



Present and future climate risks in Montenegro

Sanja Pavicevic, MSc Physics

Institute of Hydrometeorology and Seismology of Montenegro

Workshop „Climate Change Adaptation“

City Hotel, Crnogorskih serdara 5 Podgorica, Montenegro

31 October – 1 November 2013

Content

- Climate change key players in MNE
- Country profile: geographic and demographic
- Climate of MNE and climate trends
- Natural hazards: geological and hydrometeorological
- Natural Hazards Vulnerability Facts and Trends
- Conclusions

Administrative organization in the area of climate change in Montenegro

The Ministry of Sustainable Development and Tourism (MSDT) has key competencies in the area of Climate Change.

The Ministry designs policies and adopts relevant regulations.

Environmental Protection Agency (EPA), as an executive authority, plays a significant role in implementing the climate change policy.

Institute of Hydrometeorology and Seismology (IHMS) monitors climate and potential impacts of climate change on different sectors of the economy and natural resources and develops climate scenarios.

IHS also acts as the focal point of Montenegro in the Intergovernmental Panel on Climate Change (IPCC) and the Global Climate Observing System (GCOS), WMO, IHO, EUMETNET, ECMWF, EUMETSAT.

Top news

Montenegro tops WTTC report in growth of tourism contribution to GDP

Over the next ten years, Montenegro is expected to experience the world's fastest growth of total contribution of travel and tourism to GDP at 12.4 per cent a year, the World Travel and Tourism Council (WTTC) has announced in its latest report...

- PUBLIC INVITATION for participation in International Public Tender for Long-term Lease of tourism co
- THE PUBLIC INVITATION for participation on the Tender (HTP "ULCINJSKA RIVIJERA" AD, Ulcinj, Montenegro)
- FOURTH NATIONAL REPORT OF MONTENEGRO TO THE CONVENTION ON BIOLOGICAL DIVERSITY

Projects of the Ministry



Current News

10.09.2013.
Law on spatial development and construction of structures

Law on spatial development and construction of structures

[more...](#)

31.07.2013.
Interview: Branimir Gvozdenović, Montenegro Tourism and Sustainable Development Minister

Interview: Branimir Gvozdenović, Montenegro Tourism and Sustainable Development Minister

[more...](#)

26.06.2013.
Overview of the status of projects in the field of municipal infrastructure and environment

Overview of the status of projects in the field of municipal infrastructure and environment

[more...](#)

25.01.2013.
OPERATIONAL PROGRAM DEVELOPMENT 2013

Agencija za zaštitu životne sredine Crne Gore

POČETNA AGENCIJA DOKUMENTI ORGANIZACIJA KORISNO O NAMA KONTAKT

BIODIVERZITET

Praćenje stanja biodiverziteta za cilj ima njegovo očuvanje, unaprijeđenje i zaštitu, a usmjeren je na praćenje najrepresenzativnijih vrsta i staništa od međunarodnog i nacionalnog značaja.

VAZDUH

Vazduh kao jedan od najznačajnijih činilaca životne sredine, svojim kompleksnim sastavom i osobinama zahtjeva stručno praćenje i analizu.

ZEMLJIŠTE

Zemljište, voda i vazduh su elementarne komponente životne sredine. Zemljište se ubraja u uslovno obnovljive resurse.

MORSKI EKOSISTEM

AKTUELNO

Ekološki čas u OŠ "Štampar Makarije"
Podgorica, 27. Septembar 2013.
U okviru edukativnog programa iz ekologije, dana 27. septembra 2013. god. predstavnici Agencije za zaštitu životne sredine održali su e...

Press konferencija – „Informacija o stanju životne sredine za 2012.god.“
Cibevak, 26. Septembar 2013.
Povodom usvajanja dokumenta: „Informacija o stanju životne sredine za 2012. god.“, dana 26. septembra, u Podgorici u multimedijalno...

EKOLOŠKI KALENDAR

4. Oktobar
Svjetski dan zaštite životinja

6. Oktobar
Svjetski dan staništa

11. Oktobar
Dan borbe protiv prirodnih katastrofa

www.epa.org.me

Address:
IV proleterske 19
81000 Podgorica
Montenegro



Hydrometeorological and Seismological Service of Montenegro

Weather Forecast

30.10.2013.

19 do 25

24 do 26

26

Prognosa za 30.10.2013. Izgledi vremena: Prognosa vremena za pomicanje: Sunčano uz povremenu malu ili umjerenu, a tokom noći i povećanu oblačnost. Po kotlinama uljuru ili priepodnevno magla. Vjeter slab promjenljivog smjera, tokom noći ponegdje umjeren sjeverni i sjeverozapadni. Najviša dnevna temperatura vazduha od 19 do 26 stepeni.

DMCSEE
Centar za upravljanje sušama za Jadransko more

IPA (HR-CC)
Prekogranični susret

Cross-Border Programme
Croatia - Montenegro

www.meteo.co.me

Adapting to Climate Change

Montenegro so far did not have particularly determined policy on climate change or any special policy on adapting to the adverse impacts of climate change, and this area was generally examined through the **NATIONAL STRATEGY FOR SUSTAINABLE DEVELOPMENT (2007)** and the **FIRST NATIONAL COMMUNICATION ON CLIMATE CHANGE (2010)**. Contribution in this area was presented by the recently finalized **TECHNOLOGY NEEDS ASSESSMENT**.

Work on document **SECOND NATIONAL COMMUNICATION** is ongoing and will result in further climate vulnerability assessments of different sectors.

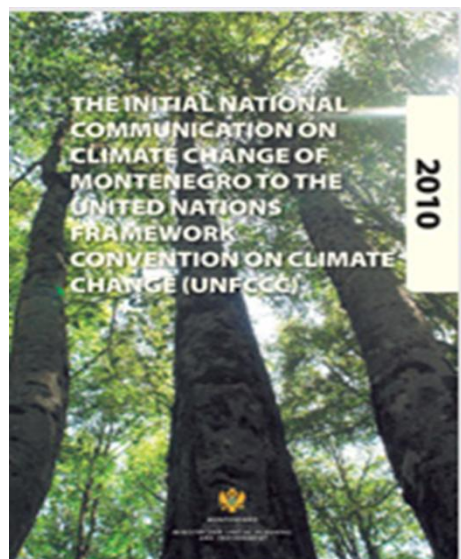
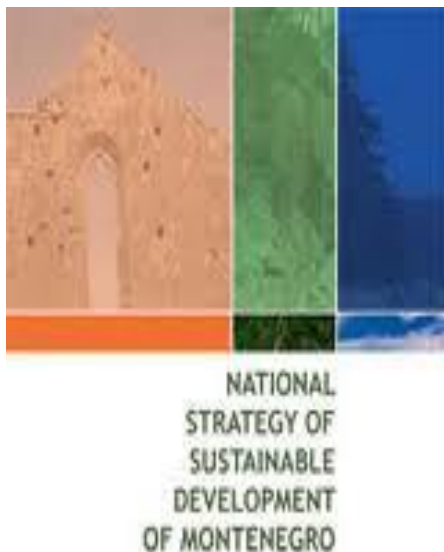
Project **COASTAL AREA MANAGEMENT PLAN (CAMP)**, which is ongoing, analyses of the coastal zone vulnerability to climate change and mapping of the vulnerable areas.

NATIONAL CLIMATE CHANGE STRATEGY BY 2030 is expected to contribute to some extent to the policy field of national adaptation to climate change.

Institute for Public Health of Montenegro supported by the Ministry of Health and Ministry of Sustainable Development and Tourism will partner with German International Cooperation Agency (GIZ) to make use of financial and technical support provided by GIZ within project “**CLIMATE CHANGE ADAPTATION IN WESTERN BALKANS (CCAWB)**”, with aim to develop Strategy for Adaptation to Climate Change in Public Health Sector and Action plan for protection from heat waves. The project documentation is under preparation and realization of these activities is foreseen in next 12 months.

These projects will provide input data for defining the actions and policies to adapt to the adverse impacts of climate change.

