ICCG Webinar Series on Disaster Risk Reduction

What is next for Ecosystem-based Disaster Risk Reduction and Climate Change Adaptation?

Fabrice Renaud – UNU-EHS

April 28th, 2017

Some definitions

Nature-based Solutions and Ecosystem-based DRR/CCA1/2

UNITED NATIONS UNIVERSITY
UNU-EHS
Institute for Environment and Human Security

Nature-based Solutions (NbS)

Nature-based Solutions are (…) actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits

Category of NbS approaches	Examples
Ecosystem restoration approaches	Ecological restoration Ecological engineering Forest landscape restoration
Issue-specific ecosystem-related approaches	Ecosystem-based adaptation Ecosystem-based mitigation Climate adaptation services Ecosystem-based disaster risk reduction
Infrastructure-related approaches	Natural infrastructure Green infrastructure
Ecosystem-based management approaches	Integrated coastal zone management Integrated water resources management
Ecosystem protection approaches	Area-based conservation approaches including protected area management

Cohen-Shacham, E., Walters, G., Janzen, C. and Maginnis, S. (eds.) (2016). Nature-based Solutions to address global societal challenges. Gland, Switzerland: IUCN.

Nature-based Solutions and Ecosystem-based DRR/CCA 2/2

UNITED NATIONS UNIVERSITY
UNU-EHS
Institute for Environment and Human Security

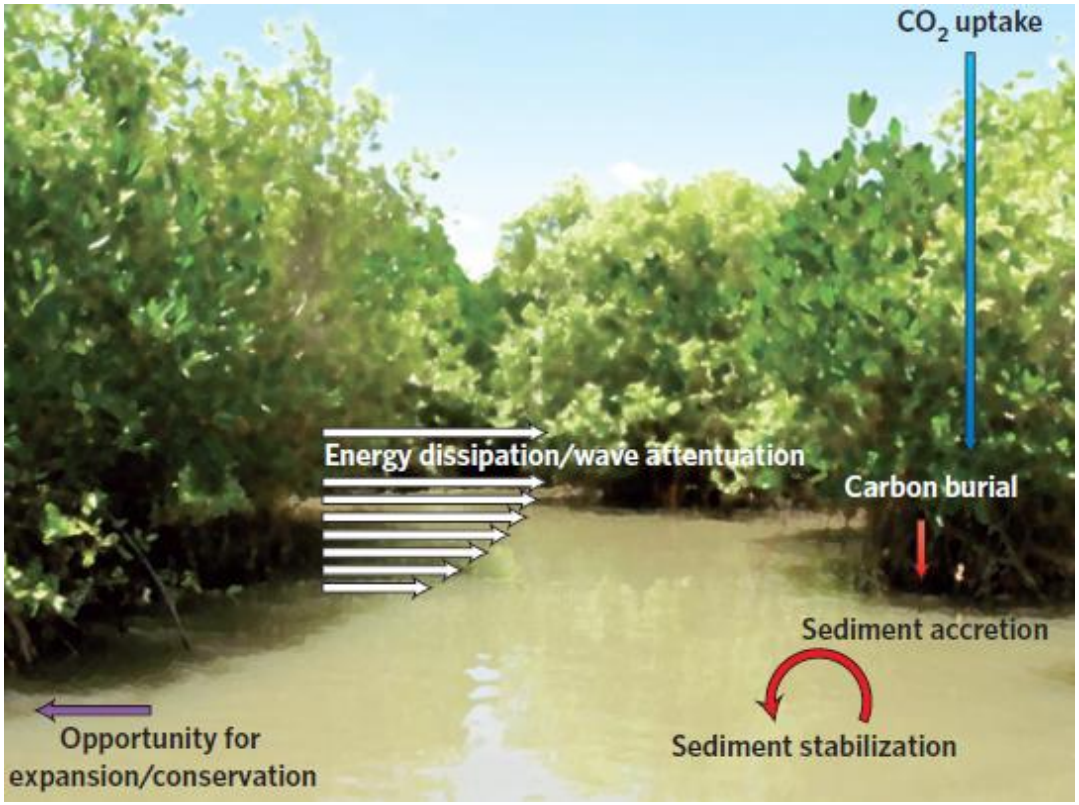
Eco-DRR/CCA

Ecosystem-based DRR/CCA is the sustainable management, conservation, and restoration of ecosystems to reduce disaster risk and adapt to the consequences of climate change, with the aim of achieving sustainable and resilient development

Eco-DRR/CCA, Ecosystem Services, and the components of risk

UNITED NATIONS UNIVERSITY
UNU-EHS
Institute for Environment and Human Security

- Regulating services
  - Erosion regulation
  - Environmental hazard regulation
  - Carbon storage
  - Exposure reduction



Source for the figure: Duarte et al (2013): The role of coastal plant communities for climate change mitigation and adaptation. *Nature Climate Change* DOI: 10.1038/NCLIMATE1970

Eco-DRR/CCA, Ecosystem Services, and the components of risk

UNITED NATIONS UNIVERSITY
UNU-EHS
Institute for Environment and Human Security

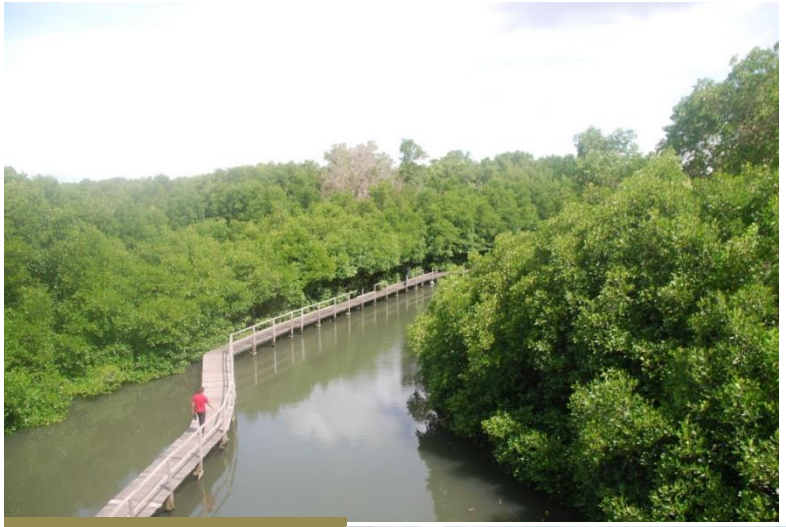
- Regulating services
  - Carbon storage
  - Erosion regulation
  - Environmental hazard regulation
  - Exposure reduction
- Provisioning services
  - Fish and seafood
  - Fire wood

