Stakeholder Workshop on Earth observation-based information products for drought risk on a national basis

Organized by

Space Research Institute of Ukraine (NASU-SSAU)

ZFL, University of Bonn

UNU-EHS

UNOOSA / UN-SPIDER

14 to 16 May 2018; Kiev, Ukraine

Introduction

The EvIDENz project included the conduction of a second stakeholder dialogue entitled *Stakeholder Workshop on Earth observation-based information products for drought risk on a national basis* (EvIDENz) in Ukraine to present the workflows developed by the Remote Sensing Laboratory of Land Surfaces of the University of Bonn (ZFL) and the Institute for Environment and Human Security of the United Nations University (UNU-EHS). These workflows have been developed to estimate the financial impact of droughts on specific types of crops in the case of Ukraine. In addition, the workshop was used by ZFL to present additional information on the EvIDENz project, on different types of applications of moderate and high-resolution satellite imagery in agricultural applications; and UNU-EHS presented its model for risk assessment in case of droughts and its explicit application in the Kiev province and to collect feedback on both the workflows and the proposed risk assessment model. The stakeholder workshop was organised by the Ukrainian Space Research Institute (NASU-SSAU) and the UN-SPIDER programme of the United Nations Office for Outer Space Affairs with the support of ZFL and UNU-EHS.

The stakeholder dialogue comprised both a workshop and a training session. The workshop was conducted in the Conference Centre of the Ukrainian Academy of Sciences in Kiev, Ukraine, on 14 and 15 May 2018. The training session was conducted in the premises of the Kiev Polytechnic Institute on 15 May.

The workshop was used to present the procedure developed by ZFL to elaborate maps depicting the degree of severity of droughts on crops for specific regions of Ukraine and to present and the procedure developed by UNU-EHS to estimate the financial losses due to droughts based on the maps elaborated by ZFL. In addition, the workshop allowed participants to become aware of the efforts conducted by UNU-EHS to characterise the degree of drought risk of municipal districts in the Kiev province and to take note of an App that is being developed by ZFL. The workshop allowed organisers to acquire feedback from participants representing Ukrainian institutions regarding the potential use of the procedures developed by ZFL and UNU-EHS, and the potential incorporation of risk assessments in Ukraine in the agricultural sector.

Background and Objectives

The duration and intensity of droughts have generally increased in several regions of the world. Agriculture is especially affected, triggering direct consequences on food security, health, and the economic situation of a country.

The EvIDENz project builds on the fact that international conventions and frameworks like the Sendai Framework for Disaster Risk Reduction 2015-2030 (SFDRR) feature more and more goals, targets, priorities for action and indicators which are quantifiable and measurable rather than qualitative. The project focuses on supporting the implementation of the SFDRR in the monitoring of impacts to the agricultural sector due to droughts. The project contributes in two ways: raising awareness regarding an improved understanding of risks due to droughts with a key focus on the agricultural sector, and developing a procedure that can be used to estimate impacts of droughts to the agricultural sector either in terms of financial losses or the number of people affected by droughts who are engaged in agricultural activities.

The Stakeholder Workshop and its complementary training activity were conducted to facilitate the uptake at the national level of ways to enhance the understanding of risk due to droughts (priority for Action 1 in SFDRR) combining information drought hazard, exposure and vulnerability of the agricultural sector; and to facilitate the use of the workflows developed by ZFL and UNU-EHS that allow for the calculation of financial losses in the agricultural sector due to crop damage or reduction in the case of specific droughts (Sendai indicator C2).

Venue and Attendance

The stakeholder workshop was conducted in the Conference Centre of the Ukrainian Academy of Sciences in Kiev, Ukraine, on 14 and 15 May 2018. It brought together 35 participants from the following Ukrainian institutions: NASU-SSAU, the Hydrometeorological Centre, the Institute of Water Problems and Land Reclamation, the Institute of Agroecology and Environmental Management, the Ministry of Ecology and Natural Resources, the Ministry of Agrarian Policy and Food of Ukraine, the National Scientific Centre for Agro-Chemistry Research, the National Forest System, the State Service Cadastre Centre, the World Data Center for Geoinformatics and Sustainable Development at the National University of Ukraine, the private company ART-Grain LLC, and the Polytechnic Institute of Ukraine. In addition, the workshop was attended by experts from UNU-EHS, ZFL of the University of Bonn and from the UN-SPIDER programme of the United Nations Office for Outer Space Affairs (UNOOSA). The list of participants attending the workshop is presented in Annex 1.

