Resilience Bond / Insurance Concept

mangrove case study

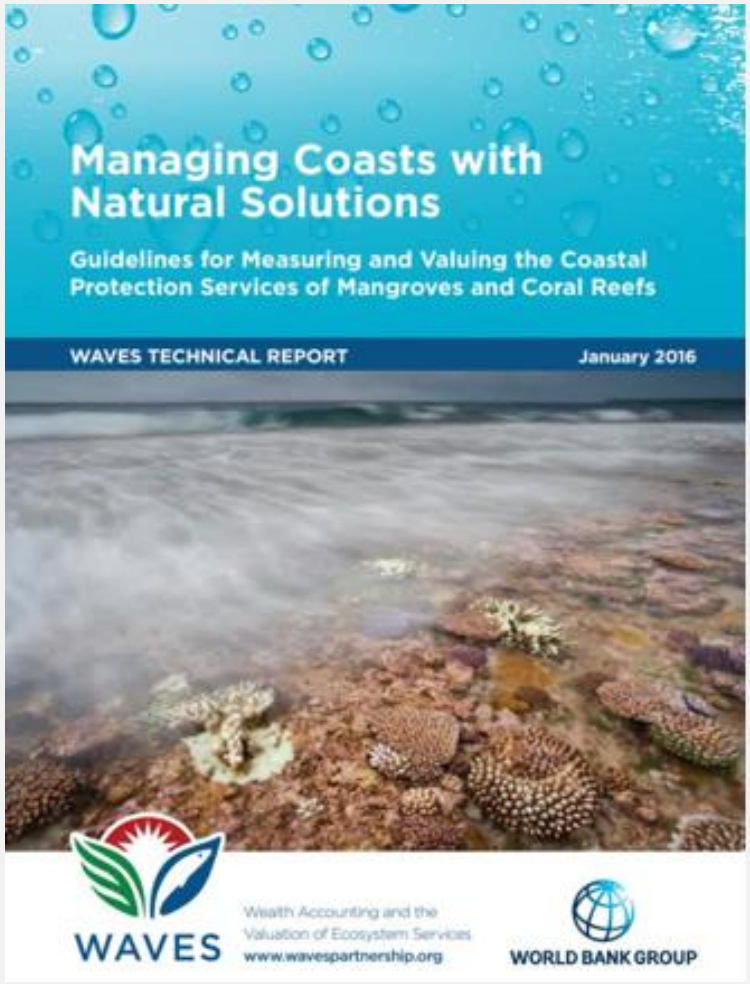
The Nature Conservancy / Munich Re
For CIFOR September 2019