Photo: Fabrice Renaud/UNU-EHS

Eco-DRR/CCA, Ecosystem Services, and the components of risk

UNITED NATIONS UNIVERSITY
UNU-EHS
Institute for Environment and Human Security

- Regulating services
  - Carbon storage
  - Erosion regulation
  - Environmental hazard regulation
  - Exposure reduction
- Provisioning services
  - Fish and seafood
  - Timber
- Cultural services
  - Recreation & tourism
  - Cultural heritage



Photos: Fabrice Renaud/UNU-EHS

Through Eco-DRR/CCA one can plan a restoration project of a coastal area by accounting for both DRR and CCA objectives

But does it work?

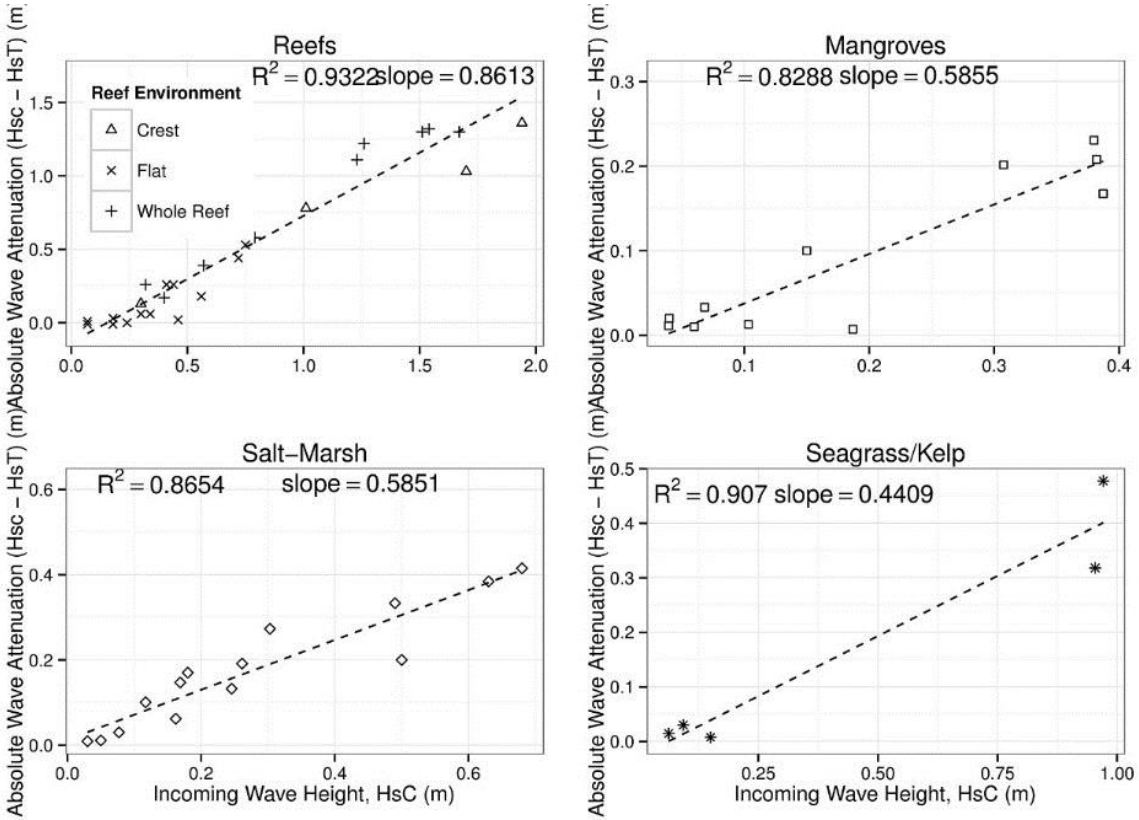
Many examples compiled

UNITED NATIONS UNIVERSITY
UNU-EHS
Institute for Environment and Human Security

Ecosystems & Wave height reduction

UNITED NATIONS UNIVERSITY
UNU-EHS
Institute for Environment and Human Security

- n = 69 studies
- Coral reefs ~70%
- Salt marshes ~72%
- Mangroves ~31%
- Seagrass/Kelp beds ~36%



