Annex II. Detailed results of the survey

Contents

Detailed results of the survey

Part 2 - Information on the development of Drought Management Plans (DMP) or National Water resources Management programs (WRMPs)

2.1 Has the DMP been developed?

Answer		∑	Country
Yes		3	BG*, HU*,RO
Level of DMP	National level	3	BG, HU**,RO
	River basin (or sub-basin) level	1	RO
	Local level		
No		7	CZ,LT,MO,PL*,SK,SLO,UA

BG*

The Programme of measures needed to limit the negative consequences of more and more frequent drought conditions **has been approved by the Council of Ministries in 2001.** These measures are of legislative, administration and investment character, and they are primarily concerned with:

- water resources protection;
- overcoming of the drinking water shortages;
- sufficient water for irrigation;
- public information and awareness about water resources savings.

For water resources protection measures to be undertaken in the decade 2001-2010, the necessary state, municipal, firms and external budget was estimated at the level of about 600 million Euro. Many of them haven't been built or implemented yet. For example, construction of wastewater treatment stations for agglomerations above 10 000 PE is planned to be finished in 2014 with the support of the EU Cohesion Fund.

Drinking water supply is one of the main problems in the drought periods. For example, in 2000 about 20% of total population suffered seasonal water shortages. The principal measures for stopping the drinking water shortages are focused on rehabilitation of old water supply system where high volume of water is lost by leakages, and construction of several dams (storage reservoirs) in drought regions. The budget foreseen in 2001 for drinking water supply improvements was about 1 600 million Euro.

Also reduction of water leakages in irrigation systems and water saving by cultivation of drought stable vegetation was mentioned in the Programme of 2001. Agriculture is one of the most important sectors of the Bulgarian economy, although this sector is responsible for a relatively small part of the GDP. Much of the Bulgarian population is involved in it.

Cultivated agricultural land covers 48% of the total territory of the country. But agriculture is still in a crisis situation at present. Most of the farms are small and do not have at their disposal sufficient financial means. Various European funds are not enough efficiently used. The government must invest to get out quickly of the crisis in this important sector of the Bulgarian economy. The needed irrigation investments were calculated in 2001 at the level of about 270 million Euro.

The institutions responsible for implementation of the 2001 Programme are Ministry of Environment and Water, Ministry of Regional Development and Public Works, Ministry of Agriculture and Forestry (now Ministry of Agriculture and Food), Ministry of Health, municipalities, and private firms. Only part of the proposed drought mitigation and adaptation measures have been fulfilled by different reasons - political, administrative and financial.

HU*

- In 2012 the Hungarian Government issued the 1432/2012. (X. 9.) Governmental Decree on "*Development of national water management, irrigation and drought strategy*".
- Following the issue of Governmental Decree the Ministry of Rural Development elaborated the "*Water strategy of water management, irrigation and drought management*" document, which was made available for national consultation in March 2013.
- In September 2013 the *"Second National Climate Change Strategy 2014-2025 - with outlook to 2050"* a Governmental policy discussion paper was made available for national consultation.
- A Governmental consultation paper on *"Long-term concept of drought management"* was issued and made available for professional consultation.

HU** Entire territory of Hungary belongs to the Danube River Basin District

PL* Preliminary analyses for DMP have been performed for the territories of 2 (out of 7) Regional Water Management Boards (RWMB)

2.2 Has the WRMP been developed?

Answer		∑	Country
Yes		5	HU,LT,MO*,RO,UA
Level of WRMP	National level	4	HU*,LT,MO*,UA
	River basin level	3	LT,RO,UA
	Local level	1	UA
WRMP published by	Ministry	3	HU*,LT,MO*
	River basin administrators	1	RO*
	Other	1	RO**
No		2	BG,SLO

HU* The "*Water strategy of water management, irrigation and drought management*" has been developed, but is has not been accepted by the Hungarian Government, yet.
MO* Mentioned issues are part of the national environmental strategy, which was recently discussed at the national Security Council.

PL* WRMP – not applicable for Poland; RBMPs – have been developed; for river basin districts; published by the Council of the Ministers (government)

RO* River basin administrators parts of National Water Administration "Apele Romane"
RO** Ministry of Environment and Water Management (as was the name in that time) plus the National Institute for Hydrology and Water Management

2.2.3 If the DMP or WRMP has been developed which items does it contain?

Item - measure		∑	Country
Indicators and thresholds establishing severity levels of the drought stages		2	HU,RO
Drought situation assessment (frequency, intensity)		5	HU*,LT,MO,RO,UA
Drought risk maps			HU**,RO
Program of measures for preventing and mitigating drought in each drought stage:		4	BG*,HU,MO,RO
Measures	Preventive or strategic measures (normal status)	5	BG, HU***,MO,RO,UA
	Operational measures applied during pre-alert and alert stages	2	HU***,RO
	Organizational measures	1	RO
	Restoration measures		
Organizational framework for the production of DMP/ WRMP and its updating		3	LT,MO,RO
Technical / bio-technological measures		1	BG

BG*

The necessary measures of the 2001 Program in the conditions of drought trends are:

- Protection of water resources:
- instantaneous measures: supporting of minimum river run-off, groundwater usage according to the permits, up-dating of water resources monitoring, evaluation of institutional management of water resources, forbiddance of clear fell excluding acacia and poplar, prevention of forests fires, forbiddance of the transport of dangerous substances– total budget 6000 thousand BGN or 3068 thousand euro;
- measures for which is necessary the establishment of work schedule: management of the transboundary water resources on the base of national protection interest (2002-2010), wastewater treatment of the agglomerations above 10000 PE (2002-2010), industrial wastewater treatment, conservation of the drillings which are out of the usage, up-dating of GIS information of water resources, erosion control and forestation of erosion areas – 1 149 757 thousand BGN or 587 861 thousand euro;
- Drinking water shortages:
- instantaneous measures: build-up of new dams and reconstruction of former ones, limitation of water losses in building/house water supply system, construction of sanitary-protection zones near water sources, establishment of new standard regarding the water demand per inhabitant, implementation of economic regulators for drinking water supply (water pricing and tax etc.) – 48 700 thousand BGN or 24 900 thousand euro,
- measures for which is necessary the establishment of work schedule: build-up of reservoirs/dams for collection of spring high waters, alternative water supply for the capital Sofia (new dam Eleshnitza, reconstruction of Beli Iskar dam), alternative water supply by groundwater in drought period, reconstruction of water supply system with limitation of water shortages – 3 110 000 thousand BGN or 1 590 118 thousand euro;
- Insurance of the water for irrigation:

- instantaneous measures: defence of dewatering of reservoirs for the fishing aims, the duty of the reservoir's concessioner to deliver the irrigation water in drought period, the usage of the water from irrigation reservoirs, defence of the usage of shallow groundwater;
- measures for which is necessary the establishment of work schedule: helping the work of Irrigation associations, stimulation of the measures for regulation of river run-off, limitation of irrigation water losses, stimulation of not pumping irrigation and drop irrigation, reconstruction of pumping irrigation stations and irrigation systems - 530 000 thousand BGN or 270 570 thousand euro;
- awareness raising for water resources saving- instantaneous measures: media information, public control and dissemination of good practices by NGOs.

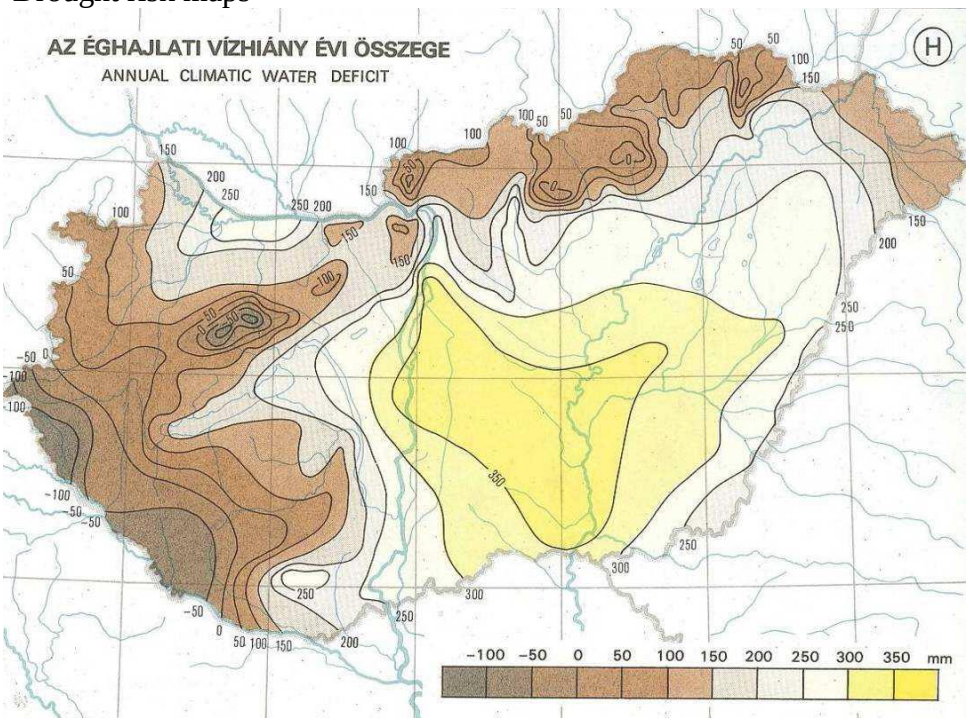
Lack of good coordination between different responsible institutions and lack of sufficient financial resources is the main reason for the problems with implementation of many drought measures. Nowadays, the floods risk is the priority and the investments are going to the reconstruction of many small reservoirs mainly which are very dangerous.

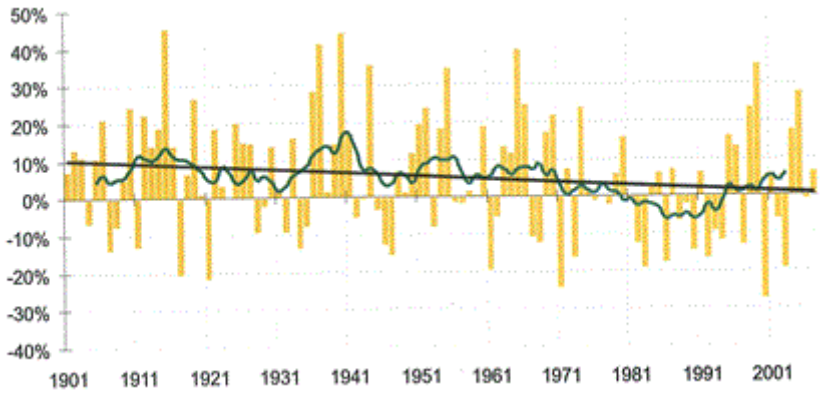
HU*

- National Meteorological Service
- National Water Authority

HU**

Drought risk maps





Decreasing trend of average precipitation, Debrecen, Hungary (Source: Bihari et al., 2008)

HU***

Program of measures for preventing and mitigating drought in each drought stage:

- A Governmental consultation paper on *"Long-term concept of drought management"* (The document has not been accepted by the Government)

Preventive or strategic measures (normal status)

- National River Basin Management Plan, Budapest, April 2010. Chapter 8. "Programme of measures": Mitigation of drought effects- Vegetation and or crop production changes in drought sensitive areas, with water retention and introduction thrifty irrigation methods
- Currently valid National Climate Change Strategy, 2008-2025.

Operational measures applied during pre-alert and alert stages

- National Meteorological Service: Small Region Alert System (operational)
- National Meteorological Service: Drought Monitoring System (under planning)

2.3 Has the DMP been included in the RBMP?

Answer	∑	Country
Yes	2	BG*, HU
No	8	CZ,LT,MO*,PL,RO,SK,SLO,UA

BG*

The national water management in Bulgaria has a long history:

- Common state water programme – 1920;
- United water management plan – 1950;
- First Bulgarian Water Act 1969;
- Bulgarian Water Act 1999 – ***Introduces the river basin principle of water management and the requirement of production of River basin management plans (RBMPs);***
- Bulgarian Water Act 2006 – harmonization with EU water legislation.

The water management in Bulgaria is realized at national and river basin level which includes: the central administration »Water Management Directorate« at the Ministry of Environment and Water, an Executive Agency for Environment, four River Basin Directorates (Danube River Basin Directorate in Pleven town, Back Sea Basin Directorate in Varna town, East Aegean River Basin Directorate in Plovdiv town, and West Aegean River Basin Directorate in Blagoevgrad town - Fig. 1), 16 Regional inspectorates and regional laboratories for environment.

