



United Nations  
Educational, Scientific and  
Cultural Organization



***Increasing Resilience to Floods  
in South Sudan***

<b>Geographical scope/benefitting country(ies)</b>	South Sudan
<b>Duration (in months)</b>	24 Months
<b>Name and Unit of project Officer</b>	Mr. Salah Khaled, s.khaled@unesco.org, +211922404102
<b>Partner(s) institutions</b>	Technical institutions of South Sudan at the national, state and community levels, CSOs, Community Associations; ICHARM, Serbia Institute
<b>Total estimated budget inclusive of Programme Support costs</b>	US\$ 5,000,000

***Rationale and background***

Heavy rains starting in the beginning of August 2013 have caused damage to houses, crops and basic infrastructure in several of South Sudan's northern states. In September 2013, the humanitarian community and the government of the Republic of South Sudan officially declared that over 150,000 people have been affected by flooding, with particularly extreme cases in Northern Bahr-el-Ghazal, Warrap, Unity, Upper Nile and Jonglei. Other areas could not be assessed as the infrastructure is inundated and inaccessible, meaning that more people are likely to be affected. The effects of the heavy rains should not be only seen as a humanitarian issue (affecting supply of food, water and shelter) but also one of development as crops and infrastructure have been destroyed; the latter translates into near future food shortages and limitation of access to goods and services for a significant percentage of the population.

## **Why UNESCO?**

UNESCO's International Hydrological Programme (IHP) has been addressing the issue of hydrological extremes over its different phases and particularly during the last two phases. Under the current 8th phase, a fully fledged sub-theme is dedicated to hydro-disasters and climate change. UNESCO, in partnership with other actors, has been implementing since 2005 the International Floods Initiative (IFI) with its secretariat hosted by the UNESCO category II centre ICHARM (International Centre for Water Hazard and Risk Management). UNESCO, through IHP and IFI, has accumulated solid experience in addressing flood disasters in various regions and countries, such as Pakistan, Namibia, Benin and other countries in Asia. Expertise in addressing flood disasters which can be easily mobilized are available within UNESCO-IHE and UNESCO category II centres such as ICHARM and the Serbian Centre on climate change and water resources.

UNESCO is currently involved in addressing flood challenges in Namibia, Benin and South Sudan. Therefore, this project will build on and will benefit from the strong expertise available within UNESCO's International Hydrological Programme family on the issue of floods disasters. The project will contribute to the Expected Result 10 on water security in UNESCO's Result Framework.

## **Overall Goal/Objective**

The objectives of the project proposal herein are:

1. Enhance South Sudan's resilience to floods by supporting information management and early warning capabilities of relevant local, provincial, and national agencies to forecast floods, communicate flood warnings, and manage flood plains and infrastructures.
2. Reduce the human and socioeconomic impacts of flooding in South Sudan, to improve the social, economic, and ecological benefits of floods, and to foster safer human settlements near flood plains.
3. Establish a framework of international cooperation to enhance South Sudan's capacity in integrated flood and watershed management.

## **Main expected results**

### **A. Strategic Augmenting of Flood Forecasting and Hazard Mapping Capacity**

- Enhanced preparedness of South Sudan agencies or Institutes to forecast floods during extreme events in targeted flood prone catchments and its floodplains.
- Improved Flood hazard mapping capacity and ability to continuously update local information required for management of floods impacting current and possible future affected population.
- Improved sustainability of resettlement through risk reduction, timely evacuation, and safe rebuilding, which are enabled by access to updated flood risk information obtained from Flood Hazard Maps.

### **B. Capacity Development for Flood Forecasting and Hazard Mapping**

- Enhanced and long-lasting capacity for flood forecasting and hazard mapping within the broader framework of Integrated Flood Management and IWRM at multiple scales.
- Strengthened resilience of the country for floods and improved odds for social stability and sustainable development.

