG [ENKE, 2003] in order to generate daily point values corresponding to meteorological stations of Germany’s national meteorological service [Deutscher Wetterdienst]. These data were used to force the conceptual water balance model LARSIM [LUDWIG and BREMICKER, 2006] to simulate the present (1981-2000) and future (2011-2050) stream flow for catchments in Hessen.

For the period 2011-2050 the IPCC emission scenario B2 was applied. LARSIM allows a process-based and spatially distributed simulation of the medium-scale mainland water cycle. The model was validated comparing measured stream flow with stream flow resulting from a simulation with observed hydro-meteorological data. Climate change impacts were related to the differences between simulated stream flow driven by the WETTREG data for the reference period 1981-2000 and stream flow driven by WETTREG data for the period 2011-2050 based on the emission scenario B2. Each simulation consists of ten statistical realisations with a time series of 20 years per decade. In the following, mean monthly values of mean discharge, low flow and annual floods were calculated and compared.

**Results obtained**

Annual precipitation amounts increase only slightly, whereas a clear disproportion towards increasing precipitation (+8%) during the hydrological winter half-year (i.e. November - April) and a corresponding decrease during the hydrological summer half-year (-8%) have been observed. Rising mean annual temperatures of between +1.2 K and +1.8 K in the decades from 2011 to 2050 compared to the reference period indicate also a decreasing influence of snow cover on hydrological processes.

In general a clear intensification of the existing hydrological regime with winterly high stream flow and summerly low flows can be expected. The changes in peak flow are quite unsure, extreme values for regional precipitation from the meteorological model as well as some other points in the whole modelling chain are responsible for this point. Concerning the extent of changes in the hydrological behaviour, two regions in Hessen can be separated:

- Rivers in the southern and central part of Hessen show increasing discharge values. In the winter half-year discharge increases between 10 and 18%, whereas a decrease by about 15% occurs during the summer half-year. Also statistical low-flow values decrease in this order of magnitude. Storm runoff values show bigger variations with an increase up to 30% in the mean monthly storm runoff from December to February, about 15% in mean yearly floods and about 20% for extreme floods;
The catchments in the north/northeast of Hessen show for all mean and low-flow values decreasing values with −1.5 to −20% for the mean yearly discharge, −25 to −50% for the summer half-year and about −10% for the winter half-year. Extreme floods increase only slightly (+5%) in this region with relatively drier conditions compared to the other regions in Hessen.

The combination of one global meteorological model with one emission scenario results in a possible projection of the future behaviour of rivers in Hessen. It is clear that more combinations of meteorological models and emission scenarios have to be examined to get quality-based results for implementations of climate change adaptations in hydrological practice.

Success factors
Cross-sectoral approach [as sub-project of the Integrated Climate Protection Programme of Hessen, INKLM 2012].

Indicators used
Mean monthly values of mean discharge, low flow and flood values.

Repeatability and Applicability
Using a process chain with results of a global atmospheric model to run a regional atmospheric model and using this hydro-meteorological scenario-input to drive a regional hydrological model to analyse the consequences for changes in stream flow and water budget. Methodology is replicable in other regions as well as for other or refined atmospheric scenarios.

Total costs
Internal administrative costs.

Further references
Website of INKLM 2012 - Module II final reports:
klimawandel.huag.de/english-information/inklm-2012/module-ii-plus/module-ii-reports.html


ES-WAMAR is a large-scale European demonstration Project on handling swine waste promoted by SODEMASA, the Society for Environmental Development in Aragon, and approved by the European Union within the framework of the LIFE-Environmental Programme. The purpose of the project is to demonstrate the feasibility and sustainability of the correct environmental management of swine waste, in accordance with local circumstances, thereby helping to minimise its impacts on the environment (water, soil and atmosphere) in compliance with the IPPC Directive. The outcomes obtained are transferred to other areas with similar problems, both in Spain and also in Europe.

The project is achieved by the development of an integrated system based on the increase in nutrient recycling through the valorisation or treatment of the pig manure provides response to a wide range of different regional scenarios. This approach has been applied to three selected study areas in Aragon (Spain), all of them with the same initial problem, the high production of liquid manure, but with different local conditions: Tauste (sufficient local land – targeted spreading to meet local crop needs) – Maestrazgo (insufficient local land but option of transport to farmland in nearby regions) and Peñarroya (insufficient local land – requirement of treatment to remove nutrient excesses Nitrification/Denitrification biological treatment). The demonstration scheme in each case is applied at a realistic and credible farm and local scale.

Results obtained

- Creation of three swine waste management enterprises (SWMEs) which are in charge of the management of the slurry in the area by means of the Best Available Techniques (BAT) in compliance with the IPPC.
- Increase of the land spread surface improving the distribution of the nitrogen load of pig farms with the consequent diffuse pollution reduction (Tauste and Maestrazgo) increasing the water quality.
- Reduction of the nitrogen load by means of a biological treatment plant in areas with insufficient land surface to valorise the total amount of slurry as organic fertilizer (Peñarroya de Tastavins) avoiding water pollution.
- Improvement of the sustainability of the livestock sector from an environmental, economic and social point of view.
- Transferability of the results to other areas within Aragón (with the construction of 4 new slurry treatment plants combining Nitrification/Denitrification and biogas process) and out of the region (participation in Congress, workshops, seminars).
Success factors

- Direct participation of the main actors involved in the slurry management (farmers, local authorities, technician).
- Cooperation and willingness among the different actors involved.
- Implementation of a collective management scheme which permits acquisition of better equipments, reduction of economic costs and general awareness, therefore allowing the sustainability of the sector.
- Dissemination works carried out in the three areas and the exchange of the know-how acquired within the project with farmers and technicians of other areas in Spain and Europe with similar environmental problems.

Indicators used

- Number of pig and land farmers involved.
- Swine manure volume managed every year with the BATs by means of the SWMEs.
- Evolution of the water quality in a monitoring network established in the three pilot areas focused on the nitrates concentration trend.
- Evolution of the composition of soil in a monitoring network established in the three pilot areas
- Number of disseminations actions.

Repeatability and Applicability
The fact that the slurry problem is approached on a global way, represented in the 3 different representative scenarios, allows the proposed models of management to be exportable to other geographic zones with the same problematic, with the added value of having already evaluated its effectiveness. The different situations covered by the project are a mirror of all the possible circumstances that can be found in other geographical areas put under the same intensive livestock activity, at local, national or European level.

Currently, results already obtained in the project have led to the building of 4 new slurry treatment plants in surplus areas of Aragon region. These areas will follow the same scheme of collective management with the constitution of new SWMEs.

Total costs
Total budget: 7.135.375 €.
LIFE+ programme contribution: 2.564.163 €.
Aragon Government co-financer: 600.000 €.

Further references
(websites, publications, etc.)
www.life-eswamar.eu
www.sodemasa.com
Project description

Objective: Optimisation of Water & Emissions Reduction.

The LIFE08 POWER project implies a qualitative and quantitative leap with regard to the objectives of the former project on which it is based; the LIFE03 OPTIMIZAGUA project was centred on the efficient water management exclusively. LIFE08 POWER introduces a second component to interact on the “water-energy binomial” on the basis of the “energy bill when moving water”. In this sense, the project seeks:

a) On the one hand, to improve the hydric savings of the former experience already demonstrated by the former OPTIMIZAGUA project through the application of additional monitoring devices, such as the early leak detection with probes in soil in various deeps or of the water pressure degrees, as well as the use of new methods to calculate the hydric needs according to the phenologic cycle and real climate conditions contrasted usually over dimensioned;

b) On the other hand, and as a greater differential element in comparison to the former project, the demonstration and quantifying of the energy-based devices applied to water pumping systems and the subsequent quantifying of the reduction of emissions to the atmosphere.

Considering the aforementioned, the quantifying of the environmental benefits, taking as a basis the use and application of the available technologies and the technologies used in the area, the estimation is 12% water saving additional to the results obtained by the OPTIMIZAGUA project as consequence of the technological arguments afore explained and a saving percentage higher than 60% of the petroleum-derived fuels consumption by the double way of: an efficient management of hydric resources complemented with the implementation of renewable energy to the pumping devices (and not only to the monitoring devices as in the case of the former OPTIMIZAGUA project).

One of the secondary results identified by the above mentioned project was the possibility of obtaining high energy savings associated to an efficient use of water and the strategic opportunity of assessing, through a new project, the potential of reducing greenhouse gases emissions by incorporating lessons learnt in good water governance and their reinforcement through the incorporation of renewable energies-based applications to irrigation management systems.

Results obtained

Regarding the potential environmental impacts at local level, following environmental benefits compared to the current starting state will be identified. They will be exclusively based on the two pilot actions of experimentation foreseen with demonstrative purposes:

- Water saving over 100,000 m³ in the area enclosed for the experimentation (percentage higher than 60% of the average saving);
- Fossil fuel saving used for energy generation over 60%, in its components of diesel and other fossil fuels and electric power of the mains; with an accumulated value equivalent to 100 toe/year;
- Over 200 tons GHG emissions reduction during the demonstrative action; and 2012 tons emissions reduction by 2012 as symbolic milestone; fruit of the formalisation of adhesions to “Good Water Governance” policies of 10 irrigation communities, 10 regions and 10 EU cities;
- Implementation of applications based on renewable energies for demonstrative purposes;
- Change of the municipal regulation to make easier the future implementation of efficient technologies and energies favourable for urban planning;
- Exemplary labour by the local public authority through the application of efficient technologies for hydric management and reduction of emissions to the atmosphere through a double way of energy efficiency and the implementation of renewable energies;
- Direct sensibilization of more than 50,000 people and key actors.

**Success factors**

- Applicability.
- Cooperation between partners.

**Indicators used**

- Water saving in the area enclosed for the experimentation.
- Fossil fuel saving used for energy generation.
- Implementation of applications based on renewable energies.

**Repeatability and Applicability**

The measures can be applied in regions in which there is a distinct wet and dry season and where problems with a seasonal water.

**Total costs**

Project 1,421,327 € (SODEMASA 230,321 €).

**Further references**

www.lifepowerproject.eu/default.asp

- ABC.es The EU chooses Aragon to develop a management pilot project (5-3-2010).
- ADN.es The EU chooses Aragon to develop a pilot project in efficient water management (5-3-2010).
- Aragón Digital Aragon will be a model in efficient water management for Europe (5-3-2010).
- Aragón Press Aragon will be a model for efficient management for Europe (5-3-2010).
- EFE The EU chooses Aragon to develop a pilot project in efficient water management (5-3-2010).
- EuropaPress.es The EU chooses Aragon to develop a pilot project in efficient water management and gas emissions reduction (5-3-2010).
- Diario de Teruel The EU chooses Aragon for a project in water management (6-3-2010).
- Heraldo de Aragón The EU chooses Aragon as a model in water management (6-3-2010).
**Project description**

Objective: Promote research into responsible water uses

The Aragonese Climate Change and Clean Energies Strategy (EACCEL) 2008-2010-2025 Horizon, endeavours to be the reference document for all of Aragonese society regarding the objectives and action lines on this subject. The aim objective in water resources is: increase efficiency in water uses.

**Results obtained**

- 1.3 million tons GEI emissions reduction at the end 2008 - 2012.

**Success factors**

- Contributing to compliance with national and international commitments to reduce GHG emissions in Aragon.

- The Strategy provides a diagnosis to the sector, improvement objectives, and recommended actions lines.

**Indicators used**

Diagnosis for the hydric resources.

**Repeatability and Applicability**

This experience could be replicable and implemented in other regions as in Aragon it has turned to be a successful tool in order to achieve social participation.

**Total costs**

FEDER contribution: 3.2 M €.

Aragon Government co-financer: 3.2 M €.

**Further references**

[portal.aragon.es/portal/page/portal/MEDIOAMBIENTE/cclimatico/EACCEL]
### Project description

**Objective:** Water saving in the agricultural sector.

Creation of a platform that offers farmers daily recommendations for watering according to the agricultural and climate conditions. With it, they will be given a tool to optimise the use of a scarce asset, such as water.

These benefits in matters of adaptation of agriculture to probable conditions of low rainfall are joined by the information which is offered on the portal about the benefits of the energy audits on watering under pressure as well as on other techniques to achieve a more efficient use of water.

**Results obtained**

N.A. It will have an evaluation at the end of period (2008-2012).

### Success factors

- Applicability.
- Direct participation of the main actors involved (farmers, local authorities, technician).
- Implementation of a collective management water scheme.

### Indicators used

- Water saving.
- Evolution of the water quality in a monitoring network.

### Repeatability and Applicability

It is full open to be applied in other regional scenarios.

### Total Cost

1,439,000 €.

### Further references

portal.aragon.es/portal/page/portal/MEDIOAMBIENTE/cclimatico/EACCEL/Plan/plan_accion.pdf
**Project description**

Construction of the climate change scenarios at small resolution (station scale) through statistical downscaling techniques.

To identify the more robust downscaling technique and to apply it in order to provide reliable and plausible future scenarios of temperature and precipitation-extremes and mean values. The studied area was mainly the Northern Italy, but some analysis was also made for case study over the Italian Peninsula. The scenarios are focused on the period 2021-2050 and 2071-2099.

Figure 1 shows the modelling scheme developed in order to produce climate change scenarios through statistical downscaling techniques. The future projections could be used then as input in the impact model in order to study the influence of climate change signal in different application.

Figure 2 presents one example of climate change projections at Bologna stations (Northern Italy) for summer maximum temperature obtained through statistical downscaling techniques applied to the predictors derived from the ENSEMBLES global climate models, A1B scenario. The Ensemble Mean has been created from the projections derived from the following atmosphere-ocean coupled general circulation models (AOGCM): FUB (EGMAM models with 2 runs), METO-HC (METOH models), INGV-CMCC (SINTEX-G model) and IPSL Global Climate Modeling Group (IPSL model). The changes are computed respect to 1961-1990 period. As it could be noted, an increase in max temperature is projected for both periods, more intense for the end of century (around 4°C).
In case daily data are required as input on impact model, seasonal signals of temperature and precipitation could be used as input to a weather generator (Richardson et al. 1984) in order to simulate daily data at each grid point. In Faenza area, situated in the Northern Italy, the water demand of kiwifruit has been estimated by means of Criteria Water Balance Model (Figure 3), using observed data for the period 1961-2009 and A1B scenario projected data for the period 2021-2050.

