

## GOVERNANCE OF ADAPTATION TO AND MITIGATION OF CLIMATE CHANGE ON AGRICULTURAL, FOREST AND WATER RESOURCES IN BOSNIA

Sabrija CADRO<sup>1\*</sup>, Sinisa BERJAN<sup>2</sup>, Hamid El BILALI<sup>3</sup>, Ognjen ZUROVEC<sup>1</sup>, Jasmina SIMIC<sup>4</sup>, Bojan RAJCEVIC<sup>5</sup>

<sup>1</sup>Faculty of Agriculture and Food Sciences, University of Sarajevo, Bosnia and Herzegovina

<sup>2</sup>Faculty of Agriculture, University of East Sarajevo, Bosnia and Herzegovina

<sup>3</sup>Department of Sustainable Agriculture and Rural Development, Mediterranean Agronomic Institute of Bari, Italy

<sup>4</sup>Cooperative Union of the Republic of Srpska, Bosnia and Herzegovina

<sup>5</sup>Agricultural Institute of the Republic of Srpska, Bosnia and Herzegovina

(Corresponding author: [s.cadro@hotmail.com](mailto:s.cadro@hotmail.com))

### Abstract

Bosnia and Herzegovina (BiH); due to its geographical position, natural capital, and the socio-economic relevance of climate-sensitive sectors such as agriculture and forestry; is highly vulnerable to climate change (CC). Using the EH5OM model, temperature is projected to increase (+0.7-1.6°C during 2031-2060) and average net precipitation to decrease. The paper aims at analysing governance of climate change in BiH with a special focus on water resources, agriculture, and forestry (WRAF). The paper is mainly based on a literature review. The research approach adopted was exploratory, descriptive and deductive. The paper (i) provides the state-of-the-art of WRAF and climate; (ii) analyses impacts of CC on WRAF and agriculture and forestry contribution to GHGs; (iii) provides an overview of state and entity policy frameworks and institutions dealing with CC; (iv) highlights international organizations and donors operating in this field and Balkan and international commitments of BiH; and (v) provides some recommendations for enhancing WRAF adaptability and resilience to CC. The paper analyses as well the focus on CC and budget of the ongoing projects in 2011 in the sectors of environmental protection, and agriculture and forestry, 16 and 12, respectively. Agriculture, water resources management and forestry represent priority areas in which the policy and legislative framework should be improved and integrated projects should be implemented. Moreover, BiH should design and implement a national climate change mitigation strategy and action plan.

**Keywords:** *climate change; Bosnia; governance; agriculture.*

### Introduction

Climate change (CC) and climate variability are among the top issues facing governments today. They pose real threats to the environment, food production and human systems specifically agricultural production (IPCC, 2007). Climate change refers to a statistically significant variation in either the mean state of the climate or in its variability, persisting for an extended period. Climate change may be due to natural internal processes or anthropogenic ones (WMO, 2012). The United Nations Framework Convention on Climate Change (UNFCCC), makes a distinction between climate change attributable to human activities altering the atmospheric composition, and climate variability attributable to natural causes (United Nations, 1992).

Bosnia and Herzegovina (BiH) covers an area of 5,112,879 ha of which the Federation of Bosnia and Herzegovina (FBiH) occupies 2,607,579 ha and the Republic of Srpska (RS)

2,505,300 ha. Of the total land area, 5% is lowlands, 24% hills, 42% mountains and 29% karst. Agricultural land covers approximately 2,525,000 ha (around 52%). According to the Initial National Communication (INC) of BiH under the UNFCCC, BiH is highly vulnerable to climate change. BiH has a high sensitivity to climate change threats because of the economic role of "climate-sensitive" sectors, such as agriculture and forestry, with significant secondary impacts. Increasing variability in the weather has been noted in all seasons, with rapid changes of short periods of extremely cold or warm weather - heat and cold waves - and periods with extremely high levels of rainfall, as well as droughts. In all model runs examined, average annual temperature increased, and average net precipitation decreased in projections. Using the EH5OM global model, temperature in BiH is projected to increase from 0.7 to 1.6°C per 1°C of global increase during the period 2031-2060. For precipitation, using the EH5OM global model, the summer climate will be noticeably drier (Vukmir *et al.*, 2009).

The objective of the paper is to analyze governance of climate change in BiH with a special focus on water resources, agriculture, and forestry (WRAF).

