Meeting Documents for Agenda Item 4

Readers' guidance*: *I - For Information; *C - For Comment; *D - For Decision*

No.	**Document**	***I**	***C**	***D**	**Pg.**
Agenda Item 4: Networking and Partnership Session (pt. 3)					
4.4.3	MoU IRDR/WMO WWRP/WG SERA		X		392
4.4.4	Report of the 4th Meeting of the WWRP WG SERA, 21-22 August 2014		X		395
4.4.5	UNEP (2014). "Promoting Ecosystems for Disaster Risk Reduction and Climate Change Adaptation: Opportunities for Integration."		X		412

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WEATHER • CLIMATE • WATER

Our ref.:7804-12/RES/ARE/WWR

Annex: 1

Dr Jane Rovins
Executive Director, International Programme Office,
Integrated Research on Disaster Risk
c/o CEODE/CAS
Room B713, No. 9 Dengzhuangnan Rd.,
Haidian District
BEIJING 100094
China

GENEVA, 24 January 2012

Subject: The Working Arrangement between the Integrated Research on Disaster Risk and the World Weather Research Programme of the World Meteorological Organization

Dear Dr Rovins,

I am pleased to send you herewith one original signed, by both parties, Working Arrangement between the Integrated Research on Disaster Risk (IRDR) and the World Weather Research Programme (WWRP) of the World Meteorological Organization.

As stipulated in item 3 of the Working Arrangement, WWRP and IRDR will jointly support the activities of the working group on SERA.

I am convinced that this partnership will benefit not only both parties, but also global society through creating a working group with sufficient visibility and critical mass to provide a strong societal and economic research foundation for disaster mitigation.

Please accept our sincere apology for this delay.

I look forward to our continued collaboration.

Yours sincerely,

(D. Terblanche)
Director
Research Department
Atmospheric Research and Environment Branch

IRDR Integrated Research on Disaster Risk

WWRP WORLD WEATHER RESEARCH PROGRAMME

WORKING ARRANGEMENT BETWEEN THE INTEGRATED RESEARCH ON DISASTER RISK AND THE WORLD WEATHER RESEARCH PROGRAMME OF THE WORLD METEOROLOGICAL ORGANIZATION

Introduction

The Integrated Research on Disaster Risk (IRDR) is a decade-long, interdisciplinary research programme sponsored by the International Council for Science (ICSU) in partnership with the International Social Science Council (ISSC), and the United Nations International Strategy for Disaster Reduction (UN-ISDR). It is a global initiative seeking to address the challenges brought by natural disasters, mitigate their impacts, and improve related policy-making mechanisms.

The World Weather Research Programme (WWRP) is a programme established by the World Meteorological Organization (WMO) to advance society's ability to cope with high impact weather by accelerating research focused on improving the accuracy and lead time of weather prediction.

The International Programme Office of the IRDR and The Research Department of the WMO (hereafter the Parties) have decided to conclude a Working Arrangement between the IRDR and the WWRP of the WMO and have agreed as follows:

Working Arrangement

I. IRDR and WWRP will cooperate in the following areas:

1. WWRP will assist IRDR with the characterization, understanding, and prediction of weather-related hazards (i.e., floods, storms, and typhoons) whose physical aspects manifest themselves at nowcasting through to sub-seasonal scales, thus contributing to IRDR Programme Objective 1— the characterization of hazards, vulnerability and risk.

2. IRDR will assist WWRP in defining and exploring critical natural and social science research questions based on an understanding of disaster risk and the implications of extreme weather or climate events for society and economy, thus contributing to the implementation of the WWRP Strategic Plan.

3. WWRP and IRDR will jointly support the activities of the Working Group on Societal and Economic Research and Applications (SERA) of the WWRP for which the research priorities include:

- Estimation of the societal (including economic) value of weather and disaster risk reduction information;
- Understanding and improving the use of weather-related hazard information in decision making;
- Understanding and improving the communication of weather-related hazard information and forecast uncertainty;
- Development of user-relevant verification methods; and
- Development of decision support systems and tools.

The Working Group will be co-chaired by representatives from both WWRP and IRDR with additional membership from each programme and suitable expertise.

4. IRDR and WWRP will collaborate in the provision of scientific information, guidance, and associated interactions with relevant international bodies, conventions, protocols, and agreements, concerning weather-related hazards and their role in disaster risk management.

This cooperation will be carried out through mutual information exchange, the participation of representatives of the programmes in respective meetings, workshops, symposia and demonstration projects, as appropriate, and working together to address societal concerns regarding weather-related hazards. This common approach will encourage the international support for relevant research to further the objectives and goals of both programmes.

II. This Working Arrangement shall be reviewed regularly by the parties with the object of further improving and extending it as deemed necessary. Any changes to this Working Arrangement shall be made in writing and signed by the parties to this Arrangement.

III. This Working Arrangement may be terminated by either party on 31 December of any year by notice given not later than 30 June of that year. This Working Arrangement shall enter into force upon signature by both parties.

Jane E Rovins

Dr. Jane Rovins
Director, International Programme Office,
Integrated Research on Disaster Risk

Date: 2 Nov. 2011

Dr. Deon Terblanche
Director, Research Department
World Meteorological Organization

Date: 20 January 2012.

WORLD METEOROLOGICAL ORGANIZATION
COMMISSION FOR ATMOSPHERIC SCIENCES
(CAS)
4th Meeting of the Societal and Economic Research and Applications Working Group of the World Weather Research Programme

Montreal, Canada (21-22 August 2014)

CAS/WWRP-WG-SERA-Meeting 4/DOC4.2
(updated 2-October 2014)

FINAL Report and Decisions for Fourth WG SERA Meeting

This report summarizes the items discussed and presentations prepared for the fourth full meeting of the Societal and Economic Research and Applications Working Group (WG SERA) of the World Weather Research Programme (WWRP), an Open Programme Area Group (OPAG) of the World Meteorological Organization (WMO). The meeting was held at the Biosphere offices of Environment Canada in Montréal, Canada from 21-22 September 2014, in conjunction with the World Weather Open Science Conference.

1. ORGANIZATION OF THE MEETING

Brian Mills opened the meeting, welcomed members and guests (Appendix A) and acknowledged newly appointed members (or alternates): Adriaan Perrels (Finnish Meteorological Institute), Jane Rovins (Disaster Reduction & Resilience Solutions, Ltd.), Jan Eichner (Munich Reinsurance Company AG), Ben Jong-Dao Jou (APEC Research Center for Typhoon and Society) and Sally Potter (Joint Centre for Disaster Research, Massey University). Ben Jou unfortunately could not attend due to a sudden and urgent ministerial commitment.

The agenda (Appendix B) was approved after amending to accommodate presentations from representatives of the Subseasonal to Seasonal (S2S) (Andrew Robertson) and High Impact Weather (Brian Golding) projects, and the working arrangements for the meeting were discussed.

2. MEMBER ROUND TABLE

Following a brief round table where participants briefly introduced themselves and highlighted recent activities, Brian introduced the generic World Weather Research Program terms of reference for working groups, confirmed his intent to step down as Chair of WG SERA, and recommended that the WG adopt a co-chair model given the breadth and relevance of the subject for WWRP and WMO. He will remain a regular WG SERA member for at least 1 year.

A general call for candidates was made with Linda Anderson-Berry and Jane Rovins offering to take on a co-chair role. Brian asked that others consider expressing their interests in becoming the WG co-chair and give notice within a couple of weeks in order to move the process forward. A vote would be held to nominate two individuals if more than the minimum required expressed interest. Nanette confirmed that the remainder of the WMO process would be as follows:

1) Current WG SERA chair to recommend co-chair model, candidates and forward supporting documentation (short CV) to the Chair, WWRP Scientific Steering Committee (SSC) (Sarah Jones);
2) WWRP SSC Chair to report and receive approval at next SSC meeting in November;
3) WWRP SSC to recommend new co-chair model and acceptance of nominations to WMO Executive Council (June 2015)
4) Terms of new co-chairs officially commence immediately following WMO EC approval.

Action: ***WG SERA members to inform Brian Mills and Nanette Lomarda if they are interested in being considered for the role of WG co-chair (15-September).***

<u>Action:</u> Brian Mills and Nanette Lomarda to prepare co-chair model and candidate recommendation and send to Sarah Jones for consideration and approval at November 2014 WWRP SSC meeting. Candidates to provide recent short CV. (30-September)

A general discussion ensued regarding the role of WG SERA and current challenges as summarized below:

<u>Communication.</u> Members noted the need to find better and more frequent means of communication—annual meetings (sometimes 1.5 years) cannot facilitate and sustain substantive involvement in WWRP projects and activities. Greater use of social media and an interactive Internet presence to store documentation (resource clearing house) and to develop two-way exchanges, receive feedback and communicate outwards was identified as being needed. The use of WMO member surveys and coordination with other parts of WMO interested in user/client evaluation and social science applications (e.g., Public Weather Services) was also recognized as important—a dedicated web site could be used to bring all of the information and meta-data (i.e., descriptions/links to resources) into one public portal was discussed.

<u>Action:</u> Brian Mills, Nanette Lomarda and co-chair candidates to confirm Web, Skype, or teleconference options available through WMO or WG members to facilitate regular quarterly meetings of available members. (ASAP)

<u>Action:</u> Linda Anderson-Berry and Nanette Lomarda to identify and assess options to develop a SERA-dedicated web-space for linking to projects and resources. (November 2014)

<u>Action:</u> WG SERA and Secretariat to review recent surveys of WMO members, assess the need (and execute if needed) for a complementary survey or scan to canvass their involvement in conducting socio-economic research. (December 2014)

<u>Methods to expand both depth and reach.</u> Participants noted the great range of disciplines and organizations currently or potentially involved in weather-related social science and applications—and the difficulty in representing them on the WG SERA in sufficient numbers to stimulate joint activities, proposals, projects, etc. This contrasts other working groups where virtually everyone has training in atmospheric science, is familiar with National Meteorological and Hydrometeorological operating centres, attends the same national and international society conferences and meetings, and year if not decades of experience working on joint projects/research areas. While such an environment is impossible to recreate within WG SERA, the participants recommended seeking other means of developing depth, for example through establishing specific panels (e.g., on economics).

<u>Funding, coordination, and supporting infrastructure.</u> Clearly the need for developing and conducting social science and research applications has grown considerably over the past 10 years and, with the recent emphasis on impact forecasting, will undoubtedly continue to grow. However, aside from occasional or ad hoc national activities, this has not resulted in a commensurate and sustained increase in the number of funding opportunities and available resources. WMO and NMHSs are unlikely to offer more than ‘seed’ resources and have expressed little desire to meet the data collection and processing challenges required to sustain a long-term R&D commitment to impact forecasting and evaluation. Participants noted a few ways to address this challenge, including:

- Clarify exactly what we require to support WWRP projects through WG SERA
- Utilize available resources from WMO and NMHSs to consolidate efforts, perhaps concentrating on engaging people to develop proposals for various foundations or granting agencies;
- Piggy-back on related continental and national research programs such as those oriented to climate change; and

- Coordinate and leverage within and outside WMO on projects, activities, and advice related to hazard and disaster risk reduction, for example through the Hyogo Post-2015 Framework for Disaster Risk Reduction and national-level programs (e.g., Australian actions related to increasing resilience).

3. WWRP RESTRUCTURING AND ROLE OF SERA WORKING GROUP

Brian provided perspective on the WWRP and its transition into a post-Thorpex era. The leadership has changed over the past couple of years with a new Director of the WMO Research Department (Deon Terblanche), new Chief of Weather Research (Paolo Ruti taking over from Tetsuo Nakazawa) and new Chair of the SSC (Sarah Jones taking over from Gilbert Brunet). While the broad intent of the WWRP strategic plan remains valid through 2017, the clear direction to the 6[1] WWRP working groups that have emerged through the transition is to have a strong presence within and make contributions to the 3 Thorpex legacy projects:

- Subseasonal to Seasonal (S2S) prediction project
- High Impact Weather (HIW) project
- Polar Prediction Project (PPP)

The first two of these projects were discussed at length during the meeting while discussion on the third was deferred due to time constraints and the general lack of polar expertise on the WG.

<u>Action:</u> Brian Mills to provide the WG with an update on the Polar Prediction Project (PPP) (October 2014).

<u>Subseasonal to Seasonal (S2S) prediction project</u>

Andrew Robertson, co-chair of the S2S project, provided a thorough overview of the initiative, summarizing many of the important aspects outlined in greater detail in the implementation plan[2] that was provided to members prior to the WG meeting. The scale of the predictions and underlying research targeted by the project is aimed at early warnings of high impact weather events which will inform decisions requiring relatively long lead times when compared to traditional short-term weather forecasts, i.e., the “Ready” (seasonal) and “Set” (subseasonal) in a ready-set-go system or call to action. A database of subseasonal forecasts is in development and expected to be on-line in early 2015, starting with a subset of models. The database will facilitate involvement from the research and applications communities and operational centres which currently or potentially wish to issue forecasts.

General support for the S2S project was expressed by meeting participants. As noted in the “Needs and Applications” pillar of the organizational figure presented by Andrew and reproduced below, WG SERA is involved in S2S through a liaison member, Joanne Robbins, who actively participates in project steering group meetings. The WG has also contributed a draft bibliography of relevant application literature.

