ClimateWater Project Mid-term workshop
Task-leader report for
Topic 2.1.1: Direct impacts on the life and health of the population and the wealth of the nations

by Géza Jolánkai

'VITUKI' Environmental and Water Research Institute, Budapest

This report is a highly condensed, digested summary of the thematic focus reports, which were prepared by various project partners for the main themes of this sub WP. These main themes are given below, as of the DoW of the project, giving the short description and (in brackets) the partner who made the thematic focus:

- **Floods** with special regard to the recently observed dramatically-rising peaks (like the nearly annual record breaking highest floods in many parts of Europe) (Thematic Focus by P6, Geonardo, **Annex I to this report**).
- **Water supply** with special regard to the availability of the quantity of drinking water resources and to the expected changes in water demand. Subdivision according to water resource types is needed like groundwaters, including karstic, shallow phreatic, and deep confined, surface inland waters, rivers lakes, reservoirs, coastal waters and seas (Thematic Focus by P3, CNR-IRSA, **Annex II to this report**)
- **Water quality** with special regard to the changes of water quality of drinking water resources (surface and subsurface) and to the quality of irrigation water. Water-contact recreation will be addressed from the water quality point of view. (Thematic Focus by P1, VITUKI, **Annex III to this report**)
- **Excess waters** such as inundation, mud-and snow- avalanches, hail-storms, etc. stemming from never previously-experienced extreme precipitation (Thematic Focus by P2, UNIDEB; incorporated in thematic focus on floods, **Annex I to this report**)
- **Droughts** and **water scarcity** with special regard to rising trends that may occur on the same place and in the same year as the extreme floods; the problems in the Mediterranean with regards to **water stress**, problems in cities, etc. as well as other implications on water management (Thematic Focus by P9, SHMU, **Annex IV to this report**)

This report is a highly condensed, digested summary of the thematic focus reports, which were prepared by various project partners for the main themes of this sub WP. These main ther
bra

For table of content

This was the first page of the Task leader report, consisting of 4 major chapters and their „thematic focus" annexes, each of which are several dozen pages (e.g., cannot be fully covered by one person).

These will be reported here by the representatives of the respective partners:

Floods and excess water – P6 Geonardo

Water supply – P3 CNR IRSA

Water Quality – P1 VITUKI

Drought and Water scarcity – P9 SHMU

An I will also report on water management

P9, SHMU, **Annex IV to this report**)

CLIMATEWATER

Bridging the Gap between Adaptation Strategies of Climate Change Impacts and European Water Policies

Thematic Focus evaluation for

Water Quality

of **WP 2 – Analysis and synthesis of water related climate change impacts**

Sub WP	2.1 – Water management and other water-related impacts on the society and on the economy		
Topic	2.1.1 – Direct impacts on the life and health of the population and the wealth of the nations		
Partner making the focus	Partner 1: VITUKI (H), refs: 2, 4, 6, 7, 9, 11	**Contributing partner(s)**	Partner 3 CNR-IRSA (I) Refs:1, 3, 5, 8, 10
Description as of DoW: Water quality with special regard to the changes of water quality of drinking water resources (surface and subsurface) and to the quality of irrigation water. Water-contact recreation will be addressed from the water quality point of view			
Notes on the items of this summary	First the site/region and type(s) of water resources affected are mentioned for each reference. Next some essential short statements of the reference are given, followed by short explanation of the processes. References are given on the end of the study. Classification of the Impact according to the DPSIR approach can be given (whenever appropriate). Adaptation strategy should be included (if any). Notes of the person making the summary may be added (on adaptation strategy and other). More details of the original processed documents are also attached in the relevant annexes.		
Impact from ref [1] (M.A. Mimikou et al. 2000):			

