PEDRR
Ecosystems for Adaptation and Disaster Risk Reduction

Workshop report

Innovating Engineering and Ecosystem-based Approaches for Disaster Risk Reduction

International Science-Policy Workshop

Bonn, Germany, 14-16 June 2016

Photo credit: Aileen Orate, UNU-EHS

1. Background

The Partnership for Environment and Disaster Risk Reduction (PEDRR) organized its Third International Science-Policy Workshop on 14-16 June, 2016, at the United Nations University Institute for Environment and Human Security (UNU-EHS) located in Bonn, Germany. This event brought together both the Eco-DRR and engineering communities to establish a dialogue on how to better promote Eco-DRR approaches in the context of disaster risk management as well as resilient development planning.

Several organizations, such as Wetlands International and The Nature Conservancy, already have ongoing collaborations with engineering companies in order to develop and improve Eco-DRR measures based on integrated, ecological and engineering standards. Yet there continues to be a large gap in terms of ecological engineering standards for Eco-DRR. This workshop was designed to provide an opportunity to take stock of current knowledge and practice of applying Eco-DRR measures, with the aim of further mainstreaming and scaling up Eco-DRR in development policies, plans and programmes. It also sought to carry forward some of the recommendations reached at PEDRR's 2nd International Science-Policy Workshop held in June 2014, in Bogor, Indonesia, which concluded a need for developing standardized Eco-DRR approaches and protocols which would enable further replication and innovation. Along with developing implementation guidelines for Eco-DRR is the importance of understanding the financial considerations, benefits as well as trade-offs of ecosystem-based DRR approaches.

2. Key organizers:

- United Nations University, Institute of Environment and Human Security (UNU-EHS)
- United Nations Environment Programme (UNEP)
- Wetlands International (WI)
- The Nature Conservancy (TNC)
- International Union for Conservation of Nature (IUCN)
- In collaboration with Dr. Deborah Brosnan
- With support from the European Commission

3. Objectives and scope

The goal of this workshop was to accelerate and scale-up implementation of ecosystem-based approaches to disaster risk reduction (Eco-DRR) in the engineering community. It specifically aimed to:

- Convene and facilitate an interactive dialogue between engineering and Eco-DRR communities, and explore areas of convergence and divergence;
- Discuss the current knowledge base and available technical guidelines/standards on ecological engineering as well as hybrid ecosystem management and engineering approaches to DRR, and identify the knowledge gaps;
- Discuss the types of standards or criteria needed that would support consideration of Eco-DRR measures as one of the solutions for risk reduction and risk management;
- Better understand the economic case for promoting ecological-engineering approaches to DRR.

4. Workshop structure

Opening remarks were given by Jakob Rhyner (UNU-EHS) and Muralee Thummarukudy (UNEP) on the importance of extending work on Eco-DRR to the engineering community as this is where many decisions are made on DRR that can also have negative long term impacts on ecosystems. Nao Furuta (IUCN) gave an overview presentation of PEDRR, followed by Fabrice Renaud (UNU-EHS) who presented the workshop objectives and expected outcomes.

Figure 1. Opening speeches. *Left:* Dr. Jakob Rhyner (UNU-EHS); *Right:* Dr. Muralee Thummarukudy (UNEP)
Photo credit: Aileen Orate, UNU-EHS

The workshop was organized around 5 main cross-cutting themes and panels:

Panel 1. What ecological engineering standards exist and why are more needed?
Panel 2. The way forward for the development of ecological engineering standards for DRR/CCA
Panel 3. How can we work together more efficiently?
Panel 4. How can we strengthen the business case for promoting Eco-DRR measures?
Panel 5. Perspective of policy/decision-makers on: What is needed for greater uptake on Eco-DRR in countries?

Each panel was followed by a structured brainstorming session which allowed participants to shape the debates and identify and prioritize key issues that then were used to shape the final workshop outcomes.

5. Detailed workshop summary

Day 1. Session 1. ***Exploring a spectrum of perspectives from engineers to conservationists***

Moderator: Karen Sudmeier-Rieux (UNEP)
Panelists:

- Adam Whelchel (The Nature Conservancy) Ecosystems and ecosystem dynamics in the context of DRR and CCA
- Claire Jeuken (Ecoshape) Ecosystem-based approaches - an engineering perspective
- Prasanth Nair (District Administrator, State of Kerala) What is needed to create demand for Eco-DRR/CCA measures and approaches? A policymaker's perspective

Figure 2. *From left to right:* Claire Jeuken, Adam Whelchel, Prasanth Nair *Photo credit*: Aileen Orate, UNU-EHS

- **Summary:**
  - Need for better typologies, calibration and integration (incl. projects with an integrated perspective) to move from "false ecoengineering" and "non-engineering" to "eco engineering"
  - Understanding the "habitat" ("site-specific envelopes") requires a transdisciplinary perspective and increased collaboration
  - Multi-functional aspects, (i.e., co-benefits) need to be emphasized that support communities living around areas where Eco-DRR measures are implemented
  - Need to involve stakeholders & communities from the beginning to ensure ownership, sustainability and acceptance
  - Need for more long-term planning
  - Importance of moving ahead with engineering under uncertainty
  - Need to understand the business potential of ecosystem-based solutions
  - Policy makers are often only presented the "grey-infrastructure" solution, thus the need for engineers to be more open to and willing to present "green infrastructure" solutions to policy makers.

- **Interactive exercise and ice breaker**

  Participants were divided into four groups and asked to consider issues (positive and negative) related to natural, hybrid and grey infrastructure solutions. They were also asked to consider where the information gaps are and how they might be addressed.

- **Key points:**
  - Cost: generally higher costs associated with grey infrastructure, especially when you figure in long term maintenance costs
  - Multiple benefits: natural infrastructure provides many other additional benefits (e.g. biodiversity and ecosystem services) beyond those provided by grey infrastructure

- Scale/time issues: in general, natural infrastructure is considered more adaptable than grey infrastructure, however it may require more time to become effective against hazard events
- Confidence/uncertainty: there is often higher confidence in grey infrastructure yet confidence in green infrastructure may largely depend on the hazard occurrence and intensity

In summary: the exercise gave participants the opportunity to discuss and share different perspectives on key issues related to grey, green, and hybrid infrastructure.

Figure 3. *Left:* Annisa Triyanti, *Right:* (*From left to right*: Udo Nehren, Sophie Lauwaars, Mark Smith).

Day 1. Panel 1. ***What ecological engineering standards exist and why are more needed?***

Moderator: Deborah Brosnan

Panelists:

- Kelly Burks-Copes (US Army Corps of Engineers)
- Eva Falke (Ramboll IMS Ingenieurgesellschaft mbH)
- Inigo Losada (Instituto de Hidraulica Ambiental, U. Cantabria)
- Christine Moos (Berne University of Applied Science)

Figure 4. Panel 1. *From left to right:* Deborah Brosnan, Christine Moos, Íñigo Losada Rodríguez, Eva Falke, Kelly Burks-Copes

- **Summary:**
  - Clear guidelines and code of practices in Eco-DRR application needed
  - Need to create more effective communication between ecologists and engineers with different approaches (numbers and tables etc.)
  - Need to engage stakeholders in the most transparent way possible, taking into account different stakeholder interests
  - Need for greater valuation of multifunctional ecosystem services
  - Issue of liability hampers uptake
  - Need for more pilot studies in large scales and long term planning
  - Need to improve quantification of risk / level of uncertainties for natural infrastructure
  - Need to include academic institutions in the earlier phase
  - Need to develop synthesis and
  - Ned to define the best scales

