1. Activity Reporting.

Activity 568-2014

Analysis and mapping of climate impact variables (e.g. catastrophic flooding events, droughts) - using RS data and publically available spatial datasets - including economic damage to agriculture, ecosystems andlivelihoods. Analysis of changing flood pattern under future climate scenarios, economic implications and links to insurance

Status	Complete	Milestone	2.1.1 2014
Start date	2013 Jan	End date	2014 Dec

Description: Information on flood-related risks and their recent changes, expressed in terms of frequency of flooding, population affected, Economic losses, crop area affected , etc. - is important for formulating flood protection measures and targeting associated investments. Such information is not available in Africa and Asia at the fine scale of spatial resolution, at which actual decisions have to be made.

Status: Complete. This activity produced several outputs but it will remain ongoing in 2015 and supported primarily by bilateral funds, and WLE. This activity has also strong links with the work supported by the CCAFS regional coordinator for South Asia - on comprehensive risk assessment and mapping in South Asia (reported separately in SA Regional report). The mapping products describing flood risks for South Asia are now available for view and download on IWMI web site. Similar products for SEA are on the way. Several papers and research reports are either accepted for publication or at the final stages of completion. IWMI joined a global Disaster Risk Reduction community and had a successful large plenary session on at the 3-d Global Risk Reduction Forum in Davos. IWMI also joined the two global GWP-WMO led programs - on Integrated Drought and Flood Management. The joint GWP-IWMI work (IWMI part supported by CCAFS funds in 2014) - on developing of on-line Drought Monitoring System (DMS) for South Asia is under way and the DMS is expected to go live in the end of 2015/ beginning of 2016

Gender Component: Not defined

Objectives:

1. To achieve activty deliverables

Deliverables:

Description	Type	Year	Status	Justification
Maps and datasets describing the pattern of catastrophic floods' (triggered by progressive Climate Change) impacts on agriculture in recent years - in South Asia, at different spatial resolution. Draft information products formulated for use in flood insurance. Mapped product(s) on the combined impact of floods, droughts, sea level rise and other natural disasters exacerbated by Climate Change in South Asia.	Data	2014	Complete	
A publication (IWMI research Report and/ or journal paper) on i) the pattern of catastrophic flooding in South Asia and flooding impacts on agriculture and ii) the pattern and combined impact of natural disasters / vulnerability to them in South Asia	Peer-reviewed journal articles	2014	On going	Significant effort went in 2014 into developing new proposals, including those under new CCAFS mode of operation. This partially affected the progress. However all required information for the content is ready and we expect that reports will be submitted in the first quarter of 2015.
A contribution (a chapter describing some recent achievements in research on floods and droughts) has been made to the IWMI Flagship Publication in 2014: "On Target for People and Planet". The Chapter was co-authored by the CCAFS Director. http://www.iwmi.cgiar.org/Publications/Books/PDF/setting_and_achieving_water-related_sustainable_development_goals.pdf	Non-peer reviewed articles	2014	Complete	

Partners:

1- CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS/CRP7):
P.K. Aggarwal <p.k.aggarwal@cgiar.org>

2- Birla Institute of Technology (BIT):
C. Jeganathan <jegan_iirs@yahoo.com>

3- The World Bank:
Mook Bangalore <mbangalore@worldbank.org>

Location(s):

Regions: South Asia (SAs),

Activity 746-2014

Feminization of agriculture, vulnerability and adaptation: building resilience in a changed rural context.

Status	Complete	Milestone	1.1.1 2015 (1)
Start date	2014 Jan	End date	2014 Dec

Description: Research will (1) analyse how agricultural practices change following male out-migration, particularly for households making the transition from being male headed to women headed. (2) Investigate constraints women farmers face in accessing irrigation resources following male out-migration, and how this affects climate change resilience (3). identify the impact of out-migration and feminization on the management and maintenance of existing irrigation infrastructure. (4) Initiate small-group discussions among men and women farmers to foster community cooperation using results from last years participatory video project (5) Enhance dialogue among farmers and other stakeholders such as local government officials, private actors, scientists, and non-governmental organizations.

Status: Complete. In 2014 our work was focused on achieving uptake, dissemination and outcomes based upon our 2013 work, particularly through a series of communication activities related to the participatory video project. We also followed up to answer some new research questions which arose during the 2013 work on gendered vulnerability to climate change. Our focus was on the impact of out-migration on agricultural decision making and investment. 120 women were interviewed in Bihar and Nepal, combining qualitative and quantitative data. This invaluable data set was analyzed in detail, and a report has been completed which sheds some light on the agricultural constraints posed by migration for stay behind populations. A further 40 interviews were carried out in Cooch Behar of West Bengal, and a joint output will be produced this year in collaboration with the ACIAR/WLE funded 'Improving dry season agriculture in the EGP' project.
We are focusing on achieving outcomes from our results by linking our findings up with new IWMI led projects in the region

Gender Component: This research is focused explicitly on engaging with gender issues in agriculture and climate change adaptation in South Asia

Objectives:

1. UNDERSTAND THE IMPACT OF THE FEMINIZATION OF AGRICULTURE ON VULNERABILITY AND ADAPTATION:
   The following questions will be addressed
   1.At a household level, it is important to better understand how agricultural practices change following male out-migration, particularly for households making the transition from being male headed to women headed. There is limited knowledge as to whether new crops or agricultural

water management patterns are being introduced, or whether resources are being diverted into other livelihood activities to compensate for the loss of male labour. This applies particularly for marginal and tenant farmers who are less likely to hire outside workers to meet labour shortages.

2. While it is known that some women farmers face difficulties in accessing irrigation resources following male out-migration, the dynamics through which this occurs is not fully understood. Possible processes which merit attention include access male social networks, gender ideologies which restrict interaction with male farmers to negotiate access to irrigation either from communal or private sources, or difficulties accessing government subsidy or credit schemes due to lack of appropriate documents (eg. land ownership certificates).

3.There is little knowledge of the impact of out-migration and feminization on the management and maintenance of existing irrigation infrastructure which are the common property of the community such as canals, ponds and group owned tube wells. There was a perception locally that resources were in a poor state of disrepair, driven in part by the out migration of males, and the failure for women to be given the opportunity to take their place in management. Given the different histories of communal institutions and different migration patterns, there are likely to be significant differences between the hills and the plains region with regards to how these are managed.

2. BUILD RESILIENCE IN FEMINISED AGRICULTURE:

To achieve this objective, we would use some of the twelve films that were produced by men and women farmers during the participatory video project conducted in Dhanusha District to animate multi-stakeholder platforms on the current challenges linked to climatic and societal changes that farmers face. Two types of platforms would be created with the following objectives:

1. Initiate small-group discussions among men and women farmers to foster community cooperation

2. Enhance dialogue among farmers and other stakeholders such as local government officials, private actors, scientists, non-governmental organizations etc.

The premise is that videos can enhance awareness and empathy and offer a useful tool for building trust.

Deliverables:

Description	Type	Year	Status	Justification
A publication on the impact of feminisation on the patterns of agricultural investment, and how his affects the capacity of women farmers to adapt to climate change	Non-peer reviewed articles	2014	Complete	
A 30-40 min film on the “Vulnerability of farming systems under climatic and societal change in the Tarai: a gendered perspective”	Articles for media or news (radio, TV, newspapers, newsletters ,etc.)	2014	Complete	
A publication on the impact of media and public debates in changing beliefs on vulnerability and changing adaptation policies.	Peer-reviewed journal articles	2014	Extended	The public debates were delayed to October-December 2014 because of search for additional sources of funding until June 2014. The IWMI research team are still waiting for the transcript of one of the workshops which will be used for data analysis.
A series of 6 radio discussions at the local level on causes and impacts of climatic and societal change for men and women, including topics such as male out-migration, irrigation, the dowry system, changing farming practices, social capital, etc.	Articles for media or news (radio, TV, newspapers, newsletters ,etc.)	2014	Complete	
A set of guidelines for the Department of Irrigation of Nepal to integrate gender into their agricultural water management projects in the context of male out-migration.	Capacity	2014	Complete	
Paper on climate change vulnerability and gender	Peer-reviewed journal articles	2014	Complete	
Policy brief on gendered vulnerability to climate and non-climatic stress in Nepal and Bihar	Non-peer reviewed articles	2014	Complete	

Description	Type	Year	Status	Justification
Policy brief on gendered vulnerability to climate and non-climatic stress in Nepal and Bihar	Non-peer reviewed articles	2014	Complete	
Policy brief on climate change adaptation for women in Bangladesh	Non-peer reviewed articles	2014	Complete	
An extensive literature review on gender and climate change vulnerability in the Ganges Basin	Non-peer reviewed articles	2014	Complete	
A research report on small scale water storage in the Nepali hills, co-funded as part of a CIDA study	Peer-reviewed journal articles	2014	Complete	

Partners:

1- Saki Bihar:

Ritesh Kumar <sakhibihar@gmail.com>

2- South Asia Institute of Applied Studies (SIAS):

3- Nepal Madhesh Foundation (NEMAF):

Location(s):

Countries: India, Nepal,

Activity 747-2014

Developing alternative carbon Investments in Ecosystems for Poverty Alleviation

Status	Complete	Milestone	3.3.1 2014
Start date	2013 Jul	End date	2014 Dec

Description: The overarching aim is to establish whether investment in soil carbon can be used successfully to alleviate poverty (in addition to or as an alternative to aboveground carbon) by restoring, enhancing or protecting the goods and services provided by ecosystems in regions where soils are degraded or under threat of degradation. We will aim to demonstrate the lasting pro-poor benefits of tackling soil degradation using contrasting research areas in Sub-Saharan Africa; Ethiopia and Uganda. We argue that effective investment (market or non-market) in soil restoration and management, with soil carbon as a key indicator, could promote and safeguard the delivery of multiple ecosystem services central to poverty alleviation under changing climate.

