Initiative on „Capacity Development to support National Drought Management Policy“ (WMO, UNCCD, FAO and UNW- DPC)

Bosnia and Herzegovina - concise country report

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Title:
Drought conditions and management strategies in Bosnia and Herzegovina

I Background:

Bosnia and Herzegovina has a total surface area of 51,209.2 km², where 51 197 km² of land and 12,2 km^2 of sea. The land is mainly hilly to mountainous, with an average altitude of 500 meters. Of the total land area, 5% is lowlands, 24% hills, 42% mountains, and 29% karst region. Less than 20% of agricultural land (half of all arable land) is suited to intensive agriculture, most of it in lowland river valleys and karstic fields.
The climate of BiH varies from a temperate continental climate in the northern Pannonia lowlands, to an alpine climate in the mountain regions, and a Mediterranian climate in the coastal and lowland areas of the Herzegovina region in the south and southeast.

Situation of drought as seen through the soil water budgeting in B&H
B&H is very diversified country in terms of precipitation (Figure 3.), potential and real evapotranspiration, water deficit and surplus (run-off and percolation). Although recent dry episodes in last decades have increased, awareness of the impact of dry conditions increased as well (e.g. the 2003 and 2012 droughts). Drought is not a primary hazard in Bosnia and Herzegovina.
Starting from the beginning of October through the end of May, usually there is no drought in the great part of B&H. The drought occurs normally from June to September, especially in the Mediterranean part of the country. The most vulnerable part related to drought is on the southwest and northeast part of B&H.
Scheme of spatial distribution of average annual precipitation (O) potential evapotranspiration (PET), surplus (V) and soil water deficiencies (M) in Bosnia and Herzegovina are given in Table 1 and Figure 1.

Hidrological parametar	B&H average	South area	Central area	North area
Precipitation(O)	1200	2000	1000	800
Potential ET-PET	725	900	650	700
Real ET-RET	600	600	600	600
Water deficit (M)	125	300	50	100
Water surplus (V)	600	1400	400	200
Drought coefficient P/PET	1.65	2.22	1.54	1.14
Outflow coefficient S/P	0.50	0.70	0.40	0.20

Table 1. Main components of the water balance (in mm):

Drought in easteren part of B&H,2012

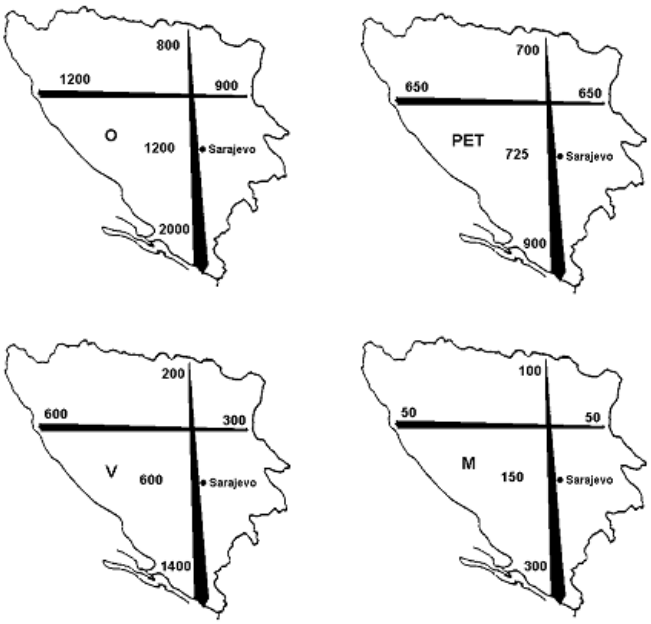


Figure 1. Scheme of spatial distribution of average annual precipitation (O) potential evapotranspiration (PET), surplus (V) and soil water deficiencies (M) in Bosnia and Herzegovina

