



master's module  
**DISASTERS, ENVIRONMENT &  
RISK REDUCTION (Eco-DRR)**

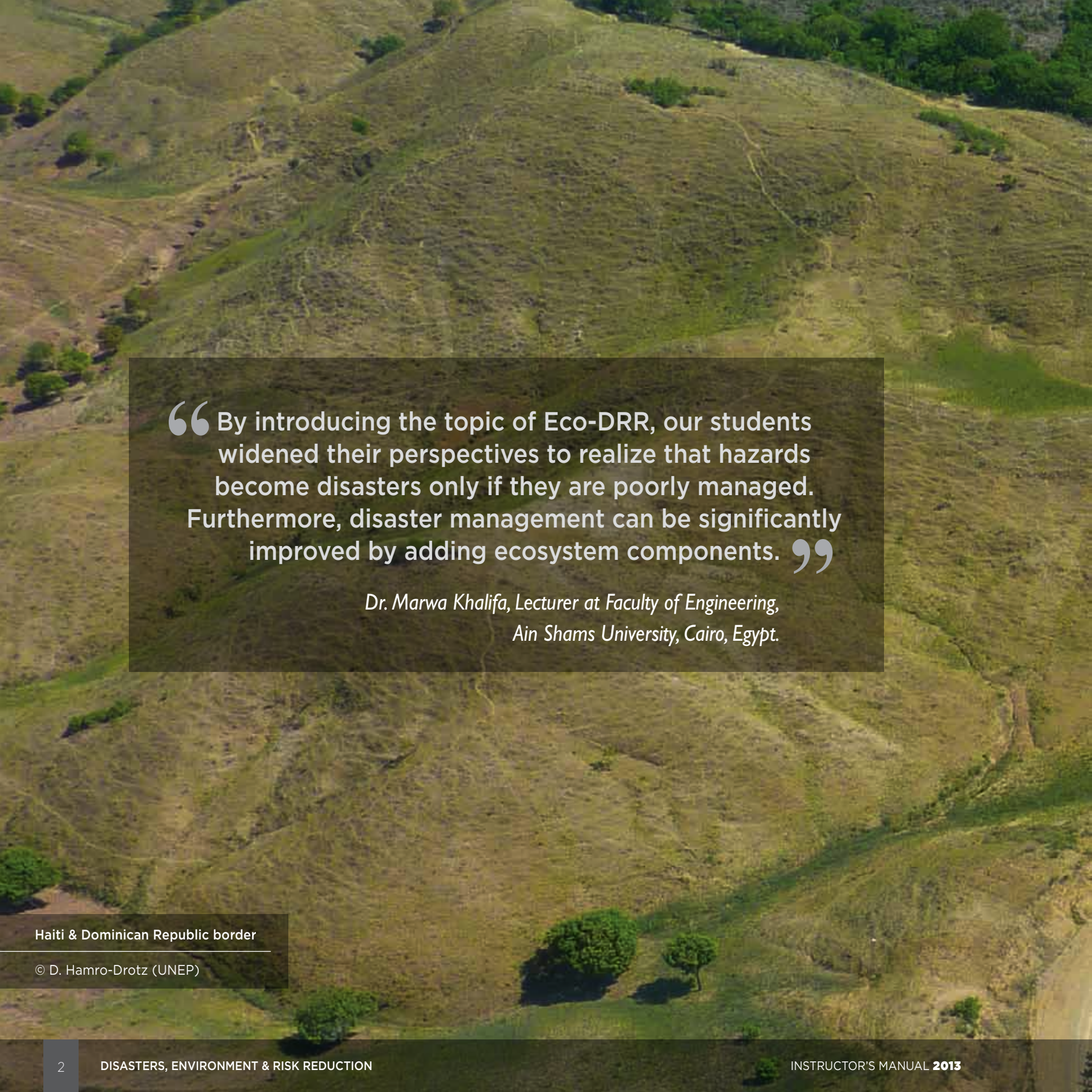
INSTRUCTOR'S MANUAL • VERSION 2013

**CNRD**

Center for Natural Resources  
and Development

**PEDRR**

Ecosystems for Adaptation  
and Disaster Risk Reduction



“ By introducing the topic of Eco-DRR, our students widened their perspectives to realize that hazards become disasters only if they are poorly managed. Furthermore, disaster management can be significantly improved by adding ecosystem components. ”

*Dr. Marwa Khalifa, Lecturer at Faculty of Engineering,  
Ain Shams University, Cairo, Egypt.*

Haiti & Dominican Republic border

© D. Hamro-Drotz (UNEP)



master's module  
**DISASTERS, ENVIRONMENT &  
RISK REDUCTION (Eco-DRR)**

INSTRUCTOR'S MANUAL • **VERSION 2013**

master's module  
**DISASTERS, ENVIRONMENT &  
RISK REDUCTION (Eco-DRR)**

INSTRUCTOR'S MANUAL • **VERSION 2013**

### CONTACT INFORMATION

**Dr. Udo Nehren,**  
(udo.nehren@fh-koeln.de)  
Institute for Technology and  
Resources Management  
in the Tropics and Subtropics (ITT),  
Cologne University of Applied Sciences  
Betzdorfer Straße 2  
50679 Köln (Cologne), Germany  
[www.cnrdrd.info](http://www.cnrdrd.info)

**Dr. Karen Sudmeier-Rieux,**  
Training consultant  
(karen.sudmeier@unep.org)  
**Ms. Marisol Estrella,**  
Programme coordinator (DRR)  
(marisol.estrella@unep.org)  
United Nations Environment Programme  
(UNEP) Post-Conflict and Disaster  
Management Branch (PCDMB)  
15, Chemin des Anémones  
CH- 1219 Châtelaine, Geneva,  
Switzerland  
[www.pedrr.net](http://www.pedrr.net)

**Ms. Simone Sandholz,**  
(simone.sandholz@uibk.ac.at)  
Institute of Geography, University of Innsbruck  
Innrain 52, 6020 Innsbruck, Austria

### DISCLAIMER • ACKNOWLEDGEMENTS

Thank you to reviewers, Dr. Aly El-Bahrawy, Faculty of Engineering, Ain Shams University, Cairo, Egypt; Dr. Junun Sartohadi, Gadjah Mada University, Yogyakarta, Indonesia and Cologne University of Applied Sciences, Germany. We would especially like to thank the German Federal Ministry for Economic Cooperation and Development (BMZ), the German Academic Exchange Service (DAAD) and UNEP for funding the development of this Master's module and publication of the Instructor's Manual.

Should be cited as: CNRD-PEDRR (2013) Disasters, Environment and Risk Reduction – Eco-DRR Master's Module, Instructor's Manual. Cologne and Geneva: Center for Natural Resources and Development, Partnership on Environment and Disaster Risk Reduction.

© CNRD & PEDRR, 2013

First published in May 2013 by the United Nations Environment Programme © 2013.

P.O. Box 30552, Nairobi, KENYA • Tel: +254 (0)20 762 1234 • Fax: +254 (0)20 762 3927 • E-mail: [unepub@unep.org](mailto:unepub@unep.org) • Web: [www.unep.org](http://www.unep.org)

This publication may be reproduced in whole or in part and in any form for educational or non-profit purposes without special permission from the copyright holder provided acknowledgement of the source is made. No use of this publication may be made for resale or for any other commercial purpose whatsoever without prior permission in writing from UNEP. The contents of this volume do not necessarily reflect the views of UNEP, or contributory organizations. The designations employed and the presentations do not imply the expressions of any opinion whatsoever on the part of UNEP or contributory organizations concerning the legal status of any country, territory, city or area or its authority, or concerning the delimitation of its frontiers or boundaries.

**Cover Image:** © Philippa Terblanche • **Report authors:** Sudmeier-Rieux, K., Sandholz, S., Nehren, U. & M. Estrella • **Design and layout:** Philippa Terblanche

UNEP promotes environmentally sound practices globally and in its own activities. This publication is printed on recycled paper using eco-friendly practices.

## CNRD

The Center for Natural Resources Development (CNRD) is a network of 11 international universities currently, based at the Cologne University for Applied Sciences (CUAS), Germany. The CNRD was established in 2009 within the program “Exceed - Higher Education Excellence in Development Cooperation”, funded by the German Federal Ministry for Economic Cooperation and Development (BMZ) and managed by the German Academic Exchange Service (Deutscher Akademischer Austauschdienst / DAAD). The core funding period of the program is five years.

The CNRD contributes to education, research and knowledge transfer related to the United Nations Millennium Development Goal 7 (MDG7) “Ensure Environmental Sustainability” with the themes:

- Integrated water resources management
- Land use dynamics and biodiversity
- Energy efficiency and renewable energy resources
- Regional management and sustainable livelihoods of the poor

The CNRD draws upon the expertise and experience of ongoing research and educational programs of the involved partners. The network is open for partnerships with universities, governmental and non-governmental organizations, and the private sector.

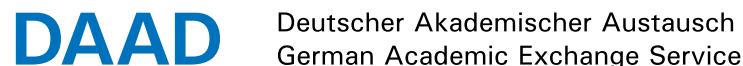
**([www.cnrld.info](http://www.cnrld.info))**

## PEDRR

Formally established in 2008, the Partnership for Environment and Disaster Risk Reduction (PEDRR) is a global alliance of UN agencies, NGOs and specialist institutes. As a global thematic platform of the International Strategy for Disaster Reduction (ISDR), PEDRR seeks to promote and scale-up implementation of ecosystem-based disaster risk reduction and ensure it is mainstreamed in development planning at global, national and local levels, in line with the Hyogo Framework for Action.

It provides technical and science-based expertise and applies best practices in ecosystems-based DRR approaches. PEDRR is guided by its vision of: “Resilient communities as a result of improved ecosystem management for disaster risk reduction (DRR) and climate change adaptation (CCA)”. Its objective is to pool expertise and advocate for policy change and best practice in ecosystem management for DRR and CCA, based on science and practitioners experiences. In addition to this Master’s module, PEDRR has also developed a short-course “Ecosystem-based Disaster Risk Reduction for Sustainable Development” intended for policy makers and practitioners.

**([www.pedrr.net](http://www.pedrr.net))**





Rice harvest in Aileu,  
East Timor, 2009

© Martine Perret/UNMIT  
(UN Integrated Mission in  
Timor-Leste)

# table of contents

master's module  
**DISASTERS, ENVIRONMENT &  
 RISK REDUCTION (Eco-DRR)**

INSTRUCTOR'S MANUAL • VERSION 2013

<b>Master's Module Disasters, Environment &amp; Risk Reduction – Eco-DRR</b>	<b>4</b>	<b>Block II and III: Case studies</b>	<b>37</b>
<b>CNRD</b>	<b>5</b>	<b>Block IV: Mainstreaming Environment and DRR in development (5 hours)</b>	<b>38</b>
<b>PEDRR</b>	<b>5</b>	<b>6. Module outline</b>	<b>42</b>
<b>Table of Contents</b>	<b>7</b>	<b>Block I: Elements of Disaster Risk Reduction (15 hours)</b>	<b>42</b>
<b>List of abbreviations</b>	<b>9</b>	<b>Block II: Ecosystem-based Disaster Risk Reduction (15 hours)</b>	<b>53</b>
<b>1. Background</b>	<b>10</b>	<b>Block III: Eco-DRR instruments and approaches: (15 hours)</b>	<b>62</b>
<b>2. Rationale</b>	<b>10</b>	Teaching note before starting Block III.	63
Defining Eco-DRR	11	<b>Block IV: Mainstreaming Environment and DRR (5 hours)</b>	<b>76</b>
Challenges and gaps in implementing Eco-DRR	15	<b>7. References</b>	<b>84</b>
The need for this module	16	<b>Annex 1. Key developers</b>	<b>88</b>
<b>3. Didactic Note</b>	<b>18</b>	<b>Annex 2. List of partnering institutions and contact persons (2013)</b>	<b>88</b>
General	18	<b>Annex 3. Learning games</b>	<b>91</b>
Tips for tailoring the module	18	Triangles Game	91
Tips for more effective learning	18	Avalanche Game	92
Tips on exam questions	21	Harvest Game	93
Field visits	22	Stop Disasters Game (UNISDR)	94
Conducting a field visit	22	<b>Annex 4. Case study template</b>	<b>94</b>
<b>4. Guidelines for Instructing the Module</b>	<b>24</b>	<b>Annex 5. Recommended readings</b>	<b>96</b>
Session content	24	Block 1	96
Teaching the Eco-DRR Module	24	Block 2	96
References and recommended reading	25	Block 3	97
Cross linkages between sessions	25	Block 4	97
<b>5. Module summary</b>	<b>28</b>	<b>Annex 6. Terminology</b>	<b>98</b>
<b>Block I: Elements of Disaster Risk Reduction (15 hours)</b>	<b>28</b>	<b>Annex 7. List of authors and contributors</b>	<b>100</b>
<b>Block II: Ecosystem-based Disaster Risk Reduction (Eco-DRR) (15 hours)</b>	<b>31</b>		
<b>Block III: Eco-DRR instruments and approaches: (15 hours)</b>	<b>34</b>		



Lady walking, Haiti, 2008

© Logan Abassi UN/MINUSTAH



# list of abbreviations

## master's module DISASTERS, ENVIRONMENT & RISK REDUCTION (Eco-DRR)

INSTRUCTOR'S MANUAL • VERSION 2013

<b>ASU</b>	Ain Shams University, Egypt	<b>IWRM</b>	Integrated Water Resources Management
<b>CBE-DRM</b>	Community Based Ecosystem and Disaster Risk Management	<b>HFA</b>	Hyogo Framework for Action
<b>CC</b>	Climate change	<b>HUA</b>	Hue University of Agriculture and Forestry, Vietnam
<b>CCA</b>	Climate change adaptation	<b>NGO</b>	Non-Governmental Organisation
<b>CNRD</b>	Center for Natural Resources and Development	<b>PEDRR</b>	Partnership for Environment and Disaster Risk Reduction
<b>CTIC-VAWR</b>	Center for Training and International Cooperation, Vietnam Academy for Water Resources	<b>PES</b>	Payment for Ecosystem Services
<b>CUAS</b>	Cologne University of Applied Sciences, Germany	<b>SEA</b>	Strategic Environmental Assessment
<b>DRR</b>	Disaster risk reduction	<b>TU</b>	Tribhuvan University, Nepal
<b>Eco-DRR</b>	Ecosystem-based disaster risk reduction, also shorthand for Disasters, Environment and Risk Reduction Master's module	<b>ToI</b>	Training of Instructors
<b>EbA</b>	Ecosystem-based adaptation	<b>UGM</b>	Universitas Gadjah Mada, Indonesia
<b>ECTS</b>	European Credit Transfer and Accumulation System	<b>UIBK</b>	University of Innsbruck, Austria
<b>EIA</b>	Environmental Impact Assessment	<b>UNEP</b>	United Nations Environment Programme
<b>GAR</b>	Global Assessment Report	<b>UNFCCC</b>	United Nations Framework Convention on Climate Change
<b>ICZM</b>	Integrated Coastal Zone Management	<b>UNISDR</b>	United Nations International Strategy for Disaster Reduction
<b>IPCC SREX</b>	Inter-agency Panel for Climate Change – Special Report on Extreme Events	<b>UNU-EHS</b>	United Nations University, Institute for Environment and Human Security
<b>IUCN</b>	International Union for Conservation of Nature	<b>VCA</b>	Vulnerability and Capacity Analysis
<b>IUCN-CEM</b>	International Union for Conservation of Nature, Commission on Ecosystem Management	<b>WEEC-JU</b>	Water, Environment and Energy Center, University of Jordan
		<b>WWF-INT</b>	World Wildlife Fund International

## 1 BACKGROUND

In October 2011, at the third network meeting of the Center for Natural Resources and Development (CNRD), CNRD and the Partnership for Environment and Disaster Risk Reduction (PEDRR) decided to develop a joint Master's module entitled, "Disasters, Environment and Risk Reduction (Eco-DRR)" for introduction at CNRD partner universities and beyond.

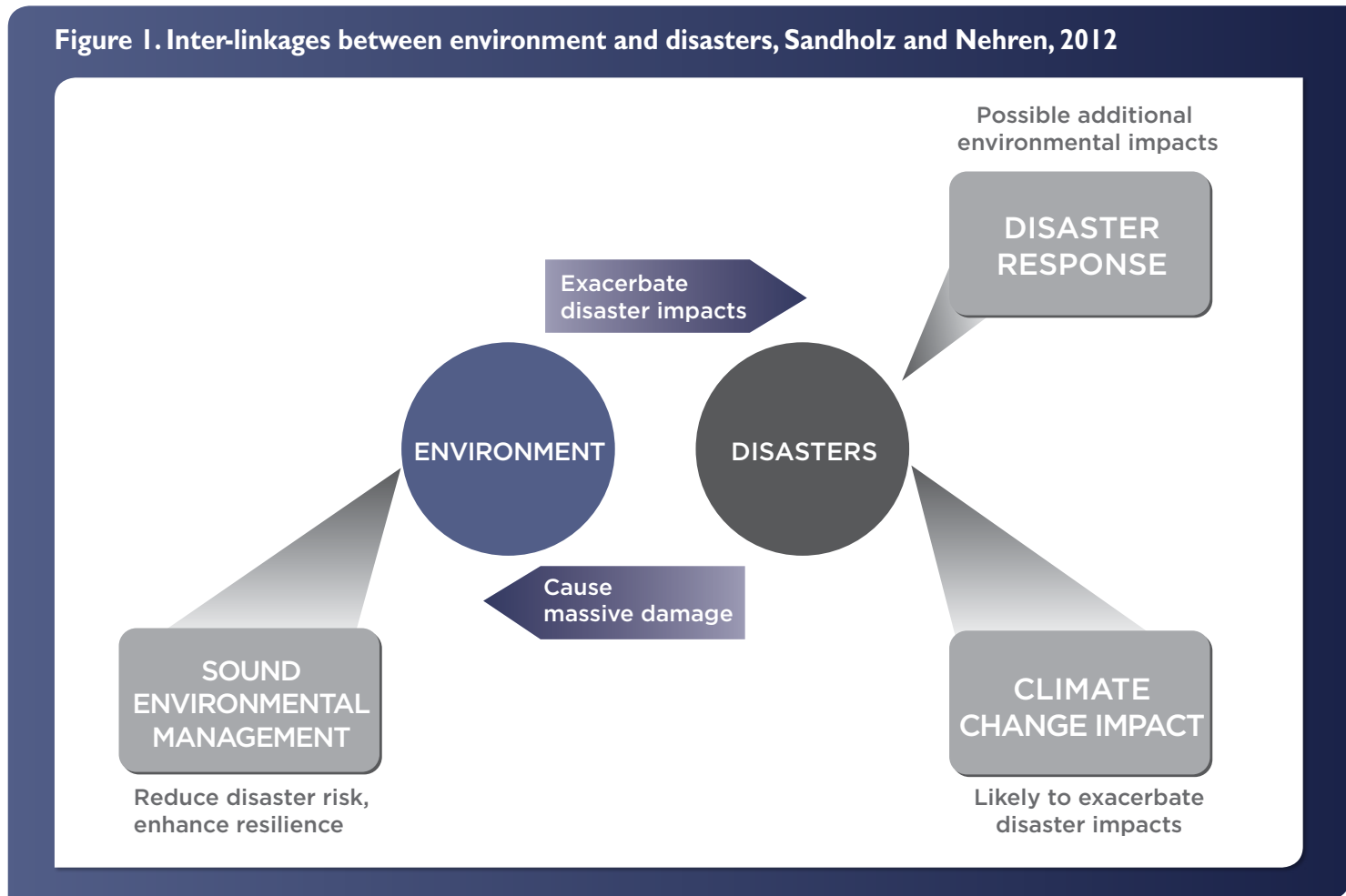
The module was developed over a period of six months followed by a Train the Instructors (ToI) workshop in August 2012 in Cologne, Germany. After an initial pilot testing phase by 10 CNRD universities, the module is to be officially launched at the 7th World Environmental Education Congress in Marrakesh in June 2013. The future goal is to reach a broad array of universities worldwide who are interested in implementing the entire or parts of the Eco-DRR module. This Instructor's Manual summarizes the rationale, goals, and guidance notes for the module and each session.

## 2 RATIONALE

As recent policy documents have highlighted, environmental degradation is a leading cause of increased disaster risk (IPCC, 2012; UNISDR, 2011). Environment and disasters interact with each other in a number of ways. Disasters cause massive damage to the environment, while degraded environments exacerbate disaster impacts. Responding to disasters often leads to additional environmental impacts, while investments in sound environmental management, especially in disaster prevention and post-disaster recovery stages, can reduce disaster risks and thus contribute to a more resilient and sustainable development. Climate change will likely exacerbate disaster impacts, while environmental management solutions are increasingly being applied for adaptation to climate change (**Figure 1**).

The close inter-linkages between sound environmental management, climate change impacts and disaster responses require a more systematic and comprehensive approach to disaster risk management, which in the past has mainly been reactive rather than preventive, engineering focused rather than based on planning and use of natural landscape features to prevent disaster risks. This is what we refer to as the "Eco-DRR" approach wherein disaster risk management incorporates ecosystem management tools, which constitute the core of this module and introduces a more innovative and systems approach to sustainable disaster risk management.

Figure 1. Inter-linkages between environment and disasters, Sandholz and Nehren, 2012



## 2.1 DEFINING ECO-DRR

Ecosystem-based disaster risk reduction (Eco-DRR) is the sustainable management, conservation and restoration of ecosystems to reduce disaster risk, with the aim to achieve sustainable and resilient development (Estrella and Saalimaa, 2013). Well-managed ecosystems, such as wetlands, forests and coastal systems, act as **natural infrastructure, reducing physical exposure** to many hazards and **increasing socio-economic resilience** of people and communities by sustaining local livelihoods and providing

essential natural resources such as food, water and building materials (Morawetz and Nehren, 2005; Sudmeier-Rieux and Ash, 2009). Ecosystem management not only offers an opportunity to strengthen natural infrastructure and human resilience against hazard impacts, but also generates a range of other social, economic and environmental benefits for multiple stakeholders, which in turn feed back into reduced risk (Figure 2). **Table 1.** (following page) outlines many hazard mitigation functions of ecosystems.

**Table 1.** Selected hazard functions of ecosystems (Modified from Estrella and Saalismaa, 2013)

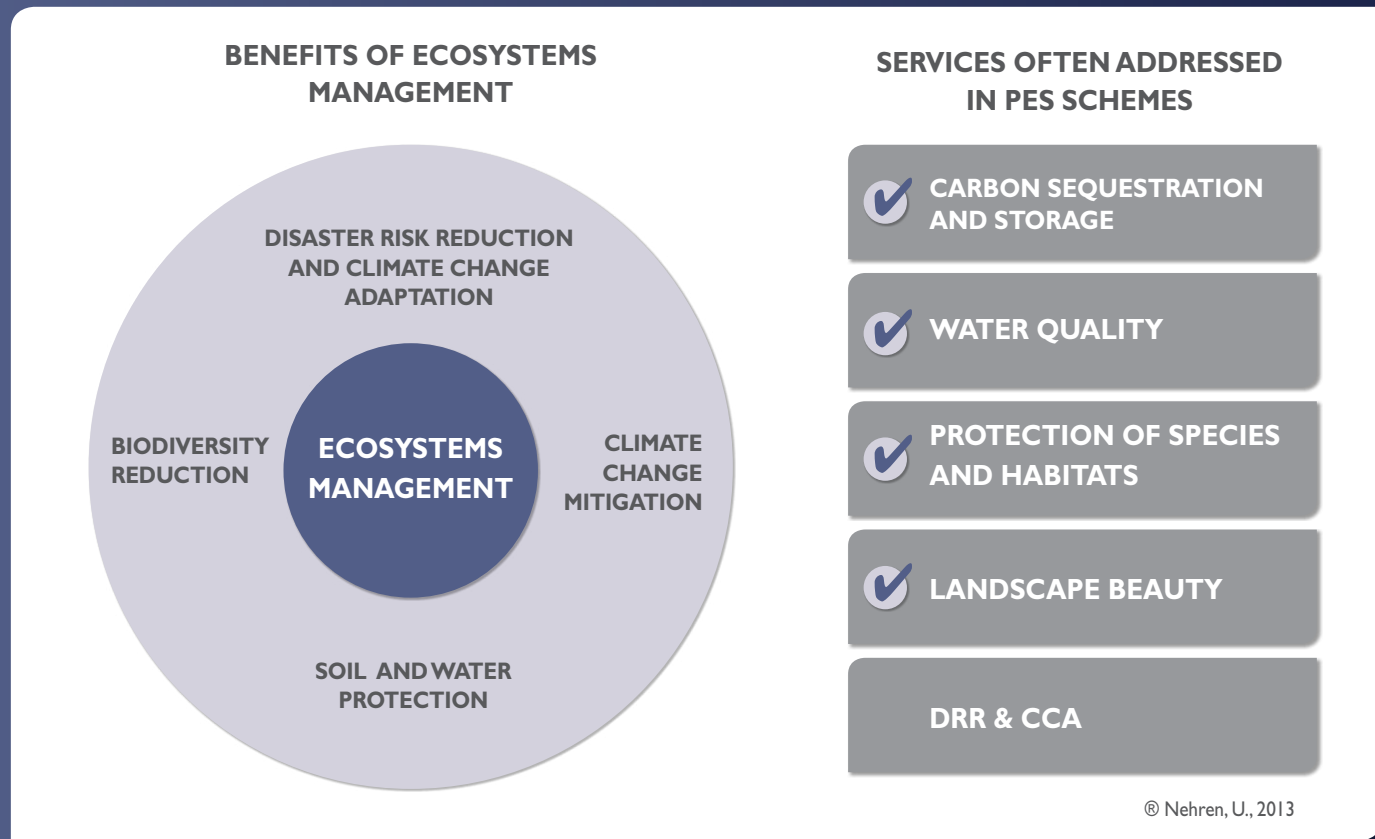
ECOSYSTEM	REGULATING SERVICES - HAZARD MITIGATION
<p><b>Mountain forests and other vegetation on hillsides</b></p>	<ul style="list-style-type: none"> <li>• Vegetation cover and root structures protect against erosion and increase slope stability by binding soil together, preventing landslides.<sup>1</sup></li> <li>• Forests protect against rockfall and stabilise snow reducing the risk of avalanches.<sup>2</sup></li> <li>• Catchment forests, especially primary forests, reduce risk of floods by increasing infiltration of rainfall, and delaying peak floodwater flows, except when soils are fully saturated.<sup>3</sup></li> <li>• Forests on watersheds are important for water recharge and purification, drought mitigation and safeguarding drinking water supply for some of the world's major cities.<sup>4</sup></li> </ul>
<p><b>Wetlands and floodplains</b></p>	<ul style="list-style-type: none"> <li>• Wetlands and floodplains control floods in coastal areas, inland river basins, and mountain areas subject to glacial melt.<sup>5</sup></li> <li>• Peatlands, wet grasslands and other wetlands store water and release it slowly, reducing the speed and volume of runoff after heavy rainfall or snowmelt in springtime.</li> <li>• Coastal wetlands, tidal flats, deltas and estuaries reduce the height and speed of storm surges and tidal waves.<sup>6</sup></li> </ul>
<p><b>Coastal ecosystems, such as mangroves, saltmarshes, coral reefs, barrier islands and sand dunes</b></p>	<ul style="list-style-type: none"> <li>• Coastal ecosystems function as a continuum of natural buffer systems protecting against hurricanes, storm surges, flooding and other coastal hazards – a combined protection from coral reefs, seagrass beds, and sand dunes/coastal wetlands/coastal forests is particularly effective.<sup>7</sup> Research has highlighted several cases where coastal areas protected by healthy ecosystems have suffered less from extreme weather events than more exposed communities.<sup>8</sup></li> <li>• Coral reefs and coastal wetlands such as mangroves and saltmarshes absorb (low-magnitude) wave energy, reduce wave heights and reduce erosion from storms and high tides.<sup>9</sup></li> <li>• Coastal wetlands buffer against saltwater intrusion and adapt to (slow) sea-level rise by trapping sediment and organic matter.<sup>10</sup></li> <li>• Non-porous natural barriers such as sand dunes (with associated plant communities) and barrier islands dissipate wave energy and act as barriers against waves, currents, storm surges and tsunami.<sup>11</sup></li> </ul>
<p><b>Drylands</b></p>	<ul style="list-style-type: none"> <li>• Natural vegetation management and restoration in drylands retain moisture to ameliorate the effects of drought and control desertification, as trees, grasses and shrubs conserve soil.</li> <li>• Shelterbelts, greenbelts and other types of living fences act as barriers against wind erosion and sand storms.</li> <li>• Maintaining vegetation cover in dryland areas, and agricultural practices such as use of shadow crops, nutrient enriching plants, and vegetation litter increases resilience to drought.<sup>12</sup></li> </ul>

1. Dolidon et al (2009), Peduzzi (2010), Norris et al (2008), Sudmeier-Rieux et al. (2011).  
 2. Bebi et al (2009), Dorren et al (2004).  
 3. Krysanova et al (2008).  
 4. See World Bank 2010.  
 5. Campbell et al (2009).

