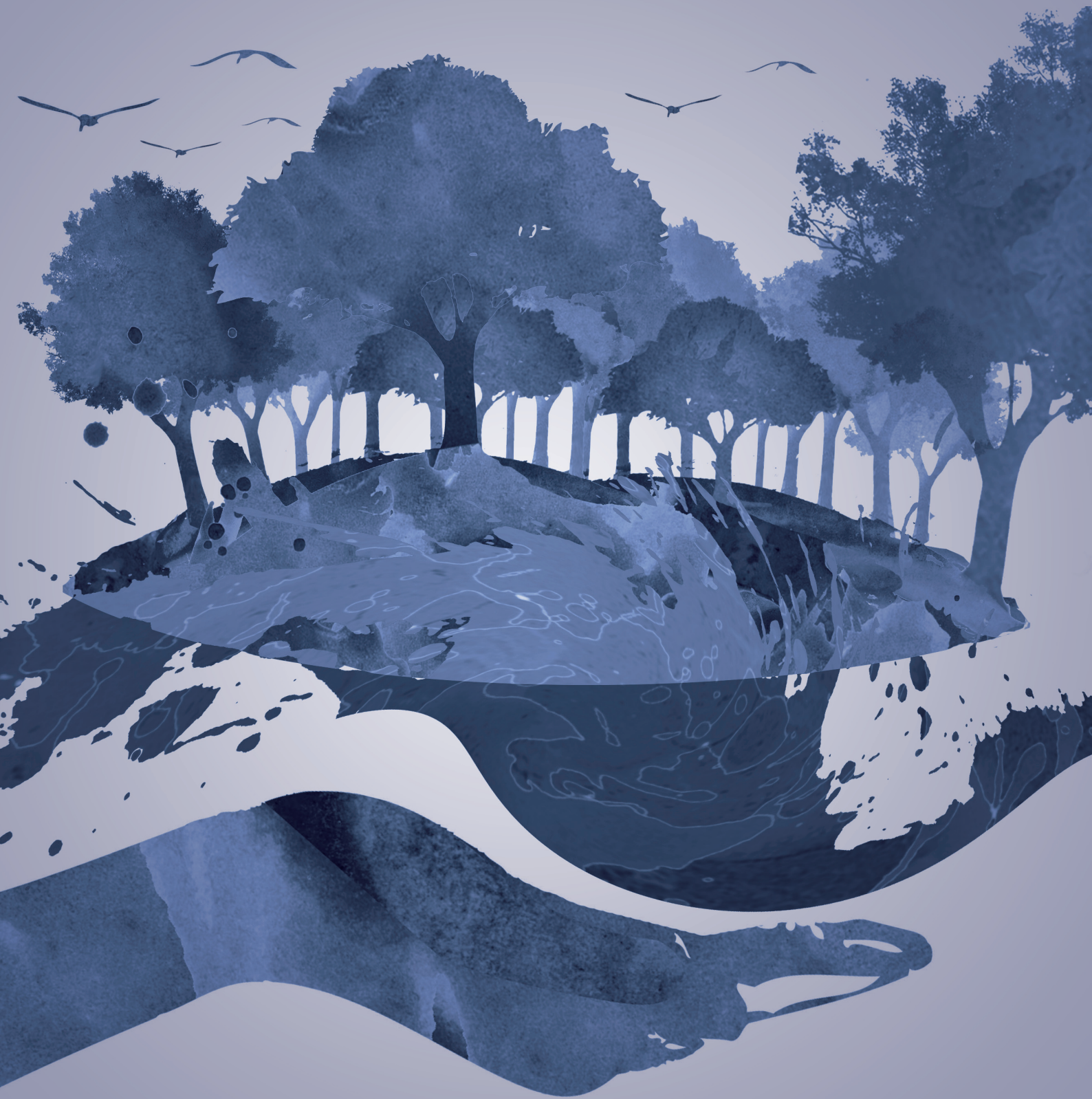




The Ecosystem-based Disaster Risk Reduction

Case Study and Exercise Source Book

PEDRR

Ecosystems for Adaptation
and Disaster Risk Reduction

CNRD

Center for Natural Resources
and Development

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Table of Contents

Introduction	3
1. Background	3
2. Introduction to ecosystem-based disaster risk reduction	4
3. Case studies	5
4. How to use the case studies	6
Case Study 1: Brazil	8
1. Overview	8
2. Background	8
3. Problem statement	11
4. Measures implemented	14
5. Lessons learned and conclusions	19
6. Exercise	20
7. Acknowledgements	22
Case Study 2: Indonesia	24
1. Overview	24
2. Background	25
3. Problem statement	27
4. Measures implemented	28
5. Lessons learned and conclusions	33
6. Exercise	34
Case Study 3: The Netherlands	39
1. Overview	39
2. Background	39
3. Problem statement	40
4. Measures implemented	42
5. Implications for ecosystem-based DRR	46
6. Strengths and weaknesses	47
7. Lessons learned and conclusions	47
8. Exercise	48
Case Study 4: Guatemala – Mexico	52
1. Overview	52
2. Background	52
3. Problem statement	54
4. Measures implemented	54
5. Lessons learned and conclusions	59
6. Exercise	60
Case Study 5: Burkina Faso – Niger	62
1. Overview	62
2. Background	62
3. Problem statement	63
4. Measures implemented	64
5. Strengths and weaknesses	66
6. Implications for Ecosystem-based Disaster Risk Reduction	67
7. Lessons learned and conclusions	68
8. Exercise	68
Case Study 6: United States of America	72
1. Overview	72
2. Background	72
3. Problem Statement	73
4. Measures proposed: Selection of suitable hazard-mitigation technology	75
5. Implications for Ecosystem-based Disaster Risk Reduction	82
6. Strengths and weaknesses	82
7. Lessons learned and conclusions	83
8. Exercise and teaching notes	84
Appendix	85
Case Study 7: Switzerland	89
1. Overview	89
2. Background	89
3. Problem statement	90
4. Measure(s) implemented	90
