

Cost-Benefit-Analysis (CBA) on Improving Aquaculture and Restoring Mangrove in Indonesia

Lugas Lukmanul Hakim, Rolf Groeneveld & **Roel Bosma**



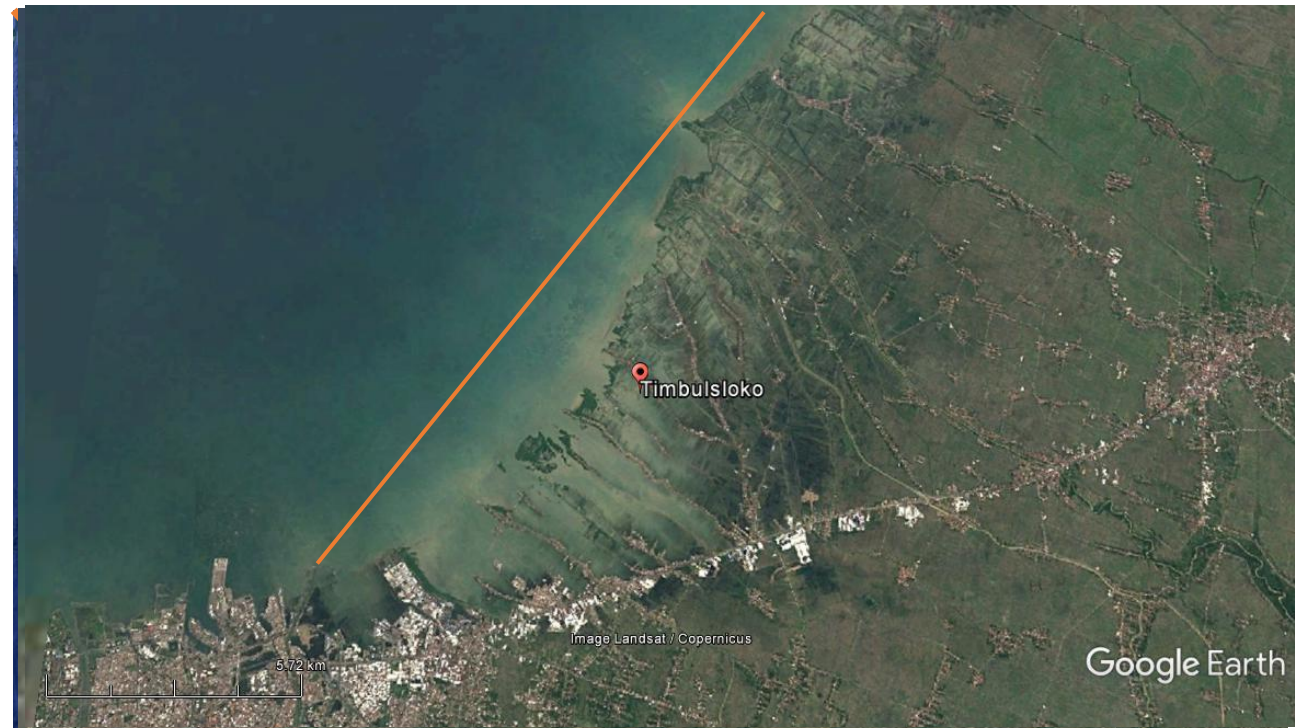
Land-loss along Java's north coast, Indonesia due to subsidence and abrasion

The case of Sayung district, Demak regency

1992

2003

2016



Low yield & vulnerability of coastal ponds

No intensification => low yield & shrimp diseases:

- Pond bottom acidifies => release of toxic substances.
- Average yield of tiger prawn **40** kg/ha per yr
- Average yield of milkfish **190** kg/ha per yr
- Farmers may cultivate milkfish only.



Low yield & vulnerability of coastal ponds

Causes:

- Pond management weak,
- No extension services (training),
- Frequent disease => harvest once on 3-4 stockings,
- Many ponds located on peat soil,
- Pond design (large, mostly too shallow, one sluice gate).

Project BwN Intervention

1. Mangrove Restoration



Permeable dams
to create habitat
for mangrove



Costs and Benefit



River
dredging



Mangrove
Planting

2. Aquaculture Improvement



Monoculture

Polyculture



Approach to Problem Solving

Building with Nature (BwN) aims to restore:

- Coastal Protection
- Sustainable Livelihoods supporting protection.