**Results obtained**
Future climate projections of climate indices and impacts on agriculture presented as maps, plots.

**Success factors**
Development of the statistical techniques for smaller scale, very useful for the impact studies.

**Indicators used**
End users applied the climate scenarios in the impact studies very usefully and effectively.

**Repeatability and Applicability**
The methods could be applied to different areas in order to produce climate change scenarios at local scale. Long time series of observed temperature and precipitation for the studied area, are required in order to produce future projections. The scenarios could be produce for mean and extreme temperature and precipitation at seasonal level, for different period and in the framework of different emission scenarios (e.g. A1B, A2, B1,...). The seasonal projections could be used as input in model impacts in order to study the impact of climate change from the studied area on different sector of activity. Similar experience has been done in the framework of AGROSCENARI project (www.agroscenari.it).

**Total costs**
35.000 €/year.

**Further references**
www.cru.uea.ac.uk/projects/stardex/
ensembles-eu.metoffice.com/
www.agroscenari.it/

Villani G., Tomei F., Tomozeiu R., Marletto V. Climatic scenarios and their impacts on irrigated agriculture in Emilia-Romagna, Italy. Italian journal of agrometeorology, issue 1-2011, pp. 5-16.


**Project description**

The project is aimed at giving technological support to decision making processes within the National Civil Protection Agency related to water management (with particular attention to potable water and water for agricultural use), mitigation of heat-wave impacts on population health, on energy production (avoidance of black-out and in general energy shortage) and on environment (forest fires risk, land slides). The technological support consists in the production of an ensemble of calibrated seasonal climate predictions over Italy.

**Results obtained**

During the present project there has been an improvement in the mitigation of heat wave impacts and of drought impacts. The various institutes responsible of water management have been invited to participate to periodical meeting aimed at coordinating their activities so as to reduce the impacts of extreme climate events on population and industrial activities. Monitoring of water resources at national level has been improved.

**Success factors**

During the heat wave and drought of summer of 2007 there was no major black-out occurrence, in general potable water was always supplied and the damages to agriculture were limited.

**Indicators used**

Evaluation of impacts of extreme climate events on population, environment and production.

**Repeatability and Applicability**

The proposed method for calibration of multi-model seasonal ensemble predictions can be applicable to any local region provided that the following main conditions are satisfied: availability of state-of-the-art operational multimodel seasonal ensemble prediction large-scale products time-series extending to at least 20 years and availability of quality controlled climatological data for the period covered by seasonal predictions. Finally, the calibration procedure requires also the existence of a statistically significant correlation between large-scale interannual variablity and local climate variability. In the absence of preexisting literature studies on this issue, the design of the calibration scheme requires preliminary predictability studies in order to evaluate the feasibility of the application.

**Total costs**

Undeclared.

**Further references**

SPIT-SPIA Special Project interim reports:

- [www.ecmwf.int/about/special_projects/renewal_2010-2012/Italy_Pavan_SPITSPIA.pdf](http://www.ecmwf.int/about/special_projects/renewal_2010-2012/Italy_Pavan_SPITSPIA.pdf)
- [www.ecmwf.int/about/special_projects/interim_reports_2009/Italy_Pavan_SP_SPITSPIA_progress_report_2009.pdf](http://www.ecmwf.int/about/special_projects/interim_reports_2009/Italy_Pavan_SP_SPITSPIA_progress_report_2009.pdf)
Calibrated probabilistic seasonal predictions

Multi-model ensemble large-scale seasonal predictions

Quality controlled climate observational data

Probability of positive climate indices anomalies
Ex:

Tercile probability predictions over selected regions.
Ex:
SON 2006 Tmed prediction

Time series of box plot probabilistic predictions and related probabilistic skill scores.
Ex:
MAM normalized precipitation anomaly
### Project description

Objective of the project: analyzing impact of climate change on electricity production by hydro power plants (for the watershed of Mati River and Fani River).

The project reviewed existing information that relate to climate vulnerability in energy sector focused in Mati River Cascade, then identified relevant forms of adaptation in power sector focus in the impact of climate change on Mati River Cascade. Current climate vulnerability in energy was assessed through:

- Analysis of impact of climate variability and extremes, hazards in the area of Mati River Cascade;
- Establishing a power baseline.

### Results obtained

Impact of expected climate changes in power sector focused in Mati River Cascade was assessed; adaptation measures for energy sector were elaborates through:

- Establishing the criteria to evaluate the adaptation measures;
- Assessing the adaptation measures for power sector, priority measures, barriers.

Conclusion of the study is that climate change impact will have a reduction generation effect in all existing and new hydro power plants of Albania. Total impact will be in reduction of 660 GWh (year 2030) or 10-12% of total hydro generation in that year. In order to meet that demand capacity of thermal power plant need to be increased up to 700 GWh, which is equivalent of 120 MW. By calculating the cost of meeting this demand there is a need of 13-60 M € (from the year 2008-2030).

### Success factors

Support by the relevant ministry in Albania, excellent cooperation on national level with different institutions providing with required data.

### Indicators used

- Electricity production from existing and new hydro power plants of Albania.
- Electricity production from new thermal plants of Albania.
- Cost of supply for meeting electricity demand as result of climate change effects in hydro power plants.
Repeatability and Applicability
The project can be repeated in all rivers with electricity production from hydropower.

Total costs
Undeclared.

Further references
Undeclared.
<table>
<thead>
<tr>
<th><strong>WG</strong></th>
<th><strong>C - adaptation to climate change</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Partner</strong></td>
<td>P9 - REC</td>
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<tr>
<td><strong>Promoter</strong></td>
<td>Regional Environmental Center for Central and Eastern Europe, Climate Change and Clean Energy Topic Area</td>
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<tr>
<td><strong>Project</strong></td>
<td>15 - “Enhance regional SEE cooperation in the field of climate policy”, Adaptation to climate change in urban areas in Turkey</td>
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<td><strong>Type</strong></td>
<td>Communication, climate policy (adaptation policies and measures)</td>
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<tr>
<td><strong>Period</strong></td>
<td>2006 - 2007</td>
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<td><strong>Location</strong></td>
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<td><strong>Target</strong></td>
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<td>National</td>
</tr>
<tr>
<td><strong>Contact</strong></td>
<td>Zsuzsa Ivanyi - <a href="mailto:zivanyi@rec.org">zivanyi@rec.org</a></td>
</tr>
</tbody>
</table>

**Project description**

Impact assessment of climate change for the water supply in some selected Turkish Municipalities.

A comprehensive analysis and study was undertaken to support the climate change adaptation strategy in Urban Water Use in Turkey.

Based on the existing climate change predictions and vulnerability assessments, the most vulnerable areas were identified. The study evaluated the potential impacts of climate change, identified and assessed the adaptation measures in the Urban Water Use in Turkey.

**Results obtained**

Conclusions and recommendations:

1. Increasing urban population and decreasing water resources make urban water management in Turkey very vulnerable to the climate change. Urgent adaptation strategies and actions are crucial and urgent.

2. So far, little attention has been given to developing policies and determining the strategic directions for adaptation in the water sector. Adjusting existing policies and planning approaches in the various sectors is crucial for the adaptation to climate change.

3. It is essential for the local governments and public authorities to initiate sustained strategies and action plans to mobilize non-conventional water resources through appropriate management structures, policies, laws, incentives and technical measures in the soonest.

4. There is a role for adaptation at all levels of social organization, from national and local governments to the private sector, civil society and individuals and households.

5. Urban water management should be taken into consideration in the broad concept of integrated water management and a National Integrated Strategy for Adaptation should be developed.

6. Strategic actions can be recommended as i) development of local level-adaptation plans by Municipalities, ii) data management and access to information, iii) interventions such as measures and in accordance with the local adaptation plans, iv) public awareness raising.

**Success factors**

Multi-stakeholder approach, involving different stakeholder groups.
**Indicators used**

Water consumption.

Sectoral water usage.

Precipitation, water budget.

Water Levels of Urban Water Reservoirs.

Loss of Precipitation and Loss of Volume of Stored Water.

**Repeatability and Applicability**

The project can be repeated for urban areas where there is concern for climate change related water issues.

**Total costs**

Undeclared.

**Further references**

Undeclared.
**Project description**

The Green and Blue Space Adaptation for Urban Areas and Eco Towns (GRaBS) project funded by Interreg IVC aims to improve the regional decision and policy making process in relation to the planning and development of new and existing urban areas in eight EU member states in the context of climate change. Atmospheric carbon dioxide concentrations are now at their highest for 3 million years and as a result urban areas are vulnerable to impacts including increased temperatures and flooding. Regional spatial planning and urban design can provide solutions to reduce vulnerability and risk. Green infrastructure including gardens, parks, productive landscapes, green corridors and green roofs and walls and blue infrastructure such as water bodies, rivers, streams, floodplains and sustainable drainage systems, play a vital role in creating climate resilient development, a role, which is currently not sufficiently recognised and utilised and lacks integration in main stream planning.

The project involves 14 partners drawn from eight EU member states representing a broad spectrum of authorities, climate change challenges and with varying degrees of related strategic policy and experience. The project facilitates the much needed exchange of knowledge and experience and the actual transfer of good practices on climate change adaptation strategies to local and regional authorities. In addition a climate change vulnerability and risk assessment tool will be produced through this interregional collaboration. Through stakeholder and community engagement, as well as the development of regional policy networks, partners will produce High Level Policy Statements and Climate Change Adaptation Action Plans to ensure climate resilient future development in their regions. In this process, partners will take part in thematic seminars, study visits and a mentoring programme as well as apply the climate assessment tool in their own locality.

**Results obtained**

A key outcome of GRaBS will be a user-friendly and easily transferable and replicable strategic planning methodology together with a vulnerability and risk assessment tool available to all European regional and local Municipalities. The project will also deliver a database of good practice case studies to showcase climate change adaptation approaches, with a particular emphasis on those relating to green and blue infrastructure and Expert Papers for dissemination throughout Europe. By advancing the knowledge and expertise of partner staff, decisions makers, politicians and communities, regional and local Municipalities will be able to make a more informed and strategic response in the context of climate change adaptation. In the long term, communities will reduce their vulnerability to the environmental, social and economic damage related to climate change impacts including extreme temperature increases and flooding incidents.
Success factors
Factors influencing the success of the development and implementation of adaptation responses include the following:

- Collaboration with external stakeholders;
- Strong leadership or championship;
- Access to funding;
- Awareness levels within the organisation;
- Outsourcing research and other actions;
- Human resources and skills;
- Public awareness and engagement;
- Quality and availability of information and data;
- Position of adaptation on the list of priorities;
- Development of local regulations and policies.

It is also necessary to monitor the impact of the adaptation strategies in order to assess their effectiveness, provide adjustments and ensure learning from the process.

Indicators used
Undeclared.

Repeatability and Applicability
As the project facilitates the exchange of knowledge and experience and the actual transfer of good practices on climate change adaptation strategies to local and regional authorities, including a database of case studies to showcase climate change adaptation approaches, with a particular emphasis on those relating to green and blue infrastructure, it is possible to learn from these, repeat and apply these adapted to own conditions.

Total costs
Undeclared.

Further references
Project website: www.grabs-eu.org/
Database of good practices www.grabs-eu.org/membersArea/files/Database_Final_no_hyperlinks.pdf
Website for REC CO Slovakia: www.rec.sk
**Project description**

The project aims to support the decision makers to acquire the knowledge and models to develop long term strategies for adapting the agricultural food production sector to the current and foreseen climate change impacts. The changes in various parameters like crop yields, harvesting times, etc. of the most important crops in the countries of the region, as a result of the projected climatic changes are planned to be determined.

The project aims to review and increase the level of data availability on the projections of climate change in the region; and apply the projections to model the impacts of climate change on food production for the years 2020 and 2050.

The project covers the Western Balkan Countries namely: Albania, Croatia, Montenegro, Macedonia and Serbia. The project focuses on the food production sector of each country, namely agricultural crop production and fish production in the fish farms.

**Results obtained**

The project outcomes involve determination of existing capacities and level of researches for assessing the impacts of climate change on food production in the Western Balkan Countries. Also an overview of models of climate change impacts on food production existing on international level, with a special regard to countries with similar economic and climatic conditions is being made.

An important outcome of the project will be an overview of the existing national climate projections up to 2020 and 2050 for each country concerned. After gathering the climate projection data, impacts of the projected climate conditions on the food production will be modelled for 2020 and 2050, describing the range of impacts. Effects of current and projected climatic changes (such as average seasonal changes in temperature, amount and intensity of precipitation, expected maximum and minimum temperature, soil humidity and other weather extremes, as frequency and intensity of droughts) on different parameters of agricultural crop production (such as crop yield, harvesting time) and fish production will be investigated.

**Success factors**

Availability of climate impact data on agricultural production.

Availability of climate projections for 2020 and 2050.

**Indicators used**

Not relevant.
Repeatability and Applicability
The project can be repeated in every country.

Total costs
94,000 €.