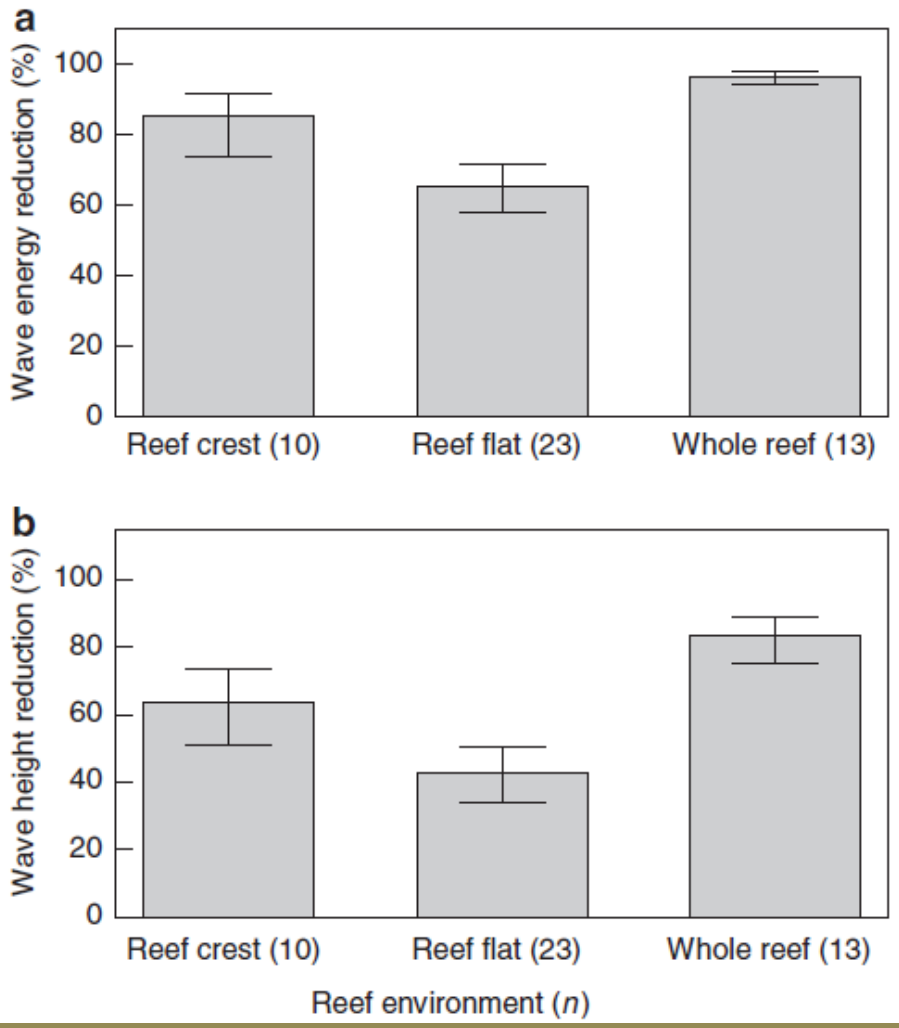
Absolute wave reduction extents are plotted against incident wave height for a) coral reefs (n = 27); b) mangroves (n = 11); c) salt-marshes (n = 14); d) seagrass/kelp beds (n = 5). This plot excludes measurements that do not report incoming wave heights.

Source: Narayan et al (2016): The Effectiveness, Costs and Coastal Protection Benefits of Natural and Nature-Based Defences. PLoS ONE 11(5): e0154735. doi:10.1371/ journal.pone.0154735

Protective role of coral reefs

UNITED NATIONS UNIVERSITY
UNU-EHS
Institute for Environment and Human Security

- Coral reefs reduce wave energy by an average of 97% and wave height by an average of 84%.....
- Providing comparable wave attenuation benefits to artificial defenses…
- Potentially protecting >100 million people…
- In a cost effectively manner (breakwaters: US$ 19,791 m^{-1} vs. Structural coral reef restauration: US$ 1,290 m^{-1})

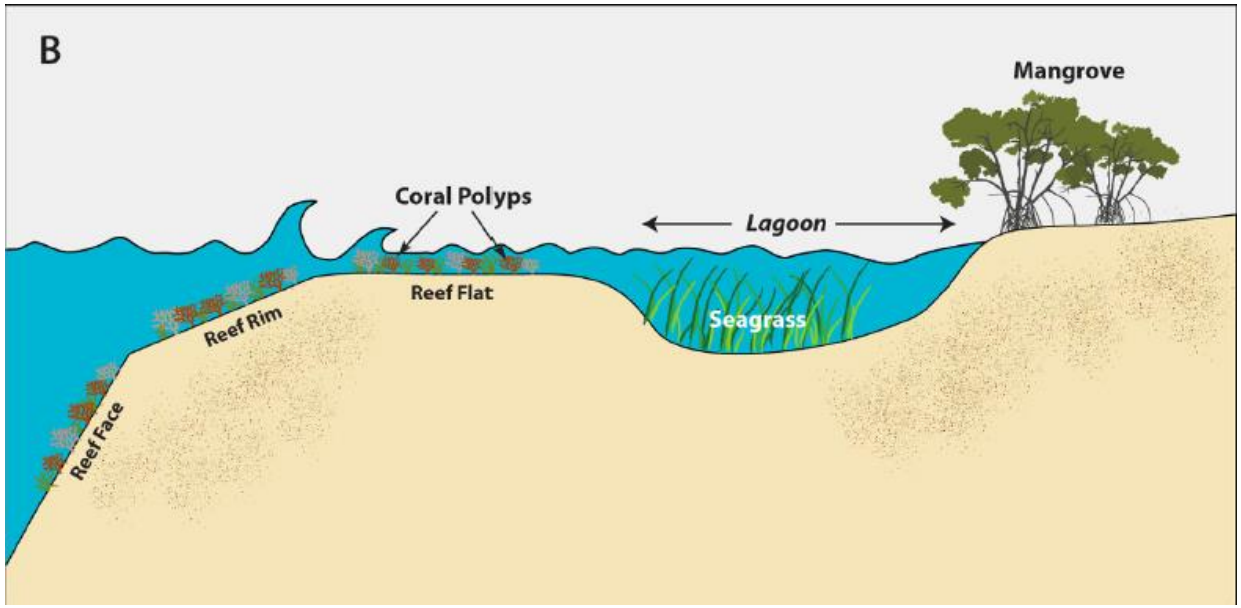


Source: Ferrario et al (2014): The effectiveness of coral reefs for coastal hazard risk reduction and adaptation. Nature Communications DOI: 10.1038/ncomms4794