MONTENEGRIN CLIMATE CHANGE PUBLICATIONS



[UNDP around the world](#)
[Operations](#)
[Research & Publications](#)
[News Center](#)
[English](#)

UNDP in Montenegro

[Our Work](#)
[Millennium Development Goals](#)
[About Montenegro](#)

[Home](#) > [Operations](#) > [Projects](#) > [Economy and Environment](#) >

Second National Communication on Climate Change

Overview

FLOODS IN MONTENEGRO IN 2010. PHOTO: UNDP IN MONTENEGRO/ MILOŠ VUJOVIĆ, MEDIABOX

Project Overview

Status:
Active

Project Start Date:
March 2011

Estimated End Date:
March 2014

Geographic Coverage:
Nationwide, Montenegro

Focus Area:
Economy and Environment

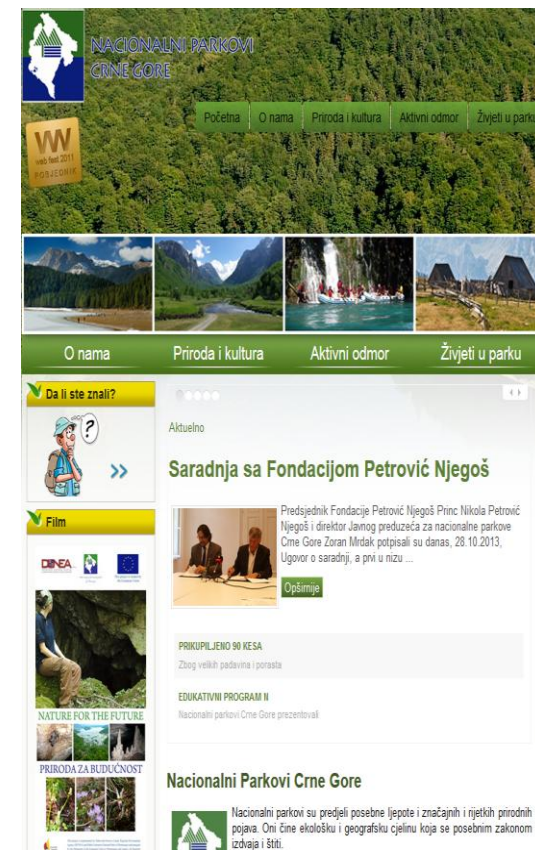
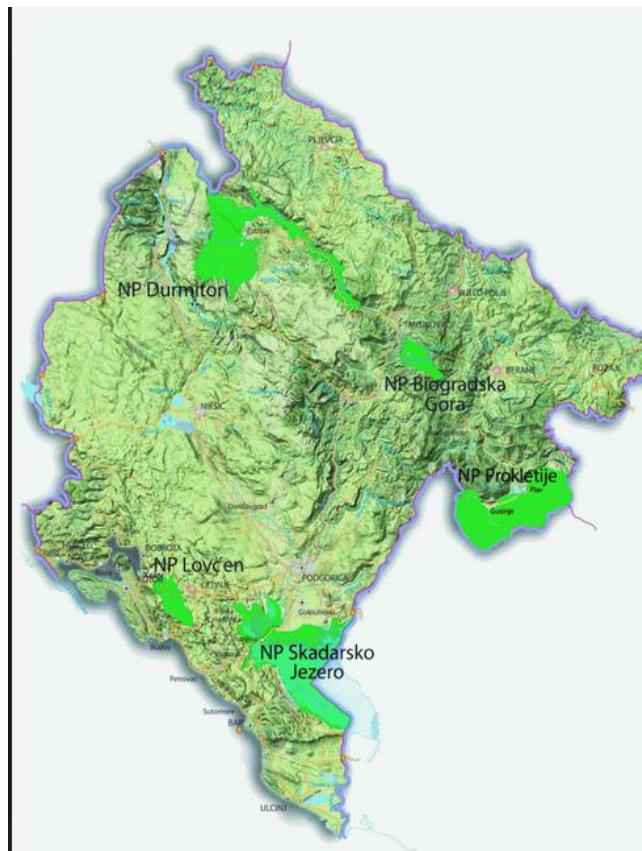
Project Officer:
Ms. Snežana Marstijepović
snezana.marstijepovic@undp.org
Tel. +382 20 22 55 33
Fax +382 20 22 55 51

Partners:
Ministry of Sustainable Development and Tourism of Montenegro

- Beautiful Cetinje
- Biodiversity Strategy and Action Plan
- Business clusters for sustainable economic growth
- Coastal area management
- Environmental indicators
- Strengthening sustainability of protected areas
- Financial sustainability of protected areas
- Promoting renewable energy sources
- Second National Communication on Climate Change

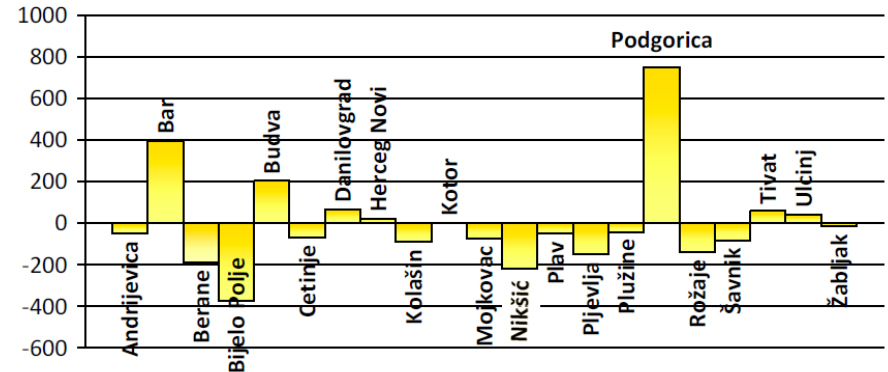
GEOGRAPHIC PROFILE

- Montenegro is an Adriatic-Mediterranean, Dinaric, South East European country. It is located between 41°39' and 43°32' latitude and 18°26' and 20°21' longitude. The sea coast is 293 km long.
- The surface of Montenegro is 13 812 km², and sea bed is 2 540 km².
- According to the 2003 census, Montenegro has 620 145 inhabitants, which makes for the population density of 44.8 inhabitants per 1 km².

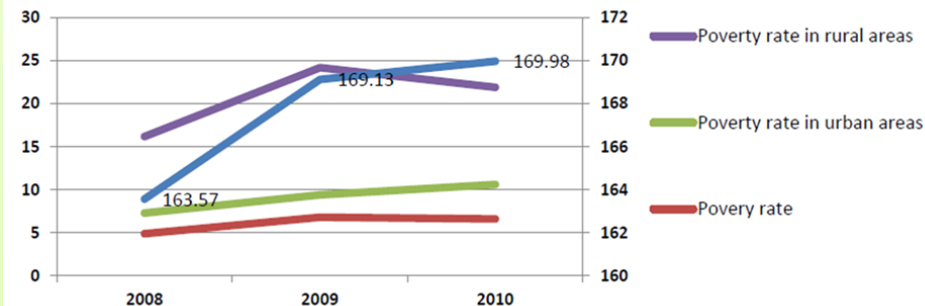


DEMOGRAPHIC PROFILE

- Regional differences hinders the country's economic growth.
- Rural area has demographically aged, since its biological substance is in danger and it is economically poorer.
- Urbanization has progressed, mostly in the central part of Montenegro, even in the southern.
- There is a significant difference in the scope of poverty in the northern region and other parts of the country

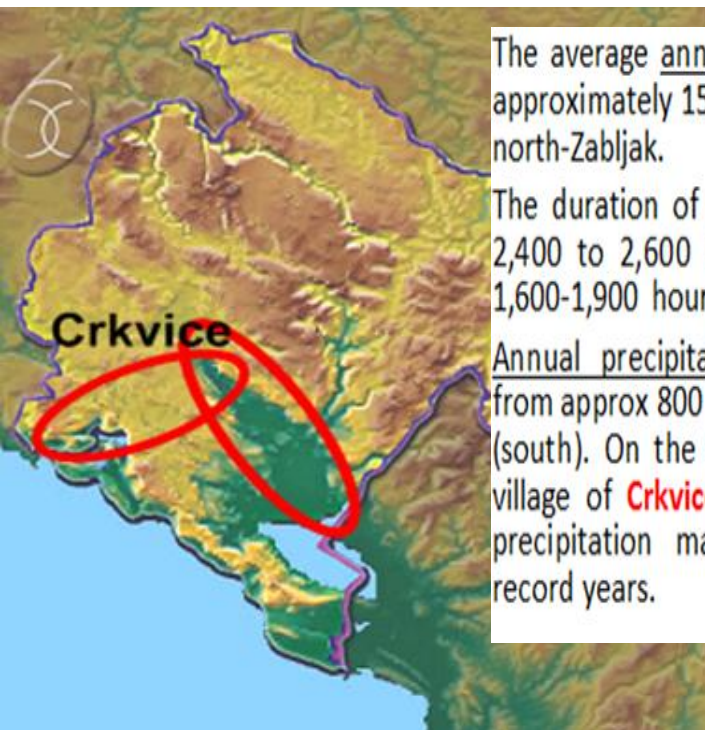


Migration balance for Montenegrin municipalities in 2010



Poverty in Montenegro between 2008 and 2010

Climate of Montenegro



The average annual air temperatures vary from approximately 15.8°C in the south to 4.6°C in the north-Zabljak.