Status: Complete. This bilateral project progressed well. There were no major issues except some delay in collecting spatial soil samples. Preparation of experimental design documents for exclosure studies and on-farm trials, review of soils, hydrology, land use, and topography of the study site, establishment of on-farm trials, experimental data collection - all progressed well. The first year data from the on-farm trials has been collected and a preliminary analysis has been carried out to determine the impacts of organic and inorganic soil amendments and their combinations on crop yield. Vegetation inventory on the range of exclosures has been completed and a preliminary analysis has been conducted to determine the changes in species richness, diversity and vegetation composition following the establishment of exclosures. The simulation model for farm income and nutrition impact analysis of organic soil amendments interventions is populated. Alternative scenarios from different management interventions are defined to carry out the simulation exercise. Overall project progress was assessed in the last project meeting in January 2015. The project will continue in 2015, but since CCAFS moved to a new mode of operation since January, and IWMI has no role in the new Flagship 3 on mitigation, the activity is considered to be complete

Gender Component: Not defined

Objectives:

1. Investigate the effectiveness of soil-based and crop management interventions in restoring SOC and adapting climate change/variability.
2. Investigate the changes in below and aboveground C following land use changes and assess the implications to adapt climate variability.
3. Determine the changes in key soil physical and chemical properties and nutrient flows following land and crop management interventions and land use changes.

Deliverables:

Description	Type	Year	Status	Justification
New information on how soil-based interventions and appropriate land uses help to adapt climate variability/chnage.	Data	2014	On going	the implementation of the on-farm trials was planned to run fro two consecutive years (2014 & 2015). as discussed above the first year data from the on-farm trials has been collected and synthesized.
Report/publication on how below and aboveground C changes with land use changes, particulrly with conversion of communal grazing lands to exclosures. In addition, report/publication on the changes in vegetation composition and diversity will be delivered.	Peer-reviewed journal articles	2014	On going	SARI, one of the partner, of this project was not an able to finalize the estimation of the changes in aboveground biomass following the establishment of exclosures.
Project report synthesized based on published and grey literature. The review document was prepared to identify the available data and data need for different models that are used by different project members.	Research report (i.e. workshop report, consultant's report, discussion paper, project report, student thesis, etc.)	2014	Complete	
A report/document prepared to guide the on-farm trials on organic soil amendments.	Research report (i.e. workshop report, consultant's report, discussion paper, project report, student thesis, etc.)	2014	Complete	

Description	Type	Year	Status	Justification
A report/document prepared to guide the restoration study. The document mainly describes data collection and analysis procedures related to the restoration study.	Research report (i.e. workshop report, consultant's report, discussion paper, project report, student thesis, etc.)	2014	Complete	

Partners:

1- Ethiopian Institute of Agricultural Research (EIAR):
Anteneh Fekadu <antenehmill@yahoo.com>

Location(s):

Countries: Ethiopia,

Activity 768-2014

Assessment of i) impacts of 2 oC global warming on water resources development in the Blue Nile basin, and ii) adaptive capacity of farmers to it.

Status	Complete	Milestone	1.1.1 2014
Start date	2011 Oct	End date	2015 Feb

Description: In this project, future impacts on natural environment (river flow) and infrastructures (hydropower, irrigation) will be projected for one of the most vulnerable regions – the Blue Nile basin. Climate change impacts on current as well as planned water resources developments in the basin will be evaluated by integrating runoff and water resources planning models. These models will also allow us to assess how large scale water resource structures contribute to climate adaptation. Model inputs are an ensemble of climate inputs for 2 Degree Celsius target using different climate scenarios, models, and dynamic downscaling results. A key product expected from this project is potential future climate changes, impacts and the corresponding likelihood in the basin. It will answer the question is the water resources development in the Blue Nile basin in danger in a +2°C scenario? The project is supported by the European Commission's 7th Framework and is coordinated by the Climate Service Center (CSC) in Hamburg, Germany.

Status: Complete. Essentially complete activity. Under this activity, a number of outputs are produced. These include (i) a participatory Workshop on Adaptive Capacity to Climate Change in the Upper Blue organised and its report- finalized, (ii) key informant interviews undertaken in the Lake Tana sub-basin and the report is finalized, (iii) An M.Sc. student will submit his final thesis in February 2015. (iv) Climate data of about 600 GB is obtained from CORDEX simulations and the data are archived at IWMI portal. A general observation that can be made is that during the past 2 years, the global climate community started to discuss the possibilities of a 4o C global warming...

Gender Component: Not defined

Objectives:

1. Prepare an ensemble of climate inputs to runoff and water resources models of the Blue Nile basin for 2°C target (different scenarios, models, downscaling).
2. Assess impacts of 2 degree global warming on water infrastructure (hydropower, irrigation) in the Blue Nile and the role of large scale infrastructure for adaptation.

Deliverables:

Description	Type	Year	Status	Justification
An ensemble of climate inputs for 2°C target (different scenarios, models, downscaling) for the Blue Nile. Impacts of 2 degree global warming on water infrastructure (hydropower, irrigation) - assesssed, and the role of large scale infrastructure for adaptation - evaluated. CORDEX (Coordinated Regional Climate Downscaling Experiment) downscaled data of climate models outputs available online through IWMI web site together with setup basin models themselves - where feasible and appropriate - for public use	Datasets	2014	Complete	
Reports/ Journal articles on the structure of data, models ensemble, and final report on impacts, vulnerability and possible water resources management strategies under 2°C in the Blue Nile Basin	Conference proceedings/papere	2014	Complete	
Report of the participatory Workshop on Adaptive Capacity to Climate Change in the Upper Blue Nile Basin held at Arba Minch University, Arba Minch, Ethiopia on 27th of December 2014.	Workshop	2014	Complete	
Assessment of adaptive capacity in the Lake Tana sub-basin	Research report (i.e. workshop report, consultant's report, discussion paper, project report, student thesis, etc.)	2014	Complete	

Partners:

1- Agenzia nazionale per le nouve tecnologie, l'energia e lo sviluppo economico sostenibile (ENEA):
Dr. Sandro Calmanti <sdr.cal@gmail.com>

2- Potsdam-Institut für Klimafolgenforschung (PIK):
Valentin Aich <aich@pik-potsdam.de>

Location(s):

Countries: Ethiopia,

Activity 771-2014

Synthesis of experiences and solutions from Africa and Asia on how farming systems adapted to progressive climate change through improved water

Status	Complete	Milestone	1.1.1 2015 (1)
Start date	2014 Jan	End date	2014 Jul

Description: The book on “Climate change and agricultural water management in developing countries” contains 15 chapters and will be published in the CABI Climate Change Series. These chapters are contributed by 10 research partners and present their studies on climate change impacts and adaptations in agricultural water management at global level and in developing countries in Asia and Africa. Surface water and groundwater management, and adaptations to sea level rise are included in the book.

Status: Complete. For all practical purposes, the activity is complete. Some minor work remains on reviewing and editing of the book - working primarily to address some Publisher requests / comments typical for the final stage. The Book is anticipated to be published by CABI in mid 2015 .
In the meantime, another book and a paper were published by collaboration of IWMI team with partners:
Lebel, L., C.T. Hoanh, C. Krittasudthacheewa and R. Daniel (Eds.) (2014). Climate risks, regional integration and sustainability in the Mekong region. Petaling Jaya, Malaysia: Strategic Information and Research Development Centre (SIRDC) and SUMERNET, Stockholm Environment Institute (SEI). 405 pp.
Phong, N.D., C.T. Hoanh, T.P. Tuong and R. Wassmann (2014). Sea level rise effects on acidic pollution in a coastal acid sulphate soil area. In: Ames, D.P., Quinn, N.W.T., Rizzoli, A.E. (Eds.) (2014. Proceedings of the 7th International Congress on Environmental Modelling and Software, June 15-19, San Diego, California, USA. ISBN: 978-88-9035-744-2.

Gender Component: Not defined

Objectives:

1. To provide a book that summarises experiences and solutions in adaptation to climate change in agricultural water management in developing countries

Deliverables:

Description	Type	Year	Status	Justification
A book summarising experiences and solutions in adaptation to climate change in agricultural water management in developing countries	Books	2014	Complete	There is no major work left on the Book, and it is simply awaiting to be published by CABI
A Book on Climate risks, regional integration and sustainability in the Mekong region.	Books	2014	Complete	
Sea level rise effects on acidic pollution in a coastal acid sulphate soil area	Books	2014	Complete	

Partners:

1- Key Laboratory of Water Resources and Hydropower Engineering Science (WaterLab):
Dr. Jun Xia <xiaj@igsnrr.ac.cn>

2- WorldFish:
Dr. Suan Pheng Kam <s.kam@cgiar.org>

3- International Rice Research Institute (IRRI):
Dr. Bjoern Ole Sander <b.sander@irri.org>

4- Tashkent Irrigation and Melioration Institute (TIIM):
Mr. Mannapova Dilafruz <pepiwm@globalnet.uz>

5- Institute of Environment and Sustainable Development in Agriculture (IEDA):
Mr. Liu Qin <liuq@ieda.org.cn>

6- University of the Philippines Los Baños:
Dr. Felino P. Lansigan <fplansigan@uplb.edu>

7- Stockholm Environment Institute (SEI):
Dr. Chayanis Krittasudthacheewa <chayanis.k@sei-international.org>

8- Nong Lam University (UAF):
Dr. Ngo Dang Phong <n.phong@irri.org>

9- UNESCO-IHE Institute for Water Education (UNESCO-IHE):

Dr. Shreedhar Maskey <s.maskey@unesco-ihe.org>

Location(s):

Regions: East Africa (EA), West Africa (WA), South Asia (SAs), South East Asia (SEA),

Activity 772-2014

Analysis and field testing through science-stakeholder interactions of appropriate adaptation options in rice production systems in Andhra Pradesh and Tamilnadu states of India;
Perception mapping of rice farmers, adatation strategies and quantifying the impact of climate change on rice yield and variability in rice yield in major rice growing states of India

Status	Complete	Milestone	1.1.1 2015 (1)
Start date	2014 Jan	End date	2014 Dec

Description: Pilot and monitor the climate change adaptation measure in selected river basins in India; introduce various capacity building programs suited to the farmers for adapting the adaptation strategies and developing policy options for upscaling the various adaptation strategies at macro level.
Survey of climate change perception of the rice farmers, documentation of the various adaptation measures followed in different rice growing regions of Indis and quantification of the impact of climate change on rice yield as well as variability in rice yield at current, mid century and end century levels by applying field tested econometric models. The study will use both cross section data and time series data for 30-40 years.

