

IDMP FOR DRIN BASIN

FINAL REPORT



NOAA FUNDED ACTIVITY 3 DECISION SUPPORT FOR DROUGHT



IDMP



WORLD
METEOROLOGICAL
ORGANIZATION



Global Water
Partnership



DMCSEE



CzechGlobe

IDMP FOR DRIN BASIN

FINAL REPORT

Editor:	Anna Smetanová	Global Water Partnership Central and Eastern Europe (GWP CEE)
Contributors:		
	Anna Smetanová	GWP CEE
	Andreja Sušnik	Slovenian Environmental Agency (ARSO) Drought Management Centre South-eastern Europe (DMCSEE)
	Andreja Moderec	ARSO, DMCSEE
	Monika Bláhová	Global Change Research Institute of the Czech Academy of Sciences (CzechGlobe)
	Žiga KLOKAJ	Research Centre of the Slovenian Academy of Sciences and Arts (ZRC SAZU)
	Aleš Grlj	ZRC SAZU
	Sabina Bokal	GWP CEE
	Gregor Gregorič	ARSO, DMCSEE
	Živa Vlahovič	ARSO, DMCSEE
	Maja Žun	ARSO, DMCSEE
	Bashkim Kastrati	Kosovo Hydrometeorological Institute: Sector of Hydrology and Hydrological Forecasts, Kosovo (KHMI)
	Klodian Zaimi	Polytechnic University of Tirana: Institute of GeoSciences: Department of Hydrology, Albania (IGEO)
	Alban Doko	IGEO
	Suzana Alcinova Monevska	Hydrometeorological Service Republic of North Macedonia North Macedonia (HMS)
	Silvana Stevkova	HMS
	Aleksandra Stevkov	HMS
	Orjeta Jaupaj	IGEO
	Elona Abazi	IGEO
	Entela Vako	IGEO
Other contributors to the project or its parts:		
	Valentin Aich	Global Water Partnership
	Dejan Panowski	Global Water Partnership Mediterranean (GWP MED)
	Sašo Peten	ARSO, DMCSEE
	Vlatko Andonovski	Balkan Foundation of Sustainable Development, North Macedonia (BFSD)
	Mirek Trnka	CzechGlobe
	Daniela Semerádová	CzechGlobe
	Baton Begolli	Ministry of Infrastructure and Environment, Kosovo Inter-Ministerial Water Council, Kosovo
	Katrin Ehlert	World Meteorological Organization: Applied Climate Services Division (WMO)
	Bob Stefanski	WMO
	Veronika Vagoová	GWP CEE
	Mirjana Ivanov	Institute of Hydrometeorology and Seismology: Department of Applied Meteorology and Climate Change; Montenegro (IHMS)
	Alena Požgayová	GWP CEE

Project: NOAA FUNDED ACTIVITY 3 DECISION SUPPORT FOR DROUGHT

Funded by: NOAA Funds via Global Water Partnership (Activity 3: Decision support on Drought)



© GWP CEE, 2022

License: All Rights Reserved

CONTENT

Executive Summary	3
Introduction.....	4
Project Workflow.....	5
1. Project concept and start up activities.....	5
2. Potential partners mapping in target countries.....	5
3. Preparation of guidelines and protocols for data integration	6
4. Understanding countries needs in terms of IDM (Kick-off meeting)	6
5. Capacity building and consultations.....	7
6. Creative workshop / final meeting with invited guest	8
7. Project Management and reporting.....	9
IDMP Related Countries' needs	10
North Macedonia	10
Current drought monitoring:.....	10
Needs related to drought monitoring and risk assessment:.....	10
Action which could be taken in a short-term:.....	11
Action which could be taken in a long-term	11
Kosovo:	11
Current drought monitoring:.....	11
Needs related to drought monitoring and risk assessment:.....	12
Albania.....	12
Current drought monitoring:.....	12
Needs related to drought monitoring and risk assessment:.....	12
Drought Watch and data integration	13
Setting up the National Drought Reporting Network	16
Countries In Regional Perspective and further development of activities started in the project	18
Capacity Building Evaluation	22
Annexes	24
Annex 1 Kick-off Meeting and Countries' Needs	24
Annex 2 Drought Watch and Data Integration.....	24
Annex 3 National Drought Reporting Network	24
Annex 4 Final Meeting.....	25
Annex 5.....	25

EXECUTIVE SUMMARY

The project “IDMP for Drin Basin” (NoAA funded Activity 3 Decision Support for Drought) has supported the advancement Integrated Drought Management Programme (IDMP) in the Republic of North Macedonia, in the Republic of Albania, and in the Republic of Kosovo. During the project, the contact with institutions in the countries were established, their needs analysed (kick-off meeting) and tailored capacity building developed. The capacity-building scoped on two tools available in wider region. The Drought Watch and National Drought Impact Reporting Network. Drought Watch Tool enables accurate and efficient drought monitoring, and integrates drought risk and drought impact maps. National Drought Reporting Network is a system built upon expert reporters giving regular feedback on local soil moisture and drought impacts in agriculture, forestry, viticulture, and similar industries through a simple online questionnaire. It provides standardized evidence for real drought impacts and was previously successfully connected to subvention payment schemes.

During the regional capacity building the representatives from the countries were introduced to the tools, get step-by-step guidelines to prepare country data. During pre-meeting and post-meeting national consultation, each country had possibility to discuss with the expert lecturers their own workflow and issue which have appeared by using own data. For the Drought Watch integration the countries have analysed available country data, and newly calculated or improved the existing calculation workflow of Standardized Precipitation Index. Project partners and countries have analysed the options to cooperate with colleagues from other institutions and for data use – both related to Drought Watch and National Drought Reporting Network. First steps to kick-start reporting on drought impacts was done in some countries. During the final creative workshop, the countries together with representatives of Montenegro, have discussed the future prospects and the opportunities for IDMP Agenda development in one and 3-5 years. The countries have concluded to continue cooperation, recognizing this contributive project was an important kick-start to develop capacities in the countries, which are required to tackle the increasing drought related threats in the years to come.

