

15.04.2015

1. Basic information

Number and name of the activity	Activity 5.2 "Assessment of drought impact on forests"
Activity leader	Galia Bardarska, GWP-Bulgaria, bwp@dir.bg
Duration of the activity	April 2013 – April 2015
Participating partners (name, organization, email)	Bulgaria: Bulgaria: National Scientific Center for Global Changes-Bulgarian Academy of Sciences: Vesselin Alexandrov (vesselin.alexandrof@gmail.com); Forest Research Institute- Bulgarian Academy of Sciences: Ivan Raev (ivan_raev@yahoo.com); Executive Forest Agency: Georgi Tinchev (tinchev70@abv.bg) GWP-Bulgaria: Galia Bardarska (bardraska@dir.bg) Lithuania: Dept. of Hydrology & Climatology with Vilnius university: Gintautas Stankūnavičius (gintas.stankunavicius@gf.vu.lt); Lithuanian Research Centre for Agriculture and Forestry with Institute of Forestry: Vidas Stakėnas (v.stakenas@mi.lt) and Povilas Zemaitis (povilaszemaitis@gmail.com) Slovenia: Slovenian Forestry Institute, Department for forest ecology: Urša Vilhar (ursa.vilhar@gozdis.si) Lado Kutnar (lado.kutnar@gozdis.si) Andrej Kobler (andrej.kobler@gozdis.si) Aleksander Marinšek (aleksander.marinsek@gozdis.si) Ukrainian Research Institute of Forest and Forest Melioration: Igor Buksha (buksha@ukr.net; buksha@uriffm.org.ua); Tatiana Pyvovar Maksym Buksha Volodymyr Pasternak
CWP	GWP-Bulgaria: Ivan Raev (bwp@dir.bg) GWP-Lithuania: Bernardas Paukstys (bernardas@iti.lt) GWP-Slovenia: Martina Zupan (martina.zupan@siol.net) GWP-Ukraine: Anna Tsvietkova (Atsvet@mama-86.org.ua)

2. Contribution to Challenges Your activity belongs to: Operational mode (e.g.next year drought, ongoing multiple-year drought) Strategic mode (e.g. future drought, prepared for global change)

Please explain (max 500 characters).

Drought is no longer merely a future scenario - it is already in progress inluding increasing risk of forest fire, and decrease in economic value of forests.

The total forested area in Bulgaria, Slovenia, Lithuania and Ukraine is about 35% of forest areas in GWP CEE region. The strategic mode is to establish adaptation measures to mitigate the drought impact on forests next 50 years on the base of projected distribution of forest areas and tree species over 7 vulnerability zones (maps for temperature, precipitation, De Marton aridity index; forest tables over vulnarability zones).

What is your activity addressing?

• Which of the seven steps described in the Guidelines for Drought Management Plans (act. 2.1)



• monitoring, forecasting / prediction, impacts, vulnerability, measures, management, risk management

This demonstration project can contribute to the better understanding of drought, its impacts on forests and establishment of adaptation/mitigation measures (STEP 4: Develop a programme of measures - Guidelines for DMP, and National strategy on adaptation to climate change – EC Guidelines, SWD (2013) 134 final).

The planned and executed steps of forest demonstration project are as follows:

- **monitoring** of the current situation of forestry sector in 4 GWP CEE countries: policy, governance, property, employment, GDP, main forest indices, education and research, problems and SWOT;
- elaboration of local maps of annual mean temperature and annual precipitation for current climate (1950-2000) and **projected changes** in annual mean temperature and annual precipitation in 2050 and 2070 according to RCPs of IPCC AR5 and WorldClim data set;
- determination of local forest **vulnerability** zones by De Martonne aridity index in current climate (1950-2000), 2050 and 2070, and forest area and tree species distribution over vulnerability zones;
- elaboration of local programmes of **adaptation measures** which mitigate the future negative drought impact on forests.

