Pacific Islands Ridge to Reef National Priorities – Integrated water, land, forest and coastal management to preserve biodiversity, ecosystem services, store carbon, improve climate resilience and sustain livelihoods

Special Topics

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Regional guidelines - Spatial Prioritization modelling
RSTC Virtual Meeting 19th 20th October, 2020

Session 5: Special Topics

1. Reflect on the (modified) approved R2R Science-Policy theory of change adapting to changing circumstances, and provide renewed commitments, if any, towards mainstreaming R2R in either planning process and/or policy development;
2. Reflect on the importance of R2R approach in natural resource management and governance, and the utility of land-sea modelling as a decision support tool and endorse the regional guidelines;
3. Discuss and appreciate the importance of available-accessible data and information sharing, including through the newly developed (and soon to launch) the “Pacific State of Coast Spatial Data Infrastructure for the Pacific Ridge to Reef Programme.”

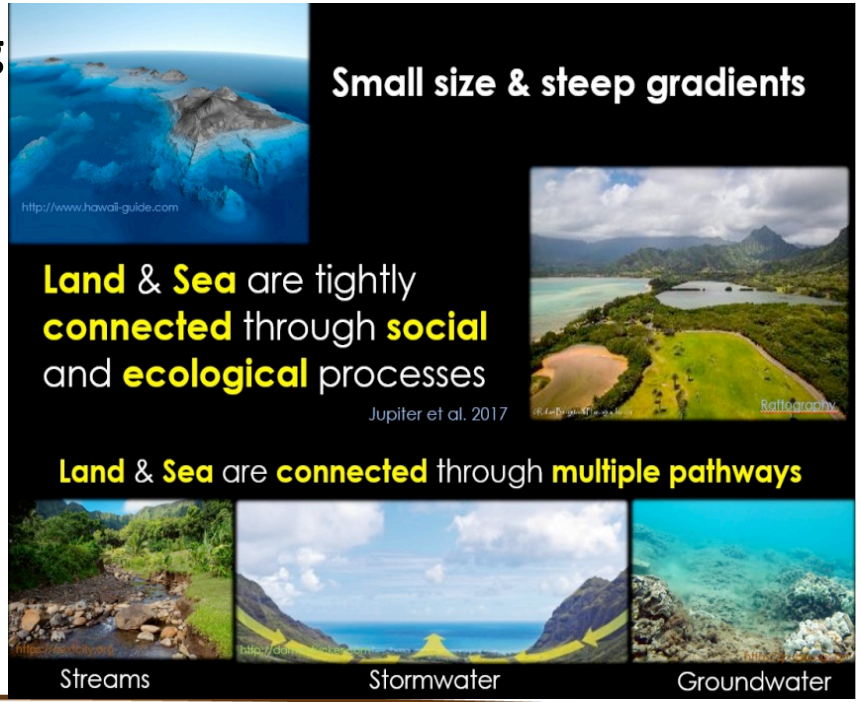
- **Regional guidelines for implementing the R2R conceptual procedural framework for the identification and spatial prioritization of conservation land/sea area**

  RATIONALE

  SCOPE

  BACKGROUND

- ***Delevaux et al. 2018***



What's spatial prioritization modelling?

Science-based and spatial planning procedure that supports selection of priority areas and sites for R2R interventions and reforms.

It demonstrates the interface between science and policy thereby improving the understanding, and enriching the knowledge base on the cause and effect relationship of "whole-of-island' environmental degradation. It also develops systems to better manage the impacts.

Degree of uncertainty and utilization in scenarios and models by direct driver.

Drivers	Utilization in Scenarios and Models	Stochastic Uncertainty	Scientific Uncertainty	Linguistic Uncertainty
Land Use Change	medium	medium	medium	medium
Climate Change	high	low	low	high
Pollution	low	low	medium	low
Natural Resource Use and Exploitation	low	high	medium	low
Invasive Species	high	high	low	low

Degree of uncertainty and utilization in scenarios and models by indirect driver

Drivers	Utilization in Scenarios and Models	Stochastic Uncertainty	Scientific Uncertainty	Linguistic Uncertainty
Economic	high	low	low	low
Demographic	high	low	low	low
Sociocultural	low	low	high	high
Governance and Institutions	medium	medium	medium	medium
Technological	high	high	high	low

National scale approach:
Adapt & apply a spatially-explicit framework with scenario planning to identify national priority areas that benefit land & sea

Local scale approach:
Downscale this framework to test the effect of proposed local R2R management actions in one priority watershed

Specific Tasks

- **Water Catchment Areas, High Islands**

  Evaluate where land-use change and habitat scenarios would impact sediment runoff and downstream coral reefs to identify priority areas on land where conservation restoration could promote coral reef resilience in the face of climate change

- Building the R2R land-sea modelling framework requires inputs of broad range of satellite and empirical data to make it work