The training segment was attended by participants from the Ministry of Ecology and Natural Resources of Ukraine; the Institute of Water Problems and Land Reclamation; the Institute of Agroecology and Environmental Management; the World Data Center for Geoinformatics and Sustainable Development of the University of Kiev; the private company ART-Grain LLC UKSA; and a group of selected students from the Polytechnic Institute of Kiev. The training segment was conducted by staff from UN-SPIDER and benefitted from the technical support provided by experts from NASU-SSAU, ZFL and UNU-EHS. The list of participants attending the training segment is presented in Annex 2.

Programme

The Stakeholder Workshop included an opening segment and three sessions:

Session 1: EvIDENz project and its workflows;

Session 2: Monitoring droughts in Ukraine;

Session 3: Sendai framework monitoring and reporting.

The training activity was originally planned to take place in the afternoon of 15 May and on 16 May, but at the request of the NASU-SSAU, the training activity was reduced to just the afternoon of 15 May. Annex 3 presents the agenda of the workshop.

Summary of workshop

Opening segment

During the opening segment, NASU-SSAU and UN-SPIDER welcomed participants and provided an overview of the *Stakeholder Workshop.* Subsequently, experts from NASU-SSAU made participants aware of on-going projects carried out under the umbrella of the Group on Earth Observations (GEO) which also contribute to the United Nations Sustainable Development Goals. These projects include:

- GEO-ESSENTIAL ERA PLANET Horizon 2020 project
- FP-7 SIGMA
- ESA Sen2Agri project
- UN-SPIDER and UNFCCC activities

The GEO-ESSENTIAL ERA PLANET project addresses interoperability issues and is linked to GEO and CEOS, and is linked to the SDGs. It aims to contribute to the interoperability of Earth observation systems at national and regional levels.

This project is geared to contribute to the monitoring of Essential Climate Variables (ECVs) under the notion of GEO essentials using Google Earth Engine, the Committee on Global Meteorological Satellites (CGMS) CGMS/WOFOST/WGEN model, the EC-JRC's CropML- WOFOST procedures; and stochastic climate simulation models.

As part of this project, NASU-SSAU has developed a workflow to estimate the proportion of agricultural area under production in sustainable way, and the proportion of degraded land. The workflow combines in-situ and satellite data to elaborate crop classification maps. Satellite data is used to obtain different vegetation indices, for example the Normalised Difference Vegetation Index (NDVI); which is then subsequently used for crop productivity assessment.

Participants took note of the comment that high quality in temporal and spatial resolution is required to carry out some of the calculations. Subsequently, data on land-cover changes and land productivity is used to estimate land degradation. Researchers at NASU-SSAU have estimated land-cover changes and correlated them with land-productivity classes. According to the UNCCD methodology, changes such as deforestation, and changes from forest to cropland, to urban areas, and to grasslands should be considered. The largest proportion of these changes in Ukraine are from forest to grassland. The results of this analysis can be used in indicator 15.3.1 of the SDGs, as well as in indicator 2.4.1.

Results of the analysis of land-use changes in Ukraine indicate that land productivity is declining in the southern region of the country in those agricultural areas which are not irrigated, so irrigation is suggested to raise the productivity of those areas.

In the context of the use of Earth observation to extract land-cover data sets; NASU-SSAU has been engaged in the comparison of global land cover maps with pixel size of 300 meters provided by the United Nations Convention to Combat Desertification (UNCCD) with national land cover maps developed by NASU-SSAU that have pixel sizes in the order of 10 to 30 meters. The land cover maps provided by UNCCD (ESA CCI) depict 7 different classes of land cover and are available annually from the year 2000 to the year 2015.

In contrast, the land cover maps produced by NASU-SSAU are available for the years 2000, 2010, 2016 and 2017; and depict 6 to 7 classes to match the UNCCD classification. NASU-SSAU has developed additional maps for the years 2016 and 2017 that cover 16 land cover classes.

The presentation stressed the fact that the national land cover classification elaborated by the NASU-SSAU is more precise than the more global one provided by UNCCD when both are compared with land-use data generated with in-situ data by government agencies in Ukraine.

Summary of Session 1: EvIDENz project and its workflows

To start this session, UN-SPIDER made participants aware of the severity of droughts in many regions of the world in recent years referring to a recently published report of the Food and Agricultural Organization (2018). Participants were made aware of the impacts of droughts compared with other natural hazards in the last decade, and regarding the impacts of droughts in Asia, Africa, Latin America and the Caribbean. UN-SPIDER then presented general details of the EvIDENz project, including a brief introduction to the core elements of the procedures elaborated by ZFL and UNU-EHS; activities conducted thus far and near future activities.