Shortly describe main challenges which you have addressed with your Activity at the international, regional (especially CEE), national level? How has your Activity contributed to these challenges? (Max 1000 characters)

"The nature of drought and its effects on key sectors such as water, agriculture, meteorology, forestry, fisheries and aquaculture, etc. call for close collaboration between these sectors and beyond in order for drought management to achieve its goals," said the Prince of Orange at UN conference in 2013.

By 2020, protection and restoration of water-related ecosystems, including mountains and forests should be integrated into the UN development agenda beyond 2015.

Many EU member states make use of the water regulating role of forests in the provision of drinking water. This is a very important issue in RBMPs.

Forest demonstration project corresponds to UN and EU forest challenges. By implementation of integrated forest adaptation measures over vulnerability zones at local level as well as at CEE level will be achieved the following:

- sustainable management of forestry sector to mitigate the drought impact on forests;
- increase the environmental, economic and social effect of forests;
- protection of water resources availability by quantity and quality etc.

3. Contribution to Objectives (max 1000 characters)

Were the Activity objectives achieved (see Activity List)? Describe how you have achieved these in qualitative and, if possible, quantitative terms. Are there any, which were not achieved?

All objectives have been achieved:

- Establishment of methodology for assessment of drought impact on forests on the base of IPCC AR5 (2014), WorldClim data set and De Martonne aridity index which was implemented in 4 GWP CEE countries.
- Determination of annual mean temperature, annual precipitation and vulnerability forest zones by De Martonne aridity index in current climate (1950-2000), 2050 (RCP2.6, RCP4.5, RCP6.0, RCP8.5) and 2070 (RCP2.6, RCP4.5, RCP6.0, RCP8.5) – 108 maps.
- Forest area distribution over 7 vulnerability zones in current climate (1950-2000), 2050 (4 RCPs) and 2070 (4 RCPs) 4 tables.
- Forest tree species distribution over 7 vulnerability zones in current climate (1950-2000) and 2050 (RCP2.6optimistic scenarion and RCP8.5-pessimistic scenario) – 4 tables.
- Identification of the main adaptation measures for the forests to mitigate negative effects of the drought Bulgaria (34 measures), Ukraine (30), Lithuania (26) and Slovenia (15).
- Raising policy makers and public awareness in 4 GWP CEE countries publications (5), presentations (4), implementation in national document (RBMPs 1, forest methodology -1).

4. Description of the implementation process and methodologies applied (max 1000 characters)

Describe and explain what actions have been taken to address the challenge(s) mentioned in point 2. What were the key implementation issues of your Activity?

- describe all phases of implementation
- actions taken, instruments used
- information and methodologies applied



• etc.

Have you encountered some problems during the implementation phase? If so, how were they overcomed? What problems could not be solved?

The implementation process of the forest demonstration project was as follows:

- presentation of current forest situation in 4 GWP CEE countries and development of the methodology for assessment of drought impact on forests;
- elaboration of maps about annual mean temperature and annual precipitation in current climate (1950-2000), 2050 and 2070;
- determination of forest vulnerability zones by De Martonne aridity index;
- determination of forest areas and tree species distribution over vulnerability zones;
- elaboration of programmes of adaptation measures to mitigate drought impact on forests;
- dissemination of the results of forest demonstration project.

WorldClim data set and climate projections from GCMs for four RCPs of IPCC AR5 (2014) were used.

For the purpose of map intersection and statistic local experts re-projected all maps into the national coordinate system. The raster resolution of all maps is 1 km^2 .

Types of the measures are normative, organisational and investment. The leading and assisting institutions are listed, responsible for implementation.

5. Outputs (max 3000 characters)

What are the main outputs of your activity? Please shortly describe each of them (how are they going to be used?)) The main outputs of the forest demonstration project are:

Output 1 (in Activity List as Output 2): Determination of vulnerability forest zones in current climate (1950-2000), 2050 and 2070 according to IPCC AR5 (2014) and distribution of forest areas and tree species over vulnerability zones. This output is a base for further determination of adaptation measures.