Status: Complete. This is primarily a bilateral project with CCAFS co-funding in 2014. There will be no co-funding from CCAFS from 2015 onwards. Annual review of the project is being planned for March 2015. The project will continue till March 2016. Implementation on direct seeding of rice, alternate wetting and drying and machine transplantation of rice was carried out in 367 acres with 74 farmers. The Kharif 2014 implementation was completed in 525 acres and 175 farmers. Soil samples were collected from farmers for soils analysis and fertiliser dose recommendations. Soil samples (85) were analysed by Coromandel International limited in a PPP mode without any charges to the farmers.
Assessment of climate change impact on rice farmers in India was completed in 13 states in India study. Time series and primary data were collected and draft reports completed.

Field visit was organized along with the irrigation department official in DC 4. With the project intervention, and recent training conducted to the irrigation department officials, they have initiated the irrigation scheduling and announced the schedule to the farmers. Field day at the village clusters on new variety and water management practices in Dec 2014.

Gender Component: A 2-days work shop in April in Chennai on “Monitoring and Evaluation – Gender Perspectives”. Gender sensitive M &E is a result based frame work, reveals the extent to which a project has achieved improvements in the lives and social and economical status of women and men. For this objective, during the work shop discussions were focused on gender sensitive annual plans and developing the indicators for each intervention which will measure the progress and results.

Objectives:

1. To pilot different (successful) adaptation strategies in different basins in Andhra Pradesh and Tamil Nadu States and introduce capacity building programs and policy interface with government departments for upscaling of successful interventions
2. To document the climate change perceptions of the rice farmers, their adaptation strategies and quantify the impact of climate change on rice yield and its variability in different rice growing states of India

Deliverables:

Description	Type	Year	Status	Justification
List of successful climate change adaptation strategies in rice production and estimated cost of those in TN and AP	Data	2014	On going	It is on-going because the main bilateral project is on-going.
List of adaptation strategies followed in different rice growing (water surplus/deficit) regions of India and macro picture of rice yield reductions in in those	Peer-reviewed journal articles	2014	Complete	
Capacity building programs along with the training modules - for TN and AP states	Capacity	2014	On going	The capacity building programs will continue in 2015 as part of bilateral Project. The adaptation practices on alternate wetting and drying, dry seeding of rice and machine transplantation will be disseminated through capacity building programs as a part of up-scaling strategy.

Partners:

1- Norwegian Institute for Agricultural and Environmental Research (Bioforsk):
Udaya sekhar Nagothu <nagothu.udayasekhar@bioforsk.no>

2- Acharya N. G. Ranga Agricultural University (ANGRAU):
Dr Gurava Reddy <reddy.gurava@gmail.com>

3- Water and Land Management Training and Research Institute (WALAMTARI):
Dr Tirupathiah <dg.walamtari@gmail.com>

4- Tamil Nadu Agricultural University (TNAU):
Geethalakshmi .V <geetha@tnau.ac.in>

Location(s):
Countries: India,

Activity 775-2014

Identifying prospective sites in the Mekong Basin for sustainable enhancement of groundwater utilization

Status	On going	Milestone	1.1.1 2014
Start date	2013 Jan	End date	2015 Dec

Description: Groundwater development can potentially offer water on demand for crop and livestock diversification and intensification but experience in the use of groundwater for irrigation is limited but could offer a great deal of promise if the available resources are adequately understood and sustainably developed. This work aims to establish a rational basis for selecting prospective areas and aquifers for groundwater development that also takes into account important non-hydrogeological variables such as soils, land capability, irrigation potential, proximity to markets etc. RS and GIS techniques, backed up by groundtruthing and field study data, are being used to map groundwater development hotspots. At the local scale existing data is being collated and new data collected and organized into an information management systems.

Status: On going. Steady progress has been made on this activity. Evaluation of the current state of groundwater governance in Lao PDR reported, for the first time ever, identifying the range of problems faced and offering pathways forward for improved groundwater management. Recharge assessments are underway in the lower Nam Ngum basin using analytical and numerical models. Three Lao nationals are being trained at M.Sc level. Three more papers are in progress. Ekxang village, one of the focal sites for the project, has been named a CCAFS Climate Smart Village – one of 6 in the GMS region. Baseline studies on the situation/needs/institutions are underway with new partners including NAFRI, Cuso Intl. (Canadian NGO), MDC (local iNGO), and the relevant District-level extension agency. The site will be a focus of numerous CCAFS Flagship Program research activities, in which at least one project led by IRRI and another led by CIAT include IWMI as a partner. The project will finish in 2015. The project web site: http://gw-laos.iwmi.org/.

Gender Component: Not defined

Objectives:

1. Assess means of buffering against climate variability by quantifying spatio-temporal variations in aquifer recharge rates and groundwater development potential at the country scale

2. Compile available data from diverse sources to develop a database on the state of knowledge of groundwater availability and suitability for agriculture and other purposes

Deliverables:

Description	Type	Year	Status	Justification
Publication that reveals the groundwater development hotspots and indicates overall potential for irrigation expansion in Lao PDR	Peer-reviewed journal articles	2014	Complete	This is another, primarily bilateral ACIAR- funded project that extends in to 2015. The country level (Lao- PDR) assessment has been done and preliminary results shared with next users. The validation component ran into difficulty with paucity of independent data. We have made extensive searches and have identified a pathway forward which will be in implemented over the first half of 2015 to validate and finalize and disseminate the products.
A comprehensive and accessible electronic database and groundwater information system that meets the needs of agencies mandated to manage groundwater	Data	2014	On going	Initial recharge assessment based on model simulations (WetSpass and Visual HELP) and revisions are being made in 2015. A database has been prepared based on available literature but has yet to be shared with next users.

Partners:

1- Department of Water Resources (DWR):

Ms Phaylin Bouakeo <phaylinbouakeo@yahoo.com>

Location(s):

Countries: Laos,

Activity 776-2014

Climate change and watershed development impacts on groundwater at the river basin and village scales in India

Status	Complete	Milestone	1.1.1 2014
Start date	2011 Jan	End date	2014 Dec

Description: Assessment of climate change and watershed development impacts on the groundwater resources at the river basin and village scales. Community involvement in watershed development to augment groundwater resources to mitigate climate variability

Status: Complete. This is primarily bilateral activity (ACIAR-funded) that is to last till June 2015. Due to departure of the Project Leader - Sanmugam Prathapar - in early 2014, the project underwent significant staff changes.
This affected some deliverables, but others were produced. For example, publications targeting the entire India, were refocused to specific states - evaluating ongoing groundwater storage trends that can help ensure food security in hardrock aquifers' areas. Journal papers have been drafted and submitted to Agricultural Water Management Journal

Gender Component: Not defined

Objectives:

1. Evaluated present and future groundwater resource capacity to provide food security in hardrock aquifer areas of India
2. Develop modelling tools to assess future scenarios
3. Trial the involvement of villagers and high school students participating in monitoring of recharge structures and responses of the groundwater

Deliverables:

Description	Type	Year	Status	Justification
Publication that evaluates present and future groundwater resource capacity to provide food security in hardrock aquifer areas of India	Peer-reviewed journal articles	2014	Complete	
Participatory approach verified by data from instrumented sites that measure climate and groundwater variables	Peer-reviewed journal articles	2014	Complete	
Evaluating the Effectiveness of Water Infrastructure for Increasing Agricultural Production – A Case Study of Gujarat, India (Submitted to Ag water management); and Evaluating the Effectiveness of Managed Aquifer Recharge Structures to Improve Groundwater Supplies in Rajasthan, India (under internal review before submission to Journal).	Peer-reviewed journal articles	2014	Complete	

Partners:

Partners not defined

Location(s):

Countries: India,

Activity 569-2014

Evaluation of the cell-phone/ web based weather and water and flood information/ advisory service provided to farmers and the rural agencies. Roll-out of cell-phone based information services to a larger community of users in participating countries. Outscaling plan development, Identification of interested service providers

Status	Complete	Milestone	2.1.1 2014
Start date	2011 Jan	End date	2014 Dec

Description: Provision of targeted new information services to farmers, on conditions of their individual fields and crops, irrigation scheduling, and anticipated water availability - alls based on modern satellite sensor data and mobile technology, is already a reality in many European countries and America. This activity explores the potential of rolling out such services in Africa.