The duration of the sunny periods varies from 2,400 to 2,600 h/year on the coast, i.e. from 1,600-1,900 hours in the mountains.

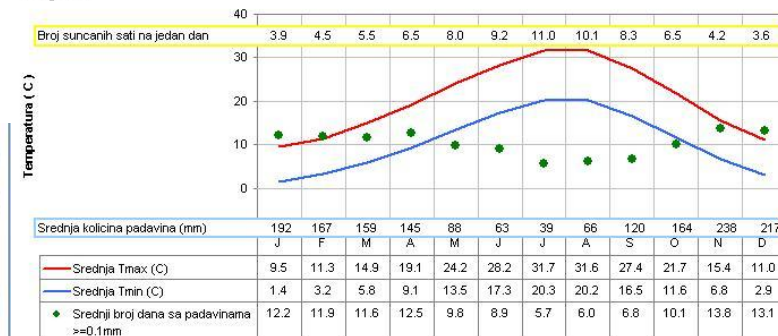
Annual precipitation is very uneven, ranging from approx 800 mm (north) to about 5,000 mm (south). On the slopes of Mount Orjen, at the village of **Crkvice** (940m above the sea level), precipitation may even reach 7,000 mm in record years.

The central and northern regions of Montenegro have certain characteristics of **mountain climate**, although the influence of the Mediterranean Sea is also evident.

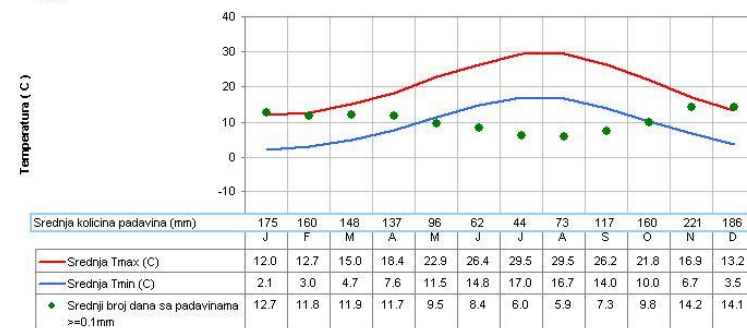
The northern part has **continental climate** characterized by large daily and annual temperature ranges, in addition to low annual precipitation.

The southern part of Montenegro and the Zeta-Bjelopavlići plain have **Mediterranean climate**, with long, hot and dry summers and relatively mild, rainy winters.

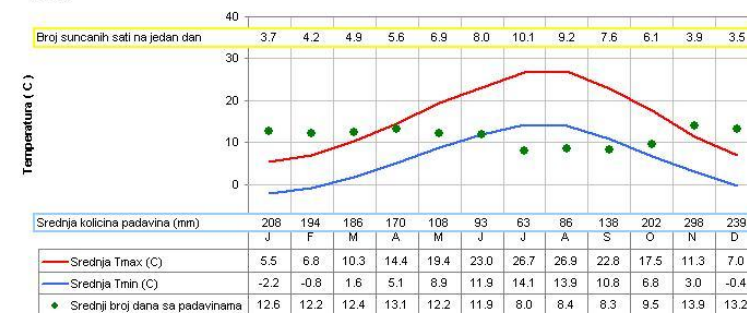
Podgorica



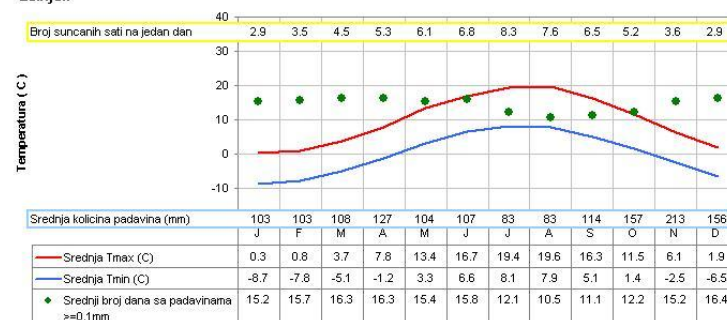
Tivat



Nišić

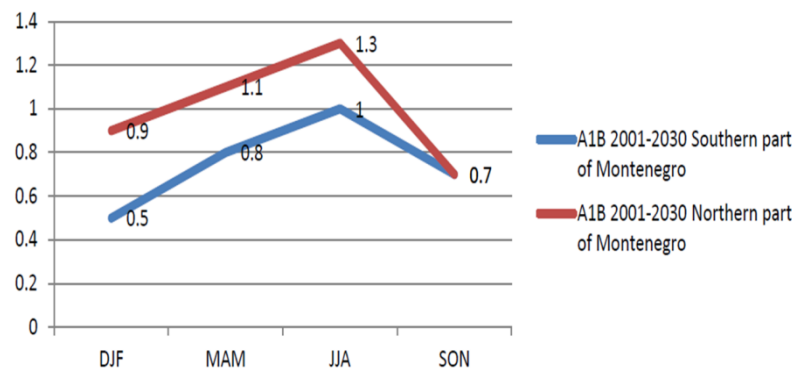


Zabljak

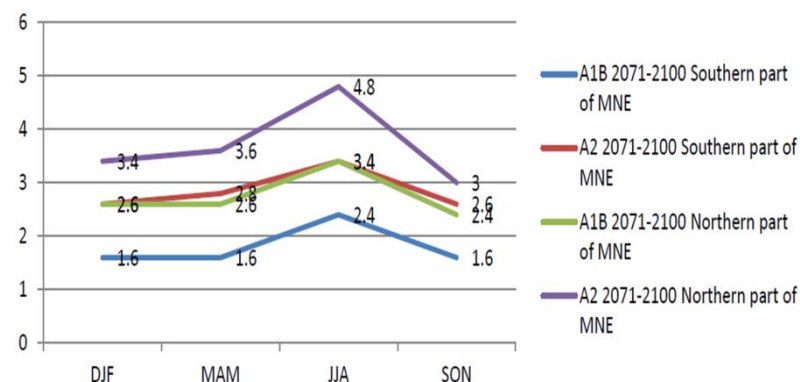


According to the projections A1B (*middle scenario*) and A2 (*high scenario*)

Significant decrease in precipitation is expected, even up to -50% in the Southern part of Montenegro during the JJA season, as well as a little increase in precipitation, up to 5% during the summer (JJA season), for the central part of Montenegro, and the north-western part (border to Bosnia and Herzegovina) in the spring season.



Projections of temperature changes (°C) according to the climate scenario A1B 2001 - 2030 in Montenegro in the seasons



Temperature change projections (°C) according to the climate scenarios A1B and A2 in Montenegro according to the seasons (based on the INC data)

Hazard and risk

- According to the UNISDR terminology on DRR:
Risk is combination of the probability of an event and its negative consequences:

$$\text{RISK} = \text{Hazard Impact} \times \text{Probability of occurrence}$$

- According to the Risk Assessment and Mapping Guidelines, for Disaster Management, developed by European Commission:

$$\text{RISK} = f (P * e * v)$$

- P - PROBABILITY,
- e - EXPOSURE PEOPLE AND PROPERTY IN HAZARD ZONES AND
- v - VULNERABILITY

NATURAL HAZARDS are hazards attributed to natural phenomena, which appear and represent a threat to people, buildings and the economy, and they can cause disasters.