ZFL then made a presentation on the technical aspects of the procedure it has developed to estimate the geographic impacts of an agricultural drought in specific geographic regions of the Kiev province. The presentation started with a brief overview of drought indices that have been developed by the space community using satellite imagery and continued with the description of the procedure. Participants took note that the procedure makes use of the Enhanced Vegetation Index (EVI) as an input for the calculation of the Vegetation Condition Index (VCI), and then a procedure makes use of the phenology of crops to identify the Start of the crop Season (SoS), the Peak of the Season (PoS) and the End of the Season (EoS). The procedure then assigns weight to the SoS, the PoS and the EoS and concludes with the classification of all pixels in the region of interest into three categories of impacts on crops:

- No damage;
- Damage;
- Destroyed/ Total loss.

The experts from ZFL presented maps depicting the severity of droughts in the Baryshivskyi rayon; and subsequently results for the Kiev province comparing the results for 2014 which was a year with no drought, and 2015, which was a year with drought. Results indicate that the northern region of the Kiev province is experiencing more drought conditions that the southern region.

The experts from ZFL highlighted the following strength:

- Use of free and open data;
- The procedure addresses seasonality and focusses on the growing season;
- The procedure takes into consideration agricultural/plant condition;
- The procedure considers vulnerability stages during the phenology;
- The procedure yields a more accurate severity detection.

In a similar fashion, the following weaknesses were identified:

- The procedure is highly dependent on quality of phenology parameters;
- The phenology parameters cannot be extracted for some land covers;
- It is difficult for the procedure to carry out drought detection in fallowed parcels;
- The procedure is not really geared for double seasonality detection;
- The procedure is not well suited if there are crop rotations over the years.

The presentation by ZFL ended with an outline of elements to be discussed, including the need for validation of results.

UNU-EHS then made participants aware of some of the Sendai targets and indicators which have been selected to track progress in their achievements. UNU-EHS highlighted those indicators related to

economic losses due to disasters, including crop losses (partial or total loss depending on the severity of drought). Subsequently UNU-EHS presented its procedure to generate its segment of the workflow. This segment uses as inputs the drought severity map developed with the ZFL segment; the land-cover map developed by NASU-SSAU as a basis to extract polygons which contain specific types of crops, as well as in-situ data on crop statistics over the past five years and the annual price of crops for these years. The presentation focused on the Kiev province and presented as an example the estimation of losses due to crop failure or crop reduction in maize parcels for the year 2015. In this specific year, the output of the procedure from ZFL indicated mostly no damage or only damaged areas and just a few areas experiencing total loss. The rest of this segment of the procedure was presented and participants took note of the financial figure regarding losses due to drought in maize crops for this particular year 2015 for the whole Kiev province.

The second part of the presentation highlighted that incorporating vulnerability into drought risk assessments can support the reduction of impacts through targeted response to drought and through targeted application of prevention measures. State-of-the-art drought risk assessments consider risk as the product of hazard, exposure and vulnerability. The hazard assessment is based on the VCI provided by ZFL. The exposure assessment considers the share of agricultural land (ecological exposure) plus the share of the agriculture dependent population (social exposure). The vulnerability assessment takes into account a set of 13 social and ecological vulnerability indicators, which were selected from a review of scientific literature on drought vulnerability in Ukraine, and informed by available data. The presentation emphasized the difference of drought hazard and drought risk and made participants aware of opportunities and challenges of understanding drought risk in Ukraine.

Summary of Session 2: Monitoring droughts in Ukraine;

In the next presentation, the Agrometeorological Department of the Ukrainian Hydrometeorological Centre made participants aware of the results of its analysis regarding droughts in recent years. The Agrometeorological Department made participants aware that since 1971, there have been 16 years where droughts took place. Participants took note that in recent years the worst droughts took place in 2003 and 2007. Additional droughts have taken place in 2015 and 2017.

The Agrometeorological Department commented that the Hydrometeorological Centre operates 164 meteorological stations used to monitor drought throughout the country, of which 122 also take note of the information on crop phenology in agricultural fields in their neighbourhood and soil moisture at different depths. Although the Department is aware of many drought-related indices, it uses nine of them on a regular basis to characterize the severity of droughts.

The Department made participants aware that since several years ago it operates a system for drought monitoring and notification which includes agro-meteorological newsletters released every 10 days. These newsletters are provided to different government users, from farmers to government agencies; and contain information on possible yields reductions in different regions of the country. Participants took note of the specific maps which have been generated by this Department in case of droughts in recent years, including 2007, 2010, 2015 and 2017; as well as information on the Standard Precipitation Index and soil moisture (0 to 20 centimetres and 0 to 100 centimetres) for different periods in 2018. The Department calculates and uses the Standard Precipitation Index (SPI) as a way to characterise the severity of droughts.