### **C. Knowledge Platforms for Sharing Transboundary Data and Community Flood Risk Information**

- Effective, efficient and quick response centered data-sharing strengthened through a knowledge platform for transboundary data.
- Enhanced flood warning service delivery capacities at the citizen-government interface through training on flood disaster management.
- Increased awareness of local and provincial decision makers of flood management issues within a participatory framework.

### **D. Establishing alternative early warning signal transmission systems**

- Established system for communication of the Early Warning signal
- Enhanced capacity in the dissemination of the flood warning signal
- Capacitated critical mass of experts

### **E. Established capacity on issues of Disaster Risk Reduction (DRR)**

- Increased awareness of National and provincial decision makers on DRR
- Increased awareness of local communities on DRR
- Trained trainers on DRR

## ***Activities and outputs/deliverables relating to the achievement of expected results***

### **A. Strategic Augmenting of Flood Forecasting and Hazard Mapping Capacity**

#### **A-1 Development of IFAS**

This pillar would enhance the flood forecasting capability of South Sudan technical institutions by installing the new flood early warning system and initiating the flood management in the country. The International Centre for Water Hazard and Risk Management under the auspices of UNESCO (ICHARM) has developed a concise flood-runoff analysis system as a toolkit for more effective and efficient flood forecasting in developing countries. This system is called "Integrated Flood Analysis System (IFAS)". A diagnostic hydrological analysis of floods in the Nile river basin in South Sudan will be carried by UNESCO (local consultant) in cooperation with the South Sudan technical institutions and ICHARM staff to clearly outline the forecasting modelling needs. The forecasting model development will be also implemented through close cooperation with UNESCO's International Flood Initiative (IFI), Japan Meteorological Agency, JAXA, NASA and their relevant partners. A detailed database comprising of the relevant spatial and temporal information will be prepared by UNESCO (local consultant) in cooperation with relevant South Sudan organizations in coordination with ICHARM.

This project will focus on developing a new IFAS as a flood forecasting and early warning system in Nile river basin which are currently not covered by flood early warning system in South Sudan.

Salient features of the IFAS are discussed below:

#### *1. Utilization of satellite-based rainfall as an input data*

IFAS will implement interfaces to input existing ground-based as well as satellite-based rainfall data, GIS functions to create river channel network and to estimate parameters of a default runoff analysis engine and interfaces to display output results. IFAS will use high resolution (0.1-deg. Grid, hourly) rainfall information using the multi-satellite (TRMM TMI,

Aqua AMSR-E, DMSP SSM/I, SSMIS, NOAA AMSU-B) as well as Geostationary Satellite data for near real time rainfall estimates using the GSMaP\_NRT system developed by JAXA. This system is currently capable of producing rainfall maps after four hours of observation. This component will need active collaboration between ICHARM and JAXA in Japan as well as the relevant organizations in South Sudan. Previous and current work implemented by other development partners, i.e. European Union's Joint Research Center work on flood early warning analysis using remote sensing, will be taken on board to avoid duplication, ensure complementarity and optimize use of resources.

### *2. Customization of the run-off analysis using local biophysical data*

The South Sudan-IFAS runoff analysis will be customized for local conditions using physics-based distributed hydrological modelling algorithms. Model parameters will be related to physical basin condition of land use and soil type using local and global data sets. Parameter estimates will be validated using the past flow estimates in gauged sub-basins, therefore, the application will be extended to other poorly gauged similar sub-basins. This component will be carried out by suitable experts in South Sudan under supervision by ICHARM senior staff in Japan.

### *3. Visualization Interface for displaying flood forecasting results*

IFAS will be customized for use by the local authorities with a dedicated interface to display output results (rainfall distribution and flood discharge) on the digital maps in a suitable user interface environment. Users will be easily able to identify the risk of floods using the river flow simulation results with the pre-calculated flood limits. This component will be lead by ICHARM with inputs from local consultant based in South Sudan.