INTRODUCTION

Integrated Drought Management Programme (IDMP) works with partners in supporting stakeholders at all levels by providing them with policy and management guidance through globally coordinated generation of scientific information and sharing best practices and knowledge for integrated drought management.

IDMP Central and Eastern Europe has been working with partners on developing IDMP approaches related to the IDMP Pillars since more than ten years. The technical support and capitalisation of the experience, tools developed within

Integrated Drought Management Programme for Drin Basin Project was a project funded by NOAA Funds via Global Water Partnership (Activity 3: Decision support on Drought) in January to August 2022. The objective of the project was to further advance integrated drought management (IDM) in Drin Basin countries, namely in the Republic of North Macedonia, in the Republic of Albania, and in the Republic of Kosovo. The project capitalizes on the solution developed by DriDanube Project (funded by: Interreg Danube Transnational Programme) and other IDMP CEE (Central and Eastern Europe) activities since 2011.

The project partners were:

- Global Water Partnership Central and Eastern Europe (GWP CEE)
- Slovenian Environmental Agency: Drought Management Centre SouthEastern Europe (DMCSEE)
- Research Centre of the Slovenian Academy of Sciences and Arts (ZRC SAZU)
- Global Change Research Institute of the Czech Academy of Sciences (CzechGlobe)

PROJECT WORKFLOW

The project main objective was to further advance integrated drought management (IDM) in three Drin Basin countries. The objective was tackled through specific activities:

1. Project concept and start-up activities
2. Potential partners mapping in target countries
3. Preparation of guidelines and protocols for data integration
4. Understanding countries needs in terms of IDM (Kick-off meeting)
5. Capacity building and consultations
6. Creative workshop / final meeting with invited guest
7. Project management and reporting

1. Project concept and start up activities

Those activities were executed by GWPCEE and DMCSEE. Start-up activities included online meetings and both-sided correspondence on project implementation approach, detailed workflow, and implementation steps.

2. Potential partners mapping in target countries

A crucial step for achieving the objectives was to identify and attract cooperation partners which have institutional mandate, position-related responsibilities, and personal interest to advance drought management in their country. This mapping was conducted by GWP CEE, DMCSEE, with external support of Global IDMP. Afterwards, we have contacted the partners.

The invited partners were from following institutions in the target countries. The representatives are co-author of this report:

- Hydrometeorological Service Republic of North Macedonia North Macedonia (HMS NM)
- Balkan Foundation of Sustainable Development, North Macedonia
- Polytechnic University of Tirana: Institute of GeoSciences: Department of Hydrology, Albania (IGEO)
- Kosovo Hydrometeorological Institute: Sector of Hydrology and Hydrological Forecasts, Kosovo (KHMI)

- Ministry of Infrastructure and Environment, Inter-Ministerial Water Council, Kosovo

3. Preparation of guidelines and protocols for data integration

DMCSEE, ZRC SAZU and CzechGlobe were involved in expert identification of tools and solution developed in previous projects (e.g., Interreg DTP Dri Danube) which would be beneficial and easy to adopt in target countries.

Partners have prepared instructions on how to prepare raster and vector data for ingestion into the DroughtWatch web platform for sharing and analysing the drought related datasets. Instructions included information on projection definition, data format, file system structure, naming convention, required metadata, required short and long data description, legend composition and colourmap codes. Furthermore, data templates for raster data (Soil Water Index – SWI) and vector data (Standard Precipitation Index – SPI) were prepared and sent to the national representatives.

National reporting network system to monitor drought and drought impacts developed by CzechGlobe was second suggested solution. The system is built upon expert reporters giving regular feedback on local soil moisture and drought impacts in agriculture, forestry, viticulture, and similar industries through a simple online questionnaire. Guidelines explaining how the national reporting network works were prepared. They contained the necessary steps to kick start the cooperation in country.

4. Understanding countries needs in terms of IDM (Kick-off meeting)

The countries were consulted about their needs in terms of IDM during the Kick-off meeting held online on 11 April 2022. The activity run simultaneously with the previous one (Activity 3). Preparation of guidelines and protocols). The meeting was prepared by GWP CEE, DMCSEE, ZRC SAZU and Czech Globe. All countries have participated. Kick-off meeting agenda (Annex 1) was the first opportunity to introduce the country teams and the state of the art of IDM in respective countries. Project partners introduced the tools which can be offered from wider region (identified in Activity 3). In the discussion session different topics were tackled, including status of drought monitoring relating to data and indices and Drought Early Warning (DEWS) part of drought monitoring and risk assessment which they wished to be strengthened. The countries committed to provide written statement about their short-term and long-term needs in terms of IDM. The written statement was given by answering of following questions

1. Current drought monitoring in their country (what data/indices are in use, what is the source of these data, any website for Drought Early Warning)
2. What part of their drought monitoring could be strengthening?
3. First thoughts on Drought Watch. What do they already have available (or would wish to have available) for integration into Drought Watch tool?
4. Have you performed any risk assessments in your country? Were they related to specific sector (Agriculture - certain crops? Energy? Water supply?)
5. Are you interested in sharing/learning/performing risk assessment related to drought impacts?

The results of discussion and summary of countries' needs are in Chapter: IDMP related countries' needs. The agenda, presentations, and meeting minutes are in Annex 1.

5. Capacity building and consultations

Targeted capacity building programme was developed based on the provided country needs. The capacity building adopted a unique approach. Firstly, regional training was accompanied by country specific – national consultation. Secondly, an innovative, client-oriented approach was selected to develop a training. Two trainings and one final creative workshop were planned. Each of them has three phases: pre-meeting, training, and post-meeting.

In the pre-meeting period partners were asked to consult the provided documents, and prepare some data, if possible. Each national team assigned a consultant/group of consultants who were funded by the project. A voluntary supervision meeting with the trainer was offered to the country teams in the pre-meeting phase.

During the online training participants were guided by the lecturer's through the learning process. Sufficient time was allocated to practical use of the tools, and targeted discussions.

In the post-meeting phase, countries were encouraged to continue the work and clarify the issues arisen. A supervision meeting was offered to each of them. The result of the post-meeting supervised learning process was part of the preparation for the final project meeting. Supervision process was documented via supervision reports prepared by GWP, and filled and delivered by lecturers.