Status: Complete. This IFAD-funded Project and all its activities have now been completed. The project designed procedures for the use of complex climate information derived from satellite datasets and delivery of this information (in the form of weather, biomass and water requirements) to smallholder farmers. Several manuals were developed for the above and training sessions held over the life time of the project; manuals and brochures on the use of ICT services was translated in local languages. Project closure workshop was held in 2014 in Netherlands to highlight the project outcomes, with participation of partners from 3 countries (Ethiopia, Sudan and Egypt). Training was provided (in Colombo) to the staff of Hydraulic Research Centre (under Ministry of Water Resources of Sudan) in methods and tools related to flood mapping and modeling for operationalising them in the Gash catchment and irrigation scheme. Research was disseminated through international events like ICT4D (Ghana) and ICT4Ag (Rwanda) - in 2014 alone.

Gender Component: The implementation of the cell-phone and web-based service and the capacity building programs specefically target the gender integration of the program participants.

Objectives:

1. To develop, test and pilot innovative approaches and technologies to provide relevant information and affordable advice in a timely manner to end users.
2. To develop capacity of different stakeholders to make use of the information and advice for better decision making, negotiation and and accountability.
3. To develop interest of agri-industry and other service providers in supporting further expansion and continued services.

Deliverables:

Description	Type	Year	Status	Justification
Cell-phone and web-based information systems on climate water and crop monitoring at field scale are tested in pilot areas in at least two countries.	Capacity	2014	Complete	
Evaluation of the service completed in Ethiopiaand Sudan sites	Research report (i.e. workshop report, consultant's report, discussion paper, project report, student thesis, etc.)	2014	Complete	
Synthesis report, communication material and an end of the Project Workshop organised with participation of key stakeholders.	Workshop	2014	Complete	

Partners:

1- Ministry of Irrigation and Water Resources, Sudan (MOIWR):
Younis Gismalla <hrs_younis@hotmail.com>

2- Hedbez Consultants PLC (HEDBEZ):
Bezabih Emana <b.emana@gmail.com>

3- Soil, Water and Environment Research Institute (SWERI):
Ahmed Taher <ahmedtahermoustafa@aol.com>

Location(s):

Countries: Egypt, Ethiopia, Sudan,

Activity 825-2014

Evaluating adaptation options for Ag-Water Sector in Sri Lanka.

Status	On going	Milestone	1.1.1 2014
Start date	2014 Jan	End date	2016 Jun

Description: Capacity building of national agencies and evaluating climate change adaptation options in different river basins

Status: On going. This project aims, first, to contribute to Sri Lanka's Third National Communication on Climate Change. The formulation of the Third National Communication is currently ongoing. IWMI contributed to this process and also to formulation of the National Adaptation Plan (NAP) in 2014, and will continue to do so in 2015. Second, the project develops and evaluates sustainable water storage scenarios for Sri Lanka to adapt to current and future climate variability. Under this objective hydrological models have been built for two river basins in different climatic (wet and dry) zones of Sri Lanka. The models have been calibrated for current climate conditions and are expected to be run up to year 2030 scenarios shortly. Water storage scenarios will be initially developed for these river basins under current and 2030 climate scenarios in 2015. Subsequently, the storage scenarios are expected to be up scaled to cover the entire country. Some new deliverables that emerged during 2014 include installation and testing of low-cost automatic weather stations assembled by IWMI in the dry zone basin to help plan existing reservoir operations, conducting capacity building of engineers and field Officers in the operation and maintenance of these weather stations, developing additional socio-economic and hydrological databases from surveys in the two study basins, and several others that are listed and described under Deliverables section

Gender Component: Not defined

Objectives:

1. To develope and evaluate sustainable storage scenarios in Sri Lanka to adapt to current and future climate variability
2. Contribution to Sri Lanka 3rd national communication on climatre change and analysis of adaptation options in selected river-basins.

Deliverables:

Description	Type	Year	Status	Justification
Contribution to Sri Lanka 3rd national communication on climatre change	Capacity	2014	On going	The Formulation Process of the Third National Communication and the National Adaptation plan (NAP) is ongoing. IWMI contributed to this process in 2014, and will continue to do so in 2015 too.
Guidelines on developing sustainable storage scenarios in Sri Lanka to adapt to current and future climate variability	Peer-reviewed journal articles	2015	Incomplete	
Hydrological models of selected river basins under current and year 2050 climate conditions	Models (i.e. Agronomic Trials)	2014	On going	Building and bias correcting future climate scenarios took longer than anticipated. The calibrated models are expected to be run under 2030 scenarios shortly. The models will be added to the IWMI model repository at the end of the project.
Installation and testing of low cost automatic weather stations assembled by IWMI in the Malwatu Oya (Dry Zone) basin to help plan existing reservoir operations	Tools (i.e. search engines, games, etc)	2014	Complete	
Workshops to train engineers and field officers on the use of IWMI assembled automatic weather stations	Workshop	2014	Complete	
Paper presented at the Symposium of the Lanka Rainwater harvesting Forum 2014	Conference proceedings/papere	2014	Complete	
Poster presented at the the 1st FOSS4G-Asia Workshop 2014	Poster	2014	Complete	
Poster presented at FOSS4G Sri Lanka, OsgeoSLIIT, SLIIT, Malabe, Sri Lanka, 2014	Poster	2014	Complete	
Hydrological Information on existing reservoir and rainfall data in Anuradhapura	Data	2014	Complete	

Description	Type	Year	Status	Justification
Socioeconomic Surveys of Study Basins	Data	2014	Complete	
Paper on identifying potential areas for underground storage of flood water in Sri lanka	Conference proceedings/papere	2014	Complete	
Journal paper on flood risk in a wet zone river basin (Kalu Ganga) in Sri Lanka	Peer-reviewed journal articles	2014	Complete	
Poster on a nantional upgrade of the climate monitoring grid in Sri Lanka	Poster	2014	Complete	

Partners:

1- Department of Meteorology:
Director General, Department of Meteorology <meteo1@sltnet.lk>

2- Department of Irrigation:
Prasanna Tillakaratne, Engineer <prasannaukt@yahoo.com>

3- Department of Agrarian Development:
Prabath Witharana <watmngcolombo@yahoo.lk>

4- Mahaweli Authority of Sri Lanka (MASL):
Mr. H.M.K.R.Herath, Resident Project Manager <phone: +94 25 2276328>

5- Lanka Rainwater harvesting Forum (LRWHF):
Thanuja Ariyananda <tanuja@sltnet.lk>

6- Sri Lanka Air Force:
Jayasiri Amarasena <crdo@airforce.lk>

7- Coordinating Secretariat for Science Technology and Innovation (COSTI):
Dr. Noble Jayasooriya <nj8583@gmail.com>

Location(s):

Countries: Sri Lanka,

Activity 909-2014

Synthesis of simulation modelling and stakeholder input for improved management of the Indus Basin Irrigation System under changing climate

Status	Cancelled	Milestone	1.1.1 2015 (1)
Start date	2014 Jan	End date	2014 Dec

Description: A combination of hydrology and water resources allocation models for the entire Indus River Basin will be produced, calibrated and run under several (2-4) scenarios of climate and irrigation development

Status: Cancelled. The activity had to be canceled in the first half of 2014 due to the sudden departure of the key staff member. The funds had to be re-allocated to other activities, and to support engagement in CCAFS' move to new mode of operation, including intensive proposal developments. Nonetheless, two Journal papers were produced which are listed under deliverables

Gender Component: Not defined

Objectives:

1. To develop and test the decision support tool in the Indus Basin and Indus Basin Irrigation System that can be used to support irrigation planning and management

Deliverables:

Description	Type	Year	Status	Justification
Tools that support the streamlining of climate change into irrigation planning and management in Pakistan	Platforms - Data Portals for dissemination	2014	Cancelled	Cancelled due to responsible staff member departure and impossibility to replace him within the rest of the year
Long-term climate trends- Indus	Peer-reviewed journal articles	2014	Complete	
Groundwater recharge under Climate change	Peer-reviewed journal articles	2014	Complete	

Partners:

Partners not defined

Location(s):

Countries: Pakistan,

2. Succinct summary of activities and deliverables by Output level.

Output: 1.1.1

Summary: This Output encompasses the bulk of IWMI research under CCAFS. The activities are diverse and cover the range of topics – from analysis of climatic trends to assessment of impacts of climate change on gender and social differentiation. Almost all activities under this output are complete; despite some setbacks caused by the departures of some key staff during the past year (in which case the alternative products were produced that are still in line with the major course of the planned activities).

The scientific products under this included, to name a few, analysis of adaptation strategies of farmers in the lake Tana basin In Ethiopia and in AP state in India; finalization of a book that summarized such strategies and experiences over Africa and Asia in a Book; analysis of climatic trends in the Indus basin; various analyses related to groundwater as an adaptation measure (including analysis of prospects for efficient groundwater governance in Laos and associated information and technical capacity needs; analysis of long-term water table data in Gujarat state of India indicating considerable fluctuation in groundwater levels from year to year, but clearly pointing to the prospects of stabilizing them by improved management of recharge structures and groundwater pumping); evaluating sustainable water storage scenarios for Sri Lanka to adapt to current and future climate variability (to 2030), using two contrasting river basins as case studies, and with a vision to design a storage development plan for the entire country, etc.

This report features two Outcome stories that have emerged from the work under this Output. One features developing the awareness of the gendered vulnerability to climate change in Nepal (supported by a case study on working with the national media in the country). Another – describing the prospects of development of a national network of low cost automatic weather stations in Sri Lanka - assembled by IWMI researchers initially to help plan existing reservoir operations.

Many featured activities have significant capacity building component, one example being ClimAdapt bilateral project in India that focuses on Implementation of rice adaptation practices in AP State, and associated, CCAFS-supported analysis of climate change impact on rice in 13 Indian states.