Regarding the weather in Ukraine, the Department made participants aware that there seems to be a trend for warmer climate, although the northern regions of Ukraine are becoming warmer faster than the southern regions. Also, there is now more days with heat stress during summer months. This is particularly noticeable in south eastern region of Ukraine.

Subsequently, an APP being developed by a researcher at ZFL was presented to participants. The APP will allow users to visualize maps elaborated with special sensors of the Sentinel satellites depicting

several of the vegetation indices that are commonly used in drought monitoring. This App processes the data from the Sentinel satellites using Google Earth Engine.

This second session included a discussion regarding current challenges in Ukraine related to the compilation of data on impacts of droughts and other hazards to generate reports to be incorporated in the Sendai Monitoring tool.

Regarding information on droughts in Ukraine, experts from the Hydrometeorological Centre indicated that the Agrometeorological Department has used information from the hydrometeorological stations throughout the country to generate information on the manifestation of droughts based on hydrometeorological data and data on crops in the neighbourhood of many of these stations.

Experts from the Agrometeorological Department indicated that a special effort was conducted by the Department to generate relevant data and maps to contribute to the EvIDENz project. The generation of these maps included the compilation of data from field stations, as not all the archived data is stored in Kiev.

In a similar fashion, experts from the NASU-SSAU indicated that they have generated information on crop types in specific years (2000, then 2010, and since 2016 with Sentinel satellite imagery).

UNU-EHS concluded this second session presenting a draft version of a Policy brief that aims to bring the results from science to government officers to encourage the use of scientific results. The policy brief has been drafted highlighting the 2015 drought. UNU-EHS suggested that decision makers sure migrate from the notion using just hazard information to using information on risk combining:

- Hazard information provided by ZFL;
- Exposure of those elements which are subject to drought (people, assets, crops, etc);
- Vulnerability based on physical, social, economic and environmental factors.

In the case of *exposure* exports from UNU-EHS suggested the combination of data on crops and rural population who are exposed to droughts. These two would be framed under social and ecological exposure. In the case of *vulnerability*, experts from UNU-EHS introduced participants to several dimensions of vulnerability including the social dimension, using indicators such as unemployment, social dependency, government support, income; and the environmental dimensions using indicators such as soil quality and crop rotation violation. UNU-EHS emphasized that the incorporation of the routine assessment of risks offers an opportunity to identify and reduce vulnerability. Nevertheless, several issues need to be addressed when considering the assessment of vulnerability. Among them:

- The validation of indicators and results;
- A review of assumptions and proxies;
- Availability of up-to-date data.

Experts from UNU-EHS indicated that policy makers should make use of information on risk assessments to design rural development strategies, incorporating the reduction of exposure and vulnerability to droughts through measures such as irrigation. They stressed the need for critical reflection to translate scientific results to policy-relevant advice. In addition, they suggested that the development of policies should take into consideration the different levels of vulnerability and exposure, and not just information related to drought as a hydro-meteorological hazard.

Summary of Session 3: Sendai framework monitoring and reporting.

This session started with the compilation of suggestions from participants related to the policy brief that was presented by UNU-EHS in the previous session. Participants were asked to reply to these three questions:

1. **Vulnerability indicators:**

How do the vulnerability indicators reflect the situation on the ground according to your experience? How do they not?

2. **Risk assessment:**
   Where do you see opportunities for disaster risk reduction (DRR) based on such a risk assessment in Ukraine?
   Where do you see challenges?

On the topic of indicators, participants manifested the importance of the use of existing indicators as opposed to bringing new indicators. Regarding suggestions of other indicators which should be used to characterise vulnerability, representatives of Ukrainian institutions suggested the following:

- Indicators that address the status of disasters preparedness so that the information from such indicators can be used to assess institutional capacities to respond in case of disasters.
- A matrix of indicators tracking changes at the municipal level in rural areas.
- Indicators on the status of forests as forests play a role in agriculture and land management. Indicators related to the levels of groundwater to understand more precisely the effects of drought on crops.
- Indicators addressing the degradation of soils as agrophysical conditions. Not only increase or decrease in content of soil moisture, but also info on soil surface properties and soil quality. Over-compaction of soils to depth of one meter can be a problem as it decreases content of organic carbon in soils that is useful for agriculture.
- Indicators addressing the differential vulnerability of crops.

Regarding the use of national statistics data, participants from Ukrainian institutions commented that some of the data presented in national statistics may not really reflect the precise or most up-to-date conditions on the ground.