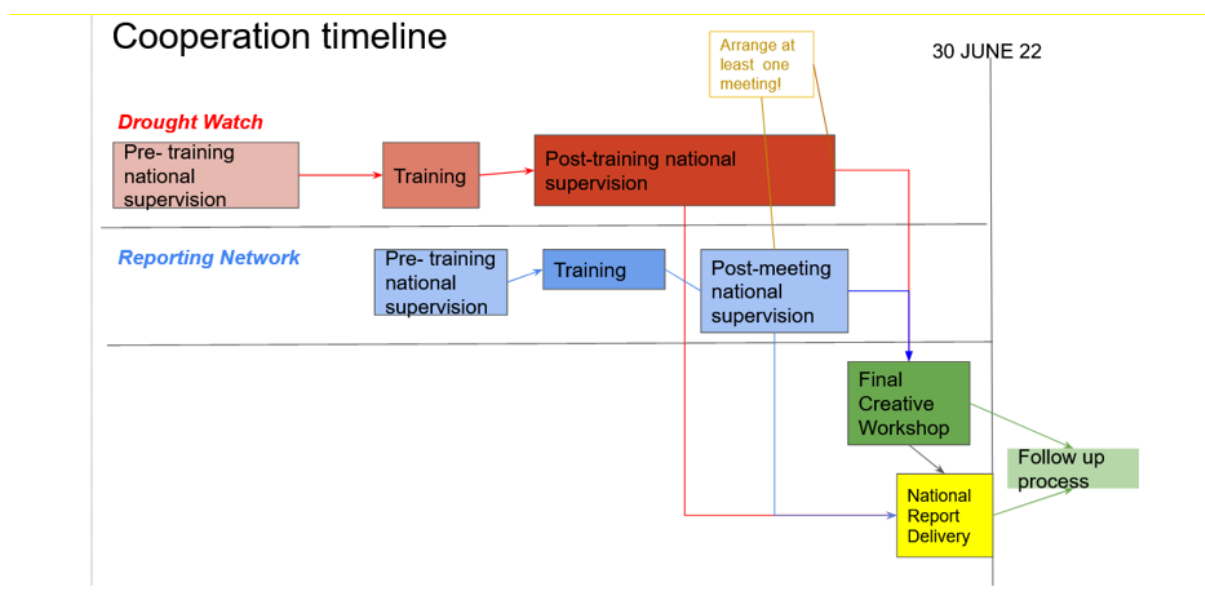


Figure 1. Design of the Capacity Building Approach

The design of the capacity building was done by GWP CEE, including all supervision templates. GWPCEE was also responsible for partners communication, project management. DMCSEE, ZRC SAZU and Czech Globe were involved in pre- and post-meeting consultations. The content and the facilitation of the first training were prepared organized by ZRC SAZU. GWP CEE provided technical support. The content and the facilitation of the second training were prepared by GWP CEE and Czech Globe.

The results of the first training and pre- and post-meeting supervisions are summarized in the chapter Drought Watch and data integration. The agenda, content and supervision reports of the first training are in Annex 2. The results of second trainings, the supervisions are in chapter Setting up the National drought reporting network, and remaining documentation in Annex 3:

6. Creative workshop / final meeting with invited guest

The third, so-called creative workshop was the final meeting of the project. Countries presented results of whole process related to both training, and the discussion session build upon them. Guest from outside the project were invited to present their IDMP work and perspectives, and the floor for discussion of follow up activities in Drin Basin countries was opened. The final meeting was designed and co-facilitated by GWP CEE and DMCSEE.

7. Project Management and reporting

The project was managed by GWP CEE. GWP CEE provided agreements to project partners and selected country representatives (suggested by country teams). GWPCEE set up templates, reporting standards, and final evaluation survey (questions in table below). Partners reports were provided by all project partners and country teams. GWPCEE wrote final report. All partners and countries provided timesheets and invoices which were included in financial report (separate document).

Table1: Questions for the final evaluation

No	Question	Type (C-compulsory, O-optional)
1	I consider the Drin Project Capacity building...	Linear scale, C 1-very well developed, 4- poorly developed
2	I consider the three trainings as useful for my current and future work on drought Drought Watch Reporting Network Final creative workshop	Linear scale, C 1- Strongly agree, 4 – strongly disagree
3	Why?	Open question, please comment on previous , C
4	I consider the three phases of a training as useful Pre-meeting national consultation Training/meeting Post-meeting national consultation	Linear scale , C 1- Strongly agree, 4 – strongly disagree
5	Why?	Open question, please comment on previous, C
6	What worked well for you in the entire Drin Basin Project Capacity building and its parts (different training, three phases)?	Open question, C
7	What can be improved in the entire Drin Basin Project Capacity building and its parts (different training, three phases)?	Open question, C
8	Which capacity building related to IDMP you would like to get? *	Open question, C
9	Any other comments?	Open question, O

IDMP RELATED COUNTRIES' NEEDS

Summaries of countries needs are stated bellow per country. The summary is made based on the kick-off meeting on 7 April 2022, and written statements delivered afterwards. Related documents are in Annex 1.

North Macedonia

Current drought monitoring:

- HMS NM monitors surface and groundwater and performs climate- and agro-meteorological observations. Use of indices allows a quantitative assessment to be made of the climatic anomalies in terms of intensity, spatial extent, and frequency, and favour the exchange of information about drought conditions.
- For drought monitoring we calculate several drought indices which are not on operational level, except SPI. We prepare the drought report, on demand/request from users, after the drought event. The most commonly applied drought indices and calculation analysis due to their simplicity include the Standardized Precipitation Index (SPI), the Palmer Drought Severity Index (PDSI), Percent of Normal Precipitation Index, De Martonne, Deciles or Percentiles, Consecutive dry days index and others statistical parameters. The data for this analysis are from the national meteorological network of HMS. Some results of calculated SPI for few stations are available on website www.meteo.gov.mk (agrometeo).
- Drought vulnerability assessment was done using Hungarian approach.