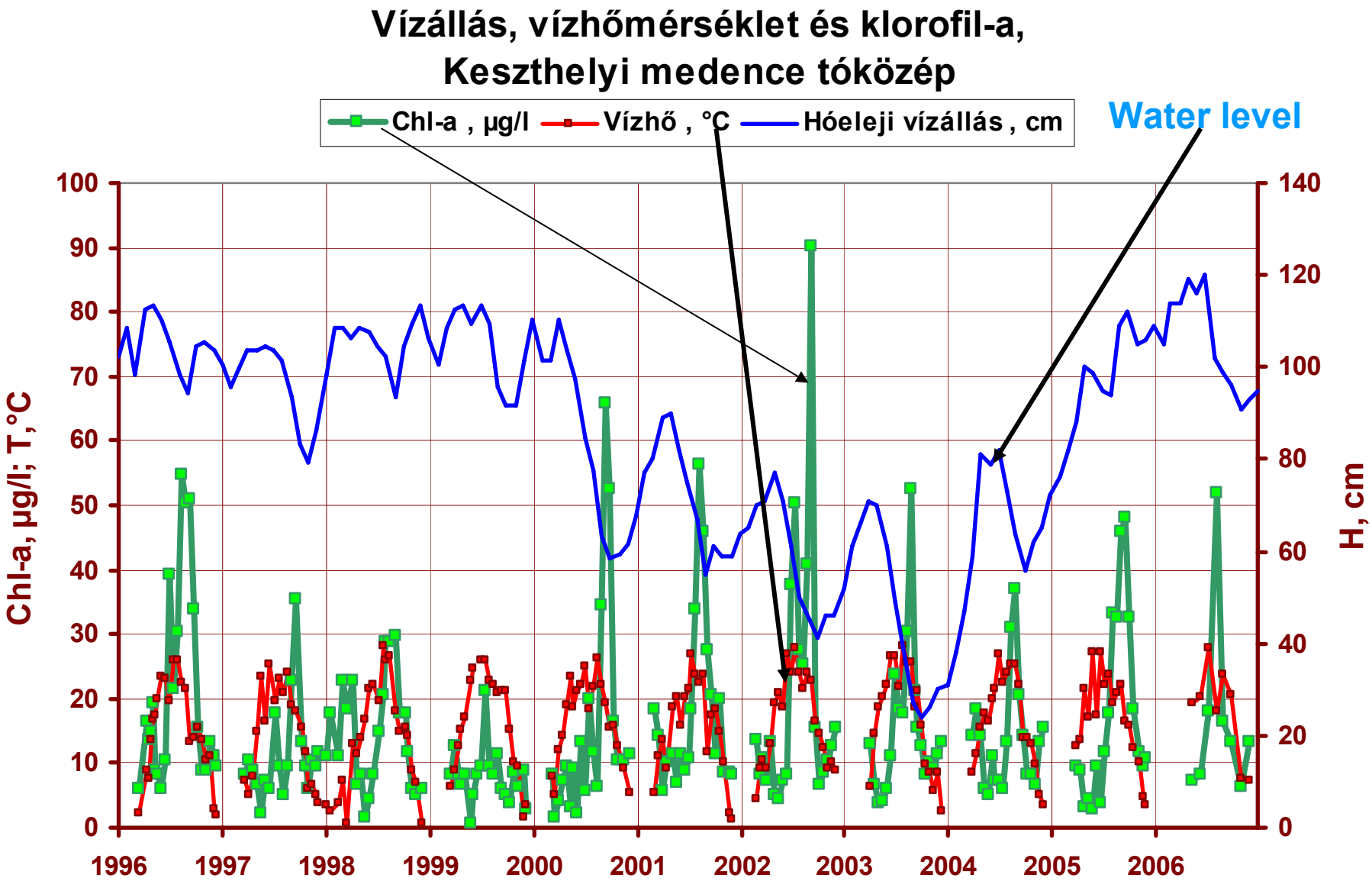
Climate change impacts on water quality

1. Oxygen household of streams will be seriously worsened by higher temperatures and lower flow velocities.

2. Lower flows result in lower dilution rates and thus in worsening WQ for many parameters.

3. Extra nutrient loads from increased washoff loads and erosion will result in increasing eutrophication thus impairing oxygen conditions in northern climate.

Impacts of drought years on the eutrophication of Lake Balaton

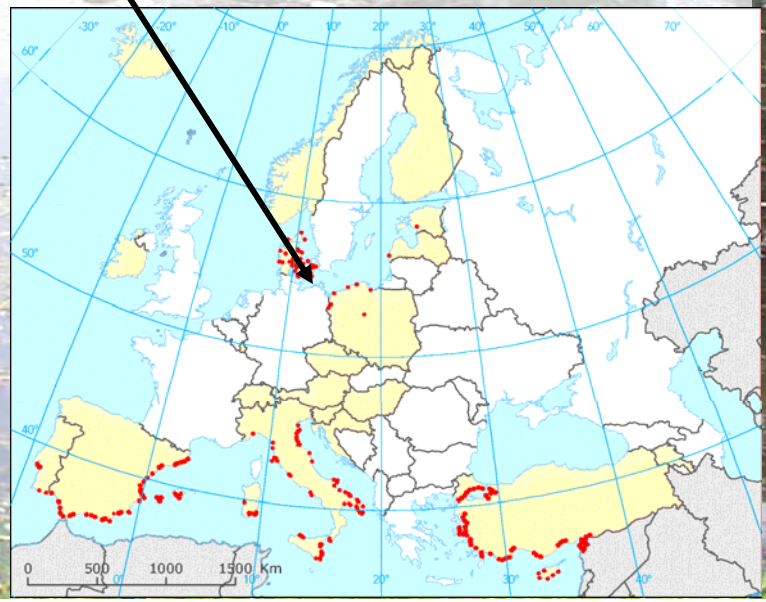


Impacts on water quality, continued

4. Supply of drinking water to the population may be threatened.

5. Under drought conditions saltwater intrusions into freshwater bodies or coastal aquifers might worsen the situation in coastal regions;

6. Changing climate also may alter chemical processes in the soil, including chemical weathering, thus will change WQ of waters. Change of hardness.



Impacts on water quality, continued

7. Expectable changes in land use and agricultural practices will have a very significant effect on water quality.
8. Increased atmospheric CO2 will affect the rate at which CO2 is dissolved in water, and hence the rate of operation of many processes.
9. Both extreme rainfall and droughts can increase the total microbial loads.
10. In lakes of northern Europe the ice-free season becomes longer.
11. Longer growing seasons, higher risk of algal blooms and increased growth of toxic cyanobacteria

Summary of major impacts on water quality

- **Extreme weather events mobilize all contaminants** (via runoff from urban and partly surfaces) and these may cause serious deterioration in terms of priority pollutants (e.g. heavy metals) and also pathogens, which may result in **serious health risk** (bathing in natural water bodies)
- Extreme precipitation-runoff events are likely to put sewerage networks under additional pressure, with specially increased risk to **both sewage and drinking water treatment**
- Intensified precipitation-runoff events, including very rapid snowmelts, **will shift the total load of many (if not most) of the polluting substances towards diffuse or non-point sources**, thus changing the need for altered RBM strategies (still focus mostly on point source treatment)
- Altered precipitation and runoff conditions may result in **extra pollution loads to groundwater resources** (especially to the near-surface phreatic ones), resulting in the deterioration of groundwater quality
- In coastal regions under drought conditions **saltwater intrusions** into freshwater bodies or coastal aquifers might cause serious water quality deterioration and risk to water supply.

Water Quality, adaptation strategies

Control of point and nonpoint sources pollution, treatment of wastewaters are the essential strategies.

Drainage basin scale water quantity (runoff control, saving of rainwater where it falls)

Water quality (land use management) that is IWRM or RBMP in the integrated quantitative, qualitative and ecological sense will provide the overall solution.

Measures to reduce flood risk could result in improved urban water quality thanks to sustainable urban drainage systems.

Water Quality, research needs

Research into the impact of climate change on the outcome of the **changes of washoff pollution (e.g. diffuse) loads** should be initiated as soon as possible (supported by ample field experiments), to clear the issue of "reduced diffuse loads" in drier climates against another hypothesis that longer pollutant accumulation periods associated with heavier than usual rainfall will result in increased diffuse event-based loads also in drier climate (with stronger impact on the aquatic environment even if the annual total load will be smaller).

Research into **nutrient loads and eutrophication** must be intensified.

Research into „**ecohydrology**" is needed (in the multidisciplinary sense)

Climate ≈ water

Water Quality, Policy implications identified:

The River Basin Management Planning methodology (RBMP of WFD) should probably be restructured with due concern to Integrated Water Resources Management (IWRM), in the sense that:

water quality, quantity and ecological management concepts be integrated at the level of assuring complete control of all point and diffuse sources of pollution, all land use practices and all hydrological runoff control measures in such a way that a decision support planning tool (modelling??) helps this planning.

There is a need for changing WFD policy towards non-point sources and their control techniques (still in baby shoes in terms of knowledge on their efficiency!!).