<u>Action:</u> Brian Mills, co-chairs “elect”, Joanne Robbins, and Nanette Lomarda to recommend to S2S co-chairs and WWRP-SSC that a third co-chair be defined on “social science” for the project. (October 2014)

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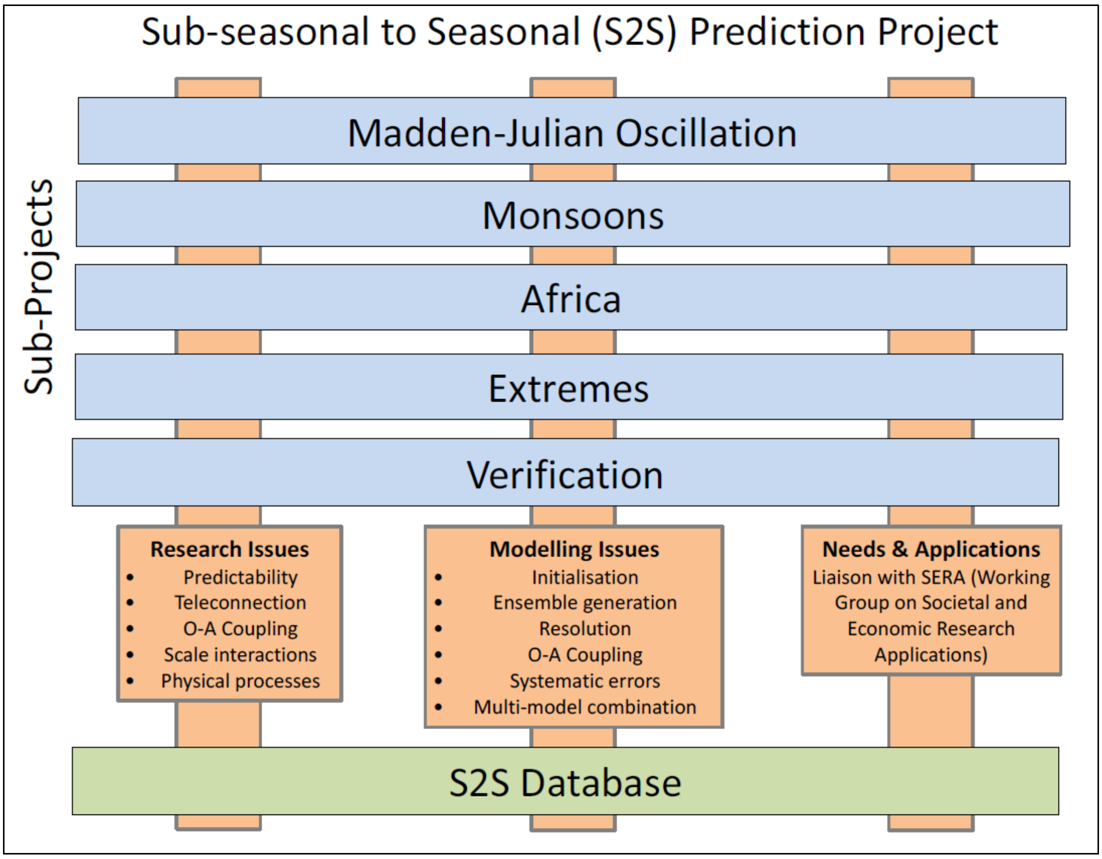
[1] Societal and Economic Research and Applications (SERA), Joint WG on Forecast Verification Research (JWGFVR), proposed merger of Nowcasting and Mesoscale Research (NMR), Tropical Research (TR), Data Assimilation and Observation Systems (DAOS), proposed Prediction-Ensembles (PE)

[2] http://www.wmo.int/pages/prog/arep/wwrp/new/S2S_project_main_page.html



Source: S2S Prediction Project (http://s2sprediction.net/documents/reports)

The difficulty often is taking the project framework and developing specific, well-bounded new projects/proposals or finding the appropriate connection to on-going activities. To aid in this task, members are encouraged to review the current descriptions of the five “sub-projects” which are now posted on the S2S website <http://s2sprediction.net/documents/reports>. It was recommended that members assess their on-going activities and re-examine the bibliography with the aim of identifying potential key areas (research questions or application topics) for SERA contributions, if not actual projects. “Low-hanging” fruit might be picked, for example associated with the “Recast” climate change project and Nordwest program on multi-hazard preparations in Finland.

Action: ***WG SERA members to review S2S subproject information and the partially annotated bibliography in order to identify potential areas (research questions, application topics, specific projects) for SERA contributions. Send ideas and comments to Joanne Robbins (15-October).***

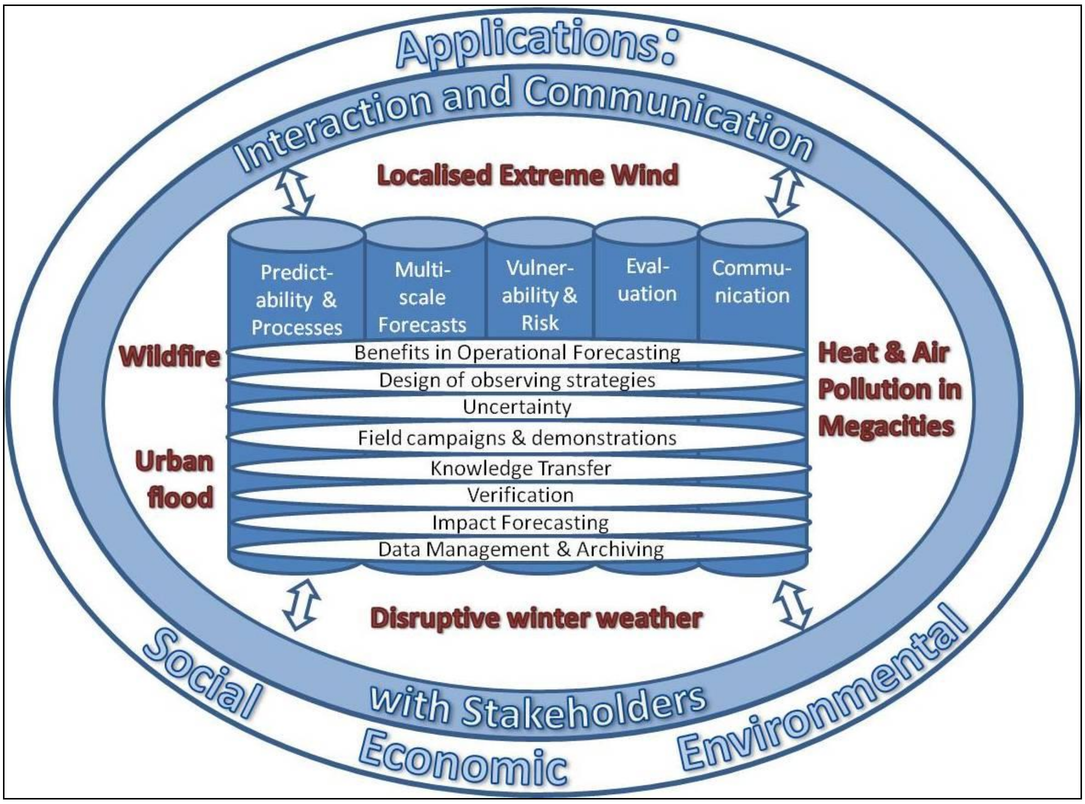
Other areas where WG SERA could assist or at least provide some input:

- Definitions of common but often misunderstood terms such as “high impact weather event” and/or “forecast” or “value”
- Approaches to better plan, develop, prioritize, and coordinate user and practitioner engagement (perhaps begin with other UN agencies and decision needs such as programs for disease vector spraying; also key international organizations such as the International Emergency Management Association)
- Methods to conduct impact-based verification (and/or evaluation) in collaboration with WG JWGFVR
- Identify, increase project awareness, and solicit involvement of social scientists (i.e., through use of existing distribution lists and networks such as those developed through the Integrated Research on Disaster Risk (IRDR) Risk Interpretation and Action and Data Working Groups and WAS*IS)

Other recommendations for S2S included adopting the HIWeather model of having Scientific and Social Scientific co-chairs, or at least leads for each of the 3 cross-cutting pillars. Members strongly encouraged the project proponents to avoid the "product-driven" approach adopted in the 1990s when seasonal prediction began. As noted in the case of monthly ENSO Outlooks offered internally to Munich Re underwriters, even services that are of high quality do not guarantee their use and application in decision-making. In other cases, assumptions by service developers about needs can be misplaced; an example from Sydney 2000 revealed that hindcasts identifying areas that likely received damage following a storm were more important than forecasts to emergency managers. Emphasizing the intended use or type of decision problem faced by users before committing to a particular product or service path will lead to better outcomes.

High Impact Weather (HIWx) prediction project

Brian Golding, WMO consultant and co-proponent of the project, summarized the primary elements of the current proposal which will be reviewed for approval at the next WMO WWRP SSC meeting in November and WMO Executive Council in 2015. As with S2S, organizational and administrative functions will be supported by an international trust funded by WMO members. Complementing the S2S project, HIWx focuses on shorter forecasting and decision scales, ranging from minutes to weeks, for a subset of hazardous or extreme weather phenomena as defined in the organizational figure below. Additional details are found in the proposal distributed to WG members.



Source: Golding, B. and S. Jones 2014. HIWeather Prediction Project presentation to WWRP WG SERA, 21-August-2014, Montréal.

Participants see the great potential in HIWx project to go well beyond what was originally envisioned and eventually realized through Thorpex. The project should have a large involvement from WG SERA. It will capitalize on the greater willingness among atmospheric science and operation forecast community to work with social scientists and represents an incredible opportunity to demonstrate the value of impact forecasting and adding this element of knowledge development, evaluation, communication, and service into the forecast process. While exciting as presently conceived, the project is very ambitious and its goals may be difficult to achieve in a 5-10 year timeframe—it may be important to focus on most vulnerable and/or where the potential to transfer results to actual implementation is greatest (similar to the disaster community's movement from response to prevention and related need to target a different, or an additional, set of actors).

WG SERA members expressed a number of salient considerations for the project, including the following:

- Depending on the intended audience, concerns were expressed about the language used in the project mission statement, specifically "dramatic increase in resilience to high impact weather". The overall loss of life due to weather-related disasters has substantially decreased in the developed world for the weather hazards prioritized in the proposal (e.g., urban flooding).
- Some additional problem-defining context would be useful along with additional precision in the mission statement (i.e., hazard-specific objectives). 'Fluffy' (vague) phrases like "saving lives" should be replaced or complemented with goals/objectives that can be baselined, measured, and reached. It will be important to include and explain the evaluation mechanisms that will be employed to measure stated goals. These might be better defined for individual studies or subprojects where specifics will be evident.
- Separating 3 highly integrated pillars seems odd (risk and vulnerability; evaluation; communication) though it serves to emphasize the importance of social science within the proposal.
- It may be useful to develop a complementary flow diagram for each hazard example that captures the entire system from a sector/user perspective rather than from a weather problem perspective—this would lead to greater appreciation of the relative importance of weather as compared to the myriad of other influences on the decisions, actions, and activities of impacted organizations.
- More generally it might be wise to prioritize and focus HIWx forecasting and project activities to where there is the most potential to improve outcomes, health or otherwise, or on regions with the greatest/least vulnerability/resilience.
- It would be helpful to clarify the terminology of several multi-faceted terms that may have different meanings to different audiences (i.e., hazard, risk, vulnerability, exposure, resilience, warnings, etc.)
- Biggest problem often is not the content of the products but rather the capacity to respond; perfect information has no value if it cannot be acted upon thus significant attention should be given to the characterization of user or decision-maker capacity.
- Huge potential to develop and assess evaluation methodologies through this project by going well beyond the traditional scope of forecast verification through the use of user and social science-driven measures.
- Lessons from other non-weather risk and hazard projects suggest it will be important to emphasize capturing what has and does actually work instead of focusing exclusively on "forecast failures".
- Be wary of potential duplication with other international and national efforts; need to canvass and identify what is already under way in IRDR, etc.
- Acquiring and managing disparate sources, formats, and quantities of impact and outcome data may be a significant challenge. Advanced efforts to secure support from high-level officials in data-holding agencies may facilitate greater and quicker access to important social and economic data sets.
- In terms of project management, there was general support for the 2 co-chair model, one representing scientific and the other social scientific aspects, as well as pillar leaders, and a strategic advisory board composed of stakeholders. It was suggested that all contributing studies involve users and have activities that address each pillar where feasible—acquiring funding will be easier in most countries if the subproject is applied or user goal-driven as opposed to pure social science research.

***Action:* Members to review the latest version of the HIWeather Project proposal and provide comments to Brian Mills who will collate and send to Brian Golding (29-September 2014)**

***Action:* Nanette (Secretariat) to advise HIWeather co-chairs of WG SERA's support and intention to become involved in the project and identify options for representation on the current task team and/or other roles. (October 2014)**

***Action:* Members to provide ideas/discuss potential activity to compare risks across HIWx priority (and other?) hazards, beginning with mortality/morbidity and damage. (October 2014)**

On-going role and collaborative activities with WMO/partners

Economic studies in Ghana

Kwabena Anaman reviewed key aspects of a paper and study recently completed to analyze the economic value of environmental capital used to generate the Gross Domestic Product (GDP) of Ghana over the period 1993 to 2012. With the specification of this fundamental model, it will be possible to extend or adapt the analysis to assess the sensitivity of Ghana's economy to weather. Other research has focused on the agricultural sector in Ghana with plans to develop further studies in other sectors if funding can be obtained. This research makes use of survey-based techniques to examine the benefits of outreach programs (for agriculture) and the method is readily adapted to examining the potential value of improved weather services. Discussion centred around developing studies and comparing results with similar studies done in other countries, including the economic sensitivity study conducted for the U.S. by Lazo et al[3].

Coastal Flood Inundation Demonstration Project (CIFDP)

Linda Anderson-Berry summarized the intent and status of this WMO-lead project which aims to integrate and apply existing models, tools and knowledge to improve coastal flood hazard forecasting in particularly vulnerable countries. The process involves bringing hydrologic and atmospheric expertise together with forecasters and key users. Originally piloted in Bangladesh and Dominican Republic cases, the project has broadened to include Fiji, Indonesia, Southern Africa, Philippines, and the Caribbean. Funding and capacity are not commensurate with the demand especially for the SERA elements of engagement, communication and system evaluation—while Linda's input has been complemented with an additional contracted social scientist (Khan Rahaman), the project has requested additional support from WG SERA. It may be possible to tie this activity into efforts to support the HIWx Project or other international efforts such as the Canadian-led Coastal Cities at Risk effort.

WMO/WB/CSP[4] Guidance Document on Assessing the Socio-economic Benefits of Meteorological and Hydrological Services

Jeff Lazo described this WMO Public Weather Services initiative designed to aid WMO members, especially developing countries, in understanding and making sound choices with respect to designing and contracting studies to assess the socio-economic costs and benefits of services as well as communicating and making use of the results of such research. WG SERA is represented by Jeff, Adriaan Perrels, and Brian Mills—others have

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[3] Lazo, J.K., M. Lawson, P.H. Larsen, and D.M. Waldman, 2011. U.S. economic sensitivity to weather variability, Bulletin of the American Meteorological Society, 92(6):709-720.

[4] World Meteorological Organization/World Bank/Climate Services Partnership

been recommended to be chapter reviewers but this decision is up to the management team. The World Bank and Climate Services Partnership are equal partners in the project with most of the funding for non-government expert participation and production coming through a US AID project. While the document is expected to be available in early 2015, the intent is to solicit country or service-level applications to use and test the effectiveness of the document. Such applications could be executed as joint activities with WG SERA.