Needs related to drought monitoring and risk assessment:

- Drought watch is very powerful tool and we need more time to implement already existing products. From first sight, the visualization of SPI for North Macedonia can be included.
- Drought risk assessment, drought assesment in relation to desertification
- Remote sensing tools and operational Earth Observation in addition to the quantitative assessment of climatic anomalies done by Hydrometeorological Service (e.g., soil moisture, vegetation state, land surface temperature and evapotranspiration).
- Drought indicators/indexes that could be used for the Drin Basin area: Standardized Precipitation Index (SPI), Effective Drought Index (EDI), Normalized Difference Vegetation Index (NDVI), Vegetation Condition Index (VCI), Soil water index (SWI), Vegetation health index (VHI), Agricultural Stress Index (ASI), Combined Drought Index (CDI), Current Precipitation and Temperature data and Soil Moisture based drought index available at Flood and Drought Portal and UNESCO/PCA Web Based Drought Monitoring Platform.

- The strengthening of the drought monitoring could be done by upgrading the automated meteorological stations with additional sensors.

Action which could be taken in a short-term:

- Review of available meteorological data and meteorological stations for the Drin Basin area.
- Prepare and integrate data
- Review of possibilities for establishment of reporting network for the Drin Basin.
- Review of arable land and forest/fruits/agricultural crops or other drought specific related sectors for drought impact evaluation in the Drin Basin area
- Get training on drought watch for overview of products/use/analysis
- Review possibility for drought alert dissemination

Action which could be taken in a long-term:

According to the short-term plan review, the strengthening of the drought monitoring could be done by upgrading the automated meteorological stations with soil moisture sensors or other data sensor for parameters needed for drought watch products.

- Establishment of reporting network for the Drin Basin
- Training for use of drought watch products
- Drought alert dissemination
- Drought impact and risk assessment analysis (maps and risk estimation)
- Development of application for drought risk management tools
- Drought policies

Kosovo:

Current drought monitoring:

- The responsible body is the [Kosovo Hydrometeorologic Institute](https://ihmk-rks.net/?page=1,84), which is part of the Kosovo Environmental Protection Agency. KHMI has used SPI and DEWS since 2012.
- KHMI is responsible to keep track of SPI and share these with organisations responsible for drought management via website (<https://ihmk-rks.net/?page=1,84>).
- Drought management is currently primarily done by the Regional Water Companies. They have started developing drought management plans since 2012: There 7 RWCs in Kosova which cover almost the entire country.
- There is not national drought management plan.

- KHMI has a network of meteo & hydro monitoring station. The meteo stations are all online. A half of the hydrostation is online. KHMI uses a number of models for forecasting and warning. For droughts we use SPI (Standard Precipitation Index), which we publish regularly in the "Hydrometeorological Yearbooks". <https://ihmk-rks.net/?page=2,1>

Risk assessment has not been performed.

Needs related to drought monitoring and risk assessment:

- Go beyond SPI, integrated in Drought Watch, staff training, risk assessment related to drought impact.

Albania

Current drought monitoring:

- Priority area for Albania is the Hydrological Drought and the impact on the hydropower sector, especially in the Drin River. There is no drought monitoring system in use in our country.
- There is not any website in use for Drought Early Warning.
- The drought is considered a slow emergency process. This year, Albanian government have declared the energy emergency, mainly from the drought

Needs related to drought monitoring and risk assessment:

- Drought Watch for energy sector. Drin River is our main source of energy (90%). It is strongly impacted by drought.
- We are interested in integrating the Agrometeo or other meteorological stations data in the DW.
- We have not performed any risk assessment in our Institute related to droughts. We have performed only Risk Assessment related to Forest Fires based on EFFIS.
- We are interested in learning how to perform the risk assessment related to drought impacts in the Meteorology, Hydrology and Energy sector.

DROUGHT WATCH AND DATA INTEGRATION

Drought Watch Tool enables accurate and efficient drought monitoring, and integrates drought risk and drought impact maps. The tool has been presented during the kick-off and based on the countries' needs, the capacity building was developed (Annex 2). It had three phases – pre-meeting, training, and post-meeting.

In the pre-meeting phase, the lecturers shared Drought Watch exercise and tips. The document (Annex 2) included step-by-step guidelines to DW use and functionalities. Furthermore, lecturers shared guidelines for data preparation prior to the training. North Macedonia and Kosovo took part in pre-meeting supervision. North Macedonian project partners have discussed with lecturers (DMCSEE and ZRC SAZU) the options to upgrade SPI calculations using recent R-scripts, and defined the parameters related to country needs. Parties discussed on specific drought years and sectors mostly affected in the past. Lecturers explained the methods behind risk products in DW. They suggested calculation based on EU Civil protection mechanism as an alternative method to national drought risk assessment. The countries agreed on concrete follow-up steps, and clarified roles and responsibilities. Partners from Kosovo discussed with lecturers (ZRC SAZU) the availability of national precipitation data and their potential integration in DW. Specific drought years and their sectoral impact was discussed. Partners showed interest in sharing, learning and performing risk assessment related to drought impacts. They discussed the concrete follow-up steps.

The Drought Watch training was on 07 June 2022. Countries reported about the progress made by them since the last meeting. Countries which held pre-meeting supervision included the results of the supervision. The hands-on exercise on data preparation was held by ZRC SAZU, was followed by facilitated breakout-group discussion. The countries have discussed:

- Usefulness of the tool
- Functionality - what would be handy for change
- Top priorities of tasks which can be performed after third meeting

Team from North Macedonia identified limitations to indices based on satellite imagery. Data were not always available due to different reasons, and even in cases when it was too dry. The Normalized Difference Vegetation Index (NDVI) did not reflect drought conditions every time (e.g., for 2011). Therefore, it was suggested to be used in combination with other indices. Potential use of SWB index was discussed. Drought conditions in North Macedonia were well reflected by SWI, NDVI, and

24h RR during vegetation period April-November 2021. The parties agreed on follow up and next steps, including preparation of SPI on different time scales (-1,-2,-6) for 3 stations (NM), and preparation of SPI and SPEI scripts by ARSO.

