

Climate Change And Agriculture Management – Western Balkan Region Analysis

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Abstract

Background: The aim of this paper is to analyze the possibilities of the agricultural sector of the Western Balkans, to assess compliance with the European Green Deal, which provides for the implementation of activities, which should enable the transition to the green sector and climate change mitigation. This paper is the first scientific paper to analyze agriculture and climate change in light of the EU Green Deal for the Western Balkan territory.

Results: Agricultural production is one of the leading industries in the Western Balkans. In the Republic of Serbia, the total gross value of agricultural production in 2019 amounted to 5.5 billion dollars, in Albania, it is the basis of the life of the population and the system of protection against unemployment, while in Bosnia and Herzegovina 1/5 of the population is employed in this sector. Montenegro has a significant share in the gross domestic product (GDP, 8%), while in the Republic of Northern Macedonia agriculture accounts for 13% of GDP. Climate change and predictions that temperatures will increase by 4°C in the coming decades pose a risk not only to agricultural production but also to the safety of the population. If it takes into account that the agricultural production of the countries of the Western Balkans depends primarily on rain, this makes this sector particularly vulnerable. Unless appropriate measures are taken and risk management for water resources and agriculture is improved, there will be a decrease in precipitation and an increase in dry days by 20%. One of the ways to implement adequate activities is the adoption of regulations related to the creation of local energy management, which will enable the assessment of climate change and based on them to give appropriate "energy response".

Conclusions: Taking this combined and ambitious approach and using the latest developments in knowledge and innovation, the Common Agricultural Policy (CAP) aligns agriculture with the European Green Deal, which aims to create an inclusive, competitive, and environmentally friendly future for Europe. Finding renewable energy sources and improving risk management can mitigate the negative impact of climate change and prevent the loss of agrobiodiversity.

Background

The Western Balkans region covers an area of about 208.000 km² and includes Serbia, Albania, Bosnia and Herzegovina, Montenegro, and the Republic of Northern Macedonia. In this climate, coastal subtropical to moderately continental climates is represented. Thanks to this climate, there is a great variety in the vegetation cover, which is considered the natural wealth of this region. With this in mind, in all WB countries, agriculture is an important sector with a significant share in the gross domestic product (~ 10%). However, despite the richness of natural resources, agri-food systems in all WB countries face a number of challenges. Among them, climate change has a significant impact. Because, in addition to agriculture, the economic sector and forestry are important, WB economies are considered medium to highly sensitive to climate change.

Figure 1. shows the climatology of the Western Balkans region with prominent coastal areas (marked in red), mountainous (marked blue), and areas with temperate and moderately warm climates (marked orange). The areas with the most annual precipitation are marked in green. The right panel shows the average annual temperature for the Western Balkans region for the period from 1961 to 2100 [1]. The "moving average" approach was used to predict average temperatures. Climate change has been recorded for several decades and is a consequence of intensive industrialization and human activities [2]. Urbanization, deforestation, and the burning of fossil fuels (primarily coal) are the main causes of accelerated and unexpected climate change. It is predicted that the average summer temperature in the Western Balkan region could rise to 7.5°C above pre-industrial levels, which would lead to the disappearance of small glaciers within a few decades. This increase in temperature poses a risk not only to agriculture but also to the safety of the population. Further predictions for the region are that with the warming of 4°C, precipitation will decrease by 20–30%, and the frequency of dry days will increase by 20%. Reduced water availability in the summer months can also be a particular problem, while annual river runoff could be reduced by more than 45% by 2100. There are also great risks of winter and spring floods, especially along the rivers of large rivers such as the Danube, Sava, and Tisza. It is important to note that the average annual production of large hydropower plants could be reduced by 15% and 20% for small power plants, respectively. In addition to all the above, there are also great risks to human health, therefore, an increase in temperature can lead to an increase in the number of deaths by about 20%. Reducing damage and losses caused by climate change is not only environmental but increasingly also a matter of security, survival of natural resources, and economic development. Reducing the harmful impact of man on climate change and its impact on economic and social development is possible by measuring, monitoring and reporting on the current impact, which is also the subject of regulation of the UN Framework Convention on Climate Change (UNFCCC) and its accompanying Paris Agreement.