Thematic Focus evaluation for

Water Management

of WP 2 – Analysis and synthesis of water related climate change impacts

Sub WP	**WP2.1 Water management and other water-related impacts on the society and the economy**		
Topic	**2.1.2 Indirect impacts on the society through direct impacts on economic activities**		
Partner making the focus	Partner 1: VITUKI (H), refs: 2, 8, 10, 12, 14	**Contributing partner(s)**	Partner 3 CNR-IRSA (I) refs: 1, 3,4,5,6, 9, 11, 13 Partner 6 Geonardo: 15, 16

Description as of DoW: Water management as a whole and as a major economic activity demanding substantial or even deterministic government funds (flood and excess water defence and control, protection of subsurface drinking, thermal and medicinal water resources, etc.). It is to be noted here that the main water policy of the EU, the Water Framework Directive, has the ultimate planning tool the River Basin Management Plans (RBMPs) and the findings of this project are likely to have a major bearing on these planning methodologies and the action plans based on them. Climate change impacts and how these are taken into account in water policies will be studied within the framework of WP5 outlined further below.

Special note of the Co-ordinator: The inclusion of water management as a tertiary sub-topic under WP 2 was not a very lucky selection!. Firstly because water management can be defined either as a sum of administrative-policy making/enforcing activities of the state (or EU) administration with the inclusion of all rules and regulations and in this case the climate change impact is that they must find new rules –policies—and should probably restructure their organisation to suit the adaptation strategies needed. Although this is a very important "impact" but this is the major objective of WP5 and will be dealt with there!. On the other hand water management is an "umbrella name" of all technical water related engineering activities (e.g. Flood control, water supply, irrigation, navigation, hydropower, etc), which latter have their own specified "box" among the topics.
Therefore here in this "impact" we include the findings of studies of larger river basins (where evidently nearly all "water management" issues occur), or special other topics that cover many water management type activities, like **land-use planning**!

Front page of the thematic focus of WM of the total of 71 pages

Introduction or the table of content

Firstly water management is an “umbrella name” of all technical water related engineering activities (e.g. Flood control, water supply, water pollution control, irrigation, navigation, hydropower, etc), and thus practically the management of nearly all activities of the society. In this case climate change impact on water management is the urgent need for finding new technical and non-technical strategies to manage water and save/sustain Man and nature the best we can

Secondly water management can be defined as a sum of water related administrative-policy making/enforcing activities of the state (or EU) administration with the inclusion of all rules and regulations and in this case the climate change impact is that they must find new rules – policies—and should probably restructure their organisation to suit the adaptation strategies needed

Introduction or the table of content

Firstly water management is an "umbrella name" of all technical water related engineering activities (e.g. Flood control, water supply, water pollution control, irrigation, navigation, hydropower, etc), and thus practically the management of nearly all activities of the society. In this case climate change impact on water management is

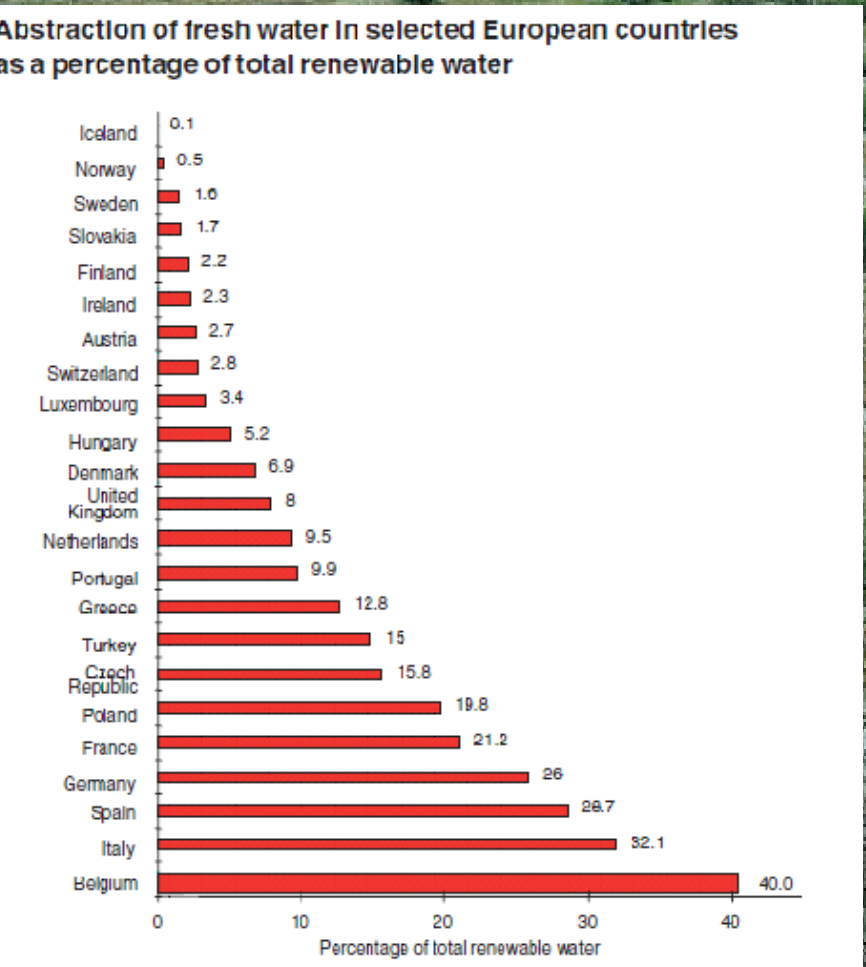
It follows from the above that only fragments of the water management issues can be handled in a presentation
And all subjects not falling into other topics can be enlisted here

climate change impact is that they must find new rules – policies—and should probably restructure their organisation to suit the adaptation strategies needed

WATER MANAGEMENT

Major climate change impacts on water management

- **Decrease in water availability during summer season**
- **Deterioration of water quality.**



Results:

- Overuse of groundwater resources (with decreasing recharge rates and drying wetlands)
- Increasing background pollution of bank-well filtered drinking water resources
- Empty drinking water reservoirs,
- Saltwater intrusion into coastal aquifers