### **Material and methods**

The paper is mainly based on secondary data from different sources such as the INC of BiH under the UNFCCC and the Donor Coordination Forum (DCF). Collected secondary data were cross-checked for avoiding inconsistencies and contradictions. The paper (i) provides the state-of-the-art of WRAF and climate; (ii) analyses impacts of CC on WRAF; (iii) provides an overview of the policy framework and institutions dealing with CC; (iv) enumerates international organizations and donors operating in this field; (v) analyses references to CC in the main agriculture, forestry, and rural development policies; and (vi) provides some recommendations for enhancing WRAF adaptability and resilience to CC. The paper analyses as well the focus on CC and budget of the ongoing projects in 2011 dealing with CC. The lack of and/or difficult access to some data was the main problem faced in the course of the present paper preparation.

### **Results and discussion**

Bosnia is situated between the continental and Mediterranean climatic zones, which creates three climatic areas: the northern part has a moderate continental climate; the mountain areas above 700 m have a mountainous climate; and the southern part has an Adriatic-Mediterranean climate.

BiH is sensitive to global climate change impacts, primarily in relation to agriculture and food production. Projections for BiH indicate a rise in temperature, with reduction in precipitation which would contribute to reducing soil moisture. Water supplies are also expected to change due to alterations in river flow. High-mountain and mountain ecosystems are exposed to the greatest impact of climate change. Peripannonian and hilly ecosystems are the second most in danger after high-mountain and mountain ecosystems (Vukmir *et al.*, 2009).

Out of the total BiH area, 76% belongs to the Sava River and 24% belongs to the Adriatic Sea catchment. Precipitation represents the greatest water resource. The annual average precipitation is about 1250 mm. The seasonal variability is characterized by unfavourable distribution of precipitation over the year, particularly manifested in the southern parts of BiH (Vlahinić, 2000).

Forestland covers about 2.5 million ha or 48% of the total land area (Spasova *et al.*, 2007). The country is geographically optimally positioned in terms of diverse climatic influences and is home to over one hundred tree species. Extensive presence of forests in BiH and the variety of climatic conditions to which they are subject, puts them in a critical

situation in the context of climate change, and are sensitive to its effects. A key problem is the slow rate of adaptation of forest ecosystems to climate change (Vojniković, 2010).

Total emissions of CO<sub>2</sub> equivalents in BiH in 1990 amounted to 34,043.49 gigagrams (Gg). The major source of CO<sub>2</sub> emissions is the energy sector, which contributes 74%, followed by agriculture (12%), industrial processes (11%) and the waste sector (3%). The main sources of methane (CH<sub>4</sub>) are agriculture (livestock), uncontrolled emissions from coal mining and waste disposal. The largest volume of N<sub>2</sub>O emissions comes from agricultural soil as a result of crop cultivation. Forests represent an important sink for CO<sub>2</sub>, at 7,423.53 Gg of CO<sub>2</sub> for the reference year 1990. Emissions of CO<sub>2</sub> equivalents from agriculture are made up of methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O). Total emissions of CO<sub>2</sub> equivalents from agriculture is 4,084 (Gg) (Vukmir *et al.*, 2009). According to INC, measures to reduce greenhouse gas emission from agriculture in BiH are: the use of biomass in biogas production; introducing new livestock breeding and feeding practices; improving the application of mineral and organic fertilizers; and introducing organic production.

Climate change can transform entire forest systems, shifting forest distribution and composition. Severe temperatures and climate conditions can affect individual trees as it can lead to greater susceptibility to pests, pathogens and severe weather events (Vukmir *et al.*, 2009). Another significant threat to forest ecosystems is caused by an increase in forest fires (Vojniković, 2010). The response of crop yields to climate change varies widely, depending on species, cultivar, soil conditions, treatment of CO<sub>2</sub> direct effects, and other location factors. Vulnerability of the agricultural sector in BiH can be seen through appearance and frequency of drought which can cause a significant yield loss or reduction. Soil drought and atmospheric drought are highly interrelated (Vukmir *et al.*, 2009). The average yield decrease as a result of drought is about 20% in BiH. Drought effect is most strongly expressed in the southern parts of BiH (Vlahinić, 2000). Research showed yield reduction for most important crops (*e.g.* tobacco, pepper, maize, soybean, potato, alfalfa) in the northern part of BiH (Žurovec *et al.*, 2010).