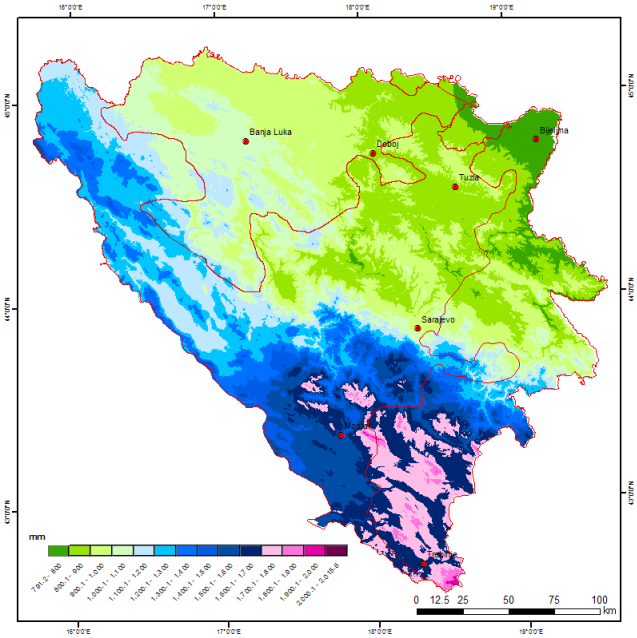


Figure 3. Average annual sum of precipitation (mm) in B&H for period 1961-1990

The severity of extreme events like drought, heat waves, forest fires and floods in Bosnia and Herzegovina has intensified over the last few decades, and climate projection predicted that the dramatic consequences of climate change are going to intensify in the coming decades. Climate change scenarios show significant decrease of precipitation in the region, especially during the summer season, which could lead to an increase of drought occurrence/frequency, intensity, and impacts.The increasing frequency and magnitude of droughts in recent decades in the agricultural and water management sector emphasize the need for assigning an urgent priority to addressing the issue of droughts. During the last decades in Bosnia and Herzegovina there were several drought years (2000, 2003, 2007, 2011, 2012):

- ✓ In August 2000, Bosnia and Herzegovina suffered from the worst drought in 120 years; about 60% of agricultural production was affected which resulted extremly food deficiency.
- ✓ "In summer 2003. godine more communities in B&H was hit by fourmonth drought which caused arround 200 million euro damages in agriculture and affected 200.000 people "
- ✓ In summer 2007. Extreme hight temperatures and drought destroyed more than 40% agricultural production and caused forest fires which affected about 250 ha
- ✓ Also in 2012 we had prolonged drought period which caused damages from 1 bilion USD in agricultural production and 70% reduced grains and vegetable yealds. Reduced energy production from power plant for 25 %.

II Drought monitoring and early warning system

Drought monitoring in Bosnia and Herzegovina are carried out by two Hydrometeorological Servises in two entities: Federal Hydrometeorological Institute in Sarajevo (FHMI) and Republic of Srpska Hydrometeorological Institute in Banja Luka (RSHMI). Roles and responsibilities of the NHMSs in Bosnia and Herzegovina related to drought includes systematic observation and monitoring of hydrometeorological parameters; providing and publishing information, forecasts, products and services related to the weather, climate and water, provision of quality-assured historical and real-time hazard data; the derivation of drought-relevant parameters, indices and indicators routinely collected data, and their comparison with past and expected values.
Currently FHMI and RSHMI have their own separate meteorological and hydrological measurements, with the objective to monitor on entity level only (Figure 3)
Data (precipitation and temperature) are collected from the entities hydro-meteorological network that belong to Hydrometeorological services in Bosnia and Herzegovina and from another network of stations that belong to the Water Agencies. Regarding droughts, HMS's analyzes extreme weather conditions and produces drought maps, depending on user requirements, or for specific projects. Drought maps is based on calculations of SPI

(Standardized Precipitation Index) on monthly basis. Also PDSI index should become operational in the near future.
Drought indices have not officially been linked to drought impacts, whereas the different severity levels are given in Table 2.