For example, income has been increasing but is not yet properly captured in national statistics. In addition, in recent years the economy is relying more and more on informal economy that is not well captured by national statistics. Participants indicated that unemployment figures may not be really be up to date and accurate.

Regarding the assessment of social vulnerability, participants indicated that statistical data may not necessarily reflect true social vulnerability.

On the results of the risk assessment presented by UNU-EHS; participants from Ukrainian institutions indicated that drought risk is present in any region in Ukraine. However, they stressed that the most vulnerable regions for drought are in the southern part of Ukraine. However, it is necessary to carry our research in risk assessment in different climate zones in Ukraine, in steep zones and in forest areas, because these zones have different types of soils. The participants from Ukrainian institutions indicated that the Kiev region is not a very good geographic region for case studies on droughts. In the Kiev region soils are better, as they are softer.

Regarding the policy brief itself, participants indicated that in its current form, the draft version is not really a policy brief as it lacks policy-relevant recommendations. Thus, it was agreed on updating the policy brief regarding recommendations and additional examples (of e.g. other countries or regions) of how risk and vulnerability assessments can support disaster risk reduction efforts.

During this third session the Ministry of Ecology and Natural Resources of Ukraine made a presentation on its activities related to the implementation of the agreements stemming from the United Nations Convention to Combat Desertification (UNCCD). The representative of the Ministry indicated that this Ministry oversees the implementation of UNCCD convention in Ukraine, and that in its framework desertification not only means deserts but land degradation. He commented that in the year 2017, a new strategy was adopted at the Conference of Parties to UNCCD (CoP) incorporating the need to address the effects of droughts, to enhance the resilience of vulnerable ecosystems and the population. Furthermore, the CoP adopted a decision on national drought policies which needs

to be integrated into national plans. Efforts are underway to develop a national plan to minimize land degradation, drought monitoring, drought early warning systems and other measures.

As a way to implement the decisions taken by the CoP, the representative of the Ministry indicated that it is important to get new products and sources of information, as well as procedures to use space-based information. He reiterated the responsibility of the Ministry to report to the CoP on the implementation of decisions, and to national authorities.

On the issue of indicators, the representative of the Ministry indicated that the Ministry currently uses several indicators, but not related to drought monitoring. The indicators currently used focus more on land-cover, soil organic carbon and land productivity. These were adopted by UNCCD CoP. Global data has been suggested by UNCCD, but it's up to countries to decide whether such data is used. Nevertheless, he indicated that UNCCD is also interested in the monitoring of droughts.

The session included a discussion on the feasibility of testing and validating the workflows developed by ZFL and UNU-EHS. However, the overall institutional situation is that unless new resources are provided, it would be difficult in Ukraine to carry out the testing and validation of the workflows. Institutions are currently engaged in specific tasks and any new project is seen as a new task for which resources cannot be accommodated.

Representatives from the Hydrometeorological Centre indicated that raw data is available which could be used to generate drought maps. Such maps could be used to test the accuracy of maps generated with the ZFL procedure, but it would require additional resources for the Centre to generate such maps as the Centre does not possess resources at this time for such a task. They commented that some of the data may not be stored in Kiev but in other areas. They also commented that data on crop yield is compiled by centre for all administrative regions and districts. And while the data is available in digital form since 1984, it would require additional processing to shape it in the format that would be required to test the ZFL and UNU-EHS procedures.

Representatives of the NASU-SSAU indicated that while there is archived raw data which could be used to test the workflows, existing institutional limitations do not allow these institutions to process such archived raw data to generate data that could be used to test the results of the workflows. Nevertheless, they commented that if the project allocated resources for this task, these institutions could of course conduct such efforts to contribute to the validation of the procedures.

Another segment of the discussion addressed the potential use of the procedures developed by ZFL and UNU-EHS by institutions in Ukraine. Representatives from the Hydrometeorological Centre indicated that they currently have their own procedures to generate information on droughts and their potential impacts on yields. Nevertheless, they indicated that the Centre is open for cooperation, but good results would be needed to encourage the national government to support the Centre in the implementation of new procedures.

Unfortunately, the national focal point for the Sendai Framework for Disaster Risk Reduction could not attend the EvIDENz workshop. Therefore, it was not possible to discuss any further steps to implement the developed processing chain on measuring Sendai indicators C-2 for the example of agricultural drought as part of the existing monitoring and reporting procedure. However, the National Civil Protection Agency nominated the Hydrometeorological Centre to represent it in the stakeholder workshop. Current activities of the Hydrometeorological Centre focus on hazard monitoring. The result of EvIDENz demonstrated the relevance of monitoring in addition the exposed elements in order to measure Sendai indicators as well as measure vulnerability to understand underlying drivers of risk. Other ministries are not active on such monitoring efforts related to Sendai targets. They indicated that in Ukraine, new procedures may be implemented only if there is international pressure to do so. They cited the example of the UNCCD convention and the responsibility of the Ministry of Ecology and Natural Resources to implement procedures stemming from the decision of the UNCCD Conference

of Parties. If the government has an obligation to report to such international actors, then the government will do it.