Integrated coastal protection systems

UNITED NATIONS UNIVERSITY
UNU-EHS
Institute for Environment and Human Security

- Model simulations
- Individual and **combined** coastal protection services
- Storm and non-storm conditions
- Current and future sea-level rise
- Integrated systems perform best

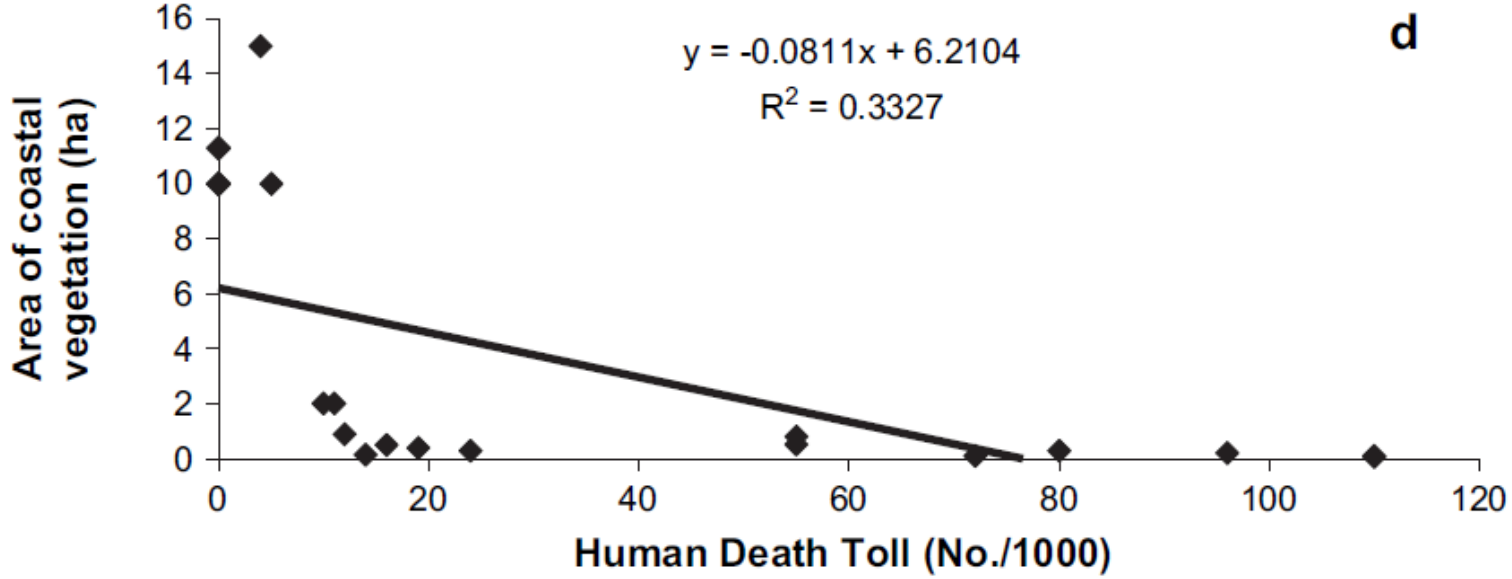


Source: Guannel et al (2016): The Power of Three: Coral Reefs, Seagrasses and Mangroves Protect Coastal Regions and Increase Their Resilience. PLoS ONE 11(7): e0158094. doi:10.1371/journal.pone.0158094

Can mangroves protect people from extreme hazards?

UNITED NATIONS UNIVERSITY
UNU-EHS
Institute for Environment and Human Security

Debate on the protective role of mangroves during 2004 tsunami: e.g. between Kathiresan & Rajendra (2005, 2006), Kerr et al (2006), Vermaat & Thampanya (2006, 2007)



Source for figure: Kathiresan & Rajendra (2005). Coastal mangrove forests mitigated tsunami. *Estuarine, Coastal & Shelf Sci 65:601-606*

For tsunamis and cyclones, the jury is still out: see review of observational studies and numerical and physical models by Marois and Mitsch (2015)

Marois & Mitsch (2015): Coastal protection from tsunamis and cyclones provided by mangrove wetlands – a review. International Journal of Biodiversity Science, Ecosystem Services & Management 11:71-83

Resistance of trees during a tsunami

UNITED NATIONS UNIVERSITY
UNU-EHS
Institute for Environment and Human Security

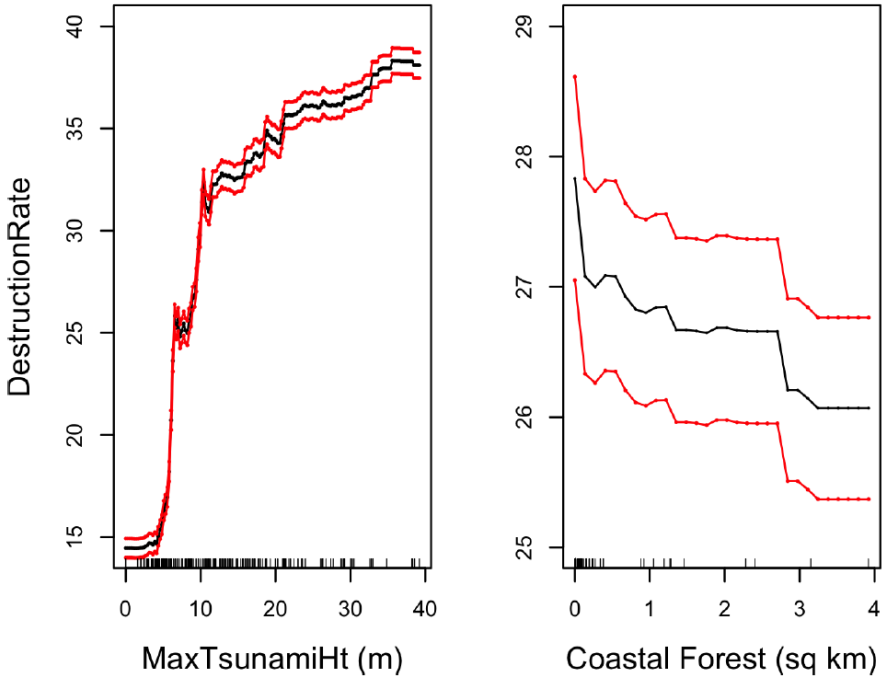
- Trunk bending and breaking closely related to:
  - tsunami water depth
  - hydrodynamic parameters
- Tree overturning was:
  - more site specific
  - Linked to root-soil strength
- Protection:
  - debris trapping
  - econdary damage to people and buildings

