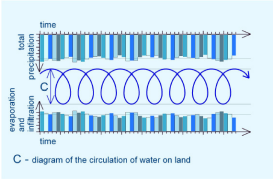
RAIN WATER AND FUNCTIONS OF THE LAND

Basic functions of the land in circulation of rainwater are as follows:

- Infiltration of rainwater into soil and groundwater
- Evaporation from soil, vegetation and surface water bodies
- Surplus water run-off from the land through river network of the watershed

STABLE WATER REGIME OF THE LAND - STABLE WATER CYCLE

A healthy land has a stable water regime, with the stable water cycle.



C - diagram of the circulation of water on land

FORMULA OF LAND WATER BALANCE

$$R = E + Q + \Delta V$$

- **R** - precipitation levels over land (per year in mm)
- **E** – evaporation from land (per year in mm)
- **Q** – surface and groundwater runoff (per year in mm)
- **ΔV –** change of water quantity in system (per year in mm), e.g. in watershed.

THE NEED OF REFORM AND INTEGRATION OF THE EUROPEAN COMMUNITY POLICIES IN THE AREA OF WATER - SOIL - CLIMATE

Presented document is relevant to European Community policies in areas:

Water, soil, climate, energy, waste, sustainability, Cohesion Policy, Rural Development policy, Common Agricultural Policy, competitiveness and economic growth, science, research and education.

The greatest challenges for the new programming period of the European Union

While we are currently in the process of implementation of European Union (EU) programming period 2007-2013, directing huge financial resources to different policy areas, in parallel with this process started revision of the policies to determine their future beyond 2013. The greatest challenges that have to be reflected in the EU legislation and budget are those fighting climate change, maintaining economic and population growth and global security.

European Union polices

Policies of European Communities solve the most significant problems in different economic, environmental and social fields of European space development, with a strong support from EU budget. Along with undisputed will to achieve sustainable solutions and tangible results, reality shows that some **processes, such as the climate change, are going beyond control. Their comprehensiveness and speed stagger everyone - from individual citizens to experts and politicians.** While the current European research pays primary attention to investigation of climate change and mitigation of its effects through reduction of greenhouse gases, other known but less medialised aspects of climate change such as landscape and surface changes are taken into consideration only marginally. **Progressing landscape change leads to alternations of its water regime which, proven by measurements, most significantly influence water circulation, energy exchange and mechanism of atmospheric processes in the lower part of the atmosphere – troposphere.** As a result, distribution of precipitation is changed in time/space, intensity and frequency of extreme weather events grow and climate gradually changes. Theses eco-system interactions are of a holistic nature. Therefore, it is obvious that understanding and matching of such holistic interactions by different directorates, ministers and agencies is fairly limited by their own competencies. Implementation of appropriate policies in practice needs inter-disciplinary and cross-sectional approach. Moreover, sectional or bureaucratic approach usually limits opportunity to investigate and solve holistic issues due to the fact that it is too narrow for innovation and reform processes.

Water policies and their connection with other European Union polices

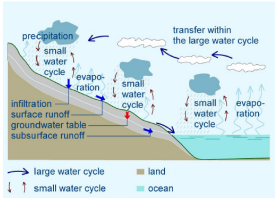
Water cycle on the land or on the Continent is a comprehensive and permanent process which has no political and administrative boundaries. Good news is that despite lack of will to study and solve climate change process on a holistic basis, preamble and philosophy of the EU Water Framework Directive is the closest to this comprehensive view. There are many directives, regulations and documents connected to the Water Framework Directive, e.g. Directive on the Assessment and Management of Flood Risks, Urban Waste Water Treatment Directive, etc. In addition, many other polices relate to water policy and especially Common Agricultural Policy, Communication on water scarcity and droughts, Soil Policy, European Parliament resolution on this summer's natural disasters (2007) and adaptation to climate change. Equally important is a policy concerning protection of consumers who can influence setting of water price and other financial policies aiming at elimination of cross-financing among policies. In this context, most statements of the European Community about natural disasters and fighting climate change are in fact related, with respect to causes of such phenomena, to water problems, distorted water regime and the water cycle.

Why is it important to talk about relation of water and climate policy?

Industrial revolution, ability to change the Earth surface on a huge scale, providing landscape changes without considering changes of water cycle and energy flows causes gradual destruction of stabile water circulation above the landscapes. It causes the microclimate and regional climate changes and more frequent and various extreme weather events. A massive interference of the mankind into the hydrological regime along with six-fold increase of the Earth population over the past 200 year significantly endangered water security in different parts of the world. Interaction of key natural components that has influence on thermal and water stability of the landscapes and ecosystems “water-atmosphere-soil-vegetation” is underestimated.