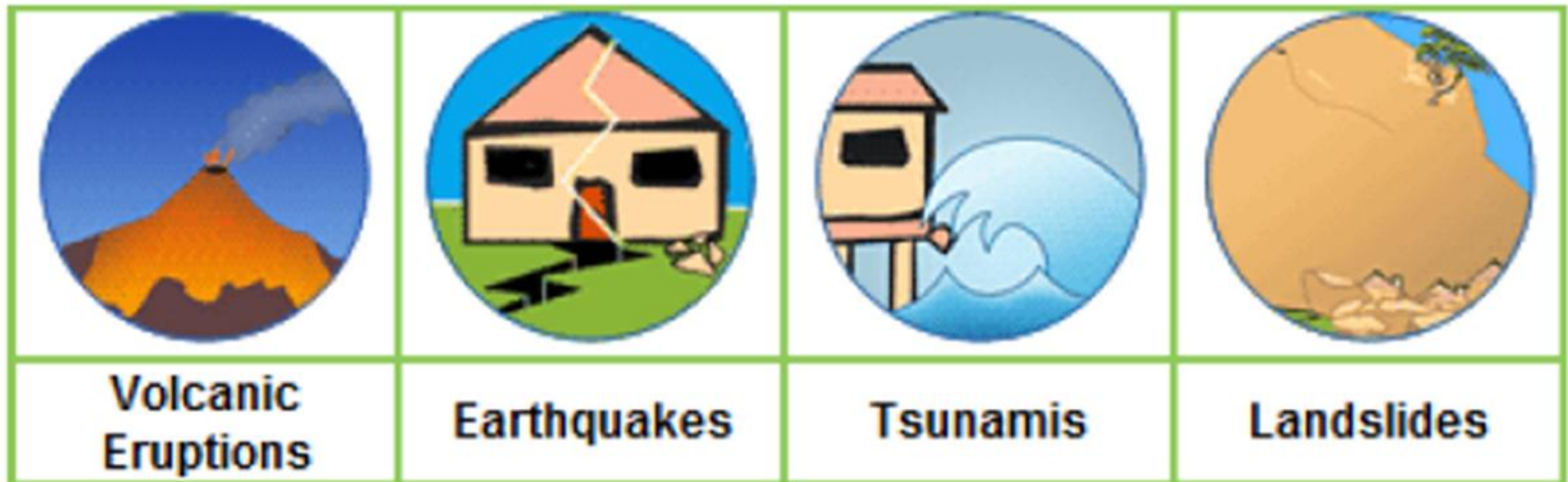
Each hazard has its own **SPECIFIC CHARACTERISTICS**,
when it comes to **its emergence**,
duration,
manifestation,
consequences and
the response to it!

The division of hazards is usually based on their causes and places where they appear on Earth.

That is how hazards are divided to **geological** and **hydro-meteorological**.

Geological hazards are reflected through the internal processes in Earth, such as earthquakes and volcano eruptions, or the external processes, such as landslides.

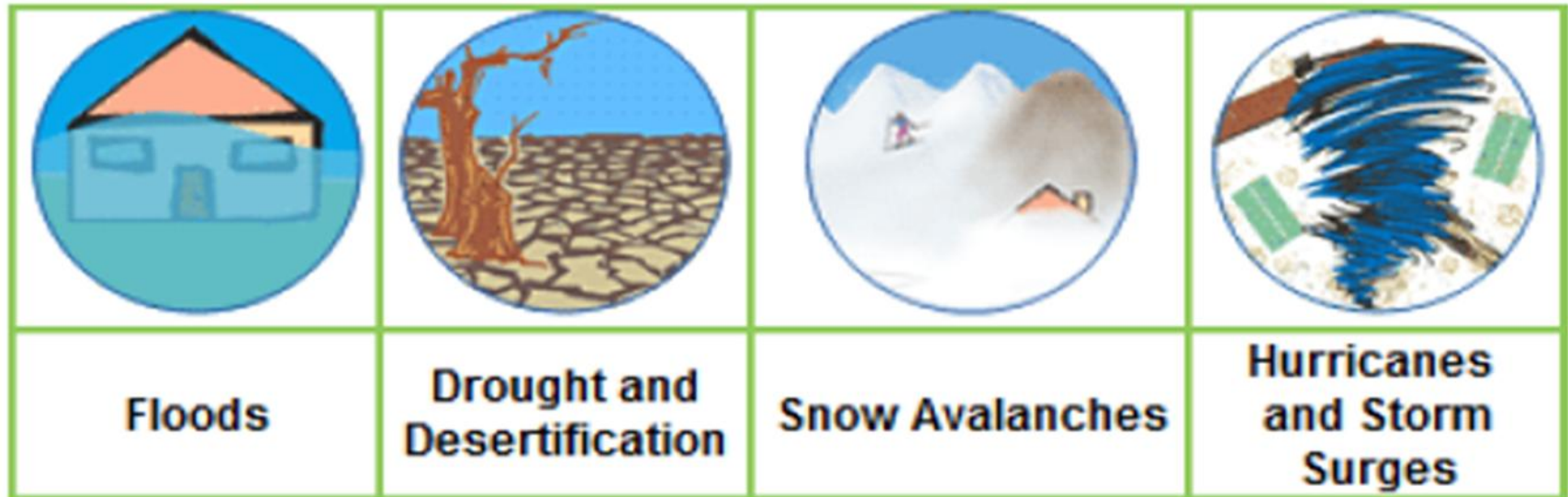
Tsunami, as an ocean process, belongs to the so called **hazard of coastal water** and they are activated by sea earthquakes and other geological events.



Hydro-meteorological hazards are most often weather dependent phenomena

(floods, extreme temperatures – heat and cold waves – droughts, soil desertification, avalanches and hurricanes)

It is important to understand that NATURAL HAZARDS CAN CAUSE ONE ANOTHER, e.g. storms cause floods, earthquakes can cause tsunamis and landslides, a volcano eruption can cause fires.



Expect significant seismicity intensification

In terms of the planned large investments, when it comes to the projected accumulations on the river Morača, **it is realistic to expect significant seismicity intensification in the zone of those accumulations** and their immediate surroundings, especially after the first filling of the accumulations.

In case of accumulations on the river Moraca, that level is 5.5 units of the Richter scale.

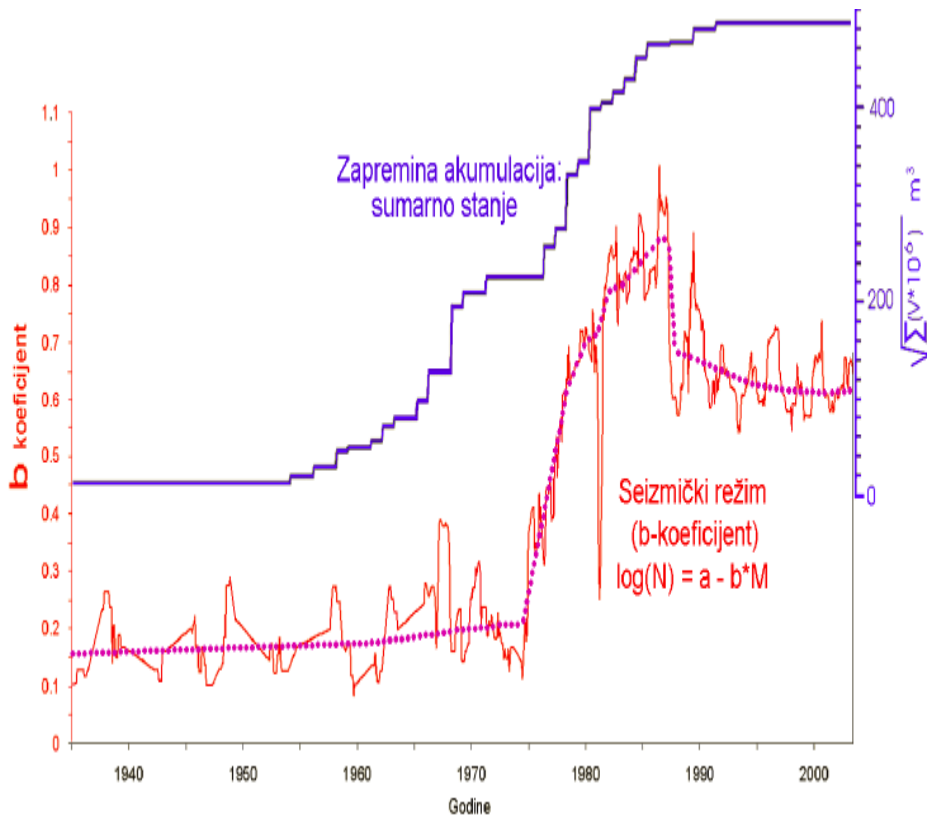
Almost all of Montenegro is exposed to frequent seismic events, especially in the coastal area, in the plains of Zeta and Skadar, and Berane basin



Seismic reyonization map of Montenegro with the position of the existing and planned energy facilities (Source: IHMS) ¹⁵

Hydroaccumulation and seismicity link

It has definitely been determined that there is a direct link between the dynamics of accumulation **filling and emptying**, (i.e. the change of hydro-accumulation total mass and the realized seismicity in the accumulation zone)

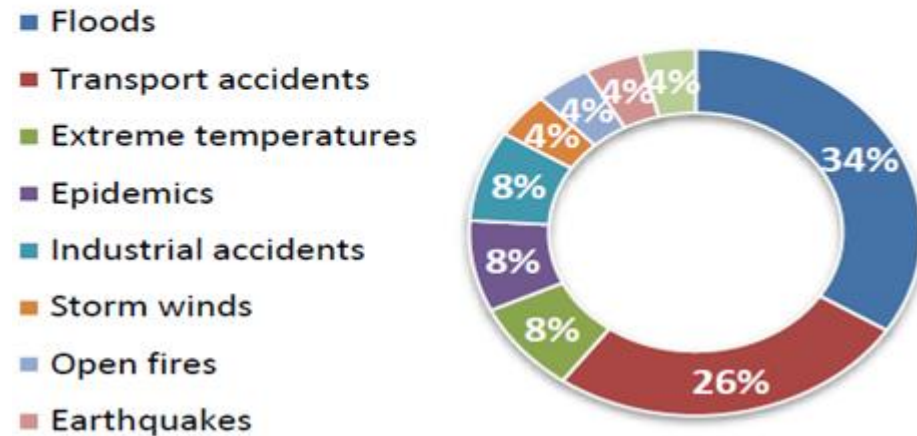


The change in seismicity character (*red*) compared to the total accumulation volume (*blue*), in the southern Dinaride during the last 70 years (Source: Seismology Institute of Montenegro)

Extreme meteorological events in Montenegro are:

- extreme precipitation and flooding,
- storm winds,
- extreme temperatures,
- freezing,
- fog and drought;
- extreme tidal waves and strong sea and coastal waves.