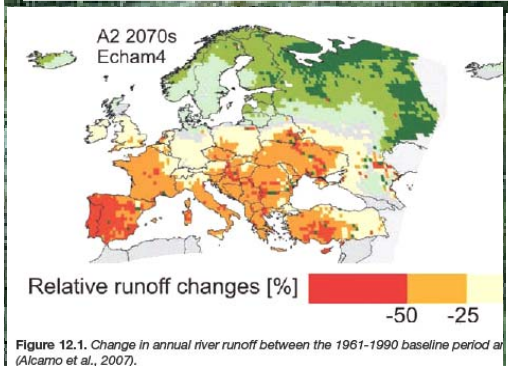
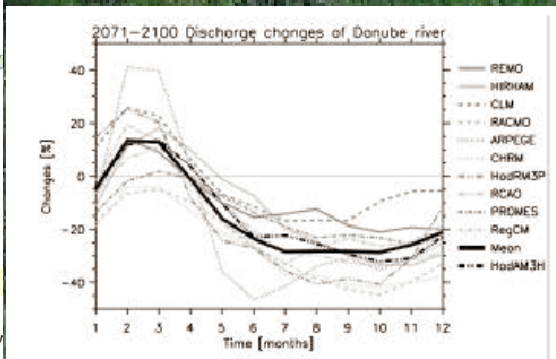
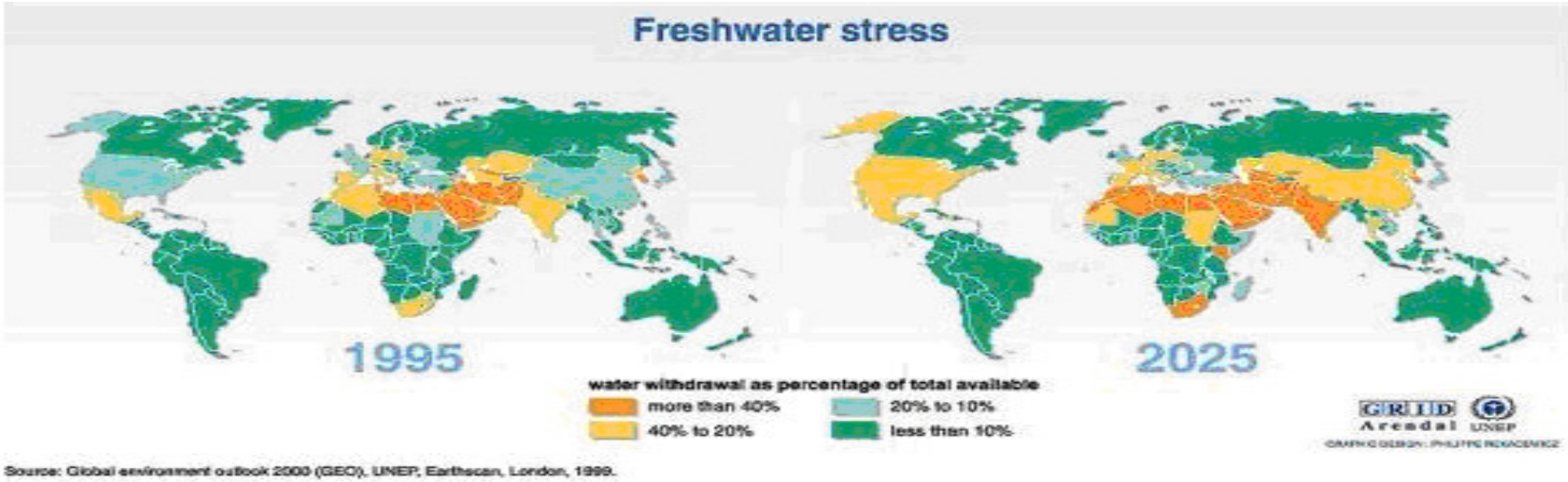


Figure 12.1. *Change in annual river runoff between the 1961-1990 baseline period a*
(Alcamo et al., 2007).

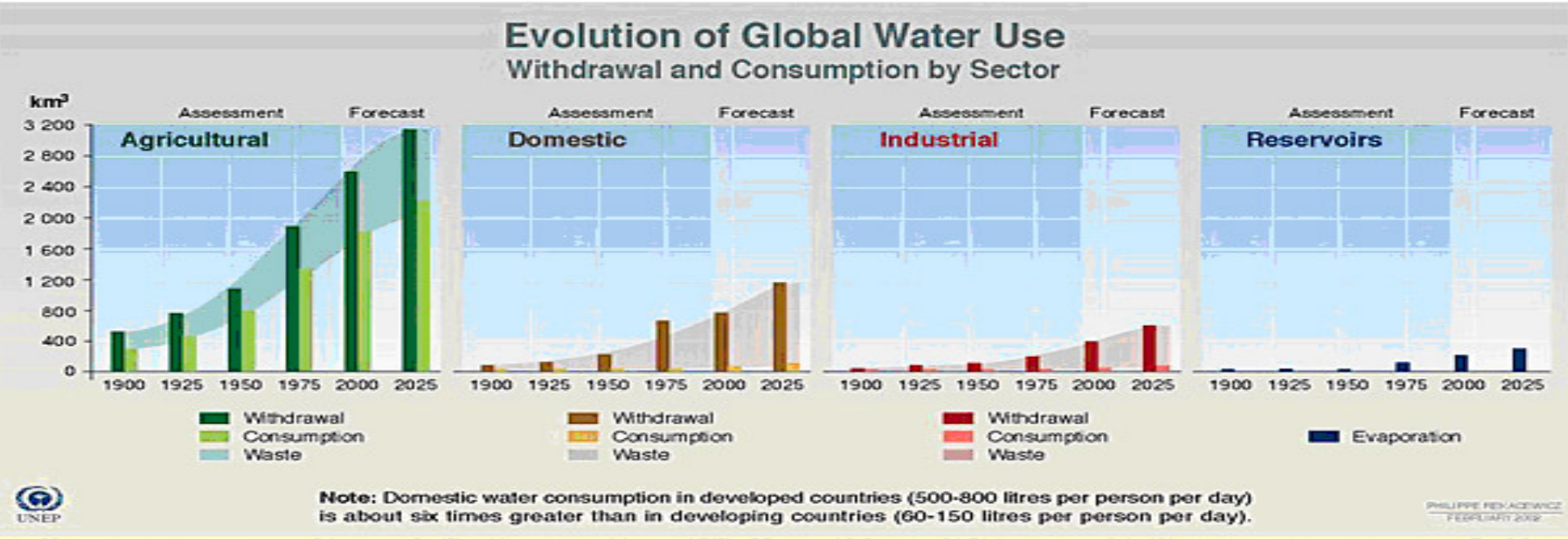


WATER MANAGEMENT

Major climate change impacts on water management



Source: Global environment outlook 2000 (GEO), UNEP, Earthscan, London, 1999.



Source: Igor A. Shiklomanov, State Hydrological Institute (SHI, St. Petersburg) and United Nations Educational,Scientific and Cultural Organisation (UNESCO, Paris), 1999.