The Nature Conservancy

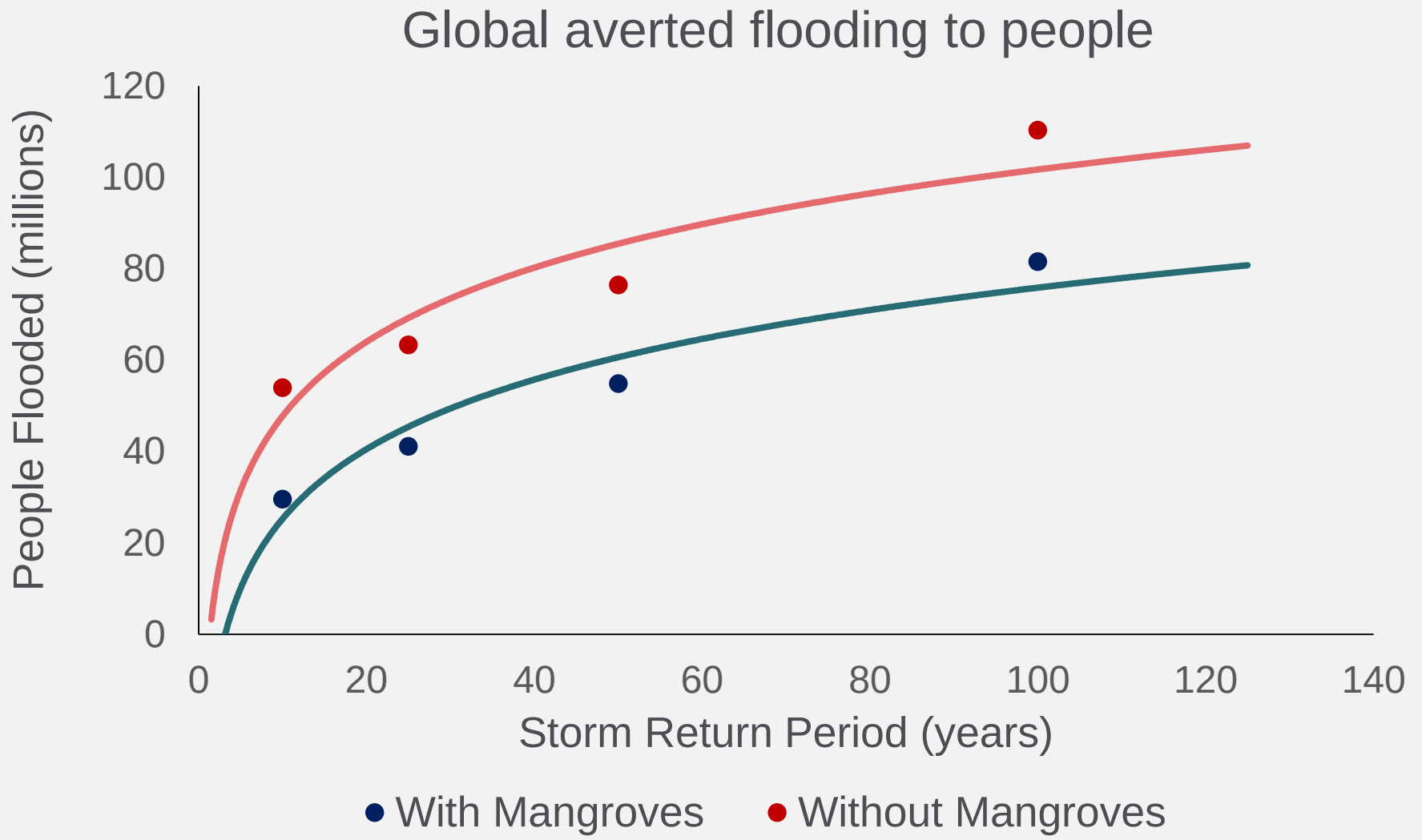
Munich RE

Mangrove science:
General background

- **Mangrove risk reduction science** indicates 10 – 30% flood risk reduction (surge-driven flooding) and 5 – 15% wind risk reduction
- The level of risk reduction depends on the type of storm and the mangrove characteristics.
- For wind-waves, wave height can be reduced by 50-100 % over 500 meters of mangrove forest.
- Mangrove species with dense vegetation are most effective at reducing wave height.
- With respect to storm surges, water level measurements and numerical models show that mangroves can reduce storm surge peak water levels by 5-50 cm/km of mangrove forest.