- **Brainstorming session summary:**
  - Need for guidelines and standards – but it is unclear what kind of guidelines and standards
  - Guidelines are needed for e.g.
    - defining the "envelope"
    - transferring methods and processes to different scales, regions etc.
    - dealing with uncertainty
  - Need to overcome or deal with the issue of liability
  - Education is crucial in order to handle holistic and multi-objective projects/approaches
  - How to deal with multiple objectives and multiple benefits – different objectives may be more or less important for different groups

- **Commentary panel:**
  - Juergen Boehmer (University of South Pacific)
  - Joy Navarro (Department of Environment and Natural Resources, Government of the Philippines)
  - Ayomi Onuma (Keio University)

Figure 5. Day 1

- **Key points:**
    - There is a need for guidelines and standards – however it is unclear what kind of guidelines and standards are being referred to as there are many
    - There is a need to overcome or deal with the liability of engineers, without accomplishing this it is hard for Eco-DRR approaches to be considered
    - Education is a crucial point as it is essential to bring together engineers, environmentalists and social scientists to come up with holistic and multi-objective projects/approaches
    - An important point is how to deal with multi-objectives -> we always name this and creating multi-benefits as goals to achieve, however this is quite fuzzy, there is a need to define which experts and stakeholders are needed to come up with the objectives, and consider that different objectives may be more or less important for different groups

Day 2. Panel 2. ***The way forward for the development of ecological engineering standards for DRR/CCA***

Moderator: Peter van Eijk (Wetlands International)
Panelists:

- Yukihiro Shimatami (Kyushu University)
- Bregje van Wesenbeeck (DELTARES)
- Dora Catalina Suarez (National University of Columbia in Manizales)

Figure 4. Panel 2. *From left to right:* Pieter van Eijk, Yukihiro Shimatami, Dora Catalina Suarez, Bregje van Wesenbeeck

- **Key points:**
    - Standards/tools/approaches for eco-DRR vary: including processes, ideal standards, technical guidelines, and tools for implementation
    - Important to learn from traditional Eco-DRR: multiple systems of defense, certain acceptance of risk
    - Important to combine engineering, social, and ecological aspects
    - Need to recognize the demand for three levels of standards:
        - Policy level
        - Strategic landscape planning (ICZM, IWRM, spatial planning cycles)
        - Engineering guidelines for implementation (design, construction, management and maintenance)
    - 10 Golden Rules of Eco-DRR: Strongly embedded in risk reduction discipline
        I. Embedded into landscape strategic plans
        II. Combine with risk reduction strategies (structural and non-structural measures)
        III. Use local ecosystems
        IV. First to conserve ecosystems that are present
        V. Use basic ecological principles of eco conservation and restoration
        VI. Connect science: ecologists and engineers for implementation
        VII. May require large-scale engineering efforts (might not be popular)
        VIII. Use standards from hard engineering structures
        IX. Measures to be implemented by accredited professionals
        X. Challenges included how to introduce eco-DRR into engineering systems; scale and the context specific nature of ecosystem solutions; designing risk reduction systems that are ecologically friendly.

- **Recommendations:**
    - Develop environmental and ecological studies for DRR (considering scale, impact)
    - Include decision makers and communities for better acceptance / ownership
    - Consider how to best integrate Eco-DRR into disaster risk management and plans and risk assessments into environmental plans / urban plans

- **Brainstorming session # 2 summary:**
    - Community involvement/training/education
    - Fill science and experience gaps
    - Develop technical standards – professionals-governments
    - Curriculum for engineers
    - Collect/review/synthesis of National policy for best practices
    - Atlas of Eco-DRR projects and monitoring – synthesis
    - Pilot projects/demonstration sites – collaboration-multiple objectives-monitoring
    - Prove legitimacy of Eco-DRR
    - Guidelines for community-based Eco-DRR

- **Top Five Priorities identified:**
    - Identify boundary conditions
    - Synthesis of results of previous Eco-DRR projects
    - Develop guiding principles

- Formalize Eco-DRR in education process
- Develop methods to articulate multiple benefits

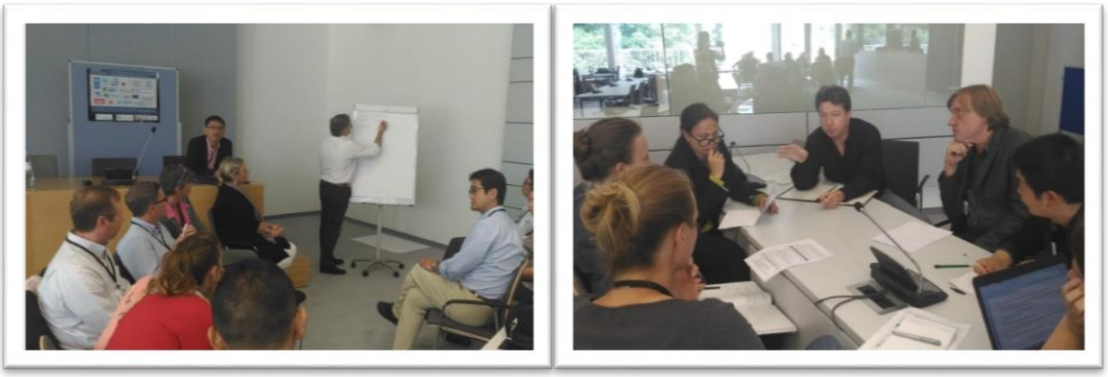


Figure 7. Day 2. Brainstorming sessions

Day 2. Panel 3. ***How can we work together more efficiently?***

What is your experience with cooperation communication and information-sharing among different stakeholder groups (experiences-needs-obstacles-best practices)?
Which kind of communications and information platforms and tools do you use and what is needed to improve efficiency in communication and information flow?

Moderator: Udo Nehren, Technical University, Cologne/Centers for Natural Resources and Development

Panelists:

- Nasser Kinaalwa (Sustainable Ecological and Educational Trends)
- Arup Misra (The Institutions of Engineers of India, Assam State Centre)
- Torsten Schlurmann (Franzius Institute, Leibniz University Hannover)
- Martijn van Staveren (Wageningen University)

- **Key issues:**
  - Trust-building and communication is important in multi-purpose Eco-DRR projects yet time-consuming
  - Ecological concepts are not yet promoted in engineers' curriculums (and engineering concepts not in ecological curricula)
  - How to standardize ecological parameters for engineering?
  - What mechanisms to identify boundary conditions?
  - Introduce eco-DRR in existing engineering networks

Figure 5. *From left to right*: Udo Nehren, Torsten Schlurmann, Martijn van Staveren, Nasser Kinaalwa, Arup Misra

- **Brainstorming session # 3 summary:**

  This session brought us closer to tangible outcomes through the formation of five discussion groups:

  1. Identifying boundary conditions: Create typology of eco-DRR features & strategies: What is done, What does it do etc.

  2. Synthesis of results of previous Eco-DRR projects: EcoDRR@works!
     - Where are Eco-DRR projects (strategy for info collection, classification scheme, user-specific criteria, include, review and use existing databases)
     - Identify target groups for this information and work with target groups
     - Establish reference sites (classification criteria, engage in long-term monitoring)

  3. Develop guiding principles for ecological engineering: document processes, identify partners, 10 golden rules working group, process guidelines, and build guidance / best practices

  4. Formalize Eco-DRR in education process: introduce ecological concepts and principals in engineering curricula and engineering concepts in ecology
     - Engage different disciplines and scientists to build interdisciplinary modules
     - Trigger collaboration between educational institutions and private sector --> broad collaboration
     - PEDRR as one platform for capacity building e.g. MOOC, Webinars etc. → Sharing the knowledge

  5. Recommending frameworks to articulate multiple benefits of Eco-DRR
     - Methods already exist to account benefits
     - Identify case studies which cover the entire cycle of assessment of ecosystem functions – services – benefits – values – policy – Eco-DRR
     - Identify and address constraints for decision makers to implement Eco-DRR projects

Day 3. Panel 4. *Promoting uptake of ecological engineering in policies and the private sector*

- What are the business criteria that determine engineering solutions?
- How can we strengthen the business case for promoting Eco-DRR measures?