Source: Tanaka et al (2012): Breaking pattern and critical breaking condition of Japanese pine trees on coastal sand dunes in huge tsunami caused by Great East Japan Earthquake. Nat Hazards 65:423–442

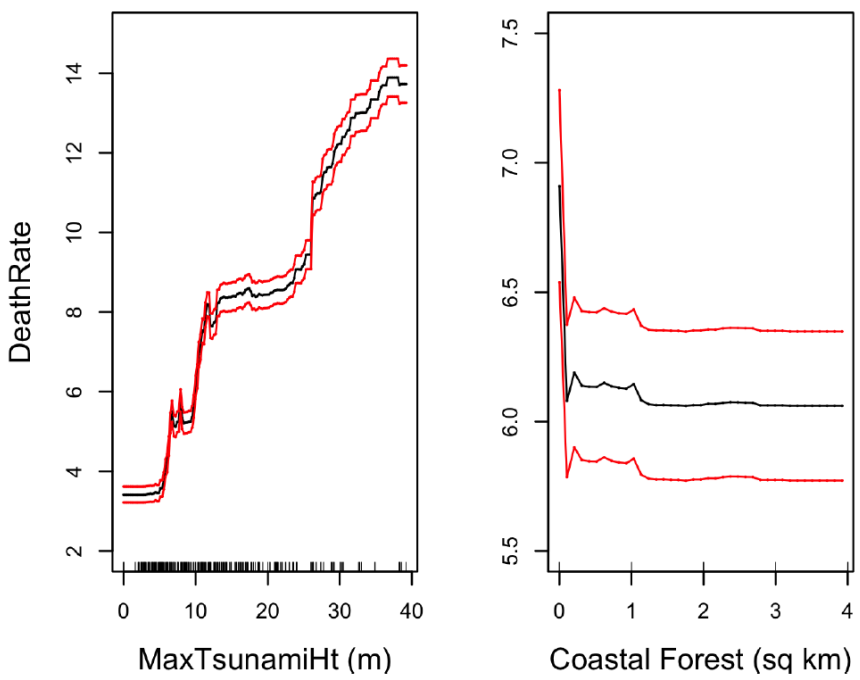
Protection role of coastal forests

UNITED NATIONS UNIVERSITY
UNU-EHS
Institute for Environment and Human Security

Destruction rate



Death rate



Sea walls > 5m height reduced destruction and death rates

Source: Nateghi et al (2016): Statistical Analysis of the Effectiveness of Seawalls and Coastal Forests in Mitigating Tsunami Impacts in Iwate and Miyagi Prefectures. PLoS ONE 11(8): e0158375. doi:10.1371/journal.pone.0158375

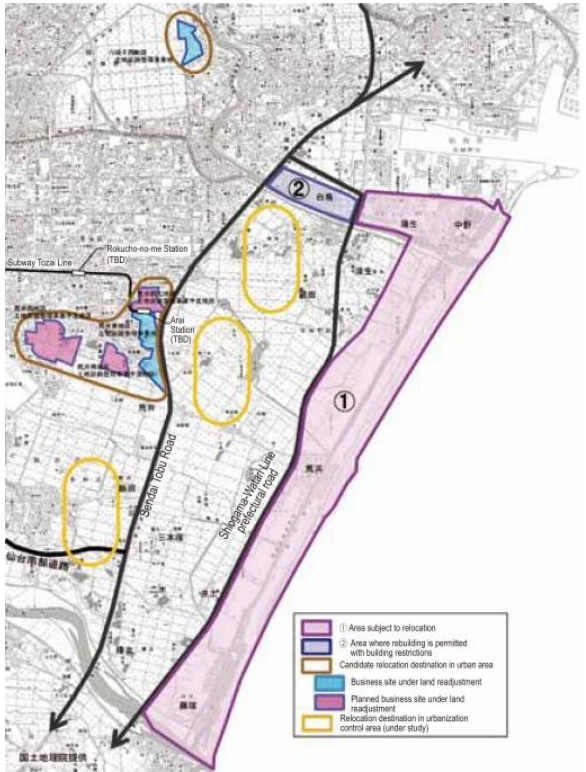
Debating on how to rebuild after a major disaster

Earthquake and Tsunami impact in Sendai, Wakabayashi Ward, Arahama District

UNITED NATIONS UNIVERSITY
UNU-EHS
Institute for Environment and Human Security

Ecosystem and DRR in the context of the Great East Japan Earthquake

UNITED NATIONS UNIVERSITY
UNU-EHS
Institute for Environment and Human Security



Source: Sendai City Earthquake Disaster Reconstruction Plan (2011)

More engineering, more ecosystem-based, or a mix?

UNITED NATIONS UNIVERSITY
UNU-EHS
Institute for Environment and Human Security

Devastation & reconstruction in Minamisanriku

UNITED NATIONS UNIVERSITY
UNU-EHS
Institute for Environment and Human Security

Photo Credit: 1-3 Fabrice Renaud/UNU-EHS, 4-5 Naoya Furuta/IUCN. Do not reproduce.