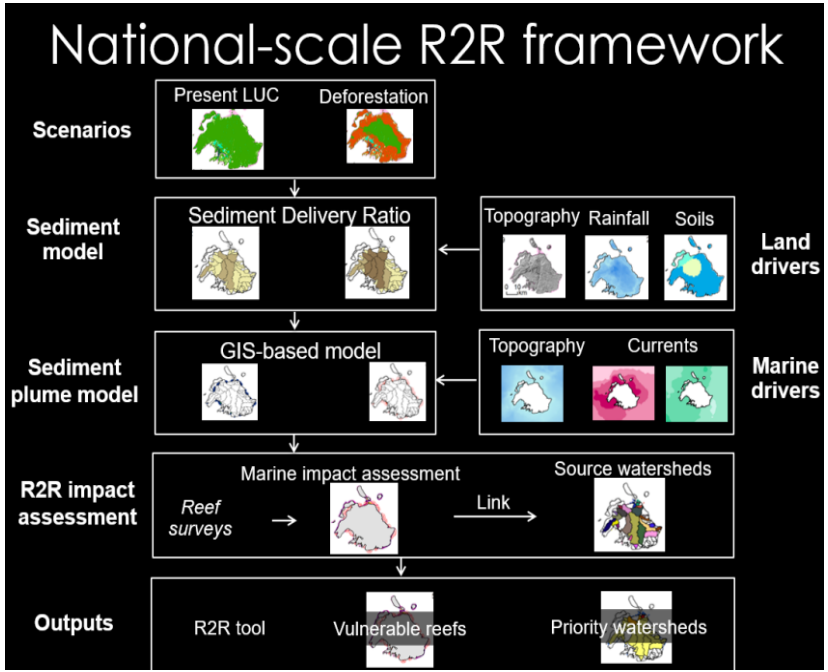
Process, Outputs

- The procedure incorporates quantifiable criteria and indicators for the identification of priority R2R sites
- The procedure reflects the importance of sites from the lenses of biological, environmental, and socio-economic conditions nationally
- The procedure will cover the following:-
  - (i) Existing data and defined criteria, identify national level priority sites or target areas
  - (ii) Results will be used to support national planning for ICM and IWRM
  - (iii) Information generated from a land-sea model at a demonstration site will highlight those areas within the overall identified priority area that are most critical to protect.

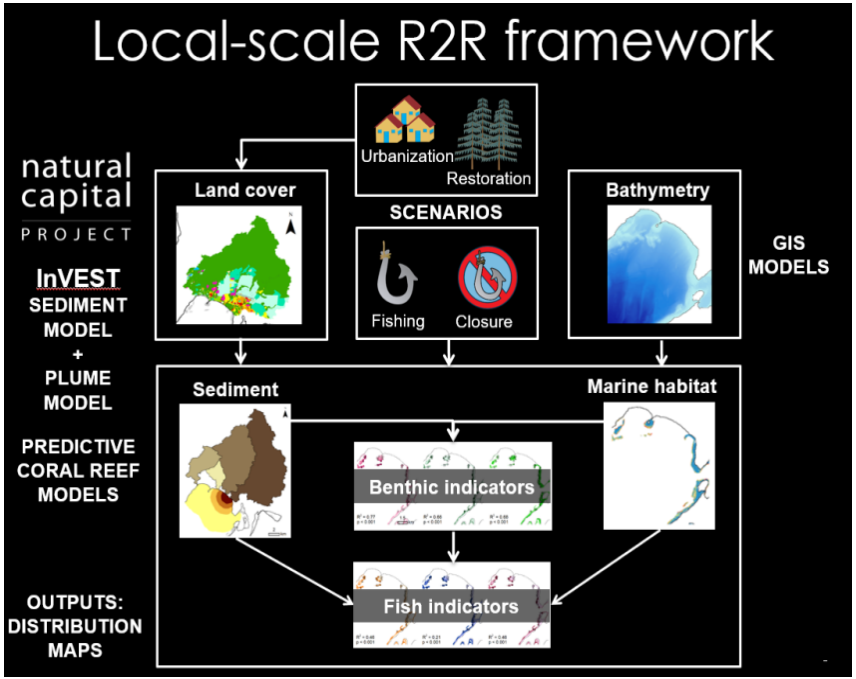
Stepwise procedures

- Participatory planning processes
- Develop potential future land-use or marine-use change scenarios
- Identify relevant spatial data gaps important for analyses and inputs into land-sea models

  If yes, then prepare to carry out field work to ground-truth & collect additional primary data
- Prepare sampling protocols & designs for field work



- Coordinate logistical arrangements including teams of people involved and their roles.
- Carry out field work closely adhering to sampling design and following deadlines and details set out in the implementation plan.
- Data processing and analyses
- Additional survey work to optimise calibration of marine and terrestrial models. The exercise should be participatory to promote capacity building.