- What will decision-makers (i.e., clients), including budgetary decision-makers need in order to incorporate eco-solutions?
- Is insurance a driver?

Moderator: Karen Sudmeier-Rieux, UNEP
Panelists:

- Shannon Cunniff (Environmental Defense Fund)
- Lucy Emerton (Environment Management Group)
- Dan Friess (National University of Singapore)
- Katrin Scholz Barth (Katrin Scholz-Barth Consulting)

Key issues:

- A number of (fundamental) needs were highlighted by the panel:
  - Need to understand/speak the language of the private sector and the thought process of different stakeholders, including private sector (financiers, insurers,), i.e. we need to adopt their vocabulary
  - Need to prove the efficiency of ecosystem-based solutions, but also provide answers to what are the (co-)benefits
  - Need to build support for ecosystem-based solutions through participatory planning
- Three critical factors for strengthening the business case for promoting Eco-DRR measures
  - *Evidence*: Does the ecosystem service exist that generates DRR benefits? → the bio-physical, economic (costs avoided, value added) and social evidence (impact on local communities) has to be provided
  - *Incentives*: we have to go beyond evidence; what is the added value for private sector, communities, etc. (what are the incentives, cost-effectiveness) → how do you give different stakeholders incentives for Eco-DRR solutions that are already provided for conventional grey solutions (e.g. tax relief, pay-off); incentives for Eco-DRR must be identified,
  - *Finance*: how are we going to pay for it?
- "Payment for Ecosystem services" (PES) can act as a framework and language to make a business case (the "what", "who" and "how" have to be considered), but there are certain critical issues/open questions, such as i) whether ecosystems are resilient/reliable enough for businesses, ii) issues around liability
- One of the major strengths of Eco-DRR is that it is located at the intersection of many different disciplines and that is usually where innovation happens

Recommendations:

- Eco-DRR ecosystem sustainability prespective in procurment process/contract document
- Build evidence, identify incentives and identify (innovative) financing solutions
- Build the support solution with multi-objectives
- Think as an engineer
- Insurance companies are a necessary ally, but the incentives need to be reframed/repackaged accordingly

Figure 6. Day 3, Panel 4. *From left to right*: Karen Sudmeier-Rieux, Lucy Emerton, Dan Freiss, Shannon Cunniff, Katrin Scholz-Barth

Brainstorming session # 4. Participants worked on the five themes to identify next steps, teams and tangibles:

List of the groups

1. Identifying boundary conditions
2. Synthesis of results of previous Eco-DRR projects: EcoDRR@works!
3. Develop guiding principles for ecological engineering
4. Formalize Eco-DRR in education process
5. Recommending frameworks to articulate multiple benefits of Eco-DRR

Description of the five working groups

1. Identify boundary conditions

Linkages between former group 3 and 5 identified, the groups joined each other and then split in a different way building Group 1a, Group 1b and Group 3

Group 1.a. Principles

Develop general guiding principles for Eco-DRR

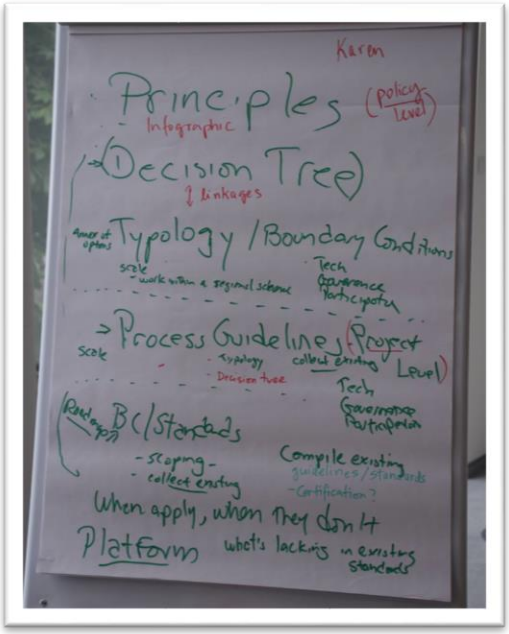
- Look at existing principles/guidelines (10 golden rules, PEDRR briefs, CBD document) - Already existing guidelines to be used, further developed
- Revise existing principles/guidelines
- Develop an info-graph; easy to communicate → basic principles should reach out
- Scoping of work →planning process needs further work

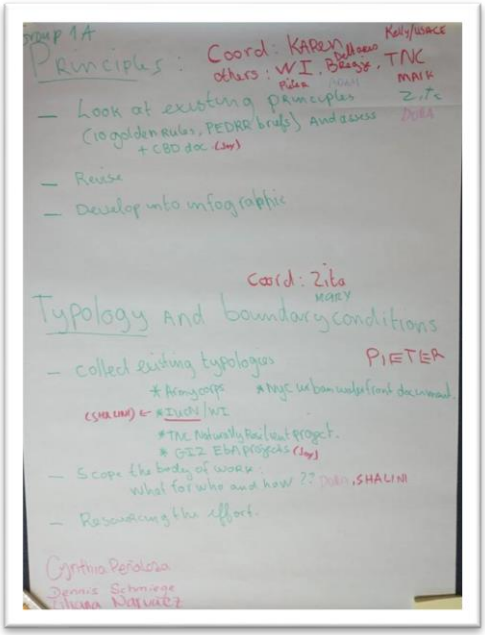
Group 1.b. Typology and Boundaries

- Collect existing typologies (existing typologies from e.g. ArmyCorps, IUCN, TNC, WI)
- What kind of ecosystem based measure could be meaningfully used under which conditions?
- Table showcasing the properties and potential services provides by certain ecosystem types in light of different hazards,

- Develop e.g. a tabular info-graphic to serve as guideline for practitioners & policy makers covering different ecosystem-based options per hazard and location

Poster documentation for group 1a and 1b:

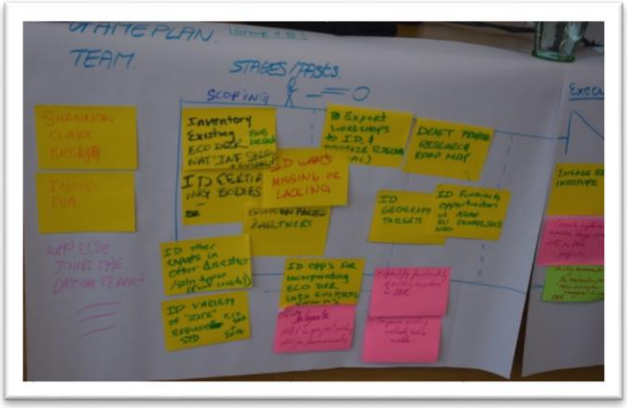




1.c Development of engineering guidelines / standards

- Scoping phase: gathering information on standards, identify gaps, expert workshops, work on each of the disaster types…
- Currently in the group expertise on coastal hazards, but lacking for other hazards
- Development of research roadmap, prioritize action
- Engage research institutions
- Source funding

Poster documentation related to the standards:



2. Eco-DRR@works! - Synthesis of previous Eco-DRR projects

Objective: establish 'Eco-DRR@works!' that will provide a 'Knowledge base!' through multi-mechanism for different target audiences