5. Lessons learned and conclusions	96
6. Exercise	96

Introduction

1. Background

In 2013, the United Nations Environment Programme (UNEP) and Center for Natural Resources and Development (CNRD) based at the Cologne University of Applied Sciences (CUAS), Germany, jointly developed a master's module "Disasters, Ecosystems and Risk Reduction," which is currently being implemented in a number of universities around the world. The current format of the course is designed for masters students enrolled in a regular university and provides lecturers with the necessary teaching materials and a sophisticated didactic concept. The instructor's manual (Figure 1) is available online and interested universities have open access to all materials (available online):

<http://www.unep.org/disastersandconflicts/Introduction/DisasterRiskReduction/Eco-DRRMasterModule/tabid/106372/Default.aspx>

The course was designed to be modular and comprises 50 hours of materials for in-class teaching including PowerPoint slides with explanations for lecturers, plus further readings, case studies from different countries, and learning games. Fields surveys and assignments are the responsibility of the participating universities (see fig. 2). The course is structured in four main blocks:

1. Elements of Disaster Risk Reduction
2. Ecosystem-based Disaster Risk Reduction
3. Eco-DRR instruments and approaches

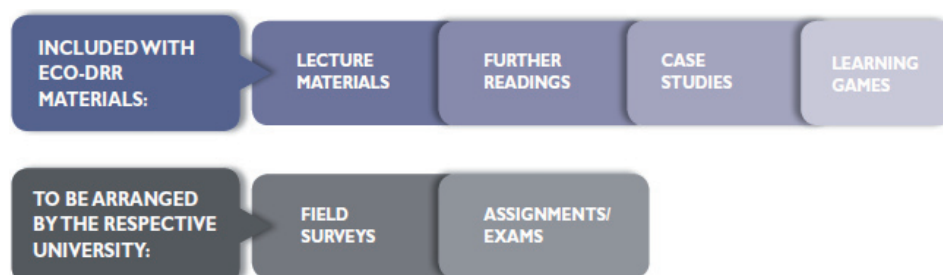


Figure 2. Course materials



Figure 1. Instructor's manual: Disasters, Environment and Risk Reduction

4. Mainstreaming Environment and DRR

A detailed description of the course content is included in the instructor's manual.

As a supplement to the course materials, the present case study document presents seven case studies with exercises for self-study compiled by researchers and practitioners. These case studies from different countries cover a range of topics in the Ecosystem-based Disaster Risk Reduction (Eco-DRR) context.