Methodology

Data in this paper are established through desk research and secondary literature review of relevant articles, publications, documents, and data from e.g. EU, FAO, and relevant state documents of the Western Balkan countries. It should be noted that the data have not been updated and that there are only estimates of the negative impact of drought on agriculture.

Results And Discussion

In this paper, the Results and Discussion are divided into four parts: *Impact of climate change on Western Balkan's agriculture* which provides the most significant data related to the impact of climate change on agriculture in the Western Balkans; *EU and Climate Change, EU Green Deal* and its implementation and a significant role in the fight against climate change; *Climate change management* - whose main aims is management in order to achieve stabilization, deceleration, and prevention of climate change and *Response to climate change in the Western Balkans* which covers activities to reduce the impact of climate change is described. Opportunities for achieving energy efficiency and modernization of

infrastructure in order to achieve a cleaner, more efficient, and more competitive growth are also described.

Impact of climate change on Western Balkans agriculture

Climate change has a great impact on the agricultural sector, especially on crop production, livestock, and fisheries [3]. In Western Balkans, almost half of the territory is used for agriculture, of which 19% is pasture and 29% is arable land, while 18–58% of the workforce is related to this sector [4]. When it comes to field and vegetable production, there is stress on plants caused by poor agro-ecological conditions and the inability to apply adequate agricultural practices and technology. The result is reduced yields and product quality, which among other things leads to irregularities in the supply chain of raw materials for the food industry. Also, these changes lead to the appearance of new pests, diseases, and weeds. The problem is microorganisms, plants, and animals that often become invasive and harmful in the new area. Climate change is well tolerated by weeds because they adapt more easily to changes in the environment [3]. The appearance of weeds (such as ragweed) causes allergies, leads to changes in vegetation and seed reserves in the soil and soil microflora yield reduction and environmental pollution. Compared to conventional production, sustainable agriculture is more exposed to the effects of climate change due to the complexity of different biological, physical, and agrotechnical measures on which it is based. Therefore, Agenda 21 of the UNCED (UN Conference on Environment and Development) action plan emphasizes the need for adjustment in agricultural, environmental, and macroeconomic policy, in order to create conditions for sustainable agriculture and rural development. Agricultural biodiversity is extremely important and is the result of the interaction between the external environment, genetic resources, and the natural resource management system (land and water). Climate change also affects the extinction of certain species, genes, and the reduction or loss of agrobiodiversity. Also, numerous autochthonous and old varieties were endangered, which were adapted to certain areas and ecological conditions. The loss of flora and fauna can lead to permanent changes in one ecosystem and serious disruption of biogeochemical processes. What is an additional problem is the fact that the crops in Western Balkans are poorly irrigated and that the storage capacities are insufficient. In particular, the increasing occurrence of drought, which mainly occurs in the summer months, has been identified as a key risk for Western Balkans agriculture [5]. Water is a basic natural resource in plant production because it plays a significant role in germination, growth, transpiration, the transformation of starch into sugar, and the absorption of nutrients [6]. The reduction in precipitation poses the greatest danger to the agricultural sector, especially due to the fact that the demand for food at the global level is increasing. Figure 2. shows the most common natural hazards that cause large losses in crop and livestock production. It is important to note that there are no accurate and reliable data on the impact of drought on the Western Balkans agricultural sector. On the other hand, such data are extremely important because they are used to measure the effectiveness of disaster risk reduction investments.