Output 2 (in Activity List as Output 3)Adaptation measures for the forests to mitigate negative effects of the drought - will be used in forestry chapter of the new National strategies on adaptation to climate change and RBMPs 2016-2021/2021-2027. Also, these measures are applicable in the future management plans of the forestry sector in 4 GWP CEE countries as well as in other CEE countries.

6. Added value (max 1000 characters)

Is there any "added value" generated by your Activity? What new (science, practical experience, guidelines or others) was developed by IDMP CEE and how your work is related to earlier knowledge (research, practice) and experiences of the past?

The team experts established the projected changes in annual mean temperature, annual precipitation and forest vulnerability zones in 2050 and 2070 using the RCPs of IPCC AR5, published in 2014. These new projections confirmed the temperature increase and precipitation descrease in forest areas of 4 GWP CEE countries from the past investigations.

The "added value" of this demonstration project is that for the first time the forest areas and tree species distribution are determined over vulnerability zones in current climate (1950-2000) and future period according to optimistic and pessimistic scenarios of IPCC AR5. This is very important for the forestry practice because the adaptation measures over vulnerability zones are related to concrete forest area and tree species. Mapping of temperature, precipitation and De Marton aridity index was made by using WorldClim data set about temperature and precipitation and national data sets about forest indices.

7. Lessons learnt and transferability (max 2000 characters)

This section considers how your experience can be used elsewhere.

What are the most important lessons from this Activity that might be useful for other countries and policy level in the preparation and/or implementation of Drought Management Plans?

Drought has more or less impact on forests in Bulgaria, Slovenia, Lithuania and Ukraine (pilot area) in current climate, 2050 and 2070. The adaptation measures have to start now to mitigate the negative effect. These measures depend on climate zone, relief and local existing practice. Different forest conditions of these 4 GWP CEE countries determine the specific list of drought adaptation measures which can be used by other countries with similar climate.

The interest of the ministries, decision makers and stakeholders to the results of this project (maps of annual mean temperature, annual precipitation and De Marton aridity index in current and future climate; distribution of forest areas and tree species over forest vulnerability zones; adaptation measures to mitigate the drought impact on forest) is a proof of future use for establishment of the National strategy on adaptation to climate change. Drought is a main focus of this strategy.

Forest demonstration project could be part of IWRM with the positive effect on water quantity and quality in forest watersheds in the period of droughts.

For the implementation of such projects are necessary not only good foresters and GIS specialists, but also specialists on meteorology, hydrology, biology, ecology, water resources etc.

8. Proposals for follow-up (max 2000 characters)

In case resources become available in what aspects would you like to continue your activity? Some concrete proposals for the follow-up projects?

As a result, the common interest for follow-up pilot projects is as follows:

- identification of sensitive habitat types and selection of appropriate tree and shrub species for forestation in areas, threatened by repeating droughts;
- developing of the system for forest restoration after large-scale disturbances by repeating droughts (e.g. forest fires, pest and diseases, invasive species, etc.);
- development of monitoring the impact of logging residues to forest site conditions and forests biodiversity;
- providing complex activities in order to preserve the forest fund at water basin level;
- keeping higher rotating ages in some forests of oak, beech, scotch pine, spruce to increase water protection role in water basins;
- restoration of wetlands by promoting native tree and shrub species and supporting their natural regeneration.

9. Annexes

Milestone reports, tables, other data, etc.

Two main reports on:

- projected changes in temperature, precipitation and forest vulnerability zones, and distribution of forest areas and tree species over vulnerability zones (Output 1; in Activity List as Output 2);
- local programmes of adaptation measures to mitigate the drought effect on forests (Output 2; in Activity List as Output 3).