Environmental issues in BiH are under the responsibility of entity governments. The competent authorities are the Federal Ministry for Tourism and Environment in the FBiH; the Ministry for Physical Planning, Civil Engineering and Ecology in the Republic of Srpska; and Department for Communal Works in Brčko District. In accordance with the law on meteorological and hydrological activities of RS, the Hydrometeorological Institute, as a governmental organization, is responsible for climate change monitoring and climate predictions. The Federal Institute for Meteorology, as an independent institution, is responsible for climate issues in the FBiH. Important stakeholders include also, the BiH Ministry of Foreign Trade and Economic relations – political and operational focal point of the Global Environment Facility (GEF); the state Committee for the Environment and Sub-Committees for Climate Change; and the Committee for Sustainable Development (Vukmir *et al.*, 2009).

The main state legal and political documents analyzing, directly or indirectly, interrelations between climate change and agriculture and forestry sectors are the National Environmental Action Plan BiH – NEAP (2003); the INC to UNFCCC (2008) and the Environmental Performance Review (2011). The main strategic documents regarding environment in the FBiH are the Federal Environmental Strategy and the Cantonal and Local Environmental Action Plans. In the case of the RS the main strategic documents are the Environmental Protection Strategy and the Strategy on Nature Protection. In the case of Brčko District it is worth mentioning the Strategy of Environment Protection and the Strategic Plan for Environment Protection.

The current state of politics in BiH leads to very little climate change-oriented activity. Thus, it comes as no surprise that climate change policy issues are not visible at every level of

the policy-making agenda in Bosnia. Numerous regulating bodies - ministries, associated institutions and institutes - complemented by a great number of laws have created an administrative and procedural "mess". In sum, there is too much room for misinterpretation and confusion and the climate change policy-making arena in BiH is fairly weak. The low level of interest of the governmental structures in this domain probably lies in the low social mobilization existing around the issue and the low level of staff capacity in climate change related spheres. An overall weakness of existing policy and strategy documents is that they are not specifically endorsed and integrated by the ministries responsible for sector policies. Therefore, environmental concerns should be integrated into sector policies (REC, 2008).

No strategy or action plan on the state, entities, regional and local level has been developed to foster Bosnian agriculture and forestry adaptation to climate change. Complicated governance structures, a lack of key strategic documents and supporting regulations, limited human resource capacity, and financial constraints lead to very limited capacity to respond to climate threats and adapt to climate change in a systematic and integrated way. At the same time, low public awareness and economic constraints limit the capacity of those potentially affected by climate threats to undertake autonomous adaptation measures. Political as well as economic factors dominate when deciding adaptation measures to climate change. Developing countries, such as BiH, have major problem due to having weaker capacity for adaptation (Vukmir *et al.*, 2009).

BiH has an "adaptation deficit" that will grow with the projected climate change. These issues increase the threat to agriculture, undermine the sector sustainability, and reduce its ability to take advantage of opportunities that may emerge. BiH should integrate climate change adaptation and environmental sustainability into agricultural policies, programs, and investments. To succeed in agriculture, producers and governments will have to adapt by reducing agriculture vulnerability to current climate variability (World Bank, 2010).

Bosnia ratified the UNFCCC in 2000 and, as a developing country, it is a non Annex I country of the UNFCCC (*i.e.* it has no obligation regarding the reduction of GHGs). BiH became in 2004 eligible to the Global Environmental Facility (GEF) support and ratified in 2008 the Kyoto Protocol. BiH submitted its INC to UNFCCC in 2010. The Second National Communication (SNC) to the UNFCCC is under preparation. The SNC will update and strengthen information provided regarding climate change, greenhouse gas inventories, climate change mitigation, vulnerability to climate change and steps taken to adapt to climate change, as well as information on public awareness, education, training and systematic research (Vukmir *et al.*, 2009). Other relevant international and regional cooperation agreements and initiatives include: The Mediterranean Action Plan (MAP); the Belgrade Climate Change Initiative (2007); and the South East European Climate Change Framework Action Plan for Adaptation.