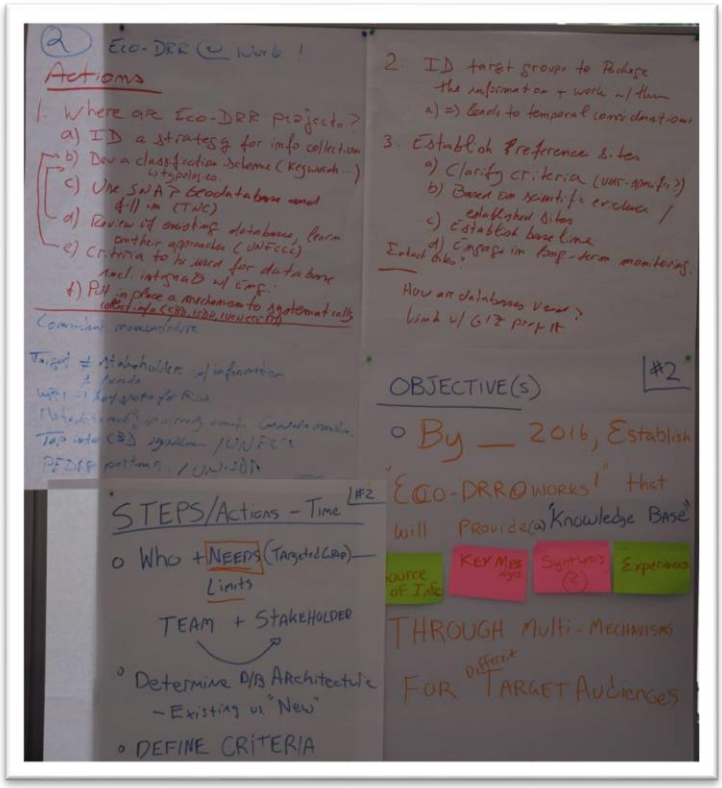
- Source of info
- Key message (golden rules, …)
- Synthesis (Typologies)
- Experiences

5 steps to be finalised:

1. Who + NEEDS/limits (target groups)
2. Determine D/B Architecture (Existing vs. New) what kind of platform can be used
3. Define criteria
4. Put in place a mechanism to systematically collect info (CBD, ISDR)
5. Establish reference sites
   - Clarify criteria
   - Based on scientific evidence / establish reference sites
   - Establish baseline
   - Engage in long-term monitoring

➔ 2-3 pager to raise funding for this activity

Poster documentation related to EcoDRR@works!

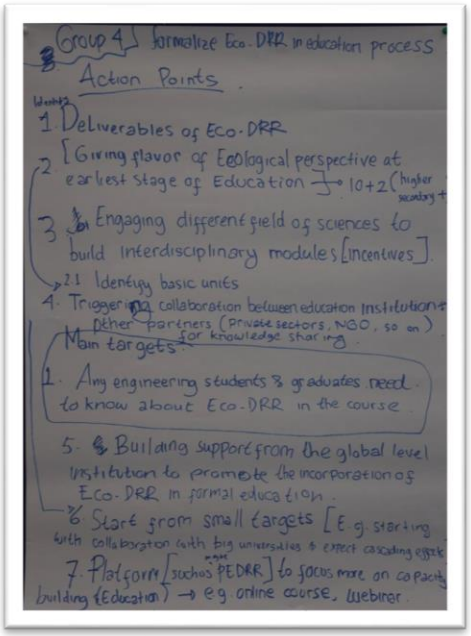


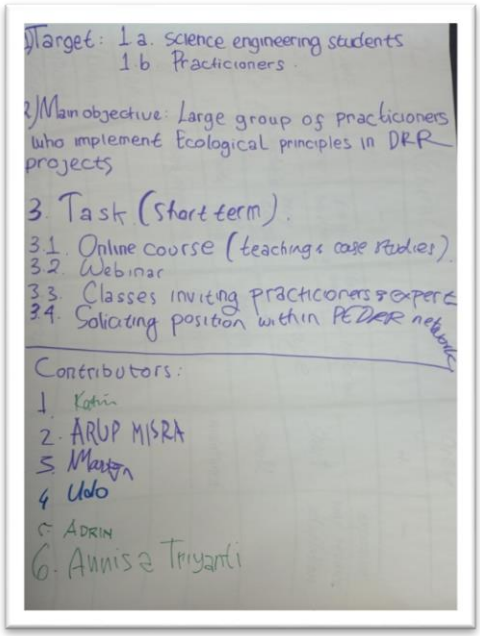
3. Eco-DRR in education

Target

- Science engineering students
- Practitioners (policy makers, NGS's, young researchers, professors, …)
- Main objective: Large group of practitioners who implement ecological principles in DRR projects
- Tasks (short term):
- Online course (teaching & case studies (practical work, apply theory)
- Webinar
- Classes inviting practitioners & experts
- Soliciting position within PEDRR network

Poster documentation related to education (Day 2 and Day 3):





4. Develop methods to articulate multiple benefits

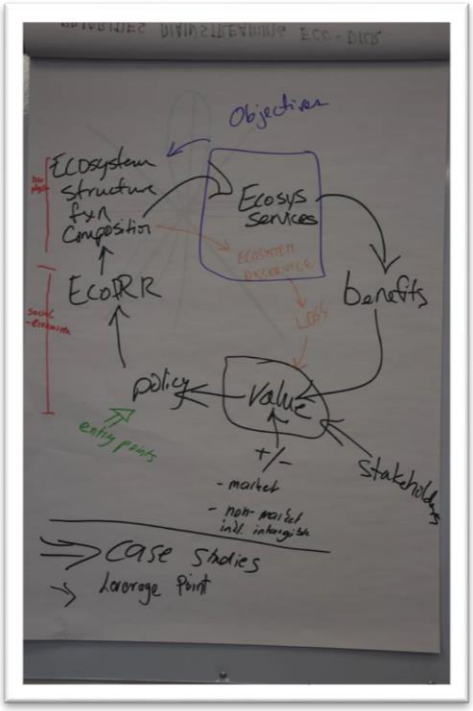
Communicate Test Mainstream	a(n)	approach framework paradigm	to	show articulate reconcile manage leverage	Eco-DRR (function, component, characteristics, elements etc.)	benefits/losses goods services disservices value stuff	for	policy decision making influencing risk reduction management engineering private sector education

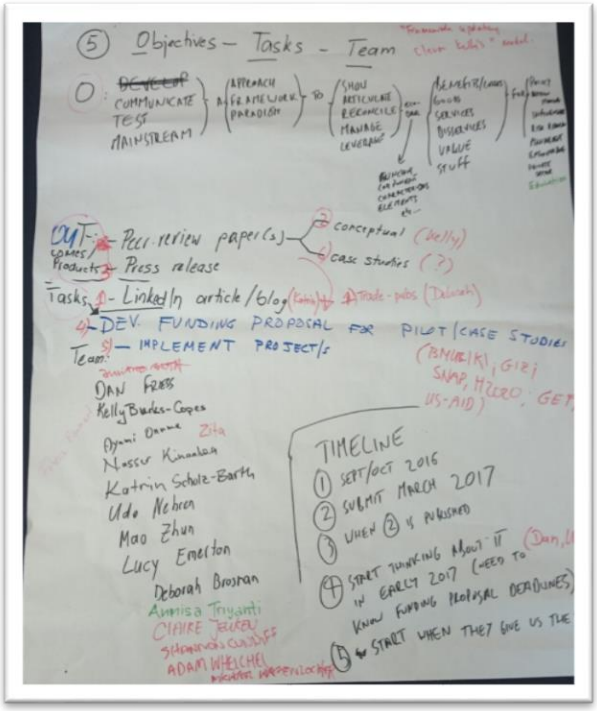
Tasks:

- LinkedIn article, blog (Katrin) and Trade-pubs (Deborah) by Sept/Oct 2016
- Peer review paper I – conceptual (Kelly) – submit March 2017
- Press release – when 2) is published

- Development of a funding proposal for pilot/case studies (BMUB-IKI, GIZ, SNAPP, H2020, GEF, US-AID) – start thinking about it in early 2017 (need to know funding proposal deadlines) – Dan, Udo
- Implement project(s) – start when funding available
- Peer review paper II – case studies

Poster documentation related to multiple benefits (Day 2 and Day 3):





Participants also brainstormed on existing initiatives and possible topics for a special edition publication (see annexes 3 and 4).