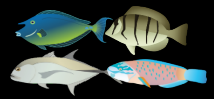
Calibrate coral reef models

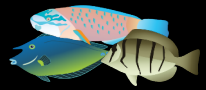

Corals


Macroalgae


Turf algae

Benthic models = sediment + habitat

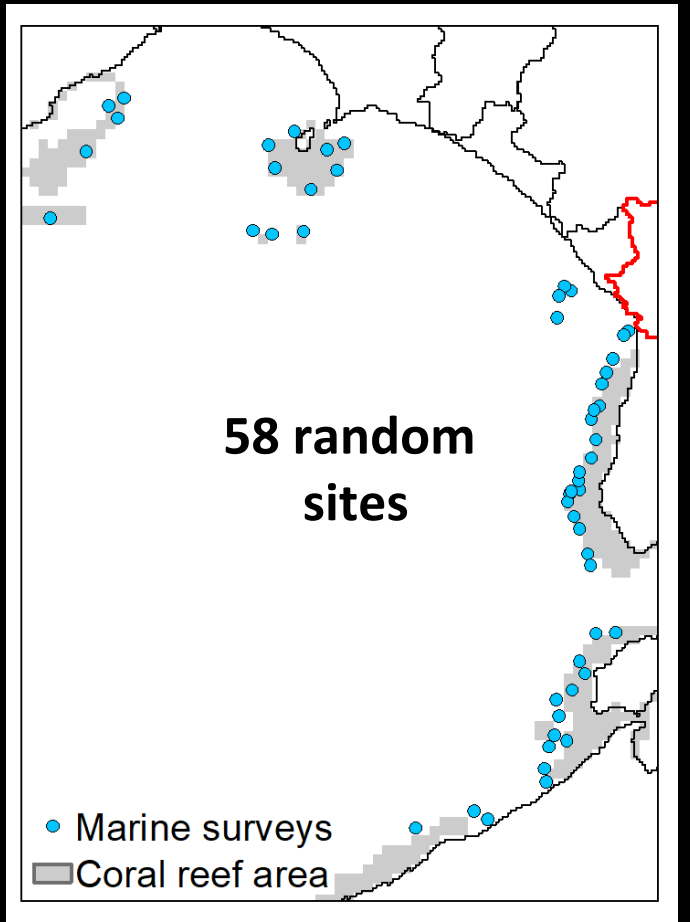

Total biomass


Herbivore biomass


Targeted biomass

Fish models =
sediment + habitat + ***benthic*** indicators

Delevaux et al. 2017, Elith et al. 2008, Smith et al. 2016



Scenario analysis

1. Predict coral reef **benthic** & **fish indicators** under **present** & **each scenario**

2. Calculate the coral reef **indicators** change for **each scenario** compared to **present**

Tracing land-sea linkages

1. Model the **sediment export** & **plume** under **present** & each **deforestation scenario**

2. Identify **coral reef areas** exposed to **significant** change in **sediment** for **each scenario** compared to **present**

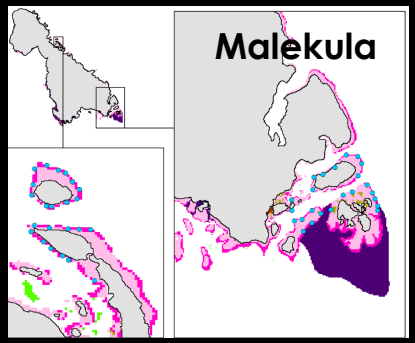
3. Identify the **watersheds** supplying the most **sediment** (>40%) to those **coral reef areas**

Spatial prioritization

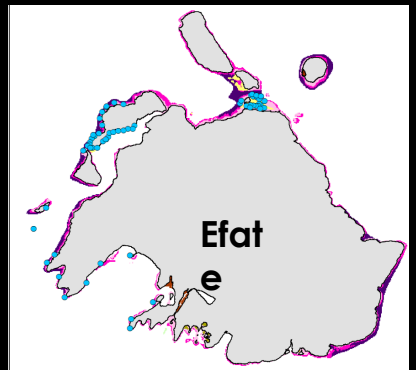
1. Characterize the **potential marine impact** using **coral % cover** & **fish biomass** from **empirical data**

2. Prioritize **watersheds** by **potential marine impact**

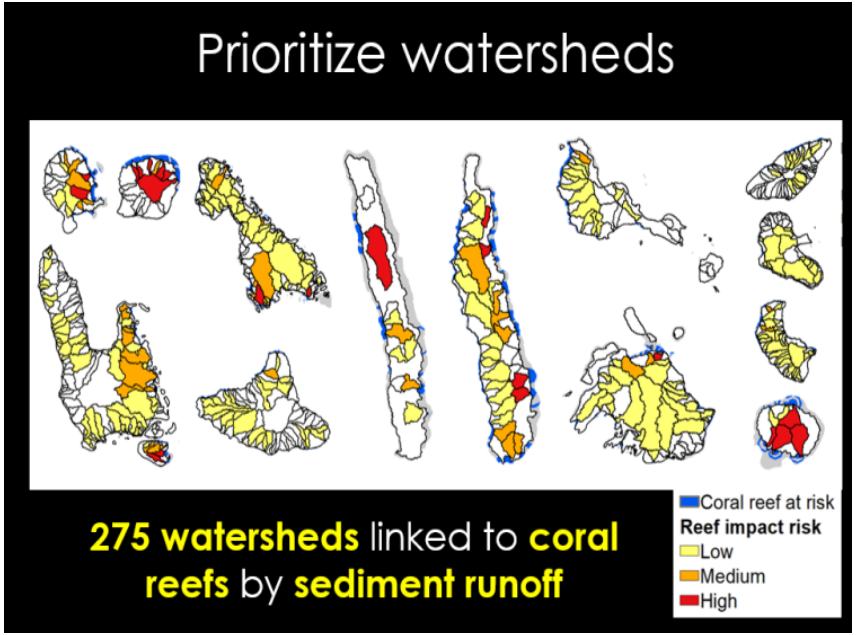
3. Identify **land areas** exposed to **significant** change in **sediment export** under **each scenario** compared to **present**