6. Batker et al (2010), Costanza et al (2008), Ramsar (2010), Zhao (2005).  
 7. See, for example Badola et al (2005), Batker et al (2010), Granek and Ruttenberg (2007).  
 8. Campbell et al (2009), Ramsar (2010), UNEP-WCMC (2006), World Bank (2010).

9. Mazda et al (1997), Möller (2006), Tanaka (2012), Vo-Luong and Massel (2008).  
 10. Campbell et al (2009).  
 11. Intergovernmental Oceanographic Commission (2009).  
 12. Campbell et al (2009), Krysanova et al (2008).

**Figure 2. Multiple benefits of ecosystems (left) and main ecosystem services considered in PES schemes (right)**



**Figure 2.** shows that ecosystem management not only contributes to biodiversity protection, climate change mitigation soil and water protection, but also to disaster risk reduction (DRR) and climate change adaptation (CCA). Unfortunately, most Payment for Ecosystem (PES) schemes do not consider the role of ecosystems for DRR and CCA.

The physical risk reduction capacity of ecosystems depends on their health and structure, and the intensity of the hazard event. Degraded ecosystems can still play a buffering role, although to a much lesser extent than fully functioning ecosystems. Healthy ecosystems reduce social-economic vulnerability by sustaining human livelihoods and providing essential goods such as food, fibre, medicines and construction materials (MEA, 2005). For example, in addition to providing coastal hazard protection, mangroves and seagrass beds support fishing and tourism activities and store high amounts of carbon (Wicaksono et al. 2011).

Ecosystems can reduce physical exposure to common natural hazards, namely landslides, flooding, avalanches, storm surges, wildfires and drought, by serving as natural infrastructure, protective barriers or buffers (Renaud et al., 2013). For example, in the European Alps, mountain forests have a long history of being managed for protection against avalanches and rockfall (Wehrli and Dorren, 2013). Protection forests in Switzerland, have been valued at USD \$1,000 per hectare per year along mountain roads and the state provides considerable financial incentives to manage forests for hazard protection (Wehrli and Dorren, 2013).

Several studies of coastal forests along Japan's coasts determined that during the 2011 tsunami, coastal vegetation did provide some natural protection by catching large debris (such as boats) as tsunami waves retreated inland (Tanaka, 2012; Tanaka et al., 2013). As a result, the Japanese government is expanding its national park system along Japan's coast with strict land use guidelines for moving critical infrastructure inland (Onishi and Ishiwatari, 2012).

In the Atlantic Forest of Rio de Janeiro, Brazil, (Nehren et al., 2009; Nehren, 2013a) analyzed the historical impact of deforestation and forest degradation from the mid-16th century to present. They demonstrated that historical deforestation not only led to higher landslides and erosion risk on steep slopes, but also to deeper river incision, higher flood risk, and even periods of water scarcity. Today, PES schemes are implemented in several parts of the Atlantic Forest to protect the watershed through reforestation and forest management measures (Nehren et al. 2012). However, until now these schemes have not included incentives for disaster prevention. The January 2011 flood and mudslide disaster with more than 900 deaths in the Serra dos Órgãos mountain range in Rio de Janeiro state, clearly demonstrated that action on different levels is necessary, including awareness and preparedness campaigns as well as improved regional planning and Eco-DRR tools.

In Kathmandu valley, Nepal, (Nehren et al., 2013b) carried out community surveys in squatter settlements, which are affected by floods and droughts. Although people were aware of the high risk in the floodplains, they did not take action, mainly because they expected more financial support from the government and also from international NGOs. For poor communities, such as those in Kathmandu valley, Eco-DRR measures are particularly promising due to the low implementation costs and simple implementation.

Several countries in Europe, such as Germany, the Netherlands, the UK, Eastern European countries bordering the Danube River and Switzerland aim to mitigate floods through "making space for water" initiatives that remove built infrastructure (such as concrete river channels) and restore wetlands and rivers to improve their water retention capacity (Textbox 1). For example, Netherlands invested €2.3 billion to re-establish floodplains, resulting in reduced flood risk for 4 million people along its main rivers (Deltacommissie, 2008).

#### Textbox 1. Sudmeier-Rieux (2012)

### On the "Making Space for Water" Program and "Making Space for People"

The U.K. Environment Agency estimates that over five million people and two million homes and businesses are currently at risk of flooding in England and Wales, with assets valued at £250 billion. However, DEFRA's Making Space for Water 2004, is taking a holistic approach to management of risk from all forms of flooding (river, coastal, groundwater, surface run-off and sewer) and coastal erosion, and seeking to ensure the programme helps deliver sustainable development.

"To manage the risks from flooding and coastal erosion by employing an integrated portfolio of approaches which reflect both national and local priorities, so as:

- to reduce the threat to people and their property;
- to deliver the greatest environmental, social and economic benefit, consistent with the Government's sustainable development principles; and
- to secure efficient and reliable funding mechanisms that deliver the levels of investment required to achieve the vision of this strategy."

**Source:** Ryedale Flood Research Group (2008) Making Space for People report

## 2.2 CHALLENGES AND GAPS IN IMPLEMENTING ECO-DRR

In spite of the many benefits of ecosystem based solutions for more comprehensive DRR, there are many challenges for it to become mainstreamed into DRR and adaptation measures:

- 1 There are not enough advocacy efforts from the conservation, disaster management and climate change communities to articulate the DRR/Adaptation functions of ecosystems.
- 2 There is insufficient technical understanding among planners/engineers to develop quantitative models to facilitate proactive use of ecosystems as a DRR/adaptation measure.
- 3 The benefits of sustainable ecosystem management are spread across so many sectors that the topic does not receive singular attention from any of the development sectors (e.g. agriculture, health, education, culture or DRR).
- 4 Ecosystem-based disaster risk reduction does not lend itself to easy identification of measurable targets or goals (e.g. X percentage of disaster losses reduced due to well-functioning ecosystems, \$ saved by wetlands preservation for flood reduction).

In addition, there remain many critical gaps between best practices and the reality of current DRR and CCA (Textbox 2).

### Textbox 2. Sudmeier-Rieux 2012

#### Gaps in current DRR and CCA practices

- Lack of integrative legislation, policies and practices to include ecosystem management for a more systemic approach to DRR and CCA;
- Lack of consideration of natural infrastructure instead of /or together with physical infrastructure;
- The need for more cost-benefit analysis of ecosystem based approaches as measured against with physical infrastructure;
- The need for more integrated spatial planning and multi-hazard projections;
- The need to include ecosystem services in risk mapping and risk assessments;
- Lack of integrated spatial planning which has high potential for incorporating ecosystem management with DRR and CCA.
- Lack of political willingness to ensure that zoning regulations keep people out of exposed areas and protect natural infrastructure.

Because of the challenges, what is needed is improved technical knowledge about Eco-DRR and a new generation of decision makers who are able to cross sectoral divides and apply systems thinking to DRR. Examples include greater emphasis on risk-sensitive land use planning, where ecosystem based solutions can add considerable value for risk reduction, while creating other benefits (Olshansky and Kartez, 1998; Sudmeier-Rieux et al. submitted, 2012) and the slowly

emerging trend to converge traditional ecosystem management tools such as 'Integrated Water Resource Management' or 'Protected Areas' with DRR and adaptation. Because the module focuses on this point of convergence, it covers only naturally occurring disasters, not technological ones as the response and prevention is based on ecosystem-based solutions to DRR.

## 2.3 THE NEED FOR THIS MODULE

While the above concepts are reasonably well-developed empirically and academically, with well-developed graduate courses on disaster management, environment or climate change adaptation, there are few universities that link environment and disasters with graduate level modules on this topic. In the absence of such academic inclusion, this field of work has progressed faster through field implementation than by systematic documentation and knowledge generation. As a

result, application is limited only to those countries and situations where there are local experts or champions with exposure to the issues and access to decision makers. There is therefore a large gap between qualified professionals, innovative research on Eco-DRR and the emerging trend toward more comprehensive DRR. Consequently, this graduate level module “Disasters, Environment and Risk Reduction” is expected to have multiple benefits:

- 1 It will create a generation of students who have had structured training on the topic which they can develop further in research or apply in the field, based on their career progression.
- 2 It will lead to more research work undertaken in this area as some of the graduate students may choose this topic for their research.
- 3 It will also expose university professors and specialists to this field of practice so they can better serve as technical advisors, address knowledge gaps through further study, propose new applications that are practicable and up-scalable.
- 4 It will generate more interdisciplinary interest and knowledge products in due course.

### Learning objectives of the Master’s module “Disasters, Environment and Risk Reduction” include the following:

- Articulate basic concepts of disasters and disaster risk reduction;
- Understand key linkages between disasters, environment and disaster risk reduction;
- Understand key international agreements, organizations and initiatives related to disaster risk reduction, including those elements in climate change adaptation that are relevant;
- Employ various tools of disaster risk and vulnerability assessments;
- Understand specific environmental management tools that can be undertaken to minimize disaster risk;
- Introduce a systems approach to disaster risk management





**Top & bottom photos**

Students preparing risk and land use maps at Universidade Eduardo Mondlane, Mozambique, 2012

© L.Artur

## 3.1 GENERAL

The “Disasters, Environment and Risk Reduction” (Eco-DRR) module is proposed as an elective module to existing Master’s degrees (Masters of Arts or Masters of Science). For example, the CNRD universities are implementing it in a variety of departments: Geography, Natural Resources Management, Integrated Watershed Resources Management, Coastal Zone Management, Agricultural Sciences, Urban Planning, or Environmental Sciences. For the full module implementation, 50 hours of coursework are proposed corresponding to 3-6 credits (reference: ECTS system), depending on each institution’s requirements, and it can be shortened or lengthened with additional materials if needed.

The main guiding philosophy of this module is “learning by doing”, combining theory with practice, whether through examples developed by CNRD partner universities, PEDRR partners and others (Khalifa and Sandholz, 2012). Another guiding principle was the development of a standard core curriculum that can be modified depending on each institution’s experiences and needs. This is why each module includes at least one full hour or more devoted to a “hands-on” case study and real life examples, which can be used during sessions or at the

end of each module block. It is also well-known that student learning is enhanced by active participation through interactive teaching methods such as role-playing, group exercises, presenting examples and in-depth individual research, for which many examples are given throughout the module. Combining guest lectures, podcasts, video projects, learning games and student presentations can add a more active dimension to lectures and if possible, at least one well-selected field trip is recommended.

The outlined curriculum below provides a detailed overview of sessions, most corresponding to one hour, unless stated otherwise. Each university can then add or remove the number of hours depending on its needs and area of expertise.

This module has been designed with learning objectives for the overall module and also for each session. Instructors can modify these to better suit their students’ levels of knowledge and the direction of their Master’s module. The style, content and examinations questions should then logically flow from the learning objectives.

## TIPS FOR TAILORING THE MODULE

- ✓ *Consider the students at the end of the module and their studies. They will be seeking employment or further studies – what skills and knowledge have they brought with them from this module?*

## TIPS FOR MORE EFFECTIVE LEARNING

- ✓ *Although this module (like most Master’s modules around the world) has been developed based on lectures and power point presentations, experience demonstrates that more active learning takes place through discussions, practice and demonstrations and student to student teaching. Studies have shown that average maximum attention span for attending a presentation is around 20 minutes. This is why we encourage you to keep lectures to a maximum of 30 minutes, allowing more time for active learning.*

Students are often faced with a disconnection between theory and practice, in other words, practical application of theoretical knowledge creates a knowledge gap that may only promote superficial learning.

To avoid this disconnect, it is often better to start with case studies first and explain theory after.

✔ *Student evaluations of this module consistently point to the importance of providing good case study examples first and explain theory later, providing much better anchoring of theoretical knowledge.*

Figure 3. Dale's cone of experience and the learning pyramid

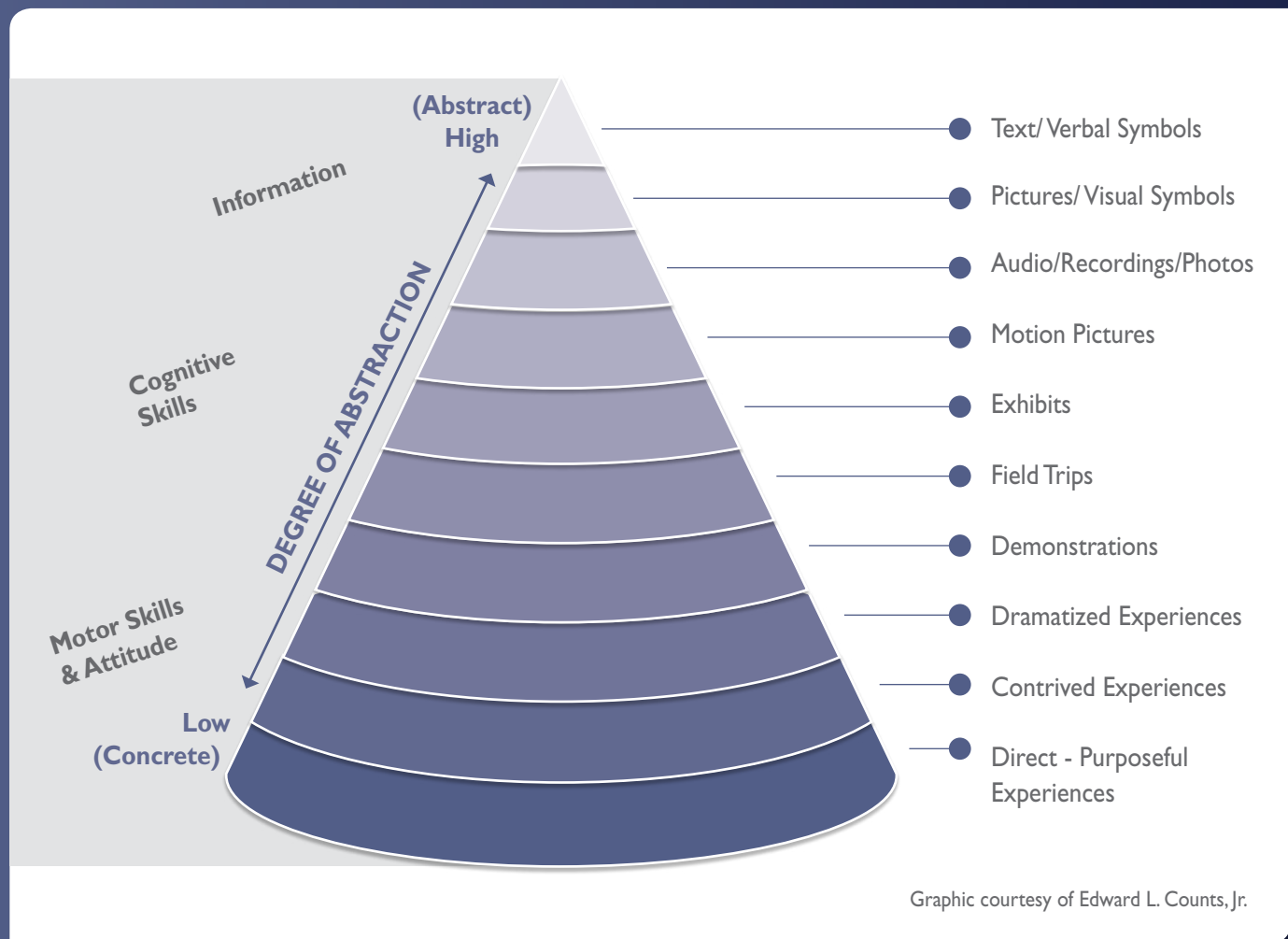
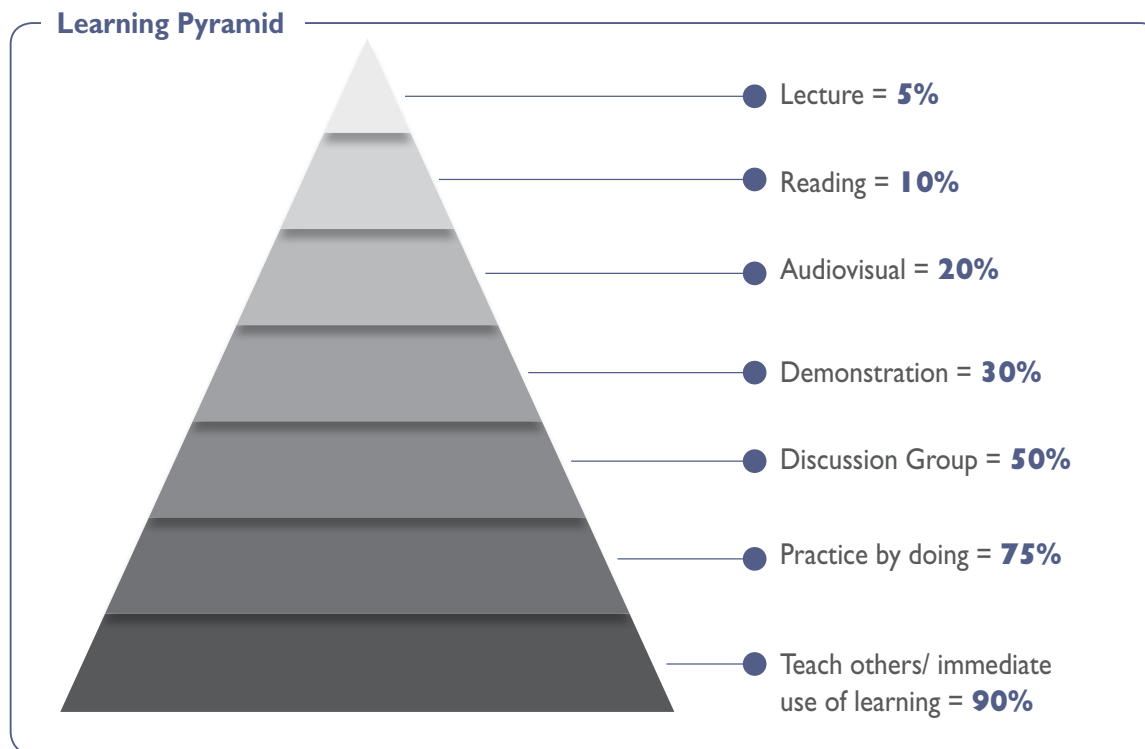


Figure 3. "Dale's Cone of Experience" demonstrates the effectiveness of different media on the learning experience, with the least effective (verbal symbols) at the top of the cone and most effective (direct, purposeful experience) at the bottom.

A second illustration that may help to consider the methods used in sharing knowledge is the Learning Pyramid (below) which charts the retention rates by information delivery:



## WHOLE GROUP DISCUSSION

Ask a question to the whole group, and discuss together, useful for easy questions that can be answered quickly, and at the start of the session to give participants a chance to speak.

## SMALL GROUP DISCUSSION/EXERCISES

Explain an exercise to the whole group, and then ask them to address it in smaller groups. This is usually when you have presented something a bit more complex. Asking them to discuss the question and answer a question together will help them digest what you have told them and then verbalise the new information for themselves. In a group format, it reduces the pressure on the individual to come up with an answer themselves.

## PAIRS EXERCISE

Ask participants to talk to their neighbour. This works when you are confident that everyone has a basic understanding of the topic, so they will not be left with only one person to help them. It also works when you have little time for an exercise, as there are less people involved in the conversation. Once you have done an exercise with an individual or a pair, you can ask them to join up with another pair, doubling the number of people who share their idea or conclusion.

## CAROUSEL

This technique is an effective way to generate a large number of ideas, alternatives, or responses among a relatively large number of people. Participants have to move around from 'station to station', which can be helpful in terms of getting people working together, and boosting energy levels.

## ROLE PLAYING

Let the participants endorse one of your stakeholder's roles and experience how they would deal with a given situation.

## SIMULATION/GAMING

New technologies are a fantastic way to learn and experience. Use simulations and games, videos, computers, tablets, etc. Make your audience physically feel and touch the heart of your message. (IUCN, 2012)

**Examples of learning games for students of ecosystems, climate change adaptation (CCA), DRR and systems thinking in general:**

- **TRIANGLE GAME:**  
to understand the dynamics of a system which faces stress and shocks, such as disasters and climate change (Booth Sweeney, L., Meadows, D. and G. Martin Mehers, 2011)
- **AVALANCHE GAME:**  
to realize the difficulty and need for good communications among stakeholders (Booth Sweeney, L., Meadows, D. and G. Martin Mehers, 2011)
- **HARVEST GAME:**  
to realize the limits of “maximum sustainable yields” (Booth Sweeney, L., Meadows, D. and G. Martin Mehers, 2011)
- **FISHBANKS SIMULATION:**  
a free online simulation game about competition for limited marine resources:  
<http://forio.com/simulate/mit/fishbanks/simulation/login.html>
- **STOP DISASTERS GAME (UNISDR):**  
a free online game about which measures are required for stopping disasters. <http://www.stopdisastersgame.org/en/home.html>  
(See Annex 3 for detailed descriptions)

### TIPS ON EXAM QUESTIONS

- ✓ *Each university has its own standards for examinations, however you may consider how to adapt your evaluation system to the learning objectives of this module. You may consider a range of evaluation types from purely knowledge based to practical adoption of learning objectives.*
- ✓ *The type of exam questions may also depend on the number of students and need for very easy grading (i.e. multiple choice) versus examination questions that may better reflect how well learning objectives have been adopted (i.e. exposés, mapping exercise or group work project). The case studies might also serve as base for elaborating term papers that are evaluated.*

### FOR EXAMPLE

- ✓ *Evaluating knowledge > multiple-response, true/false, matching responses, short answers*
- ✓ *Evaluating adoption of risk mapping > risk mapping exercise, exposé, research projects*

## FIELD VISITS

The field visit needs adequate advance preparation, both in terms of logistics as well as preparation of the participants. It is better to omit the field visit altogether than use module time to undertake a touristic outing without clear links to module content. In case community groups or other stakeholders are consulted during the visit, it is important to ensure that they understand the purpose of the visit, including that there may not be any direct follow-up for the visited group.

When planning for the overall training module programme, the organisers need to assess the feasibility of including a field visit, and identify an appropriate objective and context for the visit, such as:

- Demonstrating a practical example of ecosystem-based disaster risk reduction (i.e. visit to a wetland rehabilitation site, with links to flood mitigation).
- Practising a tool, method or approach presented during the module (i.e. conducting community-based risk assessment)

The availability of appropriate field visit sites depends very much on the national and local context. Some general criteria for choosing a field visit site include:

- Relevance of the field visit site for the module content and participants' previous experience (what can participants gain from the visit?)
- Logistical feasibility (distance, accessibility, security, cost)

### CONDUCTING A FIELD VISIT

#### PREPARATION SESSION

*A short session where essential information of the field visit content, aims and logistics is provided to the participants (i.e. the day prior to the visit). If practical work will be undertaken during the visit, then instructions are provided and clarified as appropriate.*

#### FIELD VISIT

*The duration of the visit varies depending on the context, but will generally take one full module day. The organisers need to identify an appropriate timing for the module (i.e. last module day, or in the middle of the module).*

#### REFLECTION SESSION

*Upon completion of the field visit, a feedback and reflection session to analyse the visit, and/or for groups to report back on their results (if practical work was included).*



**Top Photo**  
Field trip to Bang Chan Region, Thailand, 2012

© K. Sudmeier-Rieux

**Bottom Photo**  
Field trip in Indonesia, 2013

© S. Sandholz



## SESSION CONTENT

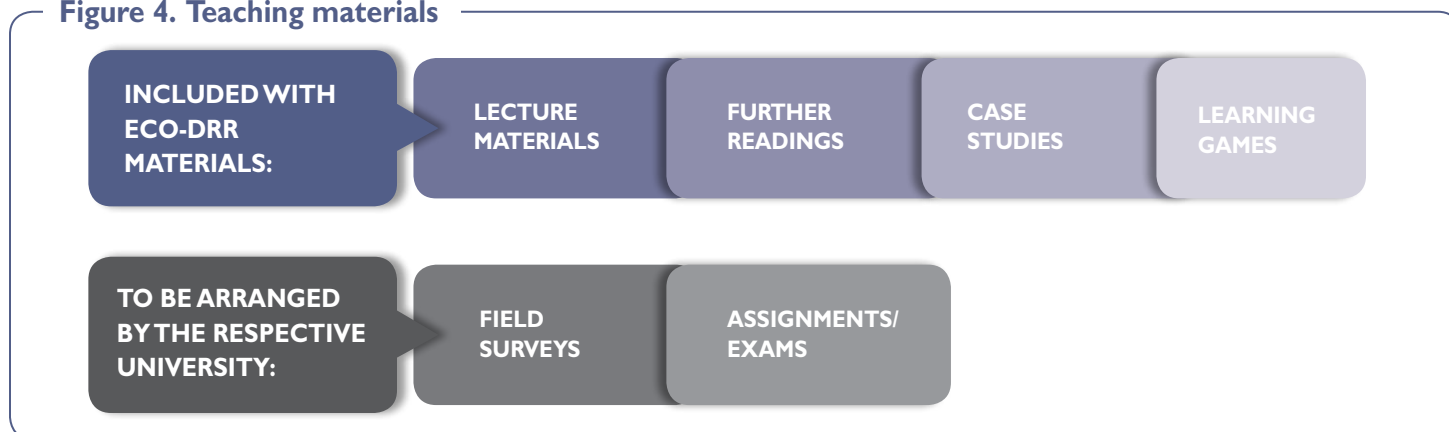
- Keep in mind when developing the sessions that this **module is unique as it is about integrating ecosystem-based management and disaster risk reduction** (e.g. the session on Integrated Water Resources Management is about its relevance to DRR).
- A brief outline is provided for each session in the curriculum outline. It has been developed based on peer review in order to cover those topics considered most relevant to the module. Unless there is a good reason for moving topics to another session, this outline will be considered final for the core curriculum. However, implementing institutions have the liberty to move topics as they see fit once the core curriculum has been developed.
- For each session an expected learning outcome of the student should be defined, as the first slide in the power point template. High value is set on equipping the students with adequate knowledge to draw their own conclusions and gain a holistic view on the topic.
- Time should be allocated for learning games, videos and other pedagogical tools to enhance the learning experience. Ideas on these tools are listed for each session and are included in the training materials for this module.

## TEACHING THE ECO-DRR MODULE

When teaching the Eco-DRR module, the implementing university is encouraged to use a diversity of teaching elements (**Figure 4**). Besides the lecture materials for the different sessions, the module authors also developed case studies from various countries (see **Block 3**). Moreover, a number of learning games are described in this training manual.

Furthermore, we recommend that if possible, universities include a field trip or field survey based on a local case study arranged by the respective university itself. **Annex 4** provides a case study template, which will assist this process. Assignment and examination regulations may differ considerably, thus no “sample assignment” or examinations are provided.