Coastal Field Schools (CFS) to:

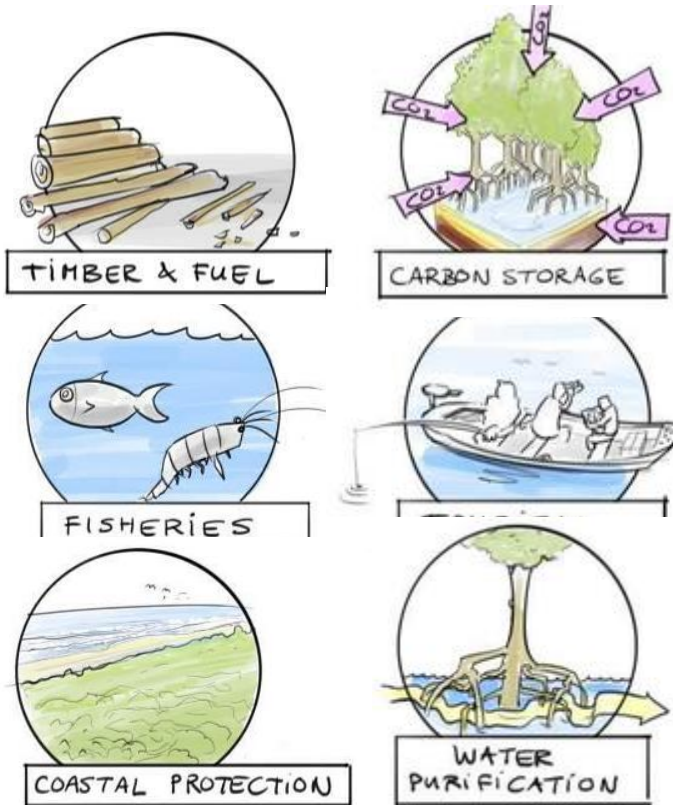
- ✓ improve aquaculture practices by training farmers in 16 sessions (Blue Forest).

LEISA : Low External Input for Sustainable Aquaculture

Team from WUR & UNDIP-FPIK's Aquaculture Dep. monitors the outcomes in three of the 10 villages.