Distribution of different hazards in Serbia and Montenegro (1989 – 2006)



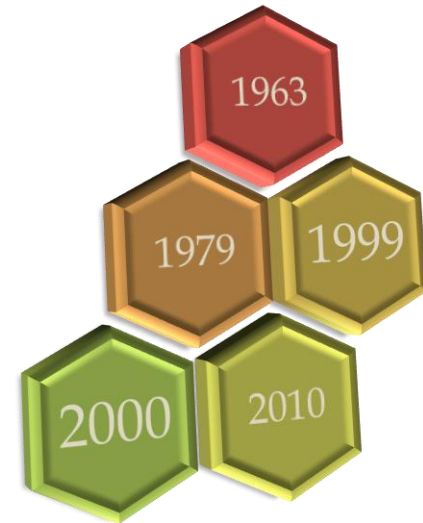
Extreme meteorological events (EMEs) become DISASTERS when they affect places in urban areas which are densely populated, and when they create a lot of damage!

Floods-the most frequent natural hazards in MNE

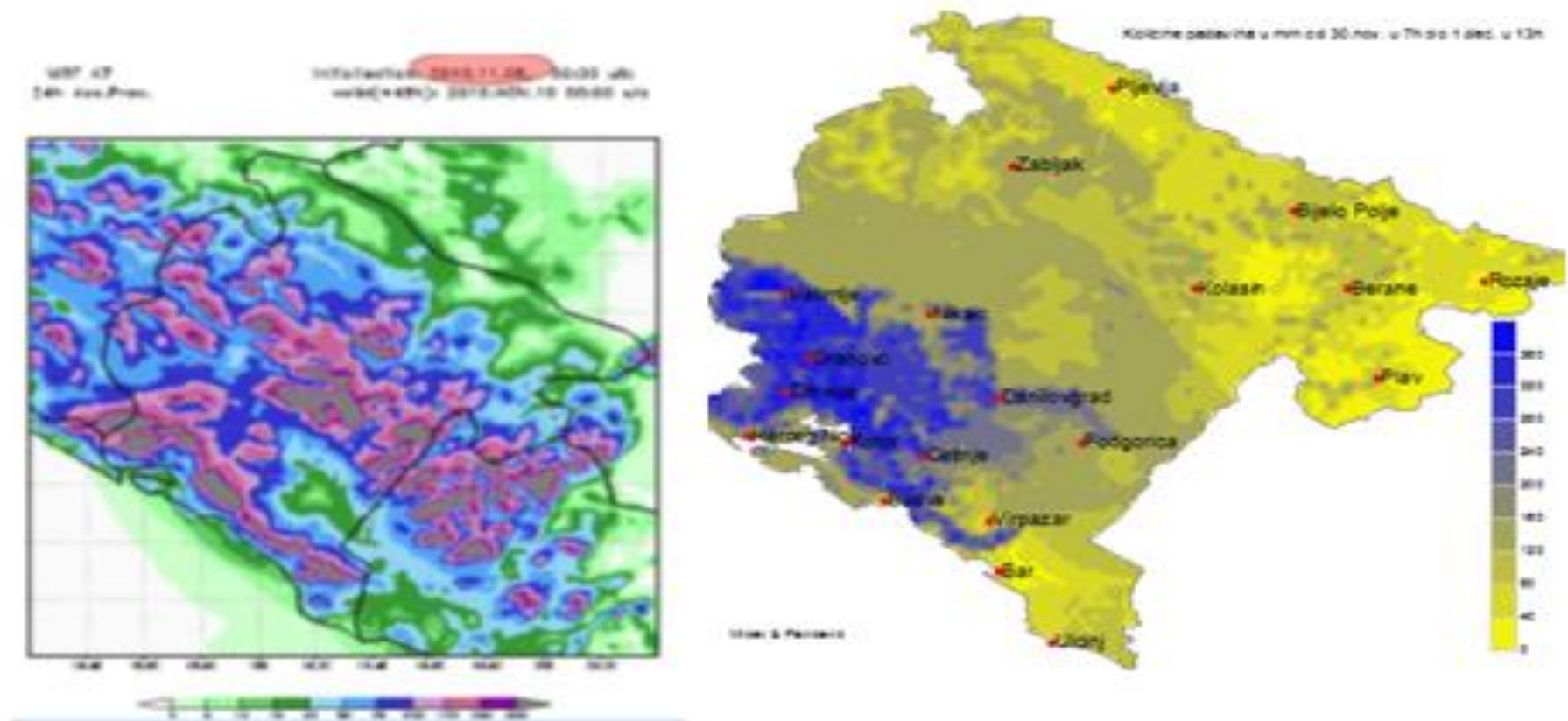
The biggest floods recorded

Areas potentially most vulnerable to floods are:

- The hydrological system
Zeta – Morača – Skadar Lake – Bojana,
- River Lim with its tributaries
(confluences of Lim's Tributaries) and
- River Tara before entering the canyon.



Extremely large amount of precipitation in the end of November 2010



Forecast of floods (Source: IHMS)

Extreme precipitation is the most significant factor causing floods



Niksic Plain, December 2010



Danilovgrad, December 2010

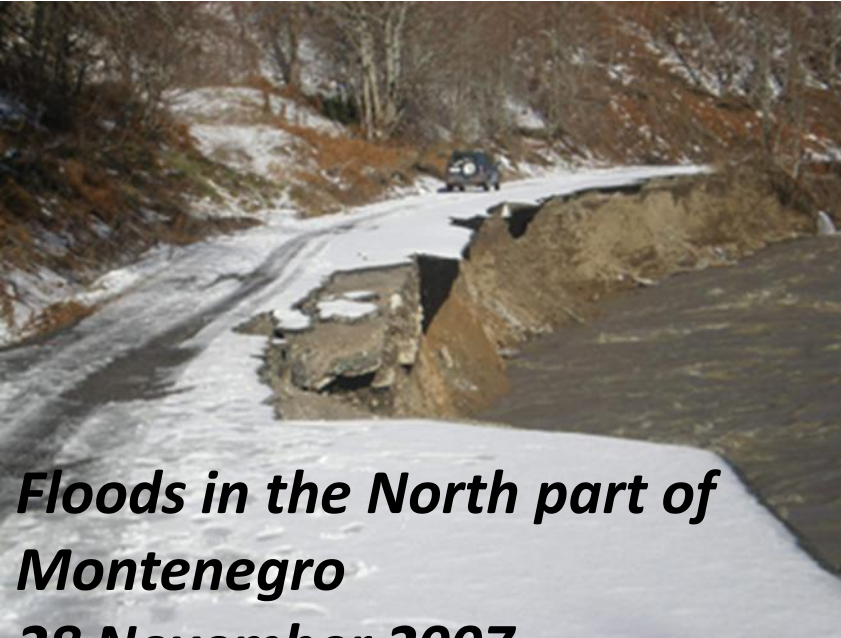


Bar, 22 October 2006
124 l/m²



Bar, 6 October 2010
201l/m²





***Floods in the North part of
Montenegro
28 November 2007***

Apart from flooding, there is a **LARGE DANGER FROM LANDSLIDES** during short-term rain fall seasons (Sept–Nov, March–April), characterized by voluminous precipitation.