Fig.1. Map of 4 River Basin Directorates in Bulgaria

Many of DMP measures are covered in the special chapter or annex of 2010-2015 RBMPs which have been elaborated by River Basin Directorates:

- Danube River Basin: Chapter 7.1.14. Measures, related with adaptation of climate changes incl. drought;
- Black Sea Basin: Annex VII-3. List of measures in which preventive measures against drought are mentioned;
- East Aegean Basin: Annex No. 7-7. Investigation, monitoring, campaigns and administrative measures for reduction of drought effect and water scarcity;
- West Aegean Basin: Chapter VII. Programme of measures for water protection and recovery regarding drought

2.4 Have water scarcity issues been identified as relevant in the RBMP or WR

Answer - effect		∑	Country
Yes		5	BG, HU,PL*,SK*,UA
No		5	CZ,LT,MO,RO,SLO
If no, has the water scarcity issues been identified as relevant in other plans?	**Yes**	1	MO*
	No	4	CZ,LT,RO,SLO
Effects identified	**Groundwater over-abstraction**	4	HU, MO,PL**,SK
	Urban water supply shortages	3	BG*,MO,UA
	Degradation of surface water quality	3	HU,MO,UA
	Wetland degradation	3	HU,MO,UA
	Disruption of environmental in-stream flow regime	3	HU,PL***,UA
	Disruption of landscape water regime (agricultural drought); by drainage, Landscape affected by mining etc.	2	MO,PL****

	Economic losses:	3	HU,MO,UA
	Industrial sector		
	Agricultural sector	3	HU,MO,UA
	Tourism	1	HU
	Other: **BG** – conflicts between different users **UA** - Rural water supply		

BG* RBMPs - Chapter 6: Short Water Economic Analysis in which the mean value of the population water scarcity for the period 2003-2007 is as follows:
- Danube Basin: 2,9 %;
- Black Sea Basin: 4,7 %;
- East Aegean Basin: 8,9 %;
- West Aegean Basin: 11,6 %.

MO* Drought management issues were identified in the environmental strategy in Moldova until 2020. According to estimations around 20 mln euro are needed for its mitigation. Main activity in this domain is development of the irrigation systems. RBMP are going to be developed in Moldova in cooperation with EU institutions according to the provisions of the EU-Moldova association agreement, which is going to be parafied in November 2013.

Marked "NO" in 2.3. and 2.4., because relevant documents have not been developed in Moldova. In regard to the program of measures drought and water scarcity related issues are mentioned in main political documents aimed at rural development and environmental strategy.

PL* water scarcity issues are considered in small retention programs for voivodships (administrative units - there are 16 of voivodships in Poland; voivodship authorities were responsible for the development of these programs). In these documents water for agricultural uses is mainly concerned. 12 documents are available in the internet, for 4 voivodships digital form is not available.
Moreover small retention programs in forests have been developed: "improvement of retention possibilities and preventing floods and draughts in forest ecosystems of **lowlands**"; "Preventing the effects of rain water outflow in the **mountainous** region". All small retention programs (for forests and voivodships) were included in RBMP, in the section "a register of any more detailed programmes and management plans for the river basin district dealing with particular sub-basins, sectors, issues or water types, together with a summary of their contents".
Furthermore water scarcity issues are considered in draft "conditions for the water use in the catchment", but none of the prepared conditions has been introduced into force yet.
PL** in the vicinity of several towns / cities
PL*** this effect has been identified in several catchments but in more detailed documents than RBMP, i.e. draft "conditions for the water use in the catchment", but none of the prepared conditions has been introduced into force yet
PL****** this effect has been identified, especially in the regions of coal mining (both black coal and brown coal opencast mining); substantial groundwater level drop also

SK* Water Plan of Slovakia (River Basin Management Plans for Danube and Vistula – a part of quantitative status assessment (5 water bodies were identified in bad status).

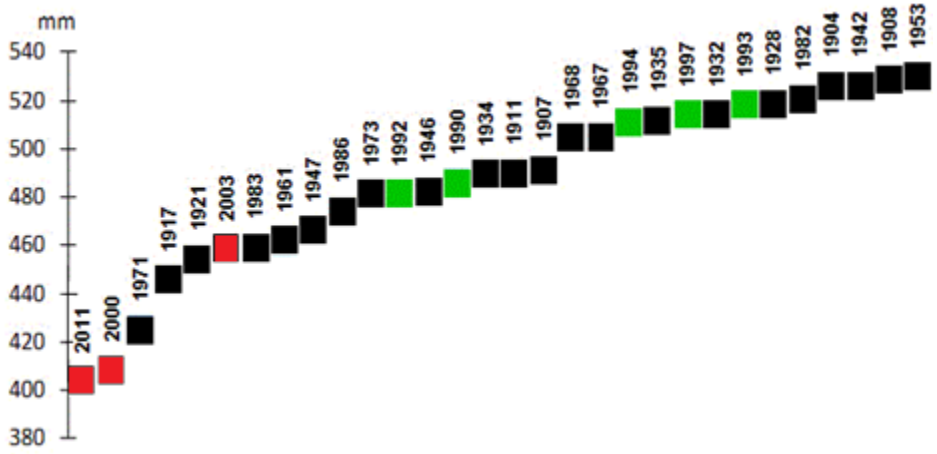
2.5 Have drought issues been identified as relevant in the RBMP or WRMP?

Answer - effect		∑	Country
Yes		4	BG*,HU*,LT,SLO*
No		4	PL,RO,SK,UA
If no, has drought issues been identified as relevant in other plans?	**Yes**	2	CZ*,MO*
	No	3	PL*,RO,SK
Effects identified	**Groundwater over-abstraction**	5	BG,HU,MO,RO,SLO
	Urban water supply shortages	1	BG
	Degradation of surface water quality	4	BG,HU,MO,SLO
	Wetland degradation	4	BG,HU,LT,MO,RO
	Disruption of environmental in-stream flow regime	4	BG,HU,LT,SLO
	Disruption of landscape water regime (agricultural drought); by drainage, Landscape affected by mining etc.	2	RO,SLO
	Economic losses:	1	RO
	Industrial sector		
	Agricultural sector	4	HU,LT,MO,RO
	Tourism	1	HU,RO
	Other: **BG -** Transboundary conflicts with neighbouring countries (mainly with Greece) because the sources of transboundary rivers: Sruma/Strymon, Mesta/Nestos and Dospat are on the territory of Bulgaria. The run-off to Greece is less in drought periods. **MO -** Agricultural lands protected measures as a part of the reduction of erosion and water ecosystems degradation were identified in main political documents. Water losses are also part of the documents, but these issues mainly refer to the development of water infrastructure including irrigation systems **SLO -** Glacier melting, degradation of groundwater quality, erosion increase, changes in hydrological regime		
Official documents issued	**BG*** – National Strategy for Water Sector – government and parliament approval in 2012 **MO*** Environmental strategy of the Republic of Moldova for the period 2020 (Ministry of Environment), Strategy for agricultural development for the period 2006-2015 (Ministry of Agriculture), National Action Plan to combat desertification, (Ministry of Environment, 2000)		

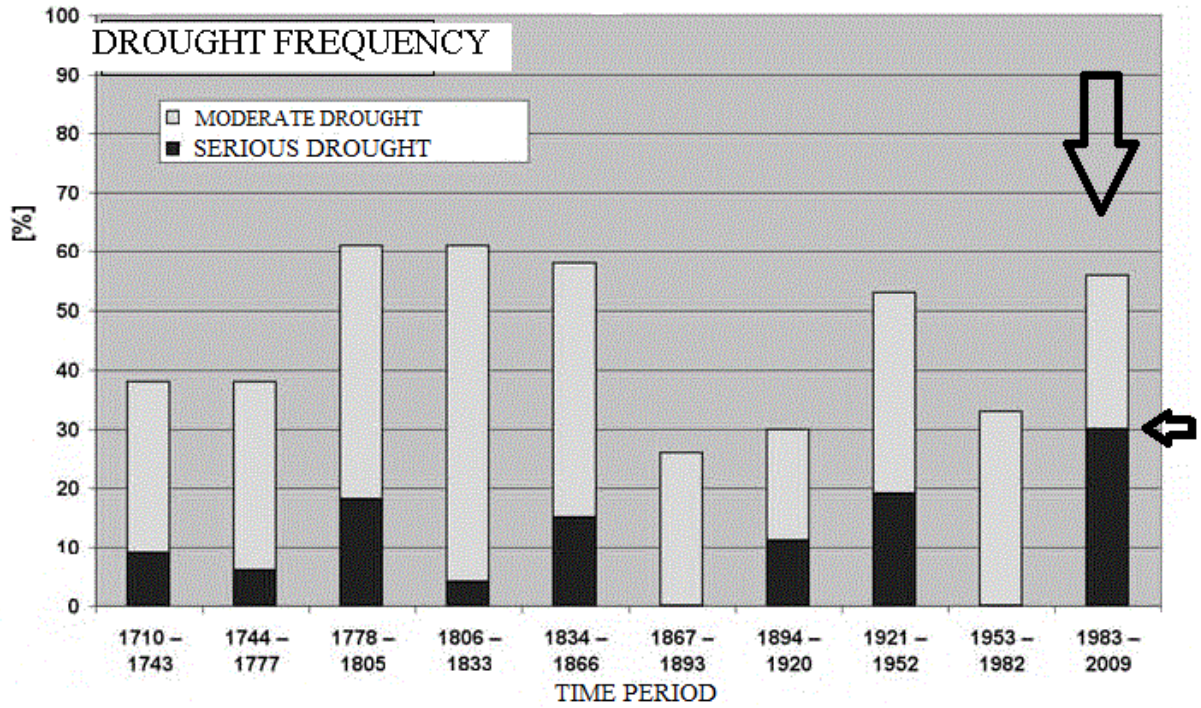
CZ*drought is identified as an issue on different RBMP levels, but in neither document drought is not sufficiently solved

CZ* The issue of long-term drought has been depicted as a severe issue and priority in the Strategy of Environmental Security 2012 - 2015 until the year 2020, approved by a resolution of Safety Council of the state no. 10/2012. In the field of environmental security both author of the strategy and administrator is the Ministry of the Environment.

HU*



The figure shows the ranking of the driest years since 1901 according to national average precipitation values in mm (Source: www.met.hu). The lower the mm value the higher the drought level. Green colour indicates drought years during 1990s, while dry years after 2000 were coloured in red. Years 2003, 2000 and 2011 were extremely dry.



Extreme drought frequency in the last 300 years' time period (source: Pálfay, 2010)

PL* in more detailed documents than RBMP, i.e. draft "conditions for the water use in the catchment", but none of the prepared conditions has been introduced into force yet.

Polish Water Law gives there provisions for DMP -1) for river basin districts and 2) water regions (sub-basins or parts of international basins): Art. 88r – 88t, 113

SLO* In the context of next planning periods, RBMP provides a number of steps to integrate climate problems in the field of water management, including:
- Preparation of the water management strategies to adapt to climate change,
- Preparation of guidelines for the consideration of climate change in water planning
- Identifying possibilities of water management adaptation to climate change.

2.5.3 If drought has not been identified as relevant in the RBMP are there plausible impacts evidencing drought relevance?

Answer - effect	∑	Country
More frequent occurrence of drought episodes during the last 20 years	6	CZ,MO,SK,UA,SLO,RO
Urban water supply shortages during drought periods	5	CZ,PL*[1],RO,SK,UA
Environmental impacts:	5	CZ,MO,PL*,SK,UA
Mortality of fish species due to drought episodes	6	CZ,MO,PL*[2],SK,SLO,UA
Impacts on river banks (vegetation, drying up of river streams)	4	CZ,MO,PL*[3],SK
Impact of wetlands	3	CZ,MO,PL*[4]
Fires risk	6	CZ,MO,PL,RO,SK,UA
Deterioration of water body status	5	CZ,MO,PL*[5],SK,UA
Groundwater dynamics (near to extreme values)	3	MO,PL,RO
Impacts on socio-economic uses:	3	CZ,PL,SK
Industrial uses	2	CZ,PL*[6]
Power production	3	CZ,SK,UA (Nuclear!),RO
Agriculture	6	CZ,MO,PL RO,SK,SLO,UA,
Tourism	3	CZ,PL,SK
Transport	1	CZ
Other		

PL* to some extend these answers assume human impact, for example in the land cover / land management of catchment

PL*[1] Temporal water level drops in shallow wells used for individual water supply; water deficits for water supply systems in small rural settlements – mainly in the sought of Poland
Two analyses are available in the internet. "Analysis of draught phenomenon in 2003 for the RWMB of Cracow" (south-eastern part of Poland) revealed that 6% of water courses length was completely dried out during this draught, so one may conclude about environmental impacts. Still the main analysed issue was water supply of different users: in 32% of water courses length intakes were not possible, in 39% intakes were restricted. The next analysed

draught phenomenon (also RWMB of Cracow) occurred in 2011 and 1% of water courses length was dry; in 9% intakes were not possible, in 39% intakes were restricted.
PL*[2] as the implication of drying up of streams; no data
PL*[3] drying up of rivers no information about bank vegetation
PL*[4] monitored within protected areas, namely national parks; data difficult to find
PL*[5] as the implication of drying up of streams; no data
PL*[6] in 1990s water intakes for the industry were restricted and operational rules of several storage reservoirs in the south of PL were temporarily changed

2.5.4 How many drought events have been occurred in the last 20 years? Please indicate "dry years" below

Country	Answer
BG	2000, 2011, 2012 (Information see below (BG*)
CZ	2000, 2003, 2012, locally (South Moravia) 2007, 2011, 2013
HU	1993, 1994, 1997, 2000, 2003, 2011
LT	7 (seven)
MO	11 (precipitation) - 15 (temperature) *(see below)
PL	Meteorological droughts: 6 years (1993, 1994, 2002, 2003, 2005, 2006, 2011) Hydrological droughts: 5 years (1993, 1994, 1998, 2000, 2003, 2011)
RO	2000, 2001, 2002, 2003, 2007, 2009, 2011, 2012 (see below explanation RO*).
SK	2000, 2002, 2003, 2006, 2007, 2008, 2009, 2011/2012
SLO	1992, 1993, 2000, 2001, 2003, 2006, 2007, 2011, 2012, 2013
UA	The particularly strong droughts were observed in 1989-2012 years. In this period the two or more month's droughts during vegetation period were observed on large areas in 16 years from 23 years, only 1993 and 1997 years were without droughts.