Given that precipitation reduction is expected due to climate change, water management will be essential for the stability and productivity of agricultural production. Regional analysis showed that extreme temperature changes in 2011 led to crop failure due to frost damage [8]. Indirectly, drought has a

significant impact on the economy, prices, and food supply, bearing in mind that the agricultural sector suffers the greatest consequences. For example, if the supply of a certain vegetable decreases, and the demand still exists, or increases, there will be an increase in the price of the product. An example of this is the drought in Tajikistan (2007–2008) which reduced yields by over 40% [9], which led to 2.2 million people being malnourished [10]. On the other hand, drought directly increases the risk of fire. In the period from 1998 to 2008, 853 forest fires broke out in the Republic of Serbia, covering an area of 16.357 ha. The damage caused by the fires was estimated at 40 million Euros, and more than 5.200 ha were completely burned [11]. The existence of a connection between drought and pests has also been determined due to the creation of optimal conditions for their development. There are some diseases that are directly caused by the stress of plants caused by drought, such as root rot, rot and wilting of trees, and greater susceptibility to flamingos. Stressed woody plants can experience the invasion of woody insects such as bronze birch, black stem, and other bark beetles [12]. In addition, drought can reduce the competitiveness of indigenous plants and increase the chances of weed invasion and thus negatively affect crop production [13]. According to the international CRED-EMDAT disaster database floods occurred most frequently in Western Balkans resulting in significant economic losses. However, the negative impact of drought should not be underestimated although accurate data are often lacking due to the lack of systematic and comprehensive data collection. As for Albania, it is estimated that more than 3 million people were affected by the drought between 1989 and 1991, which is considered one of the most significant disasters that have cost this country's economy \$ 24 million [14]. The energy crisis that led to power outages in 2007 was the result of droughts because the production of the Fierza hydropower plant was lower by 33% [15]. Drought is predicted to have a more negative impact on agriculture than floods and landslides. Different areas in Bosnia and Herzegovina are prone to drought, especially between June and September. Some of the most significant droughts that affected this country were in the period from 2002 (agricultural production was reduced by 60%), 2003 (agricultural damage of 200 million USD), and 2007 (destroyed more than 40% of field production, 250 ha affected by forest fires, which resulted in an increase in food prices). In 2012, a drought hit the Western Balkans, especially Bosnia and Herzegovina. This has reduced cereal and vegetable yields by up to 70%, and corn production was most affected. Given the large primary losses in barley, corn, soybeans, clover, and beans, livestock production decreased, as did meat supply to the domestic market, which increased food prices and reduced agricultural exports. The total losses of this drought amounted to over 1 billion USD [16]. Frequent and intense droughts adversely affect yield quality, income costs of preventing and controlling the spread of diseases, insects, and weeds as well as irrigation rates. Also, it is estimated that the agricultural sector was most affected by the drought in 2015 when water balance anomalies were 100 mm below the long-term average [17]. However, accurate data on specific damage and losses are missing. The Republic of Northern Macedonia is considered to be among the driest countries in Europe. The most endangered are the region of Povadarija, and especially the areas of the rivers Crna, Bregalnica, and Vardar. The 1993 drought was estimated at 7.6% of total national income and led to a complete decline in crops [18]. According to the second statement of the Montenegrin Ministry of Sustainable Development and Tourism on climate change from 2015, several droughts have been recorded since 1950. The agricultural drought recorded in 2003 affected the coastal region, the Zeta-Bjelopavlić region,

and the northern region up to 1.000 m above sea level. The 2007 drought is considered a hydrological drought and has affected the entire territory, and especially the northwestern and northern mountainous regions, while the 2011 drought is considered a social and economic drought. The last recorded drought affected the entire country and led to an extreme hydrological deficit in the Zeta Bjelopavlići region [19]. These extreme conditions led to forest fires the following year. In the last 20 years, three catastrophic droughts have occurred in the Republic of Serbia. In the period from 1991 to 2010, the extremely dry years were: 1992, 1993, 1998, and especially 2000, 2003, and 2007 [20]. The most endangered areas are in the eastern part and in the Pannonian Basin in the northern part of Serbia. In the period from April to September 2009, a severe drought hit Sremska Mitrovica [21]. During the summer of 2012, a drought caused losses in agricultural production of about \$ 2 billion. The largest losses were in corn (\$ 1 billion), sugar (\$ 130 million), soybeans (\$ 117 million), fruits and vegetables (\$ 100 million), sunflowers (\$ 55 million), and other crops (\$ 600 million) [22]. According to a 2013 report by WMO, UNCCD, FAO & UNW-DPC, economic losses in agriculture are estimated to be caused by floods between 38.75 and 106.25 million Euros, while for drought they were around 500 million Euros [23]. These data indicate that the impact of drought on agriculture is much greater compared to floods. However, it should be noted that due to insufficient available data on losses and damages in agriculture caused by drought, one can only speak at the level of assessment.