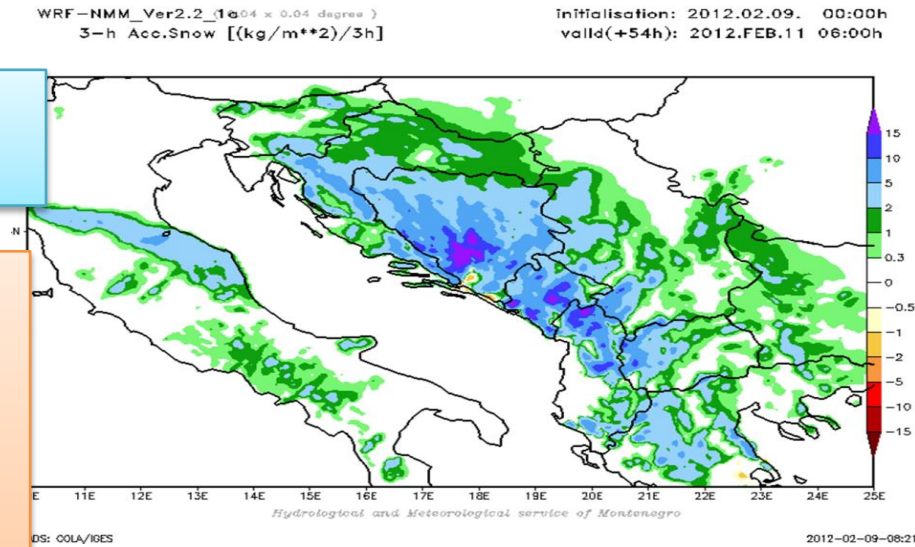
***Overflow of the river Tara
27 November 2007***

Practically all the rivers in Montenegro in their upper stream, and some in their full capacity, have a **torrential character**.

Each of the torrential streams endangers settlements and roads, as well as agricultural, forest and other lands.

Extreme snow fall is an important natural disaster

- Snow depth cover and its duration are crucial for the road traffic.
- Due to the snow fall in February 2010 most main roads, and a part of the Adriatic touts, were cut off.
- Also, the air traffic was suspended from the Podgorica Airport (Golubovci)



Žabljak, 20.03. 2007



Storm winds are represented in almost all parts of Montenegro

- Since December 2000, the Skadar lake basin was caught in a southern storm wind of destructive power, causing significant material damage.
- In November 2004 north wind reached 33 m/s in Kolasin and caused tree felling.
- The beginning of 2006 was characterized by high speeds of the north-east wind in Podgorica, reaching up to 25 m/s.
- In the Bar port, wind cut off the pipeline, which caused large amounts of fuel to pour into the sea and create a local ecological disaster.
- Strong storm winds of about 100 km/h caused a lot of damage in Zabljak on the local electro energy network and private facilities.



Storm disasters in the warmer part of the year are often accompanied by frequent hails.

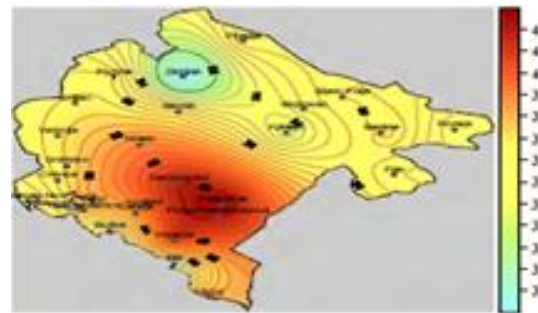
Drought

Droughts have a regional character and have more and more economic and ecological consequences.

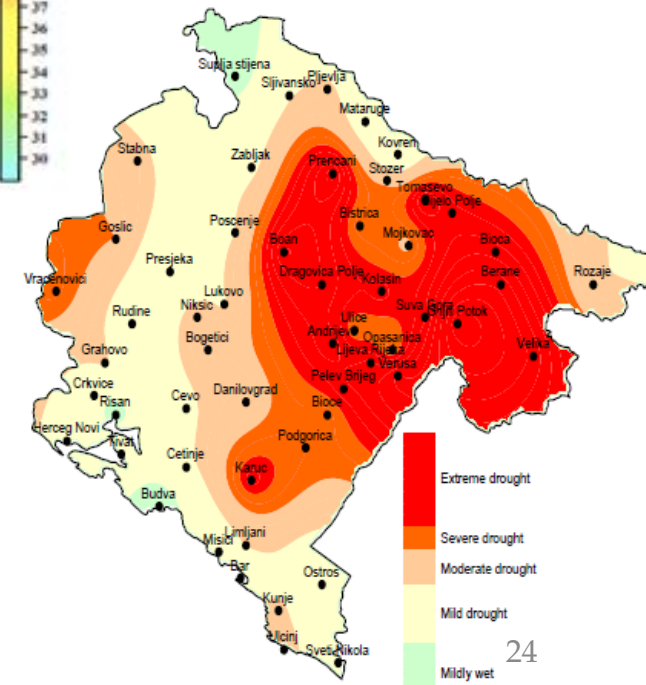
Significant droughts were recorded in the region in 1993, 1994, 1998, 2003, 2007 and 2010.

Of all the areas with climate characteristics of drought, the ones with most drought are Zetsko-Bjelopavlicka plain and the coast.

- Data and analyses done in HMI show that **during the last decades the emergence of intensive droughts**, in all the forms, was frequent in Montenegro.
- Most consequences were felt in forestry, agriculture and water procurement.



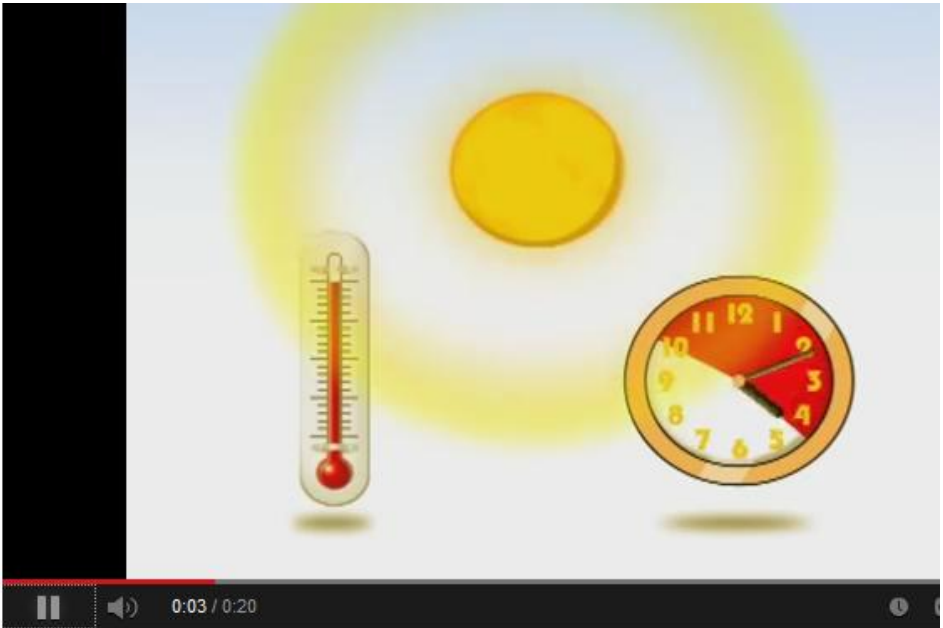
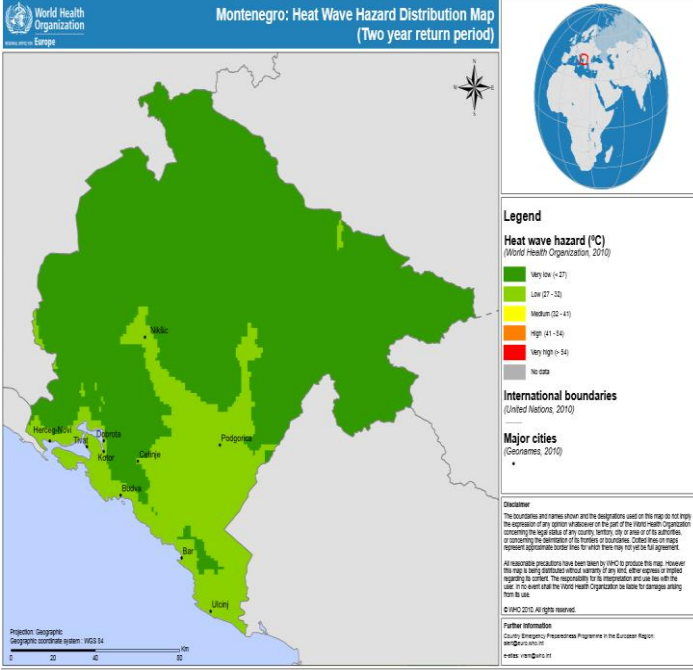
SPI12 - September 2007.