BG*
Insignificant drought can be observed when precipitation is about 75% of the normal, moderate drought – from 51 to 75% of the normal and severe drought – precipitation less than 50 % of the normal and monthly air temperature 1°C higher than the normal. A special attention has been also paid to the dry periods without precipitation. In this case the dry period is defined by more than five subsequent days without precipitation. A rainy day is assumed when daily precipitation above 1 mm occurs. The dry period is interrupted by precipitation above 5 mm.
The drought periods are shown at Fig.2 (annual air temperature) and Fig.3 (annual precipitation). The country has experienced several drought episodes in 20th century, most notably in the 1940s and 1980s. In these years the drought spells have been observed everywhere accross the country. In the more recent past, drought in Bulgaria was especially severe in year 2000 when precipitation was 30% less than the current climatic values.

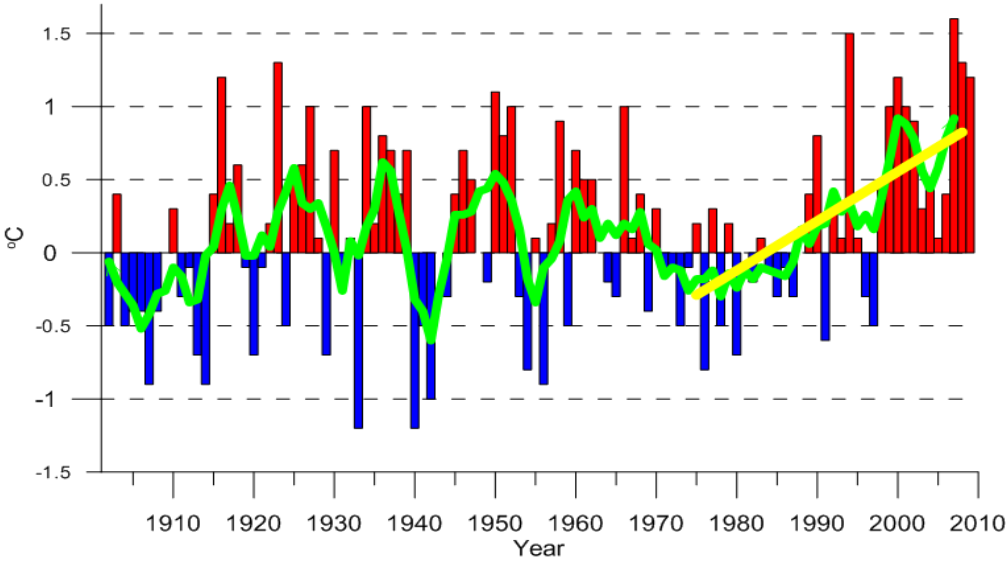


Fig.2. Anomalies of annual air temperature in Bulgaria compared to the 1961-1990

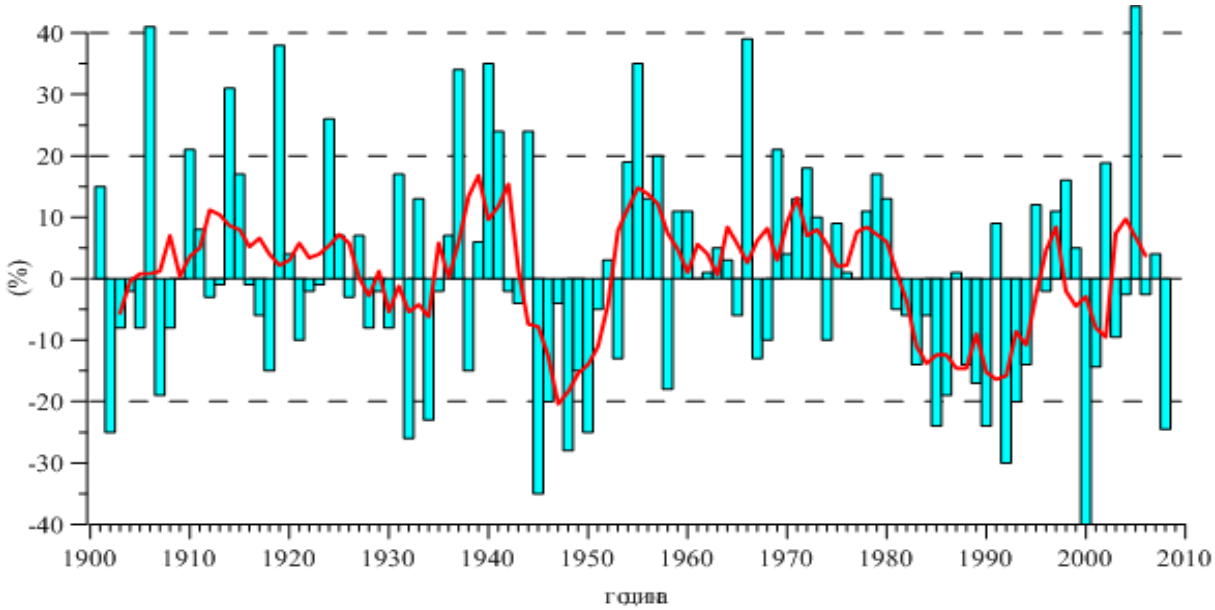


Fig. 3. Anomalies of the annual precipitation in Bulgaria compared with the period 1961-1990

In the last years the frequency of the extreme meteorological and climate phenomenon has increased. The annual amplitude between the maximal and minimal air temperatures decreases – the minimal temperature increases faster than the maximal. At the end of last century the thickness of snow cover shows tendency for decreasing. The upper border of the broad-leaved forests is moving to higher altitudes. There is tendency for increasing of the shortage of water in the soils due to increased water evaporation from the soil surface and through transpiration from the vegetation. In one of his studies for the spatial distribution of the soil dryness, using as a base the FAO soil classification, Alexandrov develops map-scheme of the municipalities in Bulgaria with conditions or risk for soil drying at water deficit, presented on Fig.4. The municipalities with increased risk or conditions for soil drying are located in all regions of the country. They are concentrated in Thracian lowland, in West Bulgaria, in North West Bulgaria along Danube, in East Bulgaria - Shumen district. Other smaller parts of them are located in pieces in Danube plain, and on North and South Black Sea

coast. All other municipalities are characterized with soil resources with low dryness risk (in green color on the map) or are located in mountain regions (grey color on the map), where the soil moisture in higher. Also, Alexandov develops a map for the temperature and water regimes of the soils in Bulgaria (Fig. 5).

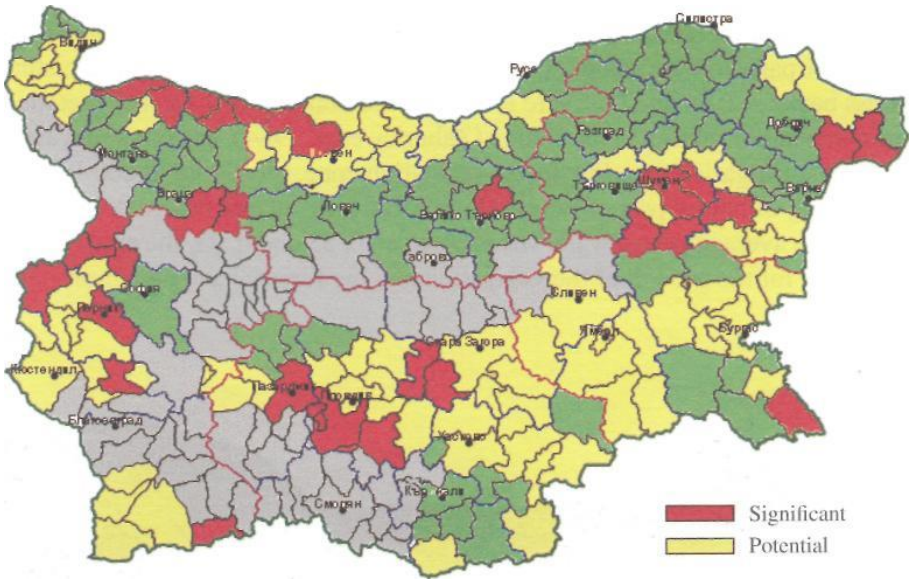


Fig.4. Municipalities with conditions (in water deficit) for soil drying

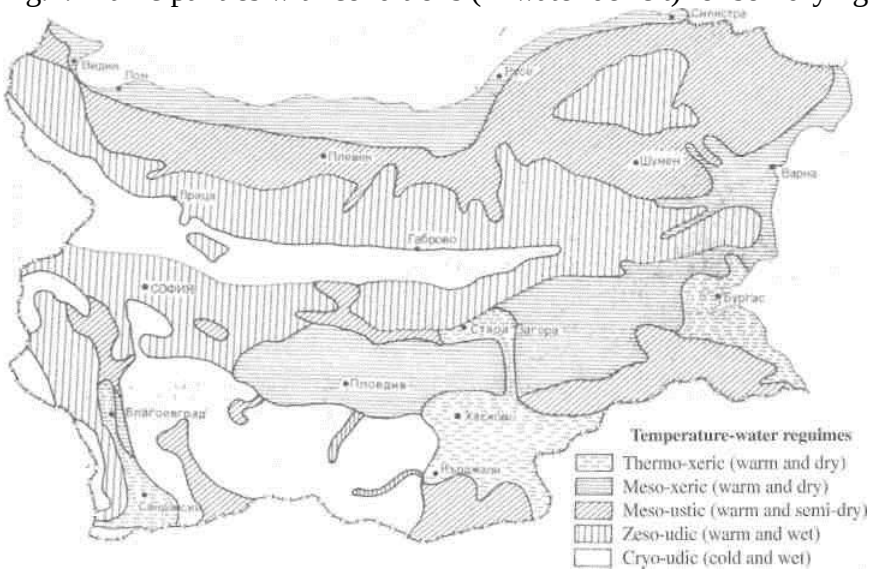
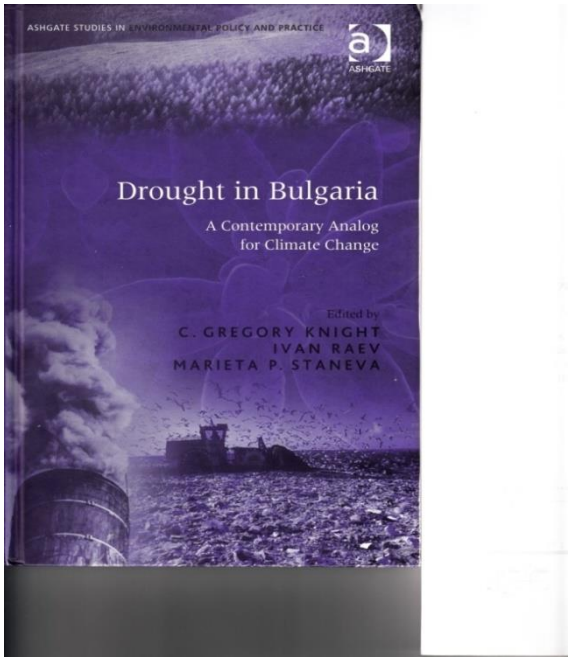


Fig.5. Temperature and water regimes of the soils in Bulgaria

Three major periods during the 20th century are characterized by long and severe droughts, namely 1902-1913, 1942-1953 and 1982-1994. During the first period, the drought years were approximately 20% of the total number of years. On the other hand, they increased to 40% during the second period and even to approximately 50% during the last period 1982-1994. Another characteristic of the last period is that years with above normal precipitation were not observed. Average precipitation in the Danube plain was about 560 mm and it was 540 mm in the Tracian lowland. Precipitation during the period May-September was 280 and 230 mm, respectively. The coefficient of variation (CV) in the two regions was about 0.25-0.35, which shows insignificant moisture resources or a dry climate.

The driest year during the study period of the 20th century (1901-1996) was 1945. Other considerably dry years were also 1902, 1907, 1932, 1934, 1946, 1948, 1950, 1953, 1985,

1986, 1990, 1992 and 1993. It is important to remark that there are some differences in the classification of dry years, regarding the regions of North and South Bulgaria.
Particular years, months or subsequent months with insignificant precipitation, i.e. periods of atmospheric drought, are not seldom events in the country and they can be considered as a normal climate characteristic in Bulgaria. Climatically, about two subsequent dry months occur in the lower areas of the country. However, there are some years with six and more subsequent dry months. Long dry periods during the cold-half of the year were observed in 1913, 1934 1967, 1976 and 1983. Similar periods during the warm-half of the year occurred in 1928, 1945, 1965 and 1985.
The year of 2011 is the driest year since the beginning of the current century. In some parts of North Bulgaria a period longer than 60 days without rain was observed. Precipitation over South Bulgaria was considerably below the average at the end of summer and the beginning of autumn. The losses caused by the long dry period on agriculture production were large. Unfortunately it is expected, drought will affect negatively the growth and productivity of crops during the agricultural season of 2012, because of low soil moisture required for germination. The rivers status was assessed to be in a crisis during the summer of 2011. The water levels in large rivers have been reduced more than 75%. Parts of Southwest Bulgaria were endangered with water supply restrictions.
The drought period of 1982-1994 has been described in the book "Drought in Bulgaria: A Contemporary Analog for Climate Change", published by Ashgate, UK, 2004



MO* During the period of the last 20 years drought events happened according to the data presented in the table. Data presented show years, when precipitation level was 100 mm less than climate norm and caused strong losses for agriculture. Average level of precipitations for Moldova is 550 mm/year.