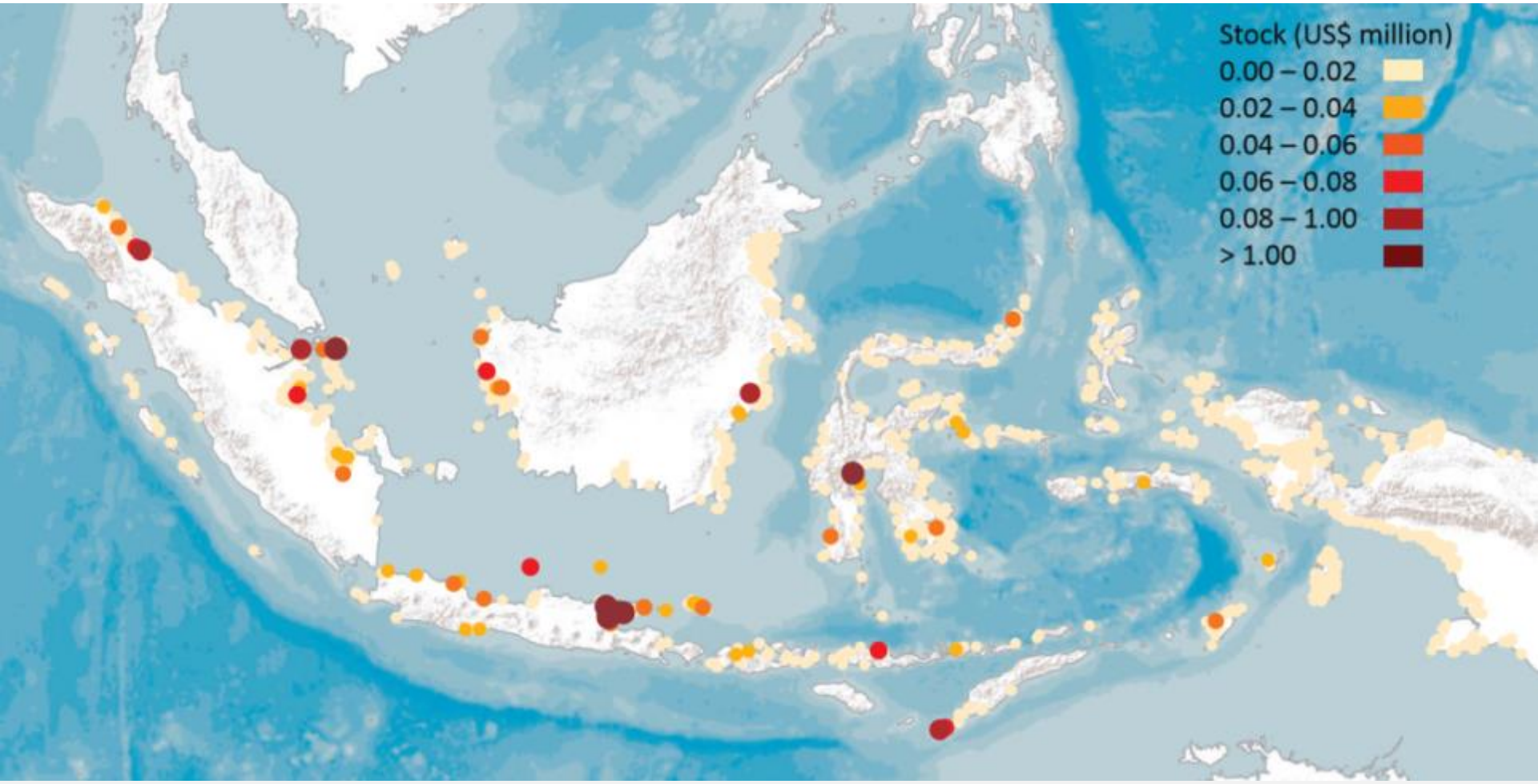
Mangrove science:
Risk reduction benefits



Source: Losada, I. J.. In press (2018). The Global Value of Mangroves for Risk Reduction: Technical Report. The Nature Conservancy, Berlin.