Panel 5 – Perspective of policy/decision-makers on: What is needed for greater uptake on Eco-DRR in countries?

Moderator: Fabrice Renaud

Panelists:

- Mary Amoroso (Housing and Land Use Regulatory Board, Government of the Philippines)
- Naoya Furuta (IUCN)
- Denis Peter (European Commission)

Key issues:

- Points were raised on the importance of integrating Eco-DRR in land use plans and planning;

- Implementation of guidelines becomes challenging when policies are conflicting - government favours one document instead of multiple sectoral plans (e.g. coastal management plan, forest land use plan, disaster risk management plan)
- Example of Japan: close collaboration with several ministries through workshops, conferences, symposia and case studies provided great opportunities to promote ecosystems and Eco-DRR and to influence policy makers.
- Multiple benefits of ecosystems provide key entry point to policy: Ministry of Environment published guidelines in 2016; decision of the CBD could be influenced together with the Japanese government; Japan International Cooperation Agency implemented Eco-DRR strategy
- Global frameworks are used as inspiration to develop EU policies.
- Political strategies and documents are essential to take up Eco-DRR: e.g. biodiversity strategy → uptake of relevance of biodiversity; green infrastructure strategy: use ecosystem management approaches and concept of ecosystem services.
- The main driver to put green infrastructure in EU calls was the EU-biodiversity strategy (Ministry of Environments set the impulse to develop an EU strategy).

Key recommendations:

- Example of a stepwise approach to achieve that an up to date land use plan is established and ecosystems and Eco-DRR integrated into this land use planning
  - Step 1: Preparation: create technical working group, prepare project proposal, achieve an executive order, conduct orientation and briefing with local officials to discuss how important land-use is, propose a budget,
  - Step 2: Analysis of stakeholders and convincing them about the importance of a land use plan
  - Step 3: Planning of strategies, where all relevant sectors are involved to assess the current needs of the communities, setting the common vision (what should be achieved, e.g. DRR, increase of biodiversity, etc)
  - Step 4: Matrix analysis
  - Step 5: Development of policy options and priorities of intervention
  - Step 6: Public consultations to coordinate interventions with local communities.
  - Step 7: Capacity building – train the trainers
- Lessons learned through close collaboration with ministries and the government in Japan:
  - One can make a difference with the right info communicated to the right person at the right time and through collaborating with partners.
  - Big disasters provide an entry point to uptake innovative measures (e.g. Eco-DRR).
  - Global policy can leverage national policy.
  - Practical experiences are essential, however Fukushima did not influence policy making with regard to ecosystems or Eco-DRR
  - Directives support the development of a strategic management plan and push member states to take different solutions.
  - Innovative aspects are essential: Novel way to include users and stakeholders, try to identify problems, establish new partnerships, recognize market and business opportunities, develop a new green market. The question is whether ecosystems can be considered as an insurance value.
  - Funding mechanisms offer new opportunities for Eco-DRR: EU regional development funds (bottom up – initiative comes from member states); LIFE program (focus on pilot projects – demonstration projects)

Closing remarks were given by Jakob Rhyner (UNU-EHS) and Karen Sudmeier-Rieux (UNEP)

This workshop was one small step, providing new energy and impetus to move forward in establishing more mainstream methods/ standards/ best practices in ecological engineering for Eco-DRR.

6. Outcomes

Already on Day 2, participants had identified four key themes that they felt are the most critical to advancing next steps on ecological engineering for Eco-DRR. These themes were then further developed on Day 3 and lead to following working groups, with a focal point and a rough timeline:

1a. Working group on Eco-DRR golden rules or principles

Articulating "Golden Rules" on ecological engineering for Eco-DRR, or principles that can be used for policy advocacy. There needs to be a careful assessment of already existing definitions and principles of Eco-DRR outlined in previous PEDRR policy papers.

Working group members (Lead: Karen Sudmeier-Rieux with Pieter van Eijk and Bregje van Wesenbeeck)

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1b. Working group on typology and boundaries

Identifying and collecting existing typologies to support decision on the kind of ecosystem based measure which could be meaningfully used under certain conditions, showcasing the properties and potential services provided by certain ecosystem types in light of different hazards, and to develop e.g. a tabular info-graphic to serve as guideline for practitioners & policy makers covering for different ecosystem-based options per hazard and location.

Working group members (Lead: Zita Sebesvari)

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1c. Working group on engineering guidelines / standards

This group aims to supportp to accelerate the process of establishing ecological engineering standards. It aims at identifying gaps in existing standards, gathering information on standards, organizing an expert workshop to develop a research roadmap as well as priorities for action.

Working group members (Lead: Kelly Burks-Copes)

Last name	First name	E-mail
Cunniff	Shannon	scunniff@edf.org
Jeuken	Claire	claire.jeuken@ecoshape.nl
van Wesenbeeck	Bregje	Bregje.vanWesenbeeck@deltares.nl
Losada Rodriguez	Iñigo	inigo.losada@unican.es
Falke	Eva	Eva.Falke@ramboll.com
Sebesvari	Zita	sebesvari@ehs.unu.edu
Burks-Copes	Kelly	Kelly.A.Burks-Copes@usace.army.mil

2. "EcoDRR @ works".

This group was formed to document and analyze Eco-DRR projects, initiatives, or a knowledge base as a source of information with key messages and experiences that will be useful for policy makers and practitioners as they seek guidance on conducting Eco-DRR projects. It will also look into proposing the establishment of Eco-DRR/CCA benchmark sites.

Working group members (Lead: Fabrice Renaud with Adam Whelchel)

Last name	First name	E-mail
Renaud	Fabrice	renaud@ehs.unu.edu
Whelchel	Adam W.	awhelchel@tnc.org
Boehmer	Juergen	boehmer_j@usp.ac.fj
Casteller	Alejandro	alejandro.casteller@slf.ch
Haas	Susanne	haas@ehs.unu.edu
Walz	Yvonne	walz@ehs.unu.edu
Hagenlocher	Michael	hagenlocher@ehs.unu.edu
Groth	Juliane	groth@ehs.unu.edu
Furuta	Naoya	Naoya.FURUTA@iucn.org
Shimatani	Yukihiro	shimatani@civil.kyushu-u.ac.jp
Emerton	Lucy	lucy@environment-group.org
van Staveren	Martijn	martijn.vanstaveren@wur.nl
Scholz-Barth	Katrin	katrin@scholz-barth.com
van Eijk	Pieter	Pieter.vanEijk@wetlands.org
Dhyani	Shalini	shalini3006@gmail.com
Dail	Jason	S6jadail@uni-bonn.de
Peter	Denis	Denis.Peter@ec.europa.eu

3. Accelerate uptake of Eco-DRR in the education process.

This group identified the need to further promote the inclusion of Eco-DRR in curricula including science, engineering and numerous interdisciplinary modules.