130 sites



- Prepare technical reports that include clearly the methods employed, model outputs, maps depicting priority areas and sites, and packaged models.
- Present and discuss methods and outputs with other actors or peer review and refinement.

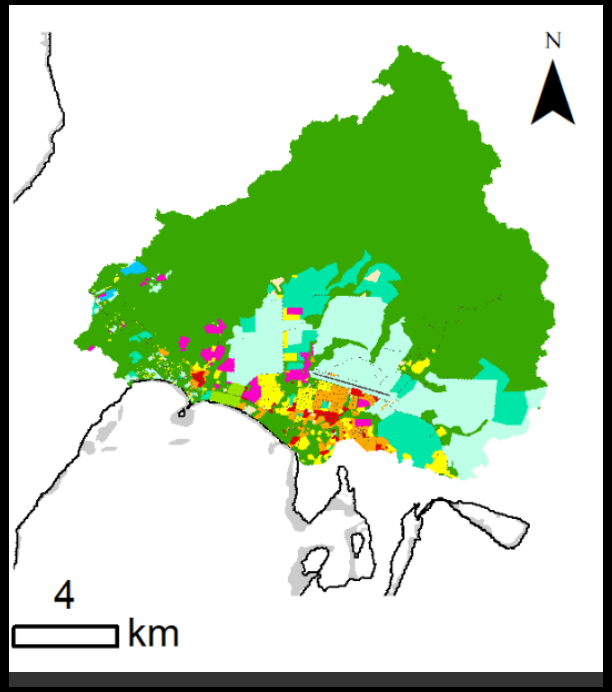


LOCAL-SCALE APPROACH RESULTS

CORAL REEF ALLIANCE

Present scenario

8% of **Human LUC**

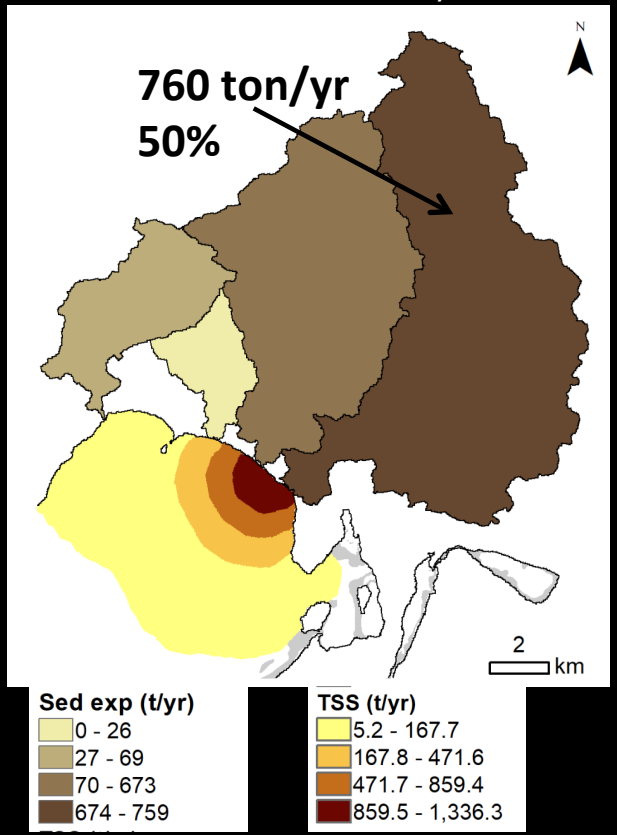