The teams of Albania and Kosovo decided to discuss together in one breakoutroom, due to the similarity of issues and previous cooperations. It was suggested that hydro-meteo data (temperature, precipitation, water level) for the Drin catchment collected automatically in the three countries could be made accessible for the countries. Countries shared they have flood forecasting EWS model in place, which could be enhanced on drought. Both countries could also imagine to use Sušomer analogy and improve it for hydrological drought, including groundwater drought. Suggestions how to approach both ideas were made, starting with contacting experts who could be interested. Furthermore, countries decided to list potential meteorological and precipitation stations which could be used for SPI. Calculation and calculate it based on the scripts.

In the post-meeting phase, ARSO and ZRC SAZU have shared exercise for SPI and SPEI calculation in R programming language. During the meeting Albanian partners described the stakeholders arena in Albania related to usefulness of indices, and outlined the option to present the tool to those who might be interested. Indicators for hydrological drought affecting the energy sector demands and country economy would be useful to develop. Data collected for flood forecasting might be used for drought monitoring. A memorandum for data sharing for flood forecasting, but without restriction to other use, was signed between the 4 countries (ALB, RKS, MKD, MNE). Therefore, all countries could make arrangements to use this data.

For Kosovo SPI has been the main index in use for national drought monitoring is SPI. Indices in Drought Watch might be used as informative/auxiliary when interpreting national drought conditions. Kosovo can in addition to the existing flood EWS database offer geothermal data (soil temperature at several depths), precipitation data. If decided it was recommended to use additional technical meetings to examine and determine the scope of data shared. Countries were interested in use of Sušomer (Droughtmeter) - a methodology for hydrological drought detection. Furthermore, they were interested in exchange of good practice on methodology for hydro drought monitoring in Slovenia, such as helpful background tools, helpful/informative statistics and ways of presenting hydrological drought information in Slovenia. Both countries expressed need for knowledge exchange through intense learning process— in person trainings and lengthier time dedicated to learn the methodology and practice use of data. This is needed to introduce a desired change/upgrade in the operational work, which is the primary motivation of any organisation to enter a training.

During the meeeting with North Macedonia, the country expressed wish for bilateral training with DMCSEE on how to calculate SPI according to new R-script. Further possibilities for alternative way to carry out drought risk assessment similar to Rainless periods (as prepared by FAUNS for Drought Watch), discussion on other factors required for drought risk calculations was conditnued. They have also announced the possibilities on using Drin flood management database for potential further hydrological drought monitoring purposes in Drought Watch. Countryies has decided on follow up steps to be announced on final meeting.

SETTING UP THE NATIONAL DROUGHT REPORTING NETWORK

National Drought Reporting Network is a system built upon expert reporters giving regular feedback on local soil moisture and drought impacts in agriculture, forestry, viticulture, and similar industries through a simple online questionnaire. It provides standardized evidence for real drought impacts and was previously successfully connected to subvention payment schemes.

The countries expressed interest into developing of National Drought Reporting Network, and therefore targeted capacity building was prepared. Similarly to DW Capacity building it had three phases (Annex 3).

Countries were provided with simple guidelines explaining how the national reporting network works in the pre-meeting phase. The necessary steps to kick start the cooperation in their country were listed. Questions which needed to be clarified to design an optional national reporting network starting point regarding the country specifics (possible partners, responsibilities, most burning issues in each country) were listed. The supervision was done by email.

The Training was on 14. 6. 2022. It was divided into two main parts. The first part focused on clearly explaining the national reporting network system with a focus on building a new network in a new country. Firstly, systems that are already running were presented. In this part, we introduced the Czech national reporting system, Slovak, and Danube systems. We emphasized that systems are becoming a crucial part of drought monitoring tools. We explained the modularity of the system and the main point of adapting the system to national needs. Second part of the training was focused on practical tips and tricks on how to start building the national reporting network. We tackled the important questions about whom to contact, who can become a reporter, and what are the first steps to reach your ideal national partner. Training also included a technical part with a detailed description of the current questionnaire. All the components of the questionnaire were explained, with a detailed guide on how to use it for drought and drought impact evaluation in various fields. Furthermore, the training was also focused on data acquired from the questionnaires and data processing workflow. After the theoretical input, facilitated discussion and consultation with the country representatives took place. Parties focused on identifying and reaching national reporting network partners, and including the system in the existing workflow. Countries discussed the specifics in drought impacts and how to incorporate those into the questionnaire system. In Albania, it was important to contact the forestry departments to understand the impacts of drought on forest ecosystems in the mountainous part of the Drin catchment. Furthermore, for agricultural drought experimental stations for specific crops could be used. In Kosovo, it was suggested to train first observers in small number of existing analog

stations. North Macedonia indicated, that trained existing observers could later train others, and though be multipliers of the network. Different crop types for drought impact monitoring were listed – grapes, vineyards, potatoes, and vegetables in Kosovo; watermelons, apples, fruit trees, vegetables in Albania, and forest (due to forest fires), vineyards, rain-fed wheat, corn in North Macedonia. Countries committed to different action, i.e., identifying stations where the questionnaire will be applicable (Kosovo), observing cooperation opportunities within existing hydromet network (Albania), and analyse who can be responsible and which questionnaires might be needed (North Macedonia).

In the post-meeting phase communication exchange between lecturer and the countries took place. Kosovo identified, three types of questionnaires which were provided for adoption (Annex 3). Some activities were reported within the post-meeting supervision of the Second – DW Training (Annex 2). Namely, North Macedonia has reported on first steps to develop the reporting network, and discussed further steps with project partners.

COUNTRIES IN REGIONAL PERSPECTIVE AND FURTHER DEVELOPMENT OF ACTIVITIES STARTED IN THE PROJECT

The final or creative workshop on 28 June was the final meeting of the project. Partners, countries representatives and following guests accepted invitation. Dr. Valetin Eich and Ms. Katrin Ehlert from IDMP Global, Mr. Dejan Panowski from Global Water Partner Mediterranean, and Ms. Mirjana Ivanov, the head of the Department of Applied Meteorology and Climate Change, from IHMS Montenegro.

Agenda of the meeting (in details, Annex 4) was, that after a short summary of the project the detail description of the project results by each country followed. Presentation of larger global and regional perspectives on IDMP was given by IDMP Global and GWP Med. The use of DW and current IDMP activities in Montenegro was presented. Facilitated discussion followed, looking on further cooperation prospects.