EU and Climate Change, EU Green Deal

Climate change is one of the key issues of the EU, and the adoption of the EU Green Deal speaks in favor of that. The aim of this agreement is to reduce the harmful impact on natural resources and emissions into the soil, water, and air. It also represents a strategic framework according to which the challenges of climate change and environmental protection are transformed into development potentials. The EU expects that carbon neutrality will be achieved by 2050, and Western Balkan's assistance is expected in that [24]. Starting in 2021, the introduction of carbon taxes on products (iron, cement, and aluminum) imported into the EU is also expected, and with the aim of expanding to other economic branches and activities. Thanks to this initiative, the competitiveness of products coming from countries without a clear fight against climate change is reduced. The EU Green Deal is based on: 1) climate action involving decarbonization, energy, and mobility; 2) circular economy with special emphasis on waste, recycling and efficient use of resources and sustainable production; 3) biodiversity aimed at protecting and restoring natural resources; 4) reduction of water, soil, and air pollution and 5) sustainable food systems and rural areas. The basic driver that will enable all of the above is digitalization in accordance with the concept of the double green and digital transition. It is also necessary to implement concrete actions supported by appropriate mechanisms and financial instruments. Five Western Balkan partners have ratified the Paris Agreement, pledging to take measures to limit global warming to 1.5°C. Climate neutrality will have a significant impact on EU bilateral relations and accession negotiations with the Western Balkans. One of the important tools for creating economic stimulus and helping to mitigate the transition to climate neutrality may be the early involvement of the Western Balkans in emissions trading. All these changes will require the support and involvement of citizens. According to research from 2019, only 65% of Western Balkans citizens consider climate change a threat [25], unlike EU citizens, where 93% consider

climate change a serious problem [26]. For example, the citizens of the Republic of Northern Macedonia will most likely hold the state responsible (31%) while Albanian citizens believe that companies are most responsible for combating climate change (27%). An interesting fact is that Montenegrins believe that they are personally responsible for climate change, compared to the representatives of any other economy. It is important to point out that the European Climate Pact could be a means of raising awareness among citizens.

Climate change management

There are different approaches to managing climate change risks, which can be divided into four categories: 1) mitigation in order to reduce greenhouse gas emissions; 2) adaptation, which means increasing society's ability to cope with climate change; 3) geoengineering which implies additional manipulations of the soil system, in order to reduce the impact of greenhouse gas emissions and 4) expanding the knowledge base on climate systems, which can help in proactive risk management [27]. Of particular importance are research, observations, scientific assessments, as well as the development of technology, that can help identify risks and opportunities associated with climate systems. Expanding the knowledge base enables policymakers to better understand, select and improve the management of certain risks. Thanks to such an approach, efficiency is increased, and new possibilities for climate protection are discovered, or reducing the risk of climate change. It should be noted that climate goals can be achieved with the active participation of all state bodies [28]. Although local governments are paying more and more attention to climate change, the problem is that their policies focus on mitigating, and not on climate change adaptation strategies [29]. In order to respond to climate change as successfully as possible, adaptation is necessary which includes planning for climate impacts, building resilience to those impacts, and increasing society's ability to respond and recover [27]. Adaptation policy may include various regulations such as reduction of harmful impact on the soil, disaster recovery, impact assessment for critical systems and resources (water, biological systems, agriculture, and infrastructure), constant monitoring, and efforts to reduce air pollution, soil loss, and degradation. When it comes to Western Balkans countries, the exchange of expertise and division of responsibilities at the regional level are the best measures for capacity building and identification of measures for climate change management. In order to ensure the health of the population, safety, and quality of life, including the development of warning systems, timely dissemination of information and general preparedness of public opinion as well as the readiness of state institutions to manage disaster risk is necessary.