Disaster Risk Reduction Focal Points of WMO Technical Commissions and Technical Programmes (DRR FP TC-TP)

Paul Kovacs represents WG SERA (actually the larger WWRP and Commission of Atmospheric Science) on this very recently established coordinating committee which is intended to provide guidance for hazard monitoring and impact analysis. Attempts have been made to survey and assess related program and activities within WMO, however bureaucracy seems to be a limiting factor thus far. Discussion revealed that the country surveys on DRR have yielded good information about risk-related activities and that these should be available to the Focal Points. The need for collaboration with UNIDNR was also noted.

Severe Weather Forecast Demonstration Projects (SWFDPs) and South Africa Flood Forecasting Ssytem

Eugene Poolman outlined the SWFDP program, its objectives and status. The original demonstration project in Southern Africa is in its final year, Eastern Africa and South Pacific SWFDPs are in progress, plans are being made for projects in Southeast Asia and the Bay of Bengal, and potential activities in South America and Central America are being considered. The Nowcasting The SWFDP involves building the capacity (training, infrastructure) of under-resourced weather services in developing countries through partnering with WMO and Service organizations in developed countries. As the program matures and benefits realized, discussions about how to sustain the support in an operational sense, for example through the World Bank or other development agency, are becoming increasingly important. While there has always been a door left open for WG SERA involvement in the SWFDPs, for example by joining the annual training sessions, limited capacity and local/regional knowledge of institutions, communities, networks, etc., and the presence of other organizations with related interests (e.g., Lake Victoria project) have kept WG SERA participation to simply observing.

Eugene also touched on the South Africa Flood Forecasting System which involves applying technologies first pioneered in the U.S. to Africa using financial support from US AID. The intent is to integrate this activity with the SWFDP and end users. There is also a requirement to determine the socio-economic benefits of these programs and this is where WG SERA might become more fully engaged, perhaps through an application of the guidance book developed to assess socio-economic benefits of meteorological and hydrological services.

***Action:* Eugene Poolman to identify the US AID contact for the South Africa Flood Forecasting System project and share with WG members (October 2014).**

Eugene also noted his involvement as the sole meteorological expert on the Commission of Hydrology Flood Forecasting Advisory Group. Composed largely of hydrologists, the group provides guidance with respect to hydrology but also is tasked with promoting awareness of the societal value of hydrological services—the potential link to WG SERA is obvious.

***Action:* Eugene Poolman to identify potential areas of collaboration between WG SERA and the WMO HyCom Flood Forecasting Advisory Group (January 2015).**

ICSU/ISSC/UNISDR[5] Integrated Research on Disaster Risk (IRDR)

Sally Potter, with input from Jane Rovins, highlighted changes and progress that has been made over the past couple of years in the IRDR program. A new executive director, Rudiger Klein, has taken over from Jane in the Beijing office. New national or regional committees have been established in Austria, Columbia, and Latin American and the Caribbean while new International Centers of Excellence, including ones for community resilience, understanding risk and safety, and vulnerability and resilience metrics have been added. A second international science conference was held in June and the IRDR working groups most closely aligned to WG SERA (Forensic investigations of disasters, Risk interpretation and action, Disaster loss data), have been active holding seminars and workshops and publishing reports and case studies.

IRDR is intent on expanding collaborations with WG SERA and WMO through the existing MOU, including sharing and deliberating progress IRDR has made on hazard classifications, socio-economic impacts, and communication issues related to warning and alert systems for a variety of hazards. As terms for many members of the IRDR Science Committee end in 2015, there will be new opportunities for expanding WG SERA representation within IRDR, subject to their terms of reference. IRDR encourages the identification of WG SERA and WWRP programs and projects that could become affiliated with both organizations. A WG SERA representative is invited to join IRDR as a delegate in a forward-planning session at the IRDR global science committee meeting in Paris, 13-15 November.

Action: ***Nanette Lomarda to update WMO/WWRP website with links to IRDR projects (September 2014)***

Action: ***Brian Mills, Nanette Lomarda and co-chairs “elect” to obtain WMO support and identify a WG SERA or WWRP representative to participate in the forward-planning session at the IRDR global science committee meeting in Paris, 13-15 November, and the 3rd UN World Conference on Disaster Reduction in Sendai, Japan, 14-18 March (September 2014).***

Action: ***Sally Potter, Jane Rovins, Brian Mills, and Nanette Lomarda to identify specific IRDR and WWRP/WG SERA programs and projects that could be candidates for cross-affiliation, including exploring a potential project in the Caribbean that involves collaboration between economists and local agencies associated with WMO (November 2014).***

Action: ***Sally Potter/David Johnston to distribute annual IRDR report to WG SERA members (October 2014).***

Action: ***New co-chairs to allocate significant time during the next WG SERA teleconference and in-person meetings (December 2014, 2015).***

Munich Reinsurance NatCat Service

Jan Eichner reviewed activities of the NAtCat Service provided by Munich Re, a substantial database of historical natural disaster event impact statistics for variables such as fatalities, displaced population, insured and uninsured losses. Significant progress has been made to normalize historic loss data to facilitate more robust comparisons and analyses through time. An interesting finding based on some preliminary analysis of standardized data is that earthquake losses seem to be increasing at a much faster rate than those for weather or

[5] International Council for Science/International Social Science Council/ United Nations International Strategy for Disaster Reduction

climate-related perils—possibly an indication of the greater emphasis and ability to design for safety rather than for property loss for seismic perils.

Other projects focus on hazard-specific losses and regions, including an evaluation of convective storms and a North American study on hail losses. Munich Re is also interested in evaluating the benefits of adaptation and disaster mitigation projects, such as major flood protection works or policies and comparable actions targeting other perils. Jan and others noted the difficulties associated with correlating hazards with loss data, something presently impossible at global scales due to the many factors that introduce noise to the analysis. There appears to be some correlation at the regional scale, for instance with Pacific temperature phases and land-falling typhoon frequency which produces substantial losses, and there are other cases where meteorological data or predictions are already used as a proxy for losses. It was noted that relying exclusively on past losses as a proxy for the future, as seems to be occurring in certain countries (e.g., Risk Frontiers project for Australian bushfire risk) ignores the dynamic social and physical features of risk.

Discussion also touched on the limited penetration of insurance in the developing world and how efforts in the Caribbean, Ghana, and elsewhere were showing the benefits of micro-insurance as a tool for both short-term weather and long-term climatic change.

UK Met Office activities

Joanne Robbins updated the working group about several UK Met Office projects. As highlighted in several presentations during the World Weather Open Science Conference, the Met Office is advancing into hazard and impact forecasting as part of its portfolio of services. In part this has been achieved through the Hazard Partnership where expertise in forecasting, for example surface water flooding, is coupled with vulnerability knowledge from the Health and Safety Lab to produce new predictive models of risk and associated services. Other hazard and impact areas in development include landslide event susceptibility and a wind package that covers transportation (roll-over potential), tourism and recreation (e.g., camping suitability), and buildings. While these activities are oriented towards short-term phenomena, the Met Office also has a number of stakeholder-driven projects aligned with seasonal and climate scales (e.g., rail slope stability). Discussion following the update raised a few of the issues associated with impact modelling, such as limited data availability and problems encountered when attempting to scale up or down or develop multi-hazard models.

4. STRATEGIES AND OPPORTUNITIES TO ADVANCE AND FUND RESEARCH, APPLICATIONS, AND TRAINING

The final session of the meeting was intended for examining next steps but evolved into broader discussion about WG SERA and overcoming challenges in fulfilling its stated role within WWRP. In large part, this was due to the fortuitous arrival of the new WMO WWR Chief, Paolo Ruti, who entered his new position only in August, at the meeting.

The general opinion of the members was that we were at a critical and exciting point in time in the evolution of WG SERA within WWRP and of social and interdisciplinary science and its relation to the weather enterprise more broadly. The many demands and potential opportunities that are on the table, including those related to the Thorpex legacy projects, require careful treatment and a guarded optimism if we are to move beyond simply providing a liaison or ‘advisory’ service to WWRP and WMO.

The desire for greater involvement of WG SERA, beyond the chair, in WWRP strategic planning, project development, and proposal writing (e.g., S2S, HIWx, PPP) was unanimous. To some extent this should be facilitated with decisions taken to hold more frequent (quarterly) meetings between annual face-to-face gatherings as well as moving to a co-chair WG model. It will also be aided through commitments by members to review project documentation and actively participate in WWRP meetings and projects.

The WMO WWRP Secretariat and Management can assist by making meetings more amenable to involvement from WG SERA members who are not part of, or necessarily well-versed in, the internal matters of National Meteorological and Hydrometeorological Services (NMHS)—this means supporting additional involvement of social scientists and sector or user specialists in all meetings and projects, not just those of WG SERA. Selective use of trust fund resources from the primary projects for proposal-writing sessions (as opposed to just supporting member travel to meetings) and seed funding of post-doc positions should be entertained through the international coordination offices—this may be the only way to encourage social scientists outside of the WG membership (and not continuously exposed to the NMHS world) to commit to becoming involved in a meaningful way.

It will also be important to establish strategic links within and outside of WMO. Collaborations with the Global Framework for Climate Services (GFCS) and Disaster Risk Reduction streams in WMO and with leading international organizations like the UN IDNDR and IRDR will be important to leverage our limited capacity. Lacking enabling resources to do all of the above, it would be important to establish a set of priority activities, users, or locations, as opposed to attempting to cover everything with little depth.

5. REVIEW OF ACTIONS AND DECISIONS

A list of actions is noted below. The item was deferred; members will review the draft report and suggest changes at that time.

LIST OF ACTIONS AND DECISIONS
WG SERA members to inform Brian Mills and Nanette Lomarda if they are interested in being considered for the role of WG co-chair (15-September).
Brian Mills and Nanette Lomarda to prepare co-chair model and candidate recommendation and send to Sarah Jones for consideration and approval at November 2014 WWRP SSC meeting. Candidates to provide recent short CV. (30-September)
Brian Mills, Nanette Lomarda and co-chair candidates to confirm Web, Skype, or teleconference options available through WMO or WG members to facilitate regular quarterly meetings of available members. (ASAP)
Linda Anderson-Berry and Nanette Lomarda to identify and assess options to develop a SERA-dedicated web-space for linking to projects and resources. (November 2014)
WG SERA and Secretariat to review recent surveys of WMO members, assess the need (and execute if needed) for a complementary survey or scan to canvass their involvement in conducting socio-economic research. (December 2014)
Brian Mills to provide the WG with an update on the Polar Prediction Project (PPP) (October 2014).
Brian Mills, co-chairs “elect”, Joanne Robbins, and Nanette Lomarda to recommend to S2S co-chairs and WWRP-SSC that a third co-chair be defined on “social science” for the project. (October 2014)
WG SERA members to review S2S subproject information and the partially annotated bibliography in order to identify potential areas (research questions, application topics, specific projects) for SERA contributions. Send ideas and comments to Joanne Robbins (15-October).
Members to review the latest version of the HIWeather Project proposal and provide comments to Brian Mills who will collate and send to Brian Golding (29-September 2014)
Nanette (Secretariat) to advise HIWeather co-chairs of WG SERA’s support and intention to become involved in the project and identify options for representation on the current task team and/or other roles. (October 2014)
Members to provide ideas/discuss potential activity to compare risks across HIWx priority (and other?) hazards, beginning with mortality/morbidity and damage. (October 2014)

Eugene Poolman to identify the US AID contact for the South Africa Flood Forecasting System project and share with WG members (October 2014).
Eugene Poolman to identify potential areas of collaboration between WG SERA and the WMO HyCom Flood Forecasting Advisory Group (January 2015).
Nanette Lomarda to update WMO/WWRP website with links to IRDR projects (September 2014)
Brian Mills, Nanette Lomarda and co-chairs "elect" to obtain WMO support and identify a WG SERA or WWRP representative to participate in the forward-planning session at the IRDR global science committee meeting in Paris, 13-15 November, and the 3rd UN World Conference on Disaster Reduction in Sendai, Japan, 14-18 March (September 2014).
Sally Potter, Jane Rovins, Brian Mills, and Nanette Lomarda to identify specific IRDR and WWRP/WG SERA programs and projects that could be candidates for cross-affiliation, including exploring a potential project in the Caribbean that involves collaboration between economists and local agencies associated with WMO (November 2014).
Sally Potter/David Johnston to distribute annual IRDR report to WG SERA members (October 2014).
New co-chairs to allocate significant time during the next WG SERA teleconference and in-person meetings (December 2014, 2015).

6. CLOSURE OF MEETING

The meeting closed at 16:00.