Accounted Mangrove Ecosystem Services



Profits: Fisheries,
Timber and firewood,
Aquaculture

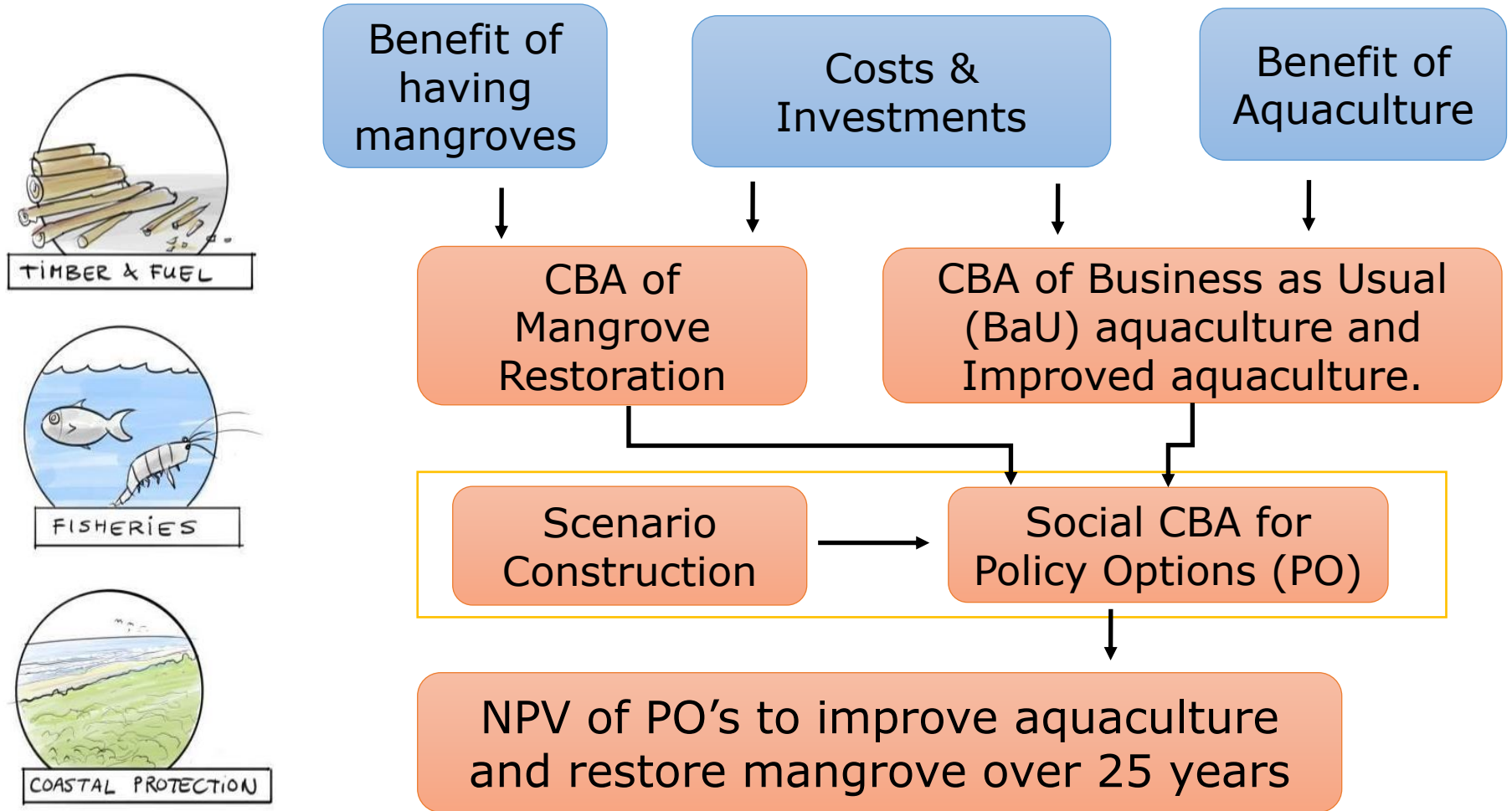
Costs: Destroyed houses,
Destroyed ponds,
Forgone benefits due to:

- Ponds => Mangrove forest
- Land lost.