Dry years	Annual
2009	407
1994	415

1992	**417**
2007	**420**
2011	**427,7**
2000	**437**
2003	**462**
2008	**472**
1999	**485**
2012	**522,8**
1993	**532**

The last 20 years are caracterized with the period of 15 years, when average annual temperature was 9,8-12,0 ^{0}C, while climate norm is 9,6 ^{0}C. Years 2007, 2009, 1994, 2008, 2000, 1999, 2002, 2010, 2005, 2001, 2004 are the hottest for last 120 year in Moldova.

Dry years	Mean annual
2007	**12,0**
2009	**11,4**
1994	**11,4**
2008	**11,3**
2000	**11,1**
1999	**11,0**
2002	**10,8**
2010	**10,5**
2005	**10,3**
2001	**10,3**
2004	**10,3**
1998	**10,2**
2006	**10,2**
1995	**10,0**
2003	**9,8**

RO* According to the NMA statistics:
The driest years during the last period are: 2000, 2001, 2002, 2003, 2007, 2009 and 2012. A total of eight droughty months were recorded during the agricultural year 2011-2012, November 2011 being the draughtiest month in the last 52 years in Romania, with a monthly mean of only 1.2 mm as against the multi-annual mean of 43.9 mm. July 2012 is the second, in top 5 draughtiest months over 1961-2012, with a monthly mean of 40.5 mm as compared with a normal value of 78.2 mm. July 2012 was also the warmest month in the last 52 years in Romania, the monthly mean temperature being 23.7°C as against the multi-annual mean of 19.2°C – a positive deviation of 4.5°C.

2.5.5 In which extend drought have been occurred in the last 20 years?

Answer	∑	Country
Local level	5	BG,LT,MO,PL,SK
River basin level	4	LT,MO,PL,SLO
Regional level	7	BG,CZ,HU,MO,PL,RO,SK

2.6 Have water scarcity and drought aspects been distinguished in DMP or WRMP?

Answer	∑	Country
Yes	2	HU,RO,
No	3	CZ*,SK,UA
Not clear	5	BG,LT,MO,PL*,SLO

CZ* Neither document was put together in the Czech Republic; generally these terms are not usually distinguished in the Czech Republic

PL* in RBMP

2.7 Are the data on water demand included (or are available) in the RBMP or WRMP?

Answer – water demand data	∑	Country
Current water demand not specified according to water use types		
Current water demand specified according to water use types	10	BG,CZ,HU,LT,MO,PL*,RO,SK,SLO, UA
Future water demand trend scenarios provided	7	BG*,CZ,HU*,LT,PL**,RO,UA
No data provided		

BG* The trends of the current water demand by different users, and optimistic, realistic and pessimistic trends of water demand by different users to 2015 and 2027 have been calculated in Chapter 6: Short Water Economic Analysis of 4 RBMPs.

HU* 2020-ig szól a stratégia.

PL* Total value for the whole river basin districts: surface and groundwater abstraction distinguished; divided into municipal, industrial, agricultural intakes
PL** indirectly – in the RBMP section "a register of any more detailed programmes and management plans for the river basin district dealing with particular sub-basins, sectors, issues or water types, together with a summary of their contents" several plans and programs were listed and some of them consider future demands for particular uses, but in RBMPs no such data is provided

2.8 Are the data on water availability included (or are available) in the RBMP?

Answer – water availability data	∑	Country
Data on **c**urrent water availability	10	BG*,CZ,HU,LT,MO,PL*,RO,SK*, SLO,UA
Future water availability trend scenarios provided	2	LT,RO,
No data provided		

BG* The current water demand availability is shown in Chapter 6: Short Water Economic Analysis of 4 RBMPs. The future water availability trend scenarios will be provided in the

up-dated versions of 2016-2020 RBMPs on the base of future climate scenarios, developed in National Strategy of Water Sector which was approved in 2012.

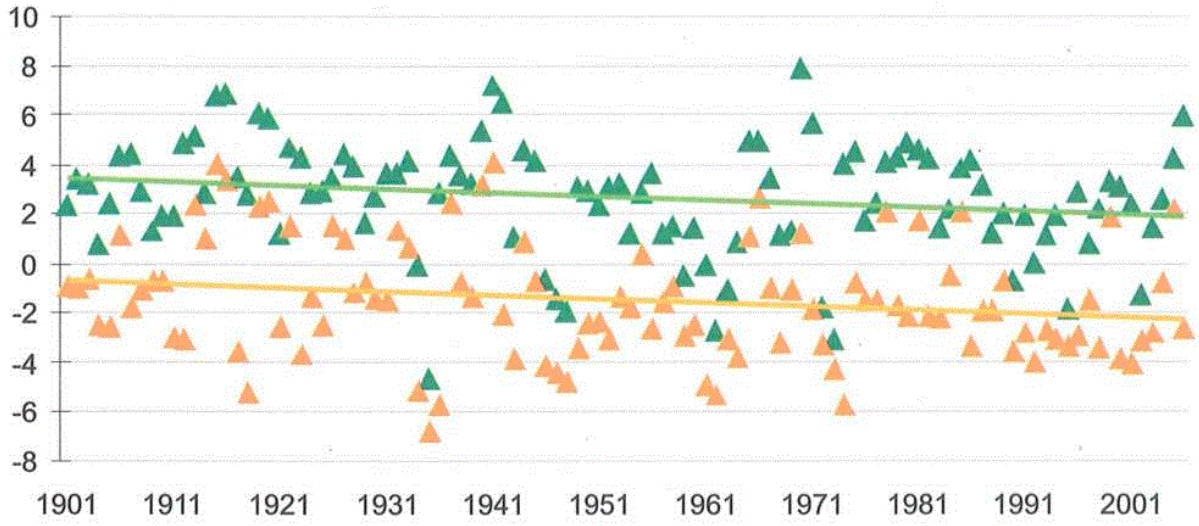
PL* a map with the classification of water reserves (5 classes - huge reserves ÷ no reserves) of groundwater bodies is provided

SK* State water balance – basis for quantitative status assessment in RBMP

2.9 Which parameters indicating the meteorological, hydrological and agricultural drought are monitored regularly?

Parameter/indicator	∑	Country
Air temperature	10	BG,CZ,HU,LT,MO,PL,RO,SK,SLO,UA
Precipitation	10	BG,CZ,HU*,LT,MO,PL,RO,SK,SLO,UA
Snow reserve	8	BG,CZ,HU,MO,PL,SK,SLO,UA
River flow	10	BG,CZ,HU,LT,MO,PL,RO,SK,SLO,UA
Stored surface reservoir volume	9	BG,CZ,HU,MO,PL,RO,SK,SLO,UA
Aquifer groundwater level	9	BG,CZ,HU,LT,PL,RO,SK,SLO,UA
Soil moisture content	10	BG,CZ,HU,LT,MO,PL,RO,SK,SLO,UA
Solar Activity cycling	4	CZ,PL,SK,SLO
Air humidity deficit	7	BG,CZ,HU,MO,PL,RO,SLO
Vapour Pressure Deficit (VPD)	3	CZ,PL,SLO
Other	1	CZ – Moisture balance CZ - Water reserve in soil

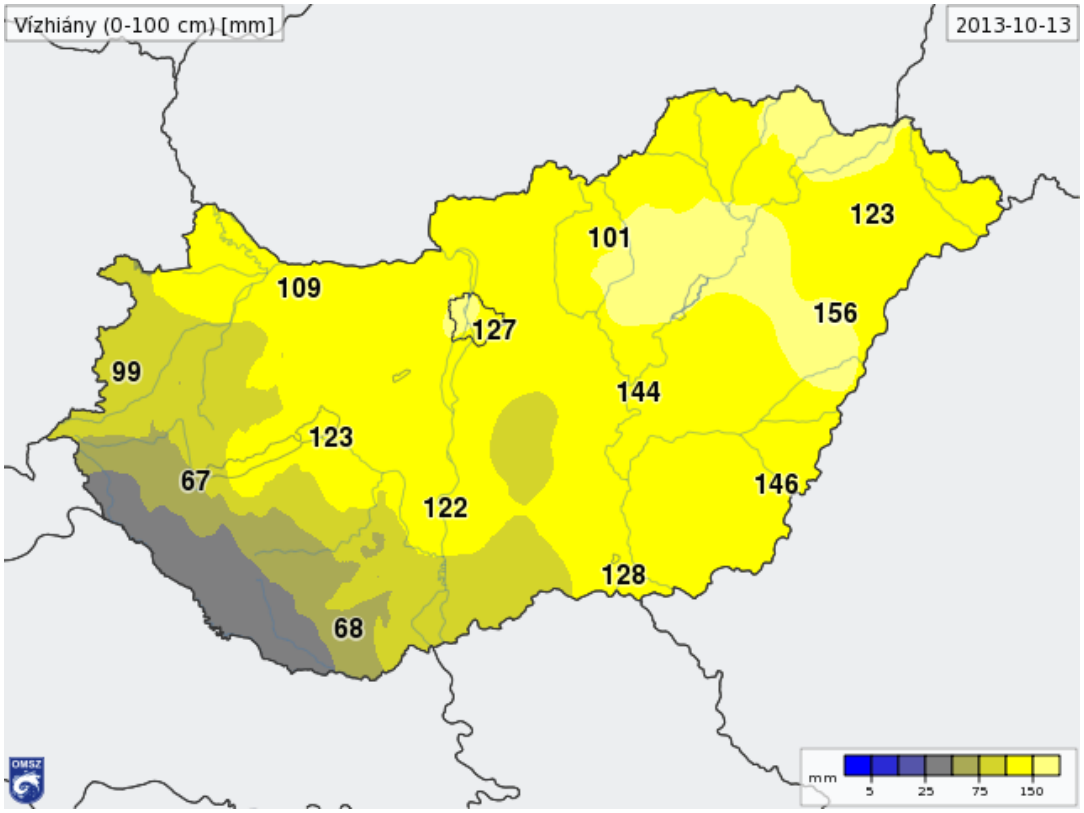
HU*



PDSI in Debrecen city, Hungary (source: Bihari et al. 2008)

Information can be gained from the official web site of the National Meteorological Service www.met.hu – For example: agrometeorological data on 1, 5, 10, 30 and 90 average air temperature, precipitation, solar radiation / sunshine duration, soil temperature, soil water content, water shortage.

An example map on precipitation deficit from long term yearly average values (14 Oct 2013)



2.10 Which parameters characterising the drought impact are regularly monitored and evaluated?

Impact		∑	Country
Impact on society (water supply)		7	BG, CZ,LT,MO,PL*,SK,SLO
Environmental impacts:		4	CZ,LT,MO,SK
	Mortality of fish species	6	CZ,LT,MO, RO, SK, ,SLO
	Impact on wetlands	3	LT,RO,SK
	Deterioration of water body status	4	MO,RO,SK,SLO
Impacts on socio-economic uses:		8	BG,CZ,HU,LT,PL**,RO,SLO,UA
	Agricultural - loss of yield / quality of crops	10	BG,CZ,HU,LT,MO,PL***,RO, SK*,SLO,UA
	Industrial uses	1	CZ,

	Power production	7	BG,CZ,HU,RO,SK*,SLO,UA
	Tourism		
	Transport	2	CZ,RO
	Drinking water supply of inhabitants	6	BG,HU,LT,MO*,RO,SLO
	Other		

Other:

UA - Risk assessment in agro sector related to the loss of several crops yield, fishes and animals used for insurance

MO* There were no shortages for population last 10-12 years

PL* Water intakes are monitored (water meters) by the users, no data on water deficits available in the Main Statistical Office or river basin authorities.
In the analysis developed for RWMB of Cracow (see 2.5.3) economic losses were partially assessed – for agriculture, forestry and municipal supply
PL** Only users – industrial plants, water supply companies – may have such data
PL*** Threshold values for "draught crisis" for different plants are defined, farmers are paid compensations if losses in the main crop exceed 25%; Institute of Soil Science and Plant Cultivation – State Research Institute is responsible for the assessment of losses in crops

SK* Indicators noted above are monitored irregularly by the touched stakeholders. Only data on loss of yield are processed statistically

2.11 Which EU indicators have been calculated?

Indicator	∑	Country
Standardized Precipitation Index (SPI)	9	BG, CZ, LT,MO,PL,RO,SK, SLO,UA
Fraction of Absorbed Photosynthetically Active Solar Radiation (fAPAR)	6	BG, CZ,MO,RO,SLO,UA
Water Exploitation Index Plus (WEI+)	2	BG, CZ,
Other comparable national indicators described below:	5	CZ*,HU*MO*,PL*RO*

CZ* Various climatologic evaluation of the Czech Republic predominantly published in the form of maps (The atlas of climate of the Czech Republic, Czech Hydrometeorological Institute).
Mentioned European indicators were calculated only for partial river basin Morava within the pilot study

HU*
In Hungary the commonly used drought index is the so called Pálfai drought index.

$$PAI_0 = \frac{t_{IV\text{-}VIII}\ (C°)}{P_{X\text{-}VIII}\ (mm)} \times 100$$

where

PAI_0 - base value of Pálfai drought index
$t_{IV-VIII}$ - average air temperature in the April- August period (C°)
P_{X-VIII} - weighted precipitation sum from October till August (mm)
(Weights are:0.1 October; 0.4 November; 0.5 December - April; 0.8 May; 1.2 June; 1.6 July; 0.9 August)

The final Pálfai drought index (PAI) is calculated form the PAI_0 with three correction factors, such as k_t temperature factor, k_P precipitation factor and k_{gw} groundwater factor and then