The countries presented their activities in the project. Each country has specific situation related to drought monitoring and management. Inspite of that there are some commonalities. Most of the countries concentrated on analysis and preparation of station data from Drin Basin suitable for drought indices (such as SPI, SPEI an others) calculation and international data exchnnagne for Drought Watch Tool. Kosovo has identified 10 suitable stations after analysing the existing network of 12 meteo stations, 35 hydrostations, and 36 precipitation stations (Figure 2)

ONLINE METEOROLOGICAL STATIONS – data

NR	STATIONS	DATA (Historic)		New (aktual)	
		from	to	from	to
1	Istog	1961	1999		From 2020 online
2	Pejë	1927	1998	2002	From 2015 online
3	Junik	-	-		From 2015 online
4	Skopjan	1954	1999		From 2018 online
5	Prizren	1927	1999	2006	From 2015 online
6	Dragash	1952	2012		From 2020 online
7	Malishevë	-	-		From 2020 online

Historical meteorological data (air temperature and precipitation), are daily, while current every 15 min

ONLINE HYDROLOGICAL STATIONS – data

NR	STATIONS	DATA (Historic)				New (aktual)	
		Water level (h)		Discharge (Qm ³ /s)		Water level (h)	Discharge (Qm ³ /s)
		from	to	from	to	from	to
1	Gryka e Rugovës	1963	1997	1963	1986	2003	2022
2	Gjonaj	1967	1997	1975	1983	2003	2022
3	Këpuz	1953	1997	1963	1986	2014	-

Data are intermittent

Historical data for water levels and discharge are daily

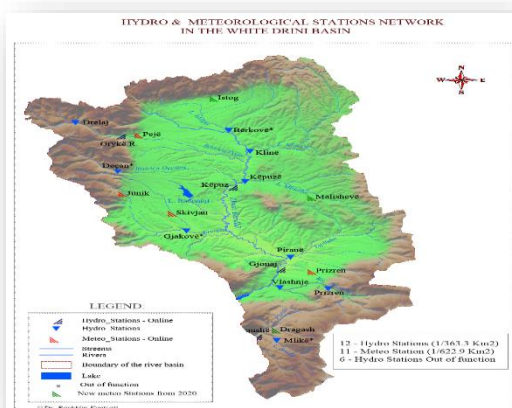


Figure 2. Kosovo stations list (prepared by Bashkim Kastrati) shared with international partners within the project

SPI calculation using the training and guidelines provided in the project was done. In Albania 1 and 3-monthly SPI indices were calculated for 2 Drin – Basin station - Bushat and Boge (Figure 3).

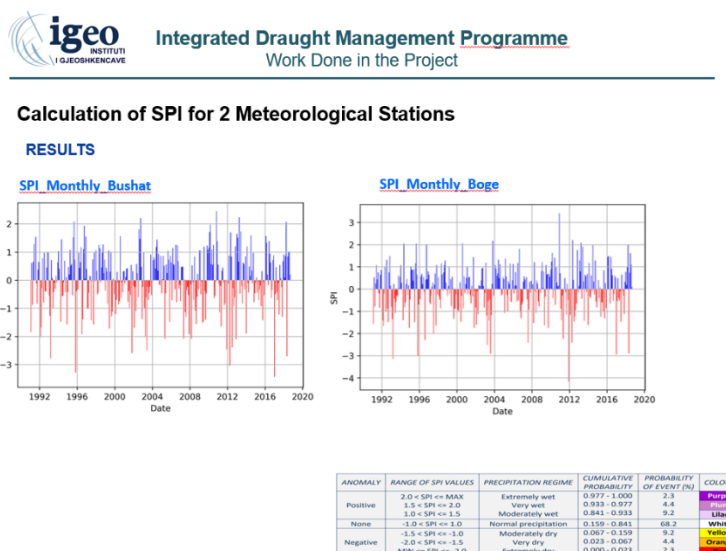


Figure 3. SPI calculation prepared by Alban Doko and Albanian project team.

In North Macedonia, three station were selected, monthly precipitation sums for (1961-2020) were calculated. Afterwards the SPI index was calculated, and data have been prepared for Drought Watch (Figure 4)

SPI (work done)

- Review of available meteorological data and meteorological stations for the Drin Basin area
- Representative meteorological stations for Drin basin, according statistical region categories;
- Main meteorological station with long precipitation data
 - Lazaropole –Polog region
 - Ohrid – Southwestern region
 - Bitola – Pelagonia region
- Digitalization of monthly precipitation sum for period 1961-2020;
- Reference period for calculation 1991-2020;
- Calculation with software from the DMCSEE project.
- Adjusting the necessary format to inter-corporate in the drought watch site (sent an example of SPI format and we are working on the correction they asked about the file format)



Figure 4. Example of countries progress within the project: Slide presented by Suzana Alcinova Monevska from HMS North Macedonia

Albania and Kosovo also presented a project on Flood Early Warning system, which was developed jointly with the countries, enables data sharing among the countries and can be possible project to build upon (Annex 4). Furthermore, partners reported on action made on National Reporting Network.

Facilitated discussion on further perspectives took place together for international guests. Representatives of Montenegro have joined the discussion. The main outcomes of the session were as follows. Countries expressed interest to apply for common projects, rather than tackle drought only at national level. Regional cooperation offers improvements and in sharing the best practice. The EWS system, such a DW, need to be tailored on sectoral and cross-sectoral issues of agriculture, water and energy sector, because those are most affected on Drin countries. Countries were ready to brain storm on this, and they identified colleagues /organisations which can contribute to the cross-sectoral discussion in their country. They support widening of the cooperation group and form wider circle of involved institutions. Countries committed to create contact list from institutions directly involved in topics related to drought. They decided to divide it into “technical contact list” for fine details on data topics, and “response contact list” for drought management, policies and measures topics. Possibility to involve municipality level in cooperation was discussed as some countries (Kosovo) have very good experience in it. Partners have identified some ongoing or upcoming project on which it is possible to build upon – Adaptation Fund on climate monitoring in Albania, KHMI 2021 Work Strategy for next 10 years, a proposal on underground monitoring network at 13 sites –in Kosovo. International project on Water-Land management in Kosovo (10 years), but it was not sure if drought was competent. In North Macedonia identified the Fourth National Communication on Climate Change as a built upon initiative. Representatives of North Macedonia have been partners in a project for predictions phenological phases for vineyard with Italian lead partner. They suggested that by further advancing their calculations (e.g., for existing indices, or new one as consecutive dry years) they would consider using regional approaches. Some development of internal work and network, such as digitalisation of historic data records, historical database extreme weather events on T, Precip., etc., are envisaged. In Montenegro, data are collected also for hydro power plants. Risk assessment on drought, prepared for the country, includes also the aspect of hydro data (hydrology, impacts, vulnerability in hydro sense). All national experts from various sectors were already included in Drought Risk Assessment preparation (each for their own aspect) will likely continue to be involved in next activities at national level.