Drought severity index	SPI	PDSI
Normal	0,49 < -0,49	0,49 < -0,49
Dry	-0,5<-0,99	-0,5< - 1,99
Moderate	-1<-1,49	-2<-2,99
Severe	-1,5<-1,99	-3< -3,99
Extreme	≤ -2	≤ -4

Table 2. Definition of drought severity levels

Figure 3. Network of meteorological stations in B&H

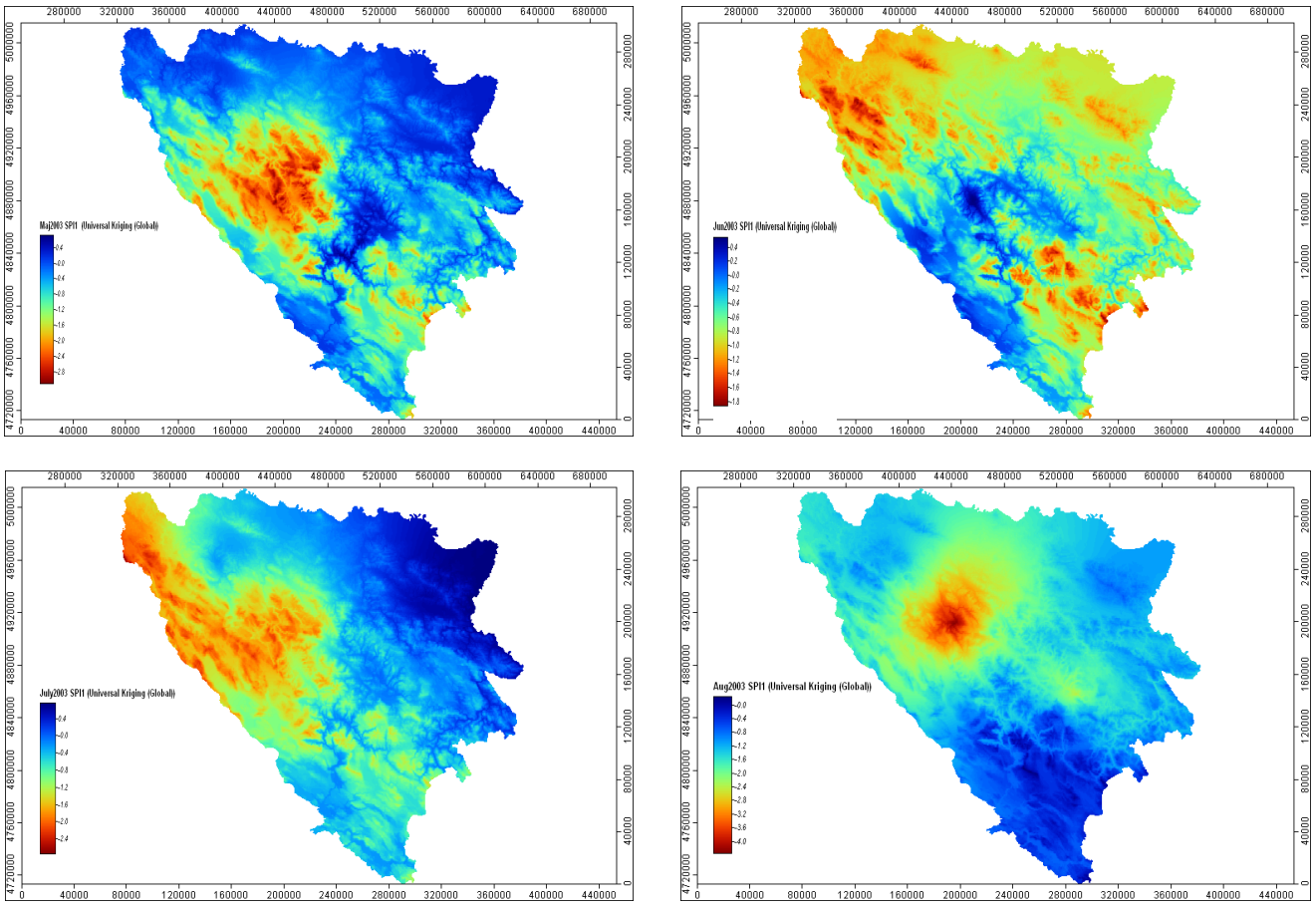
Operative procedures within monitoring of drought conditions carried out by the Department for Agrometeorology. There is great number of drought indices in operational use. HMS's uses the following agroclimatic drought indices: Standardized precipitation index (SPI), Palmer drought severity index (PDSI), De-Martonne aridity index, Seljaninov's index; Precipitation quantity expressed in the percentage of long-term average for month, season and vegetation period, effective precipitation, etc.