WATER MANAGEMENT

Major climate change impacts on water management

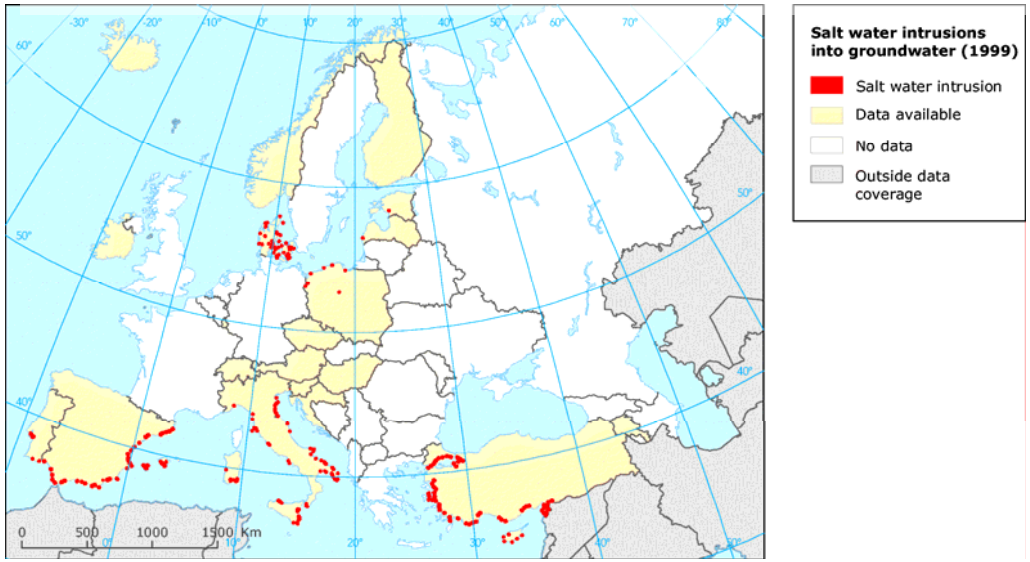


Fig. 3.2. Sectoral use of water in the countries of the European Union

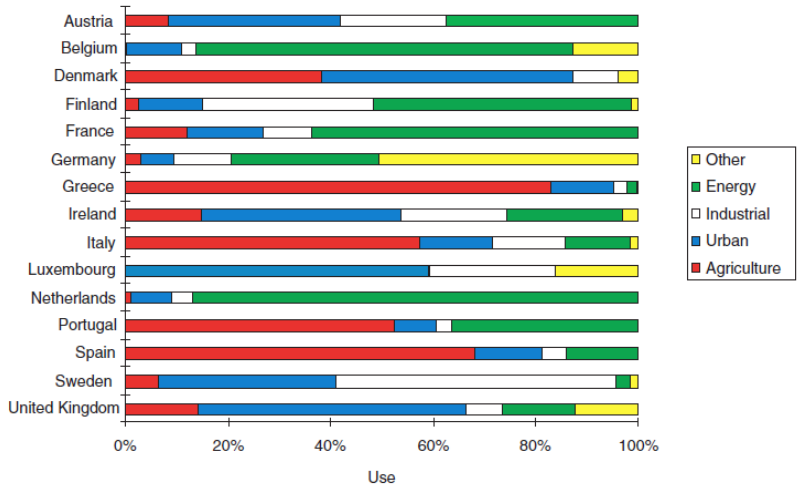


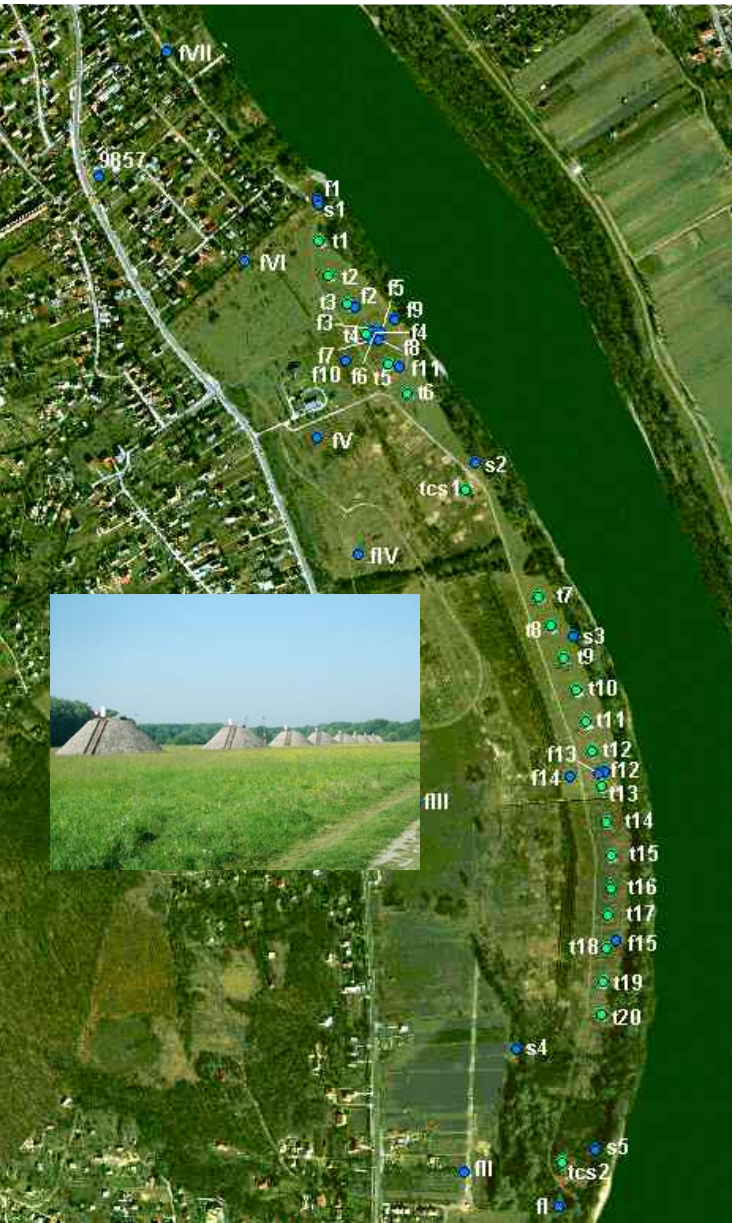
Table 2.2. Estimated water available (m^3 per person per year) in selected European countries in 1990 and 2050 based on projection of present climate conditions (change resulting from population growth and other non-climate-related factors) and three transient climate change scenarios

Country	Present climate, 1990	Present climate, 2050	Range of three climate scenarios, 2050
France	4110	3620	2510–2970
Poland	1470	1250	980–1860
Spain	3310	3090	1820–2200
Turkey	3070	1240	700–1910
Ukraine	4050	3480	2830–3990
United Kingdom	2650	2430	2190–2520

Source: McMichael et al. *(22)*.