In the warmer part of the year, droughts of stronger intensity affected the southern part of Montenegro, and in the colder part, the mountain region.

HEAT WAVES are characteristic for all seasons and in all areas of Montenegro. In August 2000, they were one of the most significant factors contributing to the emergence of large scale fires. It was difficult to control them due to the strong north wind.

Heat waves and floods in Montenegro have a huge impact on health, because they disrupt the balance of health and wellbeing <http://www.youtube.com/watch?v=9F6bs6Z1wFg>



MONTENEGRO HEAT WAVE COMMERCIAL

UNFCCC Montenegro - 1 video

Subscribe 0

Objavljeno: Petak, 26 Jul, 2013 - 12:02 Izmjena: 16:27 Izvor: CdM

Toplotni talas zahvatio Crnu Goru

Komentari (2) Autor: Tatjana Ratković Šekularac

Područje Crne Gore danas je zahvatio novi toplotni talas koji će trajati do kraj jula. Najveće vrijednosti teperatura očekuju se u nedjelju, ponedjeljak i utorak koje će u području skadarsko -podgoričke kotline prelaziti 37 stepeni, kazao je direktor Zavoda za meteorologiju i seizmologiju Luka Mitrović, na konferenciji za novinare povodom realizacije projekta "Javna kampanja za informisanje i podizanje svijesti stanovništva o uticaju klimatskih promjena".



Toplotni talas stigao u Crnu Goru



New absolute
maximum 44.8 C
at the state level
measured
24 August 2007
in Podgorica

The old
maximum was
42.2 C
in August 2003

Fires in Banjani and Orijen area
(Source: "Pobjeda", July 2007)



Fire near Tara River Canyon
(Source: "Pobjeda", July 2007)

Bare Kraljske, July 2007

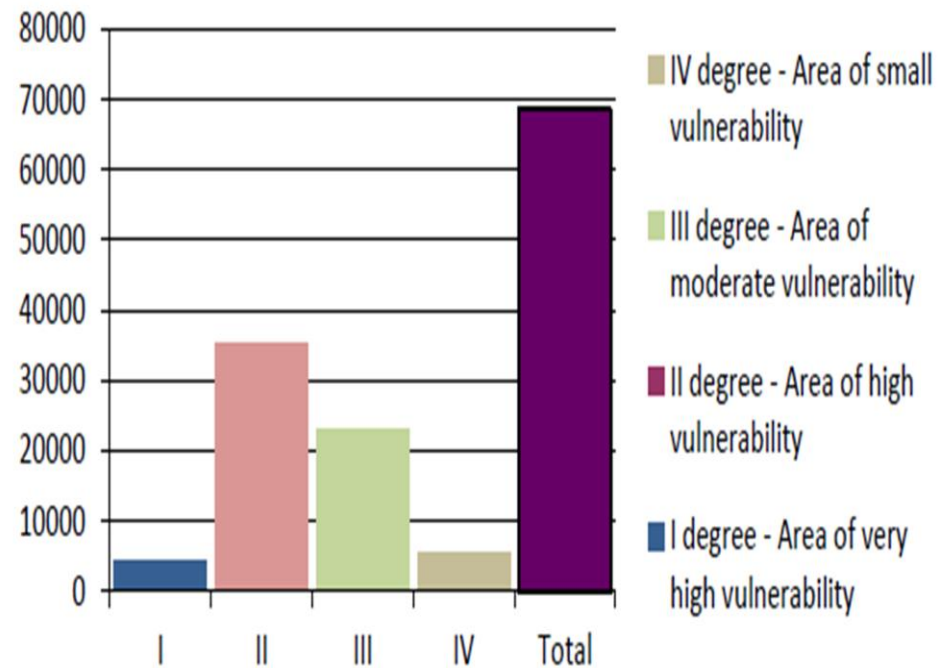
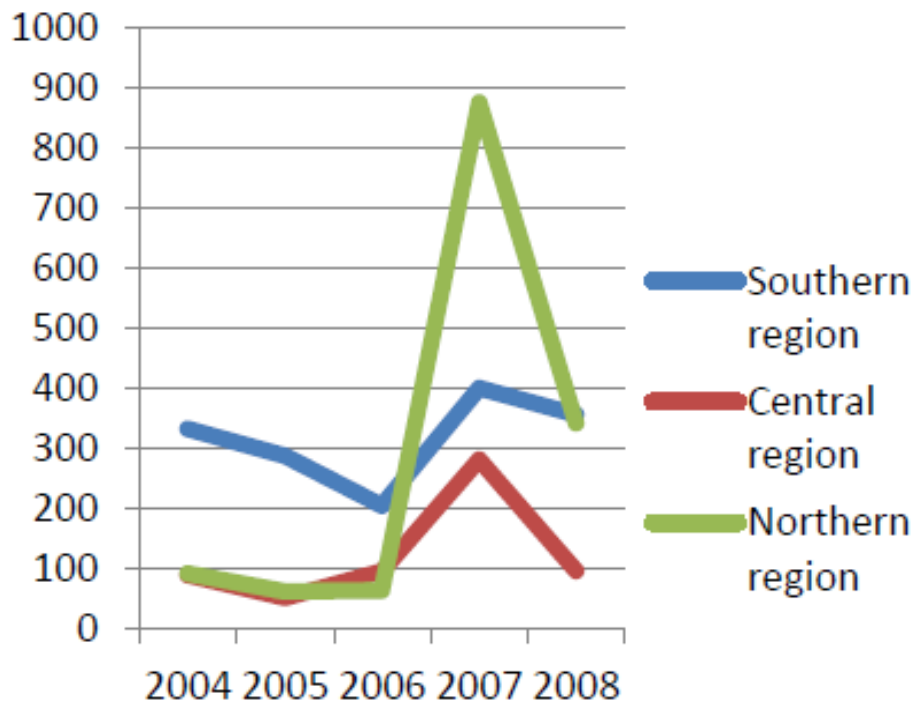
Classification of forest based on NFPP

According to the National fire protection plan(NFPP), depending on the amount and composition of fuel material, type of tree, soil and forest exposition, forests in Montenegro are classified in four groups:

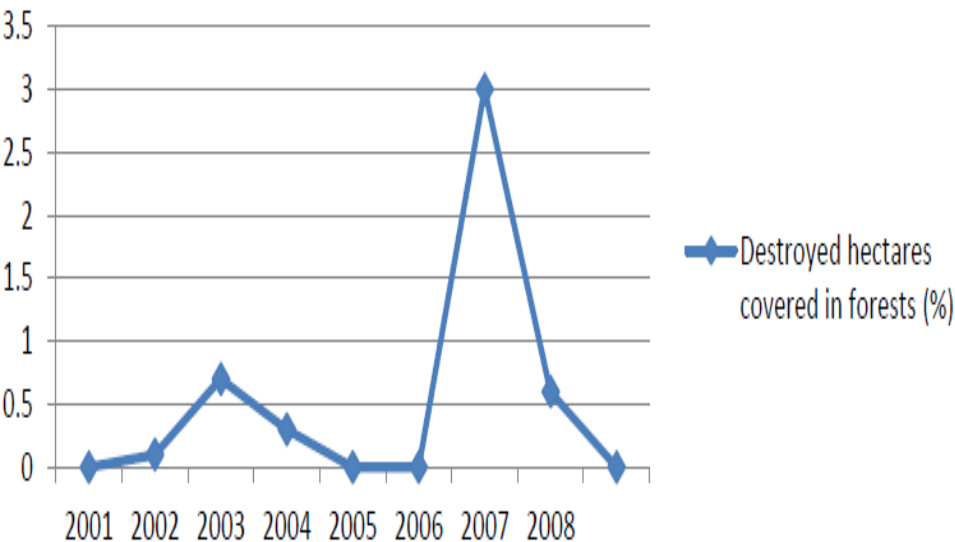
- **1st degree – area of severe vulnerability**
 - Bar, Budva, Ulcinj, Kotor, Herceg Novi, Cetinje and a part of Niksic, Danilovgrad and Podgorica
- **2nd degree – area of high vulnerability**
 - Pljevlja, Zabljak, Mojkovac, Andrijevica, Pluzine, Rozaje, Bijelo Polje, Plav, Berane and Kolasin
- **3rd degree – area of moderate vulnerability**
 - mountainous area (oak, hornbeams and other deciduous trees) and area of plains (soft deciduous trees)
- **4th degree– area of small vulnerability:**
 - north and north-eastern part of the mountainous area (beech forests)

Overview of the NUMBER OF FOREST FIRES in different regions between 2004 and 2008 based on the HMI and MONSTAT data

According to the data, THE MOST VULNERABLE REGION IS THE SOUTHERN one, which has 44% of forest fires



Fires analysis in the period 2001 – 2009 according to the percentage of the fire area



In the Mediterranean countries, such as Montenegro, it is believed that the percentage of the fire area of:

- 1 – 1.5% causes **damage in normal limits**,
- 1.6 – 3% leaves **severe consequences**, while the values
- 3.1 – 5% have **very severe and**
- above 5% **disastrous consequences**.