Sea walls not a priority for all

UNITED NATIONS UNIVERSITY
UNU-EHS
Institute for Environment and Human Security

Takeuchi et al (2016) & Furuta and Seino (2016):

- Event has created a new dynamic nationally and internationally for Eco-DRR
- Several examples where communities had the last word
- Creation of the Sanriku Fukko (Reconstruction) National Park

UNITED NATIONS UNIVERSITY

UNU-EHS

Institute for Environment and Human Security

UN-UNIVERSITY

Eco-DRR/CCA and the international policy agenda

Being "c
and maj

ecognises
y of ecosystems
oth climate
l adaptation

By
sy
pr
pr
th
cli
flo
pr

n Biodiversity and

Ramsar Convention
ster risk reduction
countries to
risk reduction
management plans

y main ES noted

Source: Adapted from Chapters 1 and 24 of Renaud et al (2016): Ecosystem-Based Disaster Risk Reduction and Adaptation in Practice, Springer. DOI 10.1007/978-3-319-43633-3_1

Next steps to scaling up

Next steps to scaling up (I) Refinement of core principles

UNITED NATIONS UNIVERSITY
UNU-EHS
Institute for Environment and Human Security

- Need to re-develop key guiding principles tackling both DRR and CCA concerns
  - No need to re-invent the wheel
    - Build on previous principles developed for Eco-DRR (PEDRR, 2010)
    - Align with existing frameworks and principles from e.g. NBS (Cohen-Shacham et al, 2016), EbA (Andrade et al, 2012), etc.
  - Focus on a few core principles
    - Refer to established best practices documents for the implementation side
- Co-develop these principles with ongoing processes?
  - Development of parameters for the NbS operational framework

Next steps to scaling up (II) Development of standards 1/3

UNITED NATIONS UNIVERSITY
UNU-EHS
Institute for Environment and Human Security

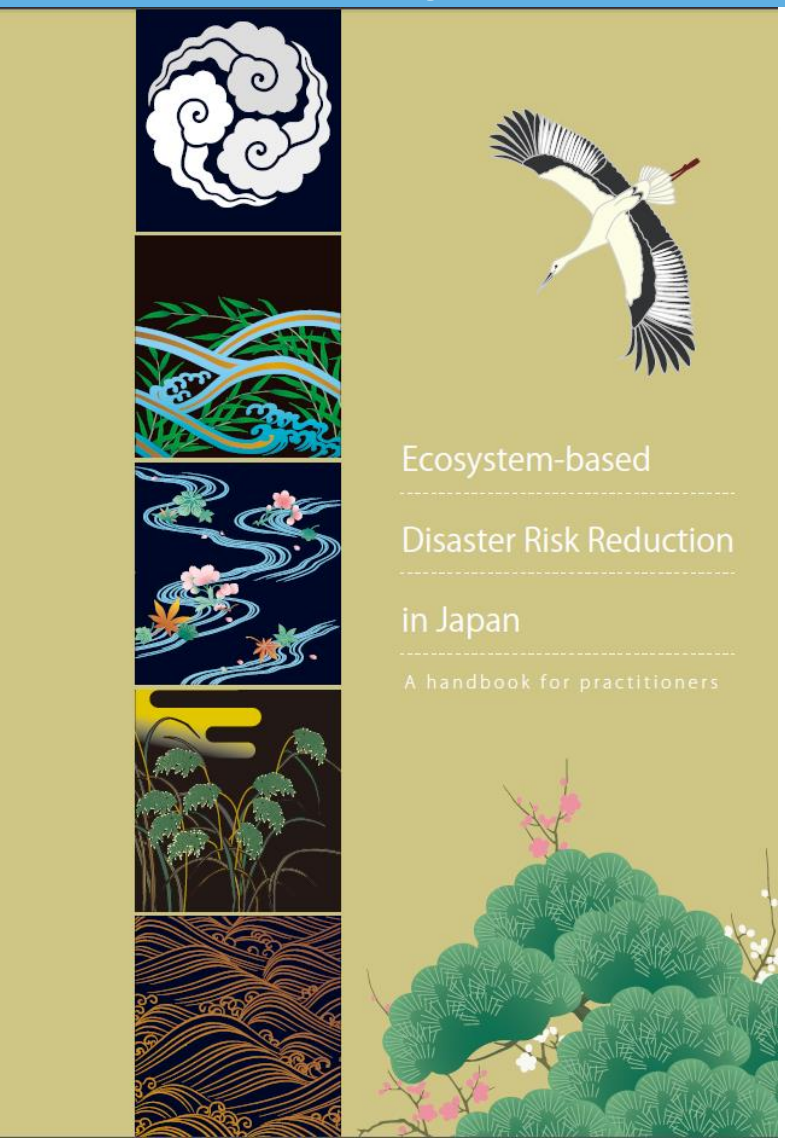
Innovating Engineering and Ecosystem-based Approaches for Disaster Risk Reduction