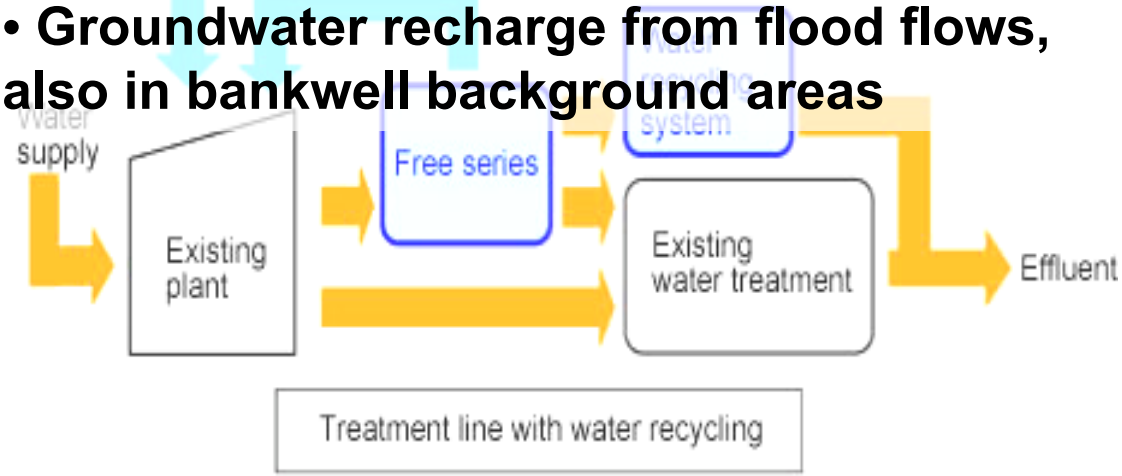
WATER SUPPLY AND WATER MANAGEMENT

Major climate change impacts on water supply

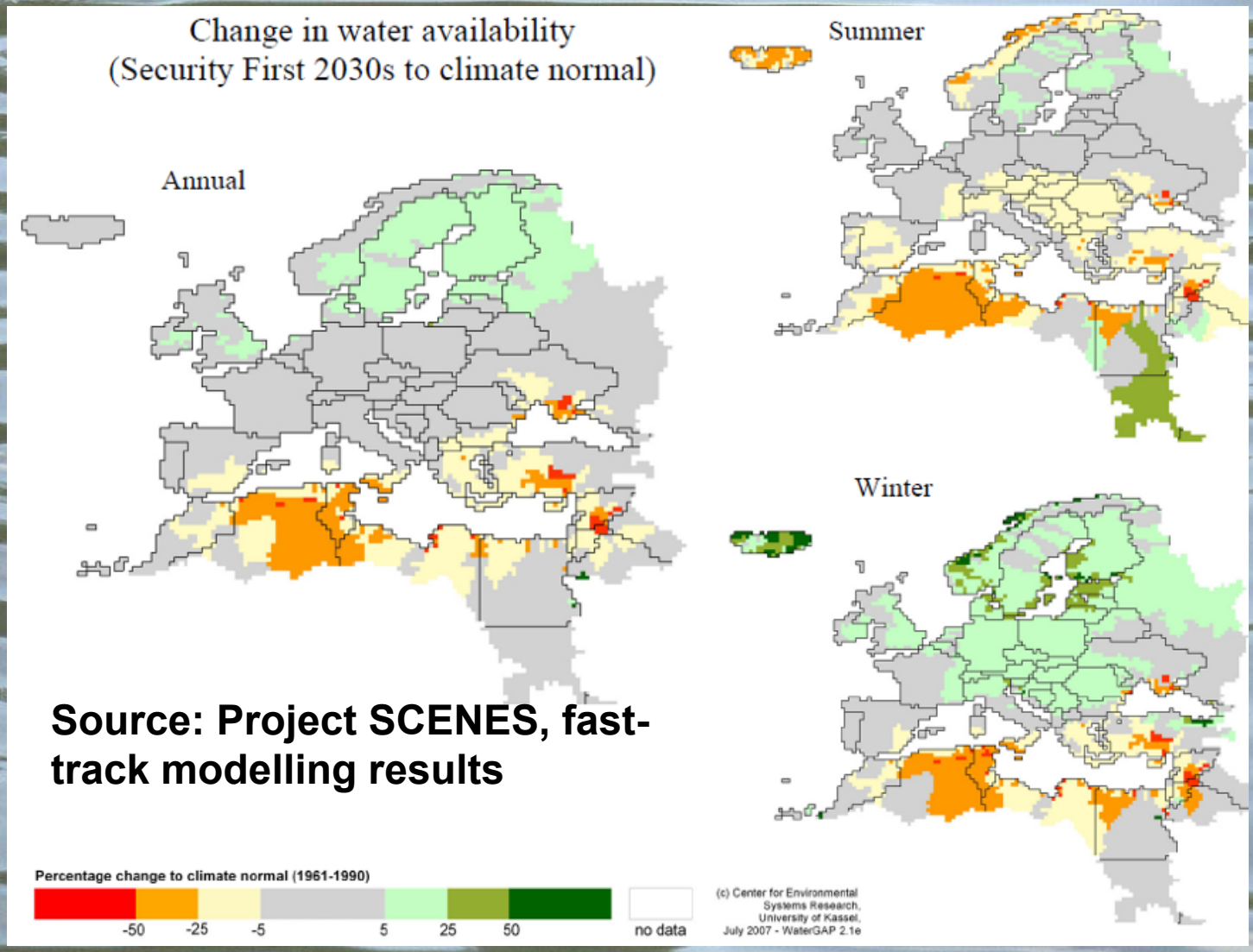


Adaptation strategies:

- **Water pricing, use-restrictions, basic changes in water-use behaviours of population and economy,**
- **More water storage, Rainwater-roof-water harvesting,**
- **Water saving and no-water technologies, full recycling, wastewater treatment to useable cleanliness;**
- **Groundwater recharge from flood flows, also in bankwell background areas**