Source (Drawing): <https://pbs.twimg.com/media/CN-21wWVEAFlwW.png>

Research Framework



■ Data Required

■ Calculation Step

→ Flow/process

□ Expert's Communication

Scenario Construction – Land Use Distribution

Initial

Restored

717.2 ha



771.9 ha

53.2 ha



155.5 ha

631 ha

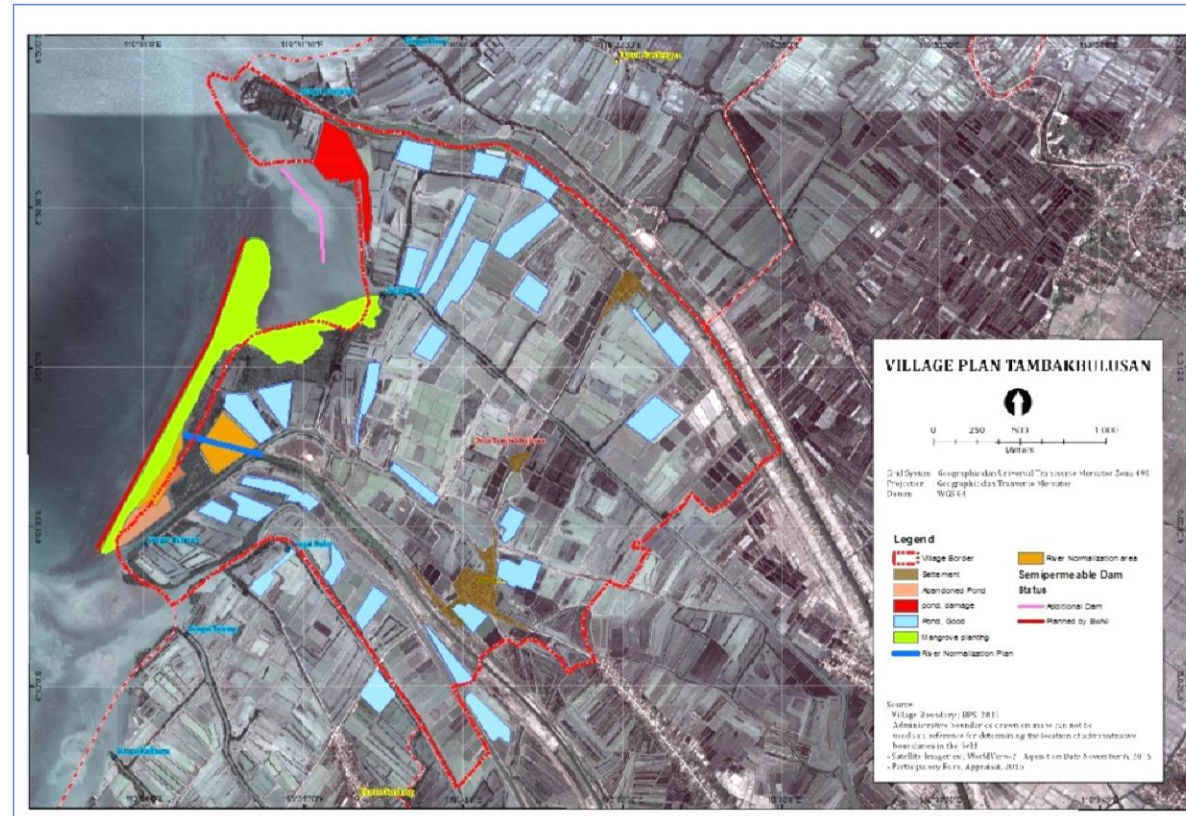


597 ha

13.6 ha



13.6 ha



Scenario Construction for Erosion:

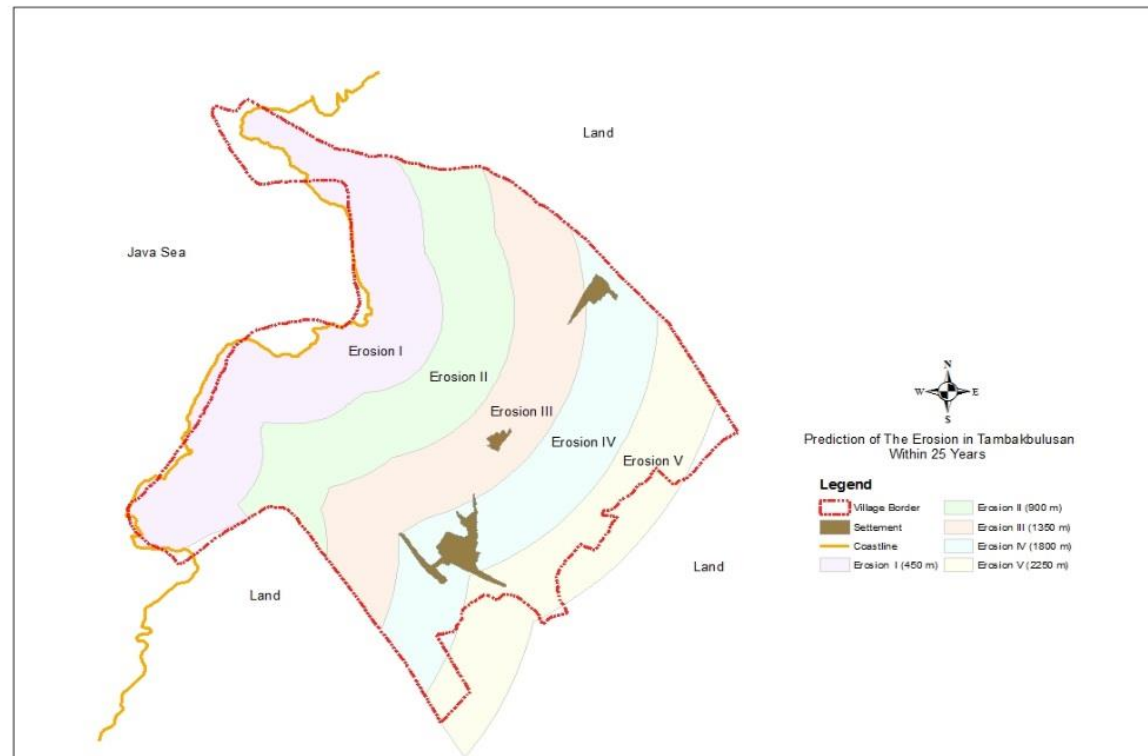
Business as Usual Scenario :