We do not have early warning system for drought at national level. Operational meteorological products provided by HMSs are mainly disseminated through regularly issued bulletins such as daily forecasts and informations on special events and warnings. Departments for agrometeorology prepare analysis and calculate drought agro-climatic indices and provide weekly agro-meteorological forecasts and warnings for the needs of farmers and other users.

These information are issued on regular basis and diffused through agrometeorological bulletins via Internet and radio stations. The main customers include Government institutions such as Ministries for Agriculture, Water Management and Forestry, manufacturing companies, scientific institutions, Disaster management department, the Media, farming community and other users-free of charge. Other information are provided by bulletins, web pages, e-mail. Users are coming from economic sectors: Ministry for Agriculture, Water management and Forestry at entity and other levels, Civil Protection, Ministry of Security at national level, Directorate for civil protection, Operational center 112, Cantonal Operations centers, Transportation, Energy, Recreation and tourism, Environment/ecosystems, Health.

Below maps for drought period in 2003 have been done, for May, June, July and August 2003, where we can see begining of drought and most affected parts of our country (Figure 4).

Figure 4. SPI 1 for May, June, July ,August 2003



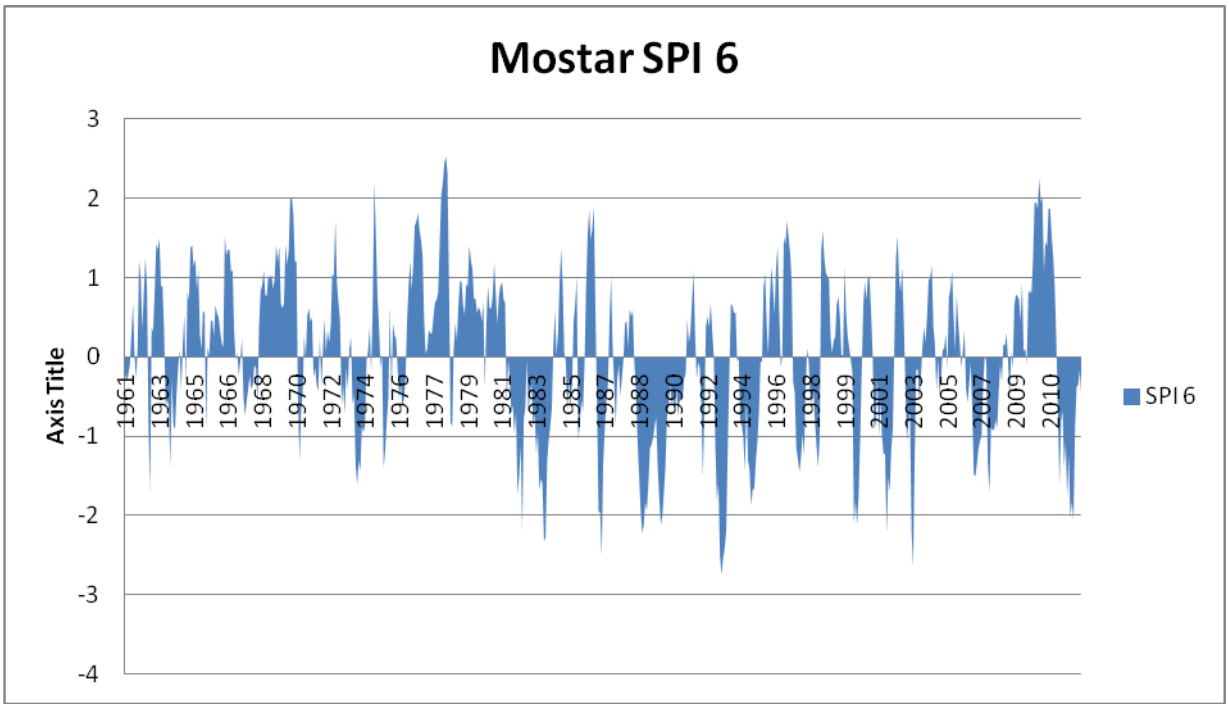


Figure 5. SPI on six months time scale for Mostar (1961-2012)