69% of **Native forest**

22% of **Grass/shrubland**

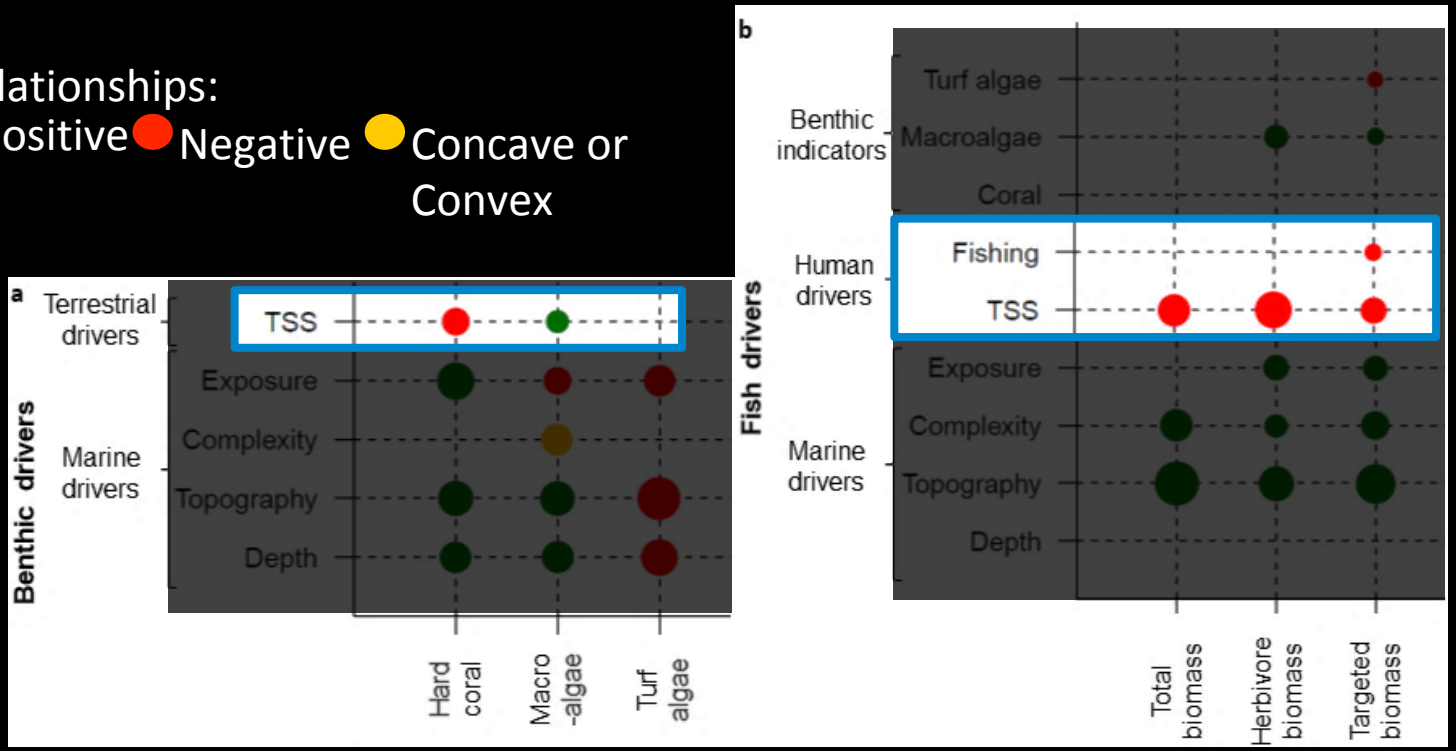
1,260 ton/yr

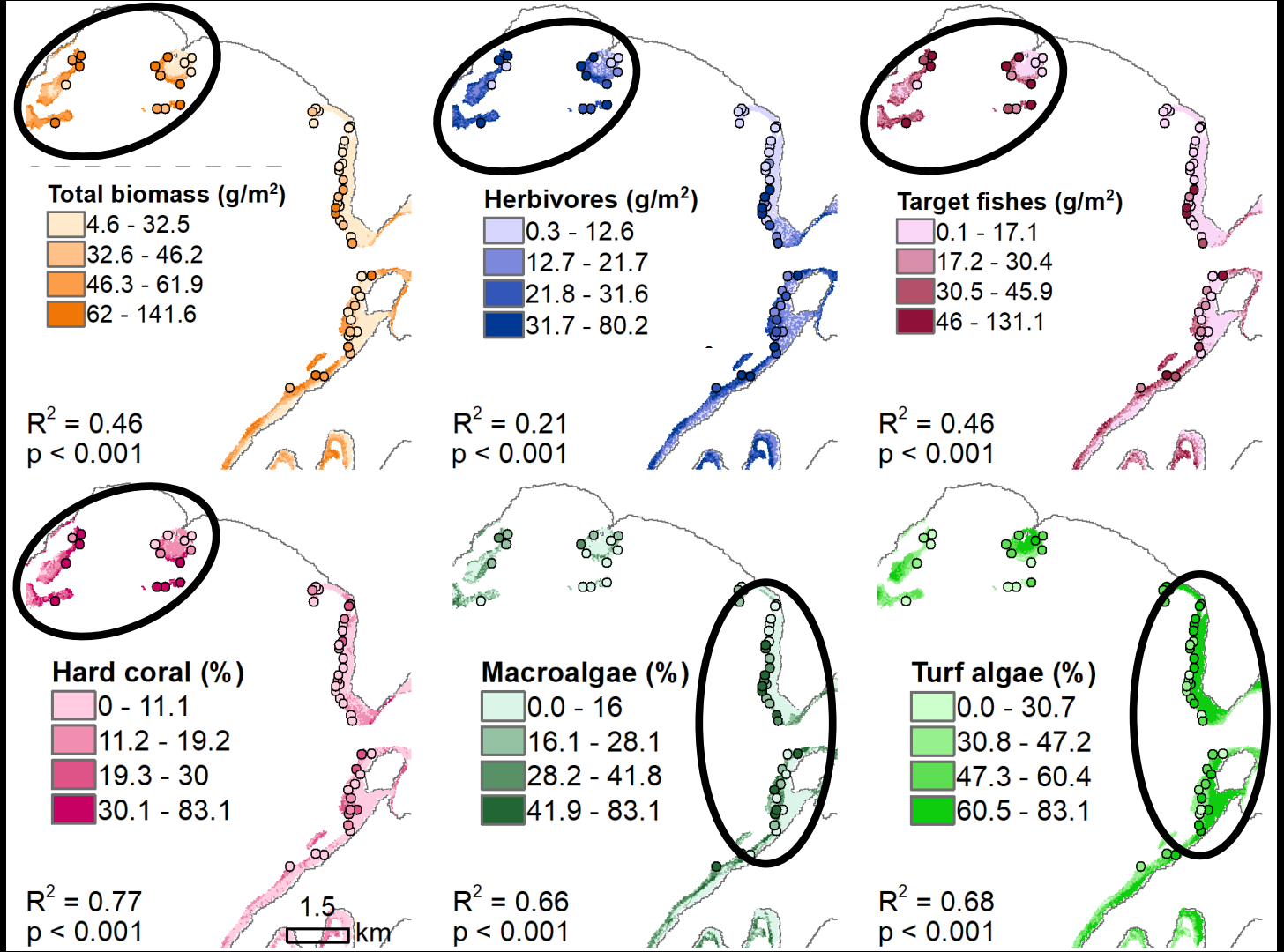
9.7 ton/km^{-2}/yr



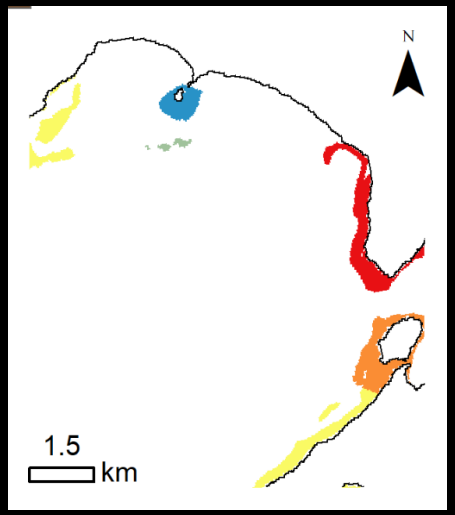
Calibrated coral reef models

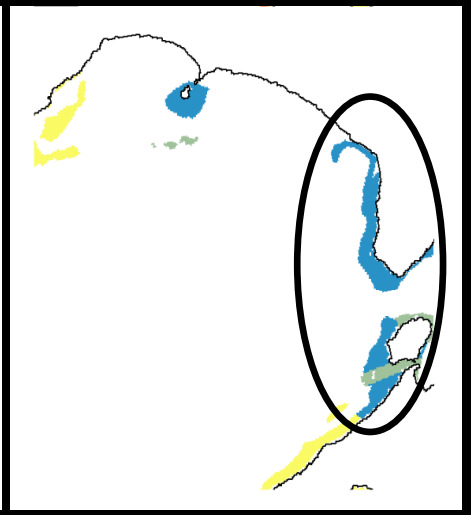
Relationships:
Positive Negative Concave or Convex

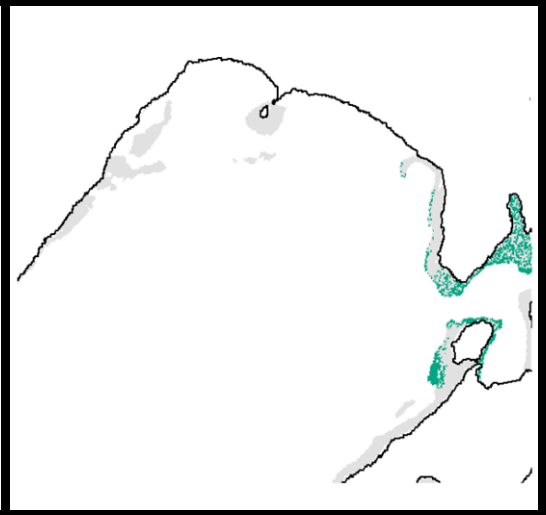



Total biomass (g/m²)
4.6 - 32.5
32.6 - 46.2
46.3 - 61.9
62 - 141.6
R² = 0.46
p < 0.001
Herbivores (g/m²)
0.3 - 12.6
12.7 - 21.7
21.8 - 31.6
31.7 - 80.2
R² = 0.21
p < 0.001
Target fishes (g/m²)
0.1 - 17.1
17.2 - 30.4
30.5 - 45.9
46 - 131.1
R² = 0.46
p < 0.001
Hard coral (%)
0 - 11.1
11.2 - 19.2
19.3 - 30
30.1 - 83.1
R² = 0.77
p < 0.001
1.5
km
Macroalgae (%)
0.0 - 16
16.1 - 28.1
28.2 - 41.8
41.9 - 83.1
R² = 0.66
p < 0.001
Turf algae (%)
0.0 - 30.7
30.8 - 47.2
47.3 - 60.4
60.5 - 83.1
R² = 0.68
p < 0.001