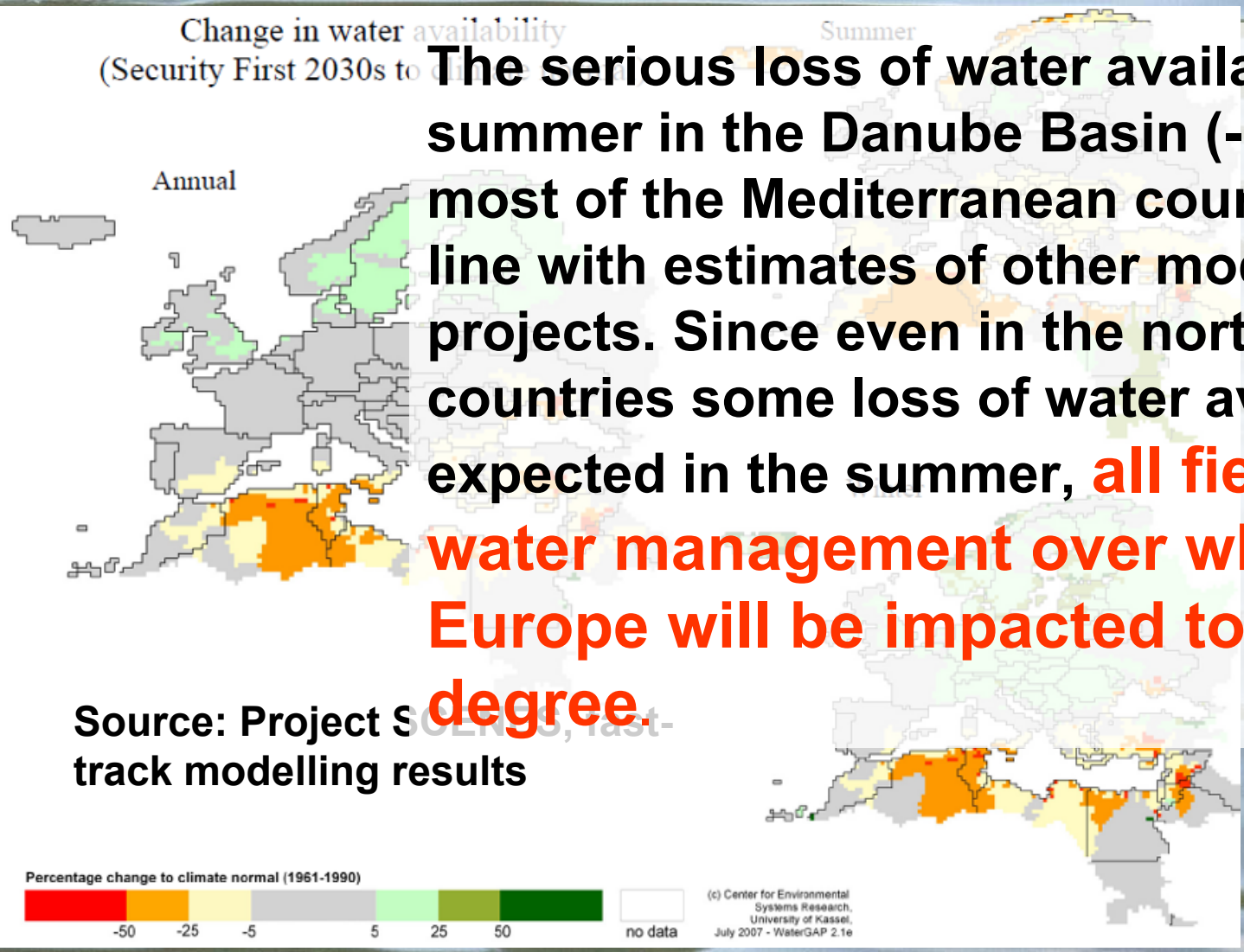


More figures and notes from the Thematic Focus on Water Management



Source: Project SCENES, fast-track modelling results

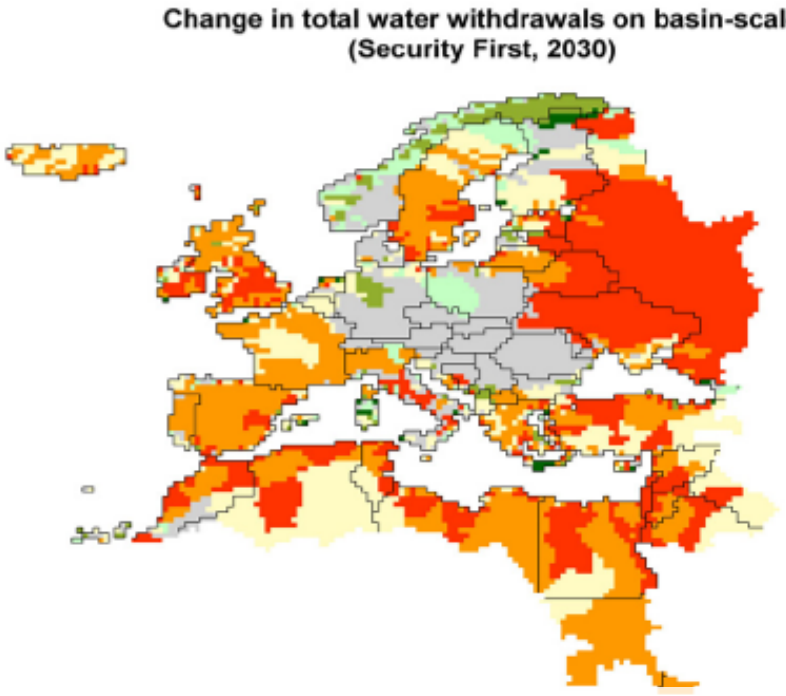
More figures and notes from the Thematic Focus on Water Management