Observations and Recommendations

The stakeholder workshop allowed participants to take note of the efforts being conducted by NASU-SSAU to generate relevant space-based information which can be used in applications related to land management and sustainable development; the efforts conducted by the Agro-Meteorology Department of the Ukrainian Hydrometeorological Centre to generate information on meteorological, hydrological and agricultural droughts; and the need manifested by the Ministry of Ecology and Natural Resources to address geospatial information needs related to the reporting to the United Nations Framework Convention on Climate Change.

While participants took note of the procedures developed by ZFL and UNU-EHS; some of them recommended that it would be better to test these procedures in southern regions of Ukraine where droughts are more frequent; as well as in provinces east and west of the Kiev province.

In addition, on the issue of testing and calibration of the workflows, participants commented that this task could only be accomplished if additional financial or in-kind resources could be accommodated for such purposes.

Regarding the assessment of risks presented by UNU-EHS, participants noted the usefulness of addressing both exposure and vulnerability. However, some participants commented that national statistics may not necessarily capture accurately information on unemployment and income due to the large informal economy existing in the country; and commented that it may not really be feasible to find accurate information on types of fertiliser used, as well as on crop rotation. In addition, participants suggested the use of additional indicators to capture vulnerability more precisely.

A post-workshop evaluation was conducted by NASU-SSAU. Results are presented in Annex 4.

Summary of the Training segment

The stakeholder workshop included a training segment that was conducted in the afternoon of 15 May. Participants from the following institutions took part in this training segment: NASU-SSAU, the Ministry of Ecology and Natural Resources; the Institute of Water Problems and Land Reclamation; the Institute of Agroecology and Environmental Management; the World Data Center for Geoinformatics and Sustainable Development of the University of Kiev; the private company ART-Grain LLC UKSA; and a group of selected students from the Polytechnic Institute of Kiev.

The training segment was conducted by staff from UN-SPIDER and benefitted from the logistical support provided by NASU-SSAU, the computer training facilities at the Polytechnic Institute of Kiev and the technical support provided by experts from ZFL, UNU-EHS and NASU-SSAU. The training segment began with an introduction to the software used in the procedures called *R-Studio*. Subsequently, participants were given an overview of the ZFL and UNU-EHS workflows, and then participants used a dedicated computer training room to execute the UNU-EHS workflow from the beginning to the end.

Taking into consideration the fact that it would normally take nearly 9 hours to run both ZFL and UNU-EHS workflows for the Kiev province, the training segment focused on the generation of results for the Baryshivskyi municipal district in Kiev. The execution of the workflow in this municipal district ensured that all participants would have enough time to complete the execution of the UNU-EHS workflow.

While the training segment was originally planned to be conducted in the afternoon of 15 May and during 16 May; NASU-SSAU cancelled the second day of the training so that training was only conducted in the afternoon of the 15th May.

Annex 1
List of participants attending the workshop

First name, Last name	Position	Affiliation	E-mail
Iuliia Danylenko	Head of Laboratory of Water Management	Institute of Water Problems and Land Reclamation of NAAS	julia_danilenko@ukr.net
Olena Vlasova	Senior Research Fellow		Elena_vl2001@ukr.net
Tetiana Matiash	Head of the Department of Information Technologies and Innovative Marketing		t.v.matiash@gmail.com
Anatoliy Krucheniuk	Chief Specialist of the Department of Information Technologies and Innovative Marketing		anatolkru@gmail.com
Volodymyr Kovalchuk	Chief Researcher of the Department of Information Technologies and Innovative Marketing		Volokovalchuk@gmail.com
Tetiana Adamenko	Head of Agrometeorological Department		adamenko@meteo.gov.ua
Oleg Skoropad		Ukrainian Hydrometeorological Center (UHMC)	omtm@ukr.net
Tetiana Donyk	agrometeorologist		Vam_gmc@meteo.gov.ua
Tetiana Ilienko	Head of Laboratory of Aerospace Sensing of Agrosphere	Institute of Agroecology and Environmental Management	tilienko@gmail.com
Savchuk Olha	Chief specialist, Division of State Border Demarcation and Delimitation, Department for Topo graphical, Geodetic andCartograph ical Activities, StateGeoCadastre	The State Service of Ukraine for Geodesy, Cartography and Cadastre (StateGeoCadastre)	savchuk@land.gov.ua
Sergeii Yanchevskyi	Head of Information-Analytical Division	NCSFCT National Center Of Space Facilities Control And Test	yan.serg.77@gmail.com
Sergeii Kharchenko	Head of the remote sensing group		poctocka@gmail.com