Figure 4. Teaching materials



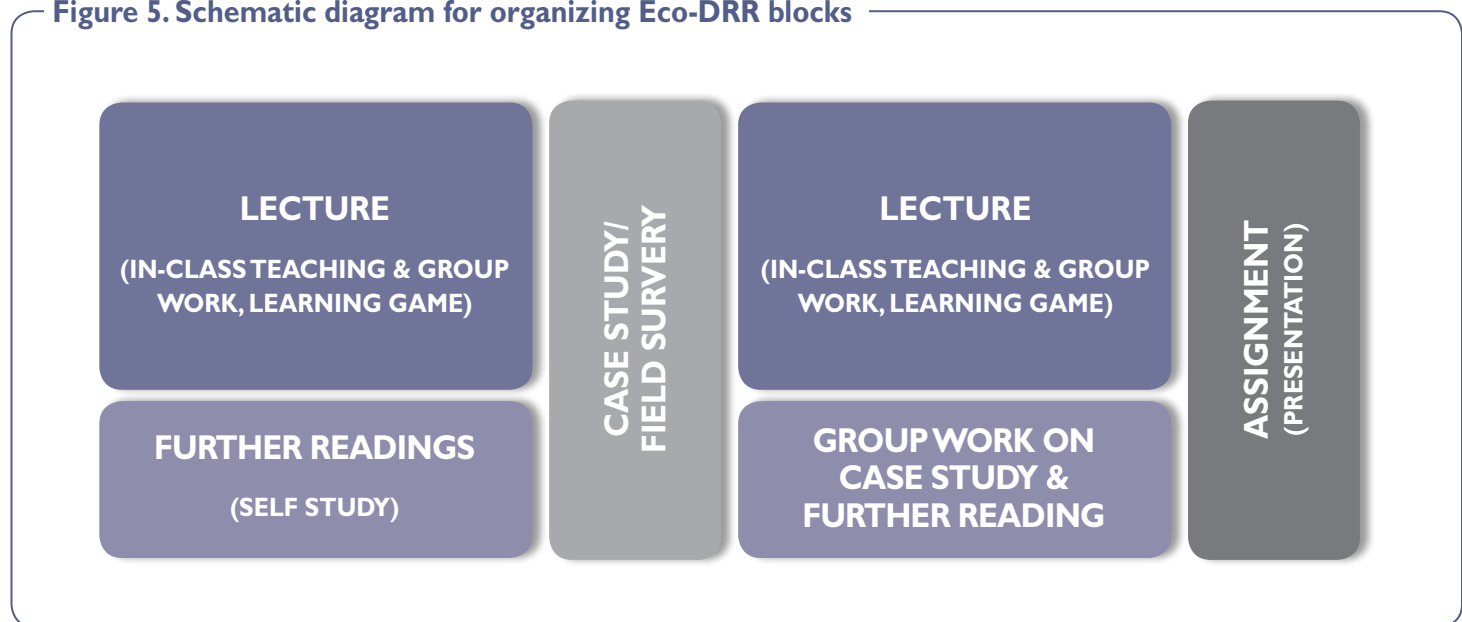


The module can be taught in a block structure or it can be included in a weekly schedule, depending on the university calendar.

**Figure 5.** gives a rough overview over how teaching the Eco-DRR module could be organized. After introductory sessions including readings, we recommend introducing a case study to better anchor

theoretical knowledge in a real-world context. This case study can be developed based on a local field situation or based on one of the case studies provided with the Eco-DRR materials. After the case study, students should continue working on the topic, preferably in groups. If possible, the report they develop might be (part of) the final assignment.

**Figure 5. Schematic diagram for organizing Eco-DRR blocks**



The teaching itself should include in-class work with the powerpoint slides provided, combined with learning games, discussions and group

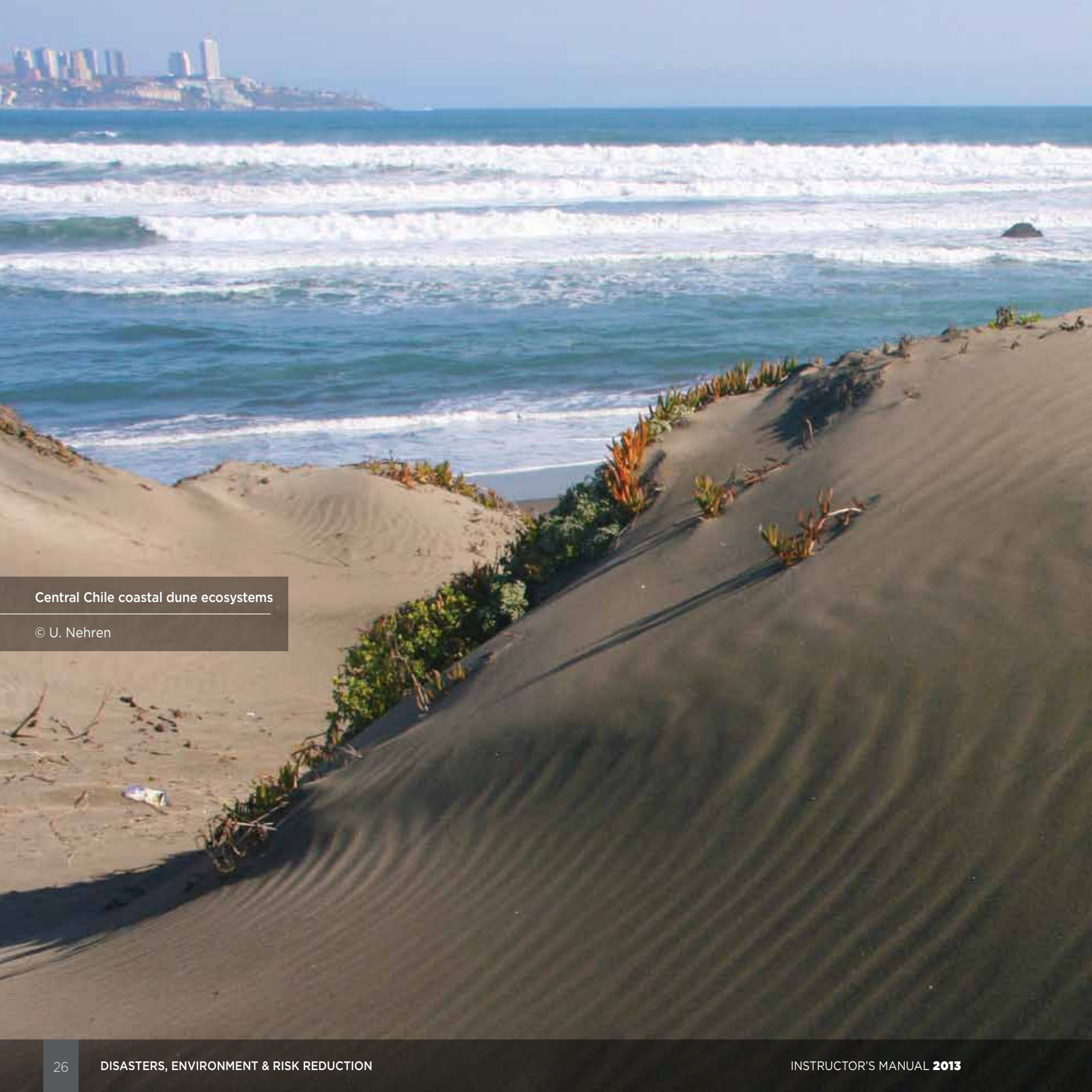
work, which can be based on the questions asked in the different session slides.

## REFERENCES AND RECOMMENDED READING

- Each reference used during a session are listed in a “reference slide“ with full citations
- 3-5 articles or documents are recommended as additional reading for each module session with most useful reference highlighted in red.

## CROSS LINKAGES BETWEEN SESSIONS

An asterix \* indicates sessions in the session powerpoint notes which have been cross referenced for further information.



Central Chile coastal dune ecosystems

© U. Nehren



master's module

# DISASTERS, ENVIRONMENT & RISK REDUCTION (Eco-DRR)

INSTRUCTOR'S MANUAL • **VERSION 2013**

## SESSION 0: BACKGROUND, PURPOSE AND PARTNERS (30 MINUTES)

SESSION AND CONTENT	RESPONSIBLE INSTITUTION/ Collaborating Institution
Genesis of Master's module Basic philosophy and purpose Module expected outcomes Module structure Key developers	<b>CUAS</b> <b>IUCN-CEM</b>
	<b>AUTHORS/CONTRIBUTORS</b>
	<b>Simone Sandholz</b> <b>Udo Nehren</b> <b>Karen Sudmeier-Rieux</b>

## BLOCK I: ELEMENTS OF DISASTER RISK REDUCTION (15 HOURS)

## LEARNING OBJECTIVES

- Understand main components and drivers of risk and disasters
- Understand most commonly used models
- Understand different terminology used by DRR and CCA communities
- Learn to obtain data and information on global trends related to DRR
- Obtain some hands on experience with participatory risk mapping and Vulnerability and Capacity Analysis (VCA)

SESSION AND CONTENT	RESPONSIBLE INSTITUTION/ Collaborating Institution
<b>I.1 Theory: Introduction to DRR (2 hours)</b> <ul style="list-style-type: none"> <li>• General risk and disaster trends worldwide</li> <li>• Basic terminology (DRR, risk, vulnerability, exposure, hazard) and differences between DRR and CCA</li> <li>• Main disaster trends and underlying drivers of risk</li> <li>• From the disaster cycle to the disaster spiral – moving from reaction to prevention</li> <li>• Overview of actors involved in DRR</li> <li>• Student exercise</li> </ul>	<b>IUCN-CEM</b> <b>UNEP</b>
	<b>AUTHORS/CONTRIBUTORS</b>
	<b>Karen Sudmeier-Rieux</b> <b>Marisol Estrella</b>

### **I.2 Theory: Global data on risk, disasters and ecosystems (1 hour)**

- UNISDR Global Assessment Report
- IPCC Special Report on Extreme Events (SREX)
- Disaster Risk Index (UNEP/GRID-EUROPE)
- World Risk Index (UNU)
- Economic data on disasters
- HFA – Global Assessment Report
- Student exercise

IUCN-CEM  
UNEP

AUTHORS/CONTRIBUTORS

Karen Sudmeier-Rieux  
Marisol Estrella

### **I.3 Theory: Linking Climate Change Adaptation and DRR (1 hour)**

- What are the impacts of CC on disasters?
- What are the impacts of CC on ecosystems?
- What are the impacts of CC on vulnerability?
- Streamlining CC adaptation and DRR
- The IPCC SREX report
- Video

UNEP  
IUCN-CEM

AUTHORS/CONTRIBUTORS

Marisol Estrella  
Karen Sudmeier-Rieux

### **I.4 Theory: Modeling Risk, Vulnerability and Sustainable Development (1 hour)**

- UNISDR Global Assessment Report
- IPCC Special Report on Extreme Events (SREX)
- Disaster Risk Index (UNEP/GRID-EUROPE)
- World Risk Index (UNU)
- Economic data on disasters
- HFA – Global Assessment Report
- Student exercise

UNU-EHS  
IUCN-CEM

AUTHORS/CONTRIBUTORS

Fabrice Renaud  
Karen Sudmeier-Rieux

### **I.5 Theory: Coping capacities and concept of resilience (1 hour)**

- Coping capacity vs. adaptive capacity
- Origin and increasing use of concept of resilience
- Resilience building – at community and national levels, what factors to consider?

IUCN-CEM  
UNU-EHS

AUTHORS/CONTRIBUTORS

Marisol Estrella  
Karen Sudmeier-Rieux

### **I.6 Theory: Disaster preparedness and prevention (1 hour)**

- Risk perceptions, culture and priorities
- Communicating disaster risks
- National and local level disaster preparedness
- Early warning and monitoring (The example of GITEWS)
- Student exercise

IUCN-CEM, UNU-EHS

AUTHORS/CONTRIBUTORS

Karen Sudmeier-Rieux  
Jörn Szarzynski

### **I.7 Theory: Disaster relief, recovery & reconstruction (1 hour)**

- Challenges and solutions
- Main actions
- Women and disasters – why are women more affected?
- Good and bad practices, including environmental considerations
- UN Cluster system, Post-Disaster Needs Assessment
- Building back better – some guidelines

**IUCN-CEM, WWF-US,  
WWF-INT, UNEP**

#### **AUTHORS/CONTRIBUTORS**

**Karen Sudmeier-Rieux  
Anita van Breda  
Elaine Geyer-Allely  
Marisol Estrella**

### **I.8 From Theory to Practice: Data and tools for vulnerability assessments (1 hour)**

- Multi-disciplinary vulnerability assessments
- Vulnerability indicators, indicator development and interpretation
- Vulnerability and Capacity Assessments
- Constructing your own VCA
- CVCA
- CRiSTAL
- Student exercise

**IUCN-CEM  
UNU-EHS**

#### **AUTHORS/CONTRIBUTORS**

**Karen Sudmeier-Rieux  
Fabrice Renaud**

### **I.9 From Theory to Practice: Data and tools for risk assessments (1 hour)**

- Reading and using maps for decision making
- Data for hazard and risk maps (local and global)
- Difference between hazard, exposure and risk maps
- Participatory risk mapping (including 3D risk mapping)
- RiVAMP (UNEP/GRID-EUROPE) combining risk and ecosystem data
- Student exercise

**IUCN-CEM  
UNEP**

#### **AUTHORS/CONTRIBUTORS**

**Karen Sudmeier-Rieux  
Marisol Estrella**

### **I.10 Practice: Group work options (5 hours)**

- Creating your own participatory risk map
- Creating your own VCA (advanced)

**IUCN-CEM, IUCN  
UNEP**

#### **AUTHORS/CONTRIBUTORS**

**Karen Sudmeier-Rieux  
Radhika Murti  
Marisol Estrella**

## BLOCK II: ECOSYSTEM-BASED DISASTER RISK REDUCTION (ECO-DRR) (15 HOURS)

### LEARNING OBJECTIVES

- Understand the link between global environmental problems, disasters, and sustainable development
- Understand the multiple benefits ecosystems offer for disaster risk reduction
- Understand how disasters are linked to the natural conditions in specific biomes / ecoregions
- Understand how ecosystem services can help to decrease disaster risk
- Understand the limits and opportunities of ecological and physical infrastructure for DRR
- Learn about methods to assess costs and benefits of DRR measures and value ecosystem services

SESSION AND CONTENT	RESPONSIBLE INSTITUTION/ Collaborating Institution
<p><b>2.1 Theory: Linking global environmental problems and disasters (1.5 hours)</b></p> <ul style="list-style-type: none"> <li>• Linkages between human and natural systems</li> <li>• Climate change mitigation, adaptation and DRR</li> <li>• Biodiversity loss and DRR</li> <li>• Global water crisis and DRR</li> <li>• Desertification, soil erosion and DRR</li> <li>• Linkages between sustainable development and disasters</li> </ul>	<p><b>CUAS HUA UIBK</b></p> <hr/> <p><b>AUTHORS/CONTRIBUTORS</b></p> <p><b>Udo Nehren, Hoang Ho Dac Thai Claudia Raedig Simone Sandholz</b></p>
<p><b>2.2 Theory: Fundamental concepts of ecosystems and ecosystem services (1 hour)</b></p> <ul style="list-style-type: none"> <li>• Natural systems</li> <li>• Ecosystems and landscape systems</li> <li>• Ridge to Reef (R2R) concept</li> <li>• Millennium Ecosystem Assessment</li> <li>• Multiple benefits from ecosystem for DRR</li> <li>• Available data on ecosystems</li> </ul>	<p><b>CUAS UNIVERSITY OF LEIPZIG IUCN-CEM</b></p> <hr/> <p><b>AUTHORS/CONTRIBUTORS</b></p> <p><b>Udo Nehren Ishrat Jahan Wolfram Lange Friederike Naegeli Karen Sudmeier-Rieux</b></p>

### 2.3 Theory: Linking sustainable development, disasters and environment (1 hour)

- How do disasters affect sustainable development?
- What are links between disasters and environment?
- Rationale for why ecosystems matter to DRR
- Including ecosystems in disaster spiral

UNEP  
IUCN-CEM

AUTHORS/CONTRIBUTORS

Marisol Estrella  
Karen Sudmeier-Rieux

### 2.4 Theory: Major eco-zones, hazards and impact on populations (1.5 hours)

- A geographical overview
- Tropical and subtropical forests in mountain regions
- Coastal ecosystems in the tropics: mangroves
- Tropical and subtropical grasslands, savannas and shrublands
- Mediterranean forests, woodland, and scrub
- Flooded grasslands and savannas

CUAS

AUTHORS/CONTRIBUTORS

Udo Nehren  
Claudia Raedig  
Ishrat Jahan

### 2.5 Practice: Ecosystem services for vulnerability reduction (2 hours)

- Group exercise
- How do ecosystems reduce vulnerability?
- How do the ecosystems provide services and goods for livelihoods (with special focus on food security)?
- How do ecosystem support sustainable development?

CUAS  
LUCCI PROJECT

AUTHORS/CONTRIBUTORS

Udo Nehren  
Claudia Raedig  
Günther Straub  
Simone Sandholz  
Ishrat Jahan

### 2.6 Practice: Ecological Engineering for DRR (1 hour)

- Natural versus physical infrastructure for DRR
- Good and bad examples
- Cost-benefit analysis
- Hybrid solutions to combining natural vs. physical engineering

UNEP  
WWF-INT  
IUCN-CEM

AUTHORS/CONTRIBUTORS

Marisol Estrella  
Catherine Ador  
Elaine Geyer-Allely  
Karen Sudmeier-Rieux



### **2.7 Theory: Valuing ecosystem services (1 hour)**

- Assessing cost and benefits of DRR measures
- Valuing ecosystem services
- Methods for valuing ecosystem services
- Ecosystem values for DRR: case studies and exercise

**IUCN-CEM  
UNEP  
CUAS  
WWF-INT**

#### **AUTHORS/CONTRIBUTORS**

**Karen Sudmeier-Rieux  
Marisol Estrella  
Udo Nehren  
Elaine Geyer-Allely**

### **2.8 Practice: Field trip/ guest lectures/ case study group work presentations (6 hours)**

*DEPENDING ON CASE STUDIES, SEE TABLE ON NEXT PAGE, BLOCK III*

## BLOCK III: ECO-DRR INSTRUMENTS AND APPROACHES: (15 HOURS)

### LEARNING OBJECTIVES

- Learn about the importance of spatial planning as an overarching concept for reducing disaster risk using ecosystem management tools
- Learn about various ecosystem management tools and approaches for reducing disaster risk for different ecosystem and hazard types
- Learn about the role of ecosystems for reducing urban risks
- Learn about the importance of community based disaster risk reduction through ecosystem management

SESSION AND CONTENT	RESPONSIBLE INSTITUTION/ Collaborating Institution
<p><b>3.1 Introduction to instruments and approaches for Eco-DRR (1.5 hours)</b></p> <ul style="list-style-type: none"> <li>• Types of instruments and approaches</li> <li>• Development of project design, management and monitoring</li> <li>• Introduction to results-based management principles / log frame development</li> <li>• Indicators for Eco-DRR</li> </ul>	<p><b>UASLP CUAS UIBK</b></p> <hr/> <p><b>AUTHORS/CONTRIBUTORS</b></p> <p><b>Patricia Julio Simone Sandholz Ishrat Jahan Udo Nehren</b></p>
<p><b>3.2 Spatial planning tools and approaches for DRR (2 hours)</b></p> <ul style="list-style-type: none"> <li>• The concept of spatial planning for DRR</li> <li>• Tools for spatial planning and DRR</li> <li>• Strategic Environmental Assessments for DRR</li> <li>• Integrating risk and ecosystems into spatial planning</li> <li>• EIAs and DRR</li> <li>• Exercise</li> </ul>	<p><b>USC ASU CUAS UIBK IUCN-CEM</b></p> <hr/> <p><b>AUTHORS/CONTRIBUTORS</b></p> <p><b>Urbano Fra Paleo Marwa A. Khalifa Simone Sandholz Karen Sudmeier-Rieux Wolfram Lange Udo Nehren</b></p>

### 3.3 Integrated Water Resources Management/River basin management (1 hour)

- Basic principles
- Ecosystem principles for DRR
- DRR applications
- Institutions and actors for DRR

JU  
ASU  
CUAS

#### AUTHORS/CONTRIBUTORS

Sana'a Al-Aqqad  
Aly El-Bahrawy  
Lars Ribbe  
Ahmed Al-Salaymeh  
Manar Fayyad

### 3.4 Integrated Coastal Zone Management (1 hour)

- Introduction
- Characteristics of the coastal area and resources
- Problem and issues of coastal areas
- Concepts of integrated coastal planning and management
- Coastal management and planning techniques
- Case study

UGM

#### AUTHORS/CONTRIBUTORS

Danang Sri Hadmoko  
Muh Aris Marfai  
Djati Mardiatno  
Bachtiar Wahyu Mutaqin

### 3.5 Protected areas (1 hour)

- Basic principles
- Ecosystem principles for DRR
- DRR applications
- Institutions and actors

IUCN-CEM  
IUCN  
WWF- INT

#### AUTHORS/CONTRIBUTORS

Karen Sudmeier-Rieux  
Radhika Murti  
Elaine Geyer-Allely

### 3.6 Managing ecosystems for urban risk reduction (1 hour)

- Basic principles of managing ecosystems for urban risk reduction
- Ecosystem – urban dynamics for DRR
- Ecosystem applications to reduce urban risks
- Institutions and actors

TU  
UIBK  
CUAS

#### AUTHORS/CONTRIBUTORS

Simone Sandholz  
Ajay Chandra Lal  
Wolfram Lange

### 3.7 Ecosystem-based Adaptation (1 hour)

- Basic principles
- Ecosystem principles
- DRR applications
- Institutions and actors

IUCN

#### AUTHORS/CONTRIBUTORS

Radhika Murti  
Kaia Boe  
Camille Buyck

### 3.8 Community-based Ecosystem and Disaster Risk Management (1 hour)

- Introduction and key concept of Community-Based Ecosystem and Disaster Risk Management (CBEDRM)
- Actors
- Key aspects of CBEDRM
- Process of CBEDRM
- Community-based early warning and monitoring

UGM  
CUAS  
UIBK

#### AUTHORS/CONTRIBUTORS

Danang Sri Hadmoko  
Simone Sandholz  
Wolfram Lange

### 3.9 Field trip/ case studies/ group work presentations (5.5 hours)

Depending on case studies,  
see table on next page,  
block III

## BLOCK II AND III: CASE STUDIES

Case studies from partner universities were prepared to provide a real experience on Eco-DRR in different counties with different disaster situation. The case studies can be used in sessions 2.8 and 3.9.

COUNTRY/CASE STUDY	INSTITUTION	AUTHORS
<b>BRAZIL</b>		
Impacts of severe storm occurred in April 2010 along Rio de Janeiro Coast	Universidade Federal Fluminense (UFF)	Guilherme Borges Fernandez
<b>CHILE</b>		
Cultural Landscape Governance, Innovation and DRR: From Amereida Open City to Amereida Farm Region of Valparaíso, Chile	Pontificia Universidad Católica de Valparaíso (PUSV)	Leonardo Vera
<b>EGYPT</b>		
The Impacts of Sea Level Rise on Egypt	Ain Shams University (ASU)	Aly El-Bahrawy, Marwa Khalifa, Hanan Farag
<b>INDONESIA</b>		
Coastal Hazards at Semarang Coastal Area, Central Java	Gajah Mada University (UGM)	Muh Aris Marfai, Danang Sri Hadmoko, Junun Sartohadi, Djati Mardiatno
<b>JORDAN</b>		
Aqaba Flood Management	Water, Energy and Environment Center, University of Jordan (JU)	Sana'a Al-Aqqad, Ahmed Al-Salaymeh, Manar Fayyad
<b>MEXICO</b>		
Land subsidence in the urban setting of a semiarid environment: the case of San Luis Potosí metropolitan area, Mexico	Universidad Autónoma de San Luis Potosí (UASLP)	Patricia Julio
<b>MOZAMBIQUE</b>		
Planting Hope in Govuro and Machanga area	Universidade Eduardo Mondlane (UEM)	Luis Artur
<b>NEPAL</b>		
Flood Hazard in Gaur Municipality, Rauthat, Central Terai	Tribhuvan University (TU)	Ajay Chandra Lal, Jishnu Subedi
<b>BRAZIL</b>		
Reducing salinity intrusion risk of coastal areas in Vietnam	Vietnam Academy for Water Resources (VAWR)	Dang The Phong

## BLOCK IV: MAINSTREAMING ENVIRONMENT AND DRR IN DEVELOPMENT (5 HOURS)

### LEARNING OBJECTIVES

- Pull together the main concepts and issues learned in **Blocks 1-3**
- Address the policy and institutional context in implementing Eco-DRR
- Understand the concept of mainstreaming and for what purpose
- Understand the key players or stakeholders involved in mainstreaming Eco-DRR in development
- Identify the opportunities and challenges in mainstreaming Eco-DRR in development

SESSION AND CONTENT	RESPONSIBLE INSTITUTION/ Collaborating Institution
<b>4.1 Theory: Fundamentals of effective advocacy (1 hour)</b> <ul style="list-style-type: none"> <li>• Policy instruments for Eco-DRR</li> <li>• Platforms for collaboration</li> <li>• Major actors in DRR, ecosystem management and CCA</li> <li>• Interagency mechanisms</li> <li>• Stakeholder analysis</li> <li>• Organizational/institutional assessments at different scales: international, national, local</li> <li>• Partnerships and networking</li> <li>• Private sector (Payments for Ecosystem Services, Insurance)</li> </ul>	<b>UNEP IUCN-CEM</b>
	<b>AUTHORS/CONTRIBUTORS</b>
	<b>Marisol Estrella Karen Sudmeier-Rieux</b>
<b>4.2 Practice: Mainstreaming Eco-DRR (1 hour)</b> <ul style="list-style-type: none"> <li>• Integrating Eco-DRR into development policies, programmes and plans</li> <li>• Integrating Eco-DRR in local land use planning</li> <li>• Integrating Eco-DRR in NAPAs, Poverty Reduction Strategies, UNDAFs</li> <li>• EIAs and SEAs</li> <li>• Good and bad practices</li> </ul>	<b>UNEP, IUCN-CEM</b>
	<b>AUTHORS/CONTRIBUTORS</b>
	<b>Marisol Estrella Karen Sudmeier-Rieux</b>
<b>4.3 Theory: Economics of Disaster Risk Reduction (1 hour)</b> <ul style="list-style-type: none"> <li>• Macroeconomic effects of natural disasters</li> <li>• Economics of disaster recovery</li> <li>• Economic costs of disasters</li> <li>• Estimation of disaster losses – who pays for disasters?</li> <li>• Investing in natural disaster risk reduction</li> </ul>	<b>CUAS, IUCN-CEM, CTIC-VAWR</b>
	<b>AUTHORS/CONTRIBUTORS</b>
	<b>Udo Nehren Karen Sudmeier-Rieux Dang The Phong Nguyen Tung Phong</b>
<b>4.4 Case study and group work exercises (2 hours)</b> <ul style="list-style-type: none"> <li>• Example: role playing</li> </ul>	<b>UNEP</b>
	<b>AUTHORS/CONTRIBUTORS</b>
	<b>Marisol Estrella</b>