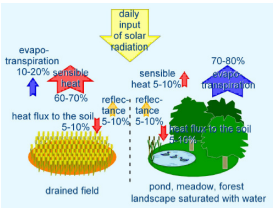
STRUCTURE OF WATER CYCLE OVER THE LAND

Water circulates in the following chain: spatial transfer of vapours over the land, precipitation, infiltration into the ground, surface runoff and groundwater discharge, evaporation from vegetation, soil and surface-water bodies. Water circulates in small and large water cycles.



RELATION BETWEEN WATER AND ENERGY

If there is insufficient water in the soil, on its surface and in plants, immense flows of solar energy cannot be transformed into the latent heat of water evaporation but are instead changed into sensible heat.



VALUE AND IMPORATNCE OF RAINWATER

Generally, rain is perceived as something obvious, and rainwater is often regarded as a burden which has to be eliminated especially in urban areas. However, rain water is a valuable asset and a primary source of water recharge in the land and watershed, which has to be protected and used.

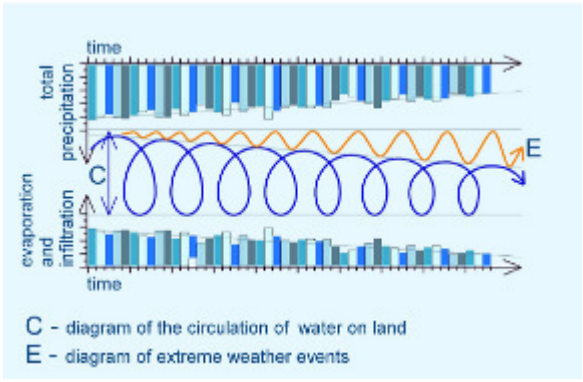
Landscape changes lead to changes in water cycle and energy flows

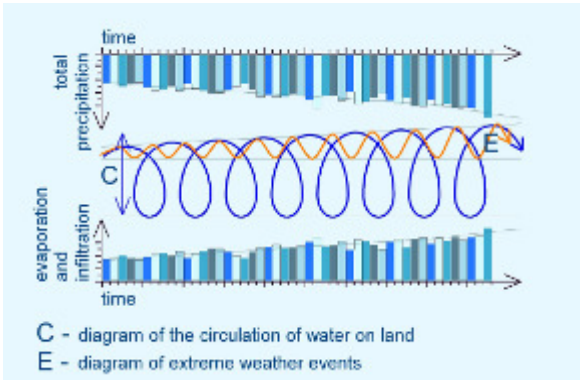
Construction, investment and economic activities in the land permanently decrease vegetation cover, natural retention capacity of watersheds, soil humidity, surface water volume, limit infiltration and evaporation which in turn has a direct impact on shortages of ground water resources and overheating of the land surface. Each year, area of build up and de-forested land is growing on a limited area of continents, counties and cities. Until now, water from many areas is drained by "melioration" systems and pumping stations. In some countries, natural streams have been canalized on a massive scale. So, water courses have been changed to channels which drain the country, instead of taking away surplus water only. With the modification of the land water regime, more solar energy is transformed into sensible heat at the expense of solar energy dissipation into latent heat of evaporation. Accumulation of the heat over urban areas and agricultural land causes microclimate change with many negative consequences, including changes of stabilised precipitation patterns, more frequent and intense extreme weather events, variations in ecosystems and impacts to human health. Problems are deepened due to setting of EU and national funding schemes, combined with a lack of knowledge on the need to preserve stable water cycle and water regime of the land.

Algorithm of the current development

Human activity gradually:

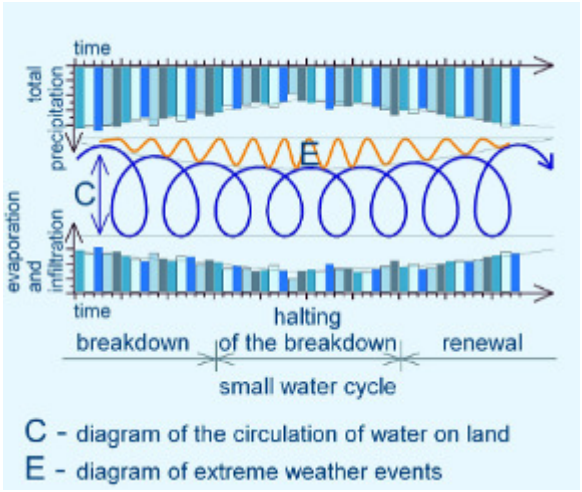
- changes structure and surface of the landscape
- changes time and space distribution of precipitation during the year
- decreases long-term sum of precipitation in Southern Europe
- increases long-term sum of precipitation in Northern Europe
- decrease of minimal and increase of maximum flows in water courses
- increases extreme weather events and their impact (floods, forest fires, etc)
- causes drying up and overheating land (creation of urban and agricultural "heat islands")
- decrease of groundwater levels, soil humidity and gradual desertification
- causes losses of forest land and areas covered by vegetation
- decreases biodiversity and ecosystem stability
- deepens soil erosion and sea levels rise





Algorithm of the possible change of current unfavourable development

The part of climatic change which is the result of human activities (draining of a land), can be reversed through systematic human activity (the watering of a land). The watering of land can be achieved through saturation of the small water cycle over land by comprehensive program of rainwater conservation, infiltration and evaporation. This can help to achieve the renewal of the small water cycle over a region, temper microclimate and extreme weather events and ensure a growth in water reserves in the territory.



Efficient use of the rainwater by landscapes

In the atmosphere, clouds are transporting water in forms of vapours which evaporates from the Earth surface and returns to the Earth from precipitation falling on the land. There is an open discussion whether clouds contribute to warming or not. The fact is that around half of the Earth surface is permanently covered by clouds and thus reducing direct sun radiation on the Earth. In the healthy land, where the water cycle is going, a key question is whether there exist conditions for regular distribution of precipitation over the year as well as regulation of natural evaporation through vegetation, rather than quantity of clouds and volume of vapour in the atmosphere. An accompanying sign of warming, which is more water evaporation into atmosphere, however, does not mean that more water resources should be generated on the continents. The land will not use efficiently too much precipitation from extreme storm clouds and on the contrary, it utilises only a small portion of rainwater. The land would indeed use the same volume of water more efficiently when precipitation falls down over longer time periods. Today, an impact of land adjustments on changes of water regime and subsequent climate change is still marginalised and influenced by many myths.

Comparison of starting points and approaches of the new and old water paradigm

Old water paradigm	New water paradigm
Water in the land has no impact on global warming, which is caused by rise in greenhouse gases concentrations from human activity.	An important factor in global warming is the change of water cycle due to water drainage, deforestation of continents by human activity and subsequent overheating.
Research is focused on impact of climate change on the water cycle.	Research is focused on impacts of water cycle changes on climate change.
Urbanisation, industrialisation and economic use of the land have a marginal impact on the water cycle.	Urbanisation, industrialisation and economic use of land (approximately 40% continent size) have a fundamental impact on the water cycle.
Rainwater is an inconvenience and needs to be quickly removed.	Rainwater is an asset that needs to be retained in soil/plants.
Sectional approach to water resources management in the land.	Integrated management of watersheds and ecosystem management of water resources in the land.

Integrated Water Resources Management (IWRM) in the land

Definition of Integrated Water Resources Management

Integrated water resources management (IWRM) is a complex process of assessment of an impact on water discharge and recharge from/to ecosystems including use and protection of water resources in the land which respects the water cycle in ecosystems as well as stability of the water regime.

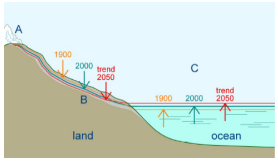
Principles of integrated water resources management in municipalities and their watersheds:

1. Principle of spatial protection of water resources in the land and priority implementation of spatial flood prevention measures in watersheds
2. Principle of respecting importance of rain water as well as the role of landscape in rain water distribution
3. Principle of cooperation and association of real estates owners/co-owners in order to protect and use rain water and to protect soil against erosion
4. Principle of impact assessment of planned construction, investment and economic activities on water cycle in the land
5. Principle of reassessment of present land adjustments which influence water balance and water regime of the land and their compatibility with integrated water resources management
6. Principle of sound waste water treatment and economic analysis of the most cost effective system of drinking water supply and waste water treatment/sewage system
7. Principle of efficient water resources management and water recycling
8. Principle of establishment and implementation of real price of water
9. Principle of preparation and approval of municipal integrated water resources management plans as a local part of river basin management planning process

SIGNS AND FEATURES OF DISTURBED WATER REGIME IN LAND

- floods and draughts
- frequent forest fires
- sudden weather changes
- abnormalities in usual weather conditions - destructive storms, abnormal precipitation levels
- increase of temperature extremes

Today, changes of water regime in land are almost completely refereed to global warming. However, this omits a fact that CO_2 presence is a condition for the process of photosynthesis.