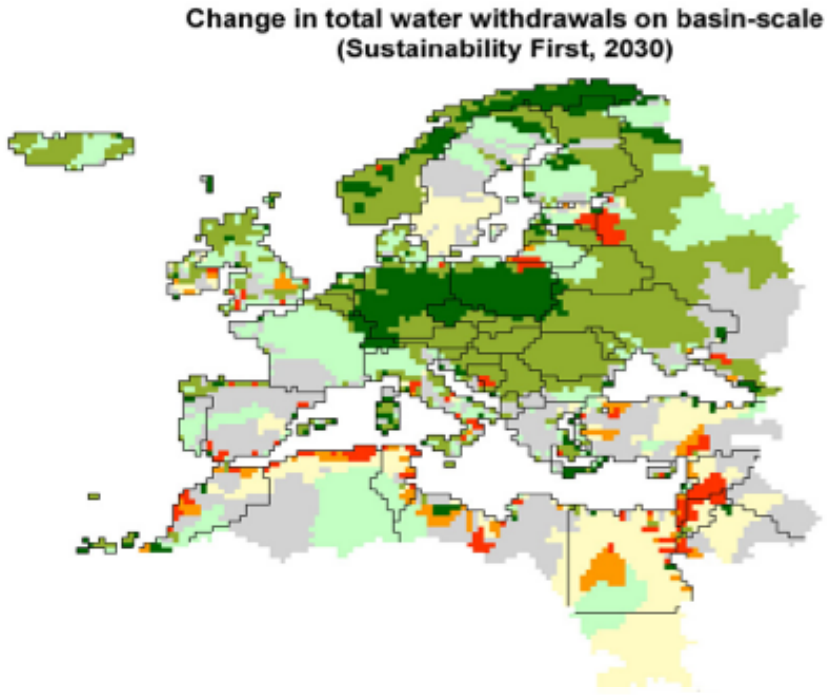


The serious loss of water availability in the summer in the Danube Basin (-5 - -25) and in most of the Mediterranean countries is in line with estimates of other modelling projects. Since even in the northern countries some loss of water availability expected in the summer, all fields of water management over whole of Europe will be impacted to certain degree.

Source: Project S track modelling results

More figures and notes from the Thematic Focus on Water Management (cntnd)

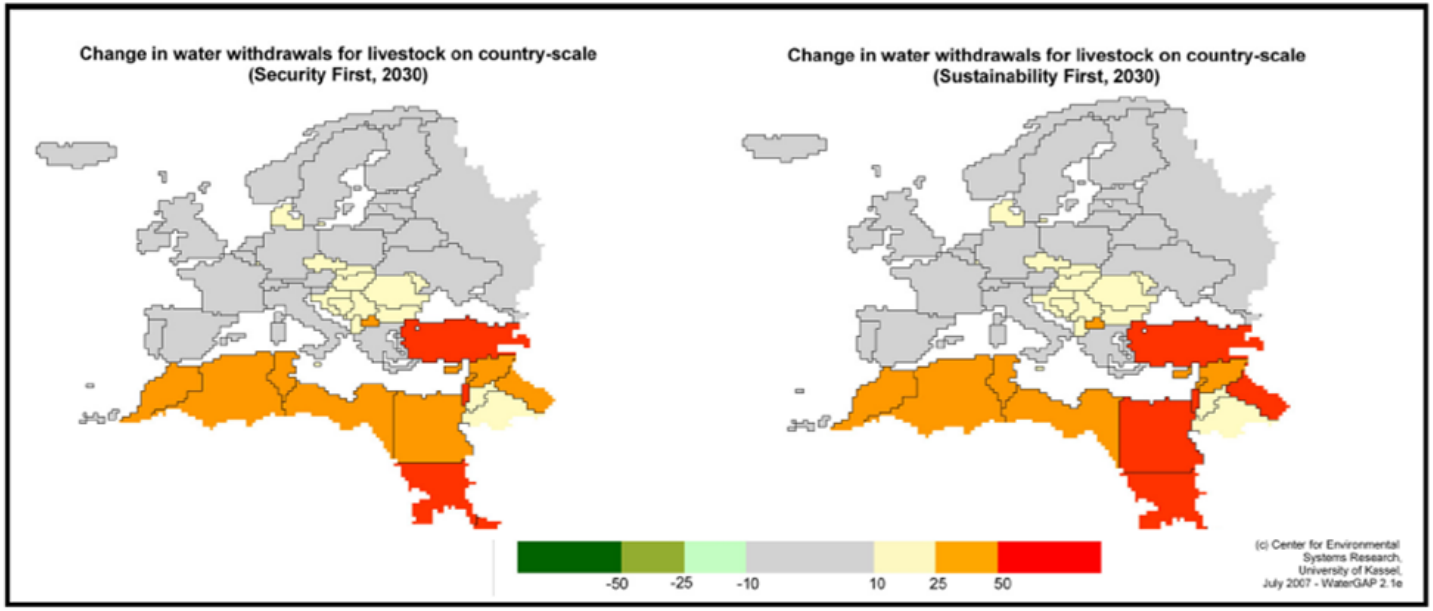




The about 25% reduction corresponding to "sustainability first" does not seem to be too realistic, unless one believes that the decision makers of the all or most countries of the Danube Basin will consider the increasing-maintaining the inflow to the Black Sea a primary "sustainability" aim. And this is not a likely objective. Sustainability strategies might (likely) be focussed not at reducing withdrawals but on increasing water storage (water diversion) with all possible means

More figures and notes from the Thematic Focus on Water Management (cntnd)

Figure 17: Percentage change in livestock water use for European countries as compared to the base year (2000), realized with two different scenarios for 2030. Left map: Security First scenario, right map: Sustainability First scenario.



Remarks: It is a likely questionable outcome of both scenarios that only the East-Middle European countries will use more water for live stock breading. This could probably be explained by an assumed growth of live stock number in these countries (which would be justifiable), but this is against the observed novel trends (in Hungary live stock was and is being drastically reduced, due to the market policy of the EU and of "free market"

Summary of Water Management from the thematic focus by JG

The climate change impact on water management, as organised management activities of the state or local government or administration in dealing with water (and environmental, aquatic ecological) resources, is that they must find new ways to manage the water resources, that is new strategies to cope with changes in water quantities (e.g. extreme runoff events, floods, droughts, standing water volumes, sinking groundwater levels etc), water quality (depletion of dissolved oxygen, increased eutrophication, increased washoff loads, etc)and to deal with resource management (so as to meet the demands of human and ecological water users, with the possible best conflict resolution).

Summary of Water Management from the thematic focus by JG

agriculture in climate models should allow more robust quantification. There is need to assess the impacts of management changes over an appropriate time period—

water management (**Ref8**). This is because the limitations of the ability to control extremes by technical means have become very clear during weather extremes

This was just a sample of the summary of water management thematic focus (of 71 pages including also the most important technical details), and will be annexed to the mid-term and the final report.

Thank you for your attention!

The paper by Severs (**ref7**) states that there is a need for reconsidering water management in terms of widening and deepening of inclusive approaches for allocating water on a catchment basis through openly agreed and fairly conducted procedures. These approaches have to take into consideration all classes of uses, including the natural world.

There seems to be a need for a new or novel paradigm of and adaptive approach to

between the broad geographical scale at which strategic planning takes place in the UK.

In managing water uses in agriculture upon the impact of changing climate many important findings were included in **Ref 16** such as those positive impacts may be anticipated for Northern Europe. Another important finding was that strong (100%) afforestation of abandoned croplands might have serious impact on groundwater resources because of the increases in evapotranspiration.