Output: 2.1.1

Summary: There were two activities under this Output in 2014. One was focusing on the provision of the mobile services to farmers in 3 countries in Africa, and another - on developing methods and tools for flood risk assessment and management, with parallel inroads to drought management in the later part the year, and focusing primarily on South Asia.

The first activity was essentially the wrapping up of the IFAD-funded project mapped partially under CCAFS, and partially - under WLE. Over ts life time, the project evaluated the suitability of the mobile service for irrigation farmers at 3 sites in Ethiopia, Sudan and Egypt, established and ran such service operationally for the duration of the project to demonstrate proof of concept, examined business development opportunities to understand and recommend the required steps to upscale such service in these countries. Use of Smart-ICT services for information and advice to smallholder farmers in

Africa is a major innovation with great potential for replication and scaling-up. This project has successfully demonstrated and evoked sufficient interest among the farmers and the relevant agencies that such services were actually useful for smallholders in Africa where agricultural extension systems are weak and specific advisories unavailable. Further countries like Kenya and Tanzania have shown keen to implement similar projects.A number of capacity building programs were run during the project life and a synthesis report has been accepted by IFAD

The second activity produced several outputs but it will remain ongoing in 2015 and supported primarily by bilateral funds, and WLE. The mapping products describing flood risks for South Asia are now available for view and download on IWMI web site. Several papers and research reports are either accepted for publication or at the final stages of completion. IWMI joined a global Disaster Risk Reduction community and had a successful large plenary session on at the 3-d Global Risk Reduction Forum in Davos. IWMI also joined the two global GWP-WMO led programs - on Integrated Drought and Flood Management. The joint GWP-IWMI work (IWMI part supported by CCAFS funds in 2014) - on developing of on-line Drought Monitoring System (DMS) for South Asia is under way and the DMS is expected to go live in a year.

Output: 3.3.1

Summary: IWMI's role in this Output is modest. The research aims to establish whether investment in soil carbon can be used successfully to alleviate poverty by restoring, enhancing or protecting the goods and services provided by ecosystems in regions where soils are degraded. Review of soils, hydrology, land use, and topography of the study site, establishment of on-farm trials, experimental data collection - all progressed well in 2014. Preliminary analysis has been carried out to determine the impacts of organic and inorganic soil amendments and their combinations on crop yield; and vegetation inventory has been completed. For now, the outputs are limited to primary data collected and project progress reports. But the bilateral project will continue in 2015 to more advanced outputs.

3. Communications.

Media Campaigns:

As discussed in detail in a Case Study, two media campaigns were held in Nepal to create broad awareness in he country on the impacts of climate change on agriculture and vulnerability of rural population to climate change- through radio, TV and newspapers. Some media companies have an estimated audience of 18 mill people (UNN Survey, April 2011).

Blogs:

1 A blog on CC study from the Koshi Basin, Nepal: http://ccafs.cgiar.org/blog/new-study-shows-how-climate-change-will-impact-water-availability-koshi-river-basin#.U-yhGGP6VD6
2. Blog: Riding the wave of the future with solar-powered desalination
http://wle.cgiar.org/blogs/2014/06/23/riding-wave-future-solar-powered-desalination/
3. http://www.iwmi.cgiar.org/2014/10/getting-more-out-of-local-knowledge/
4.http://www.iwmi.cgiar.org/2014/02/indias-climate-challenge/
5. http://www.iwmi.cgiar.org/2014/02/how-to-respond-to-the-feminization-of-agriculture-in-nepal/
6 .http://www.iwmi.cgiar.org/2014/06/freshwater-dreams/

Websites:

No specific web sites were created for promotional purposes of CCAFS during 2014. The results of IWMI work under CCAFS and other CRPs are normally promoted through IWMI organisational web site

Social Media Campaigns:

As discussed in detail in a Case Study, two media campaigns were held in Nepal to create broad awareness in he country on the impacts of climate change on agriculture and vulnerability of rural population to climate change- through radio, TV and newspapers. Some media companies have an estimated audience of 18 mill people (UNN Survey, April 2011).

Newsletters:

No regular Newsletters that specifically promote CCAFS and broader CC-related work are run by IWMI at present

Events:

Successful session at the global Disaster Risk Reduction Conference has been organized and convened with several IWMI scientists and international partners presenting. WLE has been put on the map of global risk reduction community, which houses thousands of scientists, donors and policy makers.

Videos and other Multimedia:

Video on Underground Taming of Floods: published on 05 Dec, 2014
URL: https://www.youtube.com/watch?v=KCtE7FxfNvY.

Videos production on the adaptation practices (direct seeding of rice, alternate wetting and drying, Machine rice transplantation) are in progress, as part of the bilateral ClimAdapt project reported under activity 772-2014

A 30-minute video documentary originally directed by men and women farmers of Dhanusa, a district in south-central Nepal. Produced as part of he activity 746-2014

Other Communications and Outreach:

A Chapter " Managing Floods and Droughts" in the new IWMI Flagship series that started in 2014. The first issue of the series was "On Target for People and Planet: Setting and Achieving Water-Related Sustainable Development Goals". IWMI http://www.iwmi.cgiar.org/Publications/Books/PDF/setting_and_achieving_water-related_sustainable_development_goals.pdf The Chapter, led by IWMI authors was co-authored by Bruce Campbell

IWMI is part of the United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER). IWMI Regional Support Office of SPIDER in Colombo started in Feb 2015. SPIDER supports regional and national cooperation in the access and use of space technology in disaster management and emergency response management in the event of major disasters, normally induced by increasing climate variability. Focus is on sharing of relevant IWMI research products and tools to assist regional efforts on disaster risk reduction

A capacity building and dissemination program on millet production as an adaptation measure to climate variability was conducted in June 2014 in Hyderabad, India. About 170 stakeholders from agriculture department, farmers and scientists. The results were also presented to the state level supervisory committee (SLSC) for the suggestions in improving the implementation and up-scaling strategies

As part of the ClimAdapt Project, National workshop on “climate and water: improving the water use efficiency” was conducted in association with WALAMTARI, in Hyderabad during November 2014. About 100 participants.

Andhra Pradesh technology development and promotion centre (APTDC) and confederation of Indian Industry (CII) in association with ANGRAU organised AP-TEC 2014, a conference & Exhibition focusing on technologies in modern agriculture in Dec 2014. IWMI-ClimaAdapt disseminated the technologies which are majorly concentrating on water saving methods in irrigated agriculture, all the partners in the project kept exhibits at the stall in AP-TEC 2014 as a part of dissemination strategy. Farmers, scientists, NGOs, school children, Legislative members and private industries took part in

the program. All the visitors were informed about water management practices taken up in the field by the partners and their economics for up-scaling.

4. Case studies.

Case Study #1

Title: Creating awareness on climate change impacts on agriculture and Gender in Nepal
Author: Fraser Sugden and Floriane Clemment
Type: Social differentiation and gender; Successful communications;

Project Description:

Two leading media organizations based in Kathmandu—Panos South Asia and Nepal Forum of Environmental Journalists—facilitated presentations of the IWMI-CCAFS work on feminization of agriculture, vulnerability and climate adaption in Nepal. The communication channels were chosen based on their credibility, popularity, coverage and accessibility of the target audience. Two national daily newspapers and a provincial newspaper were also used as a means of disseminating two outputs: 1) Two radio round table discussions amongst farmers and policy makers; and 2) A 30-minute video documentary originally directed by men and women farmers of Dhanusa, a district in south-central Nepal.

Introduction / objectives:

To create broad societal awareness in Nepal on how climate change affecting the poor, women in particular, how it affects feminisation of agriculture in the country, and vulnerability to climate change.

Project Results:

Ujyaalo 90 Network (UNN) is a private media agency that combines FM, satellite and online broadcasts. It brings the latest news and information about politics, society, development, environment and other issues to its local, national and global Nepali audiences. It has a network of 150 FM radios across the country and runs a web portal www.unn.com.np. UNN's estimated audience reaches 18 mill (UNN Survey, April 2011).
Panos South Asia (PSA) in partnership with Ujyyalo 90 Network (UNN) produced two episodes of a 75-minute radio programme on climate and societal change discussions amongst farmers, local government authorities and policy makers. Two half-day discussions, held in Janakpur and Kathmandu, were recorded and aired on 5 FM radios in 7 districts in December. In the radio programme, farmers raised issues and directed queries to the participating government officials. A 30-minute version of the radio programme was produced to disseminate to farmers of Terai-Madhesh, local and national planners and decision makers on agriculture, climate and socio-economic development. The radio programme allowed space for listeners to send their feedback through SMS and telephone.

Kantipur Television (KTV), a private television station, is licensed for terrestrial and satellite transmission across Nepal. KTV also offers live streaming facility of its broadcasts on its website (http://kantipurtv.com/).

The 30-minute video in Maithili, regional language, a compilation of 12 films directed by IWMI-trained farmers in 2013, was aired with Nepali subtitles on KTV four times in 2014. We used our local networks and global channels including emails and social media of IWMI to encourage project stakeholders, researchers, climate change experts, project stakeholders, water and energy experts to listen to the programme and watch the video, and provide feedback. E.g. the advertisements were published in the prominent newspapers like The Kathmandu Post, Kantipur, Janakpur Today.

Partners:

The above mentioned media organisations (UNN Panos South Asia (PSA), and Kantipur Television (KTV)) may be seen as partners of this extensive communication initiatives.

Links / sources for further information:

No additional links to list; all information is included in the above fields

Case Study #2

Title: Engaging with global disaster risk reduction community

Author: Smakhtin, V., avelic, P. and Amarnath, G.