**Top Photo**  
**Teaching Eco-DRR in Indonesia**

© A. D. Wahyu Rahmadana

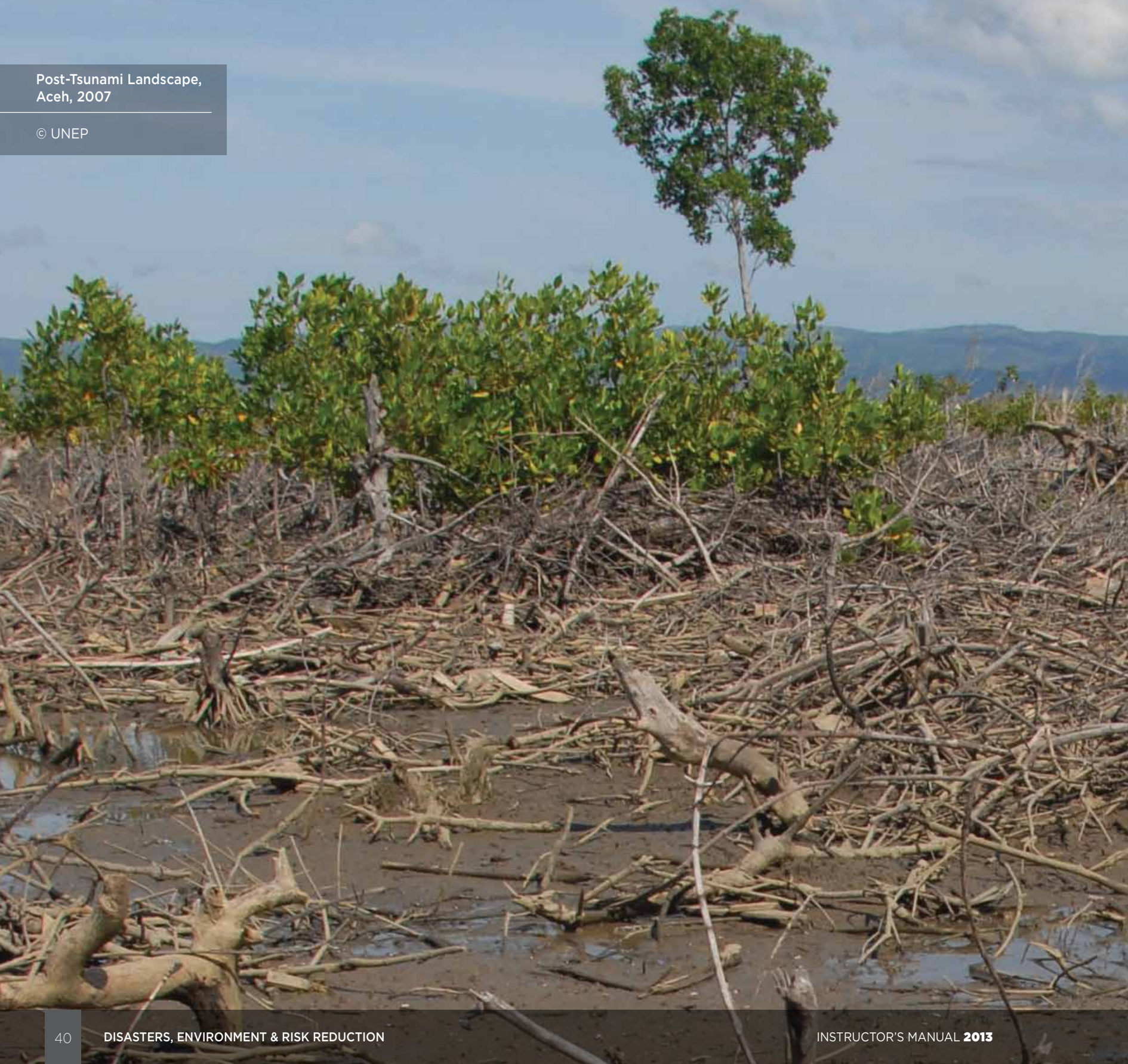
**Bottom Photo**  
**Bio-engineering in Nepal**

© K. Sudmeier-Rieux




Post-Tsunami Landscape,  
Aceh, 2007

© UNEP







master's module

# DISASTERS, ENVIRONMENT & RISK REDUCTION (Eco-DRR)

INSTRUCTOR'S MANUAL • **VERSION 2013**

# BLOCK I

## ELEMENTS OF DISASTER RISK REDUCTION (15 HOURS)

Open air school,  
post-earthquake Pakistan

© K Sudmeier-Rieux

## SESSION 0. BACKGROUND, PURPOSE AND PARTNERS (30 MINUTES)

### SESSION AND CONTENT

This prelude to the Master's module is intended to provide a brief overview and background information about the genesis of the module, its basic philosophy and purpose, main expected outcomes, its structure and the key developers. The video, "Hope in a changing climate" provides a good introduction to the field of Eco-DRR

### TEACHING RESOURCES

- Lecture (12 slides)
- 5 min. video: Hope in a changing climate (a 30 min. version is also available)

## I.1 THEORY: INTRODUCTION TO DRR (2 HOURS)

### OUTLINE

This is the introductory session that has been developed for a non-specialist group to introduce basic concepts, terminology, actors and actions that relate to managing disaster risks. It covers main disaster trends, influential policy documents, the disaster management cycle and spiral, economic costs of disasters and main drivers of risk. The session discusses disasters as a management issue often rooted in underlying risk factors, namely poverty, people living in dangerous places and environmental degradation.

Disaster management has traditionally focused on the post-disaster emergency, recovery and reconstruction phases as well as investing in physical infrastructures for protection. Over the past decade, there has been a shift toward prevention by improving preparedness and early warning. However most governments still are lagging when it comes to long term investments in reducing main drivers of risk, namely vulnerability and exposure linked to poor environmental management. One of the main messages of this session and of most current international policy documents is that main drivers of risk are aggravated by, but not primarily caused by climate change.

### LEARNING OBJECTIVES

- Understand concepts of disaster risk and key components of risk including vulnerability, exposure, hazard, coping capacity, adaptive strategy and resilience
- Learn about main trends in disaster occurrence worldwide
- Learn about main actions undertaken for DRR and a brief overview of main actors at the global national and local levels

### TEACHING RESOURCES

- Lecture (49 slides)
- Student exercise
- 15 min video: Reducing risk in a changing climate (UNISDR)
- Handout on DRR terminology

### GUIDANCE

- This 2 hour session presents many new terms and concepts that may be designed for students without previous instruction on disaster risk reduction.
- It is important that students are given ample time to ask questions and discuss key concepts as these will set the foundation for the remaining module.
- One exercise is proposed – a blank world map that can be handed out to students, who are then asked to map where they think different types of disasters occur. The purpose of this exercise is for students to consider why disasters are often concentrated along coasts, rivers and mountainous areas.

### RECOMMENDED READING

- UNISDR [United Nations International Strategy for Disaster Reduction (2005) Hyogo Framework for Action 2005-2015. [www.preventionweb.net](http://www.preventionweb.net)
- UNISDR [United Nations International Strategy for Disaster Reduction (2011) Global Assessment Report, Revealing Risk, Redefining Development. 178pp. Geneva: UNISDR.

## I.2 THEORY: GLOBAL DATA ON RISK, DISASTERS AND ECOSYSTEMS (1 HOUR)

### OUTLINE

This session covers data on risk disasters and ecosystems at the global level so that students have a good grasp of where to find data on disasters, risk and ecosystems, how to interpret the statistics, and how they are being used in key policy documents, especially the UNISDR Global Assessment Reports and the IPCC Special Report on Extreme Events (SREX).

### LEARNING OBJECTIVES

- Become familiar with sources of data on risk, disasters and ecosystems
- Become familiar with casualty and economic loss data on disasters
- Become familiar with key policy documents on disasters and climate change
- Develop critical thinking about how data on disasters are collected and used

### TEACHING RESOURCES

- Lecture (27 slides)
- Student exercise

### GUIDANCE

- This session is short in order to provide time for students themselves to explore the two main websites for data on disasters.
- The EM-DAT system normally provides data on disasters free of charge to universities: however you may be required to register in order to gain full access to the data. A number of ready EM-DAT data sets are available to the public.
- DESINVENTAR data require no specific registration, however, the database is limited to a number of countries.

### RECOMMENDED READING

- EM data website: [www.emdat.be](http://www.emdat.be)
- DesInventar database website: [www.desinventar.net](http://www.desinventar.net)

## 1.3 THEORY: LINKING CLIMATE CHANGE ADAPTATION AND DRR (1 HOUR)

### OUTLINE

Climate change will affect disaster risks in two ways, firstly through the likely increase in the frequency and intensity of specific extreme weather events, and secondly through increases in the vulnerability of communities to natural hazards, particularly through ecosystem degradation, water and food scarcity, and changes in livelihoods. Based on the IPCC SREX document, this session will cover in detail trends in climate change and what current science tells us about how climate change is affecting the frequency and magnitude of disasters, ecosystems and population vulnerability today and future projected impacts. It therefore introduces the main climate models that are used for projecting future climate trends and the uncertainties with projections. This session will also explore international policy efforts to streamline CCA and DRR as well as local perspectives on climate change. Students should be given the opportunity to discuss what observations they have made about climate change and how it is affecting their lives.

### LEARNING OBJECTIVES

- Become familiar with current climate science and global climate models
- Understand the uncertainties of climate modeling
- Become aware of local perspectives and observations about climate change
- Develop critical thinking about the different viewpoints represented by CCA and DRR

### TEACHING RESOURCES

- Lecture (35 slides)
- Student exercise
- Handout: Conceptual and practical differences between DRR and adaptation

### GUIDANCE

- The challenge with this session is to explain the complexities of climate change impacts on disaster occurrence.
- The 2012 IPCC SREX report provides a nuanced set of conclusions about the impacts of climate change on disasters. According to this report, only a few set of extreme events in certain regions, namely heat waves, can be considered directly linked to climate change.
- Therefore students should be cautioned against easily made claims about climate change increasing disasters. Rather, underlying causes of disasters lie more with poor land use planning or exposure and vulnerability, not necessarily climate change.
- IPCC SREX summary for policy makers is a useful background document.

### RECOMMENDED READING

- IPCC [Interagency Panel on Climate Change] (2012) IPCC Special Report on Extreme Events, Summary for Policymakers. 29. Geneva: Intergovernmental Panel on Climate Change First Joint Session of Working Groups I and II.
- Mercer, J. (2010) Disaster Risk Reduction or Climate Change Adaptation, are we reinventing the wheel? *Journal of International Development* 22, 247–264

## I.4 THEORY: MODELING RISK, VULNERABILITY AND SUSTAINABLE DEVELOPMENT (1 HOUR)

### OUTLINE

This session provides more theoretical introduction to the study of disasters and root causes of disasters from different perspectives. There are several different schools of thought, mainly from the climate change or the DRR perspectives, which until recently used quite different terminology and conceptual frameworks. The lecture covers most well-known models that illustrate various perspectives on how to link risk, livelihoods, vulnerability and development: SUST model; Pressure and Release Model; Sustainable Livelihoods Approach; BBC model; MOVE model. Several examples are given on how to apply the models in real life situations and how they can be modified.

### LEARNING OBJECTIVES

- Develop critical thinking about the linkages between environmental sustainability, disaster risk, livelihoods and development
- Understand the importance of environmental management and sustainable development for disaster risk reduction
- Understand the different theoretical underpinnings and respective models of risk, vulnerability and sustainable development

### TEACHING RESOURCES

- Lecture (28 slides)
- Student exercise

### GUIDANCE

- Although this session is considered an introduction to different theoretical underpinnings and models in disaster studies, the session may be considered advanced to students with little previous knowledge in this field.
- There is currently one example on how to apply the SUST model in Sri Lanka, yet this session could be enhanced with instructor's own examples on applications of the models.

### RECOMMENDED READING

- Birkmann, J. (2006) Measuring vulnerability to promote disaster-resilient societies: Conceptual frameworks and definitions. In: *Measuring Vulnerability to Natural Hazards, Towards Disaster*, Tokyo: UNU Press
- Turner, B., et al. (2003) A framework for vulnerability analysis in sustainability science. *PNAS*, 100, 8074-8079.
- Wisner, B., P. Blaikie, T. Cannon & I. Davis (2004) *At Risk, Natural Hazards, People's Vulnerability and Disasters*. London and New York: Routledge.

## 1.5 THEORY: COPING CAPACITIES AND CONCEPT OF RESILIENCE (1 HOUR)

### OUTLINE

Coping capacities and/or resilience are often considered the remedy to reducing vulnerability and risk – but are they? Resilience has become the most commonly used buzzword in the context of international development and disaster risk reduction, yet our knowledge about its exact meaning is limited. This session covers these often used terms, exploring how they are used and how they differ from “adaptive capacity” and “adaptation”. We will take a critical view of these concepts and consider what measures are needed to increase coping capacities, resilience, adaptation on the one hand, while reducing risks and vulnerability on the other hand. Although this session covers mainly theoretical viewpoints, it also gives many practical examples to highlight the issues, contrasts and complexity of these terms.

### LEARNING OBJECTIVES

- Understand concepts: coping capacity, adaptive capacity and resilience
- Develop critical thinking about the role of these concepts and their relation to reducing vulnerability and risk
- Develop critical thinking about the meaning of resilience

### TEACHING RESOURCES

- Lecture (27 slides)
- Student research questions

### GUIDANCE

- This session is intended to cover in more detail the commonly used terms coping capacity, adaptive capacity and resilience and why they have gained such importance.
- It is also intended for students to develop critical thinking about these terms – therefore the session is relatively short to allow for group discussions and reflections.

### RECOMMENDED READING

- Manyena, S. B., G. O'Brien, P. O'Keefe and J. Rose (2011) Disaster resilience: a bounce back or bounce forward ability? *Local Environment*, 16, 417-424.
- Mayunga, J. S. (2007) Understanding and Applying the Concept of Community Disaster Resilience: A capital- based approach. In A draft working paper prepared for the summer academy for social vulnerability and resilience building, 22 – 28 July 2007, Munich, Germany, 16pp. Bonn: UNU-EHS.
- Tierney, K. & M. Bruneau (2007) Conceptualizing and Measuring Resilience, A Key to Disaster Loss Reduction. In *TR News*, 14-15. Washington, D.C.: Transportation Research Board of the National Academies.

## I.6 THEORY: PREVENTION: DISASTER PREPAREDNESS AND PREVENTION (1 HOUR)

### OUTLINE

Disaster preparedness can be one of the most cost effective means for reducing risk, and one area where countries have made most progress, according to UNISDR (2011). This is likely because it is one of the most visible set of risk reduction measures and is relatively easy to develop and maintain. It requires four main elements: knowledge about disaster risks through early warning and monitoring, either locally, nationally or internationally; ability to communicate this knowledge effectively, either locally through oral traditions, locally adapted technologies, radio, sirens; ability to act upon the knowledge through short and long term actions for preventing disasters and immediate actions (i.e. evacuation plans, search and rescue); and planning ahead so that disasters are planned for, not just reacted to. Effective monitoring of risk can be based on costly 'high-tech' measures such as space based monitoring of hurricanes to locally adapted monitoring of rising flood waters or slope movement.

### LEARNING OBJECTIVES

- Gain knowledge about disaster preparedness, early warning and monitoring
- Consider different perceptions and motivations that lead people to take action to reduce risk
- Develop critical thinking about how our cultural and economic situation will define how we address risk
- Understand the difference and importance of both structural and non-structural preparedness measures

### TEACHING RESOURCES

- Lecture (35 slides)
- Student research questions

### GUIDANCE

- This session is intended to introduce students to many different types of preventive measures, including preparedness and risk communications.
- Students can be made aware about the different ways that societies will consider risk and act to reduce risk depending on their economic possibilities and culture of safety.
- Students are encouraged to think critically about how we communicate about different types of risk and how we may all act differently depending on the type of information given, thus the difficulty in designing effective disaster preparedness measures

### RECOMMENDED READING

- Hewitt, K. (2009) Culture and Risk: Understanding the Sociocultural Settings that influence Risk from Natural Hazards, E-Conference, ICIMOD, Kathmandu
- Höppner, Buchecker & Bründl (2010) Risk Communication and Natural Hazards. CapHaz-Net WP5 Report, Swiss Federal Research Institute WSL
- Paton, D. (2003) Disaster preparedness: a social-cognitive perspective, Disaster Prevention and Management Journal, Vol. 12, No. 3 . pp.210-216



## I.7 THEORY: POST-DISASTER: RELIEF, RECOVERY AND RECONSTRUCTION (1 HOUR)

### OUTLINE

This session covers the immediate, medium to longer term phases after a disaster event and different measures implemented during each. It highlights the many challenges and also some solutions to more effective relief, recovery and reconstruction. The session discusses the importance of planning for emergencies and reconstruction in order to avoid long-term recovery, post-disaster issues for livelihoods.

Solutions addressed include the UN Cluster system for more coordinated humanitarian response, the Post-Disaster Needs Assessment and a number of considerations for including environmental concerns in post-disaster recovery. These include environmental water management, sanitation, disposal of hazardous substances and medical waste and debris management. Avoiding long-term environmental problems requires collaboration between those authorities responsible for the response and reconstruction phases together with environmental authorities. This session will be illustrated with good and bad examples from the relief, recovery and reconstruction phases. It will also discuss why women and men are affected differently during a disaster.

### LEARNING OBJECTIVES

- Understand which measures are commonly taken during the disaster relief, recovery and reconstruction phases
- Understand the Post-Disaster Needs Assessment and the UN Cluster system
- Understand the importance of planning for avoiding long term recovery problems
- Understand the difficulties faced especially by women in the aftermath of disasters
- Understand which environmental measures can be undertaken during an emergency and during reconstruction

### TEACHING RESOURCES

- Lecture (39 slides)
- Student research questions
- Handout with case study examples
- Two on-line training courses

### GUIDANCE

- This session is intended to introduce students to many different types of challenges that are encountered during the post-disaster relief, recovery and reconstruction phases.
- It is based on a series of photos that show many of the typical problems that are encountered considering the need for quick action on emergencies with a high risk of creating long-term livelihoods and environmental problems.
- Solutions are highlighted, many in terms of how to avoid environmental problems – these are explained in more detail in the handout and in the online training courses.

### RECOMMENDED READING

- Post-disaster Needs Assessment (PDNA) (2009) Fast Facts Guidance Sheet. [http://www.recoveryplatform.org/pdna/pdna\\_guide](http://www.recoveryplatform.org/pdna/pdna_guide)
- WWF/GRRT: Training Toolkit for Humanitarian Aid [www.green-recovery.org](http://www.green-recovery.org)
- UNEP Training toolkit: Integrating the environment into humanitarian action and early recovery <http://postconflict.unep.ch/humanitarianaction/training.html>

## I.8 THEORY: PREVENTION: DATA AND TOOLS FOR VULNERABILITY ASSESSMENTS (1 HOUR)

### OUTLINE

UNISDR (2009) defines vulnerability as “the characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard.” Measuring vulnerability is a subject of great interest by policy makers and NGOs in order to assess the effectiveness of decades of investments in vulnerability reducing measures. However, there is no universal measure of vulnerability and there are as many ways of assessing it as there are vulnerability researchers. Social science definitions of vulnerability tend to be explanatory and seek to understand root causes of vulnerability. Natural sciences and engineering tend to use the term in a descriptive manner, either to describe future harm, or potential damage. Methods for assessing vulnerability will depend on the objectives and scale of the population, system or assets to be studied.

#### This session covers:

- Multi-disciplinary vulnerability assessments
- Vulnerability indicators, indicator development and interpretation
- Vulnerability and Capacity Assessments (VCAs)
- Measures for vulnerability reduction

### LEARNING OBJECTIVES

- Develop capability to analyze a vulnerability assessment, considering its data sources and purpose
- Develop critical thinking about different types of vulnerability indicators and the scales at which they were developed
- Develop critical thinking about different types of vulnerability reduction measures

### TEACHING RESOURCES

- Lecture (38 slides)
- Student research questions
- 5 minute video: the ABCs of VCAs

### GUIDANCE

- This session is intended to introduce students to the complexity of assessing the multiple aspects of vulnerability.
- It provides an introduction to the VCA tool, with more details given in session I.10 (Practice).
- The two recommended readings provide additional useful suggestions and concrete examples for the VCA tool.

### RECOMMENDED READING

- Birkmann, J. (2006) Measuring vulnerability to promote disaster-resilient societies: Conceptual frameworks and definitions. In *Measuring Vulnerability to Natural Hazards, Towards Disaster Resilient Societies* Ed. J. Birkmann, 9-54. Tokyo: UNU.
- CARE International, Climate Vulnerability and Capacity Analysis Tool [http://www.careclimatechange.org/cvca/CARE\\_CVCAHandbook.pdf](http://www.careclimatechange.org/cvca/CARE_CVCAHandbook.pdf)
- International Federation of Red Cross and Red Crescent Societies <http://www.ifrc.org/en/what-we-do/disaster-management/preparing-for-disaster/disaster-preparedness-tools/disaster-preparedness-tools>

## I.9 THEORY: PREVENTION: DATA AND TOOLS FOR RISK ASSESSMENTS (1 HOUR)

### OUTLINE

One critical aspect of disaster risk reduction is the risk assessment phase, which can be conducted based on qualitative data in a participatory manner as part of a community based risk assessment, or quantitatively using sophisticated data risk components. The goal of risk assessments is to communicate future potential losses from hazard events so that measures can be taken to reduce such losses. For both quantitative and qualitative cases, risk assessments need to take into account the system and environmental factors in which risk occurs. This session will cover both data for risk assessments and monitoring of disasters and risk at global, national and local levels and various types of risk assessment tools, mainly risk mapping from high-tech (earth observations, navigation and communication) to bottom-up participatory risk assessments.

Maps can be effective tools for communicating risk but also for miscommunication as there is often confusion about different types of maps and the data upon which they are based. In parallel, maps representing ecosystem services or ecological zones are developed to represent another set of data. However, as we link ecosystem services to disaster risk reduction, we find increasingly useful a combination of both. Finally participatory risk mapping, including 3D risk mapping is an extremely useful tool for communicating risks between communities, scientists and decision makers and is transferable to GIS systems.

### LEARNING OBJECTIVES

- Be able to interpret and analyse different types of hazard, vulnerability, exposure and risk maps
- Be able to analyse risk assessments, data and risk indicators
- Be able to conduct participatory risk assessments
- Consider how to combine risk and ecosystem data at national and local levels

### TEACHING RESOURCES

- Lecture (36 slides)
- Student research questions
- 1 exercise
- 2 handouts: Information on RiVAMP (UNEP); Integrated Risk Assessments

### GUIDANCE

- This session is intended to introduce students to the main types of maps for assessing hazards, vulnerability and risk, from sophisticated to simpler forms of participatory risk maps.
- It is important that students become critical about the type of data that are used for developing the maps and how to read maps. What information do these maps really convey and how reliable are they?
- The RiVAMP exercise provides one of the only examples of combining both ecosystem and disaster risk information, the basis of Eco-DRR to be discussed in more detail in Blocks 2 and 3.

### RECOMMENDED READING

- UNEP (2010) Risk and Vulnerability Mapping Project (RiVAMP) Linking Ecosystems to Risk and Vulnerability Reduction The Case of Jamaica
- Zimmermann, M., Pozzi, A., & F. Stoessel (2005) Hazard maps and related instruments, the Swiss System and its Application Abroad, Capitalisation of Experience, Berne: Swiss Development Cooperation, 19 pp.

## I.10 PRACTICE: CONSTRUCTING YOUR OWN RISK MAP AND VCA (5 HOURS)

### OUTLINE

Community based disaster risk management and integrated risk assessments are increasingly promoted as more holistic and sustainable approaches to understanding and addressing risk. It is in the context of promoting self-reliance that Community Based Disaster Risk Reduction (CBDRR) has gained interest by NGOs and governments with an emphasis on enhancing community capacities to address disaster risks. Participatory risk mapping is one tool for communicating risk among local stakeholders at the community level. This session provides hands-on practical experience with developing participatory risk maps based on either hypothetical or real-life risk situations.

The VCA uses mainly largely qualitative indicators and a grid crossing vulnerabilities and capacities with three main factors: physical/material; social/organizational; and motivational/attitudinal. The process is highly participatory, using data collection techniques developed by Rapid Rural Appraisal methods (i.e. participatory risk and social mapping, transect walks, seasonal calendars). This session is designed as a hands-on session for students to develop their own VCA using a step by step guidance, either based on a hypothetical example or real-life experience.

### LEARNING OBJECTIVES

- Develop basic map making skills using basic materials: flip chart paper and markers
- Learn basic elements needed for a good risk map: scale, title, descriptive legend, direction
- Develop practical skills for developing VCA, from data collection to presentation of VCA result and recommended vulnerability reduction measures

### TEACHING RESOURCES

- Lecture (32 slides)
- Guided instructions for practical exercises

### GUIDANCE

- This session is intended to guide students through a practical session on risk mapping. This exercise is possible to do for students with little knowledge about risk or risk mapping. They can draw a map of a place they know well where there is a risk situation, or alternatively come up with a fictitious place as long as they have considered how to describe a risk situation, sources of risk and how to mitigate risk. Students should also be instructed to consider what ecosystem components they can include in their map, as this will be the focus of Blocks 2 and 3.
- The VCA exercise is for more advanced students, who may be able to conduct some VCA research and collect data. Students should also consider how to include ecosystem threats and resources as part of the VCA.

### RECOMMENDED READING

- International Federation of Red Cross and Red Crescent Societies <http://www.ifrc.org/en/what-we-do/disaster-management/preparing-for-disaster/disaster-preparedness-tools/disaster-preparedness-tools>
- Vajjhala, S. P. (2005) Mapping Alternatives: Facilitating Citizen Participation in Development Planning and Environmental Decision Making. In Engineering and Public Policy, 177. Pittsburgh, PA: Carnegie Mellon University

# BLOCK II ECOSYSTEM-BASED DISASTER RISK REDUCTION (15 HOURS)



Terracing in the Democratic  
Republic of Congo

© R. Gangale/WFP

## 2.1 THEORY: LINKING GLOBAL ENVIRONMENTAL PROBLEMS AND DISASTERS (1.5 HOURS)

### OUTLINE

Based on a description of linkages between human and natural systems, this session addresses current global environmental problems (climate change, biodiversity loss, global water crisis, desertification and soil erosion), how these problems are linked to the occurrence of disasters and climate change impacts, and how the Sustainable Development Goals (SDGs) are linked to disasters.

Main messages of this session are that the linkages between natural and human systems are complex and interactive. Climate change will have major impacts on disasters, but many disaster problems are caused by land and ecosystem degradation at regional scale. Biodiversity enables ecosystem functioning. Loss of biodiversity will cause loss of ecosystem goods and services, and increase disaster risk. Water and soils related disasters will likely increase in many regions of the Earth in the near future due to higher land use pressures. In this context, food security is a growing challenge. Setting up binding goals for sustainable development helps maintaining ecosystem services and reduce disaster risk.

### LEARNING OBJECTIVES

- Understand the interrelations between humans and their natural environment
- Understand the linkages between global environmental problems and disasters
- Understand that sustainable land and ecosystem management will reduce disaster risk
- Understand the importance of the Sustainable Development Goals (SDG) for disaster risk reduction

### TEACHING RESOURCES

- Lecture (42 slides)
- 4 minute video on desertification

### GUIDANCE

- This session is intended to teach systems thinking to students and raise their awareness for linkages between human and natural systems with a focus on disaster risk.
- Of main importance is to introduce the main components of natural systems and to explain how humans interact with their environment. Students should understand that human evolution necessarily leads to landscape transformation processes, but that there are possibilities to minimize the negative impacts on the environment.

### RECOMMENDED READING

- IPCC [Intergovernmental Panel on Climate Change] (2007) The Fourth Assessment Report (AR4) of the United Nations Intergovernmental Panel on Climate Change
- IPCC [Intergovernmental Panel on Climate Change] (2012) Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX)
- MEA [Millennium Ecosystem Assessment] (2005) Ecosystems and human well-being: Current State and Trends, Millennium Ecosystem Assessment Washington: Island Press

## 2.2 THEORY: FUNDAMENTAL CONCEPTS OF ECOSYSTEMS AND ECOSYSTEM SERVICES (1 HOUR)

### OUTLINE

People derive indispensable benefits from nature, also referred to as ecosystem services. These include provisioning services, such as food, fuel and water; regulating services such as natural hazard mitigation, erosion control and water purification; supporting services such as soil formation and nutrient cycling; and cultural services such as recreational and other nonmaterial benefits. In practice, ecosystems reduce disaster risk in two important ways. Ecosystems, such as wetlands, forests and coastal systems, reduce physical exposure to natural hazards by serving as natural protective barriers or buffers. Well-managed ecosystems can provide natural protection against common natural hazards, such as landslides, flooding, avalanches, storm surges, wildfires and drought. In addition, ecosystems reduce social-economic vulnerability to hazard impacts by sustaining human livelihoods and providing essential goods such as food, fibre, medicines and construction materials that are important in strengthening human security and resilience against disasters. This session is an introduction to ecosystem science, covering the notion of landscapes, ridge to reef, millennium ecosystem assessment, multiple benefits of ecosystems for DRR and available data on ecosystems.