Mangrove science: Indonesia

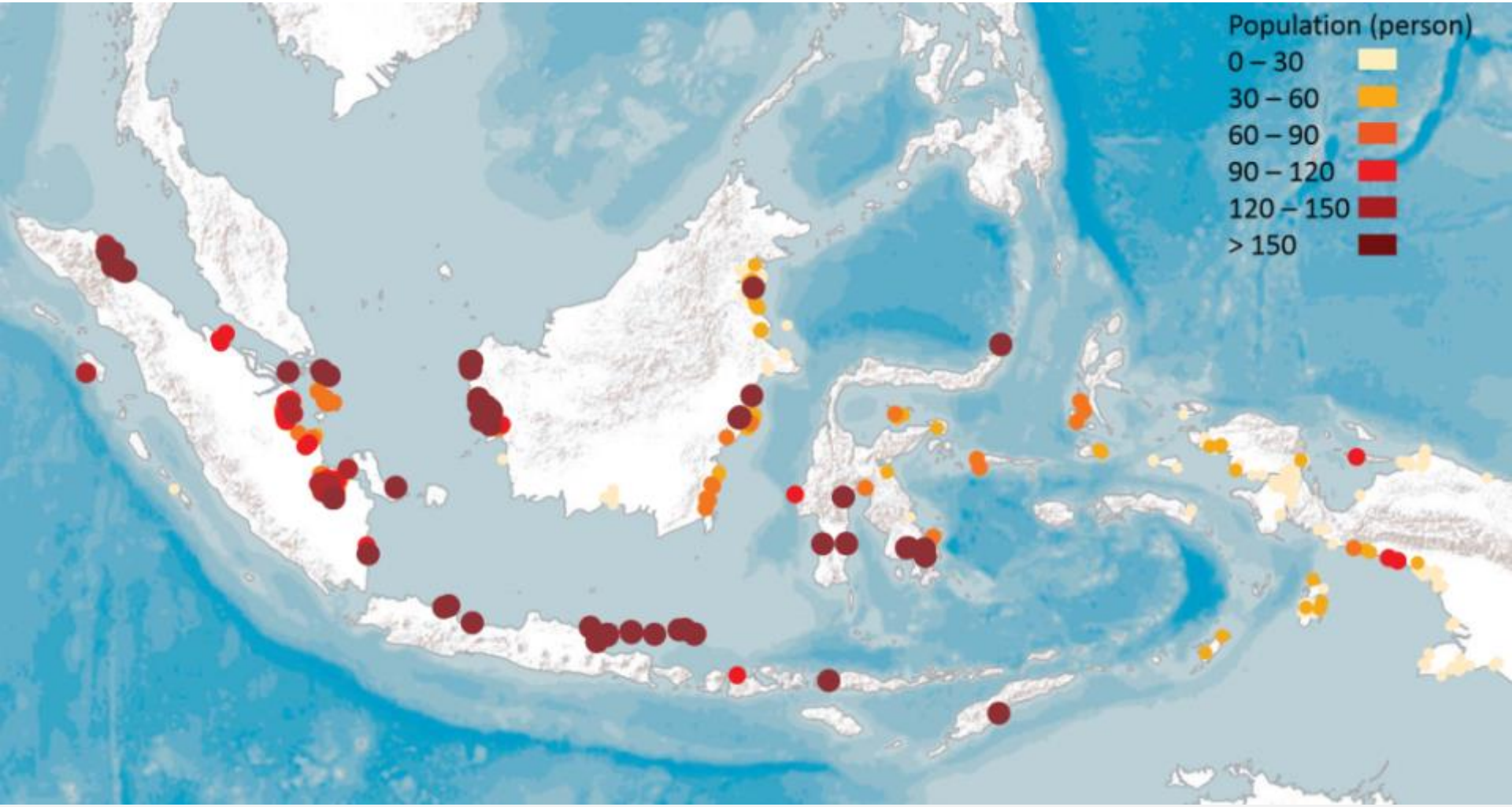
Avoided annual built capital losses ($ millions /100km)



Source: Losada, I. J.. In press (2018). The Global Value of Mangroves for Risk Reduction: Technical Report. The Nature Conservancy, Berlin.