No.	Activity	Remarks
1.	Publications:	
1.1	Buksha, I., Pyvova, r T., Buksha, M. 2014. Vulnerability assessment of eastern Ukrainian forests to climate change: case study on the base of GIS technology use In: Scientific Proceedings of Forestry Science Academy of Ukraine:No 12 . 30-38 (In English)	National academic proceedings
1.2	Buksha I., Pyvovar T., Buksha M. (in press) Climate change scenarios for eastern Ukraine and predicting the dynamics of forest condition in drought: methodological aspects and results of the first assessments.Forestry and Agroforestry № 125. (in Ukrainian)	National magazine for forestry and agroforestry
1.3	Kutnar, L., Kobler, A. (in press). Possible impacts of global warming on forest tree species composition in Slovenia. Catena, Advances in GeoEcology 43 (In English)	International level
1.4	Raev, I., Alexandrov, V., Tinchev, G. (in press). Assessmnet of drought related climate change impcats on forests in Bulgaria. Sylva Balcanica (In English)	Balcan magazine for forestry
1.5	GWP CEE. 2014. Practical Guidelines for Drought Measures in River Basin Management Plans. Water Affairs 5/6, 2-7 (In Bulgarian)	National water magaizne
1.6	GWP-Bulgaria. 2015. Integrated drought management programme in Central and Eastern European countries. Ecology 1/2, 36-43 (In Bulgarian and English)	National ecological magazine
1.7	IDMP CEE poster. 2014. Integrated Drought Management Programme in Central and Eastern Europe. National Consultation Dialogues. Water Affairs 5/6, 2 cover page (In Bulgarian)	National water magaizne
1.8	Vilhar U., Kraigher H, Kutnar L., Simončič P., Grecs Z. 2013. Planning Forest Restoration after Large-Scale Disturbances. National professional journal for forestry, 3-17 (In Slovene with extended summary in English)	National level
1.9	Vilhar U., Kutnar L., Kobal M., Urbančič M., Simončič P. 2014. Micro-site conditions as an	National level