Response to climate change in the Western Balkans

In order to reduce the harmful effects of climate change, Western Balkans are already taking appropriate measures, including cooperation with several development partners. These measures include managing risks to water resources and agriculture, as well as using opportunities to achieve energy efficiency and modernize infrastructure. Table 1 shows the laws adopted so far, as well as measures to reduce the harmful effects of climate change on Western Balkan agriculture.

Table 1
Western Balkan laws and measures in response to climate change

Country	Laws	Agriculture
Serbia	The Law on Climate Change was adopted.	Rehabilitation of drainage and irrigation infrastructure. Flood risk reduction and water resources management.
Albania	The Law on Climate Change has been adopted which represents the legal basis for the adoption of the National Energy and Climate Plan (NECP) for the period from 2021 to 2030.	Afforestation and barriers to protect arable land from erosion are crucial. Introduction of drip irrigation systems and modernization of existing systems.
Bosnia and Herzegovina	The regulation of Bosnia and Herzegovina and its legislative framework prevents the launch of a comprehensive strategy to combat climate change.	High priority investments with a goal of rehabilitation and modernization of irrigation systems.
Montenegro	In December 2019, Montenegro adopted the Law on Protection from the Negative Impacts of Climate Change.	Development of a drought adaptation plan in conditions of increased climate variability. Establishment of a national network within agrometeorological observations.
Northern Macedonia	Northern Macedonia has approved an Energy Development Strategy until 2040, making it the first country in the Western Balkans to consider abolishing coal by 2030.	Harmonization of agrarian policy with climate change and strengthening of agricultural institutions. Also, it is necessary to invest in infrastructure and greater support for agricultural farms.

Given that one of the biggest problems of Western Balkan is drought, all measures taken are aimed at the application of technologies that achieve prevention and mitigation of consequences. In the last few years, various projects have been implemented on the territory of the Western Balkan, which aimed to reduce the harmful effects of drought. The Agriculture Project Water Resources and Drought Mitigation Strategy in the Western Balkans (WATERWEB) was aimed at strategic water management and mitigating the effects of drought on sustainable agricultural practices in the Western Balkans region. The project was funded by the European Commission (FP6) in the period 2004–2006 and involved 4 EU countries and three Western Balkan partners (Serbia, Montenegro, and Northern Macedonia). As the region of Southeast Europe is also prone to drought, 13 countries have established the Center for Drought Management in Southeast Europe (DMCSEE). The aim of this center is to improve drought preparedness and undertake vulnerability and risk assessments, as well as establishment of an early warning system to reduce the effects of drought. The DriDanube project is funded by the EU and aims to strengthen the capacity of the Danube region and improve the response to drought emergencies. In addition to nine EU countries, Western Balkan countries (Serbia, Bosnia and Herzegovina, and Montenegro) are also participants. It is important to note that Western Balkans emphasize the importance of enhanced cooperation between decision-makers, the scientific community, investors, the economy, and farmers. Continuous monitoring and reporting on soil moisture and crop condition are key in the fight against drought. On the other hand, a major Western Balkan stimulus is needed to fully meet the challenge of

climate change. Investment policy decisions will significantly affect the intensity of carbon emissions and climate change in general. Bearing in mind the geographical and economic interconnectedness of Western Balkan, many issues related to adaptability, water resources management, and energy infrastructure will be a particular challenge.

Conclusions

Agriculture is an inseparable part of the environment and as such, it is affected by all meteorological, water, or land anomalies. When it comes to climate change, all segments of agricultural production will be endangered, especially crop production. The negative impact on plant and livestock production will also affect the food industry, and thus the regularity in the supply chain of raw materials. All this leads to economic and social insecurity. Therefore, the implementation of the Western Balkan Green Agenda will require significant public and private funding, both nationally, regionally, and internationally. Negotiations on external instruments are underway within the next EU Multiannual Financial Framework (MFF, 2021–2027) with the Council and the European Parliament. In order to fill a significant investment gap, it is necessary that in addition to public funding from the EU, there is also private funding. Finally, education is key to preserving the environment and must include a curriculum and acquiring skills that will enable the implementation of the Green Agenda. Combating climate change can only be successful with joint efforts and change in all aspects of life and will require the most leadership at all levels of society.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

DR prepared the concept of the study, participated in data collection, analysis, and interpretation of the results. All authors were involved in drafting the manuscript and approved the final manuscript.