Type: Successful communications; Policy engagement;

Project Description:

International Disaster and Risk Conferences (IDRC) - the world leading conferences on integrative risk management. It's a unique community of business leaders, decision makers, practitioners, UN-, IO- & NGO-agents, and scientists that shares and discusses new findings and experiences about the broad spectrum of risks societies are facing today. These fora attempt to find solutions to today's challenges by managing risks, reducing disasters and adapting to climate change, and encourage an integrative way of thinking about disasters and risks.

The IDRC Davos 2014 is organized by Global Rick Forum Secretariat residing in Davos in close cooperation with and under the patronage of the UN Office for Disaster Risk Reduction (UNISDR). The outcomes of the Conference aimed to influence the post 2015 agenda such as the Post-2015 Hyogo Framework of Action for Disaster Risk Reduction (HFA2), the Millennium Development Goals (MDGs) or the replacement of the UNFCCC Kyoto Protocol (post Kyoto).

The DRR community has thousands of participant globally. IWMI and CGIAR at large have not been represented in this community ever. To change this and engage actively with this vibrant and expending network, IWMI organised a special session on floods and droughts at the 3-d biennial DRR Conference in Davos in September 2014. It was one of the two "special panels" running in parallel for 1.5 hour and collected over 200 participants. The session demonstrated diverse solutions to floods

and droughts management (ranging from RS-based, through to holistic basin approaches, to insurance), and was one of the few on water-related disasters at the conference. In addition, throughout the entire year, IWMI consistently expanding its presence in other (new to CGIAR) global programs and initiatives to aggressively increase the outreach of CCAFS and WLE supported research on managing water variability extremes

Introduction / objectives:

This initiative was a not a special project but a set of interlinked efforts to expand CGIAR visibility in a new area and associated partnerships' network(s) of Disaster risk reduction.

Project Results:

The successful plenary session was held, featuring 3 IWMI speakers and 2 international speakers. IWMI speakers (Vladimir, Paul, Giriraj) received an invitation to contribute their examples of risk management to UNISDR Science and Technical Advisory Group series for the Third High Level World Conference on Risk Reduction in Japan in March 2015. The publication will be peer reviewed and published on the Prevention Web website and disseminated to policy makers. A summary of the UTFI approach (supported by CCAFS and WLE) has been submitted for this purpose.

The “Risk” community moves towards a post 2015 risk management framework, and, on that way, aims to bring progressively more science into future initiatives for global risk management. They are looking for establishing “international science advisory mechanism”, “promote scientific research into risk patterns and trends and the causes and effects of disaster risk in society”, “promote and support the availability and application of science to decision-making; and to use post-disaster reviews as opportunities to learn and enhance public policy”. Engagement with such networks is essentially part of the impact Pathway of IWMI-led CCAFS supported initiatives on managing water variability and extremes.

IWMI has also become a formal Participating Organization (PO) of the international Group of Earth Observations (GEO- http://www.earthobservations.org/index.html). GEO is a voluntary partnership of governments and POs that focuses on improved data support for NRM globally.

IWMI has also become a part of the GWP-WMO led Integrated Drought management Program (IDMP) www.droughtmanagement.info; and Associated Flood management Program (AFMP); and also of UN-SPIDER Initiative (see Communications section)

In recognition of his flood risk assessment and management research, Dr Giriraj Amarnath received Japan International 2014 Award for Young Agricultural Researchers.

Partners:

SWISS-Re, GEO, IDMP, WMO, GWP, UNISDRR, UN-SPIDER, UNOSA

Links / sources for further information:

GWP representative at WMO for IDMP – Frederik Pischke speaking at Stockholm with a Reuters Foundation journalist about SADMS, that IWMI and GWP co-develop:

http://www.trust.org/item/20140912102522-35ja0/?source=fiOtherNews3

IWMI becomes UN-SPIDER support office: https://intranet.iwmi.org/iwmi-becomes-regional-support-office-for-un-spider-1.aspx

Case Study #3

Title: Looking for global solutions to water and energy scarcity - combining the unlimited
Author: Sood A, Smakhtin V.
Type: Breakthrough science;

Project Description:

This case study was not part of regular 2014 activities, but it was supported jointly by CCAFS and WLE prior to that. Only after a few rejections the paper eventually saw the world in 2014. This often happens with the breakthrough science. The major present hindrance , in the view of the authors,in using desalination to help alleviate global water scarcity is the cost of this technology, which, in turn is due to energy cost involved. This study examines historical trends in desalination and breaks up the cost of desalination into energy based and non-energy based. It then develops the learning curves (relationship between cumulative production and market price) for desalination. Assuming that the photovoltaic (PV) technology will be the dominant form of energy used in the desalination process, the existing
PV learning curve and desalination learning curve are combined to explore the viability of large-scale adoption of desalination in the future.

Introduction / objectives:

The objective of this real case study was to introduce an innovative idea of combining he two virtually unlimited natural resources - sea water and solar (clean) energy (that is becoming more common) - in order to end global water scarcity once and for all.

Project Results:

The world has been divided into seven regions and it is assumed that water demand from desalinated water will be met only within the 100-km coastal belt. It is shown that, in most of the regions, other than sub-Saharan Africa, Central America, and South Asia (where water tariffs are low), the desalination (without considering energy) becomes viable by 2040. For PV technology, less than 1 million MW
per annum growth is required till 2050 to make it affordable. Globally, desalination with renewable energy can become a viable option to replace domestic and industrial water demand in the 100-km coastal belt by 2050. In essence, the study claims that water scarcity can be resolved globally in just one generation, if financial resources are channeled to this avenue.and the mind set of the society is oriented towards this way.While further research may be necessary to examine the environmental externalities and costs of the approach, the overall idea look very feasible. The reason that this study has been singled out here into a separate case study is to illustrate the type of bold ideas that CCAFS may be willing to keep supporting in the future, through innovation fund, regional funds or other means. The focus on solar energy leads to a number of spin-off ideas, ranging from harvesting solar power (as is being already investigated by IWMI in India through SA regional funds), or to the idea of ensuring free-flowing Mekong, if investments are redirected from debated hydropower solutions to solar energy - over the next 30 years (the actual time required to build all planned dams - a period during which solar energy will become affordable to all). .

Partners:

None

Links / sources for further information:

1.Riding the wave of the future with solar-powered desalination: http://wle.cgiar.org/blogs/2014/06/23/riding-wave-future-solar-powered-desalination/

2. http://www.iwmi.cgiar.org/2014/06/freshwater-dreams/

3. Muslim Science: Solar desalination for Water Stressed world: http://muslim-science.com/solar-desalination-water-stressed-world/

5. Outcomes.

Outcome #1:

IWMI (CCAFS) influences establishing a National Climate Observatory and Early Warning System for Sri Lanka

What is the outcome of the research (i.e. use of research results by non-research partners)?

The Coordinating Secretariat for Science, Technology and Innovation (COSTI) of the Government of Sri Lanka (http://www.costi.gov.lk/index.php/en/) is facilitating the formulation of a project to establish an online, publicly accessible, National Climate Observatory and Early Warning System for the country, following a similar IWMI pilot project funded by CCAFS to establish a network of low cost online automatic weather stations, in the Malwatu Oya river basin in the Dry Zone.

What outputs produced in the three preceding years resulted in this outcome?

Chemin, Y., Bandara, N., Liyanage, N., 2014. ``An Open Source Hardware & Software online rain gauge for real-time monitoring of rainwater harvesting in Sri Lanka''. In Proceedings of the 11th Symposium of the Lanka Rainwater Harvesting Forum, Battaramulla, Sri Lanka, September 5, 2014. (http://www.themimu.info/sites/themimu.info/files/documents/Ref_Doc_Symposium_on_Mainstreaming_Rainwater_Harvesting.pdf#page=21)

Chemin, Y., Bandara, N., 2014. ``OSHW and FOSS4G for an online water valet''. Poster presented at the 1st FOSS4G-Asia, Bangkok Conference, Thailand, December 2-5, 2014. (http://www.foss4g-asia.org/2014/abstracts/abstract-5/)

Chemin, Y., Sanjaya, N., Hussain, A., Muthuwatta, L., 2014. ``Water Resources Monitoring in Sri Lanka - The Open Source Way''. Poster presented at the FOSS4G Sri Lanka, OsgeoSLIIT Conference, SLIIT, Malabe, Sri Lanka, February 23, 2014. (http://www.academia.edu/8477040/Water_Resources_Monitoring_in_Sri_Lanka_The_Open_Source_Way)_

Chemin, Y., Bandara, N., Eriyagama, N. 2015. A national upgrade of the climate monitoring grid in Sri Lanka. The place of Open Design, OSHW and FOSS. EGU General Assembly 2015, Vienna, Austria. (submitted). Appendix4 (https://drive.google.com/?tab=mo&authuser=0#my-drive)

What partners helped in producing the outcome?

Key research partners were the department of Town and Country planning, University on Moratuwa, Sri Lanka (assembled the electronics and carried out field adaptation of individual weather stations), the Sri Lanka Air Force (SLAF) (Independent testing and review of individual weather stations), the Department of Irrigation (ID) and Mahaweli Authority (MA) of Sri Lanka (Field installation and testing to calibrate individual weather stations).

Who used the output?

COSTI, ID, MA, LRWHF, SLAF and MET

How was the output used?

COSTI- formulating a National Innovative Project to set up an online, publicly accessible, National Climate Observatory and Early Warning System for the country

ID & MA – Monitoring daily weather variables

SLAF, MET and LRWHF - Building and/or testing weather stations following the Open Design generated by the research

What is the evidence for this outcome? Specifically, what kind of study was conducted to show the connection between the research and the outcome? Who conducted it?