### LEARNING OBJECTIVES

- Understand different concepts of natural systems (Earth system, ecosystems, landscape systems)
- Understand on-site and off-site effects along an altitudinal gradient and the ecological consequences (Ridge to Reef Concept)
- Understand the concept of the Millennium Ecosystem Assessment (MA) and its link to hazards and disasters
- See the multiple benefits ecosystem offer for disaster risk reduction
- Access different data sources on ecosystems available

### TEACHING RESOURCES

- Lecture (41 slides)
- 10 min video: UNEP Geo Data Portal Links to access geographical database

### GUIDANCE

- This session introduces concepts of ecosystems and landscape systems to better understand the complex interactions between humans and nature. In this context, students should understand spatial interactions of natural systems as well as on- and offsite-effects of land degradation processes.
- The Millennium Ecosystem Assessment (MEA) is introduced as a fundamental concept to assess ecosystem services. In this context, students shall learn that ecosystems offer multiple benefits for disaster risk reduction.
- In the last part of the session available online geographical data sources on ecosystems are introduced.

### RECOMMENDED READING

- MEA [Millennium Ecosystem Assessment] (2005) Ecosystems and human well-being: Current State and Trends, Millennium Ecosystem Assessment Washington: Island Press
- Sudmeier-Rieux, K., H. Masundire, A. Rizvi & S. Rietbergen (eds) (2006) Ecosystems, Livelihoods and Disasters: An integrated approach to disaster risk management. IUCN, Gland, Switzerland and Cambridge, UK. x + 58 pp.

## 2.3 THEORY: LINKING SUSTAINABLE DEVELOPMENT, DISASTERS AND ENVIRONMENT (1 HOUR)

### OUTLINE

This introductory session discusses the links between environmental sustainability, disaster risk, livelihoods and development processes. In particular, it describes how environmental degradation can be a driver of risk while sound environmental management can effectively reduce disaster risks and increase resilience. As a result of environmental damage, pre-existing vulnerabilities to disasters in the affected area may be exacerbated, or worse, new vulnerabilities and risk patterns may emerge. Recognizing the links between environmental conditions, disasters and development is essential in order to account for environment-related risk factors in disaster management.

### LEARNING OBJECTIVES

- Gain knowledge about linkages between disasters, environment and development
- Understand the rationale why ecosystems matter to disaster risk reduction
- Develop critical thinking about how ecosystem management can play a role to all parts of the disaster management spiral

### TEACHING RESOURCES

- Lecture (38 slides)
- Supplementary case study material (12 slides) and accompanying handout
- Guided instructions for practical exercises (handout)
- 3 additional handouts with supplementary materials

### GUIDANCE

- This session is intended to guide students through the interface between Block 1 on disasters and its components with Block 2 on ecosystems and how the two are linked.
- Inter-linkages between disasters, environment and sustainable development are discussed in detail based on many case study examples.
- The student exercise as discussed in the handout is intended as a hands-on exercise for more active student learning.

### RECOMMENDED READING

- Estrella, M & N. Saalismaa (2010) Demonstrating the Role of Ecosystems-based Management for Disaster Risk Reduction. ed., UNISDR GAR Report, 48pp. Geneva: Partnership for Environment and Disaster Risk Reduction
- Gupta, A.K. & S.S Nair (2012) Ecosystem Approach to Disaster Risk Reduction, National Institute of Disaster Management, New Delhi, Pages 202
- Sudmeier-Rieux, K. & N. Ash (2009) Environmental Guidance Note for Disaster Risk Reduction. IUCN Commission for Ecosystem management series no. 8. Gland, Switzerland: IUCN.



## 2.4 THEORY: MAJOR ECO-ZONES, HAZARDS AND IMPACT ON POPULATIONS (1.5 HOURS)

### OUTLINE

This session provides a geographical overview over the world's main biomes/ecoregions and main natural hazards in these regions. The following biomes/ecoregions and related hazards are presented: (a) (Sub)tropical mountain forests with flash floods and landslides, (b) mangroves with cyclones, tsunamis, and coastal flooding, (c) tropical and subtropical grasslands, savannas and shrublands with droughts and flash floods, (d) Mediterranean forests, woodland, and scrub with soil erosion and wildfires, (e) flooded grasslands and savannas with floods and droughts. The session also covers land pressures, possible climate change impacts and ecosystem services of these biomes /ecoregions.

### LEARNING OBJECTIVES

- Understand the concept of biomes and ecoregions and their importance for disaster risk management
- Understand the interrelations between biomes/ecoregions, cultural landscapes, and disasters
- Understand the geographical conditions of selected biomes and their vulnerability to natural hazards
- Understand the interrelation between ecosystem degradation, climate change, and disasters

### TEACHING RESOURCES

- Lecture (43 slides)
- 18 min video on wetlands use of water of the Inner Niger Delta in a changing climate
- 4 min video on an integrated european model to protect mediterranean forests from fire

### GUIDANCE

- In this session students will learn that the natural conditions of biomes and ecoregions are an important factor which determines disaster risk. Moreover, they should understand that degradation of natural ecosystems and overexploitation of cultural landscapes increase disaster risk and that ecosystem management and restoration measures can help to reduce it.
- Two videos show how unsustainable land use management accelerates disaster risk and provides ecosystem-based solutions for DRR.

### RECOMMENDED READING

- IPCC [Intergovernmental Panel on Climate Change] (2012) IPCC Special Report on Extreme Events, Summary for Policymakers. 29. Geneva: Intergovernmental Panel on Climate Change First Joint Session of Working Groups I and II.
- MEA [Millennium Ecosystem Assessment] (2005) Ecosystems and human well-being: Current State and Trends, Millennium Ecosystem Assessment Washington: Island Press
- Olson, D.M., Dinerstein, E., Wikramanayake, E.D., Burgess, N.D., Powell, G.V.N., Underwood, E.C., D'Amico, J.A., Itoua, I., Strand, H.E., Morrison, J.C., Loucks, C.J., Allnutt, T.F., Ricketts, T.H., Kura, Y., Lamoreux, J.F., Wettengel, W.W., Hedao, P. & Kassem, K.R. (2001) Terrestrial Ecoregions of the World: A New Map of Life on Earth. *Bioscience* 51, 933.
- Olson, D.M. & E. Dinerstein (2002) The Global 200: Priority Ecoregions for Global Conservation. *Annals of the Missouri Botanical Garden* 89(2): 199-224

## 2.5 PRACTICE: ECOSYSTEM SERVICES FOR VULNERABILITY REDUCTION (2 HOURS)

### OUTLINE

This session describes how ecosystem services can help to reduce the vulnerability of communities. During the previous lectures, students have gained a good understanding of all aspects related to disaster risk and DRR. They know the technical terms as well as the theoretical concepts and models. Moreover they are already familiar with environmental and human cycles. In this section the students should apply their acquired knowledge in a practical exercise based on a case study in the Vu Gia Thu Bon River Basin in Central Vietnam.

### LEARNING OBJECTIVES

- Understand how ecosystems and related services reduce vulnerability to disasters
- Understand how ecosystems provide services and goods for livelihoods (with special focus on food security) on local, regional and national level
- Exemplify which role ecosystems can play for sustainable regional development and how different stakeholders are involved in regional management and disaster risk management

### TEACHING RESOURCES

- For lecturers:
- Lecture (40 slides) on the session including study area, and the working tasks for the students
  - Reading materials related to the study area
- For students:
- Lecture (34 slides) of the study area for self-preparation
  - Reading materials related to the study area
  - Handout with a brief work description

### GUIDANCE

- Students shall answer questions related to (a) ecosystems and hazards, (b) ecosystem services and food security, and (c) regional governance for risk reduction in the case study area in small working groups by brainstorming and applying metaplan technique. The metaplan technique should help the student to bring their findings into a logical order and help them to present their findings to their peers and classmates. Further instructions for the lecturers are provided in the document “concept for lecturers”.

### RECOMMENDED READING

- Provided reading materials related to the case study in the Vu Gia Thu Bon River Basin in Central Vietnam.

## 2.6 THEORY: ECOLOGICAL ENGINEERING FOR DRR (1 HOUR)

### OUTLINE

Ecosystems can absorb excess flood water and energy from hazard events, or act as “ecological infrastructure”. The extent to which ecosystems are effective for hazard regulation will depend on a number of factors, including ecosystem composition (size, density, species), health, and the type and intensity of the hazard event. In some cases, ecological infrastructure is not an appropriate measure due to biological limitations, space constraints, incompatibility with priority land uses, or prohibitive costs; therefore, engineered infrastructure may be required to provide necessary protection.

Conventional engineering solutions may, however, generate adverse environmental impacts, such as altering sedimentation patterns, and may fail dramatically, amplifying disaster damage. Likewise, especially in the context of climate change and the scale of solutions needed to adapt to increasing weather extremes, human-built infrastructure may not be feasible due to its high costs and technology requirements. Sometimes a hybrid approach, combining both natural and human-built infrastructure may be most effective and appropriate. For example, wetlands can be used to reduce wave action to protect human-built levees, increasing their effectiveness and lifespan.

### LEARNING OBJECTIVES

- Understand the trade-offs between ecological and physical infrastructure and the limitations and opportunities of both
- Learn about hybrid approaches and sustainability measures

### TEACHING RESOURCES

- Lecture (34 slides)
- Handout with supplementary case study material
- 15 min video: China, flood management in the Yellow River
- Student research questions

### GUIDANCE

- This session is intended to provide many good and bad examples about the advantages and disadvantages of both ecological and engineered infrastructure.
- This main message is that ecological infrastructure may bring additional benefits but also has its limitations, just as engineered infrastructure has limitations.
- It is also important to consider the context in which ecological infrastructure would be used and economic assessments used to estimate its cost-effectiveness, which is the subject of session 2.7.

### RECOMMENDED READING

- Ramachandra, T.V. et al. (2012) Ecological Approach for Mitigation of Urban Flood Risks, In: Gupta, A. K. & S.S. Nair (eds.) Ecosystem Approach to Disaster Risk Reduction, National Institute of Disaster Management, New Delhi, 103-121 pp.
- van Halsema, G.E. & H. Zingstra (2008) Revitalizing regulating services: the Netherlands floodplain policy. In: Scoping agriculture – wetland interactions. Towards a sustainable multiple-response strategy (Ed.) Wood, A. FAO WATER REPORTS 33, <ftp://ftp.fao.org/docrep/fao/011/i0314e/i0314e05.pdf>
- van Eijk, P. Baker, C., Gaspirc, R. & R. Kumar (2013) Good flood, bad flood: maintaining dynamic river basins for community resilience. In: Renaud, F., Sudmeier-Rieux, K. and M. Estrella (eds.) The role of ecosystem management in disaster risk reduction. Tokyo: UNU Press

## 2.7 THEORY: VALUING ECOSYSTEM SERVICES (1 HOUR)

### OUTLINE

It is useful to value the goods and services that ecosystems provide in order to take into account the full impacts of disasters and in order to communicate the value of protecting ecosystems for disaster prevention. The environmental impacts of disasters can carry heavy social and economic costs. People, communities and major urban areas depend on ecosystem services, which, when degraded or unavailable due to disaster-induced pollution or damage, are expensive or difficult to substitute.

Ecosystem services can thus be assessed in terms of their economic value. However there are many challenges, as it is often difficult to capture the full economic value of a given ecosystem, but even approximate estimates can be useful to guide resource management decisions. It is also important to note that ecosystem service values are often very context specific. For example, the role of a coastal vegetation to protect against extreme weather events can be vital or marginal, depending on the location of the community. In consequence, the value of a service measured in one location can only be extrapolated to similar sites and contexts if suitable adjustments are made. Regulating ecosystem services may form the largest portion of the total economic value of ecosystem services, although they are also among the most difficult to measure in economic terms. This session will also introduce cost benefit analysis for DRR and how ecosystem values may be included in such calculations.

### LEARNING OBJECTIVES

- Develop critical thinking about the advantages and disadvantages for valuing ecosystem services
- Differentiate between the various methods for valuing ecosystem services
- Appreciate the challenges in estimating ecosystem services
- Consider in which instances ecosystem valuation may be useful
- Learn basics about cost benefit analysis for DRR

### TEACHING RESOURCES

- Lecture (39 slides)
- Handout with supplementary case study material
- Student research questions

### GUIDANCE

- This session is intended to provide background on ecosystem valuation and the challenges in estimating ecosystem values. This is important as decision makers often need to make economic decisions about which type of investments to make based on cost benefit analyses (CBA).
- Students will receive an overview of this complex issue, including an introduction to CBA, for which the case studies and recommended readings may be useful in order to make learning more active.

### RECOMMENDED READING

- Pascual, U & R. Muradian (2010) The economics of valuing ecosystem services and biodiversity, Chapter 5, The Economics of Ecosystems and Biodiversity: Earthscan, London. Available online at: [www.TEEBweb.org](http://www.TEEBweb.org)
- ten Brink P., Russi D., Farmer A., Badura T., Coates D., Förster J., Kumar R. & N. Davidson (2013) The Economics of Ecosystems and Biodiversity for Water and Wetlands. Executive Summary

## 2.8 PRACTICE: FIELD TRIP/ GUEST LECTURES/ CASE STUDY GROUP WORK PRESENTATIONS (6 HOURS)

As learning is enhanced by more active student interaction, this session has been reserved for field trips, guest lectures, case studies presented by students, learning games or group work on the topic of ecosystems for DRR (*detailed case study description in session 3.9*).



**Top Photo**  
**Kenya savanna ecosystem**

© U. Nehren

**Bottom Photo**  
**Indonesia wetlands**

© S.Sandholz



# BLOCK III

## ECO-DRR INSTRUMENTS & APPROACHES (15 HOURS)

Flood-prone squatter area  
in Ho Chi Minh City, Vietnam

© W. Lange



## TEACHING NOTE BEFORE STARTING BLOCK III

- Sessions 3.1, 3.2, are recommended as mandatory for this module, other sessions can be selected and emphasized depending on specific country situation.
- We highly recommend starting this block with a case study (e.g. Coastal hazards at Semarang Coastal Areas, Central Java, Indonesia or Planting hope in Govuro and Machanga area, Mozambique). See session 3.9 for a full listing of case studies.

## 3.1 INTRODUCTION TO INSTRUMENTS AND APPROACHES FOR ECO-DRR (1.5 HOURS)

### OUTLINE

A variety of tools, instruments and approaches used in ecosystem management, such as integrated watershed management, protected area management, or integrated coastal zone management, can be readily adopted and applied as part of risk reduction strategies (some tools are presented in detail in further sessions of Block III).

Improved and routine use of risk information (e.g. types of hazards over time and space, socio-economic vulnerability profiles of communities, elements at risk, etc.) needs to feed into the design of integrated ecosystem management interventions to enhance their added value for DRR. For instance, rehabilitation of upland watersheds can be harnessed for flood mitigation by improved understanding of the local hazards, hydrology, topography as well as socio-economic demands on forest products and the types of indigenous tree species that are best suited for reforestation activities.

### LEARNING OBJECTIVES

- Gain an overview about main instruments and approaches for Eco-DRR
- Identify a range of ecosystem management tools and approaches, and understand their links with DRR and CCA
- Identify entry points for mainstreaming environmental and ecosystem tools in DRR interventions

### TEACHING RESOURCES

- Lecture (45 slides)
- 4 min video on wildfires in the Mediterranean

### GUIDANCE

- This session is intended to provide background on a variety of instruments that already are used in ecosystem management and where DRR aspects can be included. Students will get an overview on different tools, on the development of a project design, its management and monitoring processes.
- Results-based management is introduced to the students, including log-frame approach and the development of adequate indicators for Eco-DRR.

### RECOMMENDED READING

- Gupta, A. K. & S.S. Nair (2012) Ecosystem Approach to Disaster Risk Reduction, National Institute of Disaster Management, New Delhi, Pages 202
- Renaud, F., Sudmeier-Rieux, K. & M. Estrella (eds.) (2013) The role of ecosystem management in disaster risk reduction. Tokyo: UNU Press
- UNDG [United Nations Development Group] (2011) Results-based Management Handbook - Harmonizing RBM concepts and approaches for improved development results at country level (<http://www.undg.org/docs/12316/UNDG-RBM%20Handbook-2012.pdf>)

## 3.2 SPATIAL PLANNING TOOLS AND APPROACHES FOR DRR (2 HOURS)

### OUTLINE

Land-use planning frameworks prescribe, regulate and determine land use policies that specify land utilization for various purposes, namely agriculture, industrial sites, human settlements, protected areas, etc. Land-use plans often serve as a basis upon which other sectors such as agriculture or infrastructure development formulate their own plans. They can therefore play a significant and influential role in preventing or mitigating losses from hazards and managing environmental risks, as they determine the physical location of activities and investments.

Many of the contentious issues involved in land use planning revolve around the fact that different sectors value land differently, and that these values are often in conflict. Land-use planning occurs within a political context and oftentimes, short-term gains take priority over what is sustainable and what will be safe in the future. This key session will cover models of urban development, integrated planning, public participation, data and information and processes for spatial planning and case studies.

### LEARNING OBJECTIVES

- Understand the principles of spatial planning and its role in risk reduction
- Understand the political and assessment processes involved in spatial planning
- Understand existing tools and approaches, including the role of geographic information for assessment and planning
- Develop critical thinking about advantages and drawbacks of spatial planning in the process of policy implementation
- Understand how ecosystem management can be useful for reducing risk through spatial planning

### TEACHING RESOURCES

- Lecture (70 slides)
- Student research questions & case studies
- Exercise: Learning game (Stop disasters, UNISDR)

### GUIDANCE

- This is one of few sessions designed for a two-hour session, which is why it has a large number of slides. It is left to the instructor to be selective in order to allow sufficient student discussions.
- Spatial planning can be considered the over-reaching umbrella framework covering most other tools described in this session.
- It is recommended to include the “Stop disasters” learning game to practically show the importance of adequate spatial planning for risk reduction to students

### RECOMMENDED READING

- Burby, R.J. (1998) *Cooperating with Nature, Confronting Natural Hazards with Land-Use Planning for Sustainable Communities*, Washington, D.C.: Joseph Henry Press.
- Sudmeier-Rieux, K., Fra Paleo, U., Garschagen, M., Estrella, M., Renaud, F.G. & M. Jaboyedoff (submitted, 2012) *Opportunities, incentives and challenges to risk sensitive land use planning. Lessons from Nepal, Spain and Vietnam*, Background paper for Global Assessment Report on DRR..
- UNECE [United Nations Economic Commission for Europe] (2008) *Spatial planning. Key Instrument for Development and Effective Governance with Special Reference to Countries in Transition*. New York: UNECE.



### 3.3 INTEGRATED WATER RESOURCES MANAGEMENT (IWRM) (1 HOUR)

#### OUTLINE

Integrated Water Resource Management (IWRM) is a process of strategic coordination and management of water resources designed to maximize the returns from sustainable water management for economic and social welfare. The approach yield benefits for people and nature, but can be complex in implementation. Many disasters are primarily water-related, or impact upon water supply and provision for multi-sector uses. Consequently, water management approaches have lessons and experience of value to disaster risk reduction approaches, and vice-versa. IWRM can also be strengthened through greater recognition of ecosystems and improved interpretation of the guiding Dublin Principles and pillars that structure water management approaches. This session is devoted to understanding the linkages between Disaster Risk Reduction and Integrated Water Resource Management, and how integration of ecosystem based approaches can strengthen these links to build resilience.

#### LEARNING OBJECTIVES

- Understanding the basic principles of Integrated Water Resources Management (IWRM)/ river basin management
- Understanding linkages between ecosystem principles for DRR and integrated water resources management
- Applying DRR applications on water resources management
- Getting an insight into roles of institutions and actors to develop risk management strategies for DRR

#### TEACHING RESOURCES

- Lecture (38 slides)
- Handout: supplementary information on IWRM and case study example
- Student exercise: World Overview of Conservation Approaches and Technologies module and questionnaire on IWRM

#### GUIDANCE

- This session is intended to show students the linkage between DRR and IWRM. An important point in that context is to explain how the IWRM approach can be used to improve the management of water related disasters particularly in the context of droughts and floods.

#### RECOMMENDED READING

- Adikari, Y. & J. Yoshitani (2009) Global Trends in Water-Related Disasters: an insight for policymakers. In The United Nations World Water Development Report 3, Water in a Changing World, ed. UNESCO. Paris: UNESCO.
- Blackwell, M.S.A. & E. Maltby (eds), 2006. Ecoflood guidelines: how to use floodplains for flood risk reduction. Directorate General for research sustainable development, global change and ecosystems. Office for official publications of the European communities, Luxemburg.
- Cap-Net/UNDP, Nile IWRM- Net, UNISDR & UNOCHA (2009) Hydro-climatic Disasters in Water Resources Management, Training Manual. ed. Cap-Net/UNDP, 139pp. Pretoria.

### 3.4 INTEGRATED COASTAL ZONE MANAGEMENT (ICZM) (1 HOUR)

#### OUTLINE

Integrated Coastal Zone Management (ICZM) is a natural resources and environmental management framework, which employs an integrative, holistic approach and an interactive planning process in addressing the complex management issues in the coastal areas. ICZM also incorporates modern principles of planning and resource management, intensive information bases and interdisciplinary processes toward an effective general framework for dealing with conflicts arising from interactions of the various uses of coastal areas. And most importantly it requires a close coordination and working between various stakeholders involving the government line agencies, research institutes, NGOs and the communities. This session addresses main issues, stakeholders and institutions involved in ICZM and how it can be an effective mechanism for DRR.

#### LEARNING OBJECTIVES

- Understand the importance of coastal zone management, definitions and the relevance of ICZM for disaster risk reduction and climate change adaptation
- Understand the coastal ecosystem and compounds, as well as resources and challenges of coastal areas
- See the concept of ICZM and approaches on coastal environmental management models
- Access different coastal management and planning techniques

#### TEACHING RESOURCES

- Lecture (43 slides)
- Short exercise on coastal management and planning techniques

#### GUIDANCE

- This session is intended to show students the linkage between DRR and ICZM. An important point in that context is to explain how the ICZM approach can be used to improve the management of coastal environments and reduce disasters risk.
- In this context students should understand how communities can be involved in the management of coastal zones and the multiple benefits and services ecosystems provide for disaster risk reduction.

#### RECOMMENDED READING

- Hildebrand, L.P. & E.J. Norrena (1992) Approaches and progress toward effective Integrated Coastal Zone Management. *Marine Pollution Bulletin*, 25(1-4): p.94-97.
- Nightingale, M. (2012) Making Eco-Disaster Risk Reduction Work. Training Course on Environment and Disaster Risk Reduction for Sustainable and Resilient Development. PEDRR.

### 3.5 PROTECTED AREAS (1 HOUR)

#### OUTLINE

Protected areas provide an effective mechanism for maintaining natural habitats and ecosystem function. By far the most extensive application of deliberate management of ecosystems is the global protected area network, encompassing national parks, wilderness preserves, nature reserves and marine protected areas, already covering over 12.7% of the world's land surface. While the protection of ecosystems alone cannot halt the impacts of climate change, there is increasing evidence that large, healthy and functioning ecosystems are likely to be more resistant to the impacts of climate change when it occurs. This session addresses the important role of protected areas for providing essential services for livelihoods, disaster risk reduction and climate change adaptation. Students will also have the opportunity to discuss issues and trade-offs with protected areas and surrounding communities.

#### LEARNING OBJECTIVES

- Gain knowledge about the role of protected areas for livelihoods, disaster risk reduction and climate change adaptation
- Develop critical thinking about challenges and opportunities of protected areas for disaster risk reduction.
- Explore livelihood security issues and protected areas

#### TEACHING RESOURCES

- Lecture (31 slides)
- 10 min video: Rwanda- Back to the Garden
- Student research questions

#### GUIDANCE

- This session is intended for students to consider the many management goals and actors involved in protected areas management, which also encompass reducing disaster risks.
- The video and student exercise add more hands on learning to the session.

#### RECOMMENDED READING

- Dudley, N., Stolton, S., Belokurov, A., Krueger, L., Lopoukhine, N., MacKinnon, K., Sandwith T. & N. Sekhran (eds) (2010) Natural Solutions: Protected areas helping people cope with climate change. IUCN-WCPA, TNC, UNDP, WCS, The World Bank and WWF: Gland, Switzerland, Washington DC and New York, USA.

## 3.6 MANAGING ECOSYSTEMS FOR URBAN RISK REDUCTION (1 HOUR)

### OUTLINE

Urban inhabitants currently account for half of the world's population, totaling over 3.4 billion people. Urban growth is estimated to continue rapidly and by 2050, cities will be home to 6 billion people, almost 70% of the global population. People move to urban areas in search for better living – such as improved income opportunities, and better medical care and education. However, urbanization transforms land-use and social structures and may increase environmental risks, including those related to natural hazards. As a result, floods and droughts, the most common urban hazards, are increasingly affecting cities all over the world. Some of the key drivers of urban risk are: population density, economic exposure, location along rivers or coasts, poor urban governance and urban poverty, land-use change and environmental degradation.

As a large portion of the world cities are located in vulnerable ecosystems, ecosystem management is indispensable for sustainable urban planning and risk reduction, while sustainable urban planning can reduce pressure on ecosystems.

### LEARNING OBJECTIVES

- Understand the importance of urban systems for DRR in the world and the specific needs of cities as drivers of risk but also as opportunities to reduce risk.
- Gain knowledge on interaction between urban areas and the surrounding ecosystem and provide an overview of the different actors and institutions at international, national and local level.
- Enable students to identify and understand tools for urban ecosystem management.

### TEACHING RESOURCES

- Lecture (40 slides)
- Short exercise on urban planning, impact assessment and trade-offs

### GUIDANCE

- In this session students shall learn about the importance of Eco-DRR for urban regions and that the urban ecosystems and the periphery are important factors which determine urban disaster risk.
- They should be sensitized on important factors for adequate urban (ecological) planning to minimize disaster risk, the involved actor groups and institutions.

### RECOMMENDED READING

- Dakhia, K. & E. Berezowska-Azzag (2010) Urban institutional and ecological footprint: A new urban metabolism assessment tool for planning sustainable urban ecosystems, *Management of Environmental Quality: An International Journal*, Vol. 21 Iss: 1 pp. 78 – 89
- Guadagno, L., Depietri, Y. & U. Fra Paleo (2013) Urban disaster risk reduction and ecosystem services. In: Renaud, F., Sudmeier-Rieux, K. and M. Estrella (eds.) *The role of ecosystem management in disaster risk reduction*. Tokyo: UNU Press
- ICLEI [International Council for Local Environmental Initiatives] (2011) *Resilient Cities 2 - Cities and Adaptation to Climate Change – Proceedings of the Global Forum* Springer <http://www.springerlink.com/content/978-94-007-4223-9#section=1068490&page=29&locus=14>
- UNISDR [United Nations International Strategy for Disaster Reduction (2012) *How To Make Cities More Resilient - A Handbook For Local Government Leaders*, United Nations, Geneva [http://www.unisdr.org/files/26462\\_handbookfinalonlineversion.pdf](http://www.unisdr.org/files/26462_handbookfinalonlineversion.pdf)

## 3.7 ECOSYSTEM-BASED ADAPTATION (1 HOUR)

### OUTLINE

Ecosystem-based adaptation (EbA) integrates the use of biodiversity and ecosystem services into an overall strategy to help people adapt to the adverse impacts of climate change. It includes the sustainable management, conservation and restoration of ecosystems to provide services that help people adapt to both current climate variability and climate change. It is being promoted by many environmental organizations as a cost-effective solution to climate change adaptation. Ecosystem-based adaptation reduces vulnerability and increases resilience to climate risks and provides additional multiple economic, social, environmental and cultural benefits. It is closely related to ecosystem-based disaster risk reduction that advocates for sustainable ecosystem management as a strategy to reduce hazard exposure (natural barriers) and vulnerability (enhancement of livelihood capacities and resilience). Both approaches recognize the role of healthy and well-managed ecosystems in supporting communities to prevent, prepare for, cope with and recover from disaster situations and the impacts of climate change. This session highlights the many similarities and some differences between EbA and Eco-DRR, often addressed by two different sets of actors, in spite of recent efforts towards their integration.