APPENDIX "A" - PARTICIPANTS

MEMBER/GUEST	**ORGANIZATION AND ADDRESS**
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WORLD METEOROLOGICAL ORGANIZATION
COMMISSION FOR ATMOSPHERIC SCIENCES (CAS)
4th Meeting of the Societal and Economic Research and Applications Working Group of the World Weather Research Programme

Montreal, Canada (21-22 August 2014)

CAS/WWRP-WG-SERA-Meeting 4/DOC1.1
(updated 5-August 2014)

Item: Draft Agenda, Documentation Plan, Participants list

LOCATION

Biosphere, 160, Chemin Tour-de-l'Isle,
Île Sainte-Hélène, Montréal
Rooms 201 and 217

BACKGROUND DOCUMENT/WWOSC REFERENCE LIST *(attached to e-mail and indicated in RED alongside appropriate agenda item)*

1.1 WWRP-WG-SERA-Mtg4-Montreal_Doc1.1_AGENDA.pdf
3.1 HIW_proposal_v9.docx (also see WWOSC Session UAS-PA404, SCI-SPL01, SCI-PL03)
3.2 S2S_Implem_plan_en.pdf (also see WWOSC Session SCI-PS133, SCI-PL03)
3.3 Final_WWRP_PPP_Science_Plan.pdf (also see WWOSC Session SCI-PS111, SCI-PL03)
3.4 Anaman & Agyei-Sasu_World Economy Journal Paper in Environmental Macroeconomics.pdf
4.1 final_WWRP_SP_6_Oct.pdf (section 4.6 in particular)

For references to the WWOSC program, please see: WWOSCProgramGuide.pdf
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AGENDA

THURSDAY, AUGUST 21

****Meet at the WWOSC Conference Registration Desk at 1:45pm and depart for the Biosphere as a group (transit or taxi TBD)***

Refreshments will be available throughout meeting

4. ORGANIZATION OF THE MEETING (1430-1500)

- Opening of the meeting and welcome
- Review and adoption of the agenda *(Doc1.1)*
- Working arrangements for the meeting

5. MEMBER ROUND TABLE (1430-1600)

- Round table introduction and brief description of recent activities (5 minutes/member; 10 minutes for new members)
- Review of WG terms of reference
- Search for next working group chair(s)

6. WWRP RESTRUCTURING AND ROLE OF SERA WORKING GROUP (1600-1730)

- Overview and "reality check" from the prerogative of the Chair
- Introduction of post-Thorpex legacy projects:

- High Impact Weather (HIW) Project (Brian) *(Doc 3.1)*
- Subseasonal to Seasonal (S2S) Prediction project (Joanne) *(Doc 3.2)*
- Polar Prediction Project (PPP) (Brian) *(Doc 3.3)*

FRIDAY, AUGUST 22

Refreshments will be available throughout meeting

7. WWRP RESTRUCTURING AND ROLE OF SERA WORKING GROUP (CONT'D) (0900-1200)

– On-going role and collaborative activities with WMO/partners:
  - Economic approaches to measure the value of meteorological services and impacts of extreme weather events in Ghana and other nations in West Africa *(Kwabena) (Doc 3.4)*
  - Coastal Flood Inundation Demonstration Project (CIFDP) (Linda)
  - WMO/WB/CSP[6] Guidance Document on Assessing the Socio-economic Benefits of Meteorological and Hydrological Services (Jeff/Adriaan) *(see WWOSC UAS-PA402)*
  - Disaster Risk Reduction Focal Points of WMO Technical Commissions and Technical Programmes (DRR FP TC-TP) (Paul)
  - Severe Weather Forecast Demonstration Projects (SWFDPs) (Eugene) *(see WWOSC UAS-PS332)*
  - ICSU/ISSC/UNISDR[7] Integrated Research on Disaster Risk (IRDR) (Jane/Sally) *(see WWOSC UAS-PS332)*
  - OTHER COLLABORATIONS (all)

Lunch (1200-1330)

8. STRATEGIES AND OPPORTUNITIES TO ADVANCE AND FUND RESEARCH, APPLICATIONS, AND TRAINING (1330-1600)

– Open discussion facilitated by Brian *(Doc 4.1)*
– Plan of action
– Immediate next steps

9. REVIEW OF ACTIONS AND DECISIONS (1600-1625)

10. CLOSURE OF MEETING (1630)

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[6] World Meteorological Organization/World Bank/Climate Services Partnership
[7] International Council for Science/International Social Science Council/ United Nations International Strategy for Disaster Reduction

Promoting Ecosystems for Disaster Risk Reduction and Climate Change Adaptation

Opportunities for Integration

Discussion Paper – DRAFT August 2014

UNEP

DRAFT August 2014

DRAFT August 2014

Authors:
Nathalie Doswald and Marisol Estrella

We welcome your comments and inputs on the Discussion Paper

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More technical information:

http://unep.org/drr
http://pedrr.org/

Table of Contents

Executive Summary

- This paper seeks to highlight the differences and commonalities between ecosystem-based approaches to adaptation (EBA) and ecosystem-based approaches to disaster risk reduction (Eco-DRR) and suggests key integration points at the project level through examining a number of Eco-DRR, EBA and hybrid (Eco-DRR/CCA) projects.

- EBA and Eco-DRR operate under different policy fora, have slightly different foci and are often undertaken by different institutions, mirroring differences seen generally under climate change adaptation (CCA) and disaster risk reduction (DRR). Indeed, DRR covers multiple hazards, while CCA concentrates on climatic hazards. However, CCA also covers long-term mean changes in climate and the impacts these have upon ecosystems and therefore people. DRR, on the other hand, also has an emphasis on response, recovery and reconstruction that CCA does not. Whilst the broad aims for CCA and DRR are similar, current conceptual frameworks, terminology and semantics are different hampering communication between the two. Assessments under DRR and CCA can be quite different because each adopts different terminologies and approaches. CCA often examines impact of long-term climate change. However, lack of good data means that CCA often falls back on DRR-like assessments. As the focus of DRR and CCA may be different, so too are differences then reflected in project design and implementation.

- When projects do not take both long-term climatic change and multiple hazards into account the result may be mal-adaptation or increased risk. Integration of CCA and DRR practice is thus called for. Integration is most likely to succeed at the project level rather than the policy level given the significant differences in policy tracts. At the project (operational) level, it is often difficult to distinguish between CCA and DRR.

- Ecosystems and their services are important to both CCA and DRR. Each community has developed its own approach: Ecosystem-based Adaptation (EBA) for CCA and Ecosystem-based Disaster Risk Reduction (Eco-DRR) for DRR. Currently EBA is more formally “recognised” on the international arena due to specific references in UNFCCC processes.

- A total of 34 (Eco-DRR, EBA and hybrid Eco-DRR/CCA) projects were examined in terms of their aims, assessments, implementation, monitoring and evaluation (M&E) and

policy and institutional contexts to understand how in practice these approaches differ and overlap and to find key integration points.

- EBA and Eco-DRR share the differences mentioned above (for CCA and DRR) but have more similarities given their focus on ecosystem management, restoration and conservation to increase resilience of people (or reduce risk or reduce vulnerability). However, many EBA projects focus more on conservation of biodiversity and ecosystem services and impacts of long-term climate change than does most Eco-DRR practice because of EBA's roots from conservation organisations; while Eco-DRR include components such as early warning, preparedness and contingency planning, response, recovery, reconstruction phases, on which EBA usually does not focus. In formulating project aims, understanding future change and project needs by creating future scenarios that takes into account climate, environment, development and multiple hazards would help indicate who would be best involved in the project and ensure future sustainability.

- This paper identifies five areas for Eco-DRR and EBA integration in project design and implementation, namely:
    1. Defining aims of the project;
    2. Conducting risk and vulnerability assessments;
    3. Project implementation: methods, approaches, tools;
    4. Monitoring and Evaluation; and
    5. Policy and institutional engagements.

- Because both Eco-DRR and EBA are emerging fields in their own right, each are developing assessment methods and tools, in which data availability plays a large role. There is sometimes cross-over in assessment needs either resulting in duplication or missed opportunities due to lack of knowledge of the other field. Both fields could inform each other, strengthening knowledge and practice.

- Implementation approaches and activities are broadly similar between Eco-DRR and EBA. There is more of an emphasis in some EBA projects on conservation and enabling ecosystems to adapt, and using species suitable to future climatic conditions. Adaptive management, that is strongly promoted in the EBA community, is an approach that recognizes uncertain future conditions and therefore embeds learning-oriented, flexible decision-making processes. Eco-DRR could benefit from EBA knowledge to climate-proof its interventions while EBA could learn from Eco-DRR's integrated disaster management approach.

- EBA and Eco-DRR M&E is embryonic and, as such, working together (including with other initiatives such as REDD+) will help to avoid duplication and create synergies. Ensuring learning as part of M&E is essential.

- Eco-DRR and EBA projects work mostly with environmental ministries to influence policy. However, adaptation and disaster risk reduction are broader than the reach of environmental policies. Furthermore, the environment needs to be taken into account by other sectors. Eco-DRR and EBA could work together to increase multi-disciplinary approaches within project implementation and at a policy level.

- While there exists key differences in overall approach and implementation, especially at the theoretical level, practice shows that often it is a question of differences in discourse than a real difference at the local level. Nevertheless, EBA and Eco-DRR are generally undertaken by very separate communities due to differences in policy and funding tracks. Fostering collaboration at the project level would provide good lessons for future practice and facilitate integration of EBA and Eco-DRR. This would then facilitate the development of much needed integrated tools. Gaps in knowledge in both communities should be filled through dedicated research, appropriate M&E frameworks that support learning and knowledge exchange platforms.

1. Introduction

A number of stakeholders, academics, practitioners and policy-makers have called for integration of climate change adaptation (CCA) and disaster risk reduction (DRR). Currently, both processes are governed by different policy tracks which often lead to different institutions and stakeholders implementing measures on CCA and DRR. At the policy level, the Hyogo Framework for Action (HFA), the current global framework on disaster risk reduction, states the need to "promote the integration of risk reduction associated with existing climate variability and future climate change into strategies for the reduction of disaster risk and adaptation to climate change" (ISDR 2005, p.15). The Cancun Adaptation Framework, adopted by Member States to enhance action on adaptation under the United Nations Framework Convention on Climate Change (UNFCCC), invites parties to "enhance climate change disaster risk reduction strategies, taking into account the Hyogo Framework for Action" (UNFCCC 2010, p.5).

Despite the call for integration and a number of studies on why integration would be beneficial and why it is currently hampered (Thomolla et al. 2006; Shipper and Pelling 2006; Tearfund 2008; Birkman and von Teichman 2010), there exists no clear analysis on how integration is to be practically achieved (Teafund 2008; Mercer 2010).

In the field of CCA and DRR, ecosystem-based approaches are emerging as important measures to be undertaken within overall CCA and DRR strategies. Examining CCA and DRR projects that are based on this common denominator (an ecosystem-based approach) can highlight practical differences and similarities and point to key integration points. Both fields are currently elaborating their own ecosystem-based approach. Under CCA, ecosystem-based approaches to adaptation (EBA) are fast gaining interest from different stakeholders and have made their way into the policy arena. Under DRR, on the other hand, ecosystem-based disaster risk reduction (Eco-DRR) is only starting to emerge as a DRR approach in its own right (although its elements have been used in the past as part of disaster management, for instance the long history of coastal forests in Japan and mountain forests for avalanche and landslide protection in Switzerland and other Alpine countries). In terms of implementation at the project level, both are on par; although Eco-DRR has much more experience to draw upon, given the relative novelty of climate change adaptation. It is therefore a propitious point in time to examine both EBA and Eco-DRR with a view to finding integration points.

This paper will first lay out the differences and similarities between CCA and DRR and summarise the discussion on need for integration. This background is necessary to understand the context as well as norms and practices used in Eco-DRR and EBA. Second, it will discuss the role of ecosystems within CCA and DRR and outline each emerging approach, revisiting the need for integration. Third, it will examine recent/current EBA and Eco-DRR and hybrid Eco-DRR/CCA projects following the conventional project cycle: aims, assessments, implementation (ground-level and at policy-level) and monitoring and will discuss the differences and commonalities between EBA and Eco-DRR. Finally, it will then examine potential areas of integration and synergy, highlighting key entry points for EBA and Eco-DRR.

2. Climate Change Adaptation (CCA) and Disaster Risk Reduction (DRR)

Climatic hazards are the most frequent hazards facing society and any change in the climatic system exacerbates disaster risk. In the last century, we have experienced *virtually certain* changes in climate, especially the warming of the climate system, according to the latest Intergovernmental Panel on Climate Change (IPCC) assessment report (AR5). These changes are projected to continue with global increases in temperature, changes to precipitation patterns, intensification of extreme events and increasing sea level (IPCC 2013). These alterations in the climate system are likely to increase disaster risk in many areas through increasing hazards and exacerbating drivers of vulnerability.

The changes in climate seen over the last century are in large part due to an increase in greenhouse gases released into the atmosphere as a product of human development. Recognising attribution and the need to mitigate further changes in climate led governments to develop the United Nations Framework Convention on Climate Change (UNFCCC) in 1992. Whilst efforts to mitigate climate change are still ongoing, current and now unavoidable future changes in climate have raised the need for countries to adapt to climate change. The Cancun Adaptation Framework was adopted in 2010 to enhance action on adaptation, the result of which is the preparation by many countries of National Adaptation Plans (NAPs). Climate change adaptation (CCA) refers to "adjustments in natural and human systems in response to actual or expected climate change impacts, which moderate harm or exploit beneficial opportunities" (Parry et al. 2007, p.869)[1]. Thus CCA strategies aim to reduce vulnerability to climate change impacts.

Disaster risk reduction (DRR) is a field that emerged following the International Decade of Disaster Reduction in the 1990s and the Hyogo Framework for Action (HFA (2005-2015), the global framework on disaster risk reduction, endorsed by 168 Member States at the World Conference on Disaster Reduction held in Kobe, Japan, in 2004. DRR practice has its roots in the field of disaster management, involving primarily humanitarian organizations and agencies, civil protection and emergency responders. Hence, interventions were heavily focused on post-disaster response and managing or controlling hazards and placed greater emphasis on engineering solutions, such as building of dykes, dams, seawalls and channelling of rivers. Geographer Gilbert White's landmark work on "Human Adjustment" in

[1] This definition has changed with the AR5: "The process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate harm or exploit beneficial opportunities. In natural systems, human intervention may facilitate adjustment to expected climate and its effects."

the 1940s (White, 1945) was one of the first to challenge the notion that natural hazards are best addressed by engineering solutions, suggesting the importance of modifying human behaviour to reduce or prevent hazards. Starting in the 1980s and 1990s, civil society organizations and key advocates of vulnerability analysis (e.g. Ben Wisner, Terry Cannon, Piers Blaikie, Ian Davis and others) brought global attention to the importance of addressing vulnerability in order to reduce disaster impacts, thus shifting disaster management away from hazard-focused approaches and linking disaster risk reduction to sustainable development, human rights, equity and poverty reduction. Since the HFA was adopted, there is now better recognition of the key components of disaster risk (hazards, exposure and vulnerability) and the underlying root causes of risk. Nonetheless, conventional approaches to disaster management, with a focus on disaster preparedness and emergency response, still prevail in many countries.

Disaster risk reduction is defined as “the concept and practice of reducing disaster risks through systematic efforts to analyse and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events” (UNISDR 2009, p. 10-11). DRR focuses its strategies on reducing risk from multiple hazards, both natural and man-made. This highlights the substantive difference between DRR and CCA, in which the latter focuses solely on climate-related hazards and their impacts. **Figure 1** shows the overlap and difference between DRR and CCA in relation to the hazards being addressed.