Further references
www.rec.org
**WG C - adaptation to climate change**

<table>
<thead>
<tr>
<th>Partner</th>
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<tbody>
<tr>
<td>Promoter</td>
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<tr>
<td></td>
<td>- Fruit tree Research and Development Institute, Pitești-Maracineni, RO – Coordinator (<a href="http://www.icdp.ro">www.icdp.ro</a>)</td>
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<tr>
<td></td>
<td>- National Meteorological Administration, Bucharest, RO - P 10</td>
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<tr>
<td>Project</td>
<td>18 - Assessment of potential impacts of climate change on agroclimatic zoning in Romania for fruit production. Acronym: CLIMPACTPOMI project</td>
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<td>Type</td>
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<td>National Research Project</td>
</tr>
<tr>
<td>Contact</td>
<td>Dr. Emil Chitu/team leader of the project - <a href="mailto:office@icdp-pitesti.ro">office@icdp-pitesti.ro</a> / <a href="mailto:emilchitu@gmail.com">emilchitu@gmail.com</a></td>
</tr>
<tr>
<td></td>
<td>Dr. Elena Mateescu/NMA - <a href="mailto:elena.mateescu@meteoromania.ro">elena.mateescu@meteoromania.ro</a></td>
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**Project description**

The main objective of this project was based on the computation of the various thermal indices specific to the fruit tree species, for both the current (1961-2007) and the future (2040 and 2080) climate conditions, from agrometeorological stations situated in Wallachia, as well as a case study for Pitești area. Thus, for the current climatic conditions, there were used the daily values of the mean temperatures recorded in the 1961-2007 interval, whereas for the future climatic evolution, two scenarios of the possible climate change were used.

**Results obtained**

According to the assessments displayed in the Fourth IPCC Report [2007], Romania expects a mean annual warming of the same magnitude as the one projected at European level against the 1980-1990 baseline, with small differences between models in the first decades of the 21st century and much greater towards the end of the century: between 0.5°C and 1.5°C for the 2020-2029 period and between 2.0°C and 5.0°C for 2090-2099, function on the scenario.

The growth and development rhythm of the phenological phases in the fruit tree species differentiates function of the demands for heat; the intensity of the physiological processes, being directly correlated with the evolution of the thermal factor between certain thresholds specific to each genotype. In other words, the influence of the thermal factor on the succession of the growth and development phenophases prevails. The heat necessity of the fruit trees for undergoing the phenophases is determined through computing the sum of active temperature degrees, yielded by summing up the mean daily temperatures above the biological threshold specific to each fruit tree species.

For the bud bursting phase to initiate an amount of mean positive temperatures of 100°C is necessary, expressed through heat units – values computed year by year, from 1 February until the mentioned thermal threshold is reached. In the current climatic conditions, the bud bursting phase generally occurs in the fruit tree plantations from Wallachia in the second 10-day period of March (11-20 March), the earliest date being recorded at Calarasi (11 March) and the latest (20 March) at Curtea de Argeș. Under the circumstances of the possible climate change, the bud bursting will occur much earlier, as compared to the current period, i.e. by 2-8 days (between 7 and 18 March), if the temperature increases by 1°C and by 8-12 days (between 3 and 11 March) if the temperature increases by 2°C. The largest differences in the occurrence of this phase, of 10-12 days, between the current climate and the two scenarios are recorded at Pitești, Ploiești Grivita and Ramnicu Sarat stations.

**Success factors**

In the fruit tree plantations from Wallachia, the occurrence date of the flowering phase at the pear tree, expressed as mean multiannual values, ranges from 10 to 21 April, the prevailing interval being 14-17 April in most part of the region. At Calarasi, the pear tree flowering is recorded
on the average on 10 April, and the latest pear tree flowering date is recorded at Curtea de Argeș, 21 April. Also, at Calarasi, the earliest pear tree flowering date occurred in 2002 (14 March) and the latest in 1996 (28 April). At Curtea de Argeș, the earliest such date was 3 April, in 1990, and the latest was 7 May, in 1965. Noteworthy that at Curtea de Argeș (in north-western Wallachia) in 1965, 1969, 1982, 1996, 1997 and 2003 the pear tree flowering was initiated in the first 10-day period of May (between 1 and 7 May), which were the latest occurrence dates for the whole area, except for the year 1969, when the pear tree flowering was initiated at Targoviste on 2 May and also 1996, when Grivita station recorded the accumulation of 350 heat units on 1 May [thermal threshold for pear tree flowering $T_{mean}=350$ heat units starting 1 February]. Under the circumstances of the two arbitrary scenarios, flowering at the plum tree species in Wallachia may occur by at least 3 to 10 days as compared to the current period over the whole of the analysed area.

The air temperature and precipitation multiannual monthly mean, in baseline (1961-1990) climatic conditions and under the circumstances of RegCM3 regional climatic predictions for the 2020-2050 period, the SRES A1B scenario.

According to the climatic predictions in this scenario, the mean annual air temperature will rise by 0.7°C at Pitesti in the 2020-2050 period against the current period, the largest increases being likely in the warm period of the year, i.e. in April through August (1.1°C/April, 1.6°C/May, 2.6°C/June, 2.8°C/July and 1.0°C/August]. Annual precipitation will dwindle by 91.1 mm on the average [13.5% negative deviation], the largest decreases being again estimated to occur in the warm season, namely by 7.5 mm less in April and as much as 47.4 mm less in June, compared to the current climate.

When using the arbitrary scenarios, the analysis of the mean multiannual occurrence dates of the bud bursting and flowering phases at Pitesti, at all the studied fruit tree species, highlights that those dates will occur earlier by 4-8 days on the average, in the scenario where the mean air temperature will rise by 1°C and by 9-12 days if the temperature rises by 2°C against the current climate. Also, on the background of the mean air temperature increasing trend, an increase of the amount of the heat units is estimated in the 1 February – 10 April interval against the current values by 18.7% in 2040 and by 38.4% by 2080, which points at an early or even very early spring coming, with implicit augmented risk implied by the late spring frosts.

**Indicators used**

The work methodology was based on the computation of the various thermal indices specific to the fruit tree species, for both the current [1961-2007] and the future [2040 and 2080] climate conditions, from agrometeorological stations situated in Wallachia, as well as a case study for Pitesti area. Thus, for the current climatic conditions, there were used the daily values of the mean temperatures recorded in the 1961-2007 interval, whereas for the future climatic evolution, two scenarios were used of the possible climate change. Impact studies carried out at international and national levels use three types of climatic scenarios: synthetic [arbitrary] scenarios, scenarios based on analogues and scenarios based on the outputs of the general circulation models. This study used two arbitrary scenarios, where the air temperature daily values from the current climate are arbitrary modified (increased by 1°C and 2°C respectively) and regional climatic predictions by RegCM3/2020-2050/SRES A1B.

Yielded products are outlined through thematic GIS maps at the level of Wallachia region comprising the mean multiannual data zoning as regards the budding out and flowering in the apricot, plum, pear and apple tree species respectively, as well as the spring coming index, in view to determine the fulfillment intervals, along with the earliest/latest occurrence dates of those events, both for the baseline climate (1961-2004) and for the future one (2040 and 2080 decades respectively).

**Repeatability and Applicability**

The project may be expanded to other areas of the country affected by climate change. Using climatic indicators justifies specialization of agricultural production in the context of climate change and the early varieties with increased resistance to drought and high temperatures in summer or cold winter.

**Total costs**

460,000 €.

**Further references**


Mean monthly multiannual air temperature and precipitation amounts in baseline climatic conditions (1961-1990) and under the regional climatic predictions by RegCM3/2020-2050/SRES A1B (Source: NMA).

Zoning of bud bursting date at the fruit tree species from Wallachia in the current climatic conditions and in the two scenarios foreseen for the 2040 and 2080 decades (Source: NMA)
Atmospheric pollution can be harmful to humans and have several effects on agricultural and forestry production. In recent years it has been increasingly recognized that air pollution and climate change are linked in several ways, and that they could be beneficially addressed by integrated policy. While indications of the climate impacts of increasing greenhouse gas concentrations can already be seen in the rise of mean temperatures and the increase in the numbers of extreme climate events (droughts and floods), most impacts are likely to happen over the next 50-100 years. Several processes in the atmosphere-climate system must be considered – processes by which air pollution can affect climate and by which climate change can affect air pollution.

The environmental goal of AIR-AWARE project is to improve the awareness and to facilitate deterministic decision making from several groups concerning the air quality impact, with an important component in favor of prevention and mitigation actions.

Also, the overall aim of the project is to build a pilot air quality monitoring and forecasting system in order to assist spatial planning decision-making, traffic management and pollution control in the Bucharest metropolitan area by predicting the environmental impact of air pollution. The system has a distributed architecture with dedicated sub-systems for: air quality monitoring; atmospheric numerical modelling and forecasting; geospatial portal for data integration, visualization, query and analysis; rapid-flow (24 hours) feedback on air quality forecast to local authorities and slow-flow (weekly) feedback on air quality parameters for mitigation strategies.

Results obtained
The developed air pollution impact surveillance and warning AIR-AWARE system can be used by local authorities of Bucharest to predict the impact of air pollution episodes and improve overall air quality through better physical planning and urban development policies. AIR-AWARE provides visual and user-friendly data on a GIS platform for the current status of atmospheric pollution by measuring chemical contaminants in the air and reviewing bio indicator species in the city’s parks.

Using current monitoring data and weather forecast, short-term effects of acute pollution episodes can be calculated leading to the protection of the population.
Reduction of air pollution in Bucharest is expected to reduce the public health cost of airborne diseases with 175,000 € per year.
Maps of contaminants provided by AIRAWARE system will be used for updating the Bucharest Urban Zoning Plan. (Source: NMA)

**Success factors**
- The cooperation of Bucharest’s EPA with industrial polluters for building the emission inventory.
- The participation in the project of experts in air pollution and numerical weather modelling, Open GIS.
- The collaboration of all participants.
- The system can be easily adapted to be used in other urban areas of interest.

**Indicators used**
The indicators concerning the air quality data can be accessed from a stochastic database in GIS, enabling feedback on air quality. After long-term use of the system, one can trace back the stochastic (climatologically) source of pollution for given impacts, identifying the climatologically origin of pollution and proposing solutions for mitigation.

**Repeatability and Applicability**
This project can be extended to other cities potentially affected by pollution. Also, the local authorities can use this tool in their regions/urban areas in order to identify the exact cause and source of pollution, but also to estimate the impact on public health.

**Total costs**
Total budget: 1,113,477 €.
LIFE contribution: 460,239 €.

**Further references**
life-airaware.inmh.ro
**Partner**
P11 - NMA

**Promoter**
Number of partners: 16
- Charles University (CUNI), Prague, CZ – Coordinator,
- National Meteorological Administration, Bucharest, RO - P 10
In Romania, the National Agricultural Research and Development Institute Fundulea (NARDI Fundulea) will use it to identify genetic and crop management solutions for reducing the impact of predicted climate changes on wheat production.

**Project**
**20 - FP6: Central and Eastern European Climate Change Impact and Vulnerability Assessment – CECILIA**

**Type**
Sixth Framework Programme of the European Union, specific targeted research projects (FP6-STREP)
Priority thematic areas: 1.3.2 “Climate changes in central-eastern Europe” under research area 3.1.3 “Prediction of climate change and its impacts” in part 3.1 concerning the “Impact and mechanisms of greenhouse gas emissions and atmospheric pollutants on climate, ozone depletion and carbon sinks” within FP6 Sub-Priority Area “1.1.6.3 Global Change and Ecosystems”.

**Period**
2006 - 2009

**Location**
Number of countries: 12
Czech Republic, Italy, France, Denmark, Greece, Switzerland, Austria, Romania, Bulgaria, Hungary, Slovakia, Poland

**Target**
CECILIA’s primary mission is to improve the understanding of local climate change in Central and Eastern Europe and its impacts into forestry, agriculture, hydrology and air quality.
1. For decision-making purposes - to develop guidelines for adaptation to climate change. In 2008, Romania approved the “Guide on the Adaptation to the climate change effects” by Ministerial Order (OM 1170/29.09.2008).
2. For farmers – to choose the species and varieties with high capacity for adaptation to drought and desertification, and development of “dry farming” system (for example, Romanian Agricultural Procedures Associations League/ non-governmental Association)

**Level**
International, national, regional

**Contact**
Dr. Tomas Halenka/team leader of the project - tomas.halenka@mff.cuni.cz
Dr. Elena Mateescu/WP6/NMA - elena.mateescu@meteoromania.ro

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**Project description**
The overall aim of this project is to assess the impact of climate change at the regional to local scale for the territory of Central and Eastern Europe, with emphasis on using very high climate resolution in order to capture the effects of the complex terrain of the region.
From the viewpoint of climate scenario production, this goal will be achieved through a strategy of multiple and combined approaches, namely variable resolution models, RCMs and statistical downscaling methodologies. The primary tools, however, will be very high resolution RCMs run locally for targeted areas.

These objectives were achieved through the execution of the following specific tasks:
- **WP1**: Assessment and provision of climate change information for downscaling and impacts;
- **WP2**: Regional climate modelling experiments;
- **WP3**: Statistical downscaling, localization, validation and scenario construction;
- **WP4**: Climate change and extreme events;
- **WP5**: Climate change impacts on hydrology and water management;
- **WP6**: Climate change impacts on agriculture and forestry;
- **WP7**: Climate change impacts on air quality and health.
Results obtained
The CECILIA project brings for the first time very high resolution localization of climate change scenarios into the targeted areas of Central and Eastern Europe, with the added value that these climate scenarios are produced locally. This will provide necessary policy relevant information for decision makers and local authorities concerning the possibility of adaptation and/or mitigation measures. Moreover, it will provide know-how and tools which can be further systematically used for the analysis of the climate change development and climate change impacts on different sectors of the society in the target region.

Several key issues connected with climate change have become of interest in recent years, such as the occurrence of extremes (floods, droughts, and heat waves) or effects on air quality, with potentially severe impacts on the quality of life, health and safety. The occurrence of these extreme events, in some cases causing loss of human life and extensive damages or costs, is affected by the relation between extremes and climate change. This relation can be better explored using the downscaling and high resolution (10 km) climate modeling planned in the project CECILIA.

Results from CECILIA will allow to evaluate the vulnerability of different sectors in the region partners, thereby providing relevant information for decision makers and local authorities for application of appropriate adaptation and/or mitigation strategies.

Specialists from Agrometeorological Laboratory of NMA were involved in WP6. Climate change impacts on Agriculture and Forestry sectors, aimed at three topics – (i) agriculture, inclusive drought, crop production and pest; (ii) forestry, inclusive forest growth, mortality and pests; and (iii) carbon, focusing on changes in the land carbon sink and productivity of forest and grassland ecosystems. All simulations were used to draw the recommendations on improved agriculture and forest management under regional climate change scenarios. Agriculture applications addressed Austria, Slovakia, Romania, Bulgaria and the Czech Republic. The simulations aimed primarily at winter wheat, spring barley and maize. The result indicated high regional variablity of production responses to climate change.