### LEARNING OBJECTIVES

- Describe the major impacts of climate change on humans and the environment, mitigation measures
- Explain EbA based on examples
- Demonstrate the links between ecosystem based EbA and Eco-DRR

### TEACHING RESOURCES

- Lecture (29 slides)
- Handout on EbA terminology
- Student research questions

### GUIDANCE

- This session is intended to illustrate the overlaps and also differences between ecosystem based adaptation and Eco-DRR through many examples.
- This session is short so it is possible to integrate several student discussions and reflections on this important topic.

### RECOMMENDED READING

- Andrade Pérez, A., Herrera Fernandez, B. & R. Cazzolla Gatti (eds.) (2010) Building Resilience to Climate Change: Ecosystem-based adaptation and lessons from the field. Gland, Switzerland: IUCN. 164pp. <http://data.iucn.org/dbtw-wpd/edocs/2010-050.pdf>
- UNFCCC Secretariat [United Nations Framework Convention on Climate Change] (2011) Ecosystem-based approaches to adaptation: Compilation of information. Note by the secretariat. Subsidiary Body for Scientific and Technological Advice (SBSTA), Thirty-fifth session, 28 November - 9 December 2011, Durban, South Africa.
- World Bank (2010) Convenient solutions to an inconvenient truth: Ecosystem-based approaches to climate change. <http://climatechange.worldbank.org/climatechange/content/convenient-solutions-inconvenient-truth>

### 3.8 COMMUNITY-BASED ECOSYSTEM AND DISASTER RISK MANAGEMENT (CBEDRM) (1 HOUR)

#### OUTLINE

When a disaster strikes, communities are often isolated and must rely on their own skills and resources to save lives and livelihoods until outside assistance arrives, if at all. Communities often also have expert knowledge about their environments and are the most dependent on clean water and locally available resources for sustenance. The objective of the session is to introduce the concept and tools for Community Based Natural Resource Management (CBNRM) and Community Based Disaster Risk Management (CBDRM) with a focus on how the two can be combined for more effective disaster risk reduction. We explore the interlinkages between the two through specific examples and discuss how natural resources management at the community level is critical to more effective DRR. Specific tools include community-based risk assessments and participatory rural assessment tools, participatory risk mapping, including Vulnerability and Capacity Analyses will be part of the block (covered in more detail in Session 1.10).

#### LEARNING OBJECTIVES

- Understand the importance of community involvement in disaster risk reduction and how these can be linked; identify the key actors that should be involved in CBEDRM.
- Learn about specific tools for conducting community based risk assessments and the measures that can be taken at the community level to increase local capacities.
- Understand the main key aspects and steps that have to be taken into account when developing CBE-DRM.

#### TEACHING RESOURCES

- Lecture (38 slides)
- 2 case studies from Brazil and Indonesia

#### GUIDANCE

- This session intends to make students aware of the importance of community-based approaches in disaster risk management. Students should gain knowledge of the actor groups, how they can be involved and the process of community-based ecosystem and disaster risk management.
- Students get practical insight by explaining two practical examples of community-based projects from different countries.

#### RECOMMENDED READING

- Abarquez, I. & Z. Murshed (2006) Community-Based Disaster Risk Management: Critical Guideline. Asian Disaster Preparedness Center (ADPC), Bangkok, Thailand.
- Borrini- Feyerabend, G. et al. (2007) Sharing Power. A Global Guide to Collaborative Management of Natural Resources.
- UNICEF [United Nations International Children's Emergency Fund] (2008) Community-based Disaster Risk Reduction, Conference Proceedings UNICEF, India <http://www.unicef.org/india/ConferenceCommunitybasedDisasterRiskReductionreport.pdf>
- Twigg, J. (2007) Characteristics of a Disaster-resilient Community A Guidance Note. Benfield UCL Hazard Research Centre.

### 3.9 FIELD TRIP/ ADDITIONAL CASE STUDIES/ GROUP WORK PRESENTATIONS (5.5 HOUR)

As learning is enhanced by more active learning, this session has been reserved for field trips, guest lectures, case studies presented by students, learning games or group work on the topic of ecosystems for DRR.

#### SEVERE STORM IMPACTS, APRIL 2010 ALONG RIO DE JANEIRO COAST, BRAZIL

##### OUTLINE

The presented case study is based on the impact of a storm on the Rio de Janeiro Coast, Brazil. It highlights the issues of dynamic beach morphology and systematic beach profile monitoring approach to evaluate coastal storm impacts. The case study further explores several modeling tools (ocean wind wave & near shore spectral wave), which are helpful to predict the coastal vulnerability. Finally, it exhibits the importance of coastal ecosystems as buffers against storm surge impacts on the coastal urban area along the Rio de Janeiro Coast.

##### AUTHOR

Universidade Federal Fluminense, Brazil

##### TEACHING RESOURCES

- Lecture (46 slides)
- Article: Fernandez, G.B., Bulhoes E., & T.B da Rocha (2011) Impacts of Severe Storm Occurred in April 2010 along Rio de Janeiro Coast, Brazil. Journal of Coastal Research, SI 64, 1850-1854.

#### CULTURAL LANDSCAPE GOVERNANCE, INNOVATION AND DRR: FROM AMEREIDA OPEN CITY TO AMEREIDA FARM REGION OF VALPARAÍSO, CHILE

##### OUTLINE

The case study on Chile mainly focuses on the issues of “Cultural Landscape Governance, Innovation and Disaster Risk Reduction”, covering the area from the Amereida Open City to Amereida Farm Region near Valparaíso in Chile.

##### AUTHOR

Pontificia Universidad Católica de Valparaíso, Chile

##### TEACHING RESOURCES

- Lecture (30 slides)

## THE IMPACTS OF SEA LEVEL RISE ON EGYPT

### OUTLINE

The case study “Impacts on Sea Level Rise (SLR) on Egypt”- vividly elaborates the consequences of SLR on the Egyptian Coast and particularly its coastal lagoons. Furthermore, four different narrative storylines are presented to describe the relationships between driving forces of emissions, their evolution and scenarios for SLR impacts. This case study discusses main driving mechanisms to combat against SLR, including adaptation processes and policies and solutions to mitigating SLR, which include natural ecosystems (e.g., sand dunes system, restoring coastal lakes).

### AUTHOR

Ain Shams University, Cairo, Egypt

### TEACHING RESOURCES

- Lecture (34 slides)

## COASTAL HAZARDS AT SEMARANG COASTAL AREA, CENTRAL JAVA, INDONESIA

### OUTLINE

This case study discusses the major natural hazards and environmental problems in Semarang Coastal Area at Central Java, Indonesia. This study primarily highlights the issues of flood inundation due to high tide in the coastal zone and the excessive ground water pumping from the deep aquifer.

### AUTHOR

Universitas Gadjah Mada, Yogyakarta, Indonesia

### TEACHING RESOURCES

- Lecture (13 slides)
- 3 min video giving overview of flood problem in Semarang (3:00)
- Numerical and spatial geodata
- Reading materials:**
  - Marfai MA & L. King (2007) Monitoring land subsidence in Semarang, Indonesia, Monitoring land subsidence in Semarang, Indonesia, Environmental Geology, 53:651–659
  - Marfai MA, Almohammad H, Dey S, Susanto B, & L. King (2008) Coastal dynamic and shoreline mapping: multi-sources spatial data analysis in Semarang Indonesia, Environmental Monitoring and Assessment, 142:297–308.
  - Marfai MA & L. King (2008) Coastal flood management in Semarang, Indonesia, Environmental Geology, 55:1507–1518.
  - Marfai MA, King L, Singh LP, Mardiatno D, Sartohadi J, Hadmoko DS, & A. Dewi (2008) Natural hazards in Central Java Province, Indonesia: an overview, Environmental Geology, 56:335–351
  - Marfai MA, & L. King (2008) Potential vulnerability implications of coastal inundation due to sea level rise for the coastal zone of Semarang city, Indonesia, Environmental Geology, 54:1235–1245.
  - Marfai MA, King L, Sartohadi J, Sudrajat S, Budiani SR, & F. Yulianto (2008) The impact of tidal flooding on a coastal community in Semarang, Indonesia, Environmentalist (2008) 28:237–248.
  - Marfai MA, & L. King (2008) Tidal inundation mapping under enhanced land subsidence in Semarang, Central Java Indonesia Natural Hazards (2008) 44:93–109.



## AQABA FLOOD MANAGEMENT, JORDAN

### OUTLINE

The presented case study highlights the issues of flash floods in Aqaba river basin, Jordan. The study presents the major causes of flash floods and how this disaster can be prevented through different policies and plans (e.g., flood early warning, watershed management plan and projects in water sources in the basin).

### AUTHOR

Water, Energy and Environment Center, University of Jordan, Jordan

### TEACHING RESOURCES

- Lecture (18 slides)
- 3 min video: Aqaba flood management, Jordan

## LAND SUBSIDENCE IN THE URBAN SETTING OF A SEMIARID ENVIRONMENT: THE CASE OF SAN LUIS POTOSÍ METROPOLITAN AREA, MEXICO

### OUTLINE

The Mexican case study of land subsidence in the urban setting at the San Luis Potosí metropolitan area highlights the effects of land subsidence in the housing sector. The study explores how the spatial distribution of economic losses and vulnerability index maps can be an effective tool for risk management.

### AUTHOR

Universidad Autónoma de San Luis Potosí, Mexico

### TEACHING RESOURCES

- Lecture (20 slides)

## PLANTING HOPE IN GOVURO AND MACHANGA AREA, MOZAMBIQUE

### OUTLINE

This case study discusses efforts by AJOAGO a local NGO in Mambone district, Inhambane Province, Mozambique to protect two districts (Machanga and Govuro) against erosion, cyclones and flooding. This was done by planting trees along the Save River and by disseminating information about erosion, floods and disaster risk reduction.

### AUTHOR

Universidade Eduardo Mondlane, Mozambique

### TEACHING RESOURCES

- Lecture (19 slides)
- Student handout with project details (\*.doc)
- Study area data (partly in Portuguese)

#### **Reading materials:**

- FAO [Food and Agriculture Organisation] (2012) Adaptation to Climate Change in Semi-Arid Environments. Experience and Lessons from Mozambique. Environment and natural resources management series, 19, Rome.
- National Institute for Disaster Management (2009) Study on the impact of climate change on disaster risk in Mozambique. Synthesis Report – First Draft.

- Republic of Mozambique (2010) Report on the Millennium Development Goals. Ministry of Planning and Development.
- Siteo A, Salomão A, Wertz-Kanounnikoff S (2012) O contexto de REDD+ em Moçambique. Causas, actores e instituições. Occasional Paper 76. Center for International Forestry Research.
- World Bank (2010) Mozambique - Economics of Adaptation to Climate Change. The World Bank Group, Washington.
- World Bank (2010) The Social Dimensions of Adaptation to Climate Change in Mozambique. Discussion Paper No. 16. The World Bank Group, Washington.

## FLOOD HAZARD IN GAUR MUNICIPALITY, RAUTHAT, CENTRAL TERAI, NEPAL

### OUTLINE

The case study describes flood hazards in Gaur Municipality, Rauthat- Central Terai Nepal, affected by major flood events. Innovative solutions to reducing flooding are proposed, including: community based disaster reduction, livelihood and ecosystem management approach and public awareness.

### AUTHOR

Center for Disaster Studies, Tribhuvan University, Kathmandu, Nepal

### TEACHING RESOURCES

- Lecture (18 slides)

## REDUCING SALINITY INTRUSION RISK OF COASTAL AREAS IN VIETNAM

### OUTLINE

The case study focuses on the issue of salinity intrusion in the Vu Gia Thu Bon (VGTB) river basin in Central Vietnam. The study covers engineered solutions (construction of weirs) for preventing salinity intrusion, but at the same time it also shows the disadvantages of the engineering solutions and possible environmental consequences.

### AUTHOR

Vietnam Academy for Water Resources (VAWR)

### TEACHING RESOURCES

- Lecture (14 slides)

# BLOCK IV MAINSTREAMING ENVIRONMENT & DRR (5 HOURS)

Ecuador

© C. Vaucher/IUCN Photo Library

## 4.1 PRACTICE: MAINSTREAMING ECO-DRR

### OUTLINE

Formulating integrated environment-sustainable livelihoods-DRR strategies require not only a balance between the interests of society, the economy and the environment, but also between the diverse interests of different stakeholders within a community or country. These challenges are beyond the capacity of any single group or institution to address effectively. Promoting effective participation by all stakeholders in DRR requires approaches that are multi-sectoral. This session discusses the challenges and opportunities for mainstreaming Eco-DRR into development policies, programmes and plans; financial mechanisms; integrating Eco-DRR in local land use planning; integrating Eco-DRR in NAPAs, Poverty Reduction Strategies, UNDAFs; partnerships with the private sector and good and bad country practices. This session is divided between a theoretical overview and practical country examples.

### LEARNING OBJECTIVES

- Understand importance of cross sectoral partnerships for successful Eco-DRR, financial mechanisms and political challenges

### TEACHING RESOURCES

- Lecture (38 slides)
- 2 handouts: Country examples of Eco-DRR; External sources of funding for Eco-DRR
- Student research questions

### GUIDANCE

- This session is intended to give more background on how ecosystem management can be mainstreamed into both development policies and DRR actions.
- It provides many hands on examples, most which are also presented in detail in the session handout.

### RECOMMENDED READING

- ADPC [Asian Disaster Prevention Center](2010) First Regional Training Course of the RCC on Mainstreaming Disaster Risk Reduction into National Development Processes. Participant's Workbook. Regional Consultative Committee (RCC) on Disaster Management.
- Estrella, M. & N. Saalismaa (2013) Ecosystem-based Disaster Risk Reduction (Eco-DRR):An Overview, In: Renaud, F., Sudmeier-Rieux, K. and M. Estrella (eds.) The role of ecosystem management in disaster risk reduction. Tokyo: UNU Press
- Warner, K., Ranger, N., Surminski, S., Arnold, M. et.al. (2009) Adaptation to climate change: Linking disaster risk reduction and insurance. Geneva: UNISDR.

## 4.2 THEORY: FUNDAMENTALS OF EFFECTIVE ADVOCACY FOR ECO-DRR

### OUTLINE

Following the session on mainstreaming Eco-DRR into DRR and sustainable development policies and planning, this session is intended to give an overview of the main actors and policy frameworks from the international to the local level. It covers policy instruments for Eco-DRR; major actors in DRR, CCA and environmental management; interagency mechanisms; stakeholder analysis; organizational/ institutional assessments at different scales: international, national, local partnerships and networking.

### LEARNING OBJECTIVES

- Identify the key actors needed to promote Eco-DRR in development, and each of their key roles and responsibilities
- Learn about major collaborative platforms for DRR at global, regional and national levels
- Learn about major partnerships on Eco-DRR
- Understand the financial and human capacity requirements of mainstreaming Eco-DRR
- Identify existing resources and capacities that may be harnessed for Eco-DRR in development

### TEACHING RESOURCES

- Lecture (29 slides)
- 2 handouts: Who should be involved in Eco-DRR? and Case study - Risk management study, Phuket Province, Thailand

### GUIDANCE

- This session is intended to consider the international architecture and policy context in which it is possible to mainstream ecosystem management with DRR.
- The two handouts provide more in-depth information on the actors and funding mechanisms for mainstreaming ecosystem management with DRR, for student discussion and further research.

### RECOMMENDED READING

- ADPC [Asia Disaster Prevention Center] (2010) First Regional Training Course of the RCC on Mainstreaming Disaster Risk Reduction into National Development Processes. Participant's Workbook. Regional Consultative Committee (RCC) on Disaster Management.
- Estrella, M. & N. Saalimaa (2011) Demonstrating the Role of Ecosystems-based Management for Disaster Risk Reduction. ed., UNISDR GAR Report, 48pp. Geneva: Partnership for Environment and Disaster Risk Reduction
- UNDP [United Nations Development Programme] (2010) Mainstreaming Disaster Risk Reduction into Development at the National Level. A Practical Framework. UNDP Bureau for Crisis Prevention and Recovery.

## 4.3 THEORY: ECONOMICS AND FINANCING OF DISASTER RISK REDUCTION

### OUTLINE

Disasters can have major repercussions on a country's fiscal sustainability, but disaster impacts in relation to a country's coping capacity are substantially larger in less developed countries. The World Bank has estimated that between 1990 and 2000, disasters caused economic damages valued at between 2% and 15% of an exposed country's annual GDP. The cost of disasters to the environment is also substantial and can affect countries over the long term.

Many countries now appropriate annual budget allocations for disaster response, typically known as national or local government calamity funds, usually following a Post-Disaster Needs Assessment (PDNA). These funds are usually only made available after a disaster event, to finance relief, response and rehabilitation work. As a result, governments are forced to reallocate budgetary resources from ongoing or planned development activities towards recovery and sometimes also for relief and rehabilitation. In addition, limited budget is often allocated, if at all, to environmental recovery following a major disaster. This session covers the main issues related to the environmental costs of disasters; prevention versus post-disaster costs; cost benefit analysis as a decision making tool; financing disaster prevention and recovery; the international funding mechanisms supporting DRR.

### LEARNING OBJECTIVES

- Understand fundamental macroeconomic effects of disasters
- Understand the economic short and long term effects of disasters
- Estimate losses and economic costs of disasters and discuss who pays for disaster damages
- Understand how different types of investments can reduce disaster risks

### TEACHING RESOURCES

- Lecture (39 slides) including 5 slides for group discussion

### GUIDANCE

- The session is intended to show macroeconomic effects of disasters and provide students with economic approaches for the implementation of DRR measures. In this context students should learn to differentiate between short and long term economic effects of disasters, as well as macroeconomic effects and personal suffering. Moreover, they should understand that with ongoing population growth, overuse of natural resources, and climate change impacts costs of disasters will likely increase. This requires more investments in DRR measures. In this context, cost-benefit analysis of DRR measures is an important instrument for decision making.

### RECOMMENDED READING

- Cavallo, E., I. Noy, S. Galiani & J. Pantano (2010) Catastrophic Natural Disasters and Economic Growth, Inter-American Development Bank, IDB Working Papers Series No. IDB-WP-183.
- Mechler R. (2005) Cost-benefit Analysis of Natural Disaster Risk Management in Developing Countries. Manual. Deutsche Gesellschaft für Technische Zusammenarbeit. 84 P.
- Zapata-Marti, R. (1997) Methodological approaches: the ECLAC methodology. In Center for the Research on the Epidemiology of Disasters (CRED), Assessment of the economic impact of natural and man-made disasters. Proceedings of the expert consultation on methodologies, Brussels, 29–30 September, Universite Catholique de Louvain, Belgium, 10–12. P.

## 4.4 PRACTICE: ROLE PLAY: SIMULATION OF REAL LIFE SITUATION, “WHITE SANDS TOURISM PROJECT”

### OUTLINE

This session is intended as a final exercise to consolidate all the different elements learned during this module. Students are encouraged to develop an end of module project that shows creative thinking, either through the creation of an “Eco-DRR project”, the improvement of an existing DRR project by bringing in an ecosystem perspective, or a proposal for enhancing the PDNA process for financing more Eco-DRR projects in a post-disaster situation.

### LEARNING OBJECTIVES

- The objective of the role play exercise is for students to reflect on the opportunities and challenges in mainstreaming Eco-DRR in a national-local context, where there are different, often competing priorities between various stakeholders and government agencies.

### TEACHING RESOURCES

- Lecture (11 slides)
- 2 handouts: Role playing student exercise; Field trip exercise example

### GUIDANCE

- This session is intended to give students an opportunity to integrate many of the elements on both DRR and ecosystems covered in this module.
- The role playing exercise can be a very powerful means for placing yourself in a quasi real life situation to simulate the challenges inherent in negotiating many different interests related to development projects.
- Recommended time for the role playing exercise is 30-60 minutes. Instructors can use the suggested case study scenario or develop their own based on the local context.





**Top photo**  
**Teaching Eco-DRR in Indonesia**

© D. Wacano

**Bottom photo**  
**Eco-DRR course in Thailand**

© K Sudmeier-Rieux





Cabbage to market, Nepal

© K Sudmeier-Rieux



master's module

# DISASTERS, ENVIRONMENT & RISK REDUCTION (Eco-DRR)

INSTRUCTOR'S MANUAL • VERSION 2013

- Abarquez, I. & Z. Murshed** (2006) *Community Based Disaster Risk Management: Field Practitioner's Handbook*. Bangkok:ADPC.
- Adikari, Y. & J. Yoshitani** (2009) *Global Trends in Water-Related Disasters: an insight for policymakers*. In *The United Nations World Water Development Report 3, Water in a Changing World*, ed. UNESCO. Paris: UNESCO.
- ADPC [Asia Disaster Prevention Center]** (2010) *First Regional Training Course of the RCC on Mainstreaming Disaster Risk Reduction into National Development Processes. Participant's Workbook*. Regional Consultative Committee (RCC) on Disaster Management.
- Andrade Pérez, A., Herrera Fernandez, B. & R. Cazzolla Gatti (eds.)** (2010) *Building Resilience to Climate Change: Ecosystem-based adaptation and lessons from the field*. Gland, Switzerland: IUCN. 164pp. <http://data.iucn.org/dbtw-wpd/edocs/2010-050.pdf>
- Badola, R. & S.A. Hussain** (2005). "Valuing ecosystem functions: an empirical study on the storm protection function of Bhitarkanika mangrove ecosystem, India", *Environmental Conservation* 32: pp. 85-92.
- Batker, D.P., et al.** (2010) *Gaining ground—wetlands, hurricanes and the economy: The value of restoring the Mississippi River Delta*. Tacoma: Earth Economics.
- Birkmann, J.** (2006) *Measuring vulnerability to promote disaster-resilient societies: Conceptual frameworks and definitions*. In: *Measuring Vulnerability to Natural Hazards, Towards Disaster*, Tokyo: UNU Press
- Blackwell, M.S.A. & E. Maltby (eds)**, 2006. *Ecoflood guidelines: how to use floodplains for flood risk reduction*. Directorate General for research sustainable development, global change and ecosystems. Office for official publications of the European communities, Luxemburg.
- Booth Sweeney, L. Meadows & G. Martin Mehers** (2011) *The Systems Thinking Playbook for Climate Change, A toolkit for interactive learning*, Deutche Gesellschaft für Internationale Zusammenarbeit, Reinheim
- Borrini- Feyerabend, G. et al.** (2007) *Sharing Power. A Global Guide to Collaborative Management of Natural Resources*.
- Burby, R.J.** (1998) *Cooperating with Nature, Confronting Natural Hazards with Land-Use Planning for Sustainable Communities*, Washington, D.C.: Joseph Henry Press
- Campbell, A., et al.** (2009) *Review of the literature on the links between biodiversity and climate change: impacts, adaptation and mitigation*. Secretariat of the Convention on Biological Diversity. Technical series 42.
- CARE International**, *Climate Vulnerability and Capacity Analysis Tool* [http://www.careclimatechange.org/cvca/CARE\\_CVCAHandbook.pdf](http://www.careclimatechange.org/cvca/CARE_CVCAHandbook.pdf)
- Cap-Net/UNDP, Nile IWRM- Net, UNISDR & UNOCHA** (2009) *Hydro-climatic Disasters in Water Resources Management, Training Manual*. ed. Cap-Net/UNDP, 139pp. Pretoria.
- Cavallo, E., I. Noy, S. Galiani & J. Pantano** (2010) *Catastrophic Natural Disasters and Economic Growth*, Inter-American Development Bank, IDB Working Papers Series No. IDB-WP-183.
- Costanza, R., et al.** (2008) "The value of coastal wetlands for hurricane protection", *Ambio* 37: 241-248.
- Dakhia, K. & E. Berezowska-Azzag** (2010) *Urban institutional and ecological footprint: A new urban metabolism assessment tool for planning sustainable urban ecosystems*, *Management of Environmental Quality: An International Journal*, Vol. 21 Iss: 1 pp. 78 – 89
- Deltacommissie** (2008) *Working together with water: A living land builds for its future. Findings of the Delta commissie. Summary and conclusions*. <http://www.deltacommissie.com/en/advies>
- Dolidon, N., et al.** (2009) "Watershed and forest management for landslide risk reduction", in K. Sassa and P. Canuti (eds), *Landslides. Disaster risk reduction*. Berlin: Springer, pp. 633-646.
- Dudley, N., Stolton, S., Belokurov, A., Krueger, L., Lopoukhine, N., MacKinnon, K., Sandwith T. & N. Sekhran (eds)** (2010) *Natural Solutions: Protected areas helping people cope with climate change*. IUCN-WCPA, TNC, UNDP, WCS, The World Bank and WWF: Gland, Switzerland, Washington DC and New York, USA.
- Estrella, M. & N. Saalismaa** (2010) *Demonstrating the Role of Ecosystem-based Management for Disaster Risk Reduction. A Policy Paper Presented to the UNISDR Global Assessment team in preparation for the 2011 GAR*, 48 pp.
- Estrella, M. & N. Saalismaa** (2013) *Ecosystem-based Disaster Risk Reduction (Eco-DRR): An Overview*, In: Renaud, F., Sudmeier-Rieux, K. and M. Estrella (eds.) (2013) *The role of ecosystem management in disaster risk reduction*. Tokyo: UNU Press
- FAO [Food and Agriculture Organisation]** (2012) *Adaptation to Climate Change in Semi-Arid Environments. Experience and Lessons from Mozambique*. Environment and natural resources management series, 19, Rome.
- Granek, E.F., and B.I. Ruttenberg** (2007) "Protective capacity of mangroves during tropical storms: A case study from 'Wilma' and 'Gamma' in Belize", *Marine Ecology Progress Series* 343:101-105.
- Guadagno, L., Depietri, Y. & U. Fra Paleo** (2013) *Urban disaster risk reduction and ecosystem services*. In: Renaud, F., Sudmeier-Rieux, K. and M. Estrella (eds.) *The role of ecosystem management in disaster risk reduction*. Tokyo: UNU Press
- Gupta, A.K. & S.S Nair** (2012) *Ecosystem Approach to Disaster Risk Reduction*, National Institute of Disaster Management, New Delhi, Pages 202
- Hewitt, K.** (2009) *Culture and Risk: Understanding the Sociocultural Settings that influence Risk from Natural Hazards*, E-Conference, ICIMOD, Kathmandu