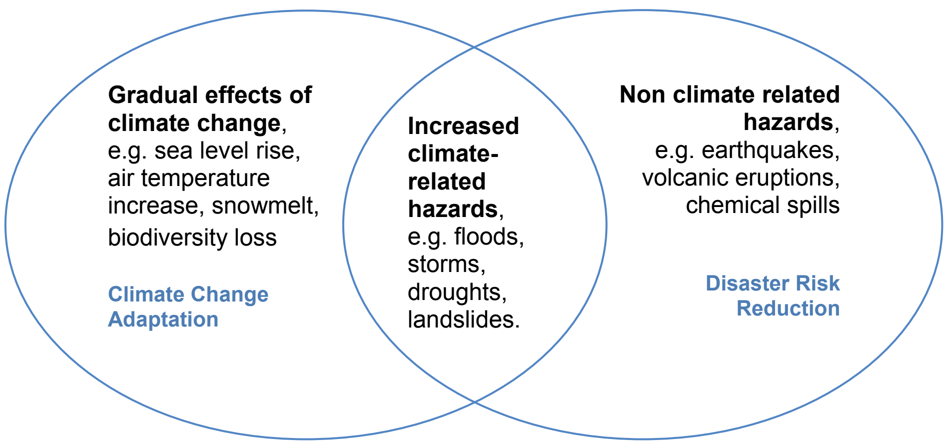

Figure 1: Hazards and impacts covered by CCA and DRR (adapted from Turnbill *et*

In DRR, disasters linked to natural hazards are often viewed as part of recurring or cyclical events, for instance in the case of monsoon rains and floods, hurricanes/tropical cyclones, earthquakes and volcanic eruptions. In contrast, climate change is often seen as a long-term process with high levels of uncertainty linked to climate change impacts. Hence, timeframes for implementation can also vary between DRR and CCA. This view forgets that DRR are measures intended to be long-term orientated even if in practice that is not always feasible (Birkman and von Teichman 2010). Whilst it is true that long-term projected changes in climate are taken into account in many CCA projects, current climatic hazards are also addressed, given that climate change impacts are already being felt today as stated clearly in the AR5. Furthermore, lack of down-scaled climate projections for many regions along with the uncertainty in the model outputs sometimes precludes their use within projects. Both CCA and DRR rely on past hazard trends and address underlying factors of vulnerability to reduce impacts and risk.

Given the overlap between CCA and DRR, integration between the two approaches has been called for and its need recognised at a policy level (see introduction). Both approaches aim to reduce the vulnerability of society to hazards and their negative impacts. Factors conferring vulnerability are multi-faceted and require an encompassing approach to reduce these. Both CCA and DRR need to take each other into account to avoid unwittingly increasing vulnerability (Tearfund 2008). Any CCA strategy that does not take non-climatic hazards into account could result in maladaptation. For example, building a sea wall to provide protection against storm surges does not necessarily take into account sea level rise, tsunamis or land subsidence, which could result in exacerbating the impacts of storm surges and coastal flooding (e.g. trapping flood waters behind the sea wall). Conversely, DRR needs to consider future changes in climate; otherwise, it will underestimate the changes in hazard intensity or frequency and increase in disaster risk as a result of climate change. For example, a modelling study showed that planting trees as a measure to decrease dryland salinity and improve environmental conditions in Australia could lead to reduced stream flow under a changing climate, which would further stress water security (Herron *et al.* 2002).

The DRR community is starting to take climate change into account through “climate-proofing” DRR projects. Yet, integration between CCA and DRR is still not standard practice mainly because each operates within different communities and policy processes. **Table 1** summarises these differences. The field of CCA has its origins in environmental sciences with a focus on a macro-level, long-term perspective. Consequently, it has traditionally involved mostly scientific research and a top-down approach to implementation (Thomalla *et al.* 2006). This is changing, however, with more community-based approaches. CCA focuses on prevention and development but also takes into account opportunities presented by climate change. For example, changes in climate may allow new crops to be grown in other areas, thus opening up market opportunities.

The field of DRR has its origins in engineering and natural sciences along with a large humanitarian tradition which focuses more on local scale and community-based work (Thomalla *et al.* 2006). DRR includes early warning, preparedness and contingency planning, response, recovery, and reconstruction phases, as well as focuses typically on community development (e.g. in the health, education and agricultural sectors). The DRR approach is in large contrast to CCA which rarely deals with disaster management issues, though early warnings systems are sometimes put in place.

Table 1: Different communities/characteristics of climate change adaptation and disaster risk reduction (adapted from Thomalla *et al.* 2006).

	Climate change adaptation	Disaster risk reduction
Organisations and institutions	United Nations Framework Convention on Climate change (UNFCC)	United Nations and UN office for disaster risk reduction (UNISDR)
	Intergovernmental panel on climate change (IPCC)	International Federation of Red Cross and Red Crescent Societies (IFRC)
	Convention on Biological Diversity	International, national and local civil society organisations
		National civil defence authorities
	Academic research institutions	National Disaster Management Agency/ National Disaster Risk Reduction or Disaster Management Council
	National environment and energy authorities	
	Conservation non-governmental organisations (NGOs)	
International conferences	Conference of the Parties (CoP)	World Conference on Disaster Risk Reduction
Strategies	National communications to the UNFCCC	UN International Strategy for Disaster Risk Reduction (ISDR)
		Hyogo Framework for Action 2005-15
	National Adaptation Plans for Action for Least Developed Countries (NAPAs)	National Disaster Management Plans and Strategies
	National Adaptation Plans (NAPs)	
Funding	Special Climate Fund	National civil defence/emergency response
	Least Developed Countries Fund	International humanitarian funding
	Adaptation Fund	Multi-lateral banks
	Green Climate fund	Bi-lateral aid
	Multi-lateral and Bi-lateral funding	Multi-lateral and Bi-lateral funding

Cross-over and integration are further hampered because of key differences in norms and knowledge base (Birkman and von Teichman 2010). The most pervasive hurdle is semantics: the use of terms and their definitions, which vary widely between communities. This hurdle impacts communication between communities because they can find themselves talking at cross-purposes due to their different understanding of terms and concepts. This can be best demonstrated through laying out the conceptual frameworks of both CCA and DRR.

DRR is based on reducing risk which is a function of hazard, exposure and vulnerability.

> **Risk** is "the combination of the probability of an event and its negative consequences" (UNISDR 2009, p.25). **Exposure** refers to "people, property, systems or other elements present in hazard zones that are thereby subject to potential losses" (UNISDR 2009, p.15). **Vulnerability** is "the characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard." (UNISDR 2009, p.30).

Disaster risk can be schematically viewed in **Figure 3**:

Figure 3: Disaster risk framework (adapted from Ciurean *et al.* 2013)

The CCA conceptual framework that the majority of projects and studies use comes from the IPCC (AR4 and earlier) and is based on reducing vulnerability to climate change which is seen as a function of exposure, sensitivity and adaptive capacity.

> **Vulnerability to climate change** is defined as "the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity" (Parry et al. 2007, p. 883). **Exposure** is the

extent to which a system will be subjected to hazards. **Sensitivity** is the extent to which a system is affected by a hazard. **Adaptive capacity** is the extent to which a system is able to exploit opportunities and resist or adjust to change.

Often studies use the framework as presented in **Figure 2**:

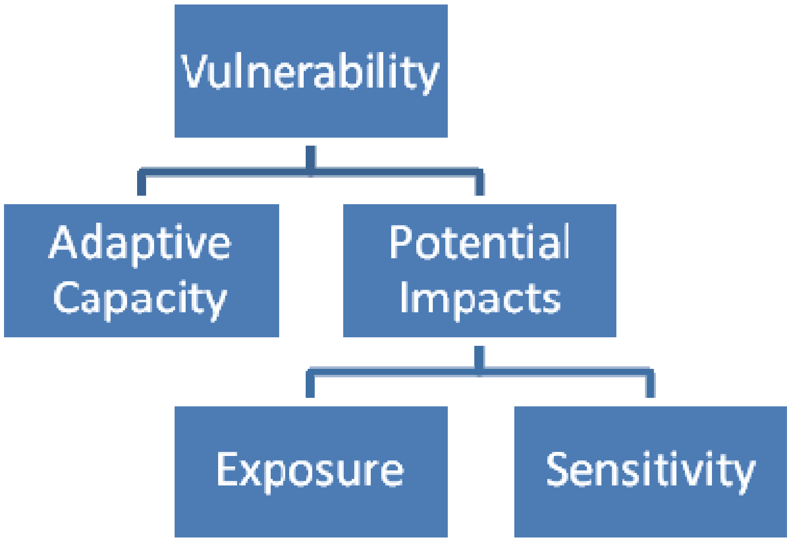

Figure 2: Vulnerability to climate change conceptual framework

As can be seen by the CCA and DRR frameworks, although the concepts are essentially the same, different terms are used and these are defined differently. Exposure for example, common to each framework, is used to denote very different things. Under CCA, determining exposure is essentially determining hazard zones, whist under DRR, exposure relates to elements (people and assets) located within the hazard zones (over a given period of time). The DRR concept of exposure can be found within CCA's sensitivity. Instead of sensitivity, the concept of susceptibility to hazards is recognized in DRR as a component of vulnerability. Indeed, the terms vulnerability within both DRR and CCA approaches are not used in the same way. In DRR, vulnerability is a characteristic of the system, whilst in CCA vulnerability is an outcome encompassing physical exposure/hazard, the characteristic of the system and its ability to cope. It thus has an element of DRR's "risk" (Birkmann et al. 2009). These differences arise because DRR generally takes a social science perspective, whilst CCA's vulnerability approach mainly takes a natural science perspective.

However, the IPCC has recently decided to change its conceptual framework and definitions used in the AR5 after a special report on managing risks of extreme events and disasters to advance climate change adaptation (IPCC 2012). Its concepts are now closer to those used in the DRR community:

> **Vulnerability** is defined as "The propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts including sensitivity or susceptibility to harm and lack of capacity to cope and adapt;" while **exposure** now refers to "The presence of people, livelihoods, species or ecosystems, environmental services and resources, infrastructure, or economic, social, or cultural assets in places that could be adversely affected." (IPCC - 28 October 2013 draft[2]).

It will take time, however, for both CCA and DRR community to be on the same page with regards to concepts and definitions, but it is promising to see a move towards a common understanding.

Resilience is a term that is used in both the CCA and DRR community. Both communities aim to increase resilience. Whilst in some cases, resilience is seen as the opposite to vulnerability, in others it is an additional component that reduces vulnerability. Lack of formal integration of resilience within CCA and DRR frameworks increases confusion surrounding the term. Within the DRR community, resilience is defined as "the ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions"(UNISDR 2009 p.24). Within the CCA community, resilience is often defined as "the ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organisation, and the capacity to adapt to stress and change" (Parry et al. 2007, p. 880)[3]. These definitions are very similar; yet understanding of these terms changes depending on whether the view point stems from social or natural sciences. Moreover, different research communities within also have different understandings thereof. In practice, however, resilience is a concept used loosely, either indicating a system attribute, or an umbrella concept for a range of system attributes

[2] Accessed 09/05/2014 http://ipcc-wg2.gov/AR5/images/uploads/WGIIAR5-Glossary_FGD.pdf

[3] Or "The capacity of a social-ecological system to cope with a hazardous event or disturbance, responding or
reorganizing in ways that maintain its essential function, identity, and structure, while also maintaining the capacity for adaptation, learning, and transformation" (Arctic Council, 2013).

deemed desirable, neither of which are easily operational (Klein et al. 2004). Indeed, indicators for resilience and adaptation to climate change are still emerging areas.

Differences in concepts and conceptual frameworks lead to different assessment methodologies in DRR and CCA. The overarching assessment tools are vulnerability and capacity assessments (VCAs), hazard assessments and disaster risk assessments (DRA) for DRR. For CCA, the most common approach is vulnerability (impact) assessment (VA or VIA). Whilst approach and methodology of each vary between projects, generic steps can be identified. **Figure 4** outlines generic steps (taken from UNDP guidance) of DRA and VA. However, tools used within the DRA and VA often overlap (further discussion in section 4). Differences in assessments can lead to differences in overall project design and implementation.

a) Disaster Risk Assessments b) V ulnerability Assessment

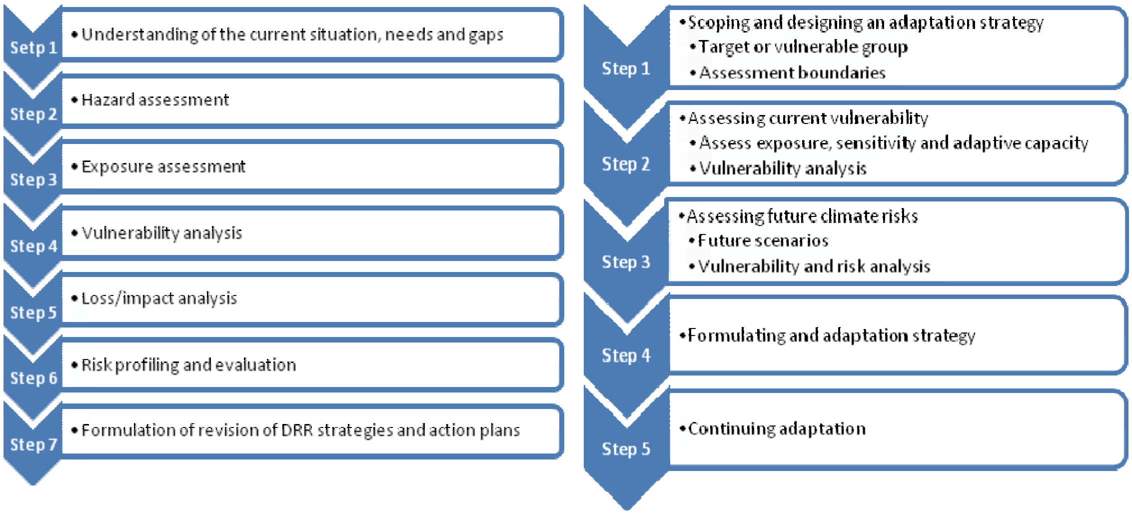

Figure 4: Generic steps in CCA and DRR assessments processes: a) Disaster risk assessment (UNDP 2010) b) Vulnerability Assessment (from UNDP Adaptation Policy Framework; Downing and Patwardhan 2004).

These similarities and differences are important to understand for both communities to work together. With the AR5, CCA community and DRR community will have a more common language and concepts which will advance integration between CCA and DRR in the future.

3. The role of ecosystems in CCA and DRR

Ecosystems and ecosystem services are central, though not primary, to the discussion of CCA and DRR. Indeed, the environment is at the same time the context, the problem and the solution to many hazards facing society. It can both increase and reduce vulnerability and risk to disasters.