Mangrove science: Indonesia

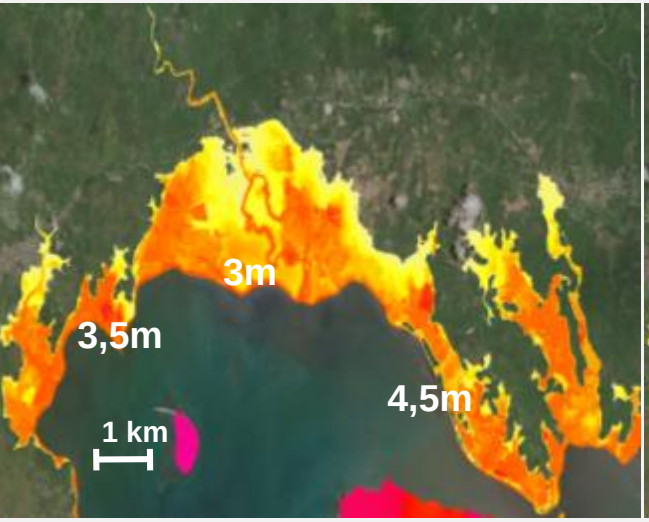
Annual averted flooding (population per 100km)



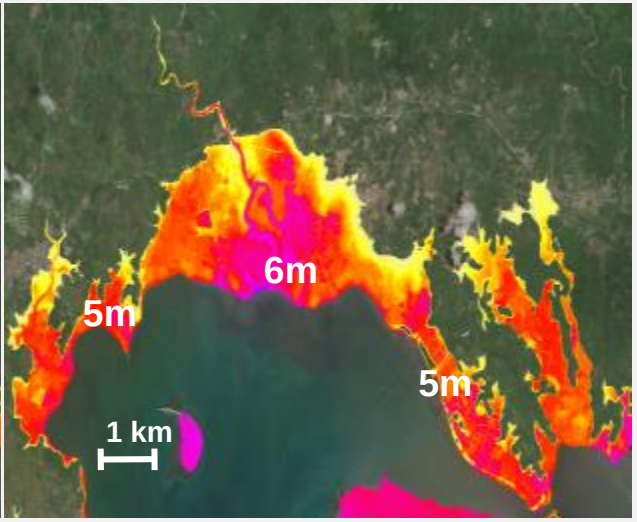
Source: Losada, I. J.. In press (2018). The Global Value of Mangroves for Risk Reduction: Technical Report. The Nature Conservancy, Berlin.