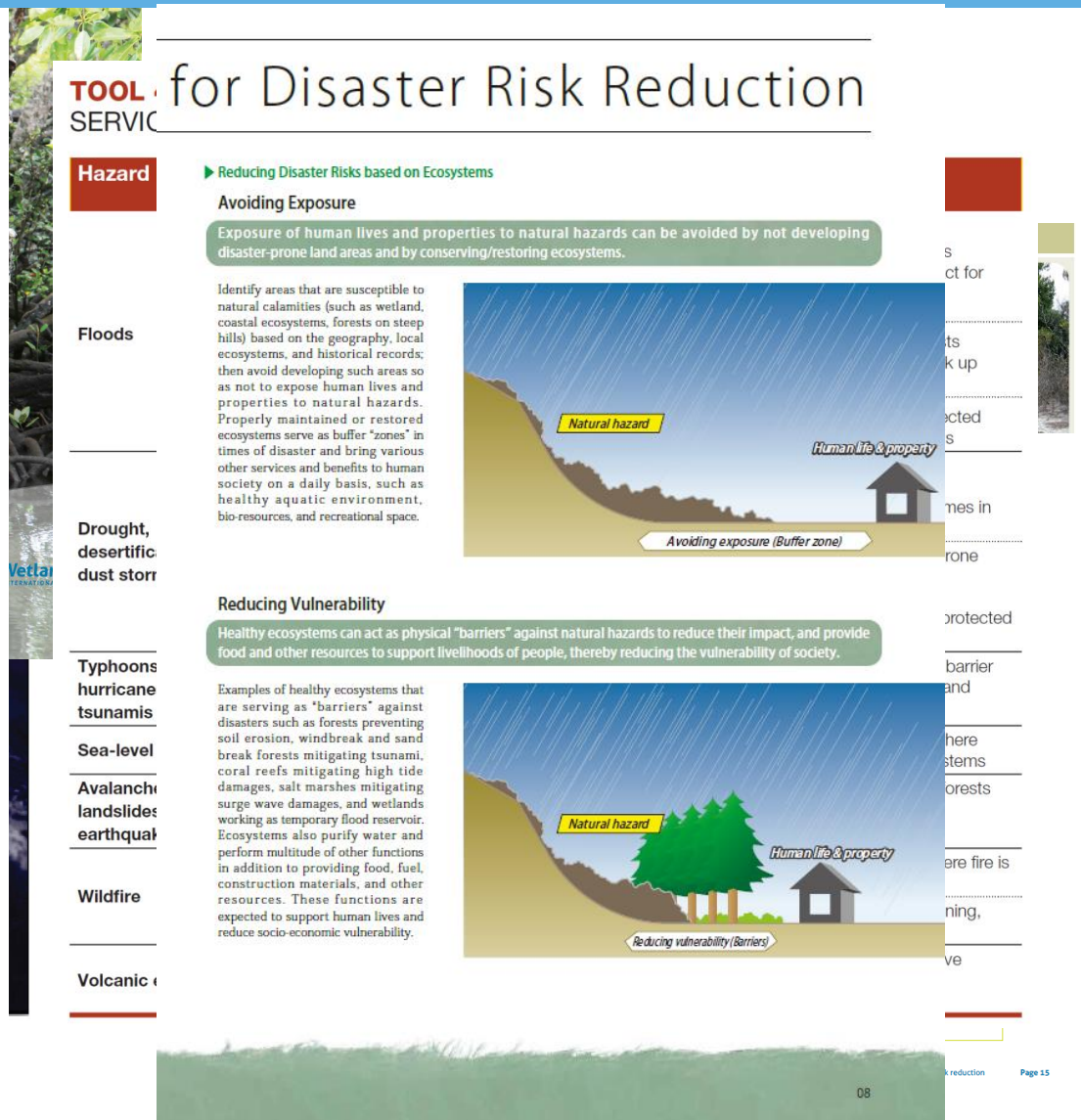
Accelerating the process of establishing ecological engineering standards

- Gather information on standards
- Identify gaps in existing standards

Next steps to upscaling up (II) Development of standards 2/3

UNITED NATIONS UNIVERSITY
UNU-EHS
Institute for Environment and Human Security





Next steps to scaling up (II) Development of standards 3/3

UNITED NATIONS UNIVERSITY
UNU-EHS
Institute for Environment and Human Security

THE WORLD BANK
IBRD • IDA | WORLD BANK GROUP

Deltares
Enabling Delta Life

UNDP
Empowered lives. Resilient nations.

EcoShape
building with nature

April 11th and 12th, 2017

Invitation

Workshop on scaling up nature-based flood risk reduction

Dear colleague, dear relation,

The World Bank, Deltares, UNDP and Ecoshape cordially invite you to participate in a two-day workshop on scaling up nature-based flood risk reduction. The meeting will focus on producing guidelines for the effective implementation of green and hybrid solutions to reduce flood risk in urban, riverine and coastal settings. The event will be held on the 11th and 12th of April 2017 in Delft, the Netherlands, at Deltares

*Participants can book a room at the Hampshire Hotel Delft for a reduced rate of €109,50 per night (one person, including breakfast and excl. tourist taxes). If you are interested in using this offer, please contact the hotel directly and mention the Deltares workshop (booking online is not possible). For more information, see www.hoteldelftcentre.nl.

Aim of the workshop

Nature-based solutions are increasingly being used for flood-risk reduction and climate change adaptation, especially in developing countries where they are most needed. Examples are the use of mangroves for wave reduction and erosion control and the use of urban green spaces for retention of storm waters. If properly implemented, nature-based solutions can aid in reducing flood risk while also providing additional benefits for people, the economy and nature conservation. However, effective implementation is challenging, as it requires integration of different disciplines and the active involvement of governments and communities. In addition, proper metrics for success and adequate monitoring methods are yet to be defined. Since nature-based solutions are currently not tested to the same standards as traditional grey infrastructure, trade-offs in terms of engineering and economics are still hard to make.

Main objectives

To support and advance up-scaling of nature-based solutions for flood risk management, this meeting will bring together a selection of key implementers, scientists and donors from around the world, with the main objectives to:

1. Exchange experiences, evidence and best practices on the engineering and economic rationale for nature-based solutions versus traditional grey measures;
2. Discuss and agree on guidelines for the design and implementation of nature-based flood risk reduction measures, based on a first draft which will be distributed to participants before the workshop;
3. Launch and discuss the alpha version of an interactive online platform which will enable information sharing and host guidelines and project examples.

There is no registration fee. Workshop participants are responsible for their own arrangements for travel and accommodation*. If you are not able to attend the meeting due to financial constraints, please contact the organization.

We would be delighted to hear if we can expect your presence. Please register before March 13th by sending an e-mail to secretariaat-zks@deltares.nl.

