

**DTU Library** 

### Benefits of interrelationships between climate change mitigation and adaptation

- a case study of replanting mangrove forests in Cambodia

Møller, Lea Ravnkilde; Jacobsen, Jette Bredahl

Publication date: 2014

Document Version
Peer reviewed version

Link back to DTU Orbit

Citation (APA):

Møller, L. R. (Author), & Jacobsen, J. B. (Author). (2014). Benefits of interrelationships between climate change mitigation and adaptation: – a case study of replanting mangrove forests in Cambodia. Sound/Visual production (digital)

#### General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.







# Benefits of interrelationships between climate change mitigation and adaptation

- a case study of replanting mangrove forests in Cambodia

Lea Ravnkilde Møller

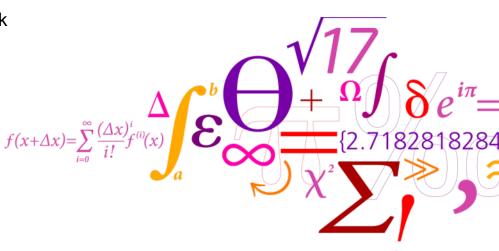
PhD candidate UNEP Risø Centre, Technical University of Denmark leam@dtu.dk

Jette Bredahl Jacobsen

Professor
Department of Food and Resource Economics,
University of Copenhagen
jbj@ifro.ku.dk

### DTU Management Engineering

Department of Management Engineering







ENERGY, CLIMATE AND SUSTAINABLE DEVELOPMENT

Climate change is an increasing global threat, and people in the developing world will be hit the hardest.

Adaptation

Mitigation

Is it possible to quantify the possible benefits of doing climate change mitigation and adaptation jointly?





## Outline...



- Local context
- Case study: Peam Krasaob Commune
- Climate Changes in Cambodia
- How to measure a possible benefit between CC mitigation and adaptation – Joint production
  - (benefit of CC mitigation)
  - benefit of CC adaptation
    - EDF
      - Storm damage function
      - Damage cost function
- Questions to you....

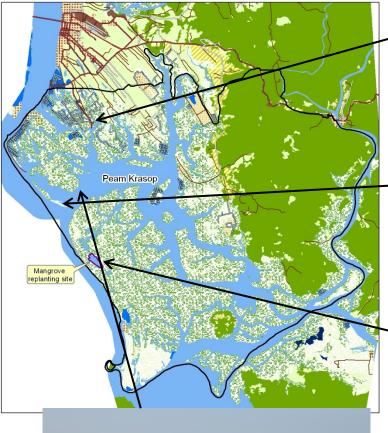




### Peam Krasaob Wildlife Sanctuary, UNEP Cambodia













# **Climate change predictions** for Cambodia

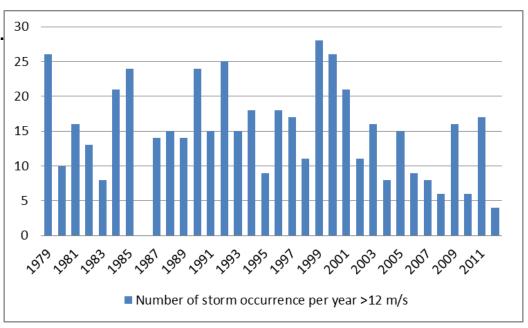
- Increasing number of hot days.
- Increasing precipitation (leading to flooding).
- Drought.



- Tropical cyclones, storm surges.
- Rising sea level
- Beach erosion.
- Saltwater intrusion (on farm land).

**2011**: 1,4 hectares of mangrove forest were destroyed do to wind damages. Estimated material damage: 59.400 US\$ (178 US\$ per HH)



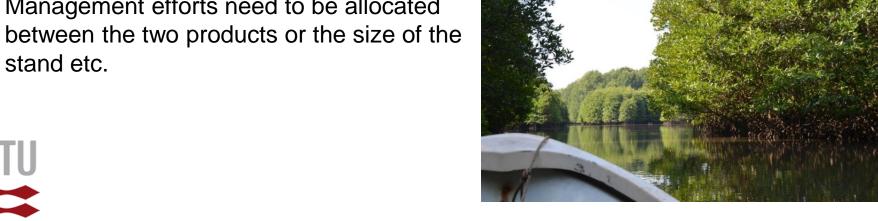




# How to measure the possible benefits of climate change mitigation and adaptation, respectively?

**Joint production** (Vincent & Binkley 1993)

- Or multiple-use forestry
- The two products:
  - CC mitigation: Carbon sequestration in the replanted mangrove forest (global benefit).
  - CC adaption: The mangrove forest's ability to protect the local community from storm damages (local benefit).
- Management efforts need to be allocated