Ecosystem services are the benefits people obtain from ecosystems, which have been classified by the Millennium Ecosystem Assessment as: *supporting services*, such as seed dispersal and soil formation; *regulating services*, such as carbon sequestration, climate regulation and pest control; *provisioning services*, such as food, fibre, timber and water; and *cultural services*, such as recreational experiences, education and spiritual enrichment (MA 2005).

It has been shown that ecosystem services can be used for climate change adaptation and disaster risk reduction (CBD 2009; World Bank 2010; Munang *et al.* 2013; Renaud *et al.* 2013). For example, forests provide flood and landslide regulation services, a fact that is harnessed in watershed management programmes (Doswald and Osti 2013; Renaud *et al.* 2013). Coastal mangroves have been shown to protect adjacent areas from storm surges (Badola and Hussain 2005; Renaud *et al.* 2013). Nevertheless, ecosystems are not invulnerable to current anthropogenic pressures and are being degraded, as outlined in the Millennium Ecosystem Assessment (MA 2005). The capacity of ecosystems to provide these services may be further undermined by climate change or hazards, as well as by certain societal measures undertaken under CCA or DRR. Strategic management of ecosystems, therefore, is necessary to ensure provision of services that are important to society in the face of climate change and hazards. However, it is important to state that solely ecosystem-based solutions may always not be entirely beneficial. Ecosystem-based solutions often require a lot of land which may not be available (Doswald & Osti 2013) or may not provide sufficient protection in some cases (Vosse 2008). **Figure 5** illustrates the importance of including an ecosystem-based approach in overall CCA and DRR.

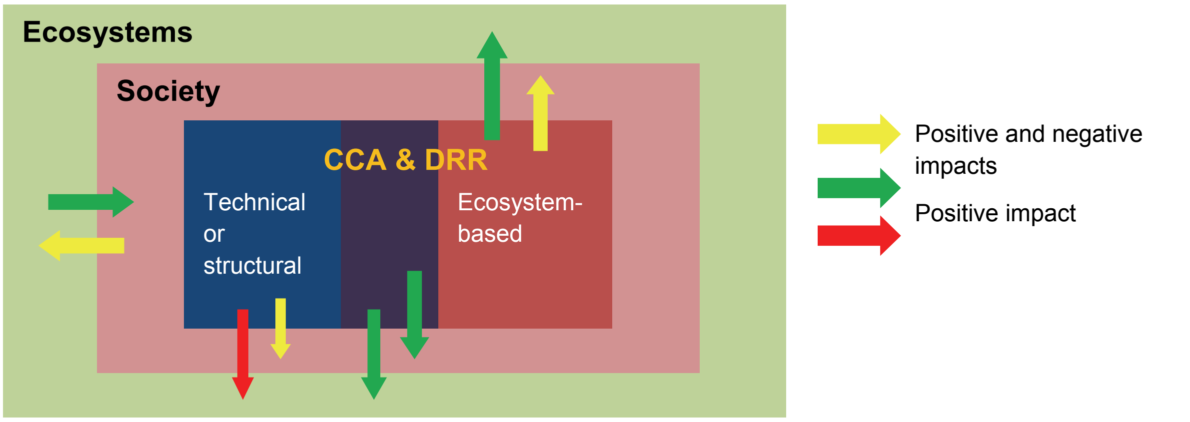

Figure 5: The relationship between ecosystems, society and climate change adaptation (CCA) & disaster risk reduction (DRR). The figure shows the impact on ecosystems and society from different scenarios of planned adaptation strategies (solely technical or structural, solely ecosystem-based, and an integrated framework containing both strategies). The impact on society from the two measures in isolation is positive and negative; negative in this instance is due to cost and feasibility.

At the policy level, the importance of including ecosystem management for CCA and DRR is recognised. UNFCCC's Cancun agreement invites parties to "build resilience of socio-economic and ecological systems" (UNFCCC 2010, p.5), whilst the HFA recognises environmental degradation as a major contributing factor in disaster risk and the need for sustainable environmental management to reduce risk, mainly through HFA Priority 4, which focuses on reducing underlying risk factors.

Ecosystem-based approaches for adaptation to climate change (EBA) have emerged in international climate policy platform as a "new" approach, involving the use of biodiversity and ecosystem services through sustainable management, conservation and restoration of ecosystems, to help people adapt to the adverse effects of climate change (CBD 2009). The EBA concept stems from a long history of using environmental management to adapt to climatic variations. The discipline of EBA is currently growing with interest in policy arenas[4], with inclusion in the AR5, and with the production of catalogues of case studies, research, and development of guidelines and tools.

[4] EBA is not mentioned directly in any agreement under the UNFCCC aside from a decision to hold a technical workshop on EBA. However, it is defined and outlined within decision X/33 of the Convention on Biological Diversity.

Ecosystem-based approaches for DRR (Eco-DRR) aims to manage the environment in such a way (through sustainable management, conservation and restoration of ecosystems) that risks to communities are reduced whilst enabling sustainable and disaster-resilient development (Estrella & Saalismaa 2013). In contrast to EBA, Eco-DRR is emerging as a field of practice but has not yet received significant attention in DRR policy contexts. Although environmental degradation as an underlying risk factor and environmental impacts of disasters are now well-recognized and accepted in the DRR community, what is less understood is the role of ecosystems and ecosystems management in reducing disaster risk.

One of the additional arguments to using ecosystem-based approaches within CCA and DRR, aside from their capacity to decrease hazard impacts, is the fact that they provide multiple social, economic and cultural benefits for local communities. They can also be effective especially in terms of adaptation, because successful adaptation is multi-faceted (Doswald *et al.* 2014). There exists a number of case studies and research that show the benefits of ecosystem-based approaches, especially to adaptation to climate change (EBA). Furthermore, studies show that its use is mainstreamed within many sectors (e.g. coastal protection, agriculture and forestry, urban areas) albeit the term EBA is not used (Doswald and Osti 2013). It is worth pointing out, however, that there is a cross-over in terms of case studies that have been used to advocate for EBA and Eco-DRR (ProAct Network 2008; Doswald and Osti 2013; Renaud *et al.* 2013). Interest from the international arena is one of the reasons that these case studies have been subsequently "labelled" as EBA rather than Eco-DRR. In many of the available case studies, there is a focus on ecosystems in relation to addressing climate-related hazards as well as climate change. This is so because ecosystem-based approaches are not widely applied for non-climatic hazards, such as earthquakes or volcanic eruptions, although several studies have shown how re-vegetation and forest management can reduce risk of rock falls or landslides triggered by earthquakes (e.g. in the case of "protection forests in Switzerland; see also Peduzzi 2010).

Just as CCA and DRR overlap, so do EBA and Eco-DRR but perhaps even more so given their focus on ecosystems. Furthermore, there exist "hybrid projects" which address CCA and DRR using an ecosystem-based approach. Yet, due to the largely different policy and institutional backgrounds of CCA and DRR, EBA and Eco-DRR still operate in separate silos. Moreover, hybrid projects tend to have either an EBA or Eco-DRR "flavour" depending on the experts involved in the project.

Understanding what are differences and similarities between both approaches, as well as examining hybrid Eco-DRR/CCA approaches at the project level will facilitate/enable identification of synergies between the two fields of practice. It would furthermore promote closer integration of Eco-DRR/EBA (as well as provide insights generally for DRR/CCA), and thus avoid the pitfalls mentioned (i.e. what can happen without integration between DRR/CCA), and improve future project and programme planning.

4. Ecosystem-based approaches to CCA and DRR: Project analysis

4.1 General overview

Whilst environmental management undertaken to tackle climate variability and climatic hazards is not new and much evidence exists as to the effective use thereof (Doswald *et al.* 2014), many EBA, Eco-DRR and EBA/Eco-DRR projects are either embryonic or currently underway. Thus, complete information on these is lacking. Therefore juxtaposing theory with practice will be useful to highlight differences and commonalities between the fields of practice. Moreover, understanding the theory behind the practice can reveal the sources of similarities and differences in practice.

Projects and initiatives were selected after both online searches for CCA and DRR projects involving environmental management and after discussions with institutions involved with such projects. A total of 34 projects/initiatives were compiled (see **annex 1**). This is not an exhaustive compilation of projects. Many more projects or initiatives that serve as EBA or Eco-DRR or both can be found (see for example Doswald *et al.* 2014; Doswald and Osti 2013; Renaud *et al.* 2013). Those which were selected provided enough information on project implementation. Classification into EBA, Eco-DRR and hybrid Eco-DRR/CCA projects was undertaken through an examination of the project labels (whether they call themselves one or the other), aims and implementation. There were 13 EBA projects, 11 Eco-DRR projects and 10 Eco-DRR/CCA projects. It is important to point out that this paper does not set out to assess projects/initiatives but only to use these to understand how EBA and Eco-DRR projects are undertaken in practice and to find key integration points.

4.1.1 Hazards/impacts covered in projects

Drought, flood, storms, landslides, erosion and fires were the hazards addressed by both EBA and Eco-DRR projects. Eco-DRR also dealt with hazards, such as tsunamis, earthquakes, dust storms and avalanches, while EBA also dealt specifically with sea-level rise and broad (potential) changes to temperature and rainfall patterns. Hybrid Eco-DRR/CCA projects also included glacial lake outbursts (see **Figure 6**).

More differences could be observed in the impacts addressed by both approaches. Whilst Eco-DRR mainly addressed impacts in terms of loss of livelihoods, lives, food security, water security and health, EBA also included dealing with long-term impacts such as biodiversity loss, changes within ecosystems (e.g. coral bleaching and habitat suitability changes) and potential increase in disease/pest outbreaks, alongside livelihoods, food and water security.

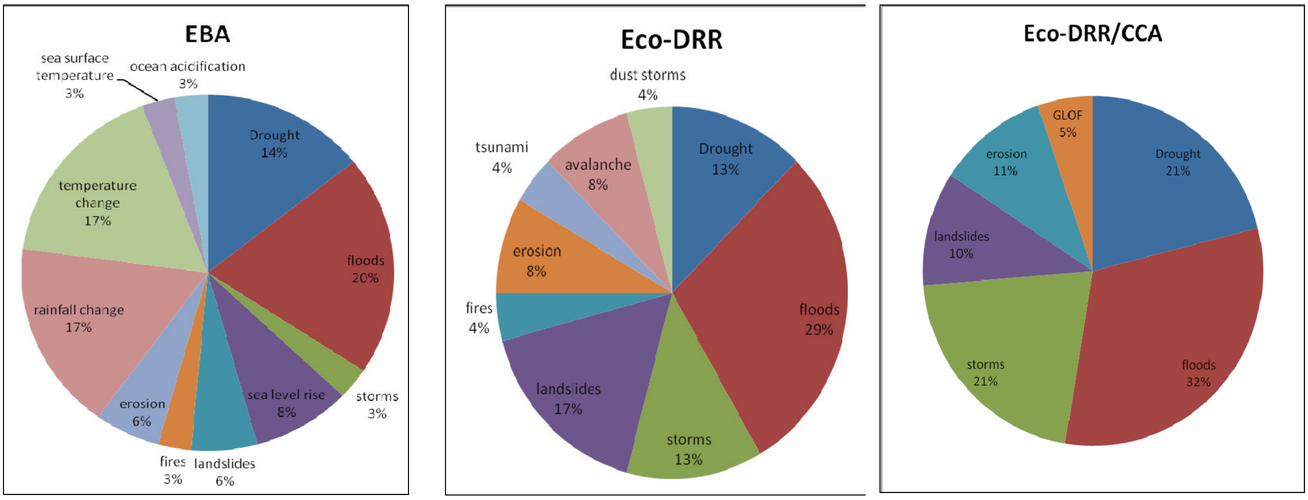

Figure 6: Percentage of hazards addressed in Ecosystem-based approaches for adaptation (EBA), Ecosystem-based approaches to disaster risk reduction (Eco-DRR) and hybrid projects (Eco-DRR/CCA)

4.1.2 Ecosystems covered in projects

Projects equally covered dryland, marine, mountain, forest, inland waters, marine and urban ecosystems. Urban projects tend to label their actions more as adaptation (i.e. EBA[5]) than disaster risk reduction (Eco-DRR). However, this is more likely due to the current political prominence of climate change (Mercer 2010) than a real difference.

[5] The term “ecosystem-based adaptation” is not used by these projects. They mostly refer to climate change adaptation in conjunction with green infrastructure or solutions.

4.2 Aims/expected outcomes of Eco-DRR, EBA and hybrid Eco-DRR/CCA projects

In terms of the projects compiled, project goals tended to be very broad and vague. Eco-DRR projects mainly aim to reduce risk, increase protection and resilience against hazards; whilst EBA projects aim to reduce vulnerability to climate change, increase resilience and undertake appropriate adaptation measures. Hybrid Eco-DRR/CCA projects typically aim to reduce risk through adaptive measures. As can be seen, the difference in stated aims is purely semantics. Nevertheless there are differences in breadth of aims and outcomes within projects.

EBA and Eco-DRR both aim to achieve their goals using same measures: sustainable management, conservation and restoration of ecosystems to achieve their goals. EBA, however, because of its connection to the Convention on Biological Diversity (see CBD 2010), has more emphasis on ecosystems and their services, and biodiversity than Eco-DRR. Indeed, some EBA projects primarily focus on maintaining and increasing the resilience of biodiversity and ecosystem services as a way to help people adapt. The focus is then on the environment that people depend upon rather than people and their surrounding environment. For example, a project funded by the Global Environmental Facility (GEF) entitled, 'Natural Resources Management in a Changing Climate in Mali', aims to "expand the adoption of sustainable land and water management practices in targeted communes in Mali. This objective will be achieved through the implementation of capacity building, *biodiversity conservation* and support to poverty reduction activities through an *ecosystem-based adaptation approach*. It is an integrated approach to conservation, restoration and sustainable management of territories to enable people to adapt to climate change, and ultimately increase their resilience".

Conservation International's (CI) EBA projects in Brazil and South Africa focus on marine, terrestrial and coastal regions as a means of improving livelihoods and *conserving biodiversity* in the face of climate change and aim to increase the resilience and adaptive capacity of vulnerable people to climate change, through implementing EBA. In the Philippines, CI's EBA project aims to "maintain and *increase the resilience of biodiversity and ecosystem services* in the Verde Island Passage in the face of climate change". However, some EBA projects make no mention of biodiversity within their aims. UNEP/UNDP/IUCN 'Mountain EBA' projects, for example aim "to reduce vulnerability and increase resilience to climate change through EBA".