First name, Last name	Position	Affiliation	E-mail
Anatolii Shmurak	Senior Expert of Climate Policy and Reporting Division of the Climate Change and Ozone Layer Protection Department	Ministry of Ecology and Natural Resources of Ukraine	shmurak@i.ua
Yuriy Kolmaz	Head of Division of Land and Mineral Resources Protection Department of Land and Water Resources Protection		Kolmaz@ukr.net
Stanislav Truskavetsky	Head of laboratory	National scientific Center "Institute for Soil Science and Agro-Chemistry Research named after O.N. Sokolovsky"	starwalkerone@gmail.com
Olena Rakoid	Associate Professor	National University of Life and Environmental Sciences of Ukraine	olenar_d@ukr.net
Viktor Putrenko	Head of GIS laboratory WDC Igor Sikorsky KPI	Igor Sikorsky KPI	putrenko@wdc.org.ua
Vira Balabukh	Head Department of Synoptical Meteorology	Ukrainian Hydrometeorological Institute, State Emergency Service of Ukraine, National Academy of Sciences of Ukraine	balabukh_vira@ukr.net
Melnik Grigorii	Agronomist		melnik8080@ukr.net
Volodymyr Kravchuk	Director of the Institute	Institute for prediction and testing of technology and technologies for agricultural production named after Leonid Pogorilly	ndipvt@ukr.net
Valerie Graw	Senior Researcher	ZFL, University of Bonn	valerie.graw@uni-bonn.de
Javier Gonzalez	Researcher	ZFL, University of Bonn	jgonzale@uni-bonn.de
Gohar Ghazaryan	Researcher	ZFL, University of Bonn	ghazaryangohar@ymail.com
Yvonne Walz	Associate Academic Officer	UNU-EHS	walz@ehs.unu.edu
Karen Dall	Researcher	UNU-EHS	dall@ehs.unu.edu

First name, Last name	Position	Affiliation	E-mail
Moses Duguru	GIS/RS Consultant	UN-SPIDER	mosesduguru@gmail.com
Juan Carlos Villagran	Head, UN-SPIDER Bonn Office	UN-SPIDER	walz@ehs.unu.edu

Annex 2
List of participants attending the training segment

Fist name and Lat Name	**Organization**	**Email**
Andrii Kolotii	Space Research Institute NASU-SSAU	andrew.k.911@gmail.com
Shumilo Leonid	Space Research Institute NASU-SSAU	shumilo.leonid@gmail.com
Viktor Putrenko	Igor Sikorsky Kyiv Polytechnic Institute, Academician of National Academy of Sciences of Ukraine	putrenko@wdc.org.ua
Bohdan Yailymov	Space Research Institute NASU-SSAU	yailymov@gmail.com
Hanna Yailymova	Space Research Institute NASU-SSAU	anna.zagorodnia@gmail.com
Stanislav Truskavetsky	National scientific center "Institute for soilscience and agrochemistry research named after O.N. Sokolovsky"	starwalkerone@gmail.com
Melnik Grigorii	Art-grain	melnik8080@ukr.net
Anatoliy Krucheniuk	Institute of Water Problems and Land Reclamation of NAAS	anatolkru@gmail.com
Iuliia Danylenko	Institute of Water Problems and Land Reclamation of NAAS	julia_danilenko@ukr.net
Mykola Lavreniuk	Space Research Institute NASU-SSAU	nick_93@ukr.net
Sergeii Kharchenko	NCSFCT National Center Of Space Facilities Control And Test	poctocka@gmail.com
Shelestov Andrii	Igor Sikorsky Kyiv Polytechnic Institute, Academician of National Academy of Sciences of Ukraine	andrii.shelestov@gmail.com
Tetyana Kuchma	Institute of Agroecology and Environmental Management	tanyakuchma@gmail.com
Kateryna Chorna	Institute of Water Problems and Land Reclamation NAAS	st.katrine90@gmail.com
Liydmyla Pidgorodetska	Space Research Institute NASU-SSAU	pidgorodetska@ukr.net
Tetiana Ilienko	Institute of Agroecology and Environmental Management	tilienko@gmail.com
Anatolii Shmurak	Ministry of Ecology and natural resources of Ukraine	shmurak@i.ua
Students		
Postoliak Diana	Igor Sikorsky Kyiv Polytechnic Institute, Academician of National Academy of Sciences of Ukraine	tepido.nix@gmail.com
Kipkalo Denis	Igor Sikorsky Kyiv Polytechnic Institute, Academician of National Academy of Sciences of Ukraine	kipkalo2016@gmail.com