Table 1. Dissemination of the results



	important factor in the transformation of spruce monocultures beech sites. Forestry Study Days, Liubliana, 4 April (In Slovenian)	National level
1 10	Vilhar U. Verlič A. Žlindra D. Simončič P. 2014. Towards a harmonized monitoring of	International
1.10	water provisioning regulating and purifying services in urban forests (noster)	level
	IUFRO XXIV World Congress 2014	
1 1 1	Vilhar II. Kestnar K. Šraj M. 2015 Changes in runoff generation due to conversion of	International
1.11	catchment vegetation (noster) Geophysical Research Abstracts Vol 17	level
	FGU2015-13646 FGU General Assembly 2015	
1 1 2	Stonevičius E. Stankūnavičius G. 2015. Drought vulnerability assessment for different	International
1.12	hydrological conditions based on Standardized Runoff Index and Flow Duration	level
	Curve in Lithuania. In Drought: Research and Science-Policy Interfacing (ed	
	Andreu I. Solera A. Paredes-Arguiola I. Haro-Monteagudo D. van Lanen H.)	
	CRC Press/Balkena The Netherlands, ISBN 9781138027794, 514 pp.	
1.13	Raev Iv. et al. 2015. Programmeof measures for forests dapatation in Republic of Bulgaria	National Level
	and mitigation of negative impact of climate change on them (poster). Forests	
	exhibition in Bulgarian Academy of Sciences, April (In Bulgarian)	
2.	Presentations:	
2.1	Alexandroy, V., Raey, I. 2014. Contemporary climate (1951-2000) and future scenarios	National level
	(RCP2.6, RCP4.5, RCP6.0 и RCP8.5) for 2050 and 2070 according to IPCC AR5.	
	Second NCD, Sofia, 26 November (In Bulgarian)	
2.2	Raev, I., Alexandrov, V., Tinchev, G. 2014. Drought impacts on forests in Bulgaria. Second	National level
	NCD, Sofia, 26 November (In Bulgarian)	
2.3	Bardarska, G. 2015. Projections for future droughts. Presentation at National celebration	National level
	of World Water Day, Sofia, 23 March	
2.4	Muller, R., Bardarska, G. 2015. WP8 Pilot use case studies. Presentation with IDMP CEE	EU level
	slides WaterInnEU wokshop, Barcelona, 26-27 March	
2.5	Buksha I., Buksha M. 2013. Assessment of drought impact on forest ecosystems:	Regional level
	existing expertise and data for Ukrainian case study. IDMP CEE workshop,	
	Ljubljana, 14-15 November.	
2.6	Buksha I., Buksha M. 2013. Assessing the impact of drought on forests in Ukraine. First	National level
	NCD, Kyiv, 10 December.	
2.7	Bardarska, G., Buksha I. 2014. Assessment of drought impact on forest ecosystems:	Regional level
	elaboration of maps for current climate, 2050 and 2070 in Bulgaria, Lithuania,	
	Slovenia and Ukraine (pilot area), and determination of vulnerability zones of	
	forest ecosystems. IDMP CEE workshop, Budapest, 2 October.	
2.8	Buksha I.2014. Hazard Zone Mapping and Events Documentation (impact of floods and	International
	droughts) for forestry in Ukraine. FAO Workshop on Hazard Zone Mapping and	level
	Event Documentation. Brcko, 30 October.	
2.09	Buksha M. 2014. Impact of drought on forests in eastern Ukraine and adaptation	National level
	measures to mitigate the drought effect on forests. Second NCD in Kyiv 12	
2.10	December.	National laval
2.10	development of adaptation measures to mitigate the drought affect on forest	National level
	and recommendation for Ukrainian national action plan to provent of soil	
	degradation and desertification. National Dialogue to support of the Special	
	Partnershin targets on water 2015 Kviv 27 March	
2 1 1	lurc D. Vilbar II. Simončič P. 2014. The contribution of forestry sector to the integrated	National level
2.11	management of river hasins. National Consultation on Water and the UN	
	Development Agenda after 2015 Liubliana 21 March	
2.12	Vilhar U. 2014. Influence of forest management on water balance of the silver fir-beech	International
	forests in the Dinaric karst. ETC-SEE Project ORIENTGATE workshop Forests for	level
	Water", Austria, 2014	
2.13	Stonevičius E., Stankūnavičius, G. (2015). Drought vulnerability assessment for different	International
	hydrological conditions based on Standardized Runoff Index and Flow Duration	level
	Curve in Lithuania. International Conference on Drought: Research and Science-	
	Policy Interfacing. March, 10th - 13th, 2015 Valencia, Spain.	
3.	Movies:	



3.1	GWP CEE movies about IDMP have been shown at Second NCD on 26 November 2014 and	National level
	2015 WWD celebration on 23 March 2015 in Sofia	
3.2	GWP CEE movies about IDMP have been shown at First NCD in 2013, at Second NCD in	National level
	2014 and at National Dialogue to support of the Special Partnership targets on	
	water 2015 in Kyiv	
3.3	GWP CEE movies about IDMP have been shown at Second NC, which took place in Vilnius	National level
	in November 2014	
4.	Implementations:	
4.1	Temperature and precipitation future projections according to IPCC AR5 are involved in	National level
	Bulgarian RBMPs 2016-2021	
4.2	Measures to mitigate the effect of large scale disturbances (e.g. drought, forest fires, wind	National level
	throw, icebreak, floods) on forests in Slovenia have been presented to	
	stakeholders and forest policy community, preparing new Forestry Act.	
4.3	Measures to mitigate the drought effect on forests from pilot study on impact of drought	National level
	on forest ecosystems in eastern Ukraine has been prepared for Ukrainian	
	national action plan to prevent of soil degradation and desertification for period	
	of 2015-2020.	
5.	Flyer:	
5.1	IDMP CEE flyer has been disseminated in 4 GWP CEE countries	National level
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