Marine closure scenario







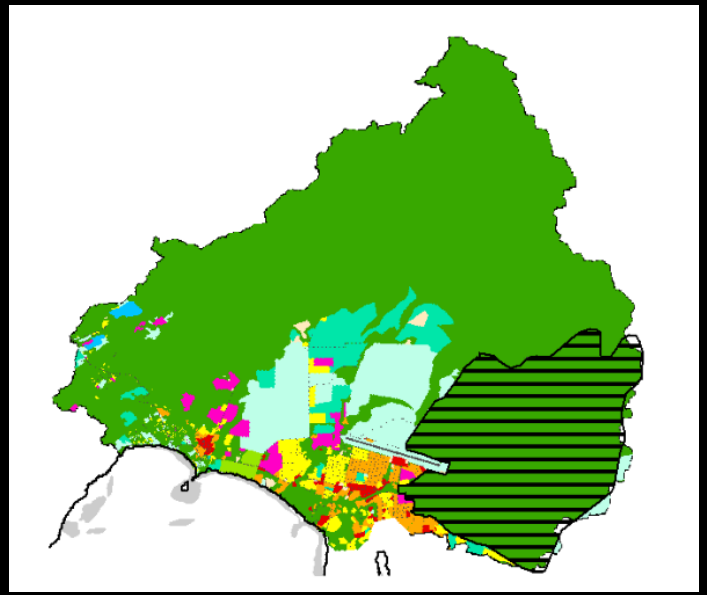
Fishing index
- 0 - Closure
- 1 - Low
- 2 - Moderate
- 3 - High
- 4 - Very high