- Hildebrand, L.P. & E.J. Norrena** (1992) Approaches and progress toward effective Integrated Coastal Zone Management. *Marine Pollution Bulletin*, 25(1-4): p.94-97.
- Höppner, Buchecker & Bründl** (2010) Risk Communication and Natural Hazards. CapHaz-Net WP5 Report, Swiss Federal Research Institute WSL
- ICLEI** [International Council for Local Environmental Initiatives] (2011) Resilient Cities 2 - Cities and Adaptation to Climate Change – Proceedings of the Global Forum Springer <http://www.springerlink.com/content/978-94-007-4223-9#section=1068490&page=29&locus=14>
- IUCN** (2012) Conservation Campus Notes. International Union for Conservation of Nature. [http://iucnworldconservationcongress.org/forum\\_\\_exhibition/conservation\\_campus/](http://iucnworldconservationcongress.org/forum__exhibition/conservation_campus/), Website accessed September 1, 2012
- IOC** [Intergovernmental Oceanographic Commission] (2009) Tsunami risk assessment and mitigation for the Indian Ocean. Knowing your tsunami risk – and what to do about it. UNESCO Manuals and Guides 52.
- International Federation of Red Cross and Red Crescent Societies** <http://www.ifrc.org/en/what-we-do/disaster-management/preparing-for-disaster/disaster-preparedness-tools/disaster-preparedness-tools>
- IPCC** [Intergovernmental Panel on Climate Change] (2012) Summary for Policy Makers. In: Managing Extreme Events and Disasters to Advance Climate Change Adaptation. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change. Cambridge, UK and New York, USA: Cambridge University Press. pp. 1-19
- Khalifa, M., & S. Sandholz** (2012) Breaking Barriers and Building Bridges through Networks: An Innovative Educational Approach for Sustainability. In: *International Journal of Environmental and Science Education* 7/2, S. 343 - 360.
- Krysanova, V., et al.** (2008) “Practices and lessons learned in coping with climatic hazards at the river-basin scale: floods and drought”, *Ecology and Society* 13, 32
- Manyena, S. B., G. O’Brien, P. O’Keefe & J. Rose** (2011) Disaster resilience: a bounce back or bounce forward ability? *Local Environment*, 16, 417-424.
- Marfai MA & L. King** (2007) Monitoring land subsidence in Semarang, Indonesia, Monitoring land subsidence in Semarang, Indonesia, *Environmental Geology*, 53:651–659
- Marfai MA, Almohammad H, Dey S, Susanto B, & L. King** (2008) Coastal dynamic and shoreline mapping: multi-sources spatial data analysis in Semarang Indonesia, *Environmental Monitoring and Assessment*, 142:297–308.
- Marfai MA & L. King** (2008) Coastal flood management in Semarang, Indonesia, *Environmental Geology*, 55:1507–1518.
- Marfai MA, King L, Singh LP, Mardiatno D, Sartohadi J, Hadmoko DS, & A. Dewi** (2008) Natural hazards in Central Java Province, Indonesia: an overview, *Environmental Geology*, 56:335–351
- Marfai MA, & L. King** (2008) Potential vulnerability implications of coastal inundation due to sea level rise for the coastal zone of Semarang city, Indonesia, *Environmental Geology*, 54:1235–1245.
- Marfai MA, King L, Sartohadi J, Sudrajat S, Budiani SR, & F.Yulianto** (2008) The impact of tidal flooding on a coastal community in Semarang, Indonesia, *Environmentalist* (2008) 28:237–248.
- Marfai MA, & L. King** (2008) Tidal inundation mapping under enhanced land subsidence in Semarang, Central Java Indonesia *Natural Hazards* (2008) 44:93–109.
- Mayunga, J. S.** (2007) Understanding and Applying the Concept of Community Disaster Resilience: A capital- based approach. In A draft working paper prepared for the summer academy for social vulnerability and resilience building, 22 – 28 July 2007, Munich, Germany, 16pp. Bonn: UNU-EHS.
- Mazda, Y., et al.** (1997) “Mangroves as a coastal protection from waves in the Tong Kong delta, Vietnam”, *Mangroves Salt Marshes* 1: 127–135.
- Mechler R.** (2005) Cost-benefit Analysis of Natural Disaster Risk Management in Developing Countries. Manual. Deutsche Gesellschaft für Technische Zusammenarbeit. 84 P.
- MEA** [Millennium Ecosystem Assessment] (2005) Ecosystems and human well-being: Current State and Trends, Millennium Ecosystem Assessment Washington: Island Press
- Mercer, J.** (2010) Disaster Risk Reduction or Climate Change Adaptation, are we reinventing the wheel? *Journal of International Development* 22, 247–264
- Möller, I.** (2006) “Quantifying saltmarsh vegetation and its effect on wave height dissipation: Results from a UK East coast saltmarsh”, *Journal of Estuarine, Coastal and Shelf Sciences* 69(3-4), 337-351.
- Morawetz, W. & U. Nehren** (2005) Rain forest management and ecotourism. – In: H. Gaese, F. Kraas & Mi Mi Kyi: Sustainability in Rural and Urban Environments, 59-74, Yangoon, Köln.
- National Institute for Disaster Management** (2009) Study on the impact of climate change on disaster risk in Mozambique. Synthesis Report – First Draft.
- Nehren U., S. Alfonso de Nehren & J. Heinrich** (2009) Forest fragmentation in the Serra dos Órgãos: Historical and landscape ecological implications. In: Gaese, Hartmut, Juan Carlos Torrico, Jens Wesenberg, Sabine Schlüter (eds.) (2009) Biodiversity and land use systems in the fragmented Mata Atlântica of Rio de Janeiro. Cuvellier publishers, Göttingen, 39-64.
- Nehren U., A. Kirchner, D. Sattler, A. Turetta & J. Heinrich** (2013a) Impact of natural climate change and historical land use on landscape development in the Atlantic Rainforest of Rio de Janeiro, Brazil. *Anais Academia Brasileira de Ciências*, in press.
- Nehren U., T. Loiza Lange, S. Alfonso, F. Naegeli, J. Monteiro, S. Schlüter** (2012) Potential for forest conservation and reforestation under CDM and REDD+ in the Atlantic Forest of Rio de Janeiro, Brazil. In: *Kieler Geographische Schriften* 123, Geographies of Inequality in Latin America, 133-158.
- Nehren U., J. Subedi, I. Yanakieva, S. Sandholz I, J. Pokharel, A. Chandra Lal, I. Pradhan-Salike, M.A. Marfai, D.S. Hadmoko, & G. Straub** (2013b accepted) Community perception on climate change and climate-related disaster preparedness in Kathmandu Valley, Nepal. *Journal of Natural Resources and Development*.
- Nightingale, M.** (2012) Making Eco-Disaster Risk Reduction Work. Training Course on Environment and Disaster Risk Reduction for Sustainable and Resilient Development. PEDRR.
- Norris, J.E., et al.** (Eds) (2008) Slope stability and erosion control: ecotechnological solutions. Springer: Dordrecht.

**Olskansky, R. B. & J. D. Kartz** (1998) Managing Land Use to Build Resilience. In Cooperating with Nature, Confronting Natural Hazards with Land-Use Planning for Sustainable Communities, ed. R. J. Burby, 167-201. Washington, D.C.: Joseph Henry Press.

**Olson, D.M., Dinerstein, E., Wikramanayake, E.D., Burgess, N.D., Powell, G.V.N., Underwood, E.C., D'Amico, J.A., Itoua, I., Strand, H.E., Morrison, J.C., Loucks, C.J., Allnutt, T.F., Ricketts, T.H., Kura, Y., Lamoreux, J.F., Wettengel, W.W., Hedao, P. & Kassem, K.R.** (2001) Terrestrial Ecoregions of the World: A New Map of Life on Earth. *Bioscience* 51, 933.

**Olson, D.M. & E. Dinerstein** (2002) The Global 200: Priority Ecoregions for Global Conservation. *Annals of the Missouri Botanical Garden* 89(2): 199-224

**Onishi, T. & M. Ishiwatari** (2012) Learning from Megadisasters, Urban Planning, Land Use Regulation, and Relocation, KNOWLEDGE NOTE 2-7 Washington, D.C.: World Bank.

**Pascual, U & R. Muradian** (2010) The economics of valuing ecosystem services and biodiversity, Chapter 5, The Economics of Ecosystems and Biodiversity: Earthscan, London. Available online at: [www.TEEBweb.org](http://www.TEEBweb.org)

**Paton, D.** (2003) Disaster preparedness: a social-cognitive perspective, *Disaster Prevention and Management Journal*, Vol. 12, No. 3 . pp.210-216

**Peduzzi, P.** (2010) Landslides and vegetation cover in the 2005 North Pakistan earthquake: a GIS and statistical quantitative approach. *Natural Hazards and Earth System Sciences* 10, 623-640.

**Post-disaster Needs Assessment (PDNA)** (2009) Fast Facts Guidance Sheet. [http://www.recoveryplatform.org/pdna/pdna\\_guide](http://www.recoveryplatform.org/pdna/pdna_guide)

**Ramachandra, T.V. et al.** (2012) Ecological Approach for Mitigation of Urban Flood Risks, In: Gupta, A. K. & S.S. Nair (eds.) *Ecosystem Approach to Disaster Risk Reduction*, National Institute of Disaster Management, New Delhi, 103-121 pp.

**Ramsar Convention on Wetlands** (2010) Flood control. Wetland ecosystem services. Factsheet 1. [http://www.ramsar.org/pdf/info/services\\_01\\_e.pdf](http://www.ramsar.org/pdf/info/services_01_e.pdf)

**Renaud, F., Sudmeier-Rieux, K. & M. Estrella** (2013) *The Role of Ecosystems for Disaster Risk Reduction*, Tokyo: UNU-Press

**Republic of Mozambique** (2010) Report on the Millennium Development Goals. Ministry of Planning and Development

**Ryedale Flood Research Group** (2008) Making Space for People, Involving Local Knowledge in Flood Risk Research and Management in Ryedale, Yorkshire, October, 2008. 61 pp.

**Shaw, R., Y. Noguchi & M. Ishiwatari** (2012) Green Belts and Coastal Risk Management, KNOWLEDGE NOTE 2-8. Washington, D.C.: World Bank.

**Sitoe A, Salomão A, Wertz-Kanounnikoff S** (2012) O contexto de REDD+ em Moçambique. Causas, actores e instituições. Occasional Paper 76. Center for International Forestry Research. Sudmeier-Rieux, K. & N. Ash (2009) Environmental Guidance Note for Disaster Risk Reduction. Gland: International Union for Conservation of Nature 49pp.

**Sudmeier-Rieux, K., et al.** (2011) "The 2005 Pakistan Earthquake Revisited: Methods for Integrated Landslide Assessment". *Mountain Research and Development* 31(2): 112-121.

**Sudmeier-Rieux** (2012) *Ecosystem Approach to DRR: basic concepts and recommendations to governments, with a special focus on Europe*. A special publication for the Council of Europe, European and Mediterranean Major Hazards Agreement (EUR-OPA) Strasbourg: Council of Europe, 45pp.

**Sudmeier-Rieux, K., Fra Paleo, U., Garschagen, M., Estrella, M, Renaud, F.G. & M. Jaboyedoff** (submitted, 2012) Opportunities, incentives and challenges to risk sensitive land use planning. Lessons from Nepal, Spain and Vietnam, Background paper for Global Assessment Report on DRR.

**Tanaka N., Yagisawa J., & S. Yasuda** (2013) Breaking pattern and critical breaking condition of Japanese pine trees on coastal sand dunes in huge tsunami caused by Great East Japan Earthquake, *Natural Hazards* 65, pp.423-442

**Tanaka, N.** (2012) Effectiveness and limitations of coastal forest in large tsunami: conditions of Japanese pine trees on coastal sand dunes in tsunami caused by Great East Japan Earthquake. *Jpn Soc Civil Eng SerB1 (Hydraulic Engineering)* 68(4):II\_7-II\_15

**ten Brink P., Russi D., Farmer A., Badura T., Coates D., Förster J., Kumar R. & N. Davidson** (2013) *The Economics of Ecosystems and Biodiversity for Water and Wetlands. Executive Summary*

**Tierney, K. & M. Bruneau** (2007) Conceptualizing and Measuring Resilience, A Key to Disaster Loss Reduction. In *TR News*, 14-15. Washington, D.C.: Transportation Research Board of the National Academies.

**Twigg, J.** (2007) Characteristics of a Disaster-resilient Community A Guidance Note. Benfield UCL Hazard Research Centre.

**Turner, B., et al.** (2003) A framework for vulnerability analysis in sustainability science. *PNAS*, 100, 8074-8079.

**UNDG** [United Nations Development Group] (2011) *Results-based Management Handbook – Harmonizing RBM concepts and approaches for improved development results at country level* (<http://www.undg.org/docs/12316/UNDG-RBM%20Handbook-2012.pdf>)

**UNDP** [United Nations Development Programme] (2010) *Mainstreaming Disaster Risk Reduction into Development at the National Level. A Practical Framework*. UNDP Bureau for Crisis Prevention and Recovery.

**UNEP** Training toolkit: Integrating the environment into humanitarian action and early recovery <http://postconflict.unep.ch/humanitarianaction/training.html>

**UNEP** (2010) Risk and Vulnerability Mapping Project (RiVAMP) Linking Ecosystems to Risk and Vulnerability Reduction The Case of Jamaica

**UNECE** [United Nations Economic Commission for Europe] (2008) *Spatial planning. Key Instrument for Development and Effective Governance with Special Reference to Countries in Transition*. New York: UNECE.

**UNEP-WCMC** [United Nations Environment Programme World Conservation Monitoring Centre] (2006) *In the Front Line: Shoreline protection and other ecosystem services from mangroves and coral reefs*. Cambridge, UK: UNEP-WCMC.

**UNFCCC Secretariat** [United Nations Framework Convention on Climate Change] (2011) *Ecosystem-based approaches to adaptation: Compilation of information. Note by the secretariat. Subsidiary Body for Scientific and Technological Advice (SBSTA), Thirty-fifth session, 28 November - 9 December 2011, Durban, South Africa.*

**UNICEF** [United Nations International Children's Emergency Fund] (2008) Community-based Disaster Risk Reduction, Conference Proceedings UNICEF, India <http://www.unicef.org/india/ConferenceCommunitybasedDisasterRiskReductionreport.pdf>

**UNISDR** [United Nations International Strategy for Disaster Reduction] (2009) Global Assessment Report on DRR. Risk and poverty in a changing climate. UN International Strategy for Disaster Reduction. Geneva. Switzerland.

**UNISDR** [United Nations International Strategy for Disaster Reduction] (2011) Global Assessment Report on Disaster Risk Reduction. UN International Strategy for Disaster Reduction Geneva. Switzerland. 178pp. [www.preventionweb.net](http://www.preventionweb.net)

**UNISDR** [United Nations International Strategy for Disaster Reduction (2012) How To Make Cities More Resilient - A Handbook For Local Government Leaders, United Nations, Geneva [http://www.unisdr.org/files/26462\\_handbookfinalonlineversion.pdf](http://www.unisdr.org/files/26462_handbookfinalonlineversion.pdf)

**Vajjhala, S. P.** (2005) Mapping Alternatives: Facilitating Citizen Participation in Development Planning and Environmental Decision Making. In Engineering and Public Policy, 177. Pittsburgh, PA: Carnegie Mellon University

**van Halsema, G.E. & H. Zingstra** (2008) Revitalizing regulating services: the Netherlands floodplain policy. In: Scoping agriculture – wetland interactions. Towards a sustainable multiple-response strategy (Ed.) Wood, A. FAO WATER REPORTS 33, <ftp://ftp.fao.org/docrep/fao/011/i0314e/i0314e05.pdf>

**van Eijk, P. Baker, C., Gaspirc, R. & R. Kumar** (2013) Good flood, bad flood: maintaining dynamic river basins for community resilience. In: Renaud, F., Sudmeier-Rieux, K. and M. Estrella (eds.) The role of ecosystem management in disaster risk reduction. Tokyo: UNU Press

**Vo-Luong, P. & S. Massel** (2008) "Energy dissipation in non-uniform mangrove forests of arbitrary depth". *Journal of Marine Systems* 74: 603–622.

**Warner, K., Ranger, N., Surminski, S., Arnold, M. et.al.** (2009) Adaptation to climate change: Linking disaster risk reduction and insurance. Geneva: UNISDR.

**Wehrli, A. & L. Dorren** (2013) Protection forests – A key factor in integrated risk management in the Alps. In: Renaud, F., Sudmeier-Rieux, K. and M. Estrella (2013) The Role of Ecosystems for Disaster Risk Reduction, Tokyo: UNU-Press

**Wicaksono, P., H. Hartono, P. Danoedoro, U. Nehren, & L. Ribbe** (2011) Preliminary work of mangrove ecosystem carbon stock mapping in small island using remote sensing: above and below ground carbon mapping on medium resolution satellite image. Remote Sensing for Agriculture, Ecosystems, and Hydrology XIII, Proc. of SPIE Vol. 8174, 81741B-1, doi: 10.1117/12.897926.

**Wisner, B., P. Blaikie, T. Cannon & I. Davis** (2004) At Risk, Natural Hazards, People's Vulnerability and Disasters. London and New York: Routledge.

**World Bank** (2010) Convenient solutions to an inconvenient truth: Ecosystem-based approaches to climate change. <http://climatechange.worldbank.org/climatechange/content/convenient-solutions-inconvenient-truth>

**World Bank** (2010) Mozambique - Economics of Adaptation to Climate Change. The World Bank Group, Washington.

**World Bank** (2010) The Social Dimensions of Adaptation to Climate Change in Mozambique. Discussion Paper No. 16. The World Bank Group, Washington.

**WWF & American Red Cross** (2010) The Green Recovery and Reconstruction Toolkit <http://green-recovery.org/>

**WWF/GRRT: Training Toolkit for Humanitarian Aid** [www.green-recovery.org](http://www.green-recovery.org)

**Zapata-Marti, R.** (1997) Methodological approaches: the ECLAC methodology. In Center for the Research on the Epidemiology of Disasters (CRED), Assessment of the economic impact of natural and man-made disasters. Proceedings of the expert consultation on methodologies, Brussels, 29–30 September, Universite Catholique de Louvain, Belgium, 10–12. P.

**Zhao, B., et al.** (2005) "Estimation of ecological service values of wetlands in Shanghai, China" *Chinese Geographical Science* 15: 151-156

**Zimmermann, M., Pozzi, A., & F. Stoessel** (2005) Hazard maps and related instruments, the Swiss System and its Application Abroad, Capitalisation of Experience, Berne: Swiss Development Cooperation, 19 pp.

## ANNEX 1. KEY DEVELOPERS

	NAME	INSTITUTION	ADDRESS	EMAIL
1	Marisol Estrella	UNEP, Post-Conflict and Disaster Management Branch	15, Chemin des Anémones, CH- 1219 Châtelaine, Geneva, Switzerland	marisol.estrella@unep.org
2	Dr. Udo Nehren	Cologne University of Applied Sciences, Institute for Technology and Resources Management in the Tropics and Subtropics	Betzdorfer Str. 2, 50674 Köln, Germany	udo.nehren@fh-koeln.de
3	Simone Sandholz	Innsbruck University, Austria, Institute of Geography	Innrain 52, 6020 Innsbruck, Austria	simone.sandholz@uibk.ac.at
4	Dr. Karen Sudmeier-Rieux	UNEP, Post-Conflict and Disaster Management Branch and International Union for Conservation of Nature, Commission on Ecosystem Management	15, Chemin des Anémones, CH- 1219 Châtelaine, Geneva, Switzerland	karen.sudmeier@unep.org

## ANNEX 2. LIST OF PARTNERING INSTITUTIONS AND CONTACT PERSONS (2013)

NO	UNIVERSITY/ COUNTRY	NAME OF THE DEPARTMENT/ FACULTY	NAME OF MASTER'S PROGRAM/ POSITION	NAME	EMAIL
<b>CNRD</b>					
1	Cologne University of Applied Sciences (CUAS), Germany	Institute for Technology and Resources Management in the Tropics and Subtropics (ITT)	MSc in Technology and Resources Management in the Tropics and Subtropics	Dr. Udo Nehren	udo.nehren@fh-koeln.de
2	Universidade Federal Fluminense, Brazil	Department of Geography/ Institute of Geosciences	MSc in Geography	Prof. Dr. Guilherme Borges Fernandez	guilhermefernandez@id.uff.br
3	Pontificia Universidad Católica de Valparaíso, Chile	Facultad de Agronomía	Master in Agronomy	Prof. Dr. Leonardo Vera	leonardo.vera@ucv.cl
4	Ain Shams University, Egypt	Department of Planning & Urban Design, Faculty of Engineering	MSc in Urban Planning	Prof. Dr. Marwa Khalifa	marwa1973@yahoo.com
		Faculty of Engineering	MSc in Irrigation and Hydraulics Department	Prof. Dr. Aly El-Bahrawy	alyelbahrawy@yahoo.com



5	Gadjah Mada University, Indonesia	Graduate School of Gadjah Mada; Faculty of Geography	MSc in Disaster Management; MSc in Geoinformation for Spatial Planning and Disaster Risk Management	Dr. Danang Sri Hadmoko	hadmokoo@yahoo.com
6	University of Jordan	WEEC Center	MSc in Integrated Water Resources Management (IWRM)	Ms. Sana's Al-Aqqad	s.alaqqad@ju.edu.jo
7	Universidad Autónoma de San Luis Potosí, Mexico	Agenda Ambiental	MSc in Environment and Resources Management	Prof. Dr. Patricia Julio	patricia.julio@uaslp.mx
8	Universidade Eduardo Mondlane, Mozambique	Faculty of Engineering/ Faculty of Agronomy and Forest Engineering/ Faculty of Arts and Social Sciences	Master in Hydraulic Engineering/ Rural Development/ Population and Development	Dr. Luís Artur	lartur@uem.mz
9	Tribhuvan University, Nepal	Institute of Engineering, Center for Disaster Risk Studies	Master in Disaster Management	Asst. Prof. Ajay Chandra Lal	ajay_ioe@yahoo.com
10	Vietnam Academy for Water Resources, Vietnam	Center for Training and International Cooperation	MSc in Technology and Resources Management in the Tropics and Subtropics	Dr. Dang The Phong	thephongvkhlt@yahoo.com
<b>PEDRR</b>					
11	United Nations Environment Programme	Post-Conflict and Disaster Management Branch	Eco-DRR Master's module PEDRR training course	Dr. Karen Sudmeier-Rieux Ms. Marisol Estrella Dr. Muralee Thummarukudy	karen.sudmeier@unep.org marisol.estrella@unep.org muralee.thummarukudy@unep.org
12	WWF- International & WWF- U.S.		WWF- Greening the Recovery and Reconstruction Training Course	Ms. Elaine Geyer-Allely Ms. Anita VanBreda	EGeyer-Allely@wwfint.org Anita.VanBreda@wwfus.org
13	United Nations University	Institute of Environment and Human Security (EHS)	PEDRR training course and E-learning course (under development)	Dr. Joerg Szarzynski Dr. Fabrice Renaud	szarzynski@ehs.unu.edu Renaud@ehs.unu.edu.unu
14	IUCN	Ecosystem management programme/ Commission on Ecosystem Management	PEDRR training course	Ms. Radhika Murti	Radhika.murti@iucn.org

## OTHER PARTNERS

15	Innsbruck University, Austria	Institute of Geography	Geography: Global Change and Regional Sustainability	Simone Sandholz	simone.sandholz@uibk.ac.at
16	University of Lausanne, Switzerland	Centre of Research on Terrestrial Environment	Centre for Research on Terrestrial Environment	Dr. Karen Sudmeier-Rieux	karen.sudmeier-rieux@unil.ch
17	University of Santiago de Compostela, Spain	Department of Agricultural Engineering, Land Laboratory	Master in Sustainable Land Planning	Prof. Dr. Urbano Fra	urbano.fra@usc.es
18	Hue University of Agriculture and Forestry, Vietnam	Library and Information Centre		Asst. Prof. Dr. Hoang Ho Dac Thai	hodacthaihoang@huaf.edu.vn
19.	University of Ghana	Institute for Environment and Sanitation Studies	PhD training	Dr. Chris Gordon	cgordon@ug.edu.gh
20.	United Nations University	Institute for Water, Environment & Health (UNU-INWEH)	Distance postgraduate level course through the Costa Rica based Latin American School for Protected Areas and Annamalai University, India	Dr. Hanneke Van Lavieren Dr. Zafar Adeel Director UNU INWEH	Hanneke.VanLavieren@unu.edu

**Examples of learning games for students of ecosystems, climate change adaptation (CCA), DRR and systems thinking in general:**

- **TRIANGLE GAME:**  
to understand the dynamics of a system which faces stress and shocks, such as disasters and climate change (Booth Sweeney, L., Meadows, D. and G. Martin Mehers, 2011)
- **AVALANCHE GAME:**  
to realize the difficulty and need for good communications among stakeholders (Booth Sweeney, L., Meadows, D. and G. Martin Mehers, 2011)
- **HARVEST GAME:**  
to realize the limits of “maximum sustainable yields” (Booth Sweeney, L., Meadows, D. and G. Martin Mehers, 2011)
- **FISHBANKS SIMULATION:**  
a free online simulation game about competition for limited marine resources:  
<http://forio.com/simulate/mit/fishbanks/simulation/login.html>
- **STOP DISASTERS GAME (UNISDR):**  
a free online game about which measures are required for stopping disasters. <http://www.stopdisastersgame.org/en/home.html>

**TRIANGLES GAME • SOURCE: BOOTH SWEENEY, L. MEADOWS AND G. MARTIN MEHERS (2011)**

**STEP 1:**

Invite people to get up and move to the place you identified for the Triangles Game.

**STEP 2:**

Ask people to get into a circle and to no longer speak.

**STEP 3:**

Invite each person to select two reference persons in the circle. They should remember who their reference persons are during the whole game. They should not tell anyone or indicate who these people are, just keep the two people in mind. Do not pick the Game operator.

**STEP 4:**

Tell people that when you say “Go” they will move and stand equidistance between their two reference people. Show them what this might mean, they can be close or further away, each time they will make a Triangle with their two people. Again without speaking

**STEP 5:**

Say “GO!” and again tell people to stand equidistant between their two reference persons, people might laugh a little when they discover that everyone is moving at the same time. Eventually the system should settle. Once it does, say you will experiment a bit with it.

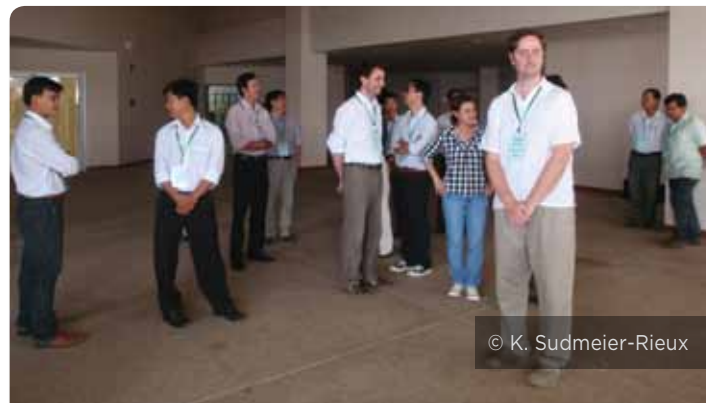
**STEP 6:**

Select one person and move him/her about 6 meters in one direction. Tell the group not to move yet. Once the person has moved, tell them to stay there. And ask people again to stand equidistance between their two people. People should start to move again and then probably most people will move. Do this 1 or 2 more times.

### STEP 7:

Debriefing. Ask people to tell you what happened in the game? What did they notice? (They will say interconnectivity, delays, the dynamic nature of systems, interaction, etc.)

You can link with the module and the interconnectivity between elements in an ecosystem, or organization and how the system might change after a disturbance such as a disaster.



Triangles game in practice during PEDRR training, Thailand 2012

## AVALANCHE GAME • SOURCE: BOOTH SWEENEY, L. MEADOWS AND G. MARTIN MEHERS (2011)

This is a demonstration game with optimally 7-10 people per group to carry out the game who must be physically able to kneel or bend down on the floor. It requires 10-15 minutes for the game and 10-20 minutes for discussion. The goal of this game is to gain practical experience of the need for good communications and negotiations among stakeholders. It can be considered in the context of CO<sub>2</sub> negotiations, or the need for adequate land use planning.

Material needed: a “hula-hoop” or large ring; diameter 1 m constructed out of light weight materials (possibly rolled up recycled flipchart paper, or very flexible branches). You need minimum 10 persons per hoop. It is possible to have several teams and hoops simultaneously.

### STEP 1:

Hold up the hoop. You can imagine that this hoop represents the level of CO<sub>2</sub> in the atmosphere. The goal of the game is to lower this level

### STEP 2: INSTRUCTIONS

- One person is designated to be the group leader and he/she should stand inside the hula-hoop.
- **There are two rules:**
  - A. Each team member (except the leader) should touch the hula hoop only with the top of their right index finger
  - B. They should not let go of the hoop.
- The leader then lets go of the hula hoop and says “Go!”, instructing the team members to lower the hoop to the ground.
- The results are often surprising, leading to a raising of the hoop, or an avalanche, rather than a lower of the hoop.
- If any team member loses contact with the bar, you must start the game over.
- Encourage the group leaders to take charge and instruct the team members to collaborate in order to lower the hoop.