$PAI = k_t \cdot k_P \cdot k_{gw} \cdot PAI_0$

MO* Climatic Water Index ; Index Nedealcov of Dry Periods; Martonne Aridity Index

PL* Climate Water Balance Index (KBW) counterpart of Standardized Precipitation Evaporation Index (SPEI), Effective Drought Index (EDI), Flow Duration Curve (FDC), hydrogeological draught index

RO* Soil moisture, heat waves

2.12 Has an early warning indicator system been developed?

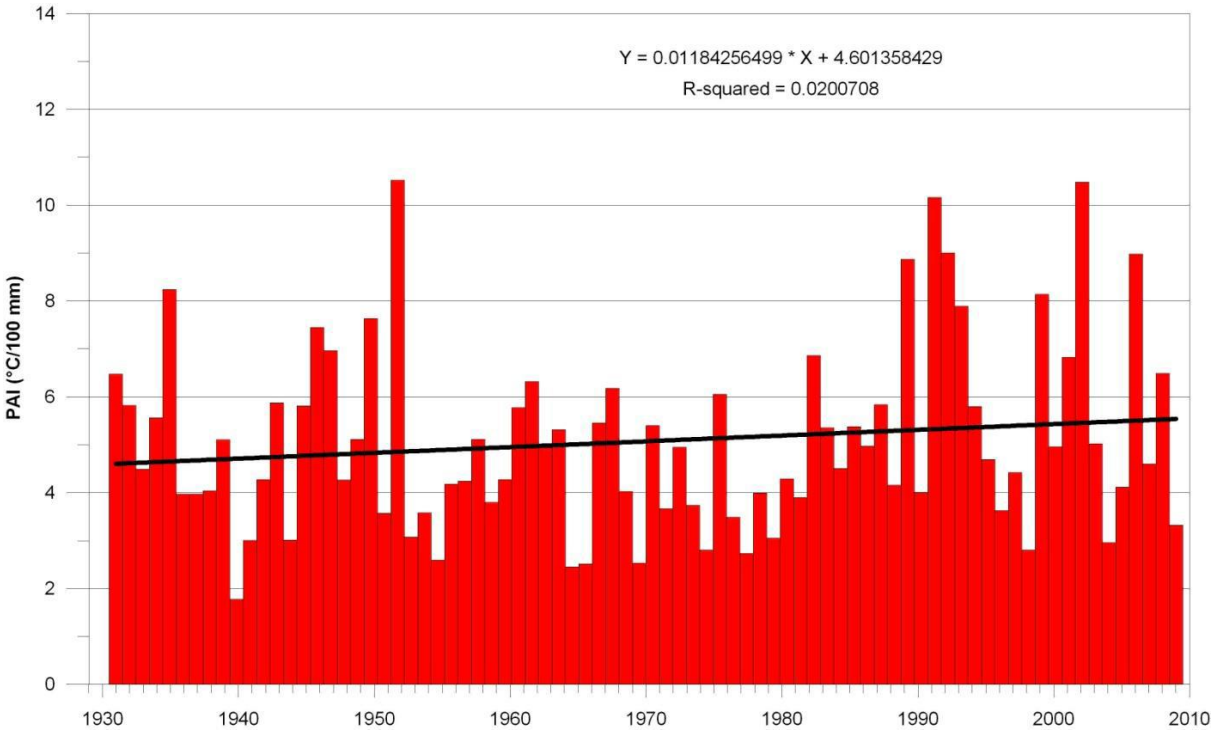
Answer		∑	Country
Yes		7	BG,HU,LT,MO,PL*,SLO**,**RO
Indicator – threshold established	Air temperature	5	BG,LT,MO,PL,RO
	Precipitation	5	BG,LT,MO,PL,RO
	Snow reserve		
	River flow	4	BG (Danube),LT,PL,RO
	Stored surface reservoir volume	2	BG,MO
	Aquifer water level	2	LT,RO
	Soil moisture content	1	RO
	Other	2	BG – wind, HU*
No		3	CZ*,SK, ,UA

CZ*Is being developed (by 2015)

HU* the Pálfai drought index is used as early warning indicator.
The graph below shows the country average PAI indexes and the trend line between 1931-2010.

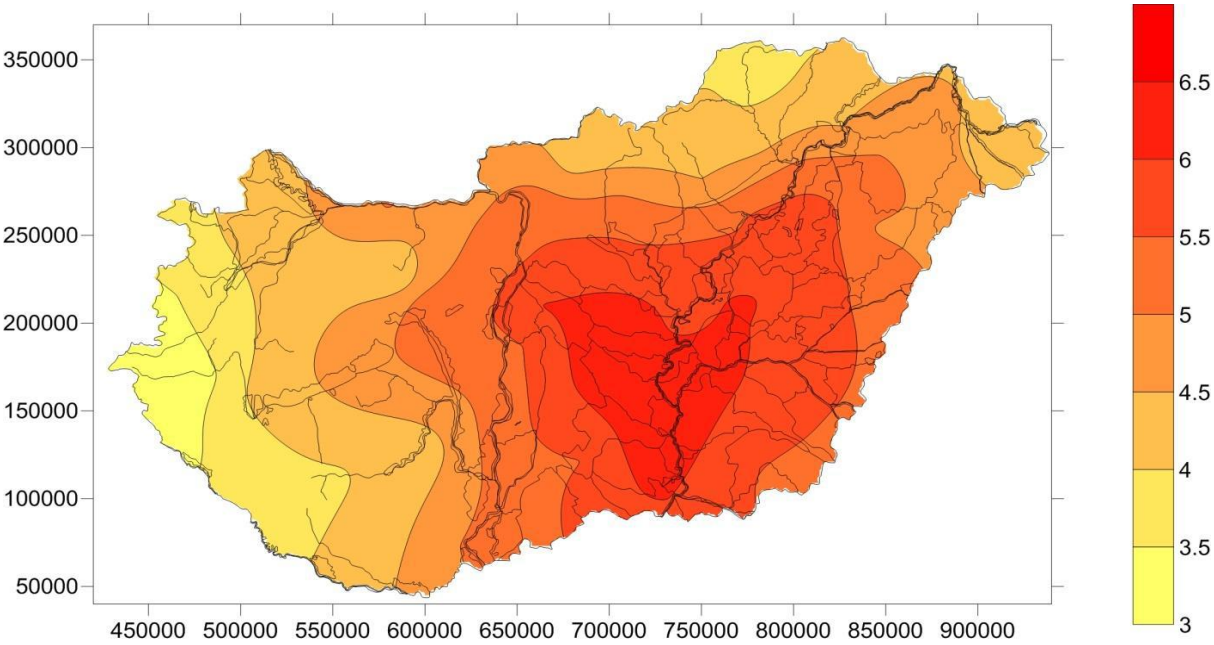
SLO* Indicators and thresholds for drought severity and duration are established and published,
During drought periods special drought bulletin is issued which covers all quantities that are listed in table 2 in EWS section;

PL* Yes/No: Quasi warning system (monitoring + short-term forecast)



(Source: Governmental consultation paper on *"Long-term concept of drought management"*)

The map below shows the area distribution of the average PAI drought index in the ten most drought years between 1931-2010



(Source: Governmental consultation paper on *"Long-term concept of drought management"*)

2.12.2 If yes, which categories of the drought stages have been classified?

Drought state	∑	Country
Normal status	3	BG,LT,PL*
Pre-alert status	2	BG,LT
Alert status	1	BG
Emergency or extreme status	2	BG,MO
Other classification system (e.g. sector specific for Agriculture, Energy, Industry, Tourism)	1	HU*

HU* When using the Pálfai drought index the following categories are applied to classify drought stages.

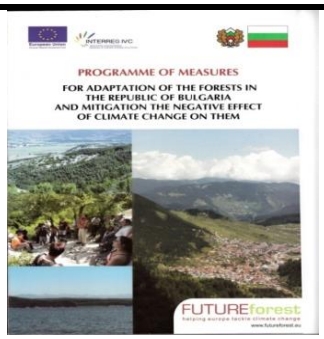
Category	Drought description	Areal average PAI
I.	Light drought	4 - 6
II.	Moderate drought	6 - 8
III.	Significant drought	8 - 10
IV.	Severe drought	10 - 12
V.	Highly severe drought	12 <

PL* risk of occurrence of draught for different crops

2. 13 Have another plans independent of DMP been developed?

Plan	∑	Country
Public supply plan	3	LT,SK,SLO
Rural Development Programme	7	HU*,LT,MO,RO,SK,SLO,UA
Climate Adaptation Plan	6	BG*,HU**,MO,PL*,RO,SK*

Other:
BG: - Master Plans of 51 Water Supply&Sewerage companies in which drought and water scarcity impact on investment programmes of the short period 2014-2020 and medium period 2021-2028 have been developed.
- National Strategy for Development of Forests Sector in the Republic of Bulgaria for the period of 2013-2020 (established by Ministry of Agriculture and Food in November 2013) in which the measures for protection of water quantity and quality in forests watersheds in drought periods are taken into account. The basic document of the forests strategy is the Programme of measures for adaptation of the forests in the Republic of Bulgaria and mitigation the negative effect of climate change on them, developed by support of GWP experts in 2011-2012.



- Draft Climate Law has been developed by MoEW with special focus on greenhouses trade.

CZ:

- Concept of Environmental Security 2012 - 2015 until the year 2020 approved by resolution of Security Council of the state no. 10/2012. The parts of resolution are tasks ordered by central organs of civil service, which are focused on decrease in drought impacts;
- On the regional level the issue of public water supply is solved conceptually in the Plans of development of pipelines and canalizations (PRVKÚ). Drought issue is partially solved in the Conception of Water Management Policy.
- In case of need 64 water management profiles are protected for the construction of big water reservoirs in the Orders of Sites for Accumulation of Surface Water in the Czech Republic.

UA - State Program "Forest of Ukraine" for 2002 — 2015 period, approved by the Decree of the Cabinet of the Ministers of Ukraine, 29 April 2002 № 581

BG* Third National Action Plan for Climate Changes in 2013-2020, produced by Ministry of Environment and Water (MoEW) in May 2012

HU*

National Climate Change Strategy 2008-2025	Chapters related to drought issues: 4. Adaptation to changing climate 4.1. Assessment of current situation, prospects 4.2. Adaptation tasks 5. Implementation of the strategy 5.1. Governmental tasks 5.2. Society tasks 5.3. Costs and benefits 5.4. Tracking the implementation
National Rural Strategy 2012-2020	Chapters related to drought issues: 4.1.4 Biodiversity, Natural areas 7.1.5 Regional water management programme
Magyary Programme	Chapters 3.1.3.3. Water flow control 3.1.3.4. Regional development and development policy

HU** In September 2013 the *"Second National Climate Change Strategy 2014-2025 - with outlook to 2050"* a Governmental policy discussion paper was made available for national consultation.

PL* Small retention programs for voivodships, small retention programs for forests (see 2.4.1)

SK* Strategy of adaptation of Slovakia against unfavourable impacts of climate change – document issued by the Ministry of Environment in August 2013 for discussion.

2.14 Have the drought risk maps been developed?

Answer		∑	Country
Yes		4	BG*, CZ*,HU,SLO*
Level of drought risk maps	Local	1	RO
	Regional		
	National	5	BG, CZ,HU,,MO*,RO*
No		3	LT,PL*,SK,
Partially		4	BG, ,MO,RO,UA
Are being prepared		2	MO,UA

BG* There is tendency for increasing of the shortage of water in the soils due to increased water evaporation from the soil surface and through transpiration from the vegetation. The risk by air drought increased (Fig. 6).

SLO* agricultural drought risk maps were developed in Slovenia

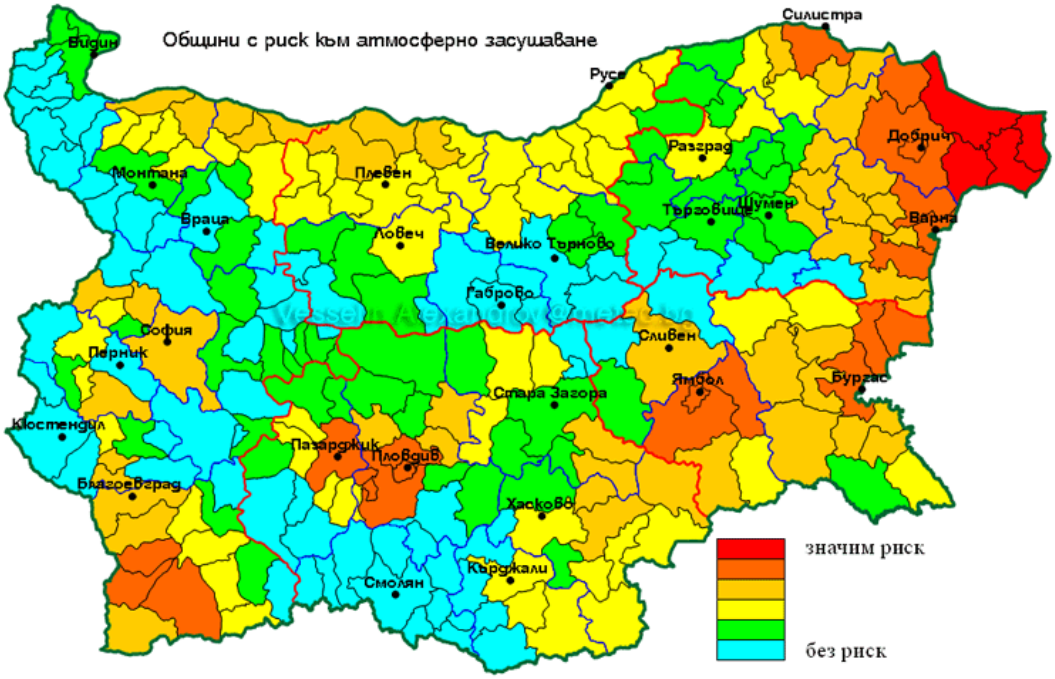


Fig. 6. Municipalities with risk by air drought

(Without risk - Snow; Low - Fires likely to be self extinguishing and new ignitions unlikely. Any existing fires limited to smoldering in deep, drier layers; Moderate - Creeping or gentle surface fires. Fires easily contained by ground crews with pumps and hand tools; High - Moderate to vigorous surface fire with intermittent crown involvement. Challenging for ground crews to handle, heavy equipment (bulldozers, tanker trucks, aircraft) often required to contain fire; Very High – High intensity fire with partial to full crown involvement. Head fire conditions beyond the ability of ground crews; air attack with retardant required to effectively attack fire's

head; and Extreme – Fast spreading, high intensity crown fire. Very difficult to control. Suppression actions limited to flanks, with only indirect actions possible against the fire's head) (Source: Vesselin Alexandrov)

A team of researchers from the Forest Research Institute, University of Forestry and National Institute of Meteorology and Hydrology, together with experts from the forestry administration, carried out an investigation on development of climatic scenarios for climate change in Bulgaria in the 21st century, definition of vulnerability zones of forest tree vegetation; determination of detailed measures for adaptation of forests in the 21st century to new conditions conformed to vulnerability zones in forests in 2010-2011 (Fig. 7).