2. Introduction to Ecosystem-based DRR

As recent policy documents have highlighted, environmental degradation is a leading cause of increased disaster risk (IPCC, 2012; UNISDR, 2011). The World Risk Report (2012) points out that “Environmental degradation is a significant factor that reduces the adaptive capacity of societies to deal with disaster risk in many countries,” which means, in other words, that “not all storms and other natural hazards need to turn into disasters.”

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 3).

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.

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 & Saalismaa, 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 (Sudmeier-Rieux & Ash, 2009).

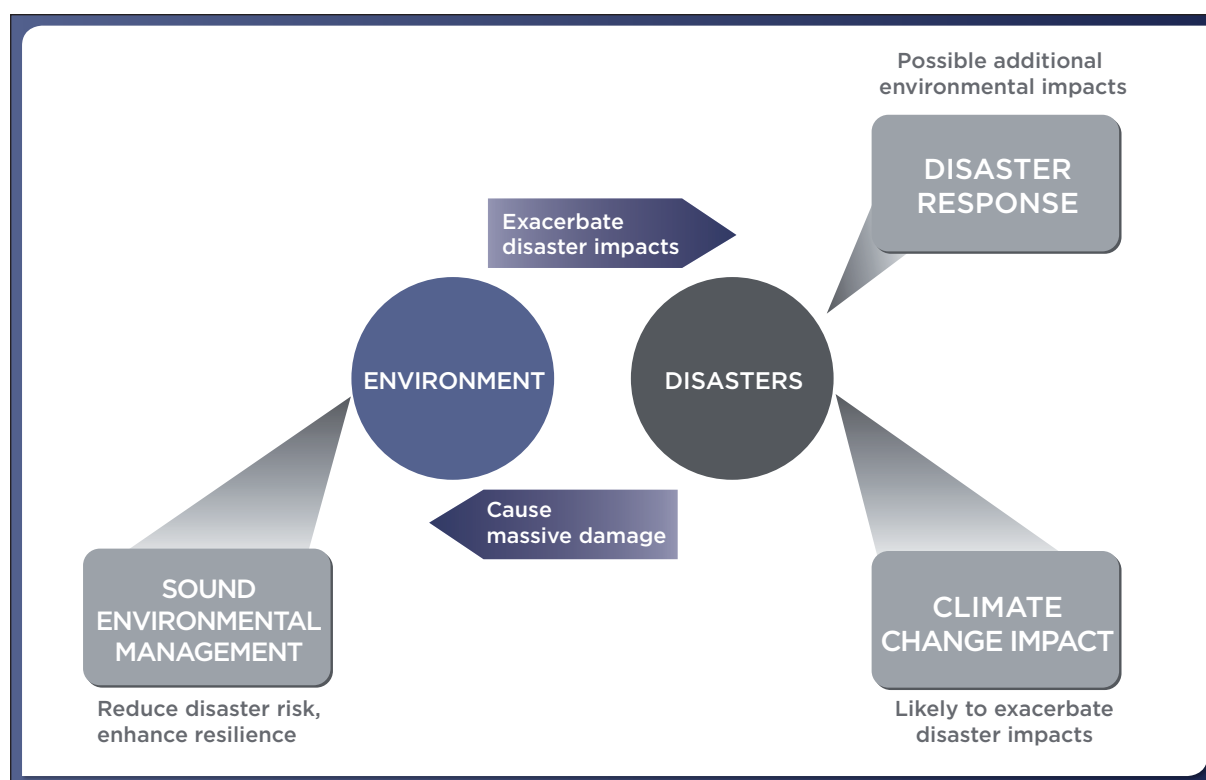


Figure 3. Inter-linkages between environment and disasters Source: Sandholz and Nehren, 2013

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 outlines many hazard mitigation functions of ecosystems.

The physical risk reduction capacity of ecosystems depends on their health and structure, and the intensity of the hazard event. 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 droughts, by serving as natural infrastructure, protective barriers or buffers (Renaud et al., 2013). However, degraded ecosystems can still play a buffering role, although to a much lesser extent than fully functioning ecosystems.