Specific measures for adaptation to climate change in the South-East Romanian agricultural area include improvement of the genotype varieties and yields. Improved use of water by crops can be reached using the cultivars resistant to abiotic stresses, different soil classes and changing the seeding date. Analyzing the results simulated on the grounds of 2020-2050 climate change estimations made by regional climatic models highlighted that the future climate evolutions may have important effects upon crops and they are conditioned by an interaction between the following factors: current climate changes on a local scale, severity of climate scenario-forecasted parameters, how the increased CO2 concentrations influence photosynthesis and the genetic nature of plant types. Winter wheat can benefit from the interaction between increased CO2 concentrations and higher air temperatures, while maize is vulnerable to climate change, mainly in the case of a scenario predicting hot and droughty conditions. A comparative analysis of the results obtained showed that future changes in regional scenario-based climate evolutions can have negative effects upon yield increase, development and formation. For both analyzed crops, the vegetation season gets shorter and there are fewer days available to reaching full ripeness. This shortening of the vegetation season is more marked in maize crops than in winter wheat. Such a forcing is mainly due to a probable increase in air temperature, estimated by the regional model.

Success factors
- The CECILIA project integrated the best European expertise in regional climate modeling with high resolution impact studies in order to provide new policy relevant information on climate change and its interactions with society at the regional scale.
- The results can be used in appropriate adaptation and mitigation response strategies in targeted areas.
- Climate change represents a major factor affecting the global and European environments. Changing availability of natural resources such as water supply may adversely affect the sustainability of European activities. A more stressed environment will be even more vulnerable to natural hazards, such as severe storms, droughts or flooding events, than in the present climatic conditions. CECILIA with its high resolution climate simulation tools can help anticipate and ameliorate the adverse impacts of climate change on the local environment and natural resources of the targeted regions.
- Finally, the results shown in this study are very important and they can contribute to laying the grounds of and developing management options to adapt to and mitigate climate change-related negative effects affecting crop systems. These options could include: using irrigation in maize crops, changing the seeding date, using certain wheat genotypes that require a high or moderate vernalization and shorter photoperiods as well as certain maize hybrids with a better resistance to drought, changing the agricultural practices and crop rotation, extending the areas cultivated with autumn crops etc.
Indicators used

Climate change scenarios used in this project to evaluate the effects on agricultural activities are based on:

- The outputs from regional climate models at very high resolution/RegCM3 - 10 km resolution;
- Two time horizons, respectively 2021-2050 and 2071-2100;
- Statistical downscaling methodologies [SDS] in order to provide local climate information;
- High-resolution (both in space and time) weather data representing present (1961-1990) and changed climate conditions (2021-2050 and 2071-2100);
- The set of weather variables and their spatial and temporal resolution may differ for various systems studies – for ex. the most important weather variables that directly determine the crop yield are solar radiation, precipitation and temperature. On the other hand, the crop response to high temperatures clearly depends on the character of the temperature increase as well as the developmental stage of the crop.
- In order to study the regional aspects and variability's of climate change impacts in Central-Eastern European agriculture three critical areas were addressed:
  1. The effect of climate change on the future agroclimatic conditions over the territory;
  2. The effect of climate change (including the effect of higher ambient CO2 concentration) on crop growth and productivity of key crops;
  3. Developing recommendations for adaptation options based on the case study results.
- A number of agronomic adaptation strategies can be recommended to avoid or reduce negative climate change effects and exploit possible beneficial options:
  1. Measures for improve management, use and protection of water resources in irrigated agriculture;
  2. Adaptation measures to improve management efficiency and use of existing irrigation systems and elaboration of technological and technical means for irrigation;
  3. Adaptation measures for use of rational and economically viable irrigation regimes.

Repeatability and Applicability

At European level, the approach can be used in the framework of a pilot project on development of prevention activities to halt desertification in Europe, [for example, EC-DGE/Grant Applications]. At national level, the research results can be used by genetics to obtain varieties and hybrids with genetic resistance to drought and climate change, or to develop guidelines for water use in agriculture. For example, the outputs from regional climatic models to obtain results in genetic modeling and technological measures to reduce climate change effects were used. The National Agricultural Research and Development Institute Fundulea (NARDI Fundulea) will use these results to obtain winter wheat varieties with an increased capacity for adaptation to climate change [GRIMPCLM project no. 51-073: Ways to reduce the impact of climate change on wheat production in South Romania], incda-fundulea.ro/cercet/contr51073.html
Total costs

2,750,000 €.

Further references

Web page: www.cecilia.eu.org

Publications:

- Elena Mateescu, D. Alexandru (2010) – “Management recommendations and options to improve the crop systems and yields on South-East Romania in the context of regional climate change scenarios over 2020-2050”, Scientific Papers, Series A III - Agronomy, University of Agronomic Sciences and Veterinary Medicine of Bucharest, Faculty of Agriculture, ISSN 1222-5339, pp 328-334.
**Project description**

The main objective of the Action is the evaluation of possible impacts from climate change and variability on agriculture and the assessment of critical thresholds for various European areas. This goal will be achieved through the accomplishment of intermediate aims, in order to define the current and future levels of critical thresholds and hazards for agricultural activity and environmental resources. The Action will be carried out by four working groups with different tasks: agroclimatic indices and simulation models review and assessment of tools used to relate climate with agricultural processes; evaluation of the current trends of agroclimatic indices and simulation model outputs describing agricultural impacts and hazard levels; developing and assessing future regional and local scenarios of agroclimatic conditions; risk assessment and foreseen impacts on agriculture. The activity of WGs has been structured as a sort of matrix, presenting on the rows the methods of analysis and on the columns the phenomenon and the hazards. Each intersection point describes the evaluation of past, present and future trends of climate and so the impacts on agriculture. Based on these results, possible actions (specific recommendations, suggestions, warning systems) will be elaborated and proposed to the end-users, depending on their needs.

**WG1:** Agroclimatic Indices and Simulation Models.

**WG2:** Evaluation of the Current Trends of Agroclimatic Indices and Simulation Model Outputs describing Agricultural Impacts and Hazard Levels.

**WG3:** Developing and Assessing Future Regional and Local Scenarios of Agroclimatic Conditions.

**WG4:** Risk Assessment and Foreseen Impacts on Agriculture.

**Results obtained**

- Determination of the possible change and variability of climate patterns in European regions.
- Collection and review of agroclimatic indices and simulation models used to assess the impacts of climate and hazards on agriculture processes.
- Establishment of analysis methods (definition of frequency, intensity, trend, etc.).
Assessment of required resolution (spatial and temporal) for practical agroclimatological applications.

Analysis of trends of agroclimatic indices and simulation model outputs based on the application of past, present and future climatic conditions.

Evaluation of the impacts on agriculture.

Addressing the specific needs of decision makers, extension services, farmers and the other end-users to define the hazard impacts on agriculture, by defining recommendations, suggestions and also early-warning systems.

Publication of the results of the Action will be of two types: scientific papers and technical manuals. The first should be promoted and encouraged by the MC in terms of co-authored papers in international journals and reviews. The second will be a very useful mechanism to disseminate the results to the NHMSs, the agriculture research institutes, the agricultural extension services and public administrations responsible for land planning. This will allow these users to put into practice the procedures and protocols established by the Action through specific well-organized guides.

Direct links will be established with the European Union (relevant DGs, e.g. Research, Environment, Agriculture), existing European networks (EUMETNET – the network of European Meteorological Services), projects (MARS project) and bodies, and also with WMO and FAO. Links will also be established with national and international societies interested in problems of agriculture and climate change and variability (European Society of Agronomy, International Society of Biometeorology, European Meteorological Society, etc.). Every year, during the meeting of the MC and WGs, international agencies involved in the fields of the COST activity, and representatives of the users, will be invited to exchange information and to coordinate and develop synergies and collaborations.

Organized workshops will also be a means for disseminating the results especially among potential users and for promoting COST activities in Europe and worldwide. Special efforts will be made to invite external keynote speakers and to publicize the workshop outside the Action. Wherever possible the Action will host workshops jointly with other international meetings.

These will include:

- European Meteorological Society annual meeting;
- European Conference on Applied Meteorology;
- European Conference on Applied Climatology;
- International Congress on Biometeorology;
- European Society of Agronomy congress and workshop.

**Success factors**

Meteorological and agrometeorological data, climatic models, indices, methods and tools can represent an useful support for all actors of agricultural sectors to better plan the analysis and the adaptation of European agriculture to climate change and variability impact.

**Indicators used**

- Survey of agrometeorological practices and applications in Europe regarding climate change impacts.
- Specific indicators: drought indices, water balance components, heat index, rainfall, soil moisture.
- Climate scenarios.

- Agrometeorological models – DSSAT, WOFOST, CERES-Wheat and Maize.
- Satellite observations – Remote sensing and GIS applications.
Repeatability and Applicability

In the field of COST Domain: ESSEM - Earth System Science and Environmental Management, on 25 March 2010 a new proposal COST Action on the topic “Agricultural Water Management” with the title “Climate change and water resources in Europe” has been sent. Challenges for (agro) meteorological services and methods for improving water use efficiency and water management considering various spatial and temporal scales”. The new proposed COST action will therefore identify research gaps, evaluate the state of art in applied methods and collect and disseminate relevant know-how at the research level. Further, the important link to stakeholders (the water consumers) will be improved considering the regional aspects and conditions for an effective implementation of recommended measures to be developed.

Total costs

80,000 €.

The following countries have actively participated in the preparation of the Action or have otherwise indicated their interest: Bulgaria, Czech Republic, Cyprus, Denmark, Germany, Greece, Hungary, Ireland, Italy, Netherlands, Norway, Poland, Romania, Slovenia, Spain, United Kingdom. Also the World Meteorological Organization (WMO) and the Food Agricultural Organisation (FAO) have expressed their interest in participating and collaborating in this COST Action. On the basis of national estimates provided by the representatives of these countries, the economic dimension of the activities to be carried out under the Action has been estimated at roughly 100,000 €.

Further references

Web page: www.cost734.eu

Publications:

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<tr>
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<td>Promoter</td>
<td>Ministry of Environment and Forests</td>
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<tr>
<td>Project</td>
<td><strong>22 - Program for installation of heating systems using renewable energy, including replacement or supplement conventional heating systems (Green House Program)</strong></td>
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<td>Type</td>
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<td>Period</td>
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<td>Location</td>
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<td>Level</td>
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<tr>
<td>Contact</td>
<td>Luminita Cornea - <a href="mailto:cluminita@apmcv.ro">cluminita@apmcv.ro</a></td>
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</table>

### Project description

The program aim is to improve air, water and soil quality by reducing pollution caused by classical heating systems that use wood and fossil fuels to produce thermal energy and to stimulate the use of systems based on renewable energy sources. Through this program funds are available from the National Environment Fund for persons domiciled in Romania, owners or part owners of property on/in which the project is implemented, as follows:

- a) Up to 1.400 € for a solar installation;
- b) Up to 1.900 € for installing heat pumps;
- c) Up to 1.400 € for heating systems based pellets, briquettes, wood filling, and any scraps and vegetable waste, etc.

Eligible persons submit their projects at Environmental Protection Agencies and, after evaluation, a financing contract is signed with selected persons. For each county there is an amount of funds available.

### Results obtained

In the first stage more than 200 houses will replace conventional heating systems with systems that use renewable energies. The Program will continue depending on funds availability.

### Success factors

The program started on 1<sup>st</sup> July 2010 and 120 persons submitted already their projects.

### Indicators used

Number of projects implemented.

### Repeatability and Applicability

This program can be repeated every year for any region to enhance the use of renewable energy.

### Total costs

262.500 € for Covasna County.

### Further references

[afm.ro/program_casa_verde.php](afm.ro/program_casa_verde.php)
Project description

‘De Groote Wielen’ is a new suburban area on the northeast side of ‘s-Hertogenbosch. Its design has been influenced by many layout elements. Water is perhaps one of the most visible elements.

Early in the planning phase of the development area Groote Wielen the Water Machine appears in the blueprints. There are three main reasons for developing the Water Machine. Firstly the provincial government and the local Water board requested that storm water storage should be managed within the suburb. There should be no hydrological influence outside the area. Every drop of water needs to stay within the area. The second reason is that water has a positive image and increases the value of the public area and the properties. Thirdly, the development area was a low lying polder to start with. To develop houses in this area the land level needed to be raised. The sand to raise the area was retrieved from what is now the central lake. This lake now functions as the main buffer for the whole storm water system. The whole rainwater system in the area is known as the “Water Machine”.

The Water Machine consists of several components. In each neighbourhood the interpretation of the water theme is different. Also, a number of components cover the whole suburb.

Central Water Machine

The suburb covering elements are:
- The central lake;
- The low ring;
- The marsh and;
- The high ring.

The low ring is the collecting system that transports water from several districts to the purification marsh. The low ring is a canal like construction. The main aim of the low ring is to transport water from the neighbourhoods to the purification marsh. The marsh purifies natural water by means of varying water depths and special vegetation. The water quality of the marsh water is acceptable to fill the central lake and the water gardens. The high ring is meant to introduce water into the suburb. This is an artificial waterway which ensures continuous flow in the water system. One branch of the high ring runs to the primary school. This has an educational purpose.

The water machine is provided with a water level management system so that fluctuations between wet and dry periods can be managed. The level of the central lake can fluctuate between +1,40 m and +1,70 m NAP. The level of the low ring is kept on 1,80 m + NAP by means of a dam. This can raise to 2,10 m + NAP. By accepting these differences in water level less pumps and power is required to keep the water system in movement.