Therefore, correlation and proximity of relation between causes and signs of climate change, taking into consideration two main probable reasons for change of climate (rise of CO_2 levels in atmosphere or change of land hydrological cycle), is more visible, logic and probable during landscape adjustments and deforestation.

A shortage has to be compensated

A failure of the land to promote its water-related functions has to be assisted with the following:

- adequate water retention volume
- adequate support to surface evaporation
- adequate support to infiltration to soil and ground

Preconditions for Integrated Water Resources Management:

- Legal environment and suitable motivation tools (financial and non-financial)
- Cooperation and co-responsibility of each owner/co-owner of the land/property
- Integration and harmonisation of isolated and individual policies influencing water resources management on the local, regional and national levels
- Integrated water resources management based on retention of rainwater "in situ" along with draining only natural surplus water by river network in the watershed

Possibilities of the European Community - a need for action

- Water retention measures (which are very often identical with anti-erosion and flood prevention measures), including program of re-forestation a re-greening of un-utilized land in watersheds should become a new pillar of Common Agricultural Policy and Rural Development Policy.
- Supplement the four aspects (turn down, switch off, recycle, walk) of the campaign "You Control Climate Change" with the fifth one **"re-water and re-forest",**
- Reform of Common Agricultural Policy, Cohesion Policy and Rural Development Policy with the creation of a new pillar **"Renewal of Water Regime on the Land,"** through water farms and water communities, which would advocate different measures (technical and bio-technical) and ways of land management, e.g. introduction of surface no-tillage methods in the frame of farming practise, with active participation of all land, property and infrastructure owners
- Application of a new generation architecture and urbanism conscious of soil and water cycle protection
- Declaration of the European Community on the need of water cycle restoration and stability on the European continent
- Introduction of a new level of water planning. Water planning on national (national water plans) and watershed level (river basin management plans) should be extended with local water policy planning - integrated water resources management plans of local municipalities. Local level enables integrate various stakeholder's interest and responsibilities towards water use and protection.

Costs of the solution and financing opportunities

The new water paradigm represents an investment for improvement of the climate and provision of sufficient water resources, which is affordable from financial and time point of view. In order to cover implementation of the necessary measures, it is expected to earmark resources on the level of 0.1-0.2% of the annual national GDP over the time period of 10-15 years. These resources are equivalent to the costs needed for preparation and implementation of surface flood prevention measures (anti-erosion and water retention measures) and re-forestation programs in the land. Average costs for renewal of the small water cycle (increase of water retention potential and decrease erosion processes) calculated on surface unit of the land depends on nature of the land, morphology and the nature of intervention. The above mentioned measures do not require massive investments/construction, are cost effective and use local construction material and workforce. Later on, landowners will be responsible for maintenance of the implemented measures in the land. It would create a useful level of primary and secondary employment on the local, regional and global level. Therefore, this approach is not only the most cost effective but the most natural and systematic than other proposed solutions for adaptations to climate change.

Virtually, implementation of the new water paradigm can be financed from existing schemes on the EU, national or regional levels with the support and participation of local municipalities and land owners. On the EU level, Common Agricultural Policy and Cohesion Policy resources can be used together with national support schemes, after reassessment of their priorities.

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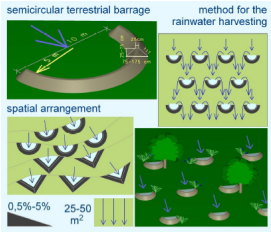
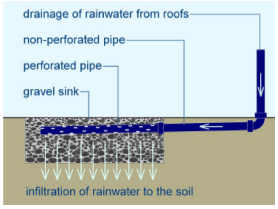
Editor of the information leaflet: Martin Kováč, August 2008, Slovakia

Rainwater retention "in situ"

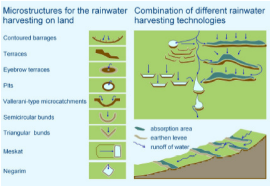
Rainwater has to be ideally retained on the place where it falls down in the form of precipitation.



In case of urban and build up areas, it may be necessary to implement alternative measures - technical, bio-technical and economic.



At the same time, the land surface has to be covered by sufficient vegetation as prevention against land overheating.



The proposed measures therefore help to secure enough water resources in quantitative and qualitative terms.