Appendix1: Minutes of the stakeholder roundtable states IWMI presented the proposal (https://drive.google.com/?tab=mo&authuser=0#my-drive).

Appendix2:The presentation made at the roundtable discussion lists IWMI as the presenter (https://drive.google.com/?tab=mo&authuser=0#my-drive).

Appendix3: A list of meetings among working groups (with IWMI being in ICT and Modelling groups) set up to formulate the final national proposal (https://drive.google.com/?tab=mo&authuser=0#my-drive)

Outcome #2:

Increased awareness amongst policy makers and practitioners on the structural basis of climate change vulnerability

What is the outcome of the research (i.e. use of research results by non-research partners)?

Using publications, engagement activities, audio-visual media and community radio, the results of two years of intense research have been disseminated to policy makers and practitioners (I/NGO sector) to reframe dominant understandings of climate change to encompass structural constraints to adaptation rooted in class, caste, gender, and macro political-economy. Our research has begun a process of reframing discourses of climate change adaptation, has led to some changes in community mobilization on the ground, and has stimulated debate in the public sphere.

What outputs produced in the three preceding years resulted in this outcome?

• Twelve participatory videos produced by farmers and twelve TV episodes including farmers' films and a 30 minute documentary broadcast on national TV
• 6 community-level debates in six VDCs of Dhanusa District in October and November 2014, based on the film screening
• Two radio roundtable discussions and two workshops organized in Janakpur and Kathmandu in November and December 2014, attended by high level policy makers and politicians and aired on 5 national radio stations
• A publication in Global Environmental Change on the structural sources of gendered vulnerability to climate change and a policy brief
• An extensive review of literature on Gender in the Ganges Basin was completed as a tool for researchers and policy makers
• A paper in preparation: "Who should adapt to Climate Change? Unheard Narratives from men and women farmers in Nepal" (to be submitted in February 2015 to Global Environmental Change)

What partners helped in producing the outcome?

Only IWMI

Who used the output?

• Department of Irrigation
• Groundwater Resources Development Board
• IWMI's partner NGOs in Nepal (iDE Nepal, Nepal Madhesh Foundation) both of whom have been very active in our dissemination workshops, while agreeing to collaborate with IWMI on a number of follow on projects.
• Panos South Asia

How was the output used?

• Research findings on groundwater access for marginal farmers used to inform comments on the draft of Nepal's Groundwater policy
• Outputs led to development of two new research IWMI led projects which will pilot potential

institutional and technical innovations in collaboration with the Department of Irrigation and Groundwater board.

What is the evidence for this outcome? Specifically, what kind of study was conducted to show the connection between the research and the outcome? Who conducted it?

- The Department of Irrigation in Nepal has shown an interest in requesting IWMI to provide comments and guidance in the development of its new Gender Policy

-The videos shown by to district level government officials led to development actions on the ground in Dhanusha (including repair of bridge)

7. Outcome indicators.

Outcome Indicator:

One to five flagship technical and/or institutional approaches identified and developed with farmers, key development and funding agencies (national and international), civil society organizations and private sector in three regions, which would directly enhance the adaptive capacity of the farming systems to the climate change conditions

Achievements:

Coordinating Secretariat for Science, Technology and Innovation (COSTI) of the Government of Sri Lanka (http://www.costi.gov.lk/index.php/en/) is facilitating the formulation of a project to establish an online, publicly accessible, National Climate Observatory and Early Warning System for the country, following a similar IWMI pilot project funded by CCAFS to establish a network of low cost online automatic weather stations, in the Malwatu Oya river basin in the Dry Zone.

Evidence:

Appendix1: Minutes of the stakeholder roundtable states IWMI presented the proposal (https://drive.google.com/?tab=mo&authuser=0#my-drive).

Appendix2:The presentation made at the roundtable discussion lists IWMI as the presenter (https://drive.google.com/?tab=mo&authuser=0#my-drive).

Appendix3: A list of meetings among working groups (with IWMI being in ICT and Modelling groups) set up to formulate the final national proposal (https://drive.google.com/?tab=mo&authuser=0#my-drive)

Outcome Indicator:

Integrated adaptation strategies for agricultural and food systems inserted into policy and institutional frameworks at regional, national or sub--national level in 2 target regions. Policy makers and key stakeholders use CCAFS research outputs - guidelines, tools and methods-- to support the development of NAPAS, sector specific adaptation plans, or germplasm benefit sharing policies.

Achievements:

IWMI research in Nepal on climate change impacts on feminisation of agriculture is reframing discourses of climate change adaptation in tghe country, has led to some changes in community mobilization on the ground, and stimulated debate in the public sphere;

At the request of the Climate Change Secretariat of the Ministry of Environment of Sri Lanka,IWMI conducted a capacity building workshop to water sector agencies on vulnerability assessments in the water sector. IWMI also contributed to the formulation of the National Adaptation Plan (NAP) (especially the water sector) in an advisory role since one of its staff members serves on the National Expert Committee on Climate Change Adaptation. The Ministry has requested for a second capacity building workshop on the water sector, which is expected to take place in 2015. Taking part in the NAP process will continue in 2015 too.

Evidence:

Department of Irrigation in Nepal requested IWMI to provide comments and guidance in the development of its new Gender Policy;
The videos shown to district level government officials led to development actions on the ground in Dhanusha (including repair of bridge)

Outcome Indicator:

One to five flagship risk management interventions evaluated and demonstrated by farmers and agencies at benchmark locations in three regions

Achievements:

Emerging Outcome from ClimAdapt Project: The weather based crop insurance is under progress with Bajaja Allianz. The terms of policy were developed for chilly, cotton and paddy in Guntur district, AP. The program will begin with the onset of monsoon and canal water release. IWMI will fix the weather recording devices on pilot basis with selective sample size for 2014 and 2015.

Evidence:

ClimaAdapt Project Annual Report

Outcome Indicator:

Three food crisis response, post-crisis recovery, and food trade and delivery strategies tested and evaluated with partner crisis response organizations at benchmark locations in three regions

Achievements:

Ministry of Water Resources, Sudan through their field and research offices (HRS, Wad Medani) in the Gash Region collaborate with IWMI on establishing mobile phone information service to farmers in the Gash basin and irrigation scheme. Service includes floods prediction and spate irrigation information. Gash Region Development Authority ensures participation of farmers and farmer organisations and the development departments.

Evidence:

e-mail communication with Director- HRS, Wad Medani, Sudan; and with the officials of Ministry of Water Resources, Sudan , in 2014.

8. Leveraged funds.

There is no Leverage funds

9. Publications.

Publication #1:

A new technique to map groundwater recharge in irrigated areas using a SWAT model under changing climate.

Citation:

Awan, U. K.; Ismaeel, Ali. 2014. A new technique to map groundwater recharge in irrigated areas using a SWAT model under changing climate. Journal of Hydrology, 519:1368-1382. http://dx.doi.org/10.1016/j.jhydrol.2014.08.049

Identifier	CCAFS Themes	Type	Access
http://dx.doi.org/10.1016/j.jhydrol.2014.08.049	Theme 1,	Peer-reviewed journal articles	Limited

Publication #2:

Analysis of long term meteorological trends in the middle and lower Indus Basin of Pakistan

Citation:

Ahmad, Waqas; Fatima, A.; Awan, U. K.; Anwar, Arif. 2014. Analysis of long term meteorological trends in the middle and lower Indus Basin of Pakistan: a non-parametric statistical approach. Global and Planetary Change, 122:282-291. http://dx.doi.org/10.1016/j.gloplacha.2014.09.007

Identifier	CCAFS Themes	Type	Access
http://dx.doi.org/10.1016/j.gloplacha.2014.09.007	Theme 1,	Peer-reviewed journal articles	Limited

Publication #3:

Past and future variability in the hydrological regime of the Koshi basin, Nepal.

Citation:

Bharati, Luna; Gurung, Pabitra; Bhattarai, Utsav. 2014. Past and future variability in the hydrological regime of the Koshi basin, Nepal. Hydrological Sciences Journal, 33p. (Online first). http://dx.doi.org/10.1080/02626667.2014.952639

Identifier	CCAFS Themes	Type	Access
http://dx.doi.org/10.1080/02626667.2014.952639	Theme 1,	Peer-reviewed journal articles	Green

Publication #4:

The projected impact of climate change on water availability and development in the Koshi Basin, Nepal.

Citation:

Bharati, Luna; Gurung, Pabitra; Jayakody, P.; Smakhtin, Vladimir; Bhattarai, Utsav. 2014. The projected impact of climate change on water availability and development in the Koshi Basin, Nepal. Mountain Research and Development, 34(2):118-130. http://dx.doi.org/10.1659/MRD-JOURNAL-D-13-00096.1

Identifier	CCAFS Themes	Type	Access
http://dx.doi.org/10.1659/MRD-JOURNAL-D-13-00096.1	Theme 1,	Peer-reviewed journal articles	Limited

Publication #5:

Pathways for effective groundwater governance in the least-developed-country context of the Lao PDR

Citation:

Pavelic, Paul; Xayviliya, O.; Ongkeo, O. 2014. Pathways for effective groundwater governance in the least-developed-country context of the Lao PDR. Water International, 39(4):469-485. http://dx.doi.org/10.1080/02508060.2014.923971

Identifier	CCAFS Themes	Type	Access
http://dx.doi.org/10.1080/02508060.2014.923971	Theme 1,	Peer-reviewed journal articles	

Publication #6:

Earth observation data: monitoring floods and drought

Citation:

Amarnath, Giriraj. 2014. Earth observation data: monitoring floods and drought. Geospatial Today, 6(June):15-19.