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References

1. Vuković A, Vujadinović Mandić M (2018) Study on climate change in the Western Balkans region. Regional Cooperation Council Secretariat. Printline d.o.o., Sarajevo, Bosnia and Herzegovina. ISBN: 978-9926-402-09-9
2. Božanić D (2020) Analysis of the legislative framework of climate change. Secretariat of the Informal Green Parliamentary Group. Belgrade Fund for Political Excellence (BFPI). <https://bfpe.org/wp-content/uploads/2021/03/Analiza-zakonodavnog-okvira-Klimatske-promene.pdf>. Accessed 17 March 2021
3. Stričević R, Prodanović S, Đurović N, Petrović OO, Đurović D (2019) Influences of climate change on Serbian agriculture. United Nations Development Program. ISBN:978-86-7728-262-2
4. Abramović V, Jacimović D, Jocović M (2016) Klimatske promjene i njihov uticaj na zemlje regiona. Ekonomske ideje i praksa, p 20
5. Gocic M, Trajkovic S (2014) Spatiotemporal characteristics of drought in Serbia. J of Hydrology 510:110–123
6. Filipović A. 2020 Water Plant and Soil Relation under Stress Situations. IntechOpen. doi: 10.5772/intechopen.93528
7. FAO (2017) The future of food and agriculture – Trends and challenges. Rome. ISBN 978-92-5-109551-5
8. Regional Environmental Center for Central and Eastern Europe (2011) The Impacts of Climate Change on Food Production in the Western Balkan Region. Szentendre, Hungary
9. CAREC (2015) Tajikistan: Country situation assessment. Working paper. Almaty. p 60
10. FAO (2008) FAO's Role in the 2008/2009 Humanitarian Food Security Appeal for Tajikistan. Rome. http://www.fao.org/fileadmin/user_upload/emergencies/docs/tajikistan_appeal_2008_2009.pdf
11. Aleksić P, Krstić M, Jančić G (2009) Forest fires – ecological and economic problem in Serbia. Botanica Serbica 33(2):169–176
12. Kujawski R (2011) Long-term Drought Effects on Trees and Shrubs. UMassAmherst. The Center for Agriculture, Food and the Environment
13. Australian Government (2017) Factors influencing weeds. <http://www.environment.gov.au/biodiversity/invasive/weeds/weeds/why/factors.html>. Accessed 17 March 2021
14. UNDP (2015) Climate change and disaster risk reduction snapshot. Albania. Istanbul. p 4