Working group members (Lead position is vacant)

Last name	First name	E-mail
Scholz-Barth	Katrin	katrin@scholz-barth.com
Nehren	Udo	udo.nehren@th-koeln.de
Triyanti	Annisa	annisa.triyanti@childrenyouth.org
van Staveren	Martijn	martijn.vanstaveren@wur.nl
Tohari	Adrin	adrin.tohari@gmail.com
Misra	Arup	arupkmisra@gmail.com

4. Working group on multiple benefits

This group aims to communicate/test/ mainstream a(n) approach/framework/paradigm to show/articulate/reconcile/manage/leverage Eco-DRR benefits/losses/(dis)services/value for policy/decision making/influencing/risk reduction/management/engineering/private sector/education.

Working group members (Lead: Deborah Brosnan with Kelly Burks-Copes and Lucy Emerton)

Last name	First name	E-mail
Groth	Juliane	groth@ehs.unu.edu
Friess	Dan	dan.friess@nus.edu.sg
Burks-Copes	Kelly	Kelly.A.Burks-Copes@usace.army.mil
Onuma	Ayumi	onuma@econ.keio.ac.jp
Kinaalwa	Nasser	kinaalwa@gmail.com
Scholz-Barth	Katrin	katrin@scholz-barth.com
Nehren	Udo	udo.nehren@th-koeln.de
Zhun	Mao	zhun.mao@cirad.fr
Emerton	Lucy	lucy@environment-group.org
Brosnan	Deborah	deborahbrosnan@gmail.com
Triyanti	Annisa	annisa.triyanti@childrenyouth.org
Jeuken	Claire	claire.jeuken@ecoshape.nl
Cunniff	Shannon	scunniff@edf.org
Whelchel	Adam W.	awhelchel@tnc.org
Hagenlocher	Michael	hagenlocher@ehs.unu.edu
Renaud	Fabrice	renaud@ehs.unu.edu
Sebesvari	Zita	sebesvari@ehs.unu.edu

Journal special issue on ecological engineering for Eco-DRR

- Fabrice Renaud will be contacting individuals interested in contributing to a special journal edition. It is likely that the work of the above mentioned work groups will contribute to this special edition. Next step includes a call for abstracts with a deadline of August 31, 2016.

Journal special issue on ecological engineering for Eco-DRR

- Fabrice Renaud will be contacting individuals interested in contributing to a special journal edition. It is likely that the work of the above mentioned working groups will contribute to this special edition. Next step includes a call for abstracts with a deadline of August 31, 2016.

7. Conclusions

Further planned outcomes include a special issue to which participants suggested over 20 various article contributions related to Eco-DRR and ecological engineering. Many of the abovementioned working groups will lead to an article contribution for this special edition. In addition, participants listed a number of various on-going Eco-DRR initiatives in which they and their organizations are involved.

The workshop ended with concluding remarks from UNU-EHS Director Jakob Rhyner and Karen Sudmeier (on behalf of UNEP) with the importance of making progress toward mainstreaming Eco-DRR in development, engineering and disaster discourses, education and publications, such as this workshop.

8. Acknowledgements.

A special thanks to the rapporteurs for each session: Michael Hagenlocher, Simone Sandholz, Annisa Triyanti, Riyanti Djalante, Alejandro Casteller, Juliane Groth, Shalini Dhyani, Adrin Tohari, Yvonne Walz, Kirstin Surmann and a special thanks goes to Karen Sudmeier for preparing the report and to Carl Anderson for editing the document.

9. Annexes

1. **Workshop agenda**
2. **List of participants**
3. **Existing initiatives related to Eco-DRR / Ecological engineering**
4. **Proposed article titles for special edition journal**

Photo gallery

Annex 1. Workshop Agenda

14 June 2016 **Day 1: Stocktaking and identifying gaps in ecological engineering for DRR**	
Introduction to the workshop (Moderator: Karen Sudmeier-Rieux, Rapporteur: Zita Sebesvari)	
10.00-10.25	Welcome addresses: Jakob Rhyner (UNU-EHS) and Muralee Thummarukudy (UNEP) Security briefing/Practical information: Zita Sebesvari (UNU-EHS)
10.25-10.30	The Partnership for Environment and Disaster Risk Reduction (PEDRR): Nao Furuta (IUCN)
10.30- 10.40	Objectives of the workshop: Fabrice Renaud (UNU-EHS)
10.40-10.45	Group Photo
Developing DRR/CCA solutions from "hard engineering" to "Eco-DRR /CCA", exploring a spectrum of perspectives from engineers to conservationists	
10.45-11.00	Presentation 1 - Ecosystems and ecosystem dynamics in the context of DRR and CCA: Adam Whelchel (TNC)
11.00-11.15	Presentation 2 – Ecosystem-based approaches - an engineering perspective: Claire Jeuken (Ecoshape)
11.15-11.25	Presentation 3 - What is needed to create demand for Eco-DRR/CCA measures and approaches? A policymakers perspective: Prasanth Nair (District Administrator, State of Kerala)
11:25-11:35	Quick Q&A – Clarifications and flagging key questions/issues for rest of workshop
11.35-12.30	Interactive exercise: Putting theory into practice – Mapping out what we know, what we think we know, and what we know we don't know (Karen Sudmeier-Rieux, UNEP) -Eco-DRR exercise to bring out potential solutions (and their pros and cons), key issues, knowledge/practice gaps.
12.30-13.30	**Lunch (provided) – UN canteen, 29th floor of Langer Eugen building**
13.30-14.00	Panel 1 –What ecological engineering standards exist and why is more needed? Moderator: Deborah Brosnan Panelists: Kelly Burkes-Copes (US Army Corp of Engineers) Eva Falke (Ramboll IMS Ingenieurgesellschaft mbH) Inigo Losada (Instituto de Hidráulica Ambiental, University Cantabria) Christine Moos (Bern University of Applied Science) Rapporteurs: Michael Hagenlocher & Annisa Triyanti
14.00-15.30	Brainstorming 1: What ecological engineering standards already exist, and which ones are being used/not used and why? What are the knowledge gaps and what are the challenges in developing and applying standards? What is missing? During this discussion, we will cover coastal, floodplains and mountain environments in as much of an integrated way as possible. If different thematic issues arise, breakout groups will be possible.
15.30-16.00	Tea break and Poster Session 1
16.00-17.00	Brainstorming 1 continued
17.00-17.30	Panelists comments on Day 1. Juergen Boehmer (University of South Pacific) Joy Navarro (Department of Environment and Natural Resources, Government of the Philippines)