Vulnerability zones of the forest ecosystems in Bulgaria : a- contemporary climate (1961-1990); b- 2020 realistic scenario; c- 2050 realistic scenario; d- 2080 optimistic scenario; f- 2080 realistic scenario; g-2080 pessimistic scenario
Zone A – very high vulnerability; Zone B (Б) – high vulnerability; Zone C (В) – moderate vulnerability; Zone D (Г) – low vulnerability; Zone E (Д) – very low vulnerability

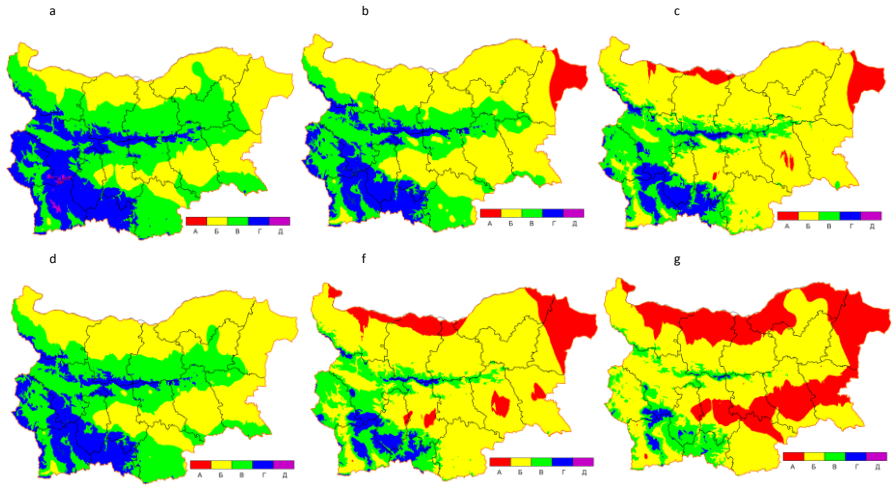
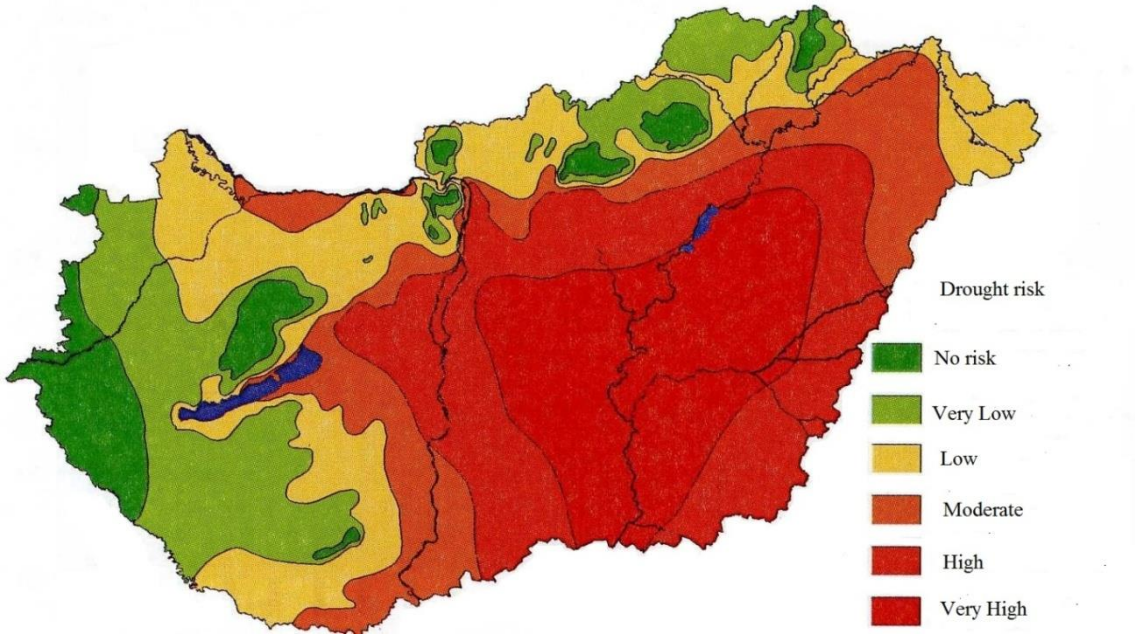


Fig. 7. Vulnerability zones of the forests ecosystems in Bulgaria

CZ* - On a state-wide level the maps of risk areas (e.g. from the point of view of rainfall frequency, moisture balance, maps susceptible to drying) are part of a Database of sources of risks in GIS, created and continuously being updated for the needs of crisis management (according to the Act no. 240/2000 Coll.). Database is administered, updated and funded by the Ministry of the Environment of the Czech Republic. Among the users belong e.g. the Ministry of Agriculture, the Ministry of Defence and Armed Forces and the Ministry of the Interior of the Czech Republic. For creation of database the backgrounds processed by the Czech Hydrometeorological Institute (data, background maps) are used.

HU*
Map of drought risk level distributions determined on the bases of long term average PAI is shown below.



MO* Related to agriculture

PL* As a planning document – no, present state of agricultural draught risk is presented in the internet; assessment is performed for the smallest administrative units (gminas); meteorological & hydrological draughts are presented for gauging / meteo stations

RO* Digital map for drought risk for forests in Romania (http://www.icasbv.ro)
Google map for drought areas (https://maps.google.ro/maps/ms?ie=UTF8&oe=UTF8&msa=0&msid=206354695963469290525.0004d857f526ca00f018d)
Maps for drought area at national level calculated based on the Martonne index for 1961-2010. http://harmih.gg.unibuc.ro/rezultate_ro/etapa-4.pdf The document includes several other drought maps.

2.15 Have some guidelines for DMP/WRMP or drought risk maps been developed?

Answer	∑	Country
Yes		
No	7	BG,HU,LT,RO,SK,SLO,UA
Are being developed	3	CZ*,MO,PL*

Title/description of the guideline:

CZ *- The research project of T. G. Masaryk Water Research Institute and Czech University of Life Sciences (Proposal of a system for managing emergency situations associated with drought and water scarcity in the Czech Republic).

PL* Protection against Draught in Water Management Planning – A methodology (phase II, 2013); submitted to the National Water Management Board

2.16 Are there on going activities focused on development or updating DMP or WRMP?

Answer	∑	Country
Yes	10	BG*,CZ*,HU*,LT*,MO*,PL*,RO,SK*, SLO*,UA*

Specification of activity:

BG* The 4 River Basin Directorates confirmed the time schedule of the establishment of new 2016-2020 RBMPs. The process started at the beginning of 2013. The main drought measures will be taking into account at river basin level i.e. up-dating of 2001 DMP is not actual.

CZ *- Within the Program of security research (the provider of finance is the Ministry of the Interior of the Czech Republic) the project "Proposal of a system for managing emergency situations associated with drought and water scarcity in the Czech Republic" is being realized. Its aim is to create the system of indicators of meteorological, hydrologic and agronomical drought, to propose the way of determination of threshold values for these indicators for three degrees of threat by drought and also to identify the measures for better drought management in its each phases – which means from preventive and strategic measures to operative measures and measures connected with revitalization. The end of the project solving is in 2015.The evaluation of current and possible future drought periods in conditions of small and medium river basins of the Czech Republic and Slovak Republic (T. G. Masaryk Water Research Institute).

HU*

- In 2012 the Hungarian Government issued the 1432/2012. (X. 9.) Governmental Decree on "*Development of national water manegement, irrigation and drought strategy*".
- Following the issue of Governmental Decree the Ministry of Rural Development elaborated the "*Water strategy of water management, irrigation and drought management*" document, which was made available for national consultation in March 2013.
- In September 2013 the *"Second National Climate Change Strategy 2014-2025 - with outlook to 2050"* a Governmental policy discussion paper was made available for national consultation.
- A Governmental consultation paper on *"Long-term concept of drought management"* was issued and made available for professional consultation.

LT* In the new river basin management plans for 2015-2021 drought issues will be addressed again

MO* There are no special documents on DMP or WRMP. Anyway political documents recently developed contain activities focused on Drought management. This mainly refers to agriculture and population water supply and sanitation.

PL* Preliminary analyses for DMP development have been performed for the territories of 2 (out of 7) Regional Water Management Boards (RWMB); one more of RWMBs intends to start similar analysis and prepare draft DMP

RO* Periodical updates of the river basin water resources management plans and of the drought action plans.

SK* Only Slovak case study within IDMP

SLO* The activities are planned only and not on going yet! Minister for Agriculture and the Environment assured at press conferences that the plan will be prepared and included to the RBMP 2015. **UA*** RBMP development in some basins Water Strategy of Ukraine Drafting		
No		

2.17 Have the National Action Programmes (NAP) key instruments in the implementation of the Convention (UNCCD) been developed?

Answer	∑	Country
Yes	1	BG*
No	3	CZ,LT,SLO
Partially	2	PL,SK

BG* There is a national program: GEF, UNDP. 2007. National program for sustainable management program of land and combat desertification in Bulgaria 2007- 2013, November, pp 156. The total investments of the desertification program are 9 288 000 BGN or 4 748 878 euro.

Part 3 – Institutional analysis

Key institutions designated to deal with the drought management issues	Country	Name of the institution
Ministries:	BG	Ministry of Environment and Water Ministry of Agriculture and Food (incl. Forestry Agency) Ministry of Regional Development Ministry of Finance Ministry of Inter Affairs (Civil Protection) Ministry of Economics
	CZ	Ministry of Agriculture Ministry of the Environment Ministry for regional development, Ministry of the Interior Ministry of Transport
	HU	Ministry of Rural Develeopment
	LT	Ministry of Environment Ministry of Agriculture, Environmental Protection Agency
	MO	Ministry of Environment, Ministry of Agriculture, Ministry of Regional Development
	PL	Ministry of Environment, Ministry of Agriculture and Rural Development,

		Council of Ministers (introducing state of natural disaster)
	RO	Ministry of Environment and Climate Changes Ministry of Water Forest and Fishery Ministry of Agriculture and Rural Development Ministry of National Education National Committee to Combat Drought, Land Degradation and Desertification, National Committee for Emergency and Disasters (NCED)
	SK	Ministry for Environment – competent authority for implementation of the Water Framework Directive including drought issues Ministry of Agriculture – responsible for preparation on the National Action Plan under UNCCD Convention Ministry of Interior – responsible for risk management
	SLO	Ministry of Agriculture and Environment Ministry of Foreign Affaires Ministry of Economic Development and Technology
	UA	The State Service on emergency situation; Ministry of Agropolicy UkrHydrometcenter
Professional institutions:	BG	National Institute of Meteorology and Hydrology – Bulgarian Academy of Sciences Institute of Meliorations and Mechanization Soil Institute "Pushkarov" Agricultural Institute in General Toshevo Agricultural University in Plovdiv
	CZ	Czech Hydrometeorological Institute, T.G. Masaryk Water Research Institute, Research Institute for Soil and Water Research, Academy of Science of the Czech Republic
	HU	National Academy of Sciences (NAS), Soil Scence and Agrochemistry Research Institute of NAS, National Meteorological Service, National Water Authority
	LT	Nature Research Center, Lithuanian Research Centre for Agriculture and Forestry within the Institute of Forestry
	MO	Hydrometeo Service, Apele Moldovei (Moldavian Waters) – subdivisions of the Ministry of Environment), Academy of Sciences, Soil Research Institute, Institute ACVAPROIECT (under Ministry of Agriculture)