## **A2- Floodplain and Hazard Mapping in South Sudan**

A second element of this intervention would focus on developing inundation maps and flood hazard maps using existing river bathymetric, remote sensing data, historic and recent flood inundation extent data, and digital elevation maps.

The mapping exercise will utilize images and data acquired during the recent flood from satellite based observations systems such as ASTER, NOAA, Landsat and SPOT through UN-SPIDER and other similar initiatives. Using existing and augmented digital terrain maps, inundation mapping (depth and extent of flooding using terrain models using IFAS flow and water height analysis for previous floods) and flood hazard mapping (likelihood of different extents of flooding due to breaching of different protection works) will be carried out for various river reaches in a suitable GIS interactive environment compatible with existing GIS systems in South Sudan. The flood hazard maps will also include possible routes and refuge bases for the safe evacuation activities, and likely estimate of population affected by floods.

Key components of this pillar will include:

- a) Diagnostic analysis to understand hydrological cycle and its links with floods
- b) Augmenting existing databases and information network technologies using the satellite based precipitation information in near real-time
- c) Integrating existing databases (population, satellite images, land cover, etc.) to estimate possible effects of floods on population
- d) Participating or co-leading early warning flood working group/taskforce to ensure coordination and timely dissemination of information
- e) Implementation of IFAS using remote sensing technologies
- f) Developing flood hazard mapping and hazard warning dissemination using IFAS flow and water level results for previous floods

## **B. Capacity Development for Flood Forecasting and Hazard Mapping**

As flood forecasting and hazard mapping are one aspect of integrated flood management, this component will be implemented in close relationship with possible capacity development activities for integrated flood management in the framework of IWRM (Integrated Water Resources Management) at national, basin and sub-basin level.

This component would focus on strengthening South Sudan's capacity to produce, and disseminate flood forecasting and hazard mapping through training courses at ICHARM and in cooperation with UNESCO's wider network such as the Institute for Water Education (IHE). Key activities will include:

- Master's Degree training at ICHARM for 2 South Sudan experts with course project on flood forecasting and early warning with satellite data available in Japan – the research theme of the students will focus on IFAS implementation;
- A short training course at ICHARM per year (2 total) for ten senior water managers on IWRM and integrated flood management;
- Training workshops in South Sudan or other neighbouring countries conducted by UNESCO field office on use of flood forecasting models and flood hazard maps (2 times per year - 4 in total) for National, Provincial and Local Government officials (30 participants per workshop) in South Sudan through centres under the auspices of UNESCO.

## **C. Knowledge Platforms for Sharing Transboundary Data and Community Flood Risk Information**

This component would also strengthen the service delivery capacity at different levels through the provision of necessary hardware (e.g. provision of computers to relevant regional offices) and systems support and through additional human resources capacity for dissemination of flood related information; training on needs based and participatory planning; grievance redress and advocacy; and information sharing as well as provision of special technical expertise related to flood risk reduction. This will result in strengthening of the flood forecasting dissemination system.

To strengthen local capacity, the interventions will focus on empowerment of local communities; awareness and sensitization of political leadership and elected representatives on flood related damages, and sensitization and training of local authorities by improving the training curricula and advocacy to understand the needs of vulnerable groups and women to cope with extreme floods.

The implementation of these activities will build on the previous results obtained from Flood Forecasting and Early Warning System in Pakistan and UNESCO's International Hydrological Programme and its wider network of centers of excellence such as the Integrated Water Resources Management Guidelines for floods management. Training and capacity building activities would be conducted in full partnership with local and provincial authorities. This activity will be led by UNESCO field office in Juba in collaboration with ICHARM, JAXA.

This component will include the following inputs:

- Conceptualization of the software platform
- Software encoding using web based technologies for data sharing
- Installation of software at the appropriate levels

## **D. Establishing alternative early warning signal transmission systems**

The reception of vital information on an upcoming flood event by the communities residing in the area to be inundated is of extreme importance and gives value to the early warning system to be established. Appropriate technologies and systems will be evaluated in order to define their use in various regions of South Sudan. Community radio stations and use of SMS will be initially evaluated, while other options on Java, IOS and Android platforms will be discussed and considered.