Abrasion Rate as village south-west

Abrasion Rate **90m/year**

Village is gone within **25 years**

Abrasion hits settlement: **2029-2038**



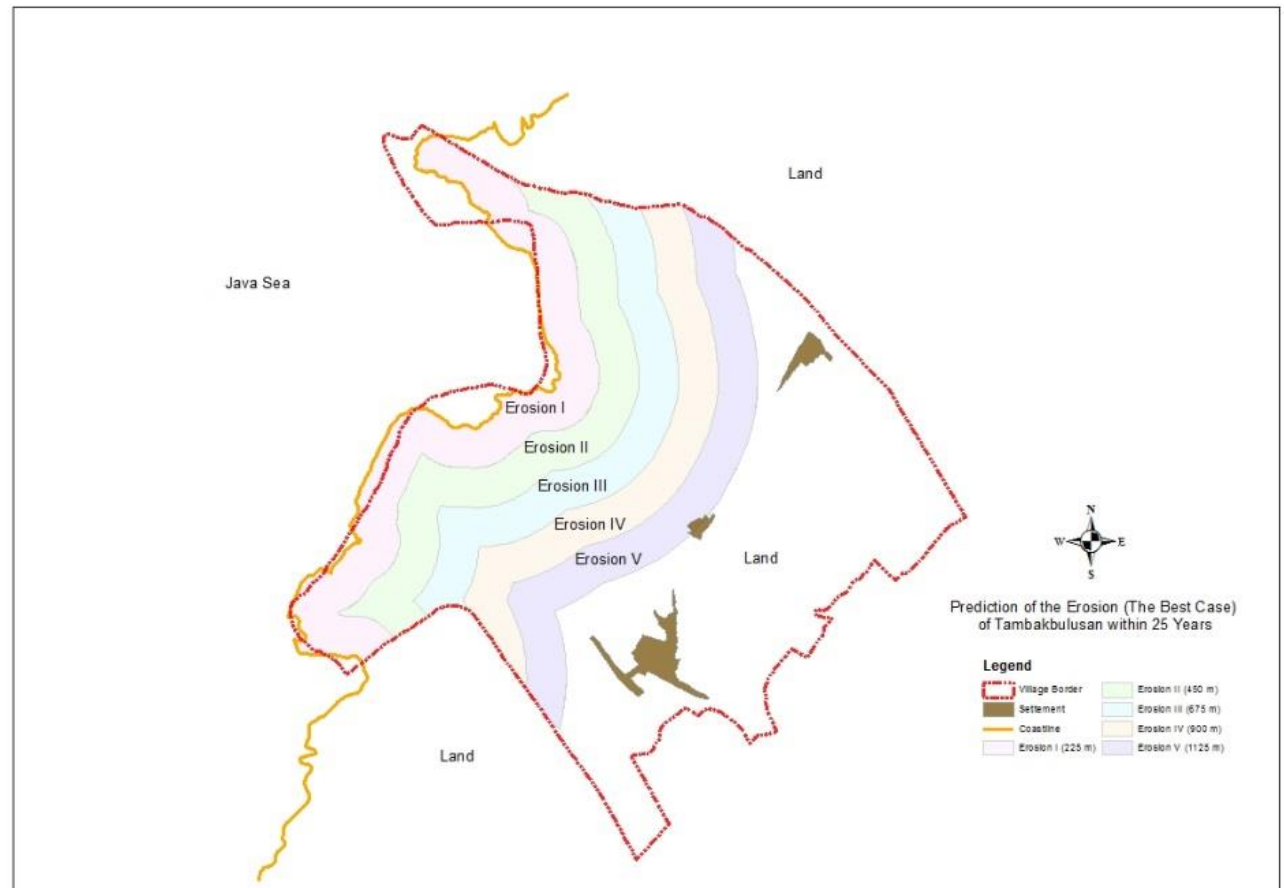
Scenario Construction for Erosion:

Best Erosion Scenario

Abrasion Rate 45 m/year

=> Village is gone within 50 years

Abrasion hits settlement: 2040



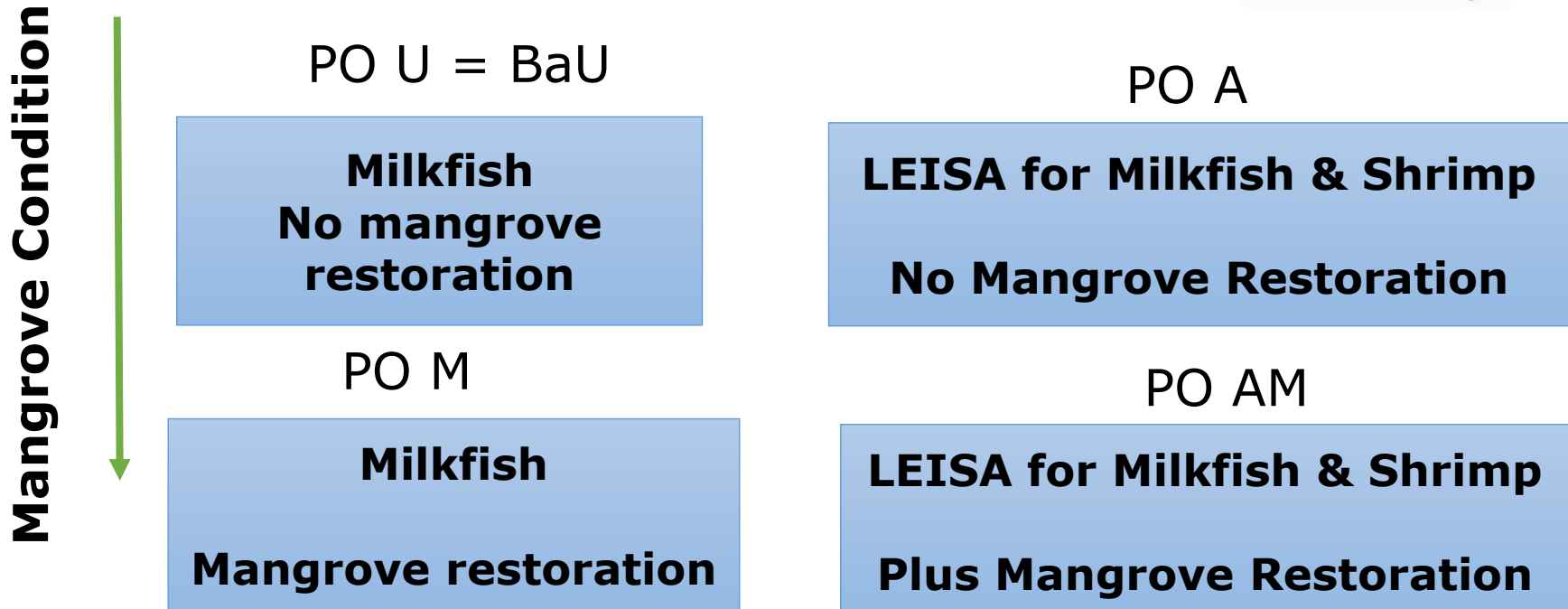
Scenarios Mangrove - Aquaculture

Aquaculture Practices

Monoculture



LEISA + Polyculture



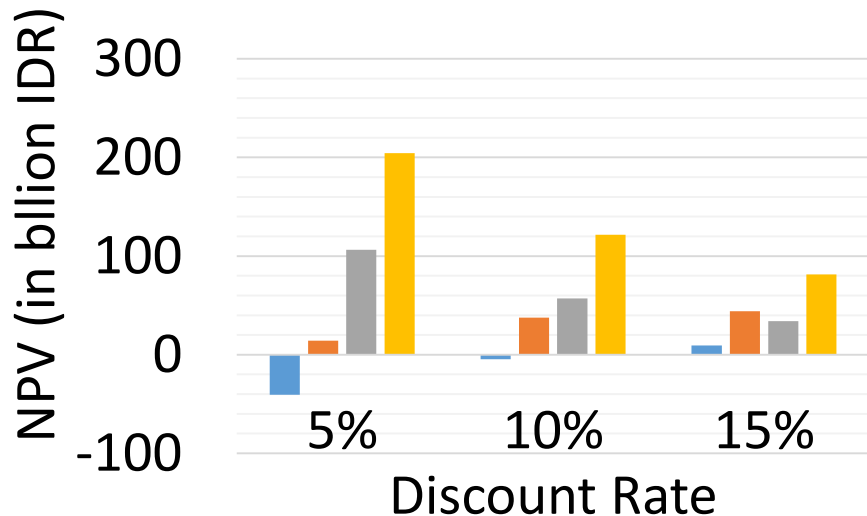
PO = Policy Option