	Ayomi Onuma (Keio University) Rapporteurs report on ideas and outputs generated during brainstorming 1
19.00-20.30	Joint dinner (provided): DelikArt Restaurant, LandesMuseum, Colmantstraße 14-16, Bonn (walking distance to Bonn main station)
15 June 2016 **Day 2: Developing ecological engineering standards for DRR**	
08.45-09.00	Refresher on outputs from Day 1: Dr Zita Sebesvari
09.00-09.30	Panel 2 – The way forward for the development of ecological engineering standards for DRR/CCA Moderator: Pieter van Eijk Panelists: Carmen Lacambra (Grupo Laera & Global Climate Adaptation Partnership) Yukihiro Shimatami (Kyushu University) Bregje van Wesenbeeck (DELTARES) Dora Catalina Suarez (National University of Columbia in Manizales) Rapporteurs: Riyanti Djalante & Alejandro Casteller
09.30-10.30	Brainstorming 2: What are the next steps in terms of addressing knowledge gaps and developing standards for Eco-DRR/CCA, what are the priorities, how can this be achieved? During this discussion, we will cover coastal, floodplains and mountain environments in as much of an integrated way as possible. If different thematic arise, breakout groups will be possible.
10.30-11.00	Coffee break
11.00-12.00	Brainstorming 2 continued
12.00-12.30	Rapporteurs report on ideas and outputs generated during brainstorming 2
12.30-13.30	Lunch (provided) – UN canteen, 29th floor of Langer Eugen building During lunch: informal dialogue on standards
13.30-14.00	Panel 3 – How can we work together more efficiently? Moderator: Udo Nehren Panelists: Nasser Kinaalwa (Sustainable Ecological and Educational Trends) Arup Misra (The Institutions of Engineers of India, Assam State Centre) Torsten Schlurmann (Franzius Institute, Leibniz University Hannover) Martijn van Staveren (Wageningen University) Rapporteurs: Juliane Groth & Shalini Dhyani
14.00-15.30	Brainstorming 3: What mechanisms do we need to create in order to accelerate cooperation between policy-makers, ecologists, engineers, the private sector and DRR and CCA specialists? What can partnerships such as PEDRR (and others) achieve and how?
15.30-16.00	Tea Break and Poster Session 2
16.00-17.00	Brainstorming 3 continued
17.00-17.30	Rapporteurs report on ideas and outputs generated during brainstorming 3
16 June 2016 **Day 3: Promoting uptake of ecological engineering in policies and the private sector**	
08.45-09.00	Refresher on outputs from Day 2: Dr Zita Sebesvari
09.00-09.30	Panel 4 – What are the business criteria that determine engineering solutions? How can we strengthen the business case for promoting Eco-DRR measures? What will

	decision-makers (i.e., clients), including budgetary decision-makers need in order to incorporate eco-solutions. Is insurance a driver? Moderator: Karen Sudmeier-Rieux Panelists: Shannon Cunniff (Environmental Defense Fund) Lucy Emerton (Environment Management Group) Dan Friess (National University of Singapore) Katrin Scholz Barth (Katrin Scholz-Barth Consulting) Rapporteurs: Simone Sandholz & Adrin Tohari
09.30-10.30	Brainstorming 4: How engineering professionals design and cost out eco-engineering measures? Do applications of such measures provide professionals with a competitive advantage in the marketplace? How can we strengthen/increase demand for Eco-DRR measures and eco-engineers?
10.30-11.00	Coffee break
11.00-12.00	Brainstorming 4 continued
12.00-12.30	Rapporteurs report on ideas and outputs generated during brainstorming 4
12.30-13.30	**Lunch (provided) – UN canteen, 29th floor of Langer Eugen building** **During lunch: informal dialogue on increasing demand for Eco-DRR measures and eco-engineers**
13.30-14.30	**Panel 5 – Perspective of policy/decision-makers on: What is needed for greater uptake on Eco-DRR in countries?** Moderator: Fabrice Renaud Panelists: Mary Amoroso (Housing and Land Use Regulatory Board, Government of the Philippines) Naoya Furuta (IUCN) Sophie Lauwaars (Hydraulic Engineering & Ecotechnic, Dutch Ministry of Infrastructure and the Environment) Denis Peter (European Commission) Rapporteur: Yvonne Walz, Marisol Estrella & Kirstin Surmann
14.30-15.30	Next Steps Moderator: Mark Smith (TNC)
15.30-15.45	Closing remarks: Jakob Rhyner (UNU-EHS) and Karen Sudmeier-Rieux (UNEP)

Annex 2. Workshop participants

Family name	First name	Affiliation	Country
Amoroso	Mary	Housing and Land Use Regulatory Board, Government of Philippines	Philippines
Boehmer	Juergen	The University of the South Pacific (USP)	Fiji
Brosnan	Deborah	Virginia Tech	USA
Burks-Copes	Kelly	US Army Corps of Engineers (USACE)	USA
Casteller	Alejandro	Swiss Federal Institute for Forest, Snow and Landscape Research (WSL), Institute for Snow and Avalanche Research (SLF)	Switzerland/ Argentina
Chandrakeerthi	Prabath	Coast Conservation and Coastal Resources Management Department, Government of Sri Lanka	Sri Lanka
Cunniff	Shannon	Environmental Defense Fund (EDF)	USA
Dhyani	Shalini	National Environment Engineering Research Institute (CSIR-NEERI)	India
Djalante	Riyanti	United Nations University, Institute for Environment and Human Security (UNU-EHS)	Germany/Indonesia
Emerton	Lucy	Environment Management Group	Sri Lanka
Estrella	Marisol	United Nations Environmental Program (UNEP)	Switzerland
Falke	Eva	Ramboll IMS Ingenieurgesellschaft mbH	Germany
Friess	Dan	National University Singapore (NUS)	Singapore
Furuta	Naoya	International Union for Conservation of Nature (IUCN), Japan	Japan
Groth	Juliane	United Nations University, Institute for Environment and Human Security (UNU-EHS)	Germany
Haas	Susanne	United Nations University, Institute for Environment and Human Security (UNU-EHS)	Germany
Hagenlocher	Michael	United Nations University, Institute for Environment and Human Security (UNU-EHS)	Germany
Jeuken	Claire	Ecoshape	The Netherlands
Kinaalwa	Nasser	Sustainable Ecological and Educational Trends (SEET)	Uganda
Lacambra	Carmen	Grupo Laera, Global Climate Adaptation Partnership (GCAP)	Colombia
Lauwaars	Sophie	Hydraulic Engineering & Ecotechnic, Dutch Ministry of Infrastructure and the Environment	The Netherlands
Losada Rodriguez	Iñigo	Environmental Hydraulics Institute, University Cantabria	Spain
Misra	Arup	Assam Science and Technology Institute, Institute of Engineering Association	India
Moos	Christine	Bern University of Applied Science	Switzerland
Nair	Prasanth	District Administrator, State of Kerala	India
Navarro	Joy	Biodiversity Management Bureau (BMB), Department of Environment and Natural Resources, Caves, Wetlands and Other Ecosystems Division	Philippines
Nehren	Udo	Institute for Technology and Resources Management in the Tropics and Subtropics (ITT), Center for Natural Resources and Development (CNRD)	Germany
Onuma	Ayumi	Keio University, Japan	Japan
Peter	Denis	European Commission, Directorate-General Research	Belgium
Renaud	Fabrice	United Nations University, Institute for Environment and Human Security (UNU-EHS)	Germany
Rhyner	Jakob	United Nations University, Institute for Environment and Human Security (UNU-EHS)	Germany
Sandholz	Simone	Center for Natural Resources and Development (CNRD)	Germany

Schlurmann	Torsten	FRANZIUS Institute, Leibniz University Hannover	Germany
Scholz-Barth	Katrin	Katrin Scholz-Barth Consulting	Germany/US/Qatar
Sebesvari	Zita	United Nations University, Institute for Environment and Human Security (UNU-EHS)	Germany
Shimatani	Yukihiro	Faculty of Engineering, Kyushu University	Japan
Smith	Mark P.	The Nature Conservancy (TNC)	USA
Suarez	Dora Catalina	Institute for Environmental Studies, National University of Columbia in Manizales	Colombia
Sudmeier-Rieux	Karen	United Nations Environmental Program (UNEP), University of Lausanne (UNIL)	Switzerland
Thummarukudy	Muralee	United Nations Environmental Program (UNEP)	Switzerland
Tohari	Adrin	Indonesian Institute of Sciences (LIPI)	Indonesia
Triyanti	Annisa	Focal Point- Science-Policy Interface Platform on Disaster Risk Reduction (SPI-DRR)	The Netherlands
van Eijk	Pieter	Wetlands International (WI)	The Netherlands
van Staveren	Martijn	Wageningen University	The Netherlands
van Wesenbeeck	Bregje	DELTARES	The Netherlands
Walz	Yvonne	United Nations University, Institute for Environment and Human Security (UNU-EHS)	Germany
Whelchel	Adam W.	The Nature Conservancy (TNC)	USA
Zhun	Mao	Botany and Modelling of Plant Architecture and Vegetation (UMR AMAP), National Institute of Agricultural Research (INRA)	France/China