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**Project 23 - The water machine – suburban area with a closed water system**

**Type**: Technological  
**Period**: 2006 - 2015  
**Location**: ‘s-Hertogenbosch  
**Target**: Municipalities  
**Level**: Local  
**Contact**: René Klerks - Rklerks@brabant.nl, Stax@s-hertogenbosch.nl

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**Provincie Noord-Brabant**
Water quality

The goal is to attain the highest possible water quality, where public health is one of the most important concerns. This means that the water quality is measured several times per year. The central lake has recently been allocated as a swimming water location. This is monitored once every fortnight by the local Water board.

Results obtained

By giving water a central place in this new suburban area, a very attractive living environment has been created. The water system is closed: all the rainwater is held in the area and stored in a central lake. From the central lake it is distributed into the area again.

The quality of the water is very good, making a sustainable water management possible.

Success factors

Active use of water in an suburban area: creating an attractive living environment, recreational use of water (swimming, fishing, boating) and closing the local water system.

Indicators used

Closed water system.
Water quality.

Repeatability and Applicability

This example of water management in a suburban area can very well be repeated in other new suburban areas.

Total costs

Undeclared.

Further references

www.degrootewielernl
www.s-hertogenbosch.nl
**Project description**

**Introduction**

Rural areas in the South of the Netherlands are coping with (seasonal) water scarcity. This is a problem for many (economic) sectors: agriculture, nature conservation, drinking water supply, shipping, recreation and tourism. Due to climate change (more and longer dry periods in the summer) these problems will increase in the future. The total area concerned covers about 6,000 km² in the Dutch provinces of Brabant and Limburg. To cope with these problems the Waterboard Aa en Maas initiated a regional project in which the water authorities cooperate with farmers’organisations and the State Forestry Service.

**Aim**

The project aims at defining regional adaptation strategies by stimulating self-support in fresh water supply (buffering and infiltration), diminishing water demand and the sensitivity for water shortages (new crops, robust nature and re-allocation of land use) and promoting efficient use of available water (irrigation, inlet from the Meuse river).

**Challenges**

- Engaging public and political support for innovative adaptation measures.
- Cooperation with national research initiatives (Knowledge for Climate, [www.knowledgeforclimate.nl](http://www.knowledgeforclimate.nl)). The Deltaplan Dry Rural Areas is the policy counterpart of the scientific research programme Knowledge for Climate.
- Cooperation with national adaptation measures (Delta Programme, [www.deltacommissaris.nl/english](http://www.deltacommissaris.nl/english)).

**Results obtained**

- Specification of consequences of climate change for the different functions in the area (future balance between water supply and demand).
- Selection of feasible and acceptable adaptation strategies and measures.
- Active network of cooperating stakeholders.

**Success factors**

- Cooperation between all relevant regional stakeholders in the field of water management and water use.
- Connection with policy development and planning at the national level (Delta Programme).
- Small scale pilot projects, room for experiment.
- Consensus between institutions and stakeholders, effective process of participation.
Indicators used
- Number of pilot projects.
- Number of stakeholders involved.
- Degree of active cooperation and co-funding (in terms of written agreements and €).

Repeatability and Applicability
Although the content of the project is highly tailored to the regional setting, the process may prove an example for other regions facing similar problems.

Total costs
100.000 €.

Further references
www.aanmaas.nl (in Dutch)
### Project description

**Introduction**

The Brabant countryside – although still retaining a rural character – is a densely populated and regulated area. Demands for available space are many and often conflicting. Land prices are high. Adaptive measures to cope with climate change impacts can be space consuming, adding even more pressure on available space. One of the solutions may be multifunctional land use, increasing land use efficiency and providing added value in economic, ecologic (biodiversity) and public sense.

A complicating factor is the process of transformation (driven by social and economic changes) happening already in the regions concerned. As future spatial claims may differ greatly from current land use patterns, solutions for multifunctional use must bear a certain amount of flexibility and resilience.

Two – interconnected – projects on multifunctional land use are now running in the region of Brabant:

- **MFL – Groene Woud**: focussing on combining agricultural land use and biodiversity;
- **MFL – Knowledge for Climate**: focussing on developing innovative land use combinations for climate change adaptation (e.g. water retention and biomass production).

**Objective**

The main objective of both projects is to analyse the spatial claims associated with climate change ‘proofing’ of water, agriculture, nature and housing and to identify possible adaptive strategies in dry rural areas. Central question is how these claims and strategies can be combined with current or future land use types, focusing on multifunctional land use.

**Key deliverables**

One of the key deliverables of both projects is the completion of business plans. It is the ‘proof of the pudding’ for multifunctional land use in Noord-Brabant. Definition of the business plans involves 5 steps:

- An analysis of the effects of climate change on spatial plans and developments in Noord-Brabant;
- An inventory of multifunctional land use combinations, suitable for the Noord-Brabant setting;
- A ‘speed dating’ workshop with stakeholders, aimed at sharing ideas and building coalitions;
- A second workshop with stakeholders, aimed at visualisation and detailing of selected ideas;
- The writing of concrete business plans.
Results obtained

- An overview and analysis of practical solution for multifunctional land use as an adaptation strategy.
- A business plan for 4 locations in Noord-Brabant, which describes some of these practical solutions in ‘real life’ cases.
- Guidelines – on both content and process – for the implementation of multifunctional land use as an adaptation strategy in dry rural areas.

Success factors

- Spatial analysis, leading to selection of relevant cases.
- Identification of mutual gains for stakeholder, land owners and entrepreneurs.
- Emphasis on the economic ‘drivers’ for multifunctional land use.

Indicators used

- Number of business cases.
- Number of stakeholders involved.
- Number of users of factsheets and guidelines.

Repeatability and Applicability

The overview (factsheets) and the guidelines contain general information on multifunctional land use. Cases are selected from the Netherlands and abroad (EU). The business plan approach can be transferred and adapted to any setting in which multifunctional land use is a preferred solution (high spatial pressure, competing claims, demand for high returns on land investments). Part of the project is carried out within the international orientated Knowledge for Climate project. Research and development within KfC is aimed at application on a European scale.

Total costs

200,000 €.

Further references

www.knowledgeforclimate.climateresearchnetherlands.nl (in English, project information and downloads)
www.hetgroenewoud.com (in Dutch)
**Project description**

**Introduction**

Knowledge for Climate is a national programme for climate change adaptation. In this programme, practise orientated research is carried out in order to support project implementation.

The Province of North Brabant is coordinator of the ‘hotspot’ Dry Rural Areas within this programme. At the moment research projects are running focussing on three themes:

- Rural areas: development of water supply and demand strategies for agriculture and nature;
- Governance: new coalitions and roles for dealing with climate change adaptation in regional networks;
- Decision support systems: supporting policy development, project development and transfer of information in the science-policy interface.

**Challenges for dry rural areas in the Netherlands**

Flooding and water stress are significant problems in agriculture and nature conservation. This presents water managers with new challenges, especially given the stricter requirements which have been made with regard to the water quality (the Water Framework Directive). The current intensive use of land by agriculture is not climate proof and interferes with achievement of the more stringent water quality requirements. It also increases the risk of diseases and pests, such as bluetongue.

Large areas of countryside situated on higher sandy ground, are currently undergoing a transition from a food production landscape to a more consumerist multi-functional landscape. During this transition period, national and local government try to encourage intensive livestock farms to switch from cost price oriented production for the world market to a market in which, for example, better quality or more consideration for animal welfare can be realized. This will help the system to make a contribution to water management, environmental quality (groundwater directive, acidification, Water Framework Directive), nature conservation and scenic qualities. An increasing number of civilians, both individuals and non-agricultural businesses, are joining farmers and are looking for qualities that are found in rural areas and thus becoming the new economic contributors to the countryside. In addition, it will also be necessary to deal with the increasing pressure of urbanization.

Climate change puts this complex transition process under heavy pressure, therefore businesses and individuals will increasingly choose to locate to those areas of the Netherlands, which are above sea level. Consequently, the national ecological network will need to be made climate proof; the water retaining capacity of the landscape will need to be increased; and more space will need to be created for water storage. Various claims on space will mean that tension between private and public interests will increase and the need for coordination between spatial scales will become essential. Solving this tension between diverging interests on a range of the spatial and administrative spectrum must be an important part of the development planning.
Objective
To develop knowledge regarding the effects of climate change on regional development in the short and medium terms. Rural areas on higher sandy ground will undergo a dramatic transformation: during the coming years they will transform into a multi-functional landscape. An increasingly dynamic water management system means that a climate change will put this transformation under a lot of pressure. Flooding and water stress will also cause problems more often.

Main issues
- Effects of water storage and effectiveness of measures on agricultural areas.
- Effects of water stress and effectiveness of measures.
- Effects of climate change (incl. water stress) on the realisation of the spatial national ecological network (connectivity) and biodiversity protection.
- Investigate at a regional level how climate-related risks can be incorporated into the planning process and the regional decision-making process.

Results obtained
- Adaptation strategies for dry rural areas (region based).
- New alliances and networks in the science-policy interface.
- Water demand and supply forecast in climate change scenarios.

Success factors
- Cooperation between scientists and stakeholders.
- Combination of applied (demand driven) and fundamental research.
- Linking scales (regional-national-european).

Indicators used
- Number of regional cases involved.
- Number of publications (scientific, professional, general).
- Number of stakeholders involved.

Repeatability and Applicability
Although research is carried out in selected cases, emphasis is put on widely applicable output and outcome. Knowledge for climate focuses on information exchange on an international scale. To ensure this comparative studies are carried out in an international partner network.

Set up of the programme is comparable with the German KLIMZUG [www.klimzug.de].

Total costs
The total programme has a budget of 50 million €. The Brabant co-financing is 150,000 €.

Further references
www.knowledgeforclimate.org
### Project description

Since the year 1995 the Ministry provides the following two storybooks for children of the ages 3 to 10 years old:

**“Ein Wassertropfen auf Reisen” – The travelling water drop.**
A story book for children of the ages 3 to 10 years old focussing on water saving attitudes.

The two water drops, Plitsch und Platsch enjoy their way of life with their friends at a beautiful spring in the woods. One day this source runs dry. Therefore Plitsch and Platsch begin to investigate who may be made responsible for the disappearance of the water. Plitsch and Platsch figure out that mankind consumes a lot of water. Together with their friends Anna and Peter they start to develop ideas for saving water.

**“Plitsch und Platsch. Abenteuer am Bach” - Plitsch and Platsch. Brook Adventures.**
A storybook for children of the ages 3 to 10 years old focussing on the brook biotope.
The story emphasises the dimension of close to nature waters and sensitis children on problems that may occur out of water pollution.

While having a downstream boat trip Plitsch and Platsch meat a lot of typical plants and animals. They also realise a waste water treatment plant and learn by their friends Anna and Peter how to analyse the water quality.

### Results obtained

- Since 1995 over 510,000 copies distributed in German.
- 10,000 copies each produced and distributed in Polish and Czech.

### Success factors

Over the period of 15 years now this storybook is reprinted based on the request of Kindergartens, elementary schools and families.

### Indicators used

Number of distributed copies over the period of 15 years (on average 34,000 p.a.).

### Repeatability and Applicability

It can be a model for other regions in Europe.

### Total costs

Since 1995: 300,000 € for approx. 500,000 copies of the story book.

### Further references

[www.hmuelv.hessen.de/irj/IVLIV_ Internet?cid=3516f3fe4c705089d1de64372a9e9e6a](www.hmuelv.hessen.de/irj/IVLIV_ Internet?cid=3516f3fe4c705089d1de64372a9e9e6a)
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<td>Project</td>
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<tr>
<td>Contact</td>
<td>Susana Escobar - <a href="mailto:sescobar@sodemasa.com">sescobar@sodemasa.com</a></td>
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### Project description

The Aragon Water Institute, a public law entity of the Department of the Environment of the Government of Aragon has been carrying out diverse activities to disseminate advice on saving and correct practices in the use of water as part of the Aragon Strategy for Climate Change and Clean Energies.

“La Chiflada Historia del Agua” project consisted of organising four sessions of dramatised environmental education concerning water in four large shopping centres in Zaragoza over the Christmas period. The initiative is to create awareness amongst a public consisting of children and families about the importance of correct water consumption habits in the home.

The objective of the play is to make children and adults aware of the importance of taking care of water and the environment to ensure the “good health” of the natural resources in the future.

During the session, children were transported to 2020 and discovered that the rivers were sick. Thanks to amusing characters, they investigate and discover why the rivers are in this condition: the blame lies with humans and their bad habits. Through games and songs and using a language that is understandable to everyone, children and adults become aware of the importance of taking care of the environment and in particular, of rivers.

At the end of the play, the children receive a “good citizen handbook” which consists of a brochure with advice for saving and good practices in water consumption at home.

As a complement to the play, awareness creation activities were carried out in the shopping centre, consisting of handing out brochures by mimes who rode around the aisles on original bicycles.

The activity was advertised in the local press and by means of the shopping centres’ own resources (their websites, PA systems, posters, etc.)

### Results obtained

- 2,000 people attended the sessions.
- 5,000 brochures were handed out.

### Success factors

The sessions were performed in the main shopping centres in the city, during the Christmas period when the influx of public is very high. The children were accompanied by their families who also saw the play and received the messages, therefore the awareness creation activities managed to reach a diverse public and not just the children.
**Indicators used**
The attendance data was provided by the shopping centres which hosted the performances.

**Repeatability and Applicability**
The scripts, ideas about how to dress, sets and other information in order to represent this play with local actors are available for anyone interested in repeating this project in other contexts.

**Total costs**
32,700 €.
Mounting the Play - 25,000 € VAT included.
Brochures - 3,700 € VAT included.
Advertising - 4,000 € VAT included.