The Millennium Ecosystem Assessment (2005, p. 2) comes to the conclusion that “over the past 50 years, humans have changed ecosystems more rapidly and extensively than in any comparable period of time in human history, largely to meet rapidly growing demands for food, fresh water, timber, fiber, and fuel.” On a global average, land conversion with an increasing use of provisioning ecosystem services has led to net gains in well-being and has contributed to economic development, but at the same time regulatory, maintenance and cultural services have been deteriorated in many places. As land and ecosystem degradation are accompanied by increasing costs, risks, and poverty for some population groups, sound land and ecosystem management is essential to sustain livelihoods for present and future generations. Against this background, the Eco-DRR approach comprises much more than just punctually preserving or restoring ecosystems, such as mangroves or dune systems, or

implementing ecological infrastructure to reduce disaster risks. Rather, we consider the approach as an essential component of an integrated land management approach with the overall goal to create resilient landscapes.

Within the last years the ecosystem-based approach has received much attention in the disaster risk and climate change communities, but there are still many needs in research, education, and practice. With the Eco-DRR master’s course we would like to fill some of these gaps by providing students with theoretical concepts and practical tools in understanding environment and disaster linkages and applications of ecosystem-based disaster risk management. The seven case studies presented in this booklet cover a range of geographical regions, ecosystems, hazard types, and DRR measures. We hope to encourage students to become familiar with the topic and become future members of a global Eco-DRR community.

3. Case studies

This case study booklet can be used as either a free standing publication or as supplemental material to the master’s course, in addition to the case studies that were originally designed for the course. Student evaluations of this course consistently point to the importance of providing good case study examples first and explaining theory later, providing much better anchoring of theoretical knowledge. Case studies were selected to cover a range of ecozones, hazards and to address a number of different Eco-DRR topics.

- 1) Landslide hazard regulation and mitigation: Creating Resilient Landscapes in the Serrana region of Rio de Janeiro State, Brazil:** This case study gives an overview of natural hazards and implemented measures to reduce disaster risk in the Serrana region of Rio de Janeiro State in Brazil, where in 2011 more than 900 people were killed by mudslides, landslides and floods. Special focus is placed on the concepts of resilient landscapes and ecosystem services to reduce disaster risk.

2) **Integrated Coastal Zone Management in Semarang (ICZM), Central Java, Indonesia:**

ICZM is a multi-disciplinary approach to managing coastal areas, which are often highly populated and exposed to multiple hazards. In order to present this approach, Semarang in Central Java, Indonesia was chosen as case study area. Semarang is facing several disaster risks, in particular related to coastal flooding, salinization and land subsidence. Different structural, non-structural and ecosystem-based measures have been implemented to reduce the flood risk.

3) **Room for the River - Flood Risk Management, The Netherlands:**

This case study features the Room for the River programme, the Dutch government's modern approach to flood management, including the steps and measures taken to achieve increased protection against high water levels and improved spatial quality in the riverine region.

4) **Integrated Water Resources Management – Tacaná Watersheds, Guatemala- Mexico:**

This case study features the IUCN Tacaná Project, an integrated water resources management initiative that focused on the watersheds on the border between Guatemala and Mexico. It begins with a background of the project and the problem statement, followed by a presentation of the different pilot projects and a discussion of the outcomes.

5) **Linkages between Disaster Risk Reduction and Climate Change Adaptation – Burkina**

storm surge prevention measure, as well as the methods used to identify it as the most suitable and sustainable short-term measure to increase beach resilience against coastal hazards in a town on the north-eastern coast of the United States.

7) **Eco-DRR and Mountain Ecosystems: Protection Forests of Switzerland and other Alpine countries:**

This case study features protection forests in Switzerland and other Alpine countries, which are regarded to be a highly effective and efficient measure against natural hazards in the Alps, playing a key role in integrated disaster risk management strategies in the region. Modern management of protection forests is mainly based on harnessing the protection potential of natural ecosystems (structures and processes), aiming to maximize both effectiveness and efficiency.

4. How to use the case studies

The Eco-DRR/CCA case study booklet is designed as a guided learning resource and supports a problem-based learning approach. The basic idea is that master's students of the Eco-DRR course can work independently on the provided case studies and exercises, but the booklet can also be used as a free standing publication. Therefore the case studies are self-explanatory and no further documents are needed. However, where necessary the lecturer can support the students with introductory explanations and also prepare for a final in-class discussion of each case study.

预览已结束，完整报告链接和二维码如下：

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