Eco-DRR projects do not have such a heavy focus (at least in the stated aims) to protect biodiversity. Instead, the focus is on increasing resilience of people or reducing risks from hazards using environmental management or utilising ecosystem services. UNEP's Eco-DRR project in The Democratic Republic of Congo, for example, aims to "strengthen the community's capacity to maximise the ecosystem service benefits provided by the Lukaya river catchment, including its potential to regulate floods and for water pollution mitigation."

Hybrid Eco-DRR/CCA projects mainly state aims to reduce risk or increase resilience and apply adaptive measures often in broad terms. For example the Partnership for Resilience's project in Ethiopia aims "to reduce vulnerability of the community to current hazards, but also incorporate measures that help people prepare for the future and adapt to climate change".

Although these differences in aims may seem small, it can mean a large difference in approach taken in terms of assessment and implementation. However, differences are not always obvious between aims of EBA and Eco-DRR projects. The project focus also depends on the implementing institutions. When biodiversity conservation organisations are involved, a more ecosystem-focus is applied.

4.3 Assessments

The projects assessed for this document tended to use VA and DRA approaches (see section 2), often adapting them to their needs. Both Eco-DRR and EBA aim to incorporate ecosystems and the environment within their assessment frameworks. There is currently no set methodology to do so (in both communities) and many institutions are creating their own ways of doing so depending on their starting point or main objective.

Presently, some EBA projects start their assessment processes with an ecosystem focus: examining how ecosystems (and their services) may be impacted by climate change and thus how this impacts communities that depend upon them. For example, CI's South Africa EBA project, modelled future changes in biomes under climate change to assess areas of stability and change. They then modelled areas important for supporting resilience to climate change. Combining both maps along with certain priority maps (such as water yield areas), they determined priority areas for undertaking EBA. In UNEP/UNDP/IUCN Mountain EBA project taking place in Peru, potential changes to agricultural crops were modelled alongside water yield and other factors to indicate areas vulnerable to climate change within agricultural and water sectors. Not all EBA assessments take a modelling approach (see next section); often they follow an indicator approach, a descriptive-analytical approach, or a combination. EBA assessments are often top-down; although community assessments (and mixed approaches) have been used, especially in community-based adaptation projects that have an ecosystem focus.

Eco-DRR and hybrid Eco-DRR/CCA assessments usually start with the hazards, exposure and vulnerabilities stemming with a particular focus on linkages to environmental conditions, natural resource use and environmental / natural resource management in the participating communities. Community-based risk assessments and mapping are common. UNEP's Eco-DRR projects in Afghanistan, Sudan, Haiti and the Democratic Republic of the Congo (DR Congo) held community consultations to identify the types of hazards, people and assets exposed, environmental vulnerability (e.g. status and extent of environmental degradation, current and historical trends in natural resource use and access) and potential ecosystem-based interventions.

No two VA or DRA are the same. Some institutions are developing guidance and methodologies, yet there is currently no standardisation. Difficulties arise especially for ecosystem-based approaches because existing methodologies and tools do not take ecosystems and services properly into account. Recently, there has been a project with the aim to develop an assessment methodology that integrates ecosystems and climate change factors in the analysis of disaster risk and vulnerability (see RiVAMP[6]), which was used in a Government of Jamaica/European Union/UNEP project in Jamaica. However, the RiVAMP methodology is data demanding and may not be easily applied in countries with limited baseline information.

The Natural Capital Project has created a software called InVEST (Integrated Valuation of Environmental Services and Tradeoffs) that can be used as part of risk assessments with a focus on ecosystem linkages and exposure to different types of hazards. Developed as a package of assessment tools that are designed to provide qualitative assessments and be less data intensive, InVEST has already been tested in several countries especially in the Caribbean, with Belize recently having completed a nation-wide application of InVEST. UNEP is testing the InVEST model in its Eco-DRR Projects in Haiti with a focus on the role of coastal and marine ecosystems in reducing exposure to coastal storm surges and in DR Congo with a focus on modelling revegetation/reforestation and soil erosion reduction. The availability of data plays a huge role in shaping the types of VA and DRA used in EBA / Eco-DRR projects.

Some generalities in terms of differences and similarities between VA and DRA can nevertheless be drawn from the projects examined. The DRAs often use environmental impact assessments (EIA), Socio-economic assessments (SEA), and early warning monitoring, which at present many VAs do not (European VAs tend to include EIAs). This stems from DRR's prevention, preparedness and humanitarian focus, aspects that Eco-DRR does not ignore. The VAs tend to put high importance on future vulnerability, taking long-term projections into account. They tend mostly to look at the impact of changes in temperature, and precipitation sometimes undertaking climate impact modelling. They also examine sea level rise and use relevant models for this, when data are available. In practice, one finds that future climate change projections used in the VAs are not useful for more than giving an overview of possible future risk. Generally, the scale of projections is not useable for small areas where interventions are needed, and current climate models are not good at predicting extreme events although these have improved in the AR5. VAs then tend to fall

[6] http://www.unep.org/disastersandconflicts/Introduction/DisasterRiskReduction/Capacity developmentandtechnicalassistance/RiVAMPinJamaica/tabid/105927/Default.aspx

back on examining past and current vulnerability in a manner more reminiscent to that undertaken under DRAs. The VA undertaken for UNEP's 'Mountain EBA' project in Mount Elgon, Uganda, is a good example of this.

Whilst climate impact modelling, future scenario development or sea level rise impact analysis may be tools specific to EBA assessments, many tools used for Eco-DRR assessments have high relevance for (and are sometimes used within) VAs. These include modelling or analyses concerning erosion, landslides, floods, drought, etc. However, these tools are not as often as could be applied to VAs mainly because of a focus on broad changes in climate and sometimes because of a perceived inability to predict climatic extremes by the climate change community. Here the EBA community could learn much from the Eco-DRR community and vice versa. An area where both communities use very similar/the same tools is in coastal areas, for instance in the analysis of beach erosion and coastal flooding either as a result of storm surges or sea level rise. Given the embryonic nature of giving place to ecosystems/environment within assessments, benefits would arise from discussion on EBA/Eco-DRR assessment/conceptual frameworks.

4.4 Implementation

Implementation of projects is multi-faceted and often a combination of “hard” and “soft” approaches. For the purposes of this report, “hard” approaches in this case refer to activities such as tree planting; whilst “soft” approaches refer to activities such as capacity building and policy development[7]. In this paper only “hard” approaches will be discussed because these are where Eco-DRR and EBA are more distinctive to other DRR and CCA measures. Within this section, we will examine a) the overall methodology or approach taken in projects and b) on the ground activities.

4.4.1 Methodology/approaches

Nearly all Eco-DRR projects use early warning systems in contrast to EBA. EBA (and Eco-DRR/CCA projects) on the other hand often include establishment or improved management of protected areas and protected area networks, including corridor establishments, whereas it is less common in Eco-DRR projects surveyed (with exception to UNEP’s Eco-DRR projects in Haiti and Afghanistan). For example, UNEP’s ‘Mountain EBA’ project in Peru involves the management of a protected area. In the Philippines, CI’s EBA project has strengthened the marine protected areas within the Cape Verde Passage, as well as protecting mangrove areas. Finally, the GEF-funded EBA project in Colombia implemented by Conservation International Colombia, established a coral conservation area within their marine management plan to meet anticipated impacts of climate change in insular areas. This project also focused on high mountain areas, where land use planning was established with the aim to enabling the continued delivery of ecosystem services and reducing vulnerability of agro-productive systems.

Certainly, most methodologies and approaches used by both EBA and Eco-DRR are exactly the same, which is expected since both describe themselves as using sustainable management, restoration and conservation of ecosystems. The approaches include:

- Land use planning and zoning
- Sustainable (natural resource) management within forestry, agriculture and pastureland (grazing)
- Integrated water resource management (IWRM)
- Integrated coastal zone management (ICZM)
- Integrated watershed or river basin management (IWM)

[7] In the literature, “hard” approaches to CCA/DRR often refer to structural or technical (or “grey”) solutions, whilst “soft” approaches refer to ecosystem-based (“green”) solutions.

- Integrated land management (ILM)
- Protected Areas Management
- Drylands management
- Community-based action
- Stewardship systems

From the description of projects, it is impossible to know whether there exist differences in how these instruments are used to contribute to Eco-DRR and EBA. An Eco-DRR approach within these instruments would consciously aim to reduce exposure and vulnerability, specifically through buffering hazards. So for example, tree planting within an IWM would be focused near flood areas. EBA would likely undertake similar measures; however, it would also take into account climatic suitability of species within the area (i.e. planting trees that are suitable to the emerging climatic conditions) as well as utilising tools to help ecosystems adapt to change (e.g. through use of corridors).

4.4.2 Implementation – activities on the ground

Intuitively, this is where one would expect most overlap between EBA and Eco-DRR because of the findings above. Indeed, nearly all projects include some form of re-vegetation and reforestation: for example, land rehabilitation, to improve ecosystem function (and thus services), to prevent impacts, such as soil erosion, landslides and floods, to increase water security and to act as windbreaks, storm surge breaks. Both EBA and Eco-DRR projects sometimes involved removal or control of invasive/alien species, sand dune re-establishment, agroforesty, river re-naturalization, and soil conservation techniques.

Yet there are slight differences between classic Eco-DRR and EBA (and hybrid Eco-DRR/CCA projects). Because EBA and Eco-DRR/CCA projects often take a long-term view, they acknowledge that ecosystems themselves will need to adapt to climate change and that current species within ecosystems may no longer find suitable conditions in situ. This recognition in project implementation leads to the careful selection of species for planting; species that are suitable to the emerging new conditions. This is most readily seen in agricultural areas, where for example drought-resistant seeds and species are used. For example, many of the Partnership for Resilience projects include giving communities drought-resistant seeds. However, analysis and action on plant species/climate suitability remains limited to agricultural areas within hybrid Eco-DRR/CCA projects. Furthermore, because of the uncertainty in the direction of change (indeed different models provide different projections) EBA calls for adaptive management through time.

Adaptive management is a structured, iterative process of decision making in terms of natural resource management in the face of uncertainty (Williams 2011). It aims to reduce uncertainty over time via system monitoring which feeds into management practices. It is based on learning and thus improving long term management (Salafsky *et al.* 2002; Palh-Wostl 2007). Despite the importance of taking into account uncertainty with respect to future climatic change, many EBA projects do not include adaptive management within their plans because projects have a set end-date and limited funding. Finding ways of laying the foundation for adaptive management at the community level would be an excellent way forward.

As part of increasing resilience of communities and enabling them to adapt to changes, Eco-DRR and EBA projects also involve promoting diversified livelihoods. These typically involve promoting agroforestry, honey production, eco-tourism, etc. For example, CARE's EBA/Eco-DRR project in Vietnam on mangrove restoration also included establishing alternative livelihoods using the products found in mangrove ecosystems (e.g. honey and fisheries.). New alternative livelihoods may arise not only from an ecosystem-based approach but also due to changes in climate, which increase suitability for certain species. Increasing resilience therefore in an Eco-DRR sense is often similar to exploiting opportunities under EBA.

4.5 Monitoring and evaluation

Fourteen projects (41%), equally spread over EBA, Eco-DRR and EBA/Eco-DRR, had some information on monitoring project outcomes. With the information provided in the projects, it is impossible to say whether there are any differences or commonalities between EBA and Eco-DRR in terms of M&E. Projects included monitoring of water (quality and quantity), forest, and coastal ecosystem (e.g. species, sea-temperature, and erosion), as well as gathering socio-economic indicators through community appraisals, etc., alongside M&E of project outputs, such as number of workshops undertaken, etc. Some projects show an emphasis on learning. For example, UNEP/UNDP/IUCN 'Mountain EBA' projects use a learning approach in conjunction with a logical framework.

Monitoring of outcomes in such a way that generates learning is crucial especially under the uncertainty surrounding how to adapt/be resilient to climate change. All discussion papers on M&E for adaptation stress the need for M&E to generate learning on what (doesn't) work and why (see Bours *et al.* 2013). Adaptive management, as mentioned above, calls for careful monitoring so that proper responses can be made and lessons learned as to what works and what doesn't under what circumstances. As such, any project that includes adaptive management would have a solid M&E. M&E for EBA and Eco-DRR is in its infancy, not only because of the relative novelty of standalone ecosystem-based approaches for CCA and DRR but also because M&E for these elements is in development.

With the rise in CCA projects and programmes, many organisations are in the process of questioning how to best monitor for CCA (for a discussion on challenges involved in M&E for CCA see Villanueva 2011; Spearman & McGray 2011; Bours 2013) and are developing frameworks, guidelines and step-by-step guides. Bours *et al.* (2013) give a comprehensive overview and review of these.

Limited attention has been given to M&E for DRR (CDKN, n.d.; Villanueva 2011). However, this has instigated some of the DRR community to develop integrated M&E for both DRR and CCA. Sanahuja (2011) for example, provides a conceptual overview for practitioners. While M&E in the CCA community is growing, there is also significant work currently being invested in developing output and outcome indicators for DRR in the context of the post-2015 global framework on DRR, the successor to the current HFA which will expire in 2015 (see UNISDR 2014). There is increasing demand for greater accountability to demonstrate progress towards DRR globally and at the country level; therefore, M&E work in the DRR arena will likely mature as the post-2015 global framework on DRR is deliberated.

Logical framework and results-based management approaches are by far the most common frameworks for M&E of projects (Bours *et al.* 2013). This seems also to be the case in the projects surveyed for this paper although some have participatory monitoring put in place. Recent useful resources for community-based adaptation/resilience M&E are from CARE (Ayers *et al.* 2012) and UNDP (2013). The literature highlights that logical framework and results-based management approaches may not necessarily provide the insights needed for learning and that including process-based evaluations is necessary. It is also clear that M&E needs to be tailored to each project and that there is no one size fits all.