**Further references**
Undeclared.
**WG**  | **D - communication/participation**
---|---
**Partner** | P3 - GdA
**Promoter** | Dept. of the Environment of the Government of Aragon
**Project** | 3 - Advertising campaign "Tenemos un Plan, ¿cuál es el tuyo?" (We’ve got a plan, what’s yours?)
**Type** | Awareness raising and education
**Period** | December 2009, January 2010 and February 2010
**Location** | Zaragoza
**Target** | Citizens, companies
**Level** | Local
**Contact** | Susana Escobar - sescobar@sodemasa.com

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**Project description**

The Aragon Water Institute, a public law entity of the Department of the Environment of the Government of Aragon has been carrying out diverse activities to disseminate advice on saving and correct practices in the use of water as part of the Aragon Strategy for Climate Change and Clean Energies. This Strategy is a document to plan the activities to combat the climate change, to which all the institutions, companies and organisations that commit themselves to carrying out action plans to reduce emissions may adhere.

In December 2009, the need to create a new creativity with the clear objective of “insight into action” was verified. Several studies showed that the general public had understood the importance of taking care of the environment in addition to detecting an improvement with regards to awareness about the problem of the climate change and its consequences, but it was also clear that the citizens did not know how they can be protagonists in the fight against climate change. Therefore, and following the design line of previous campaigns a new slogan was created: “Tenemos un plan, ¿Cuál es el tuyo?”

The campaign used a very direct message: “We have already mobilised ourselves in the fight against climate change, what are you waiting for to do so?”, which became the slogan: “Tenemos un plan, ¿Cuál es el tuyo?’ (We’ve got a plan, what’s yours?). At all times, creativity calls for action through the presentation of comic strip drawings that consume water in a responsible way. These drawings aim to be an example to be followed by the general public who wanted to have an “action plan”.

The following media were chosen for the campaign: radio, local television, local press, Internet and external advertising (urban bus). Complementary actions were also carried out, such as sending out Christmas cards with the “Tenemos un plan, ¿cuál es el tuyo?” campaign adapted with Christmas motives.

The months chosen for the launch were: December 2009, January 2010 and February 2010.

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**Results obtained**

The campaign was well accepted by the general public and the institutions, who increased their interest in adhering to the Aragon Strategy for Climate Change.

**Success factors**

The time chosen for launching the campaign was correct, as it was made during the Christmas period, when citizens are more open to receiving positive messages, but at the same time, it is when they follow more consumerist habits. The first step to achieve an action is a change of attitude and it was verified, through surveys and participation levels of the general public at events in favour of the environment, how the general public of Aragon had assimilated the importance of taking care of the environment and was therefore ready to move on to a higher level of commitment.
Indicators used
Number of visits to the web page of the project. At this moment this web is not available.

Repeatability and Applicability
It can be repeated in other contexts.
Suitable formats to be adapted by local designers can be asked to the project promoter.

Total costs
136,000 €.
20,000 € creative concept and design.
116,000 € campaign in the media.

Further references
Undeclared.
WG: D - communication/participation

Partner: P3 - GdA
Promoter: Dept. of the Environment of the Government of Aragon
Project: Project 4 - Free distribution in the streets of water-saving packs
Type: Awareness raising and education
Period: 2009 July 29th - August 2nd
Location: Zaragoza, Huesca, Teruel and Calatayud
Target: General public
Level: Regional
Contact: Susana Escobar - sescobar@sodemasag.com

**Project description**

The Aragon Water Institute, a public law entity of the Department of the Environment of the Government of Aragon, has been carrying out diverse activities regarding dissemination and creating awareness, as part of the “Ríos de calidad” (Quality Rivers) campaign, aimed at fostering good practices regarding saving water at home.

The specific objective of the campaign “Free distribution in the streets of water-saving packs” was to create ecological consumption habits amongst the general public which are sustainable over time.

As a starting point, it aimed to make the use of the aerator (a device for saving water in taps) at home more widespread, by means of handing out units, free of charge. Together with the aerator, people were given a brochure which informed about other small everyday gestures which together mean a considerable saving of water at home.

To carry out this campaign, 10,000 aerators were acquired and a small explanatory brochure was designed, using the same image as the “Ríos de Calidad” campaign, to which it belongs. These two items made up the “water-saving pack”.

To distribute these packs, several activities were carried out in the street, in the form of a travelling point of information, which visited the four main cities in Aragon: Zaragoza, Huesca, Teruel and Calatayud. The target for the campaign was, therefore, the citizens of the main urban centres in Aragon.

It was felt to be a good idea to hand out the items in the main squares and places with a high influx of people. To do this, mobile marquees were set up, decorated with the image of the “Ríos de Calidad” campaign, in which a host or hostess was responsible for handing packs out to passers-by.

The importance of creating awareness in a complete way and adapted to the level of commitment of each citizen was understood. For this, specialist staff from the Aragon Water Institute accompanied the hosts and hostesses and offered the possibility to increase information and deal with any doubts in situ.

The campaign started on 29th of July 2009 (a Wednesday) and ended on 2nd of August (a Sunday), lasting 5 days in all. When choosing these dates, we took into consideration the fact that during the summer months the consumption of water is greater than during the rest of the year and also coinciding with the driest period.

**Results obtained**

The aerators handed out allow for a 50% saving on the consumption of water in each tap. In view of the fact that 10,000 devices were handed out, consumption of the equivalent of 5,000 taps was saved.
Success factors
The choice of handing out the items in the street was a success. The advantages are:

- To reach a very diverse public including all ages and social classes;
- The marquee itself is an advertising feature, not just for the citizens who come to it to receive the pack, but also for passers-by, drivers, bus passengers, etc;
- The free handing over of an aerator which is very simple to install encourages people to make the first step towards action;
- Summer is a time when the general public is more receptive to messages about the responsible consumption of water.

Indicators used
Number of aerators and brochures handed out.

Repeatability and Applicability
It can be repeated in other contexts.
Suitable formats to be adapted by local designers can be asked to the project promoter.

Total costs
23.770,03 €.
Design and printing of the brochures: 1.250 € VAT included.
Purchase of the aerators: 15.070,72 € VAT included.
Setting up the information point: 7.449,58 € VAT included.

Further references
Undeclared.
Project description

The 2008 International Exposition took place in Zaragoza between 14th of June and 14th of September.

“Water and sustainable development” was the broad subject of the Exposition. This subject was divided into various themes; “Water, a scarce resource”; “Water for life”; “Water landscapes” and “Water as a feature for relating between peoples”.

As part of this Exposition, the Department of the Environment decided it would be a good idea to publish a book called “Aragón: El libro del Agua” to continue with the actions of dissemination and awareness creation that the Government of Aragon had been carrying out and aimed at creating awareness amongst the general public about the importance of water in everyday lives. A novelty was the use of artistic expression as a vehicle for creating environmental awareness.

The large-format, high-quality book aimed, by means of a large number of images, to bring people closer to the aesthetic statements of water in Aragon through its presence and absence.

The set of more than 500 photographs invited one to reflect and to rethink matters related to water, such as the shortage of it, man’s administration of water or the beauty of water in nature.

The 607-page book started with a series of prologues written by the Minister of the Environment of the Government of Spain and the President and Vice President of Aragon.

From this point onwards, literature and photography were the disciplines chosen to give expression to the marks that water has left on art.

Famous artists, politicians, social leaders, business people or representatives of associations of a national scope offered their reflections about water through articles and various documents compiled in the part called “visions of water”.

After this, the set of photographs were ordered according to several categories:

- Suspended water;
- When water takes on suggested shapes;
- Where water flows and where it seems to appear;
- Subsistence culture;
- Water well administrated;
- The eyes of the river;
- Engineering;
- Exodus and drought;
- Secular traditions.
The book finished up with a part in which the general public could offer their visions about water in short inspiring sentences. For this, the mass media had previously informed about how to send in these short phrases, for the book “Gotas”. (“Droplets”)

1,000 copies of this unique book were published which, in part, were distributed free of charge to Libraries and Town Councils.

In addition, part was separated to be sold in the Aragon Pavilion of the 2008 International Exposition and in bookshops.

Results obtained
The Aragon Pavilion at the 2008 Zaragoza Expo offered ideal conditions to gauge the reactions of the general public with regard to water. One of the indicators of this trend was the good sales of the book “Aragón: el libro del agua”, which sold out quickly.

Success factors
By setting the project in the 2008 Zaragoza Expo, it made the most of growing environmental awareness particularly focused on matters concerning water, its importance and the responsibility of human beings in the management of a resource that is essential for life.

Indicators used
Number of copies sold.
Register of Libraries.

Repeatability and Applicability
Art is a form of expression without barriers. Using art as a form of creating environmental awareness, through the work of local artists, can be useful and relevant in any region.

Total costs
30,000 €.

Further references
Undeclared.
Project description

The regional communication campaign “Water, vital saving” was initially launched in 2004 following a public opinion survey which had been realised by the Region on water consumption within the household/domestic sphere. The campaign started a process of important cognitive changes (to favour a larger acknowledgement on the issue of water consumption), of action and behaviour (to propel choices and domestic behaviours which bring along a higher saving) and of values (raising awareness towards the water thematic), which allowed to make the citizens more informed and conscious of the problematic related to water domestic consumption. In the communication plan of the campaign, the main instrument has been a brochure, rich in useful suggestions and coloured images, delivered via mail to the Emilia-Romagna households in almost 2.000.000 copies; other instruments have been a web site, radio and TV commercials, poster and advertisements as well as a bookmark. In occasion of the major national fairs and public events dedicated to environment, many brochures have been distributed to citizens and participants and when possible also thousands of “kits” for domestic water saving (flow reducers and faucet aerators). During 2008, the campaign has been restyled (new slogan: “Half full or half empty? Whatever you think save water!”) and re-launched, with new slogan and the sending of other 2.000.000 new brochures.

The encouraging results obtained from the demonstrative initiatives and the projects put in place by the Region have concretely shown that, with small efforts, such as simple domestic attentions and minimised economic investments, it is possible to obtain water savings up to a high 12-18%: an exceptional result in the context of drinking water issues. The overall result is extremely encouraging: alongside the concrete “numbers” emerged from many of these experiences, the most important output is without any doubt attributable to the strong repeatable significance which water saving and conservation policies have highlighted, allowing not only for their vast and capillary diffusion, but also for their strengthening and consolidation in terms of credibility and goodness.

Results obtained

Modifications of domestic/urban water use behaviours, e.g. as below:

What people do to save water

<table>
<thead>
<tr>
<th>Activity</th>
<th>2002</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use fully loaded dishwasher</td>
<td>1.4%</td>
<td>72.7%</td>
</tr>
<tr>
<td>Avoid leaving the tap open while brushing teeth, shaving or washing hands</td>
<td>11.1%</td>
<td>45.5%</td>
</tr>
<tr>
<td>Install water efficient taps or tap aerators</td>
<td>2.2%</td>
<td>38.5%</td>
</tr>
<tr>
<td>Use water saving toilets</td>
<td>2.8%</td>
<td>29%</td>
</tr>
</tbody>
</table>
Success factors
The key elements that made this campaign successful and effective have been the informative documentation provided to the public, together with the distribution of the kits for domestic water saving.

Indicators used
Number of distributed brochures (4,000,000 total); number of families involved (4,000,000 total); number of institutions involved (9 Provinces, 349 Municipalities, etc.); number of informative materials requested to the Region by the stakeholders (> 100,000); number of distributed faucet aerators (> 100,000); number of web site contacts/visits (2009: 12,555).

Repeatability and Applicability
Highly applicable and repeatable communication campaign in other contexts.

Total cost
200,000 € (approx.).

Further references
www.regione.emiliaromagna.it/wcm/acquarisparmio/index.htm
Project description

The ‘National Forum on water saving and conservation’ was established in 2005 with the objective of increasing the efficiency in the use of water through the amelioration of the coordination and of the knowledge sharing among the actors involved in the water cycle. This project started from the recognition of several difficulties in the diffusion of positive experiences due to the high territorial fragmentation. In response to these lacks, the Forum was established with the aim of becoming a shared and organised platform to dialogue and share knowledge amongst the world of researchers, water services managers, associations, national and local institutions, non-governmental organisations, environmental associations. The objectives of the Forum are: to favour the diffusion of news, data and experiences; to tackle with the Regions and the other relevant actors the factors which limit and slow down the policies on water saving (e.g. tariff method); to develop a non-episodic national communication campaign; to put together a technical table with the Regions that defines a national program and cooperates with the EU for the implementation of the Water Framework Directive, also to foster the attention for water in the other sectors; to extend and exchange projects so as to become the “dragging factor” which allows for the valorisation of the already existing initiatives, which have not yet become “system”; to integrate the institutional policies with the entrepreneurial initiatives and citizens participation. The Forum is articulated in thematic work groups in which both public and private actors participate.

Success factors

The success of this experience derives from the creation of a network among stakeholders and institutions which facilitates the distribution and the access to information and best practices. In addition to that another important aspect which led to the success of the initiative is the creation of different organisational levels that facilitates the concrete identification and implementation of the best policies and activities to raise awareness on water saving.

Results obtained

The creation and the development of the Forum brought to the realisation of several documents and publications resulting from meetings and conferences which took place over the years. The results produced are available in Italian on the Forum’s website. In December 2009 the Region Emilia-Romagna inserted the Forum in the Regional Law 27/2009, which will allow to structure it as a National Association for a better recognition of the work done so far by the Forum and for the further development and strengthening of the project. So far almost 700 individuals and 50 institutions and agencies have registered to the Forum and participate in the different working groups. Furthermore almost 2500 people have subscribed the newsletter.

Indicators used

Number of stakeholders registered to the Forum (750-800); number of subscribers to the newsletter (2500); number of participants to the Forum conference/workshop/seminar (400-500 per year).
Repeatability and Applicability
Highly applicable and repeatable networking system on water saving.

Total cost
150,000 € (approx.).

Further reference
www.forumrisparmioacqua.it
**Project description**

The permanent exhibition on irrigation technologies is aimed to provide farmers and technicians with clear, up to date information about irrigation technologies available on the market and to disseminate and provide training on High Efficiency Irrigation Technologies. Water saving novel technologies are presented drawing the attention of the end users and of the Extension Services on the opportunity to improve the irrigation water management at field or farm scale. The operating irrigation technologies are placed in open field. More than 50 models of drippers, 80 mini and micro sprinklers, movable sprinkler solid sets, pumps, filters, dosing or injection pumps for fertigation are composing the exhibition. The show is upgraded every year. During the visit a collection of publications, that popularizes bench test results of microirrigation materials, most of them included in the show, studies on irrigation technical-economic aspects and on irrigation water saving management, is distributed to the visitors. Students from High School of Agriculture and Agricultural Universities can take a practical class on irrigation technologies visiting the Permanent Exhibition. The permanent exhibition offers the opportunity to the irrigation water stakeholders (CER, CER's associated Land and Water Reclamation Bureau) to provide the basic knowledge addressing a more efficient water use besides the water distribution.