### STEP 3:

In most cases, the hoop will actually rise up as some players are struggling to have a closer control over the hoop. Ask the groups what made this exercise so difficult and what was the strategy to make it a success. You can also compare what happened between the teams and discuss why one team was more successful than another one.



Avalanche game in practice during training session, PEDRR training, Thailand 2012

“In the 1980s I created FishBanks, Ltd, a 2-hour, computer-assisted role playing game that teaches key ideas about the sustainable management of renewable resources. Thousands of sets are in use in at least 15 countries. But there has been demand for a simpler, faster version that does not require a computer. So I created the following exercise, which I call Harvest. Some features of this exercise were originated and used by others, long before I came along. But the exercise described below has unique characteristics for which I am responsible. It is in the public domain, and it may be copied and adapted by anyone for any purpose. It would not be correct to give me full credit for this game. I do not know its parentage. I am describing here a very simple version intended for children. But you’ll see it could be modified by replacing the candy with money or poker chips. Then it would work as well for adults. A slightly more complex version of Harvest, based on teams, is described in the Systems Thinking Playbook.”

**SUPPLIES:**

To run the game you need one medium-sized bowl, a whistle or bell, and 150 - 200 pieces of candy.

**PARTICIPANTS:**

The game may be run for groups of from 3 to 15.

**PLAYER INSTRUCTIONS:**

*Here is a bowl with 50 pieces of candy in it.*

*In just a moment I will blow my whistle to start the first round. Then all of you will have 5 seconds to take from the bowl as many pieces of candy as you wish to or are able to grab.*

*After 5 seconds I will blow my whistle again, and you must stop.*

*After you stop, I will count how many pieces of candy are left in the bowl, and I will double them or bring the total up to 50, whichever requires fewer pieces of candy. So, for example, if you left 35 pieces in the bowl, I would add 15, making the total for the next round 50. If you left 20 pieces in the bowl, I would add 20.*

*After I have added the required number of pieces of candy, I’ll give you a few moments to consider your strategy, and then I’ll blow the whistle again to start the second round. In that round each of you will once again have 5 seconds to take as many pieces as you wish to or are able to grab.*

*After 5 seconds, I’ll stop the round, count the candy, add the necessary pieces, and give you few moments to consider your strategy. Then I’ll blow the whistle for the third round.*

*We will continue in this way for several cycles.*

*Your goal is to get as much candy for yourself as you can.*

**FACILITATOR NOTES:**

I usually try to blow the whistle for the first round before they have a chance to talk about a common strategy. But after that, if they ask about the possibility of talking together, I say they should do whatever they feel will let them maximize the amount of candy they can get. If they ask how many rounds will be played, just say, “We’ll do this for a while, until I decide to stop.”

**FACILITATOR NOTES:**

One key issue in the game is the choice between collaboration and competition. Collaboration requires joint decision making, coordination, and trust. It is useful to get the participants to share their thoughts, observations, and strategies on this choice and to discuss where and how this choice confronts them in real life.

The game introduces a concept analogous to “Maximum Sustainable Yield” in a renewable resource system. If the participants take the candy to zero, you do not add any more for the subsequent rounds. But blow the whistle anyway for several more rounds, so they can experience intensely the frustration of going to an empty bowl. If they do not take any candy, leaving it at 50, you also do not add any. By taking enough candy in each round that the bowl is left with 25 pieces, the participants can maximize the amount that they must add each round.

Of course, over the long term, they cannot take out on a sustainable basis more than you put in. You can draw a graph to make this clearer. On the horizontal axis is “Number of pieces at the end of the round” ranging from 0 to 50. On the vertical axis is “Number of pieces added” ranging from 0 to 25. The data curve has the shape of an equilateral triangle with its peak at the point (25,25). Engage them in discussions about where this kind of regeneration confronts them in real life. The relation to fisheries, forests, and ground water is obvious. The game also makes points about softer resources, like faith in government.”

## STOP DISASTERS GAME (UNISDR)

A free online game about which measures are required for preventing and mitigating disasters. The game requires that students have access to computers.

<http://www.stopdisastersgame.org/en/home.html>

You may consider whether ecosystem components are adequately addressed in this game or how they may further be incorporated.

## ANNEX 4. CASE STUDY TEMPLATE

### Identifying links between ecosystems management and disaster risk reduction (or lack of): Case study template (developed by Marisol Estrella/Nina Saalismaa)

Case studies are needed to take stock of lessons and experiences and identify gaps and priority areas for action. Both negative and positive examples can be useful to highlight what should be avoided and what can be inspiring.

The length of the case studies should be approximately two to five pages, or 10 power point slides. Links to additional material can be included. When using material from other members, do not forget to credit authors and institutions accordingly.

Case studies should focus on the role of ecosystem management in reducing vulnerability to natural hazards and will differ depending on for which block they are developed. Case studies in the context of climate change adaptation may be included, but should also be contextualized within the overall DRR framework. Very welcome are case studies within the framework of ongoing research projects of the CNRD and PEDRR partners, which allow deeper insights and provide background information and data.

### CASE STUDIES COULD CONSIDER THREE DIMENSIONS FOR SUCCESS/FAILURE:

- Links between provisioning ecosystem services (goods, water) for reducing economic vulnerability
- Links between regulating ecosystem services (natural barriers) for reducing physical vulnerability
- Institutional aspects of ecosystem management leading to reducing social vulnerability, including good/bad practices of land use planning.

### STRUCTURE:

- Header
- Title:
- Authors: (Name and Institutions)
- Key words:
- Catcher/abstract: (50 - 200 words max.)
- Information (filling this information will allow queries)
- Related to which hazards: (we should provide a list with check box)
- Type of Ecosystems: (mountain, coastal, dry land, wetland, river basins)
- Country or region location: (we should provide a list with check box)
- Geographical coordinate: Top left, bottom right (Decimal Degree)
- Dates

## PROPOSED CASE STUDY STRUCTURE

TOPIC	CONTENT
1. Introduction	<ul style="list-style-type: none"> <li>• Background material / Context setting</li> <li>• Summary of key lessons learned and priority issues</li> </ul>
2. Overview or general description of project / initiative / effort	<ul style="list-style-type: none"> <li>• Location: who, where, how much (useful facts and figures)</li> <li>• Purpose / objectives of project, initiative, etc.</li> <li>• Activities being undertaken</li> </ul>
3. Outputs / outcomes (or lack thereof)	<ul style="list-style-type: none"> <li>• What is being achieved (or not) in practical terms</li> <li>• E.g. include real examples (quotes etc) of how activities have contributed to risk reduction, why this work is of value</li> </ul>
4. Lessons: Analysis of experience	<ul style="list-style-type: none"> <li>• What worked and what did not, why?</li> <li>• Identify triggering factors or causes of success or failure, which could be categorized into key priority issues for example: <ul style="list-style-type: none"> <li>• Governance</li> <li>• Capacity development</li> <li>• Individual commitment / charisma</li> <li>• Partnerships</li> <li>• Institutional mechanisms</li> <li>• etc.</li> </ul> </li> </ul>
Support material	<ul style="list-style-type: none"> <li>• Photos, satellite images, etc.</li> <li>• Provide table for statistics</li> <li>• Maps, graphs and other visuals</li> <li>• Related links</li> <li>• Related Publications</li> </ul>

## ANNEX 5. RECOMMENDED READINGS

### BLOCK I

Birkmann, J. (2006) Measuring vulnerability to promote disaster-resilient societies: Conceptual frameworks and definitions. In: *Measuring Vulnerability to Natural Hazards, Towards Disaster*, Tokyo: UNU Press

CARE International, Climate Vulnerability and Capacity Analysis Tool [http://www.careclimatechange.org/cvca/CARE\\_CVCAHandbook.pdf](http://www.careclimatechange.org/cvca/CARE_CVCAHandbook.pdf)

International Federation of Red Cross and Red Crescent Societies <http://www.ifrc.org/en/what-we-do/disaster-management/preparing-for-disaster/disaster-preparedness-tools/disaster-preparedness-tools>

IPCC [Interagency Panel on Climate Change] (2012) IPCC Special Report on Extreme Events, Summary for Policymakers. 29. Geneva: Intergovernmental Panel on Climate Change First Joint Session of Working Groups I and II.

Manyena, S. B., G. O'Brien, P. O'Keefe & J. Rose (2011) Disaster resilience: a bounce back or bounce forward ability? *Local Environment*, 16, 417-424.

Mayunga, J. S. (2007) Understanding and Applying the Concept of Community Disaster Resilience: A capital-based approach. In A draft working paper prepared for the summer academy for social vulnerability and resilience building, 22 – 28 July 2007, Munich, Germany, 16pp. Bonn: UNU-EHS.

Mercer, J. (2010) Disaster Risk Reduction or Climate Change Adaptation: Are we Reinventing the Wheel? *Journal of International Development J. Int. Dev.* 22, 247–264 (2010)

Tierney, K. & M. Bruneau (2007) Conceptualizing and Measuring Resilience, A Key to Disaster Loss Reduction. In TR News, 14-15. Washington, D.C.: Transportation Research Board of the National Academies.

UNEP [United Nations Environment Programme] (2010) Risk and Vulnerability Mapping Project (RiVAMP) Linking Ecosystems to Risk and Vulnerability Reduction The Case of Jamaica

UNISDR [United Nations International Strategy for Disaster Reduction] (2005) Hyogo Framework for Action 2005-2015. UNISDR, Geneva, Switzerland

UNISDR [United Nations International Strategy for Disaster Reduction] (2011) Global Assessment Report, Revealing Risk, Redefining Development. 178. Geneva: UN/ISDR.

Wisner, B., P. Blaikie, T. Cannon & I. Davis (2004) *At Risk, Natural Hazards, People's Vulnerability and Disasters*. London and New York: Routledge.

Zimmermann, M, Pozzi, A. & F. Stoessel (2005) Hazard maps and related instruments, the Swiss System and Its Application Abroad, Capitalisation of Experience, Berne: Swiss Development Cooperation, 19 pp.

### BLOCK II

Chapin, F.S., G.P. Kofinas & C. Folke (2009) *Principles of Ecosystem Stewardship. Resilience-based natural Resource management in a changing world*. Springer, 401 pp.

Costanza, R., d'Arge, R., de-Groot, R., Farber, S., Grasso, M., Hannon, B., Limburg, K., Naeem, S., O'Neil, R., Paruelo, J., Raskin, R., Sutton, P., & J. van den Belt (1997) The value of the world's ecosystem services and natural capital. *Ecol. Econom.* 25 (1), 3–15.

Diaz, S. J., Fargone, F., Chapin, S. III & D. Tilman (2006) Biodiversity Loss Threatens Human Well-Being. *PLoS Biol* 4(8): e277. DOI: 10.1371/journal.pbio.0040277.

Gunderson, L.H., C.R. Allen & C.S. Holling (2010) *Foundations of Ecological Resilience*. Island Press, Washington, Covelo, London, 466 pp.

Gupta, A.K. & S.S. Nair (2012) *Ecosystem Approach to Disaster Risk Reduction*, National Institute of Disaster Management, New Delhi, Pages 202

MEA [Millennium Ecosystem Assessment] (2005) *Ecosystems and Human Well-Being: Synthesis*. Washington, D.C, USA: Island Press.

Olson, D.M., Dinerstein, E., Wikramanayake, E.D., Burgess, N.D., Powell, G.V.N., Underwood, E.C., D'amico, J.A., Itoua, I., Strand, H.E., Morrison, J.C., Loucks, C.J., Allnutt, T.F., Ricketts, T.H., Kura, Y., Lamoreux, J.F., Wettengel, W.W., Hedao, P. & K.R. Kassem, (2001) *Terrestrial Ecoregions of the World: A New Map of Life on Earth*. *Bioscience* 51, 933.

Pascual, U. & R. Muradian (2010) The economics of valuing ecosystem services and biodiversity, Chapter 5, *The Economics of Ecosystems and Biodiversity: Earthscan*, London. Available online at: [www.TEEBweb.org](http://www.TEEBweb.org)

Russi D., ten Brink P., Farmer A., Badura T., Coates D., Förster J., K. R. & N. Davidson (2012) *The Economics of Ecosystems and Biodiversity for Water and Wetlands*. Final consultation draft. *The Economics of Ecosystems and Biodiversity*, 119pp. [www.TEEBweb.org](http://www.TEEBweb.org)

Steiner, F.R. (2002) *Human Ecology*. Washington, D.C: Island press, 237 pp.

Sudmeier-Rieux, K. & N. Ash (2009) *Environmental Guidance Note for Disaster Risk Reduction*. IUCN Commission for Ecosystem management series no. 8. Gland, Switzerland: IUCN.

Udvardy, M. (1975): *A classification of the Biogeographical Provinces of the World*. Prepared as a contribution to UNESCO's Man and the Biosphere Programme Project No. 8, IUCN Occasional Paper No. 18. Morges, Switzerland.



## ANNEX 5. RECOMMENDED READINGS

### BLOCK III

Andrade Pérez, A., Herrera Fernandez, B. and Cazzolla Gatti, R. (eds.) (2010) Building Resilience to Climate Change: Ecosystem-based adaptation and lessons from the field. Gland, Switzerland: IUCN. 164pp. <http://data.iucn.org/dbtw-wpd/edocs/2010-050.pdf>

Abarquez, I. & Z. Murshed (2004) Community Based Disaster Risk Management: Field Practitioner's Handbook. Bangkok: ADPC.

Dudley, N., S. Stolton, A. Belokurov, L. Krueger, N. Lopoukhine, K. MacKinnon, T. Sandwith and N. Sekhran (Eds) (2010) Natural Solutions: Protected areas helping people cope with climate change. IUCN-WCPA, TNC, UNDP, WCS, The World Bank and WWF: Gland, Switzerland, Washington DC and New York, USA.

Gupta, Anil K. and Nair, Sreeja S. (2012) Ecosystem Approach to Disaster Risk Reduction, National Institute of Disaster Management, New Delhi, Pages 202

Millennium Ecosystem Assessment (2005) Ecosystems and Human Well-Being: Synthesis. Washington, D.C, USA: Island Press.

Renaud, F.G., Sudmeier-Rieux, K. and M. Estrella (2013) The Role of Ecosystems for Disaster Risk Reduction, Tokyo: United Nations University Press

Sudmeier-Rieux, K. and N. Ash (2009) Environmental Guidance Note for Disaster Risk Reduction, IUCN, Gland, 40pp.

Sudmeier-Rieux, K., Fra Paleo, U., Garschagen, M., Estrella, M, Renaud, F.G., Jaboyedoff, M (accepted, 2012) Opportunities, incentives and challenges to risk sensitive land use planning. Lessons from Nepal, Spain and Vietnam, Background paper for Global Assessment Report on DRR.

UNDG (2011) Results-based Management Handbook - Harmonizing RBM concepts and approaches for improved development results at country level <http://www.undg.org/docs/12316/UNDG-RBM%20Handbook-2012.pdf>

UNECE (2008) Spatial planning. Key Instrument for Development and Effective Governance with Special Reference to Countries in Transition. New York: UNECE.

UNFCCC Secretariat (2011) Ecosystem-based approaches to adaptation: Compilation of information. Note by the secretariat. Subsidiary Body for Scientific and Technological Advice (SBSTA), Thirty-fifth session, 28 November - 9 December 2011, Durban, South Africa.

UNISDR (2012) How To Make Cities More Resilient - A Handbook For Local Government Leaders, United Nations, Geneva [http://www.unisdr.org/files/26462\\_handbookfinalonlineversion.pdf](http://www.unisdr.org/files/26462_handbookfinalonlineversion.pdf)

World Bank (2010) Convenient solutions to an inconvenient truth: Ecosystem-based approaches to climate change. <http://climatechange.worldbank.org/climatechange/content/convenient-solutions-inconvenient-truth>

### BLOCK IV

Cavallo, E., I. Noy, S. Galiani & J. Pantano (2010) Catastrophic Natural Disasters and Economic Growth, Inter-American Development Bank, IDB Working Papers Series No. IDB-WP-183.

Estrella, M. and N. Saalismaa (2010) Estrella, M and N Saalismaa (2010). Demonstrating the Role of Ecosystem-based Management for Disaster Risk Reduction. A Policy Paper Presented to the UNISDR Global Assessment team in preparation for the 2011 GAR, 48 pp.

Mechler R. (2005) Cost-benefit Analysis of Natural Disaster Risk Management in Developing Countries. Manual. Deutsche Gesellschaft fur Technische Zusammenarbeit. 84 P.

Meyer, V. et al. (2012) CONHAZ – Costs of Natural Hazards – A Synthesis, WP9 Report, EU- FP7 Project 63 pp.

Renaud, F.G., Sudmeier-Rieux, K. and M. Estrella (2013) The Role of Ecosystems for Disaster Risk Reduction, Tokyo: United Nations University Press.

### **CAPACITY:**

The combination of all the strengths, attributes and resources available within a community, society or organization that can be used to achieve agreed goals. Capacity may include infrastructure and physical means, institutions, societal coping abilities, as well as human knowledge, skills and collective attributes such as social relationships, leadership and management. Capacities are the positive factors that increase the ability of people and the society they live in, to cope effectively with hazards, that increase their resilience, or that otherwise reduce their susceptibility to disasters (UNISDR, 2009 Terminology of Disaster Risk Reduction).

### **CLIMATE CHANGE:**

A change in the state of the climate that can be identified by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forces, or to persistent anthropogenic changes in the composition of the atmosphere or in land use. In other words, a change in the climate that persists for decades or longer, arising from either natural causes or human activity (UNISDR, 2009 Terminology of Disaster Risk Reduction).

### **CLIMATE CHANGE ADAPTATION:**

The adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Various types of adaptation exist, e.g. anticipatory and reactive, private and public, and autonomous and planned (IPCC, 2012).

### **CLIMATE VARIABILITY:**

Variations in the mean state and other statistics (such as standard deviations, the occurrence of extremes, etc.) of the climate on all spatial and temporal scales beyond that of individual weather events. Variability may be due to natural internal processes within the climate system (internal variability), or to variations in natural or anthropogenic external forcing (external variability) (IPCC, 2012).

### **COPING CAPACITY:**

The ability of people, organizations and systems, using available skills and resources, to face and manage adverse conditions, emergencies or disasters. This capacity may differ according to demography, location, gender and other factors. The capacity to cope requires continuing awareness, resources and good management, both in normal times as well as during crises or adverse conditions. Coping capacities contribute to the reduction of disaster risks (UNISDR, 2009 Terminology of Disaster Risk Reduction).

### **DISASTER:**

A serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources. Disasters are often described as a result of the combination of: the exposure to a hazard; the conditions of vulnerability that are present; and insufficient capacity or measures to reduce or cope with the potential negative consequences (UNISDR, 2009 Terminology of Disaster Risk Reduction).

### **DISASTER RISK:**

The potential disaster losses, in lives, health status, livelihoods, assets and services, which could occur to a particular community or a society over some specified future time period (UNISDR, 2009 Terminology of Disaster Risk Reduction).

### **DISASTER RISK REDUCTION:**

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 Terminology of Disaster Risk Reduction).

### **ECOSYSTEM:**

A dynamic complex of micro-organism, plant, animal and human communities and their non-living environment interacting as a functional unit (Millennium Ecosystem Assessment, 2005).

### **ECOSYSTEM SERVICES:**

The benefits that people and communities obtain from ecosystems. These include “regulating services” such as regulation of floods, drought, land degradation and disease, along with “provisioning services” such as food and water, “supporting services” such as soil formation and nutrient cycling, and “cultural services” such as recreational, spiritual, religious and other non-material benefits. Integrated management of land, water and living resources that promotes conservation and sustainable use provide the basis for maintaining ecosystem services, including those that contribute to reduced disaster risks (Millennium Ecosystem Assessment, 2005.; UNISDR, 2009 Terminology of Disaster Risk Reduction).

### **ENVIRONMENT:**

The complex of physical, chemical, and biotic factors (such as climate, soil, and living things) that act upon individual organisms and communities, including humans, and ultimately determine their form and survival. It is also the aggregate of social and cultural conditions that influence the life of an individual or community. The environment includes natural resources and ecosystem services that comprise essential life-supporting functions for humans, including clean water, food, materials for shelter, and livelihood generation (WWF –US and American Red Cross, 2010).

### **ENVIRONMENTAL DEGRADATION:**

The reduction of the capacity of the environment to meet social and ecological objectives and needs. Degradation of the environment can alter the frequency and intensity of natural hazards and increase the vulnerability of communities. The types of human-induced degradation are varied and include land misuse, soil erosion and loss, desertification, wildland fires, loss of biodiversity, deforestation, mangrove destruction, land, water and air pollution, climate change, sea level rise and ozone depletion (UNISDR, 2009 Terminology of Disaster Risk Reduction).

### **EXPOSURE:**

People, property, systems, or other elements present in hazard zones that are thereby subject to potential losses. Measures of exposure can include the number of people or types of assets in an area (UNISDR, 2009 Terminology of Disaster Risk Reduction).

### **HAZARD:**

A dangerous phenomenon, substance, human activity or condition that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage. Hazards arise from a variety of geological, meteorological, hydrological, oceanic, biological, and technological sources, sometimes acting in combination. Natural hazards are natural processes or phenomena, such as earthquakes, droughts and tropical cyclones, but their occurrence and scale of impact are often influenced by human-induced activities such as inappropriate land use, poor building codes and environmental degradation (UNISDR, 2009 Terminology of Disaster Risk Reduction; Estrella and Saalimaa, 2010).

### **NATURAL RESOURCES:**

Natural resources are actual or potential sources of wealth that occur in a natural state, such as timber, water, fertile land, wildlife and minerals. A natural resource qualifies as a renewable resource if it is replenished by natural processes at a rate comparable to its rate of consumption by humans or other users. A natural resource is

considered non-renewable when it exists in a fixed amount, or when it cannot be regenerated on a scale comparative to its consumption (Estrella and Saalimaa, 2010).

### **RESILIENCE:**

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. Resilience means the ability to “resile from” or “spring back from” a shock. The resilience of a community in respect to potential hazard events is determined by the degree to which the community has the necessary resources and is capable of organizing itself both prior to and during times of need (UNISDR, 2009 Terminology of Disaster Risk Reduction).

We can also consider resilience as the “ability to bounce forward”, which implies not just returning to the initial state as before a shock but improving from that initial state (Manyena et al., 2011).

### **SUSTAINABLE ECOSYSTEMS OR HEALTHY ECOSYSTEMS:**

Imply that ecosystems are largely intact and functioning, and that human demand for ecosystem services does not impinge upon the capacity of ecosystems to maintain future generations. (Sudmeier-Rieux, K. & N. Ash, 2009).

### **VULNERABILITY:**

The characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard. Vulnerability arises from various physical, social, economic, and environmental factors, such as poor design and construction of buildings, inadequate protection of assets, lack of public information and awareness, limited official recognition of risks and preparedness measures, and disregard for wise environmental management. The losses caused by a hazard will be proportionally much greater for more vulnerable populations, e.g. those living in poverty, with weak structures, and without adequate coping capacities (UNISDR, 2009 Terminology of Disaster Risk Reduction).

## ANNEX 7. LIST OF AUTHORS AND CONTRIBUTORS

- **CATHERINE ADOR** United Nations Environment Programme, Post-Conflict and Disaster Management Branch, Switzerland
- **SANA'S AL-AQQAD** Water, Environment and Energy Center, University of Jordan, Amman, Jordan
- **LUÍS ARTUR** Faculty of Agronomy and Forestry Engineering, Universidade Eduardo Mondlane, Maputo, Mozambique
- **KAIA BOE** International Union for Conservation of Nature Ecosystem management programme
- **GUILHERME BORGES FERNANDEZ** Geosciences Institute, Faculty of Geography, Universidade Federal Fluminense (UFF), Niterói, Brazil
- **ANITA VAN BREDA** World Wide Fund for Nature US (WWF-US)
- **CAMILLE BUYCK** International Union for Conservation of Nature Ecosystem management programme, Switzerland
- **ALY EL-BAHRAWY** Faculty of Engineering, Ain Shams University, Cairo, Egypt
- **MARISOL ESTRELLA** United Nations Environment Programme, Post-Conflict and Disaster Management Branch, Switzerland
- **HANAN FARAG** Ain Shams University, Cairo, Egypt
- **MANAR FAYYAD** Water, Environment and Energy Center, University of Jordan, Amman, Jordan
- **URBANO FRA PALEO** University of Santiago de Compostela, Spain
- **ELAINE GEYER-ALLELY** World Wide Fund for Nature (WWF) International, Switzerland
- **DANANG SRI HADMOKO** Faculty of Geography and Research Center for Disasters, Gadjah Mada University, Yogyakarta, Indonesia
- **ARWA HAMAIDEH** Water, Environment and Energy Center, University of Jordan, Amman, Jordan
- **HOANG HO DAC THAI** Hue University of Agriculture and Forestry, Vietnam
- **ISHRAT JAHAN** Center for Natural Resources and Development, Cologne University of Applied Sciences, Germany
- **PATRICIA JULIO** Ciencias Sociales y Humanidades Programas de Posgrado en Ciencias Ambientales. Universidad Autónoma de San Luis Potosí, Mexico
- **MARWA A. KHALIFA** Department of Planning & Urban Design, Faculty of Engineering Ain Shams University, Cairo, Egypt
- **AJAY CHANDRA LAL** Institute of Engineering, Center for Disaster Studies, Tribhuvan University, Kathmandu, Nepal
- **WOLFRAM LANGE** Institute for Technology and Resources Management in the Tropics and Subtropics, Cologne University of Applied Sciences, Germany
- **GEORG MEIER** Institute for Technology and Resources Management in the Tropics and Subtropics, Cologne University of Applied Sciences, Germany
- **DJATI MARDIATNO** Department of Environmental Geography, Faculty of Geography, Gadjah Mada University, Yogyakarta, Indonesia
- **MUH ARIS MARFAI** Faculty of Geography, Program on Management of Coastal Area and Watershed, Gadjah Mada University, Yogyakarta, Indonesia
- **RADHIKA MURTI** IUCN Ecosystem management programme, Switzerland
- **BACHTIAR WAHYU MUTAQIN** Faculty of Geography, Gadjah Mada University, Yogyakarta, Indonesia
- **FRIEDERIKE NAEGELI** University of Leipzig, Germany
- **UDO NEHREN** Center for Natural Resources and Development, Cologne University of Applied Sciences, Germany
- **DANG THE PHONG** Center for Training and International Cooperation, Vietnam Academy for Water Resources, Vietnam
- **NGUYEN TUNG PHONG** Center for Training and International Cooperation, Vietnam Academy for Water Resources, Vietnam
- **CLAUDIA RAEDIG** Institute for Technology and Resources Management in the Tropics and Subtropics, Cologne University of Applied Sciences, Germany
- **FABRICE RENAUD** United Nations University, Institute for Environment and Human Security, Bonn, Germany
- **LARS RIBBE** Institute for Technology and Resources Management in the Tropics and Subtropics, Cologne University of Applied Sciences, Germany
- **AHMED SALAYMEH** Water, Environment and Energy Center, University of Jordan, Amman, Jordan
- **SIMONE SANDHOLZ** Germany/ Institute for Geography, University of Innsbruck, Austria
- **JUNUN SARTOHADI** Gadjah Mada University, Yogyakarta, Indonesia / Center for Natural Resources and Development, Cologne University of Applied Sciences, Germany
- **GÜNTHER STRAUB** Center for Natural Resources and Development, Cologne University of Applied Sciences, Germany
- **JISHNU SUBEDI** Institute of Engineering, Center for Disaster Studies, Tribhuvan University, Kathmandu, Nepal
- **KAREN SUDMEIER-RIEUX** IUCN-Commission on Ecosystem Management, Consultant with United Nations Environment Programme, Post-Conflict and Disaster Management Branch, University of Lausanne, Geneva
- **JÖRG SZARZYNSKI** United Nation University, Institute for Environment and Human Security, Bonn, Germany
- **LEONARDO VERA** Facultad de Agronomía, Pontificia Universidad Católica de Valparaíso, Chile





Teaching Eco-DRR in Nepal

© S. Sandholz



**DAAD**

Deutscher Akademischer Austausch  
German Academic Exchange Service