Mangrove science: Philippines
High-resolution flood mapping example

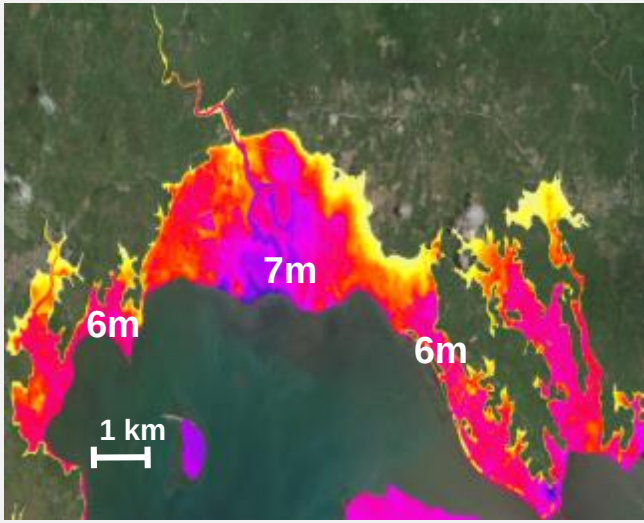
1 in 50 year flooding case study



Historical – 1950



Current



No Mangroves

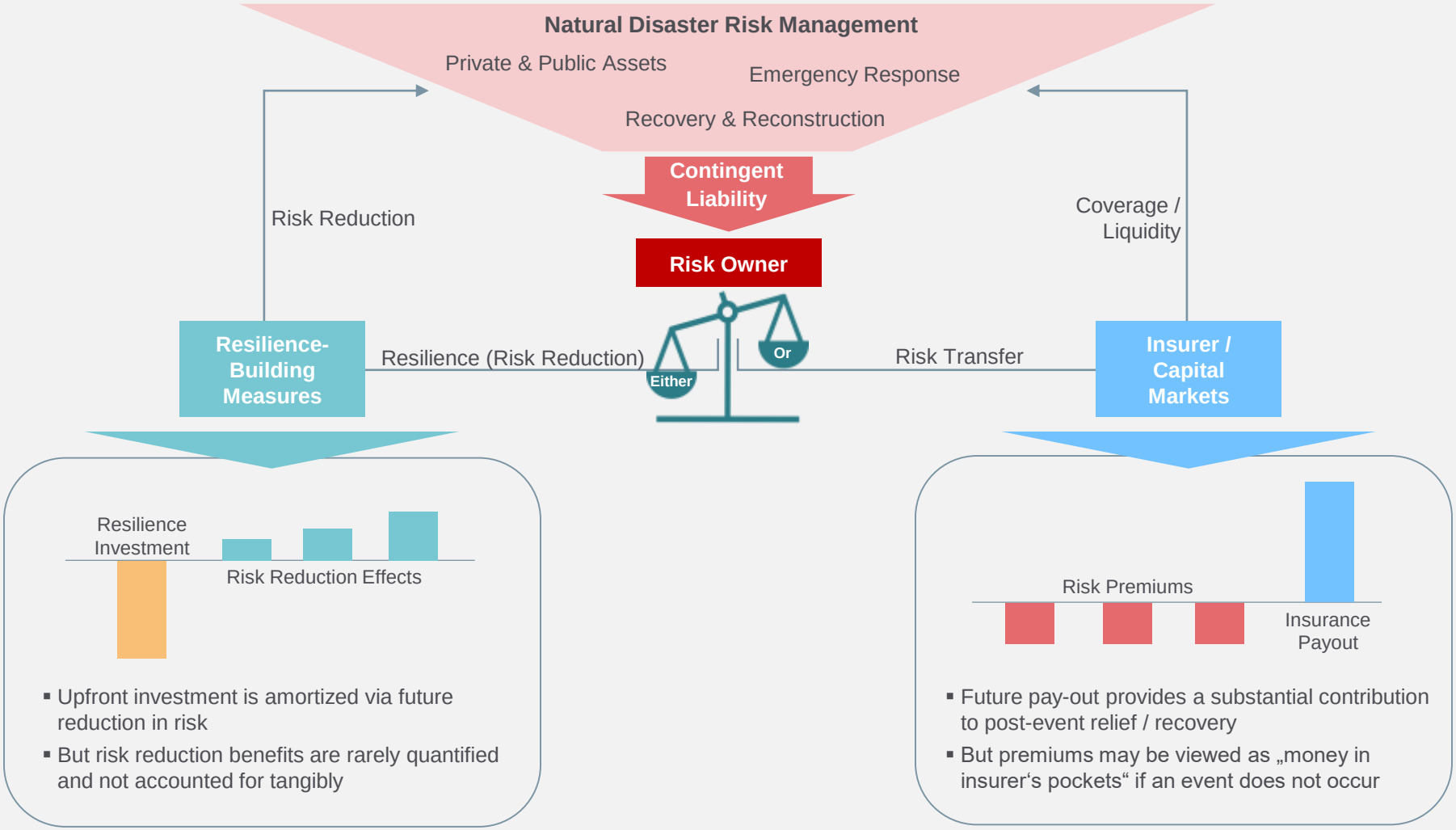
Source: Beck, M. W. et al.. 2017. Policy Note- Valuing the Protection Services of Mangroves in the Philippines. World Bank, DC.
Losada, I. et al.. 2017. Technical Report- Valuing the Protection Services of Mangroves in the Philippines. World Bank, DC.