The most important donors and organizations dealing with environment protection, agriculture and forestry sectors in BiH are: UNDP, the World Bank, the EC, USA/USAID, Sweden/SIDA, Norway, the Netherlands, Czech Republic, Italy/IC, Switzerland/SDC/SECO, and Hungary. The number of ongoing projects in the environmental sector (EPS) is 16 with a total budget of €29,006,945. In the agriculture and forestry sector (AFS) there are currently 12 projects with a total budget of €34,288,886 (DCF, 2011). In table 1 are shown ongoing projects dealing, directly or indirectly, with CC in BiH. Only 4% (€1,279,390) of EPS budget and 1% (€230,876) of AFS budget is allocated to projects dealing with CC. There is weak support to projects in EPS and AFS regarding CC issues. BiH is highly vulnerable to climate so support has to increase both in terms of projects number and funding. Increasing investments and international aid in the sectors of environmental protection and agriculture and forestry is vital.

Tab. 1. Projects in environmental protection, agriculture and forestry sectors dealing with CC.

Sector: Environment Protection				
Name of project	Donor	Implementing Agency	Start - End	Amount (€)
1 Bosnia and Herzegovina Biomass Energy for Employment and Energy Security Project	UNDP	UNDP	21.10.2009 – 31.12.2013	681,215
2 Climate Change Facility for BiH Cities	UNDP	UNDP	1.12.2009 – 31.12.2011	243,175
3 PIMS 4497 CC EA Preparation of the BiH SNC to the UNFCCC/EE	UNDP	UNDP	1.10.2010 – 1.10.2013	355,000
			Total	1,279,390
Sector: Agriculture and Forestry				
Name of project	Donor	Implementing Agency	Start - End	Amount €
1 Capacity Building of Agricultural Business in Drought Adaptation in BiH	Sweden/SIDA	USAID	23.9.2010 – 22.3.2012	230,876
			Total	230,876

Source: Donor Coordination Forum, 2012.

No donor or international body has assumed a lead role in the environmental sector. Ideally, either the EU or the OSCE would take a lead role in advancing environmental policy in BiH in partnership with domestic institutions. The EU invested EUR 91.280 million in Bosnia under the 2011 budget of the Instrument for Pre-Accession Assistance (IPA). The funding focuses also on environment and climate change (EC, 2011). The Ministry of Environment and Tourism of FBiH, supporting a project of consulting companies and non-governmental organizations, has financed the formation of a climate change web portal. The portal was made by the Regional Center for Education and Information on Sustainable Development in Southeastern Europe (REIC). Several Clean Development Mechanism (CDM) projects are under development. Projects are designed to reduce emissions of N<sub>2</sub>O (coke industry), CH<sub>4</sub>, SF<sub>6</sub>, and CO<sub>2</sub> (Vukmir *et al.*, 2009).

Important tasks for the successful adaptation of agriculture to climate change include improving climate monitoring; and providing timely climate forecasting information. For fostering WRAF sectors adaptation to CC, the following measures are needed (Vukmir *et al.*, 2009): increasing investments and international aid in building capacity; creation of an Environmental Protection Agency that would ensure the full, coordinated implementation of environmental action plans; drafting a strategy and action plan for climate change adaptation; improving early warning and response systems; undertaking research on the development of drought-resistant varieties and crops; building multi-purpose water management facilities; modifying crop rotations according to the natural soil water regime; harvesting water by constructing farm ponds for catching precipitation runoff; introducing drip irrigation and techniques that save water (windbreaks, mulch, etc.); etc.

### Conclusions

Bosnia is a non-Annex I Party to UNFCCC and has no obligations to reduce its GHG emissions; nevertheless it has already experienced climate change consequences. Climate change affect the sustainability of agricultural and forestry systems as well as water resources. The climate change policy-making arena in BiH is weak. The current state of politics in BiH leads to very little climate change-oriented activity. Moreover, there is weak support of donors

to projects regarding CC issues. BiH should integrate climate change adaptation into agricultural and forestry policies and research and investment programs to reduce their vulnerability to the current climate variability. Agriculture, water resources management and forestry represent priority policy and activity areas in which the policy and legislative framework should be improved and far-reaching, cross-cutting and integrated projects should be implemented. Future implementation of environmental policies in Bosnia is not possible without integrating environmental concerns into sector policies. In order to address properly the challenges represented by climate change and its effects, BiH should develop and implement a national climate change mitigation strategy and action plan, national Clean Development Mechanism strategy and take tangible steps to implement its international and regional commitments. It is important to increase interest in and capacity of state institutions to address the problem of CC; that's why the creation of a state agency that deals with CC issues is highly recommended. Moreover, better cooperation is needed on this issue between the two entities.

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