Identifier	CCAFS Themes	Type	Access
	Theme 1,	Peer-reviewed journal articles	Gold

Publication #7:

Spatiotemporal patterns in the mean and extreme temperature indices of India,

Citation:

Panda, D. K.; Mishra, Atmaram; Kumar, A.; Mandal, K. G.; Thakur, A. K.; Srivastava, R. C. 2014. Spatiotemporal patterns in the mean and extreme temperature indices of India, 1971–2005. 34(13):3585-3603. http://dx.doi.org/10.1002/joc.3931

Identifier	CCAFS Themes	Type	Access
http://dx.doi.org/10.1002/joc.3931	Theme 2,	Peer-reviewed journal articles	

Publication #8:

Uncovering consistencies in Indian rainfall trends observed over the last half century

Citation:

Lacombe, Guillaume; McCartney, Matthew. 2014. Uncovering consistencies in Indian rainfall trends observed over the last half century. Climatic Change, 123(2):287-299.

Identifier	CCAFS Themes	Type	Access
http://link.springer.com/article/10.1007%2Fs10584-013-1036-5#page-1	Theme 2,	Peer-reviewed journal articles	Limited

Publication #9:

A methodology for quantifying global consumptive water use of coffee for sustainable production under conditions of climate change

Citation:

Eriyagama, Nishadi; Chemin, Yann; Alankara, Ranjith. 2014. A methodology for quantifying global consumptive water use of coffee for sustainable production under conditions of climate change. Journal of Water and Climate Change, 5(2):128-150.

Identifier	CCAFS Themes	Type	Access
URL	Theme 2,	Peer-reviewed journal articles	

Publication #10:

Regional extreme-dry-spell frequency analysis using the L-moments method in the middle reaches of the Yellow River Basin, China

Citation:

She, D-X.; Xia, J.; Zhang, D.; Ye, A-Z.; Sood, Aditya. 2014. Regional extreme-dry-spell frequency analysis using the L-moments method in the middle reaches of the Yellow River Basin, China. Hydrological Processes, 28(17):4694-4707. http://dx.doi.org/10.1002/hyp.9930

Identifier	CCAFS Themes	Type	Access
http://dx.doi.org/10.1002/hyp.9930	Theme 2,	Peer-reviewed journal articles	

Publication #11:

Analysis of climate variability in the Manas River Valley, North-Western China (1956–2006)

Citation:

Zhang, F.; Hanjra, Munir A.; Hua, F.; Shu, Yunqiao; Li, Y. 2014. Analysis of climate variability in the Manas River Valley, North-Western China (1956–2006). Mitigation and Adaptation Strategies for Global Change, 19(7):1091-1107. http://dx.doi.org/10.1007/s11027-013-9462-2

Identifier	CCAFS Themes	Type	Access
http://dx.doi.org/10.1007/s11027-013-9462-2	Theme 2,	Peer-reviewed journal articles	

Publication #12:

Climate risks and adaptation strategies in the Lower Mekong River Basin

Citation:

Bastakoti, Ram C.; Gupta, J.; Babel, M. S.; van Dijk, M. P. 2014. Climate risks and adaptation strategies in the Lower Mekong River Basin. Regional Environmental Change, 14(1):207-219. http://dx.doi.org/10.1007/s10113-013-0485-8

Identifier	CCAFS Themes	Type	Access
http://dx.doi.org/10.1007/s10113-013-0485-8	Theme 1,	Peer-reviewed journal articles	

Publication #13:

Afrontar el cambio: Cuidar del agua, de la agricultura y de la seguridad alimentaria en una era de incertidumbre climatica. In Spanish. [Tackling change: future-proofing water, agriculture, and food security in an era of climate uncertainty]

Citation:

McCornick, Peter; Smakhtin, Vladimir; Bharati, Luna; Johnston, Robyn; McCartney, Matthew; Sugden, Fraser; Clement, Floriane; McIntyre, Beverly. 2014. Afrontar el cambio: Cuidar del agua, de la agricultura y de la seguridad alimentaria en una era de incertidumbre climatica. In Spanish. [Tackling change: future-proofing water, agriculture, and food security in an era of climate uncertainty] Colombo, Sri Lanka: International Water Management Institute (IWMI) 36p. http://dx.doi.org/10.5337/2014.216

Identifier	CCAFS Themes	Type	Access
http://dx.doi.org/10.5337/2014.216	Theme 2,	Books	

Publication #14:

Climate change and agriculture in India: studies from selected river basins. New Delhi, India

Citation:

Kuppannan, Palanisami; Ranganathan, C. R.; Nagothu, U. S.; Kakumanu, Krishna Reddy. 2014. Climate change and agriculture in India: studies from selected river basins. New Delhi, India: Routledge. 339p.

Identifier	CCAFS Themes	Type	Access
URL	Theme 2,	Books	

Publication #15:

Managing water variability: floods and droughts.

Citation:

Smakhtin, Vladimir; Pavelic, Paul; Amarnath, Giriraj; McCartney, Matthew; Campbell, B. 2014. Managing water variability: floods and droughts. In van der Bliek, Julie; McCornick, Peter; Clarke, James (Eds.). On target for people and planet: setting and achieving water-related sustainable development goals. Colombo, Sri Lanka: International Water Management Institute (IWMI). pp.34-37.

Identifier	CCAFS Themes	Type	Access
URL	Theme 2,	Book chapters	

Publication #16:

Artificial neural network model for forecasting future ainfall scenario of Jharkhand state of India

Citation:

The citation is not defined yet.

Identifier	CCAFS Themes	Type	Access
URL	Theme 2,	Peer-reviewed journal articles	

Publication #17:

Adaptation to climate change-exacerbated water scarcity, droughts and flashfloods: the Khojabakirgansai, a small transboundary tributary of the Syr Darya in Kyrgyzstan and Tajikistan

Citation:

tucker, D.; Kazbekov, Jusipbek; Yakubov, Murat; Wegerich, Kai. 2014. Adaptation to climate change-exacerbated water scarcity, droughts and flashfloods: the Khojabakirgansai, a small transboundary tributary of the Syr Darya in Kyrgyzstan and Tajikistan. In Stucker, D.; Lopez-Gunn, E. (Eds.). Adaptation to climate change through water resources management capacity, equity and sustainability. New York, NY, USA: Routledge - Earthscan. pp.43-66. (Earthscan Studies in Water

Resource Management)

Identifier	CCAFS Themes	Type	Access
	Theme 1,	Book chapters	

Publication #18:

Women's vulnerability to climatic and non-climatic change in the eastern Gangetic Plains.

Citation:

International Water Management Institute (IWMI). 2014. Women's vulnerability to climatic and non-climatic change in the eastern Gangetic Plains. Colombo, Sri Lanka: International Water Management Institute (IWMI). 4p. (Also in Nepali) (IWMI Water Policy Brief 35) http://dx.doi.org/10.5337/2014.215

Identifier	CCAFS Themes	Type	Access
	Theme 1,	Other	

Publication #19:

Promoting productive gendered spaces for adapting to climatic stress: two case studies from rural Bangladesh.

Citation:

International Water Management Institute (IWMI). 2014. Promoting productive gendered spaces for adapting to climatic stress: two case studies from rural Bangladesh. Colombo, Sri Lanka: International Water Management Institute (IWMI). 4p. (IWMI Water Policy Brief 36) http://dx.doi.org/10.5337/2014.234

Identifier	CCAFS Themes	Type	Access
	Theme 1,	Other	

Publication #20:

Managing water resources in agriculture: opportunities from earth observation

Citation:

Amarnath, Giriraj; Sharma, Bharat; Smakhtin, Vladimir. 2014. Managing water resources in agriculture: opportunities from earth observation. [Abstract only]. In India Geospatial Media and Communications. India Geospatial Forum 2014 on Converging Geospatial Trade and Practices, Hyderabad, India, 5-7 February 2014. Programme guide. Noida, Uttar Pradesh, India: India Geospatial Media and Communications. pp.53.

Identifier	CCAFS Themes	Type	Access
	Theme 3,	Other	

Publication #21:

Climate change, out-migration and agrarian stress: the potential for upscaling small-scale water storage in Nepal

Citation:

Sugden, Fraser; Shrestha, L.; Bharati, Luna; Gurung, P.; Maharjan, L.; Janmaat, J.; Price, J. I.; Sherpa, Tashi Yang Chung; Bhattarai, Utsav; Koirala, S.; Timilsina, B. 2014. Climate change, out-migration and agrarian stress: the potential for upscaling small-scale water storage in Nepal. Colombo, Sri Lanka: International Water Management Institute (IWMI). 38p. (IWMI Research Report 159) http://dx.doi.org/10.5337/2014.210

Identifier	CCAFS Themes	Type	Access
http://dx.doi.org/10.5337/2014.210	Theme 1,	Other	

Publication #22:

Earth observation technologies for flood-risk mapping, modeling and management. Training manual prepared for Capacity Building Workshop on Earth Observation Technologies for Flood-risk mapping, Modeling and Management

Citation:

Amarnath, Giriraj; Inada, Yoshiaki; Ghosh, Surajit; Yakob, Umer; Alahacoon, Niranga; Kota, Harada; Inoue, Ryosuke; Schlaffer, S. 2014. Earth observation technologies for flood-risk mapping, modeling and management. Training manual prepared for Capacity Building Workshop on Earth Observation Technologies for Flood-risk mapping, Modeling and Management, Peradeniya, Sri Lanka, 18-21 November 2014. Peradeniya, Sri Lanka: University of Peradeniya. Postgraduate Institute of Science. 170p.

Identifier	CCAFS Themes	Type	Access
	Theme 2,	Other	