15. Laska MA, Mustaqi V, Jaupaj O, Como E, Bardhi A, Dvorani M (2012) Droughts and their impact on the Albanian Territory. *Agriculture Forestry* 58(1):7–17
16. Zurovec O, Vedeld OP, Kumar Situala BK (2015) Agricultural Sector of Bosnia and Herzegovina and Climate Change—Challenges and Opportunities. *Agriculture* 5:245–266
17. ICPDR (2015) The 2015 Droughts in the Danube River Basin. Vienna. p 20
18. WMO (2012) Strengthening Multi-Hazard Early Warning Systems and Risk Assessment in the Western Balkans and Turkey: Assessment of Capacities, Gaps and Needs. Geneva. p 310
19. Ministry of Sustainable Development and Tourism (2015) The Second National Communication on Climate Change. Podgorica, p 296
20. WMO/UNCCD/FAO & UNW-DPC (2013) Country Report. Drought conditions and management strategies in Serbia. Initiative on Capacity Development to support National Drought Management Policy, Belgrade, p 12
21. Duričn S, Bodrož D (2013) The impact of drought on yield position of the group enterprises from agricultural sector. *Economics of Agriculture* 1:25–37
22. USDA Foreign Agricultural Service (2012) Drought Driven Declines in Serbian Crops Increased Food Prices. Global Agricultural Information Network, Belgrade, p 3
23. WMO/UNCCD/FAO & UNW-DPC (2013) Country Report Drought conditions and management strategies in Serbia. Initiative on Capacity Development to support National Drought Management Policy, Belgrade, p 12
24. Beogradski fond za političku izuzetnost (2020) Analiza zakonodavnog okvira klimatske promene. Sekretarijat neformalne Zelene poslaničke grupe
25. Balkan Barometer (2019) <https://www.rcc.int/pubs/89/balkan-barometer-2019-public-opinion-survey>. Accessed 17 April 2021
26. Special Eurobarometer 490 (2019) Climate Change Report. https://ec.europa.eu/clima/sites/clima/files/support/docs/report_2019_en.pdf. Accessed 17 April 2021
27. Higgins PAT (2014) Climate Change Risk Management. An AMS Policy Program Study. The American Meteorological Society, Washington, DC
28. Dobravec V, Matak N, Sakulin C, Krajačić G (2021) Multilevel governance energy planning and policy: a view on local energy initiatives. *Energ Sustain Soc* 11:2
29. Hoppe T, van den Berg M, Coenen F (2014) Reflections on the uptake of climate change policies by local governments: facing the challenges of mitigation and adaptation. *Energy Sustain Soc* 4:8

Figures

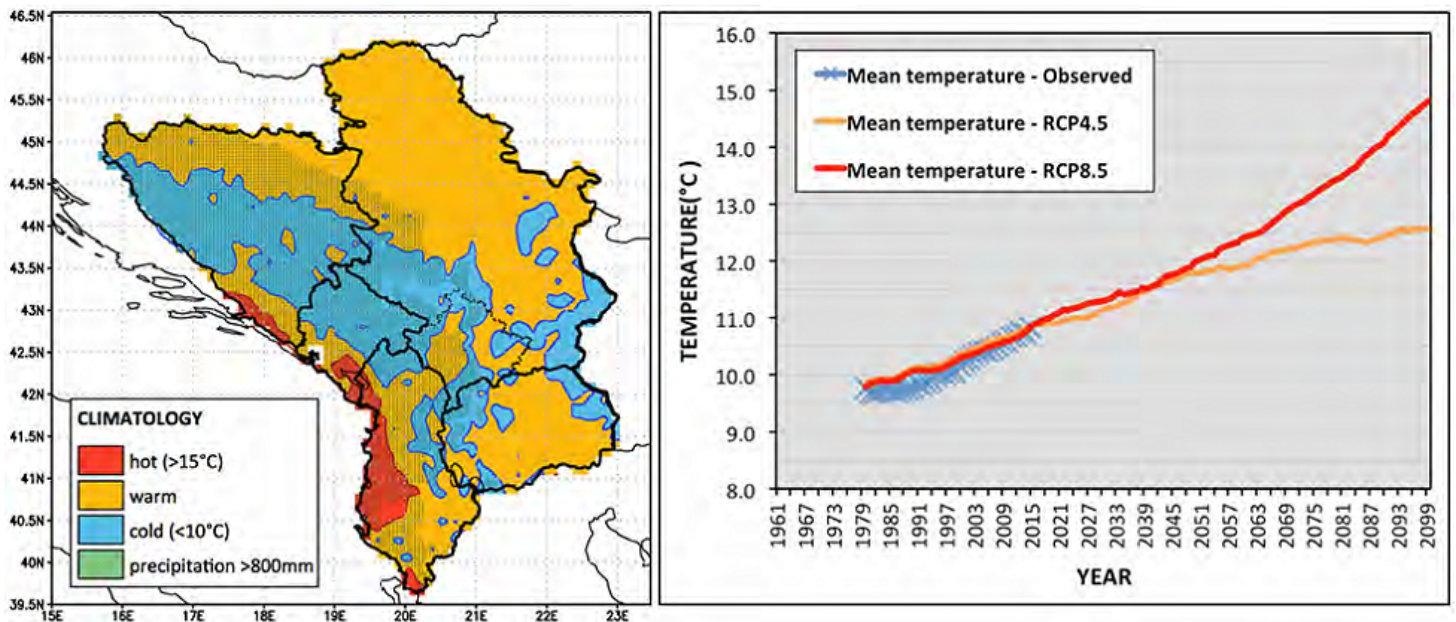


Figure 1

Climatology of the Western Balkans [1]