Annex 3. List of existing initiatives related to Eco-DRR / Ecological engineering

Wetlands International	- Mangroves for coastal defense guidelines - Integrating ecosystems for community resilience guideline - Policy guide on river restoration - Guideline on restoring eroding tropical mud-coasts (in progress)
Young Professionals	Network IUCN-CEM
Ecosystem Services Partnership	Working group on ES and DRR/CCA (UNU, Fabrice, Zita)
Denis Peter	EU Research programme (projects) as multi-stakeholder dialogue that form to promote innovation with nature to address societal challenges possible way to interact with PEDRR
Annisa Triyanti	Youth Science Policy Interface Platform (SPI) → DRR UNMGCY
IUCN	- Blue Carbon Initiative - Mangrove Specialist Group
Claire Jeuken	- Online Knowledge Repository (cases, tools) - Connection to Ecoshape Network (→Engineers)
ESP – TWG 8: Ecosystem Services	Partnership – Working Group on Eco-DRR
Coastal Resilience Network	www.CoastalResilience.org
US Army Corps	Engineering with Nature
PIANC	Working with Nature
Kelly Burks-Copes	- North Atlantic Coast Comprehensive Study - Natural Infrastructure Metrics (NIMS) Working Group - National Ecosystem Services Partnership (NESP)
Landscape Architecture Foundation	Landscape performance Series - Could be Eco-DRR or become Eco-DRR
Marc Smith (TNC)	- Typology info - Case study framework - List of strategies from naturally resilience community project - Materials from Envision Infrastructure certification system - New York Urban Waterfont guide as example of typology
Kelly Burks-Copes	Association of Climate Change Officers (NNBF Bootcamp)
	GIZ Climate support on EbA
	ASEAN Task Force on Peatlands
	Tidal Flats Fans Club
	- Community Resilience Building Workshop (www.Community ResilienceBuilding.com) - Community-based process to generate resilience solutions including Eco-Engineering
Udo Nehren	- CNRD-University Network - IUCN-CEM
	SNAP –coastal defence
	- RISE/UNEP - Natural Coastal Infrastructure - Taxonomy & Typologies - “a primer” on risk reduction performance & other ecosystem benefits

Dora C. Suarez	- Promotion of Eco-DRR Program for the Mosana Region in Colombia. - Helping to link Columbia's adaptation fund to PEDRR
Deborah Brosnan	- Coastal resilience tool (GIS based interactive) - Project that integrate ecosystem + engineering (can send list) - With ASCE
	- EU GI strategy
World Business Council for Sustainable Development and UNEP	- Training package for private sector - Case studies and tools on NI for private sector on the WBCSD website
UNEP and interested PEDRR partners	New MOOC: Translating the post-2015 international framework agreements into action! Integrating development, risk and ecosystems - Fundraising under way

Annex 4. Proposed article titles for special edition

Suggestions for papers

Paper idea	Names
Economic Effects of Eco-DRR in terms of IO analysis - Income creation, employment, etc. - Leakage of ripple effects maybe smaller n Eco-DRR than Gray-DRR	Ayumi Onuma
Eco-DRR system must be coordinated with the community	Prabath
Landscape Architecture Foundation - Tool: landscape performance series → help evaluate performance, show value, introduce sustainable landscape solutions (Eco-DRR?)	
10 Golden rules / Guiding principles	Bregje, Inigo, Fabrice, Kelly, Karen, Deborah, Lucy, Losada
Business approach to Eco-DRR	
Art Community - Making Eco-DRR part of public art, Infrastructure like public realm, walkways, parks, etc.	
Perspective paper - From an ecological perspective, directed to Engineers, how ecologists conceive of, plan and design Eco-DRR - Pts to make: 1. Focus is on process + fxn 2. Scaling-up 3. Ecosystem services (co-benefits) 4. Costs + leverage Counter paper to the Engineer paper from SNAP	Bregje, Inigo, Claire, Burks-Copes, Zhun, Deborah
Comparative paper about controlled flooding restoration in polders Netherlands & Bangladesh	M van Staveren
10 lessons why PES(?) for Eco-DRR won't work	Dan, Lucy
Innovative Financing for Eco-DRR	Dan, Lucy
Identification of Eco-DRR possibilities in Columbia, for further promotion of guidelines and standards	Dora C. Suarez
Eco-DRR should be coordinated with the development projects. This problem facing by the developing countries	Prabath
Traditional knowledge / approach to Eco-DRR/CCA	Adam W.
Ecosystem Goods + Services Co-benefits aligned with Eco-DRR - CEM indicating entry points - Service/Disservices - Leverage pts - Case study(s): Singapore	Deborah, Zhun, Burks-Copes
Conceptual model that incorporate entry points +/- services + case study/studies	Lucy
What ecologists need to know about financing	Deborah, Lucy, Kelly, SEC
Guidelines / principles for ecologists working with engineers	Kelly, Bregje, Claire, Losada, Deborah
Corporate initiatives for DRR – Case study from Zn mines of India	Shalini Dhyani et al.
Eco-DRR in urban areas – India	Shalini Dhyani, Deborah
Participatory learning & crowd-co-design to advance multi-objective, multi-benefit hazard mitigation & economic development	Shannon, Kelly
Moving towards multiple lines of defence (maybe 10 golden rules for this too?)	Shannon, Kelly
Building Engineering Certainty	Shannon

➔ Research Agenda Accelerating ➔ Communicating needs	
Willingness to pay survey for Eco-Engineering solutions	Adam
Paper tackling boundaries – defining ecosystem and social boundaries of ecosystem based DRR solutions – review, gap ID	Zita
Traditional knowledge and modern Eco-DRR approaches for landslide risk mitigation	Shalini, Arup
Role of Eco-DRR Initiatives/measures for combating flood devastation in Assam (India)	Arup
A review on the effects of forests on natural hazard risk and methods for quantifying its risk reduction	Moos, Zhun
Governance for effective implementation of Eco-DRR projects	Annisa
Eco-engineered structures in resilient landscapes	Udo
PES for DRR-opportunities and limitations	Udo
Traditional practices of DRR in Japan and lessons learned to promote Eco-DRR	Yukihiro Shimatani, Naova Furuta
Forest-avalanche interactions in the southern Andes	Alejandro Casteller
Quantifying ecosystem services related to bio-engineering practices in Nepal	Karen Sudmeier Sanjay Devkota Marta Vicarelli

Platforms to publish:

- DevEx - media platform for the global development community
- GreenBiz - A resource of environmental information, tools and data aimed at the mainstream business community
- Linked in blog(s)
- BSR - Business for Social Responsibility: Provides information, tools, training and advisory services to make corporate social responsibility an integral part of business operations and strategies
- ASCE – American Society of Civil Engineers
- HRB – Harvard Business Review
- Stanford Business
- Ethical Corporation
- Eco-Business
- Financial Times
- New York Times: Science, Magazine, “what were we thinking”

Organizing PEDRR Partners:

In collaboration with: Dr Deborah Brosnan

With support from:

The Partnership for Environment and Disaster Risk Reduction / PEDRR