	PL	Institute of Meteorology and Water Management – National Research Institute, Polish Geological Institute – National Research Institute, Institute of Soil Science and Plant Cultivation – State Research Institute, Institute of Technology and Life Science
	RO	National Meteorological Administration (NMA) "Romanian Waters" National Administration (RWNA) National Institute for Hydrology and Water Management INHGA National Institute for Research for Agriculture (ICPA) National Research Institutions in different locations (like Danube Delta, Black Sea Coast) Professional Associations
	SK	Slovak Hydrometeorological Institute Soil Science and Conservation Research Institute
	SLO	Environment Protection agency of the Republic of Slovenia Water Institute of the Republic of Slovenia Agricultural Institute of Slovenia
	UA	Institute of Water problems and melioration Vysotskyi Research Institute of forestry economy and agro-forest melioration
River basin authorities:	BG	Danube River Basin Directorate Black Sea Basin Directorate East Aegean Basin Directorate West Aegean Basin Directorate
	CZ	River basin Morava, Labe, Vltava, Ohře, Odra; state enterprises
	HU	Lower Tisza Valley Water Management Directorate
	LT	
	MO	Danube – Dnester water authority
	PL	National Water Management Board Regional Water Management Boards
	RO	National Administration "Apele Romane" which has 11 river basin branches that were designated during the last reform within the water management responsible bodies. In the 50's and latest during EU/WFD implementation activities Years: since 2000-2009 for the first cycle
	SK	Slovak River basin enterprise Banská Štiavnica (4 branches –Bratislava, Piešťany, Banská Bystrica, Košice)
	SLO	
	UA	RBA of River Dniester and River Prut
	BG	There are 16 Regional Inspectorates of Environment

Local competent authorities (e.g. Inspectorates):		in the towns of Blagoevgrad, Burgas, Varna, Veliko Tarnovo, Vratsa, Monana, Pazardjik, Pernik, Pleven, Plovdiv, Rousse, Smolyan, Sofia, Stara Zagora, Haskovo and Shumen
	CZ	Municipalities with widened authority, regions, the Czech Environmental Inspectorate
	HU	
	LT	
	MO	Environmental inspectorates (subdivision of the Ministry of Environment), sectorial authorities (agricultural, energy)
	PL	agricultural advise centres – voivodship level and lower (poviat) level – some limited issues
	RO	County Water Management Systems Environmental Protection Agencies at the county level (41)
	SK	
	SLO	
	UA	
Universities:	BG	University of Architecture, Construction and Geodesy – Water Department, Sofia Sofia University "St. Kliment Ohridsky", Sofia Forestry Institute, Sofia Economic Research Institute – Bulgarian Academy of Sciences National Statistic Institute
	CZ	Mendel University in Brno, University of South Bohemia in České Budějovice, Czech University of Life Sciences, Charles University in Prague – Fatulcy of Science
	HU	Universities with agricultural faculties, such as - University of Debrecen - Szent István University
	LT	Vilnius University Department of Hydrology and Climatology
	MO	Free International University of Moldova, Agricultural University
	PL	
	RO	Technical University Bucharest Poly-technical Institute Bucharest Universities from Bucharest, Iasi, Timisoara, Cluj, Sibiu , etc Institute For Soil and Agro-chemistry
	SK	Slovak technical University Comenius University – Faculty of Natural Sciences Agricultural University Nitra
	SLO	University of Ljubljana, Biotechnical faculty University of Ljubljana, Faculty of Mathematics and Physics

	UA	
NGOs:	BG	Scientific-Technical Union of Water Affairs in Bulgaria Bulgarian Water Association Earth Forever WWF – Bulgaria Green Balkans Ekoglasnost GWP Bulgaria
	CZ	Agrarian Chamber of the Czech Republic, Union of Towns and Municipalities of the Czech Republic
	HU	National Association of Water Management Societies
	LT	Baltic Environmental Forum GWP-Lithuania
	MO	Ecological Movement of Moldova, ECO-Tiras, Biotica, ECOS (host Institution for GWP, Moldova), BIOS, ECOSTRATEGII, ECOSPECTRU, etc
	PL	WWF
	RO	Climate Action Network - Romania (RAC-RO) Global Water Partnership –Romania
	SK	Civil Association Slatinka GWP Slovakia
	SLO	Slovenian National Committee on Irrigation and Drainage Union of Slovenian Organic Farmers Association
	UA	GWP Association of Dniester River Keepers - ECO-Tiras
Key stakeholders (e.g. farmers)	BG	Citizens, farmers, mayors of the small towns and villages with permanent or seasonal water scarcity
	CZ	Farmers, industry, water management and canalization companies
	HU	Farmers
	LT	
	MO	Union of farmers Union of the mayors of the towns Union of Water users Association of agricultural producers Relevant Ministries and institutions mentioned above
	PL	
	RO	Farmers Associations
	SK	
	SLO	Agriculture and Forestry Chamber of Commerce
	UA	Farmers Insurance agencies

3.2 Have the drought management organisational structures been established?

Question - answer		∑	Country
Have the drought management organisational structures been established?	Yes	2	HU,UA
	No	8	BG, CZ,LT,MO*,PL,RO,SK SLO
Sectors involved	Environment	2	MO*,RO
	Agricultural	4	HU,MO*,RO,UA
	Forestry	2	RO,UA
	Power industry		
	Other		

3.3 Has the competent entity for the DMP development been established?
3.4 Has been working groups established to identify drought impacts and develop DMP?

Question - answer		∑	Country
Has the competent entity for the DMP development been established?	Yes	5	HU*,PL*,RO*,SK*,SLO*
	No	5	BG, CZ,LT,MO,UA
The name for the competent entity **HU*** Ministry of Rural Development (Please note that from January 2014 the governmental structure of water management and environmental management will be changed. The final set up has not been publicized, yet.) **PL*** National Water Management Board – for river basin districts Regional Water Management Boards – for water regions **SK*** Ministry of Environment is competent authority for implementation of the WFD, it means that this body is responsible also for RBMP and DMP production as well **SLO*** Ministry of Agriculture and Environment			
Has been working groups established to identify drought impacts and develop DMP?	Yes	2	CZ*,HU*
	No	7	BG,LT,MO**,PL,SK,SLO,UA
Sectors	Environment	3	CZ,MO**,RO
	Agriculture	4	CZ,HU,MO**,RO
	Forestry	2	CZ,RO
Institutions	Ministries	4	CZ,HU,MO**,RO
	Hydro met services	2	MO**,RO
	Agricultural professional institutions	2	MO**,RO

	Forest professional institutions	1	RO
	Stakeholders (e.g. farmers)	1	RO
	Other	2	HU**,RO**

CZ* The National Platform for Disaster Risk Reduction deals with drought issue. Generally, the administrator is the Ministry of the Environment of the Czech Republic, members of the platform are deputies to the ministries (the Ministry of Agriculture, the Ministry of Interior of the Czech Republic), members of research institutions (the Academy of Science, Charles University, Technical University in Ostrava), organizations (Unions of Towns and Municipalities of the Czech Republic), committees (Czech National Committees for restricting of consequences of catastrophes) and the others.

HU* Ministry of Rural Development (Please note that from January 2014 the governmental structure of water management and environmental management will be changed. The final set up has not been publicized, yet.)
HU** With the leadership of the National Academy of Sciences wide range of expert group is involved.

MO* Drought management is performed on the base of the ad-hoc. Anyway new environmental strategy presumes development of such structures

MO** Working groups are established to estimate impacts of droughts for sectors of economy (mainly agriculture) in the ad-hoc regime. They do not produce such plan, but develop proposals to reduce impacts of droughts. Mainly it refers to irrigation and attraction of best practices for soil moisture conservation (guidance on moisture conservation are strongly needed)

RO* National Meteorological Administration
National Institute for Hydrology and Water Management INHGA
RO** Research institutions

Bulgaria, as a part of European civilization, provides for more than 134 years its information and scientific contribution to studying of the problems related to the climate change, weather and water resources, including droughts.

According to WMO GOS Catalogue, in Bulgaria there are 36 meteorological stations with GOS stations density 0,32/1000 km^2 (http://www.dmcsee.org/en/countries/?item_id=5). Based on the data of DMCSEE obtained by questionnaire, (http://www.dmcsee.org/en/countries/?item_id=5), there are also:

- 47 automatic weather stations (AWS) with AWS density 0,42/1000 km2. Less than half of the stations measure precipitation;
- 437 manned meteorological stations (measuring at least precipitation, with manned stations density 3,94/1000 km2;
- 31 soil moisture measurement sites and 373 groundwater measurement sites in Bulgaria;
- data on soil type and soil water holding capacity are also available.

The real time meteorological/hydrological data processing, preparation of meteorological/hydrological predictions and products as well as the development and set-up of relevant methodologies and software are the major tasks of the National Institute of Meteorology and Hydrology at Bulgarian Academy of Sciences (NIMH-BAS) (www.meteo.bg).

The NIMH-BAS is the main provider of the scientific research and operational activities in the fields of meteorology, agrometeorology and hydrology in the country. The guiding principles of these activities, especially the operational ones, are the Technical Regulations of the World Meteorological

Organization (WMO) of the United Nations. Division of Climatology and Meteorological Network is the main methodological coordinator and performer of operational service, applied research and theoretical scientific investigations at the NIMH-BAS in the fields of meteorological stations' network, meteorological and agro-meteorological databases, climatology and agro-meteorology. The Division provides meteorological and climate data, information, analyses, consultations, expert assessments, scenarios and predictions for the needs of governmental organizations and institutions; develops meteorological and climate expert assessments, consultations, scenarios and predictions due to official users' requests from various sectors such as industry, economics, environment, agriculture as well as to private companies and interested citizens; promotes meteorology and especially climatology by means of training, demonstrations and seminars for students and citizens etc.

Division of Meteorological Database and Information Service establishes, manages, maintains and develops a meteorological database; maintains meteorological (hard copies) archives; provides meteorological data, information, analyses, consultations, expert assessments, scenarios and predictions for the needs of governmental organizations and institutions; develops meteorological expert assessments, consultations, scenarios and predictions due to official users' requests from various sectors such as industry, economics, environment, agriculture as well as to private companies and interested citizens; creates annual meteorological tables within the Annual statistical book for Bulgaria; and contributes to the Annual information bulletin on precipitation and water resources - needed for the Bulletin of the water resources status, issued by the Ministry of Environment and Water.

Division of Agro-meteorology provides agro-meteorological data, information, analyses, consultations, expert assessments, scenarios and predictions for the needs of governmental organizations and institutions; develops agro-meteorological expert assessments, consultations, scenarios and predictions due to official users' requests from various sectors such as agriculture and environment, as well as to private companies and interested citizens; provides methodical and technical support as well as optimization of the agro-meteorological network, measurements and observations in Bulgaria, where the NIMH-BAS has responsibilities; investigates the know-how in the field of methods for agro-meteorological measurements, observations as well as data control and proposition of measures for their introduction at the NIMH-BAS agro-meteorological activities; evaluates the current status of the agro-meteorological network as well as suggestions of measures and strategies for its development, improvement and optimization; updates the methodological handbooks on agro-meteorological measurements, observations as well as data processing, stations' files, metadata, etc., according to the respective normative documents and activities of the WMO; manages, maintains and controls the agro-meteorological instruments for measurements and observations as well as related technical support; implements specific agro-meteorological experiments, measurements and observations across the country; establishes, develops, manages and maintains the NIIMH-BAS agro-meteorological database; maintains the agro-meteorological (hard copies) archives; promotes meteorology and

especially agro-meteorology by means of training and demonstrations for students and citizens etc.

The NIMH-BAS agrometeorological service (network) does not expand. Furthermore, some of the agrometeorological and phenological stations are closed down, because of the lack of funds. But the service has the following design:

1. Central agrometeorological service by the Institute of Meteorology and Hydrology offered to the central government departments and specially to the Ministry of Agriculture;

2. Agrometeorological services offered by the four branches of the Institute of Meteorology and Hydrology - branch Pleven - in Northeast part of Bulgaria, branch Varna - the eastern part of the country, branch Plovdiv - in the southern part of Central Bulgaria and the Kjustendil branch which is in the south - Western Part of the country;

3. Regional agrometeorological services by the 23 hydrometeorological observatories of regional administrative bodies, agricultural observations and farmers.

The agrometeorological services are accomplished in the following manners:

- daily agrometeorological evaluations of agricultural crop growth and opportunities for work in the field;
- weekly agrometeorological evaluation of the conditions for agricultural crop growth as well as of the conditions for carrying out hydrological activities. It is distributed by National radio broadcaster;
- monthly bulletin;
- monthly agrometeorological forecasts, distributed by National TV and Bulgarian National Radio – program "Horizont";
- utilization of agrometeorological data in agricultural production and economical effectiveness.

Hydrological forecasts, the operational hydrological data and products are important instruments in water management and drought/flood prevention in Bulgaria. The real time hydrological data processing, preparation of hydrological predictions and products as well as the development and setup of relevant methodologies and software are the major tasks of the Division of Hydrological Forecasting at the Hydrology Department of NIMH.

The new Division of Water Management and Use has been established on July 1, 2010, by the researchers of the closed Institute of Water Problems-BAS. They will continue to work on water resource systems planning and management, assessment of the river basin water resources and demands balances, etc.

The Scientific Coordination Center for Global Change of the Bulgarian Academy of Sciences (SCCGCBAS) is a voluntary association of representatives of academic research and development institutes and units, universities and higher educational establishments, institutions, agencies, organizations, companies and other entities in Bulgaria which organizes and conducts activities related to global change in environment, as well as to the economic, political, social and spiritual aspects of global change on society. The SCCGC-BAS is a consultative/advisory body of the Steering Committee of the Bulgarian Academy of Sciences on global change in Bulgaria. Since 31 May 2006 the residence of the SCCGC-BAS is located at the National Institute of Meteorology and Hydrology in Sofia. The SCCGCBAS is a center for coordination of research and scientific-methodological activities under the implementation of national and international projects and contracts in the field of global change.