Mangrove science
Implementation aspects and comparison

	Mangroves	Coral Reefs
Restoration Techniques	▪ Succesful restoration (for risk reduction) – tens of thousands of hectares ▪ Native species and location matter (non-native species in novel places fail) ▪ May need to reduce seaward erosion first	▪ Biological restoration – e.g., coral planting ▪ Structural restoration – e.g., reef blocks
Costs and Timeline	▪ *Planting costs*: $5 - $10k per hectare, implying $100 - $200k costs per km of coastline protected ▪ *Benefits delivery*: 2-10 year growth window with risk reduction growing rapidly	▪ *Restoration costs*: $1 – 3 mill. per km of structural reef restoration ▪ *Benefits delivery*: Immediate upon structural reef restoration (also influence on sediment and coastal stability)
Risk Reduction Impact	▪ 10 – 30% flood risk reduction (surge-driven flooding) ▪ 5 – 15% wind risk reduction (after fully grown) (Das and Crepin, 2013)	▪ 10 – 50% flood risk reduction (wave driven flooding) ▪ Potential benefits on shoreline accretion & stability (not quantified)

Mangrove restoration is less expensive than coral reef restoration. The risk reduction effects will materialize faster than coral reef biological restoration but slower than coral reef structural restoration.

Appendix: The trade-off between risk transfer and resilience-building measures (I/II)



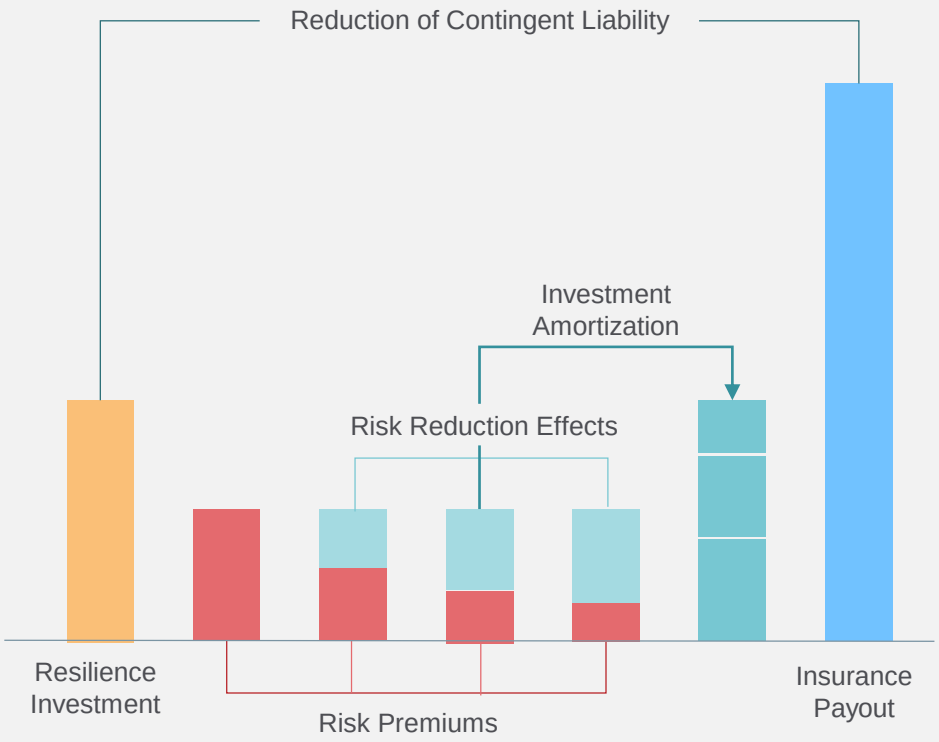
- Upfront investment is amortized via future reduction in risk
- But risk reduction benefits are rarely quantified and not accounted for tangibly

- Future pay-out provides a substantial contribution to post-event relief / recovery
- But premiums may be viewed as „money in insurer‘s pockets“ if an event does not occur

Appendix: Can risk reduction and risk transfer be coupled in a combined insurance solution? (II/II)

A resilience insurance solution aims to overcome the trade-off between risk reduction and risk transfer, linking the risk reduction effect with an insurable risk within a combined solution:

- A resilient investment at the beginning of the period reduces the underlying risk
- The risk mitigating impact is monetized via reduced premiums
- An incentive is created both for risk-reducing infrastructure as well as for risk transfer resulting in increased community resilience



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