The permanent exhibition is among the actions taken to fulfill the water saving objectives set by the Regional Action Plan for Rural Development 2007-2013.

**Results obtained**

The indirect impact of the project on the water saving cannot be assessed.

**Success factors**

Stimulation of a water saving awareness and culture among end users. Fast and wide dissemination of novel irrigation technologies, boosting adoption of the more efficient technologies promoted and co-funded in the frame of the Regional Action Plan for Rural Development.

**Indicators used**

The exhibition hosted 350 groups of visitors, totalising more than 3500 farmers and technicians.

**Repeatability and Applicability**

Similar exhibition on irrigation technologies can be easily set up everywhere. Permanent exhibitions on irrigation technologies were set up in other Italian regions (Campania, Molise, Puglia, Sardinia) under the CER supervision.

**Total costs**

15,000 € per year.

**Further references**

www.consorziocer.it/ricerca_campi.html
<table>
<thead>
<tr>
<th>WG</th>
<th>D - communication/participation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Partner</td>
<td>P5 - ERR</td>
</tr>
<tr>
<td>Promoter</td>
<td>Comune di Sala Bolognese – Consorzio di Bonifica</td>
</tr>
<tr>
<td>Project</td>
<td>9 - Ecomuseo dell’Acqua (Ecomuseum on water)</td>
</tr>
<tr>
<td>Type</td>
<td>Education and awareness raising</td>
</tr>
<tr>
<td>Period</td>
<td>Since 2007</td>
</tr>
<tr>
<td>Location</td>
<td>Ecomuseo dell’Acqua - Cassa di Espansione del canale Dosolo, Via Zaccarelli, 16 - 40010 Sala Bolognese - BO - Italy</td>
</tr>
<tr>
<td>Target</td>
<td>Institutions, universities, associations, farmers, technicians, students</td>
</tr>
<tr>
<td>Level</td>
<td>Local/Regional</td>
</tr>
<tr>
<td>Contact</td>
<td>Emanuele Cimatti - <a href="mailto:ecimatti@regione.emilia-romagna.it">ecimatti@regione.emilia-romagna.it</a></td>
</tr>
</tbody>
</table>

**Project description**
Sponsored by the Municipality of Sala Bolognese and “Consorzio di Bonifica” (shared with Emilia Romagna Region and Province of Bologna) the “Ecomuseo dell’Acqua” museum illustrates the relationship between people and water in an area that for centuries has to deal with excesses of its rivers, beginning with the river Reno. The aim of the museum is the diffusion of knowledge of all aspects of the water world: technical, cultural, social and environmental. These didactic educational aims are achieved through organizing:
- Conferences, seminars, training courses;
- Activities: cultural, historical, social, environmental, and so on;
- Educational activities for schools;
- Non-profit activities.

**Results obtained**
Around 6000 visitors from 2007 to present.

**Success factors**
The secret of success is to communicate technical concepts easily.

**Indicators used**
Number of visitors, number of schools, number of events.

**Repeatability and Applicability**
The project is replicable, adapting to the aquatic environment of the area.

**Total costs**
1,000,000 €.

**Further references**
www.ecomuseodellacqua.it
Partner: P9 – REC
Promoter: The Regional Environmental Center (REC)
Project: 10 - The Green Pack Programme
Type: Education and awareness raising
Period: 2001 - 2011 ongoing
Location: EU Ms: Bulgaria, Czech Republic, Hungary, Slovakia, Poland, Other countries: Albania, Azerbaijan, Bosnia and Herzegovina, Kazakhstan, Kosovo, Kyrgyzstan, FYR Macedonia, Montenegro, Russia, Serbia, Tajikistan, Turkey and Ukraine.
Target: Children from grades 5 to 8, secondary school students and their teachers
Level: National, regional, local
Contact: Kliment Mindjov, Senior Expert, Regional Environmental Center (REC) - kmindjov@rec.org

### Project description
The Green Pack, a multimedia environmental education kit, intended primarily for secondary school teachers and their students about environmental protection and sustainable development. The Green Pack’s interactive and multi-media presentation makes it a lively source of information for anyone interested in environmental challenges. Inspired by the political process “Environment for Europe”, the Green Pack interactive educational materials have interpreted its sophisticated political messages on sustainable development by adapting them for teachers and students.

It includes a 200-page teachers’ guide, an interactive CD-ROM for students, a video-film collection, a board game and various other educational aids. Each Green Pack is adapted to a particular country, with national and regional information supplementing the core material.

The Green Pack has been produced in 18 national and regional editions, each one adapted substantively, in collaboration with national education and environmental ministries, to the particular country’s environmental context and translated into the relevant language or languages. Distribution is carried out in cooperation with national education ministries and targeted at school teachers via training workshops. National versions have appeared in Polish, Hungarian, Bulgarian, Czech, Slovakian, Russian, Albanian, Turkish, Macedonian, Azerbaijani, Croatian, Bosnian, Montenegrin, Ukrainian and a general European version has been produced in English.

The Green Pack includes 22 topics related to environmental protection and sustainable development, including water, divided into five chapters:

- Environmental Components: air, water, soil and biodiversity;
- Threats to the Environment: urbanisation, noise, waste and chemicals;
- Human Activities and Impacts: energy, transport, industry, agriculture, forestry and tourism;
- Global Challenges: climate change, ozone depletion, acidification and issues affecting seas and oceans;
- Values: ethics and values related to consumerism, human health and the environment, citizens’ rights and responsibility for the Earth’s future;

The chapter on water includes a section on reducing water use, saving water at home as well as conserving and protecting water in general.

Green Pack Junior, a version of the Green Pack specifically geared towards the educational needs of children from grades 2 to 6 and for schools with less technical equipment and fewer multimedia facilities. The materials are divided into 10 topics that look at the interaction between environment, society and economic development. These topics are used to demonstrate how human beings are
connected to, and how we affect, the environment in which we live and, most importantly, what this means for society.

Each topic comprises a structured lesson plan and the supporting materials required to plan and deliver a class on the subject. The lesson plans create an interactive way of learning by using discussions, brainstorming, role playing and outdoor activities. Each lesson plan provides the teacher with background information on the topic, teaching objectives, a methodology, the required materials, suggested timing and possible teaching locations. At the end of each lesson plan teachers will also find supporting factsheets and other tools such as colouring pages, tests and even fairytales. The topics present the key issues facing the world today: pupils are encouraged to think critically about them and to, ultimately, become involved citizens.

### Results obtained
Since 2001, the Green Pack has been implemented in 18 countries. Over 33,000 Green Packs have been produced, more than 35,000 teachers have been trained to use it, and some 3 million students have been taught using its interactive multi-media materials.

### Success factors
Each Green Pack is adapted to a particular country, with national and regional information supplementing the core material, in collaboration with national education and environmental ministries and local experts.

### Indicators used
Undeclared.

### Repeatability and Applicability
It has been already repeated, applied and adapted to 14 countries’ conditions. Lessons learned and methodology are available at REC.

### Total costs
Undeclared.

### Further references
Project website: [www.greenpackonline.org](http://www.greenpackonline.org)
[archive.rec.org/REC/Programs/Greenpack/gp_online.html](http://archive.rec.org/REC/Programs/Greenpack/gp_online.html)
**Project description**

The main aim of the project “Sharing waters” is to enhance biodiversity protection and nature conservation by improving water management in the Neretva and Trebisnjica rivers basin and to promote local organisations and cross-border exchanges between local organisations and people in the interest of managing shared resources. Nature Park “Hutovo blato” is selected for the conservation target of the highest priority. In water management terms, “Hutovo blato” represents summation of all upstream influences and it is a heart where waters from rivers of Neretva and Trebisnjica meet. In nature conservation terms, it is a Ramsar site, important for bird migration. There are endemic fish species and it is generally rich in biodiversity.

World Wide Fund for nature (WWF) Mediterranean Programme in collaboration with REC BiH established a team of respectful experts with task to analyse the water needs (quantity, quality and timing) of the key species (birds, fish and flora) of the Nature Park “Hutovo blato”. Beside biodiversity researches, hydrology and hydrogeology studies have been developed in order to understand complex water regime of Hutovo blato, which is situated in karstic area with vast number of underground connection that the nature uses to bring water in and out. The natural water regime is heavily disrupted by hydrotechnical infrastructure in upper parts of the basin, which jeopardises wetlands of Hutovo blato. The Sharing waters project aims to provide recommendations to secure quality, quantity and timing of water that would stop biodiversity loss.

**Results obtained**

The project expert team focused on the biodiversity needs in terms of water of Hutovo blato ecosystems. At this aim five most important areas for biodiversity (hotspots) have been identified which suffer of lack of water. The predominant ecosystems are floating meadows whose restoration is needed. The ecological needs of the five areas have been identified by the experts team and can be summarized in the following key parameters:

- At least 10 cm level of water is necessary between October – March;
- Up 10 cm in period April – June;
- Dry period from July to September except the streams of Hutovo blato and Derane lake which must never dry up in any period of the year.

**Success factors**

The project team has been discussing all potential solutions that could secure favourable conditions in the five hotspots. There is a list of seven solutions as the outcome of various brainstorming internally and externally of the experts team. It is important to remark that each of them has pros and cons that must be carefully evaluated.

The first group of solutions consisted of bringing water to these hotspots using natural underground connections between Popovo field and Dabarsko field with Hutovo blato i.e. to literally mimic natural flows. These solutions would be the most favourable but they are interrelated with many uncertainties and some of these solutions would be technically hard to achieve.
The second group of solutions are technically based. These solutions would be more effective in terms of providing waters but one needs to be very careful because they have some possible adverse effects that can pose an additional threat to Hutovo blato’s biodiversity.

**Indicators used**

In order to further investigate influences of water regime to biodiversity in these five hotspots, the team has set up monitoring plans for water quantity, quality, ichthyology, ornithology and flora.

**Repeatability and Applicability**

Experience can be repeated and applied in any transboundary river basins taking into account the specific conditions.

**Total costs**

250,000 € (approx.).

**Further references**

[www.panda.org/what_we_do/where_we_work/mediterranean/about/med_freshwater/neretva/](http://www.panda.org/what_we_do/where_we_work/mediterranean/about/med_freshwater/neretva/)
### Project

**12 - ACCRETe Project/Agriculture and Climate Changes: how to Reduce human Effects and Threats**

**Type**  
Awareness raising and education

**Period**  
2005 - 2007

**Location**  
Number of countries: 6  
Italy, Czech Republic, Greece, Germany, Romania, Slovenia

**Target**  
Farmers, decision-makers

**Level**  
Interregional, national

**Contact**  
Dr. Anne Storz/team leader of the project - comess@interfree.it - info@accrete.eu  
Dr. Elena Mateescu/NMA - elena.mateescu@meteoromania.ro

### Project description

The aim of the project was to make private and public actors of the agriculture sector sensitive to possible consequences of climate change on agriculture production. Also, the project aimed to make people and agricultural users fully aware of this connection in order for them to assume proper attitudes, achieve new technologies and also promote a sustainable agriculture.

**Goals:**

- Be aware of the mutualism “agriculture – climate change”;  
- Make private and public actors of the agriculture sector sensitive to the possible production consequences caused by this interaction;  
- Improve forecasting – and preventing systems of natural risks affecting agriculture (network).

The project included: study phase, transnational exchange of experiences, observation, information, dissemination through new products (DVD, code of attitudes, Declaration…).

### Results obtained

The project ACCRETe intended to achieve the following results:

- **Observatory:** establishment of a transnational network to examine how agriculture interferes with climate change in the partner regions.  
  **Aim:** to monitor the mutual relationship between agriculture and climate change in the partner regions, specifically to analyze the data referring to the dosage CO2 and the measurement of UV radiation increase. Results: specific website and publication of the collected data;

- **Thematic Workgroups:** information, promotion and dissemination through three thematic work groups to change attitudes and raise awareness for the link between climate change and agriculture, also involving local actors;

- **Chirsovoi, Greece – February 2006. Topic:** develop renewable energies and implement controlling of energy and energetic effectiveness in agriculture;

- **Potenza, Italy – November 2006. Topic:** how to transfer patterns of better water resource management to agriculture and reduce the climate change effects;

- **Parma, Italy – February 2007. Topic:** increase more sustainable cultivation methodologies, particularly organic farming;
• Code of Attitudes for farmers (on DVD). This presentation summarizes risks for agriculture that are due to climate change. It will also promote attitudes which should help to reduce human-induced impacts on the climate.

The Code of Attitude was disseminated by all partners to specific users of each member country, respectively to the ministries in decision-making position, to the farmers for implementation of technologies in current practice. Also, on February 21, 2008, Ministry of Environment in collaboration with the Chamber of Deputies of the Romanian Parliament organized a Conference called “adaptation and mitigation of climate change” where these products were presented to publicize and implement project results.

• A Transregional Declaration of Intents: “Transregional Understanding ACCReTe”. All partners undersigned the declaration that shows they are firmly willing to follow up with research, cooperation, support of sustainable agriculture and activities in the issues.

• An Awareness Campaign, to inform citizens about risks that are due to climate change. Particularly repercussions on agriculture will be stressed. “We still have time!” - the ACCReTe Project’s video-spot is the basic message of this project directed to creating a new attitude towards the environment and making people more sensitive to the risks, in order to tone down human-induced effects on climate change.

Success factors
• The Code of Attitudes for farmers represents the main instrument to be used by the political actors for raising the farmers’ awareness on the necessity to adapt actual technologies to climate change. Furthermore, this code is meant to reduce the anthropogenic impact upon climate.