Net revenue Aquaculture increases from 2.5 to 8 million IDR/ha/yr.

Results : Accumulated NPV

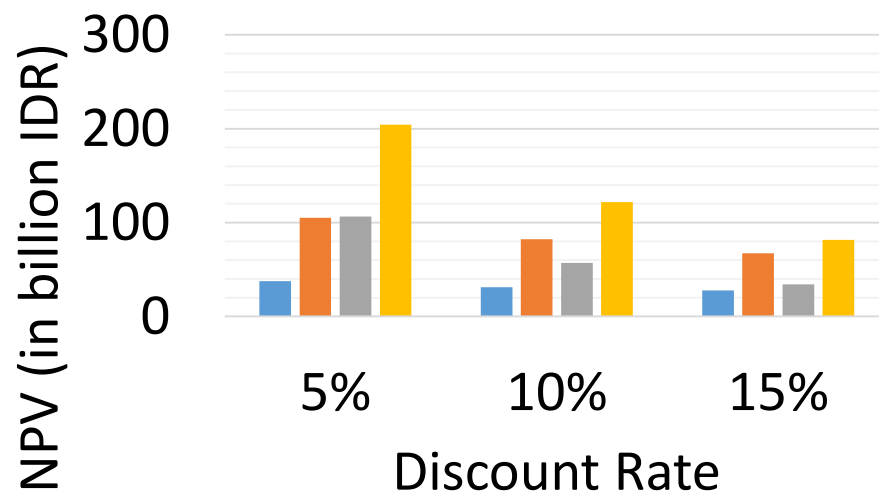
for 3 discount rates (r)

Business as Usual



■ BAU ■ PO A ■ PO M ■ PO AM

Best Erosion Case



■ BAU ■ PO A ■ PO M ■ PO AM

Best = do both Mangrove & Aquaculture (PO AM)
2nd = either A or M, depending on discount rate.