# CC adaptation benefits?



ENERGY, CLIMATE AND SUSTAINABLE DEVELOPMENT

- Expected Damage Function (EDF)
  - (Hanley & Barbier 2009, Barbier 2007)

EDF costs avoided (do to replanting of the mangrove forest (**S**))

- EDF cost
- = The benefit of the adaptation capacity











The state of the s

Assumption made (Barbier 2007, Hanley & MATE Barbier 2009):

- The local community owns all economic activities and properties, and the properties are threaten from damages of storm.
- The households are identical, so one household can represent all households.
- The representative household expenditure function is expressed as  $m(P^x, Z, U^0)$ .
  - P<sup>x</sup> is the price vector for acquired goods consumed by the household.
  - z represents the number of storms and natural hazard occurrences (which can vary).
  - U<sup>o</sup> is the utility level for the household's minimum spending necessary to reach this utility level.



2021 2023 2025 2027 2029 2031

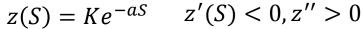
2033 2035 2037 2039

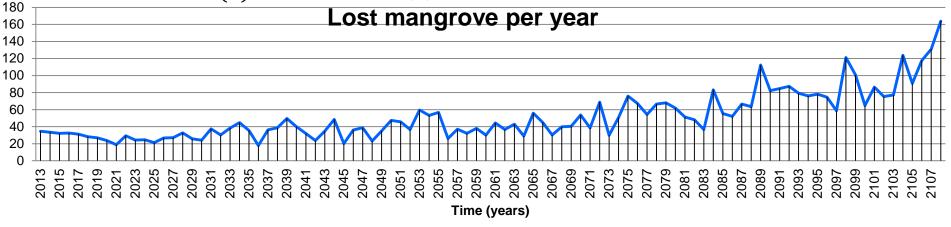
2043 2045 2047 2049 2049 2053

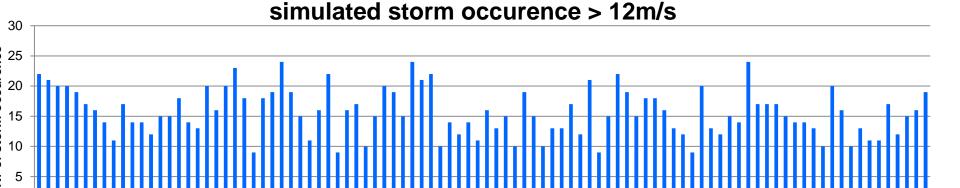
**Storm damage function** -damages on the mangrove forest caused by natural disasters and storm -We simulate the storm occurrences over the next 100 years – assuming that the function for damage per storm looks like this:



DEVELOPMENT







2061 Time (years)

2059 2057

2063 2065

2067 2069 2071 2073 2075 2075 2079

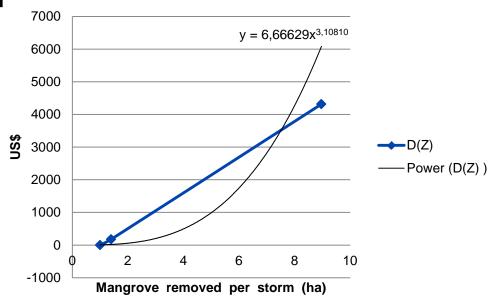
2081 2083 2085 2087 2089 2091 2093 2095

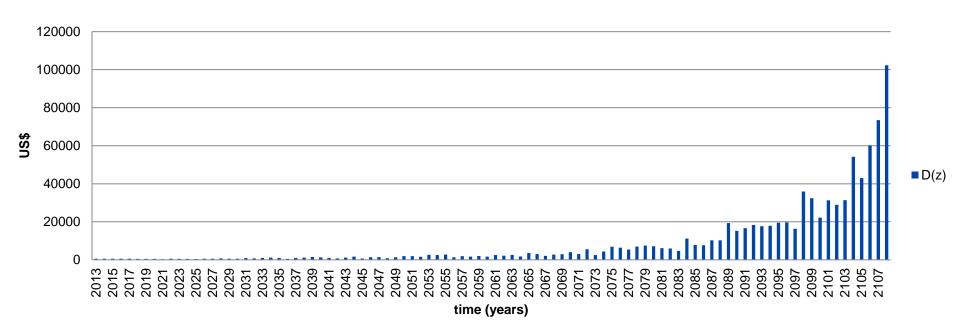
2055

# Damage cost function

- Based on what we know of z(S) (lost mangrove per storm do to storm and natural hazards), we can plot what we know:
  - Estimated damages in 2011 per HH.
  - Estimated cost of total destruction of HH.
- Assuming this damage function:

$$D(z) = bz^g$$



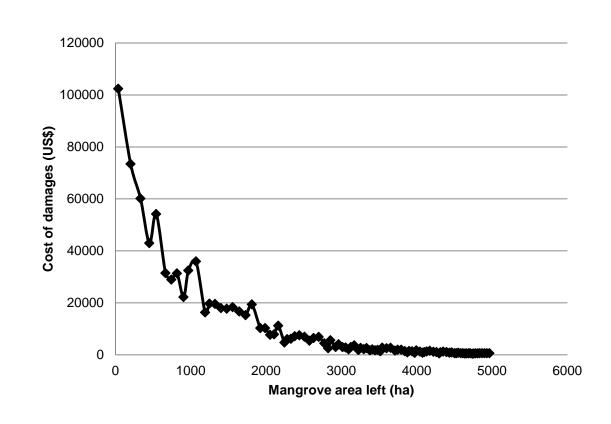




### Expected Damage Function $\sim D(z(S))$



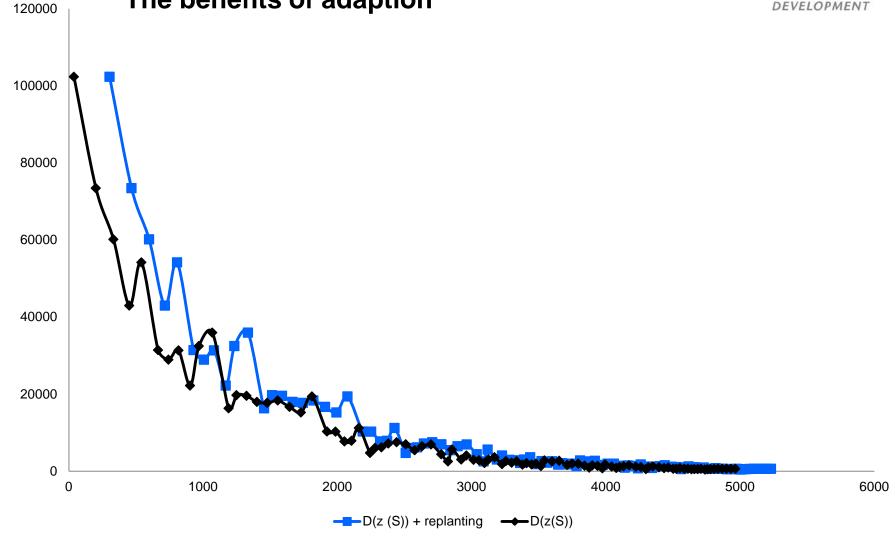
- $D(z(S)) = b(Ke^{-aS})^g$
- Knowing the storm damage function z(S) for storm hazards per year and the damage cost function D(z) per year, it is possible to calculate the expected damage cost of a change in the mangrove area.
- It is also possible to determine the benefits for the mangrove forest protecting the local community.





EDF ( cost avoided; when replanting of the
mangrove forest) - EDF (costs; when
loosing the mangrove forest) =
The benefits of adaption

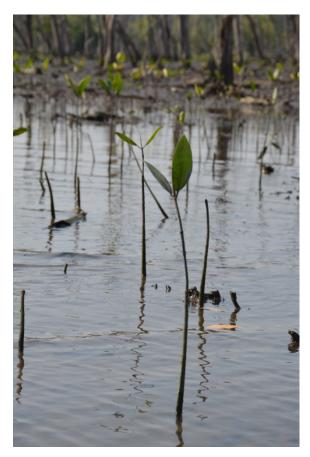






# Questions to you....





- What are the local and global benefit, respectively, of carbon sequestration in the replanted area?
- Are there other ways to simulate climate changes' impact (damage) on the mangrove forest?
- Is it realistic to consider it a joint production, as no immediate trade-off is found between mitigation and adaptation (in this case)?
- Is the assumption concerning the storm damage function and the damage cost function acceptable?









ENERGY, CLIMATE AND SUSTAINABLE DEVELOPMENT

Thank you...







### References



ENERGY, CLIMATE

- Barbier, E. B. (2007). Valuing Ecosystem Services as DEVELOPMENT
   Productive Inputs. Economic Policy, 177-299.
- Hanley, N., Barbier, E. B., & Barbier, E. (2009).
   Pricing nature: cost-benefit analysis and environmental policy. Edward Elgar Publishing.
- Vincent, J. R., & Binkley, C. S. (1993). Efficient multiple-use forestry may require land-use specialisation. Land Economics, 69, 370-376.