III Vulnerability assessment

The impact of drought, whether economic, environmental or social are greather than those from any natural hazard. Agriculture, forestry and fisheries depend heavily on water and any losses in crop yelds or livestock production, or increase in insect infestations, wind erosion or forest fires through drought will be a fatal for the economy.

The environment is great risk from drought. Plants, animals and their habitats and air and water quality are all affected. Also, there is often a loss of biodiversity. For consequence, land becomes degraded by different causes and soil erodes, sometimes permanently.

When a drought begins, the agricultural sector is usually the first affected because of its heavy dependence on stored soil water. Soil water can be rapidly depleted during extended dry periods. If precipitation deficiencies continue, sectors dependent on other sources of water will begin to feel the effects of the shortage, too.

Sectors relying on surface water (i.e. reservoirs and lakes) and subsurface water (i.e. groundwater) are usually the last affected. A short-term drought that persists from 3 to 6 months may have little impact on these sectors, depending on the characteristics of the hydrologic system and water use requirements. The incidence of forest and range fires substantially augments during extended droughts, which in turn places both human and wildlife populations at higher levels of risk.

Vulnerable groups of the society: small farmers, young, women. Social impacts mainly involve public safety, health, conflicts between water users, reduced quality of life.

IV Emergency relief and drought response

Governmental organizations have responded by providing relief to those most affected. Under the Article 10 of the provision of the UNCCD, Bosnia and Herzegovina is preparing National Action Programmes (NAPs) to, among others, identify the factors contributing to and practical measures necessary to combating desertification and land degradation, and mitigate the effects of drought. In this framework, NAPs should enhance national climatological, meteorological and hydrological capabilities and the means to provide a drought early warning system. This includes strengthening drought preparedness and management at local, sub-regional, regional, entity and national levels and incorporating long-term strategies to mitigate the effects of drought, in line with national policies for sustainable development. Strategically, country should come with recommendations for drought related policies and legislation to facilitate the implementation of the NAPs, in particular at national drought mitigation strategies and contingency plans.

V Practices to alleviate drought impacts

It is critically important, as the first step in this process, to determine the scientific, operational and institutional capacity that exists at the national and entity levels. Institutions at national and entity levels will provide leadership for the identification of specialized seminars, workshops, and conferences to build institutional capacity in the country on a risk-based approach for drought management. Drought expert from Federal Hydrometeorological Institute in Sarajevo was seconded to DMCSEE for the period of three month in the framework of the Regional Programme in Disaster Risk Reduction in South Eastern Europe. Topics that had been successfully implemented were: drought index calculation, treatment of data series, mapping (including use of GIS tools) and use of irrigation scheduling software for drought analysis. Bosnia and Hercegovina still needs more training in drought vulnerability assessment and remote sensing techniques for drought monitoring management, mitigation strategies, planning and policy. Training activities must also be conducted for end users to help them understand drought management tools and to solicit their input on tools and methodology development from the outset. The development of decision-support tools must be viewed as an end-to-end-to end process, incorporating user needs, expectations, and feedback at all stages.

VI The needs for knowledge and skills on drought management

Improved Operational Services:

a.) To establish drought early warning systems on national and entity levels;
b.) To upgrade and modernize the hydro-meteorological observation network, data management and forecasting system and to provide sustainable organisational, human and technical resources to maintain and operate it;
c.) To train drought vulnerability and risk assessment;
d.) To enhance cooperation and networking between hydro-meteorological sector and different stakeholders and end-users of hydmet data, services and early warnings;

e.) To strengthen against drought preparedness and management stategies including contingency plans at local, entity and national level;
f.) To develop sustainable irrigation systems, etc.

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