Pekarchuk Danil	Igor Sikorsky Kyiv Polytechnic Institute, Academician of National Academy of Sciences of Ukraine	pekarchukdanil@gmail.com
Kharchenko Vlad	Igor Sikorsky Kyiv Polytechnic Institute, Academician of National Academy of Sciences of Ukraine	xapchenko2000@gmail.com
Kyrylo Medianovskyi	Igor Sikorsky Kyiv Polytechnic Institute, Academician of National Academy of Sciences of Ukraine	kmedyanovskiy@gmail.com
Andriy Swidonov	Igor Sikorsky Kyiv Polytechnic Institute, Academician of National Academy of Sciences of Ukraine	yukihirosm@gmail.com

Annex 3
Agenda

14 May 2018 (stakeholder workshop): National Academy of Sciences of Ukraine

Day / Time	Activity	Remarks
8:30 am - 9:00 am	Registration of participants	
9:00 am - 9:30 am	Welcome (Ukrainian Space Agency and UN-SPIDER)	Welcome Stakeholders and have a round table introduction
9:30 am – 10:00 am	Ukrainian Space Agency	Recent advances in the use of space technologies in Ukraine in the agricultural sector and key challenges to monitor impacts as per the Sendai framework targets
10:00 am-10:30 am	Coffee break, Group Photo	
Session 1: EvIDENz project and its workflows		
10:30 am-11:00 am	Overview by UN-SPIDER	Overview of the EvIDENz project and overview of the Sendai framework and its targets
11:00 am-11:30 am	ZFL	Segment of the workflow on the use of remote sensing-based technologies for drought monitoring and classification
11:30 am-12:00 pm	UNU-EHS	Workflow to estimate economic loss due to drought and understanding drought risk in Ukraine
12:00 am-13:30 pm	Lunch break	
Session 2: Monitoring droughts in Ukraine		
13:30 pm-14:00 pm	Government Agency in charge of Drought monitoring in Ukraine	Presentation on recent advances in Ukraine to monitor drought as a weather event and its impacts on hydrologic resources
14:00 pm-14:30 pm	State Emergency Service of Ukraine	Comments by State Agency on procedures to report on the implementation of the Sendai Framework using the Sendai Monitoring tool.
14:30 pm-15:00 pm	ZFL	Presentation of App to track droughts in Ukraine
15:00 pm-15:30 pm	Coffee break	
15:30 pm-16:30 pm	UN-SPIDER	Discussion: What are the current challenges in Ukraine regarding the compilation of data on impacts of droughts and other hazards to generate reports to be incorporated in the Sendai Monitoring tool?
16:45 pm-17:00 pm	UNU-EHS	Brief introduction to proposed Policy Brief and distribution of Policy Brief
17:00 pm- 17:15 pm	UN-SPIDER	Wrap-up of the first day
17:15 pm	End of stakeholder workshop	

15 May2018 (stakeholder & user workshop): National Academy of Sciences of Ukraine

Day / Time	Activity	Remarks
Session 3: Sendai framework monitoring and reporting		
09:00 am-09:15 am	UN-SPIDER	Recap of first day
09:15 am–09:30 am	UNU-EHS	Compilation of suggestions from participants regarding the Policy Brief
09:30 am-10:30 am	Discussion	Incorporating new methods to assess and report on crop losses in Ukraine: use of space-based information
10:30 am-11:00 am	Coffee break	
11:00 am-12:00 am	Discussion (continued)	Next steps to incorporate EvIDENz workflow to assess and report on crop losses in Ukraine: • Modifying workflow to address other crops in Ukraine • Testing • Potential implementation
12:00 am-14:00 pm	Lunch break	
Training segment – National Technical University		
14:00 pm-15:00 pm	Introduction to the Work-flows - UNSPIDER	Introduction to: • Types of data used in the workflows (MODIS composite products); • Additional, in-situ data needed; • Overview of EvIDENz Recommended Practice in the UN-SPIDER Knowledge Portal
15:00 pm-17:30 pm	Beginning of training on the use of workflows	Training on the use of the UNU-EHS workflow
17:30 pm	Wrap up	

Annex 5
Result of the evaluation of the workshop (participants from Ukraine)