Additionally, the Forest Research Institute at Bulgarian Academy of Sciences and Forestry University in Sofia have several forest ecological stations for monitoring the main drought parameters – temperature and precipitation. These stations are part of European network ENFORS.

It is considered that the country has a well-developed system for soil monitoring. For example: Bulgaria manages a National Monitoring System (NMS) and an information system

on components and factors of the environment, including soils. The quality control of the soils is among the NMS, which covers the whole territory and supports a database on national and regional scales.

The Ministry of Environment and Water (MOEW) controls the NMS exploitation. The NMS is leading by the Executive Environmental Agency at MOEW.

The Regional Centers on Environment and Water (RCEW) in the country control the soil quality in respect to erosion, acidity and salinity. For example since 2003 the RCEW in Stara Zagora monitors soil salinity (NUTS4 strategy plan for 2007-2013, 2006).

The soil drought monitoring in the country is implemented by various organizations, for example research institutes such as:

- Institute of Meliorations and Mechanization – national center in the field of irrigation;
- Soil Institute "Pushkarov" – with recent national projects, including investigations on soil degradation (e.g. erosion, acidity, salinity, etc.) and changes of the soil physical conditions under drought. Development of systems and levels of soil monitoring is also included in these projects. All this can be incorporated as elements of the foreseen monitoring of the system "soil-vegetation-atmosphere" in the context of the UNCCD;
- Agricultural Institute in General Toshevo, Agricultural University in Plovdiv, etc.

It is necessary to point out that the above mentioned organizations implement soil drought monitoring (including measurement of soil moisture) mainly in limited regions or locations. It is considered that the main national system for direct measurement of soil moisture is based in NIMHBAS.

Bulgaria is the member and one of the founding countries of the Drought Management Centre for South-Eastern Europe located in Lubljana, Slovenia. Moreover Bulgaria played an important role in the establishment of the Centre. At the request of the Ministry of Environment and Water of Bulgaria, the UNCCD Secretariat in cooperation with WMO organized in Sofia, Bulgaria from 26 to 28 April 2006 the Second Technical workshop on the establishment of a subregional centre relating to drought in Southeastern Europe in the context of the UNCCD. The main objective of the second workshop was to reach an agreement on the main issues relating to the establishment and functioning of a Centre.

The participants at the workshop in Sofia adopted a framework proposal on the establishment of a subregional "Drought Management Centre for South-Eastern Europe" (DMCSEE) within the context of the UNCCD and World Meteorological Organization (WMO). In September 2006, Slovenia was elected as the host country of DMCSEE and the Centre started its activities in the year of 2006. Bulgaria efficiently participate in the Centre's activities especially in the field of drought monitoring where soil drought monitoring is an important part.

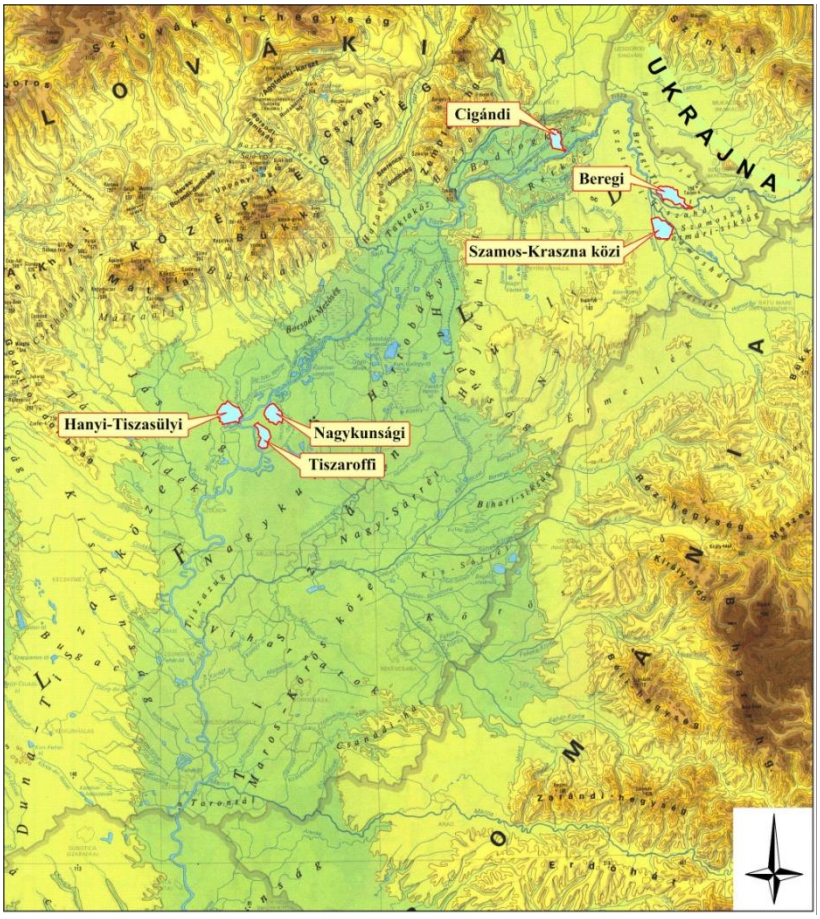
Part 4 – Analysis of management measures/good practices

4.1 Which measures to deal with WS&D have been implemented or are planned?

Measures	∑	Country
Modification of the water pricing system to foster a more efficient use of water	8	CZ,HU,LT,MO,PL,RO,SK,UA
Subsidies for shifting to less water-demanding land uses		
Development or upgrade of reservoirs or other water regulation works	6	BG,CZ,HU*,PL,RO,UA

Development or upgrade of water transfer schemes	4	HU,PL,RO,UA
Promotion of rainwater harvesting	4	CZ,HU,MO,PL
Measures to increase treated water re-use	3	HU,PL,UA
Measures to foster aquifer recharge	2	CZ,RO
Measures to enhance water metering	8	BG,CZ,LT,MO,PL,RO,SK,UA
Improvement of the efficiency of water agricultural uses	5	LT,MO,PL,RO,UA
Adoption of binding performance criteria for new buildings, public and private networks	2	LT,UA
Development of fiscal or economic incentives for promotion of water-efficient devices and practices	2	MO,PL
Reduction of losses in urban distribution networks	8	BG,LT,MO,PL,RO,SK,SLO, UA
Reduction of groundwater abstraction	2	CZ,SK
Training, education and capacity-building in water saving	7	BG,LT,MO,PL,RO,SLO,UA
Studies, research and pilot projects to solve water scarcity problems and improve response to drought	7	CZ,HU,MO,PL,RO,SK,SLO
Restrictions to new urban developments	2	MO,PL*
Restrictions to new irrigation schemes	2	MO,PL*
Reduction / management of groundwater abstraction (e.g. by controls, registers)	4	BG,HU,PL*,RO
Establishment of water rights markets or schemes to facilitate water reallocation		
Measures to enhance the resilience of the ecosystems to water scarcity and droughts	3	MO,RO,UA
Measures to enhance water governance	7	CZ,LT,MO,PL,RO,SK,UA
Other	2	PL,RO*
Specification of other measures: **PL*** introducing the priorities for different water sources (surface / groundwater) in draft "conditions for the water use..." – groundwater may be used if surface water resources are insufficient **RO*** Adaptation of measures taken at the source and by users (ensuring the availability at the source, utilities of water demands, flood management, drought management)		

HU*
In the frame of the new Vásárhelyi Plan flood retention basins are constructed with multi-purpose utilization, including drought mitigation using stored water after flood events.



PL* issuing water permits – water resources must be documented

Part 5 – Transparency and public participation in development of the DMP

Questions 5.1 – 5.3 (in the table)

Questions - answers		∑	Country
5.1 Is the RBMP publicly available?	yes	8	BG,CZ,HU*,LT,PL,RO,SK,SLO
	no		
5.2 Is the DMP or WRMP publicly available?	yes	4	BG,HU**,RO,UA
	no		
	Not exist	6	CZ,LT,MO*,PL*,SK,SLO
5.3 Have the contact points been determined for making information	yes	8	BG*,CZ*,HU***,LT*,PL**,RO,SK, UA*

accessible?	no		SLO

BG* Danube Basin : http://www.bd-dunav.org/content/upravlenie-na-vodite/plan-za-upravlenie-na-rechniia-baseyn/
Black Sea Basin : http://www.bsbd.org/v2/bg/BSPLAN2009.html
East Aegean Basin : http://www.bd-ibr.org/details.php?p_id=0&id=69
West Aegean Basin :
http://www.wabd.bg/bg/index.php?option=com_content&task=view&id=16&Itemid=32

CZ* Ministry of the Environment is a focal point for International Strategy on Disaster Risk Reduction OSN (UNISDR); it is an administrator for the activity of National Platform for Disaster Risk Reduction. Among others the aim of this platform is to exchange and share information on national and international level.

HU* RBMP is accessible at www.euvki.hu
HU** Information is available from www.kormany.hu/download/5/9e/c0000/**Nemzeti**
HU*** Information is available from www.kormany.hu/download/5/9e/c0000/**Nemzeti**

LT* Environmental Protection Agency

MO* Environmental information including drought management and water scarcity issues is a responsibility of the informational centre near Ministry of Environment. Fragmentary information is also available from the Ministry of Agriculture (losses of agricultural crops) and research institutions dealing with estimation of extreme weather events.

PL* Preliminary analyses for DMP prepared for 2 RWMB are not available in their web pages. These analyses may be obtained at the request or may be found in the list of projects financed by National Environmental Protection Fund

PL** for RBMP development and monitoring of waters - National Water Management Board, Regional Water Management Boards – plans, General Directorate for Environmental Protection – monitoring

UA* River Basin Authority (BUVR)

5.4 How can you characterize public participation in preparation of the RBMP or DMP/WRMP?

Characterization of public participation		∑	Country
Active	Active participation (together)	6	BG, CZ, HU,LT,MO,RO,
	All data and information publicly available	5	BG, CZ, HU,LT*,RO
	~~Regular consultations of the competent~~ authority with the stakeholders	4	HU,LT,PL,RO
	Workshops, conferences for broader public organized	8	BG, CZ, HU,LT,MO,PL*,RO, SK
	Direct involvement of the public in the planning process (e.g. through projects)	4	CZ, HU,MO,RO
Passive – only obligatory planning documents made available for the public		3	SK,SLO,UA

No communication		
No data available	2	PL?**,SK*

Another problems:
BG* The stakeholders are not so much interested of workshops and conferences as well as some decision makers and politicians.

LT* Although all data and information are publicly available the society is not actively using this information

PL* Both workshops and regular consultations with local users and authorities – organized by Regional Water Management Boards
PL?** limited part of the data is available at the request of interested party

SK* only limited data and basic information used for water status assessment (e.g. from monitoring) are available for public (even at the request of interested subject).

SLO* Public participation and consultation in the country is necessary to strengthen! Actually it does practically not exist

5.5 Which are the main weaknesses in preparation of the DMP or WRMP?

Problem characterization	∑	Country
Coordination and communication among sectors and institutions not sufficient	9	BG, CZ,LT,MO,PL,RO,SK SLO,UA
Insufficient legislation	6	CZ,LT,MO,SK,SLO,UA
Drought is not priority of competent authority	6	BG,LT,PL,SK,SLO,UA
Insufficient monitoring	4	LT,PL,SK
Data availability not sufficient	4	BG,LT,PL,SK
Limited human resources available	4	LT,MO,PL,SK,RO
Methodologies not available	4	PL,RO*,SK,UA
Limited financial resources available	8	BG, CZ,LT,MO,PL,SK,SLO, UA
Other	3	HU* ,PL*,SLO*

HU* Only consultation material was made available**.**

MO* Moldova is going to parafy association agreement (not candidate status) and will assume relevant responsibilities to develop RBM with inclusion of the DMP issues.

PL* (RBMP instead of WRMP) - organizational weakness: lack of continuity of the planning process, lack of the maintenance and updating of the data bases; low "water awareness" – water management is interesting only during flood events; also weakness of the water management sector – among other economic sectors

RO* in all sectors

SLO* Insufficient awareness of the severity of the problems associated with climate change in the political and decision making level

6. Remarks

BG:

Bulgarian institutions and decision makers need much more information about good practices for mitigation of the drought impact and limitation the water scarcity i. e. the Guidelines produced by GWP CEE, will be very useful.

CZ:

DMP in the Czech Republic is recently from a great part deputized by legislation, where it is possible enable competent water authorities in crisis cases (floods, droughts, ecological catastrophe...) crisis directing of permission of water uptake. There is no will to make DMP obligatory in the Czech Republic, as long as it will be obligatory for the whole EU.

MO:

Moldova is not an EU candidate country and relevant management planning documents for the river basins are not developed accordingly to the EU Directive. Anyway membership in different international conventions allowed development of relevant planning documents, which were used for responding on the questionnaire.

PL:

Polish Water Law assigns special powers to the Director of RWMB if the state of draught is declared. The Director may restrict water intakes of the users in spite of the rights they have in the water permits. These powers are not used because a methodology for such cases is lacking.

SLO:

See the report and conclusions of the 1th NC on Climate Change Adaoptation on February 6 2014.

UA: RBMP development is not a subject of legislation yet, all available examples are pilot projects.