Best regards, World Bank - Brenden Jongman, Glenn-Marie Lange and Niels Holm-Nielsen
Deltares - Bregje van Wesenbeeck and Stéphanie IJff
UNDP - Pradeep Kurukulasuriya
Ecoshape - Henk Nieboer

Date: April 11th and 12th, 2017 Location: Deltares, Boussinesqweg 1, 2629 HV Delft, The Netherlands

The meeting focused on producing guidelines for the effective implementation of green and hybrid solutions to reduce flood risk in urban, riverine, and coastal settings

Upcoming (end 2017): IJDRR Special Issue **Innovating Engineering and Ecosystem-based Approaches for Disaster Risk Reduction and Climate Change Adaptation**

- Editors: Whelchel (TNC), Renaud (UNU), Sudmieier-Rieux (UNEP), Sebesvari (UNU)
- 15 papers planned (technical, economic, policy aspects)
- Case studies from the Bangladesh, Brazil, EU, India, Japan, Nepal, the Netherlands, Switzerland, USA

Next steps to scaling up (III) Showing that it works

UNITED NATIONS UNIVERSITY
UNU-EHS
Institute for Environment and Human Security

- Ensuring that as many people as possible can access and study examples from across the globe. Many initiatives exist:
  - PEDRR newsletter
  - PANORAMA which disseminates good practices of nature based / ecosystem-based solutions (GIZ, IUCN)
  - Database on ecosystem-based approaches to adaptation (UNFCCC)
  - *The Nature of Risk Reduction* website will showcase projects for disaster risk reduction, and present implementation and guiding principles (under development – Deltares, WB, GFDRR)"
  - AdaptationCommunity.net (under construction - GIZ)
  - …….
- Many initiatives from many different networks. Can/should we link them?
- Need to continually emphasize the multiple benefits provided by the approaches

Next steps to scaling up (IV) Capacity development

UNITED NATIONS UNIVERSITY
UNU-EHS
Institute for Environment and Human Security

Needed to achieve a “paradigm shift” in terms of thinking of solutions for DRR and CCA

- Government level – particularly at the level of “influential” ministries
  - Institutional: to consider new approaches in a more systematic manner
  - Personal: not just 1-2 persons who receive occasional training
- Local level (local governments, NGOs, communities)

PEDRR

Ecosystems for Adaptation and Disaster Risk Reduction

The Partnership for Environment and Disaster Risk Reduction

UNDP · UNEP · IUCN · WWF · UNITED NATIONS UNIVERSITY · UNU-EHS Institute for Environment and Human Security · UNESCO United Nations Educational, Scientific and Cultural Organization · GLOBAL RISK FORUM GRF DAVOS GRF · ProAct network environmental partnerships for community resilience · HELVETAS Swiss Intercooperation · Asian University Network of Environment and Disaster Management AUEDM · Wetlands INTERNATIONAL · EUR-OPA EUR-OPA MAJOR HAZARDS AGREEMENT ACCORD EUR-OPA RISQUES MAJEURS · COUNCIL OF EUROPE CONSEIL DE L'EUROPE · The Nature Conservancy Protecting nature. Preserving life.® · adpc · ISDR · SEI STOCKHOLM ENVIRONMENT INSTITUTE

Asian Disaster Preparedness Center (ADPC) • Asian University Network of Environment and Disaster Risk Management (AUEDM) • Council of Europe • Global Fire Monitoring Center (GFMC) • Global Risk Forum (GRF) • Helvetas Swiss Intercooperation • International Union for the Conservation of Nature (IUCN) • ProAct Network • Stockholm Environment Institute (SEI) • The Nature Conservancy (TNC) • UN International Strategy for Disaster Reduction (UN/ISDR) • United Nations Development Programme (UNDP) • United Nations Educational, Scientific and Cultural Organization (UNESCO) • United Nations Environment Programme (UNEP) • United Nations University-Institute for Environment and Human Security (UNU-EHS) • Wetlands International • World Wide Fund for Nature (WWF)

www.pedrr.org

Convention on Biological Diversity · World Business Council for Sustainable Development · iisd International Institute for Sustainable Development / Institut international du développement durable

THANK YOU!

UNITED NATIONS UNIVERSITY
UNU-EHS
Institute for Environment and Human Security

UN-UNIVERSITY

UNITED NATIONS UNIVERSITY

Institute for Environment
and Human Security (UNU-EHS)

Platz der Vereinten Nationen 1
53113 Bonn, Germany

e-mail: renaud@ehs.unu.edu
www.ehs.unu.edu

Additional cited references

UNITED NATIONS UNIVERSITY
UNU-EHS
Institute for Environment and Human Security

- Andrade A et al (2012): Principles and Guidelines for Integrating Ecosystem-based Approaches to Adaptation in Project and Policy Design. *IUCN- CEM, CATIE. Turrialba, Costa Rica. 4p*.
- Cohen-Shacham E et al (2016): Nature-based Solutions to address global societal challenges. Gland, Switzerland: IUCN.
- Furuta N & Seino S (2016): Progress and Gaps in Eco-DRR Policy and Implementation After the Great East Japan Earthquake. In F.G. Renaud et al. (eds.): Ecosystem-Based Disaster Risk Reduction and Adaptation in Practice. Springer
- PEDRR (2010): Demonstrating the Role of Ecosystem-based Management for Disaster Risk Reduction. Partnership for Environment and Disaster Risk Reduction
- Takeuchi K et al (2016): Ecosystem-Based Approaches Toward a Resilient Society in Harmony with Nature. In F.G. Renaud et al. (eds.): Ecosystem-Based Disaster Risk Reduction and Adaptation in Practice. Springer

Q&A

If you have any questions, please write us on the GoToWebinar chat.

For time management reasons, we don't assure that all questions will be answered.

Follow our next webinar on «Disaster Risk Reduction»!

All details will be published on the ICCG website: **www.iccgov.org**

International Center for Climate Governance