Eco-DRR and EBA pose perhaps more challenges for M&E because monitoring ecosystem services, biodiversity and environmental health and developing meaningful indicators, that capture the complexities of ecosystems, is challenging (Dale and Beyeler 2001; Feld *et al.* 2009). Aside from guidance relevant to developing biodiversity indicators, little attention has been given to developing indicators for EBA and Eco-DRR. But interest in this area is growing. UNEP and IUCN are working to develop M&E and learning frameworks for their respective Eco-DRR field projects. For instance, UNEP's M&E framework for its Eco-DRR projects in Sudan, Afghanistan, Haiti and DR Congo focuses on measuring how improved ecosystem-based interventions reduce disaster risk, either in terms of hazard mitigation/prevention, exposure and vulnerability reduction and/or increasing community resilience against disaster impacts.

However, because appropriate indicators for Eco-DRR or EBA are likely to be context specific, establishing key guiding questions will be useful, as done in publications such as the United Kingdom Climate Change Impact Programme's (UKCIP) *AdaptME Toolkit* (Pringle 2011) or the Biodiversity Partnership' s (BIP) *Guidance for national biodiversity indicator development and use* (Bubb *et al.* 2010). Including participatory approaches that engage different stakeholders in the development of indicators and monitoring would also be beneficial in order to select indicators that are more meaningful and relevant for decision-making and for adjusting project implementation.

In developing an M&E approach for EBA or Eco-DRR projects, it would be useful to examine what other monitoring is being undertaken in country and for the project site to avoid duplication and create synergies. Other schemes, such as REDD+ for example, may be setting up relevant monitoring. Indeed, many REDD+ programmes and projects are aiming to achieve multiple benefits including those related to DRR and CCA. For example, in an effort to track these benefits, REDD+ projects might monitor stream flow, monitoring that is highly relevant for M&E of DRR and CCA in relation to water resources. Clear synergies therefore could be made.

4.6 Policy and institutional contexts

Both Eco-DRR and EBA projects almost always involve partnering with environmental agencies or ministries and environmental NGOs, given the clear emphasis on the environment. Eco-DRR and EBA projects would also generally partner with actors from key development sectors, such as agriculture, water, urban development, among others. Both recognize the importance of mainstreaming DRR and CCA in national and local development policies, programmes and plans. One major difference between EBA and Eco-DRR (and Eco-DRR/CCA projects) is that EBA rarely involves working with humanitarian agencies and NGOs.

EBA projects often work with national governments on the national adaptation strategy, either helping to develop it (e.g. CI-Brazil through the EBA project) or working with the current strategy (e.g. UNEP/UNDP/IUCN 'Mountain EBA' project in Nepal works in accordance with the countries National Adaptation Programme of Action (NAPA) and especially Local Adaptation Plans of Action (LAPA)). EBA projects also work within specific policies. For example in Europe, some EBA projects are undertaken under the EU water framework directive. EBA projects are also working to develop guidelines/policies for land management and population (e.g. CI's EBA project in South Africa and the GEF-funded project in Colombia). In South Africa, CI's EBA project has made EBA an integral part of the disaster risk reduction strategy locally and is working nationally to influence policy. Aside from this one example in South Africa, there is not enough information on the projects to know whether EBA projects generally try to work with national DRR policy.

Eco-DRR projects, on the other hand, aim to work and influence DRR and environmental policies at national and local levels. The UNEP Eco-DRR project in the Democratic Republic of Congo is trying to work with the Ministry of Social and Humanitarian Affairs to ensure that environment is part of their disaster management framework and strategies. However, this is challenging given the marginal roles played by environmental ministries within DRR. Otherwise, Eco-DRR projects work to improve environmental policies or target specific development sectors such as water and agriculture. For instance, UNEP' Eco-DRR projects in Sudan and DR Congo are aiming to influence the water policy, while in Afghanistan the project seeks to influence the five-year development plans of the provincial government in Bamyan.

There is not enough information in the projects reviewed to know how much Eco-DRR projects or CCA projects work to influence adaptation policy. The EU funded 'Climate Change Adaptation and Disaster Risk Reduction in Jamaica' project aims to help the country to develop a Climate Change Policy Framework and Action Plan working with environmental ministries.

As can be seen by the examples, the EBA and Eco-DRR projects work mostly with environmental ministries, institutions and departments. One special case is the Partnership for Resilience Eco-DRR/CCA projects that work with humanitarian institutions such as the International Federation of Red Cross and Red Crescent Societies, Cordaid and CARE. Given the broad scope of both adaptation and disaster risk reduction, there would be mutual benefits for Eco-DRR and EBA communities to work together in a more integrated and interdisciplinary manner.

5. Findings, synergies and key integration points

This paper has examined the differences and similarities between Eco-DRR and EBA. While there exist key differences in overall approach and implementation especially at the theoretical level, practice shows that often it is a question of differences in discourse than a real difference. Indeed in many cases one can substitute “risk reduction” by “adaptation” and vice-versa (though not always).

Nevertheless EBA and Eco-DRR are generally undertaken by very separate communities due to difference in policy and funding tracks. Hybrid Eco-DRR/CCA projects are emerging as each community converges towards each other because of mutual needs for integration. However, hybrid projects tend to be still more recognisable as either Eco-DRR or EBA depending on who is involved in the project as well as depending on factors such as data availability and outcomes sought (i.e. whether hazards play more of a role than general climatic change).

Reducing disasters has received broad political consensus and is guided by an internationally endorsed global framework on DRR (the HFA) but is not restricted by a legal framework, as is the case in CCA (Hannigan, 2013). CCA, on the other hand, is receiving much more financial and political attention. Convergence between DRR and CCA is occurring although it is not embraced by all, especially among DRR academics who consider the adaptation and resilience discourse to be more like a band-aid solution instead of a real remedy for addressing the main underlying causes of disaster risk that is rooted in poverty, poor governance and structural inequalities (Hannigan, 2012). According to Pelling (2011) conventional approaches to CCA are too conservative as they rarely embrace the transformational changes needed to truly reduce underlying vulnerabilities and address climate risks. In a similar context, resilience has also been regarded as a band-aid approach by many (academics and practitioners); nonetheless, wide acceptance of the concept of resilience is providing clear opportunities for DRR and CCA integration. Given that negotiations for the post-2015 global framework on DRR (successor to the HFA) and post-2015 climate change agreement are taking place almost in parallel, this period also provides a key opportunity for greater integration between DRR and CCA practice.

Synergies between both DRR and CCA communities should be maximized, in order to avoid mal-adaptation and/or increase risk, as well as avoid duplication in efforts. EBA is still growing and could benefit from Eco-DRR knowledge. Potentially, Eco-DRR could help EBA in decision-making in the face of uncertainty of climate change impacts through its focus on reducing disaster risk. EBA in turn could help provide more adaptive management that is sensitive to climatic and environmental changes and thus ensure long-term sustainability of Eco-DRR projects. Given that policy, institutional and funding tracks are likely to stay separate, integration is more likely to be achievable at the project level. Key integration points are outlined within **Box 1**.

6. Conclusion: way forward

Fostering collaboration at the project level would provide good lessons for future practice and facilitate integration of EBA and Eco-DRR. This would then promote the development of much needed integrated multi-level governance tools for CCA and DRR, integrated multi-hazard and climate change assessments, as well as community-based approaches for both strategies. Gaps in knowledge in both communities should be filled through dedicated research, appropriate M&E frameworks that support learning and knowledge exchange platforms.

Box 1: Key integration points at the project level

When planning and implementing projects, there are a number of points where EBA and Eco-DRR communities could beneficially work together to ensure good adaptation and risk reduction:

1. **Aims**: **Understanding future change taking into account all drivers and hazards**

At this stage it is essential to lay out what the project is trying to achieve and construct a future scenario under the project (i.e. climate, development and multiple hazards). This will help indicate who would beneficially be involved. Ensuring that climate change and multiple hazards are taken into account will result in more integrated Eco-DRR/CCA practice.

- **Assessments: Exchange of knowledge and tools**

Both the EBA and Eco-DRR have much to offer each other in terms of knowledge and tools. However, it will be key to ensure a common language in relation to terms and conceptual frameworks used when working together.

- **Implementation**: **Multi-hazard and climate-proof approaches making use of adaptive management**

It is important to ensure that interventions are climate-proof and multi-hazard proof. Depending on EBA project focus, drawing from Eco-DRR or involving relevant institutions in response, recovery and reconstruction could be beneficial. Eco-DRR projects would benefit from taking into account that ecosystems are likely to need to adapt to change as well. Adaptive management should be considered for both to effectively deal with uncertainty over the long-term and ensure sustainability.

- **Monitoring and Evaluation: Foster information sharing and learning over the long-term**

Under uncertainty of climate change and evolution of disaster risk, it will be important to foster information sharing and learning. Integrating monitoring schemes of DRR and CCA will facilitate more effective decision making and support adaptive management, because monitored information would anticipate current and future changes and uncertainties as well as utilize more locally relevant data. EBA and Eco-DRR could co-develop guidelines and training on M&E. However, development of M&E needs to be context specific.

- **Policy and institutional context**: **Work across sectors and disciplines**

Both Eco-DRR and EBA could work to bring together different actors and expertise across sectors and encourage multi-disciplinary approaches within project implementation and at policy level. This will create greater coherence and effectiveness, avoid duplication and missed opportunities, reduce the possibility of mal-adaptation and increasing risk.

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Annex 1

Project	Country	Ecosystems	Hazards addressed	EBA/DRR	Main Partners
Integrated approach towards community resilience	Ethiopia	Drylands	Floods; drought	EBA	The Partners for Resilience: Netherlands Red Cross, CARE Netherlands, Cordaid, the Red Cross/Red Crescent Climate Centre, and Wetlands International.
Integrated approach towards community resilience	Guatemala	Mountain	Floods; drought; landslides; storms; fires	DRR	The Partners for Resilience
Integrated approach towards community resilience	India	Coastal wetland	Floods; storms; erosion	EBA/DRR	The Partners for Resilience
Integrated approach towards community resilience	Indonesia	Coastal	Floods; storms; erosion; landslides tsunami	DRR	The Partners for Resilience
Integrated approach towards community resilience	Kenya	Drylands	Floods; drought	EBA/DRR	The Partners for Resilience
Integrated approach towards community resilience	Mali	Drylands	Floods; drought	DRR	The Partners for Resilience
Integrated approach towards community resilience	Nicaragua	Inland waters	Floods; drought; landslides; storms	EBA/DRR	The Partners for Resilience
Integrated approach towards community resilience	Uganda	Drylands	Floods; drought; landslides	DRR	The Partners for Resilience
Mountain EBA	Nepal	Mountain	Drought; floods; landslides	EBA	UNEP; UNDP; IUCN
Mountain EBA	Peru	Mountain	Floods; changes in climate	EBA	UNEP; UNDP; IUCN
Mountain EBA	Uganda	Mountain	Drought; floods; landslides	EBA/DRR	UNEP; UNDP; IUCN
Integrated National Adaptation project	Columbia	Mountain; inland waters; Marine	Increased temperatures; changes in rainfall patterns; sea-level rise	EBA	GEF/World Bank; Conservation International
Natural Resources Management in a Changing Climate in Mali	Mali	Drylands	Drought; floods	EBA	GEF/World Bank; Environment and Sustainable Development Agency (government of Mali)

Ecosystem-based Adaptation in marine, terrestrial and coastal regions as a means of improving livelihoods and conserving biodiversity in the face of climate change	South Africa	Drylands	Increased temperatures; changes in rainfall patterns	EBA	Conservation International
Ecosystem-based Adaptation in marine, terrestrial and coastal regions as a means of improving livelihoods and conserving biodiversity in the face of climate change	Philippines	Marine	Increased sea surface temperatures; changes in rainfall patterns; storms;	EBA	Conservation International
Ecosystem-based Adaptation in marine, terrestrial and coastal regions as a means of improving livelihoods and conserving biodiversity in the face of climate change	Brazil	Coastal; forest	Increased temperatures; changes in rainfall patterns; floods; fires; sea level rise;	EBA	Conservation International
Promoting Improved Ecosystem Management in Vulnerable Countries for Sustainable and Disaster-Resilient Development	Afghanistan	Mountain	Floods; avalanche	DRR	UNEP
Promoting Improved Ecosystem Management in Vulnerable Countries for Sustainable and Disaster-Resilient Development	Haiti	Coastal; marine	Floods; storms; erosion	DRR	UNEP
Promoting Improved Ecosystem Management in Vulnerable Countries for Sustainable and Disaster-Resilient Development	Sudan	Drylands	drought	DRR	UNEP
Promoting Improved Ecosystem Management in Vulnerable Countries for Sustainable and Disaster-Resilient Development	DRC	Forest; inland waters	Floods; erosion	DRR	UNEP
Building Resilience to Climate Change through Farmer-managed Natural Regeneration in Niger and Land Rehabilitation in Burkina Faso	Burkina Faso; Niger	Drylands	Drought; erosion	EBA	WRI; IFPRI

Community-based Rangeland Rehabilitation for Adaptation to Climate Change and for Carbon Sequestration	Sudan	Drylands	Drought	EBA/DRR	GEF/World Bank; UNEP
Community-based Mangrove Reforestation and Management in Da Loc, Vietnam	Vietnam	Coastal	Storms; sea-level rise	EBA/DRR	CARE
Fiji climate change adaptation project	Fiji	Coastal	Storms; sea-level rise; erosion	EBA	WWF
Combating desertification in Iran	Iran	Drylands	Desertification; dust storms	DRR	Government of Iran; others
NAIS	Switzerland	Mountain	Avalanches; landslides	DRR	Government of Switzerland
The Great Fen project	UK	wetlands	Floods; drought	EBA	Wildlife Trust
WAVE project	Netherlands, UK, France, Belgium and Germany	Inland waters	Drought; flood	EBA	WAVE project partners
Climate buffers project	Netherlands	Inland waters	Floods; sea level rise	EBA	Natuurmonumenten; State Forest Service; Birdlife Netherlands; ARK Nature; Nature Landscape Heritage; Wadden Sea Society; World Wildlife Foundation
The Humber project	UK	Coastal	Floods; sea level rise	EBA/DRR	UK Environment Agency
Green and Blue Space Adaptation for Urban Areas and Eco Towns (GRaBS)	Global	Urban	Floods; heat waves; water quality; landslides	EBA	Local authorities
Climate Change Adaptation and Disaster Risk Reduction	Jamaica	Inland waters; coastal	Storms; sea-level rise; erosion	EBA/DRR	Government of Jamaica; European Union; UNEP
Reducing climate change-induced glacial lake outburst floods (GLOF) risk in Punakha-Wangdue and Chamkhar valleys	Bhutan	Mountain	Glacial lake outburst	EBA/DRR	UNDP