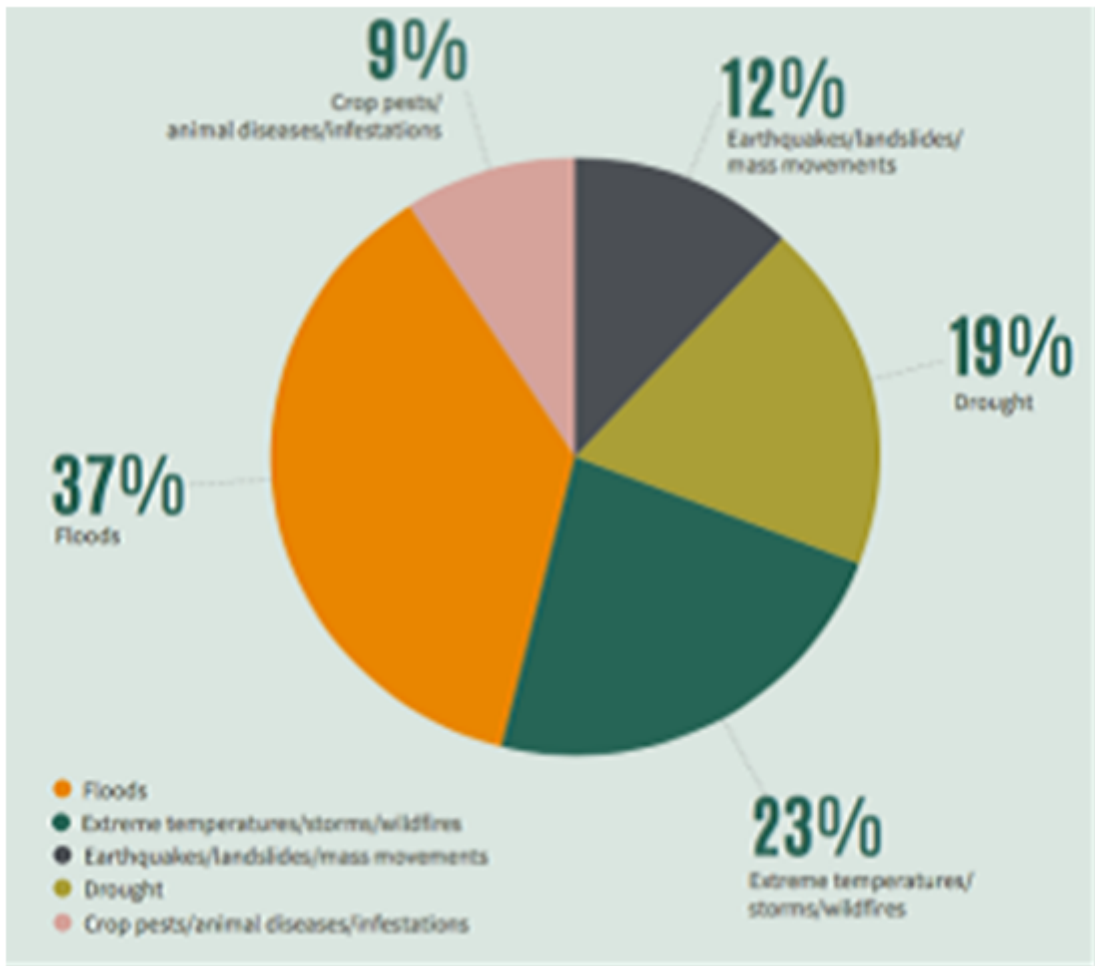


Figure 2

Losses in crop and livestock production in the period 2005-2014 [7]