The establishment of central system(s) connected to that of the Early Warning System is the first deliverable of this activity. Provision of equipment necessary for the system and training of personnel on their use and maintenance are the main pillars upon which capacities will be built.

## **E. Established capacity on issues of Disaster Risk Reduction (DRR)**

Increasing losses from disasters have driven the paradigm shift from reactive emergency response to proactive DRR. DRR strives to reduce disaster risk by addressing the causal factors of disasters in terms of exposure to natural hazards and vulnerability of communities (UNISDR, 2007). DRR activities reduce the likelihood of a disaster occurring or strengthen community resilience to respond and cope with disasters (AusAID, 2012). Disasters are recognized as key threats to development gains, exposing vulnerable communities to income shocks and destroying schools, hospitals and other critical infrastructure vital for sustainable development.

The objective of this activity is to educate a number of entities and communities on DRR and its components and raise awareness and sensitize both decision makers and communities on the matter.

### ***Beneficiaries and stakeholders***

The project will benefit all flood-affected areas by working closely with all relevant departments and institutions in South Sudan. Primary beneficiaries will be the personnel of the various technical entities involved during a flooding occurrence. The communities residing in the most flood prone zones will be the ultimate beneficiaries.

### ***Implementation strategy***

The project is aimed at enhancing the country's capacity to deal with floods and watershed management in a holistic manner while providing for strategic strengthening of the country's flood early warning system to ensure safe evacuation and resettlement of the affected population. The project will further explore ways of transmitting the early warning via appropriate methods (SMS, radio etc.) to the communities residing in the vulnerable areas, with a particular focus on messaging to target women in communities who are the primary household caretakers in times of crisis.

This project is developed around the following interrelated pillars:

- Strategic augmenting of flood forecasting and flood hazard mapping capacity
- Capacity Development for Flood Forecasting and Hazard Mapping
- Master plan for flood management in South Sudan
- Early warning transmission, management and dissemination

- Capacity building on Disaster Risk Reduction (DRR) through training and awareness raising

Built into these components are short-term and medium-term interventions to provide the much needed support for immediate strengthening of the early warning systems, while building on the entry points created by current floods to address the longer term disaster management and data collecting issues. Following is a succinct description of the proposed interventions under each of the components:

1. Strategic Augmenting of Flood Forecasting and Hazard Mapping Capacity
2. Capacity Development for Flood Forecasting and Hazard Mapping
3. Knowledge Platforms for Sharing Transboundary Data and Community Flood Risk Information

Following the technical component (flood mapping and forecasting), interventions will be implemented to ensure that the early warning message reaches the vulnerable communities and thus decreasing the effects of the hazard. Furthermore, cultivating a culture of disaster risk reduction will be promoted, raising awareness on the value of prevention rather than response and sensitize government officials and communities while capacitating them on issues of DRR. The following activities are envisioned:

- I. Establishing multiple early warning signals transmission platforms
- II. Training on the newly developed tools

### ***Sustainability and exit strategy***

This project will build upon the outcomes of the Capacity Building Workshop on Floods Risk Management, IWRM and Preparation of National Water Capacity Building programme, held in Juba, South Sudan, on the 27-28 May 2013. The workshop participation was drawn from several governmental ministries and agencies such as MWRI, MOPI, MAFCRD, MWC&I, MED, the NGO fraternity, and UN agencies, all of whom are expected to play an instrumental role in taking ownership of this project and its outcomes.

The sustainability of the regional flood early warning system will be ensured by the integration of a system of seasonal flood forecasting at the regional IGAD Climate Prediction and Application Centre (ICPAC) based in Nairobi. After the project, ICPAC will continue its support to IGAD member countries and their capacity building to ensure that the early warning tools established are utilized in flood forecasting and mitigation planning, as part of its normal mandated duties.