Furthermore, countries were asked to express their short-term and long-term commitment. Short-term commitments were action achievable within one year, while long-term within 3-5 years.

Within one year, it was possible:

- dedicate more focus given on drought aspect (human resources, departments topics) - Albania
- have a training on hydrology drought monitoring and EWS with DMCSEE, if possible - Albania
- maintain and strengthen the network of stakeholders involved in drought-vulnerable sectors (hydro, energy, ecology, agriculture) - Albania
- create contact list of these institutions; inter-institutional sharing of good practices to bring improvements in to national approach. - Albania
- work on SPI; use Drought Watch more often – Kosovo
- begin Drought Impact Reporting network for agriculture, with a perspective of functioning in next 2-3 years together with stakeholders and internal colleagues - Kosovo
- ready for further collaboration with own IT and Drought Watch developers for integration of automatic hydro-met data into Drought Watch – Kosovo
- using R tool for SPI, SPEI; determine scope of data preparation; integration into Drought Watch; deliver data for North Macedonia; - North Macedonia
- start with the establishment of Drought Impact Reporters. North Macedonia
- continue with started activities to produce the results which Drin project kick-started – North Macedonia

Countries expressed constraints which can be limiting for achieving any long-term goals. The main issue was the human resources limitations, and departments which cover various topics related to drought (sectorality). Recommendation was done to invest into in person and personnel trainings, and empowering the staff. For some countries (e.g., North Macedonia) is important to expand the activities to whole country, as drought is not Drin Basin specific. North Macedonia is willing to establish Drought Impact Reporting on a regular basis, establish drought alert dissemination to other institutions; and expand Drought Impact analysis to improve.

Furthermore, participant exchanged important links (Annex 4), and defined how they will stay in cooperation after the project end. All countries are willing to continue after summer, and a DMCSEE driven training (e.g., on SPI / SPEI calculation scripts) will be prepared in the fall 2022. GWPCEE will contribute and facilitate meetings of the partners. DMCSEE suggested a way of keeping in touch through national inputs on drought impacts

As follow up of the final meeting partners and countries representatives have developed written short project reports (Annex 5) and GWPCEE wrote final report (this document).

CAPACITY BUILDING EVALUATION

Eight participants took part in the final evaluation survey. Together 87% of respondent have considered the capacity building developed very well, while 12% poorly developed. Each training was considered to be very useful (87%) or useful (Figure 5). Pre- and post-meeting national consultation gained the same score, while trainings were considered very useful by all participants.

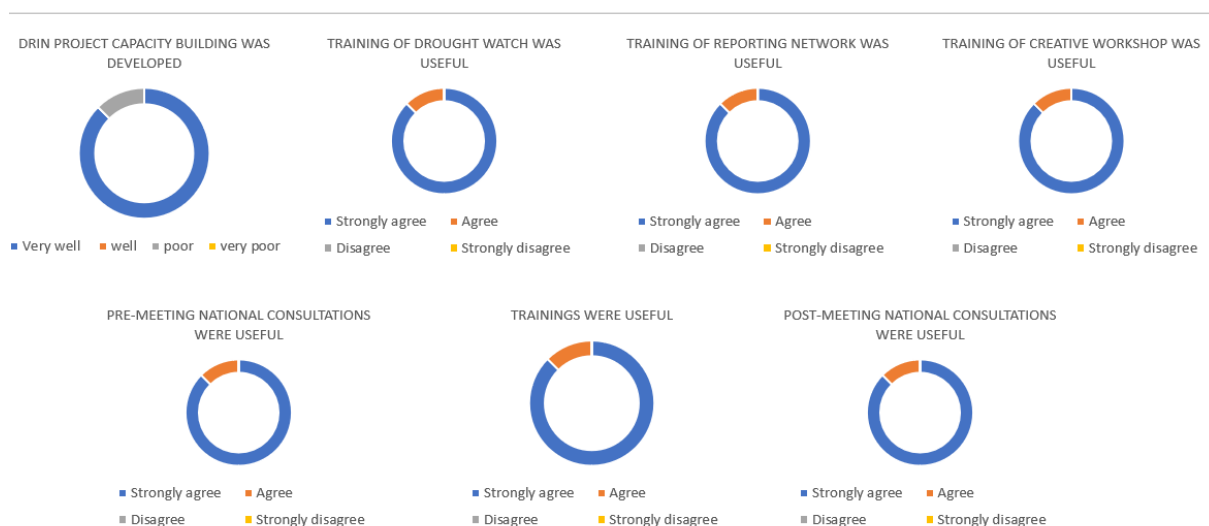


Figure 5 The usefulness of the capacity building and its parts

The participants appreciated the capacity building content (trainings), due to the content of two trainings which presented tools very relevant for their work. In some countries where drought monitoring is not in place, the “IDMP project was first activity to develop this type of expertise”.

Participants appreciated the creative workshop as creating the space to show way forward. The capacity building increased their interest to proceed with IDMP in their country.

The capacity building approach divided in pre- and post- meeting national consultation, and in regional training was commented as follows: “I strongly agree that the three phases of Pre-meeting, Training and Post-training were very useful because allowed us to learn a lot of things and also having plenty of discussions”. Furthermore, the participants pinpointed that the concept enabled them to “have interactive communication for whole period”, and “enabled direct and concise communication”. They also highlighted the creative and dynamic aspects of the training, and availability of the project team for consultation, and the direct communication. Some participants have described, how the concept have helped to motivated them to actively participate. The participant, who considered the capacity building poorly developed, have commented that as such capacity building was “sufficient for the initial purpose, but I think it should be continued with the next steps”.