Based on this classification, the fires in 2007 had severe consequences.

Natural Hazards Vulnerability

In compliance with the available projections, due to temperature increase and change in precipitation, there will be a drastic increase of changeability of river exemplified by floods and hydrological droughts.

A large part of the coast will be flooded, and the flooding capacity will significantly increase in places which had never been affected by flooding waves.

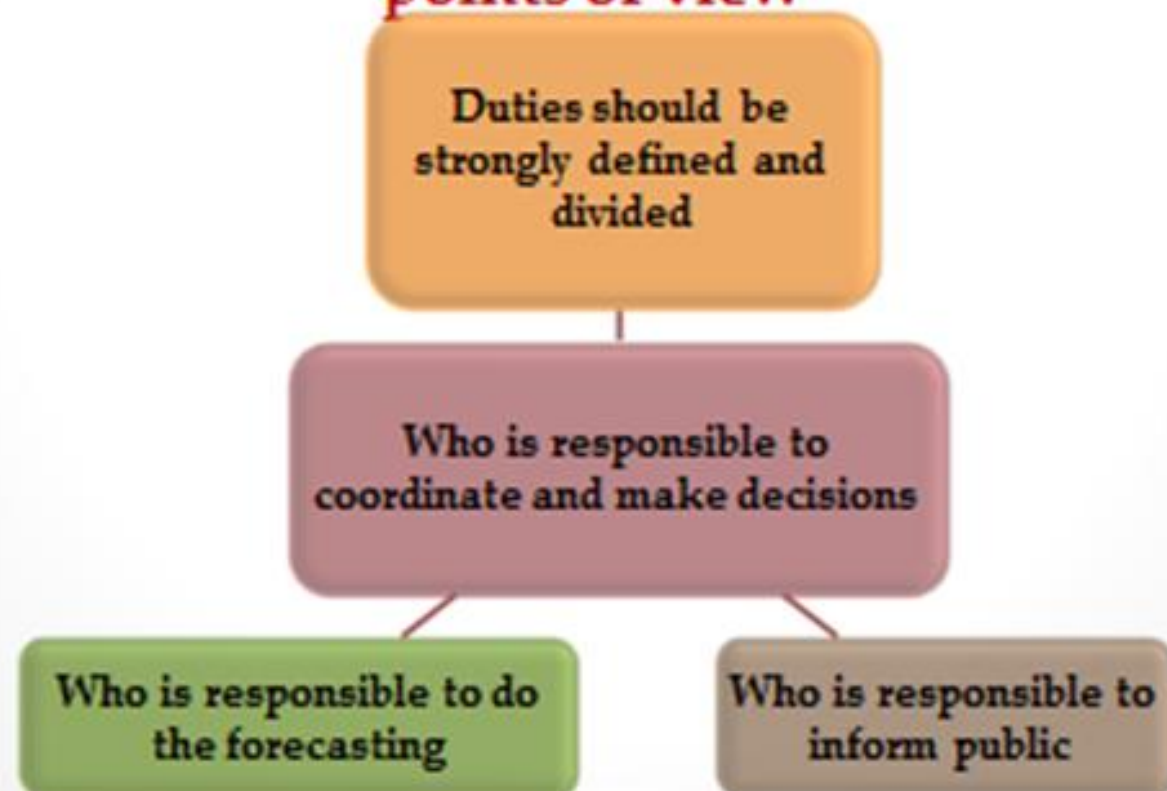
Large parts of beaches will become smaller, and some will even disappear. Forecasts say that the Bojana River will not be able to flow naturally to the sea as it has so far, so that Bojana delta will disappear.

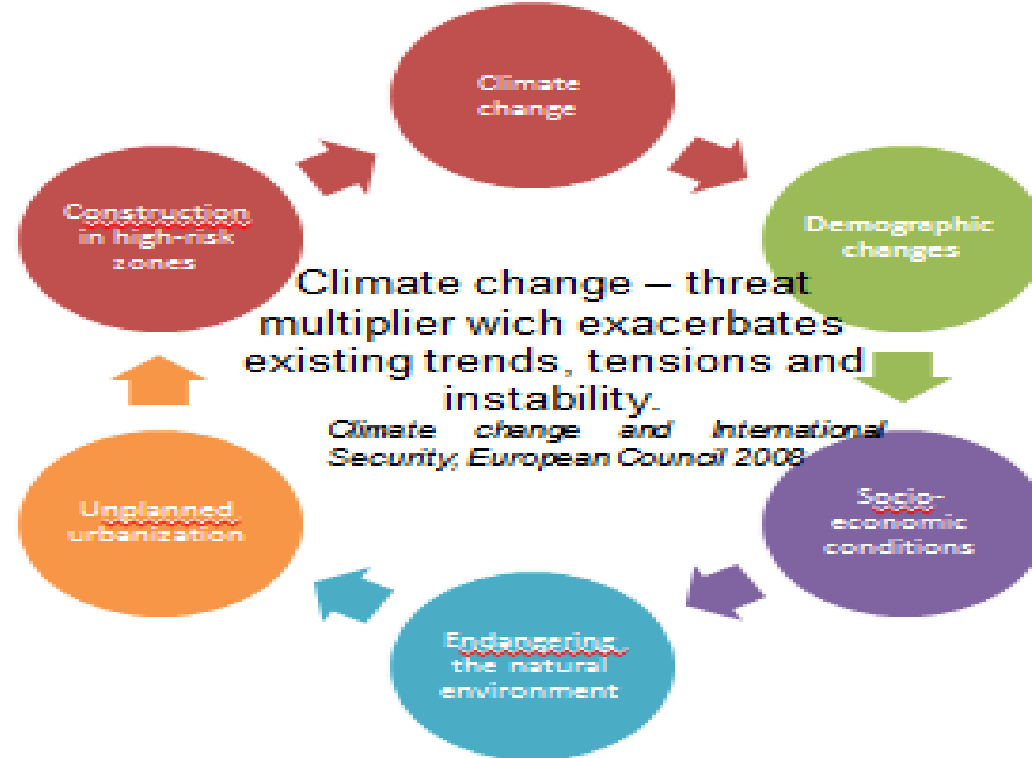
About 40% of Montenegro is in the zone of significant seismic intensity higher than 8 degrees of the Richter scale. This affects about 60% of the Montenegrin population.

EMEs will mostly affect the poor population which is mostly dependent on agriculture (especially in the north).

Disasters do not always have to be completely natural, as human activities inevitably worsen the risks, whether it is about the lack of attention when constructing settlements or the lack of care in exploiting the natural resources

=>That is why disasters are very complex events, and the problem of disaster prevention should be seen from a few points of view





...make Montenegro an area very vulnerable to natural disasters, particularly its southern part, which was recognized in the Strategy of regional development of Montenegro 2010 – 2014

2

Climate hazards and illegal buildings seriously influence Montenegro's vulnerability.

In combination with a greater frequency and intensity of the so called water-related hazards it creates a larger risk of a big economic influence and health impact.

Conclusions

According to the estimates, special attention should be paid to new settlements on the coast, because they will be affected by extreme weather events in the upcoming period.

The fact that most illegal buildings are a high seismic risk and a part of them is vulnerable to floods is a particular problem.

From the point of view of disaster risk, the **POSSIBLE DOMINO EFFECT OF EARTHQUAKES AND OTHER CLIMATE DISASTERS**, including floods, is likely to happen.

It is evident that Montenegrin territory is exposed to extreme climate and hydrological events and processes.

There is a need to develop and implement impact assessment studies (environmental, spatial and natural resources). It is needed to conduct serious analysis and develop CLIMATE CHANGE ADAPTATION STRATEGY.

Thank you for your attention!

Sanja Pavicevic, MSc Physics

Head of Group of Satellite and Radar Meteorology,
Department for Meteorological Monitoring

Institute of Hydrometeorology and Seismology of Montenegro

IV Proleterske 19

Podgorica, Montenegro

Phone/fax: + 382 (0)20 655 431/197

Mob.: + 382 (0)67 209 949

E-mail: sanja.pavicevic@meteo.co.me
sanjapavicevic15@gmail.com

Skype: sakapavicevic

www.meteo.co.me