• The video-spot and all products (case studies presented at the project thematic groups and Declaration) was translated in the language of all partners, including English version.

• Publications of the exchange of transnational good practices on sustainable agriculture and scientific publication regarding the results of the scientific observatory.

Indicators used
The Code of Attitudes for farmers:

• The main agricultural activities impacting climate are outlined, together with the list of good practices farmers can adopt to reduce impacts and vulnerability.

The chapter 3 contains the main agricultural activities and their specific aspects impacting climate. Treated topics are:

3.1 Crop Management and land use;
3.2 Soil management and fertilization;
3.3 Livestock managements;
3.4 Water management;
3.5 Renewable energies and energy efficiency.

For each of the main agricultural activities, a general description of its mutual interactions with climate is reported. Suggestions for the adoption of best practices are given with emphasis on benefits for farmers and environment.

For example, Chapter 3.4.1 Irrigation best management practices

Good practices:

• Rate irrigation highly within the management system;

• Know the soils property like capacity of soil to hold water, and where in the soil profile the roots of the crop are;

• Design and maintain irrigation systems correctly. Irrigation system setup, age and maintenance are limiting factors in their ability to manage irrigation;

• Monitor all aspects of each irrigation event before, during and after the irrigation. Deciding of when, monitoring of where water is going, both during the irrigation, by measuring system performance and uniformity of application, and after the irrigation, by assessing under- and over-irrigation;

• Use more than one objective monitoring tools to schedule irrigation. The most common and simplest included digging holes to check soil water, observation of the appearance of plants and the checking of test-wells or drain flows after irrigation and subsequent adjustment in practice at the next irrigation;

• Retain control of irrigation scheduling. With modern technology, it is possible to set up irrigation systems to operate entirely automatically, based on the readings from a probe or a set of probes;

• Use software for water balance, running on personal computers or on web servers. Models for practical use must be simple, avoiding too many parameters, useful only for experimental purposes.
Farmer benefits:
- Optimal use of irrigation water.

Management practices:
- The message of videospot is: “We all are responsible for climate change and individuals can and need to do the right thing to limit this threat the sea, water, mountains, snow nature is harmony…balance it is our home…it is the world we live in yet, something is changing fruits of the earth do not have water enough to grow man has become an arrogant polluting presence…so nature defends itself stop all this, be environmentally-friendly…We are still in time!”

**Repeatability and Applicability**
The Guide can be used as a model for other good practice guides, for example with special reference to drought and desertification, or floods. The exchange of experience creates the opportunity for other approaches than the current status.

**Total costs**
750,000 €.

**Further references**
Web page: www.accrete.eu

publications:
- Elena Mateescu (2007) – “EU-ACCRETe Project – Agriculture and Climate Change: how to reduce human effects and threats. Presentation of the case studies presented at the project thematic goups”, Publisher by Municipality of Chrissopolis, Greece, pp. 11-14, 14-18, 20-22;
- Elena Mateescu, V. Turcu (2007): “EU-ACCRETe Project – Agriculture and Climate Change: how to reduce human effects and threats. Regional facts and challenges” - Chapter 2 – Climate change in Europe and Chapter 3 – Regional climate change impacts on agriculture, Publisher by University of Rostock, Germany, pp. 18-71.
<table>
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<tr>
<th>WG</th>
<th>D - communication/participation</th>
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<td>Provincie Noord-Brabant Telos – Brabant Centre for Sustainable Development, University of Tilburg</td>
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<td>Project</td>
<td>13 - The People-Planet-Profit Scan (PPP-scan)</td>
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<td>Type</td>
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<tr>
<td>Period</td>
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<td>Location</td>
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<td>Target</td>
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<td>Level</td>
<td>Regional, Local</td>
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</table>
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John Dagevos - jldagevos@uvt.nl |

**Project description**

The PPP-scan is an internet based tool for assessing and promoting sustainable development. It is built for use in early planning stages (ex ante), when major decisions still have to be made and adapting plans to new needs and insights is still possible. Groups of stakeholder may use the tool to explore expectations and common goals in a structured way. Based on a questionnaire and a set of long term sustainability demands for the people, planet and profit domain, the scan presents strong and weak points of a plan/project and provides insight in the amount of (dis)agreement between stakeholders. The outcome of the scan should be used for further discussion among stakeholders, leading to consensus on improvement of the assessed project.

The tool has been designed on basis of a method developed by Telos (the Brabant Centre for Sustainable Development at the University of Tilburg). Another application of this method is the Sustainability Balance Sheet, used for ex-post monitoring of the development of a specific region from the perspective of sustainability.

A Sustainability Balance Sheet of Brabant has been made every four years since the late nineties. Because of its wide use, the Telos method has become the ‘common language’ of sustainability in Brabant.

**Results obtained**

As using the tool effectively leads to improved plans (and thus the original plans are never executed), measurable results are hard to obtain. However user reviews provide some insight in the effects of the PPP-scan. A wide array of users (regional government, Municipalities, NGOs, business organisations) value the PPP-scan as easy to use and effective in improving the ‘sustainability’ of projects. In provincial policy making, the use of the tool contributed to the development of projects focussing on the use of economic drivers for water management (including dealing with water scarcity and fresh water supply). Use of the PPP-scan is promoted by the Social-Economic Council (Sociaal Economische Raad), an influential national advisory board.

**Success factors**

The PPP-scan has been used in a large number of projects, ranging from the planning of new estates and the development of a shopping mall to the definition of a new provincial water plan. It is also applied in several other Dutch provinces and – through some Interreg projects – in other regions in Europe. Recently there has been interest in using the PPP-scan for water management in Eastern Turkey and desert development in Egypt.

Key factors of success are:
- Universally applicable;
- Simple set up and easy to use;
- Effective in project development and communication;
Providing a common language for sustainable development;
Integrating ecological, economic and social issues;
Freeware.

**Indicators used**
The PPP-scan does not provide an objective outcome (like the sustainability of a project is 7 on a scale of 10), but shows expected effects (based on opinions) on ecology, economy and society of proposed projects and plans. In this sense it is a planning and communication tool, aimed at improving projects in an early planning stage.

**Repeatability and Applicability**
Experience with application in projects in the Netherlands and abroad shows the PPP-scan can be used in very different projects and very different settings. In dealing with water scarcity its strength lies in integrating the ecological, economic and social dimensions of this issue. In this it supports thinking ‘out of the box’, leading towards innovative solutions and new coalitions between stakeholders.

**Total costs**
There are no costs for users of the PPP-scan (freeware). Customising or translating the tool is possible on request.

**Further references**
The scan itself (English version) can be found on: www.pppscan.org
A description of the method (in Dutch) is available at:
www.brabant.nl/dossiers/dossiersapthema/milieu/milieuinformatie/meteenvandujzzaamheid.aspx/-/related/Hb75722d04247e0a4e15a1b1aed33ef
An introduction on the use of the tool for water management (in English) is available at:
www.telos.nl/Publicaties/PublicatiesArtikelen/76822.aspx?g=Grov%20with%20the%20flow
**Project description**

There is a relation between the consumption of products and the impact on water systems everywhere in the world. Many of the goods consumed in a country or region are not produced there but come from abroad. Some goods, in particular agriculture-based products, require a lot of water during their production.

The Waterfootprint is an indicator of direct and indirect water use of consumers and producers. The Waterfootprint of an individual, a community or business is defined as the total volume of freshwater that is used to produce the goods and services they consume.

Global pressure on freshwater resources is increasing, because of a growing demand for water intensive products such as meat, sugar and cotton, mainly caused by changes in global population and income levels. Therefore, it is vital that we understand the link between food water resources in numerous areas of the world.

The Waterfootprint can be used as a tool to achieve that issues like water shortages and pollution can be better understood and addressed by considering production and supply chains as a whole. In this way, governments, civil society communities, business, but also consumers can play a role in achieving a better management of water resources.

Governments can and should engage with consumers and businesses to work towards sustainable consumer products. They can promote product transparency by means of voluntary agreements per sector, standard setting, labelling or eventually legislation. For example: 80% of the winter strawberries exported to Northern European countries are from the Cota Donana, a sustainable wetland in the South of Spain. The harvest of these winter strawberries costs huge amounts of water which causes severe drought. Many producers in this region extract groundwater in an illegal way. In Holland, a big supermarket has made an agreement with some growers in Spain because they export only strawberries grown in a sustainable way (legal and less water use, less insecticides etc.).

To achieve that Brabant will be considered as a sustainable province it is important to communicate about the waterfootprint to producers and consumers. Agreements with business, stakeholders, environmental foundations and other governmental authorities (national and international) can lead to important communicative tools to realize this.

**Results obtained**

The waterfootprint is not used yet as a standard method, but nevertheless there is interest from business to give product transparency and to support regulation from governments. Some companies already initialized their own (not standardized) labelling.

The Waterfootprint Network invites stakeholders with an interest in the Waterfootprint concept to become partner to jointly execute research and Waterfootprint projects, to share practical knowledge and get involved in open debates on critical issues related to Waterfootprint and sustainable water management.
Otherwise there are many figures about the Waterfootprint of Dutch consumers, published by Prof. André Hoekstra, University of Twente, developer of the Waterfootprint. Especially the Waterfootprint due to the consumption of agricultural products can be specified further into product categories.

Reducing the Waterfootprint can be part of the environmental strategy of a business, just like reducing the carbon footprint. Second, many businesses actually face serious risks related to freshwater shortage in their operations or supply chain. What is a brewery without secure water supply or how can a company in jeans survive without continued supply of water to the cotton fields? A third reason to do Waterfootprint accounting and formulate measures to reduce the corporate Waterfootprint is to anticipate regulatory control by governments. In the current stage it is not so clear how governments will respond, but obviously regulations in some sectors of business may be expected. Finally, some businesses see a corporate Waterfootprint strategy also as an instrument to reinforce the corporate image or to strengthen the brand name.

Success factors
First of all, environmental awareness and strategy is often part of what a business regards as its ‘corporate social responsibility’. Reducing the Waterfootprint can be part of the environmental strategy of a business, just like reducing the carbon footprint. Second, many businesses actually face serious risks related to freshwater shortage in their operations or supply chain. A third reason to do Waterfootprint accounting and formulate measures to reduce the Waterfootprint is to anticipate regulatory control by governments. Finally, some businesses see a corporate Waterfootprint strategy also as an instrument to reinforce the corporate image or to strengthen the brand name. When information is available on the impacts of a certain article on the water system, consumers can make conscious choices about what they buy.

Key factors of success are:
- Universally applicable;
- Cooperation with business and foundations;
- Cooperation with Waterfootprint Network;
- Effective in project development and communication;
- Providing a common language for sustainable development;
- Integrating ecological, economic and social issues;
- Freeware.

Indicators used
The Waterfootprint does not provide an objective outcome (like the sustainability of a project is 7 on a scale of 10), but shows expected effects (based on opinions) on ecology, economy and society of proposed projects and plans. In this sense it is a planning and communication tool, aimed at improving projects in an early planning stage.

Repeatability and Applicability
First experience with application in projects shows the Waterfootprint can be used in very different projects and very different settings. In dealing with water scarcity its strength lies in integrating the ecological, economic and social dimensions of this issue. In this it supports thinking ‘out of the box’, leading towards innovative solutions and new coalitions between stakeholders.

Total costs
Freeware.

Further references
Information about the Waterfootprint (English version) can be found on:
www.waterfootprint.org
**Project description**

The handbook aims to enlighten the decision makers on the advantages of various alternative resources. It will allow to describe the general conditions of the ecological, technical and economic measures (for instance the focus on financial balance of water departments).

**Results obtained**

The handbook issued on the whole territory should provide useful tips at different steps of the decision-making process from the very first choice between a large range of water recovery options to the operational phases. A set of individual records of the handbook summarizes who-does-what, how, at which cost, under which safety conditions,...etc.

The rain water recovery policy will be issued on a large scale and for multiple market targets throughout downloaded files on a website.

**Success factors**

The General Council of Herault has commissioned a survey office to conceive the handbook, sum up the knowledge on this topic, and carry on a communication file addressed to the local authorities.

**Indicators used**

- Number of calls for information.
- Number of implementations or projects fulfilled.

**Repeatability and Applicability**

Information spread throughout the guide, updating (especially in a fast running technical evolution) taking into account experience feedback and use of the guide for local training sessions and the e-learning program.

**Total costs**

30,000 €.

**Further references**

Website:
- [www.herault.fr/environnement/publication/guide-ressources-de-substitution](http://www.herault.fr/environnement/publication/guide-ressources-de-substitution)
- [www.herault.fr/environnement/eau-potable](http://www.herault.fr/environnement/eau-potable)
### Project 16 - Awareness campaign in schools for the promotion of water savings and distribution of small water savings kits

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<td>16 - Awareness campaign in schools for the promotion of water savings and distribution of small water savings kits</td>
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</table>
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Philippe Lenoir - plenoir@cg34.fr  
Coopere34 - info@coopere34.org |

#### Project description

The pedagogic project has been set to encourage pupils toward a better understanding of impacts about water shortage and establish a diagnostic either at school or at home. The program includes also the correct use of water saver devices and developing behaviours in water savings.

The aim of this initiative was also to test the implementation of water saving equipments (hydroeconomic kits) within households in Herault.

#### Results obtained

The project was implemented in an experimental way in 37 classrooms and touched roughly 970 kids.

#### Success factors

Both teachers and associations involvement in designing and implementing the pedagogic program. It was created and conducted in school with the active engagement of environmental education actors.

#### Indicators used

Pedagogic projects were assessed according to different criterions:

- Home equipments of water savings devices;
- Volumes of water saved in schools;
- Volumes of water saved in each family.

#### Repeatability and Applicability

Amongst numerous actions the General Council of Herault wishes to promote the dissemination of awareness campaign in the framework of a planning and a coordinated policy. Under those conditions the reiteration of measures to promote water savings can be deployed successfully.

#### Total costs

34,630 €.

#### Further references

Website:  
www.herault.fr/environnement/eau-potable