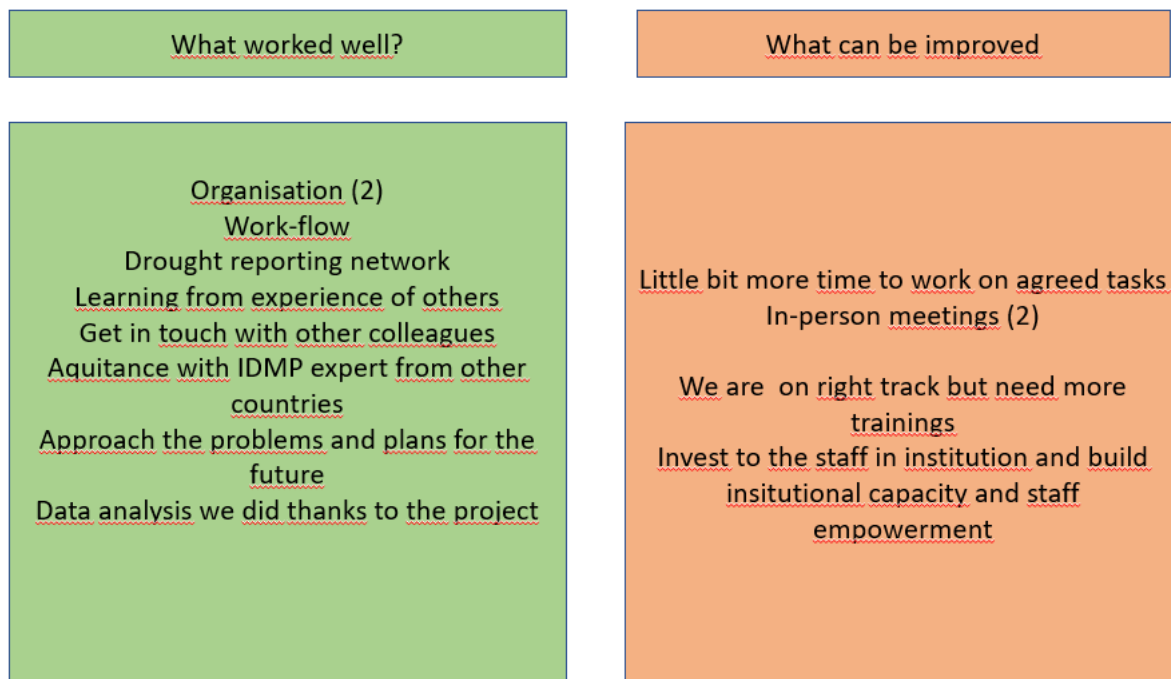


Figure 6 What worked well and what can be improved in the capacity building

The participants appreciated the organisational and international aspects, the exchange and communication, as well as the work done (Figure 6). They have expressed need for longer periods for individual work, and in-person meetings. Some participants understood, this was a necessary step, but to build up empowered staff, more training is needed.

Parties have expressed interest for following training in the future:

- drought impact and risk assessment analysis
- estimation of different indexes related to hydrological drought and hydrological drought assessment
- setting up a system of drought alert dissemination for other institutions
- further training / support for Drought Impact Reporting
- drought monitoring, alert triggers, early warning system
- Better information/data
- technical and technological training, including programs, models, etc.
- Sušomer (Drought Meter) which is a platform for hydrological drought detection in Slovenia.

Previously countries expressed interests to be part of the technical training on use of R-scripts for SPI calculation, which was agreed to be planned after the project end.

For the open question on other comments, the wish for continuation of the work was expressed.

ANNEXES

Annex 1 Kick-off Meeting and Countries' Needs

Kick off meeting Agenda

Smetanová, Bokal (2022) IDMP and Drin Project: Background, outline and outcomes

Sušnik, Gregorič, Grlj (2002) Drought Watch Tools and its functionalities

Bláhová (2022) National Drought Reporting Network

Meeting minutes (with participant lists)

Annex 2 Drought Watch and Data Integration

First Training on DW_07.06.22_Invitation and Agenda

Pre-meeting: Drought Watch_Exercises and Tips

Pre-meeting: Data Preparation Instructions

Pre-meeting Supervision Report North Macedonia

Pre-meeting Supervision Report Kosovo

Training: Participants list

Training: Breakoutrooms and Discussion Minutes

Links Shared During the Training

Post-meeting Supervision Report Albania and Kosovo

Post_meeting Calculation_of_SPI_and_SPEI_Exercise, Data and R-Script

Annex 3 National Drought Reporting Network

Second Training NRN – invitation

Pre-meeting_Training_Introduction

Participants List

Kastrati, B. (2022): Kosovo- 14.07.2022

Doko (2022) Calculation of SPI for Albanian Stations

Bláhová, M. (2022) National reporting network system

Bláhová, M. (2022) Reporting questionnaire and questionnaire administration

Pollev Questions to Partners

Meeting Notes and Discussion - Miro Board

Questionnaires Shared in Post Meeting Phase – agriculture, forestry, fruit

Annex 4 Final Meeting

Final Meeting– Invitation with attachment (IDMP Factsheet)

Final Meeting – Agenda

Participants List

Smetanova (2022) Final Creative Workshop for Drin Basin Project

Doko et al. (2022) Situation on drought management and work done in the project

Kastrati (2022) Monitoring and early warning, Vulnerability and impact assessment, Mitigation, preparedness & response in Kosovo

Zami and Kastrati (2022) Flood Forecasting Project in Drin Basin

Andovski et al. (2022) IDMP Drin Basin Project: Work Done and Future Prospects in Republic of North Macedonia

Aich et al. (2022) IDMP – a global perspective

Discussion notes Miro and written

Important links and documents shared during the meeting

Annex 5

Final Report Albania

Final Report Kosovo

Final Report North Macedonia

Final Report DMSCEE and ZRC SAZU

Final Report Czech Globe