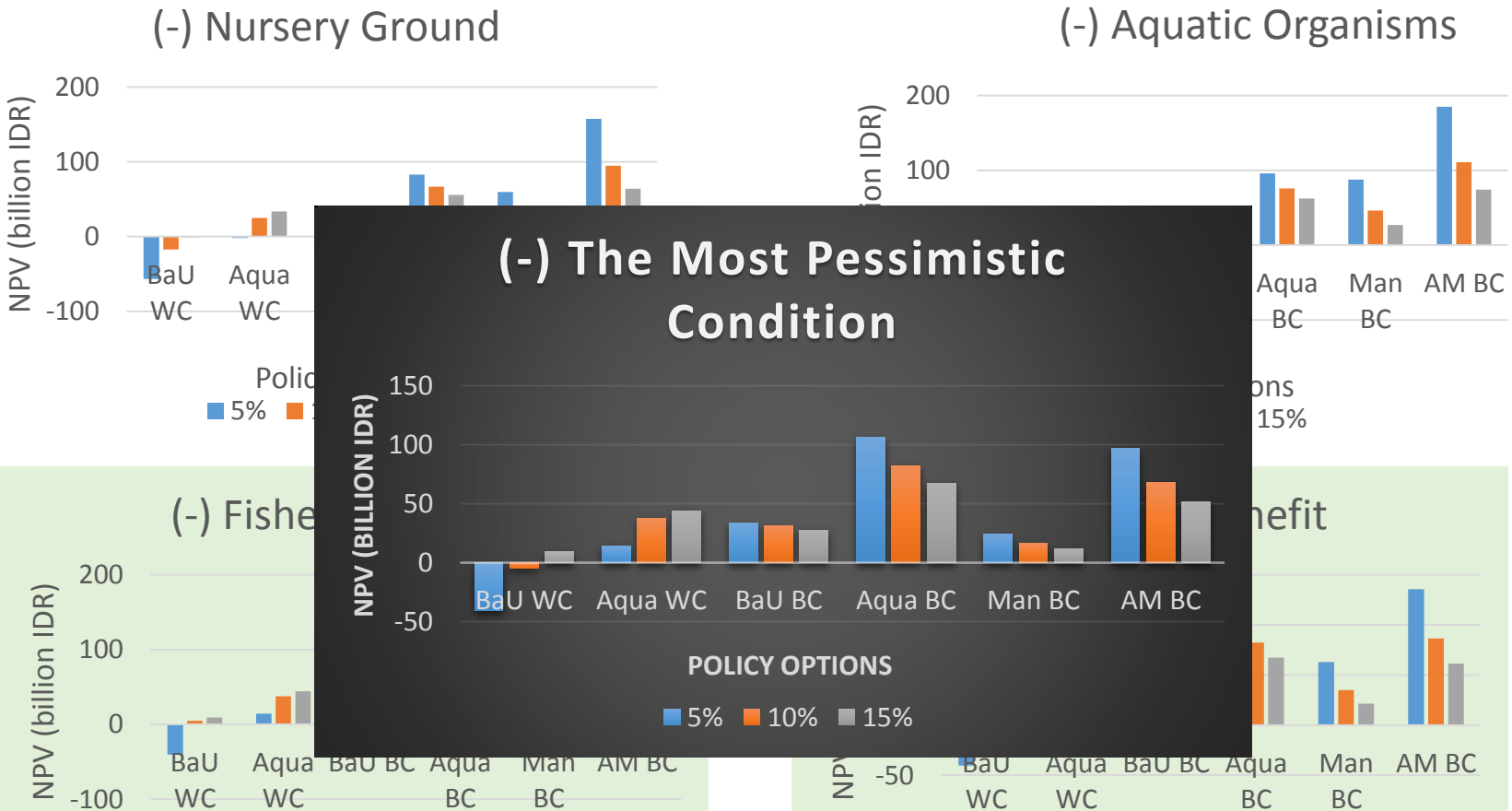
Preliminary NPV Result (*1,000 USD)

Parameter	Invest	NPV after 25 years	
		Worst Erosion	Reduced Erosion
No-intervention	0	- 2,900	2,500
Mangrove-only	85	10,300	5,200
Aquaculture-only	85	3,900	5,100
Aquaculture plus mangrove	170	17,500	12,200
Most pessimistic benefits	170	9,600	4,500

Not accounted cost: - (Lost) public infrastructures;
 - Invest in other water sources than aquiver.

Margin Aquaculture: - Baseline 4* higher (due to a.o. recruitments);
 - Results 10* higher.

Results – Sensitivity Analysis



PO AM = best option for Worst & Best Case Abrasion

PO Aqua seems best option for BC in pessimistic condition, but

Conclusion

- ✓ **Both Activities *are important***
 - Recovering mangrove = *climate change mitigation,*
 - Improving aquaculture = *climate change adaptation.*
- ✓ **Doing both simultaneously increases benefits**
 - for Farmers,
 - and Climate Change Mitigation & Adaption.
- ✓ *Aquaculture can support mangroves recovery if policies are conducive and well implemented.*

Thank you for your attention

You're invited to
contribute through
funding further policy
related PhD research in
Indonesia & Bangladesh



Contacts: geert.wiegertjes@wur.nl (Health);
johan.schrama@wur.nl (Nutrition);
marc.verdegem@wur.nl (Aquaculture systems);
roel.bosma@wur.nl (Farming systems).
office.afi@wur.nl : Aquaculture & Fisheries,
Wageningen University & Research (WUR), NL

Building with Nature Indonesia

Securing degraded coastline for rehabilitation and revitalization of Northern coast of Java



Coastal safety measures: Permeable Structure



Capacity building Indonesian water sector



Embedding in policy and planning:



Sustainable aquaculture



Implementation with/by communities:



Coastal Field
Schools



Biorights
approach

By contractors:



Scaling up to similar coastlines