Closed area

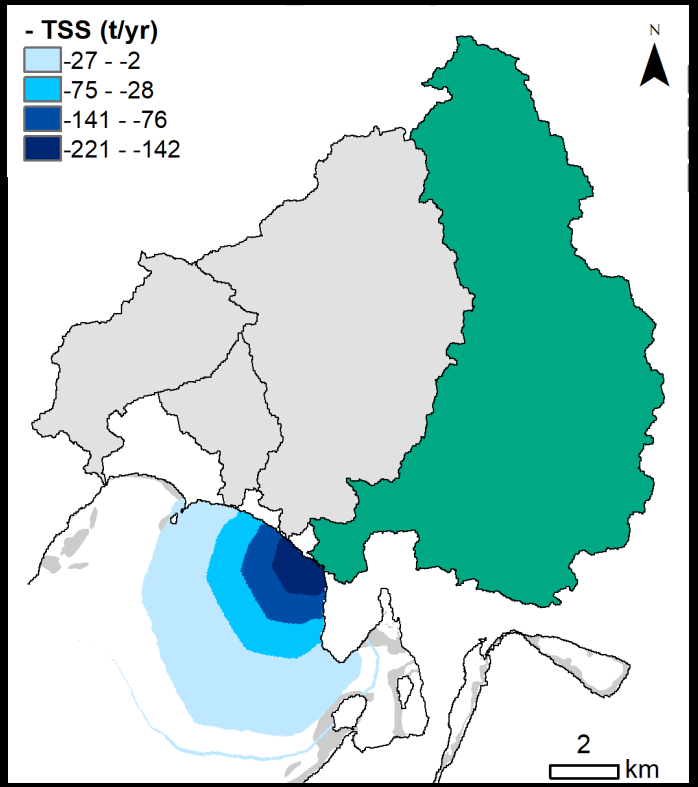
Fish biomass
+2.5 tons

Restoration scenario

+1,330 ha of
Native forest

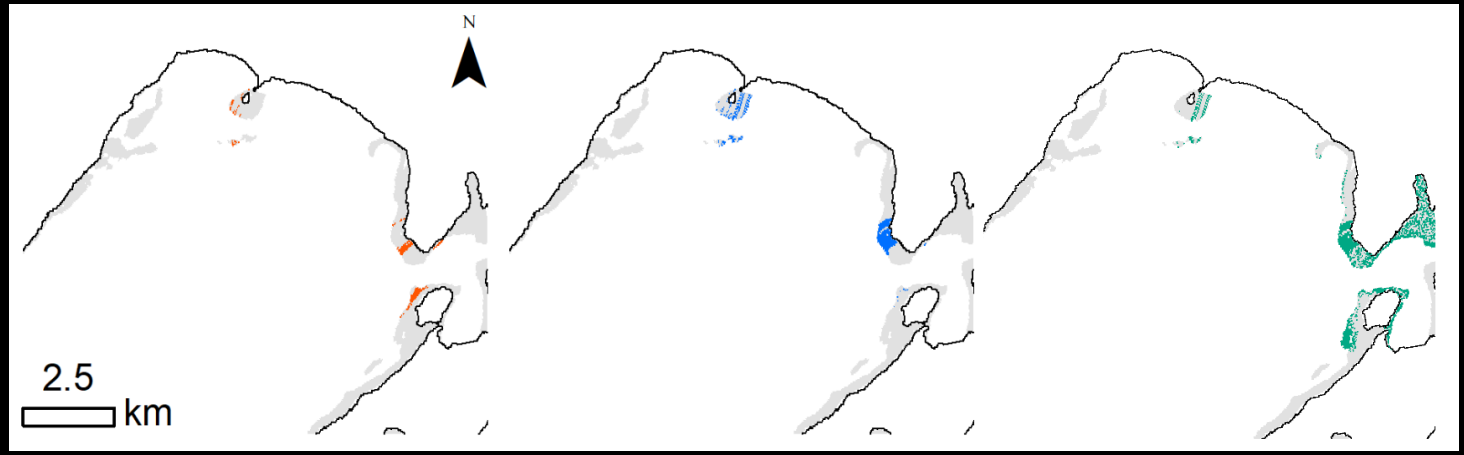


- 210 ton/yr



Restoration scenario

+Marine closure



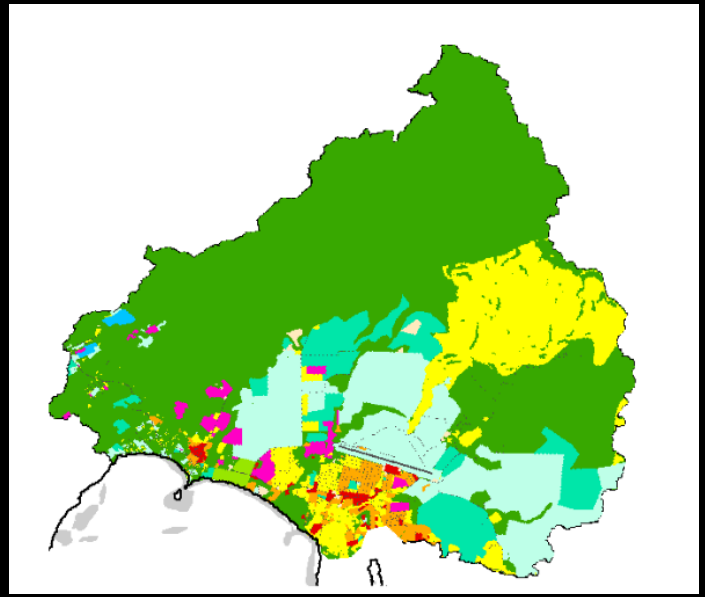
Habitat quality
20 ha
+3% coral
-1.5% macroalgae

Fish biomass
+0.7 tons

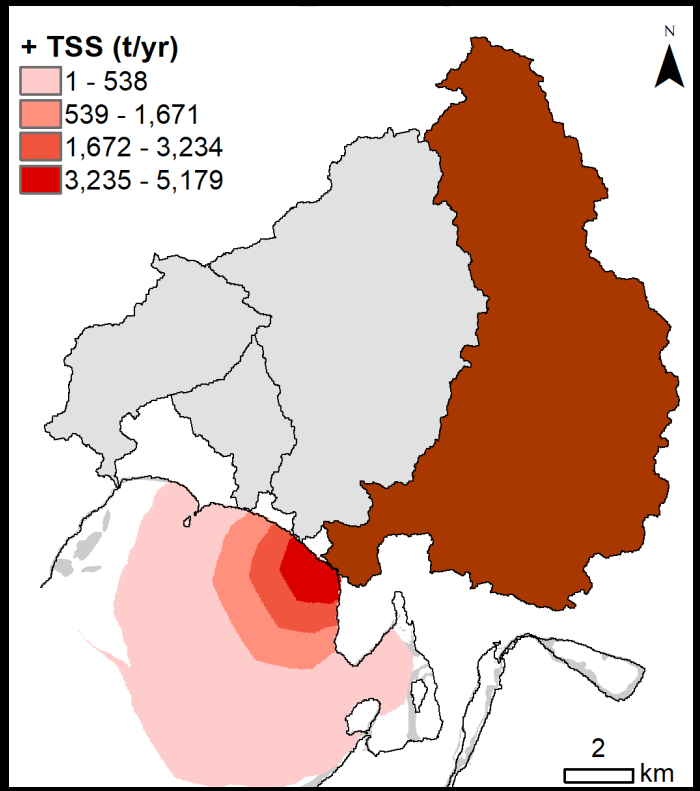
Fish biomass
+3.3 tons

Urbanization scenario

+ 1,340 ha of
Human LUC

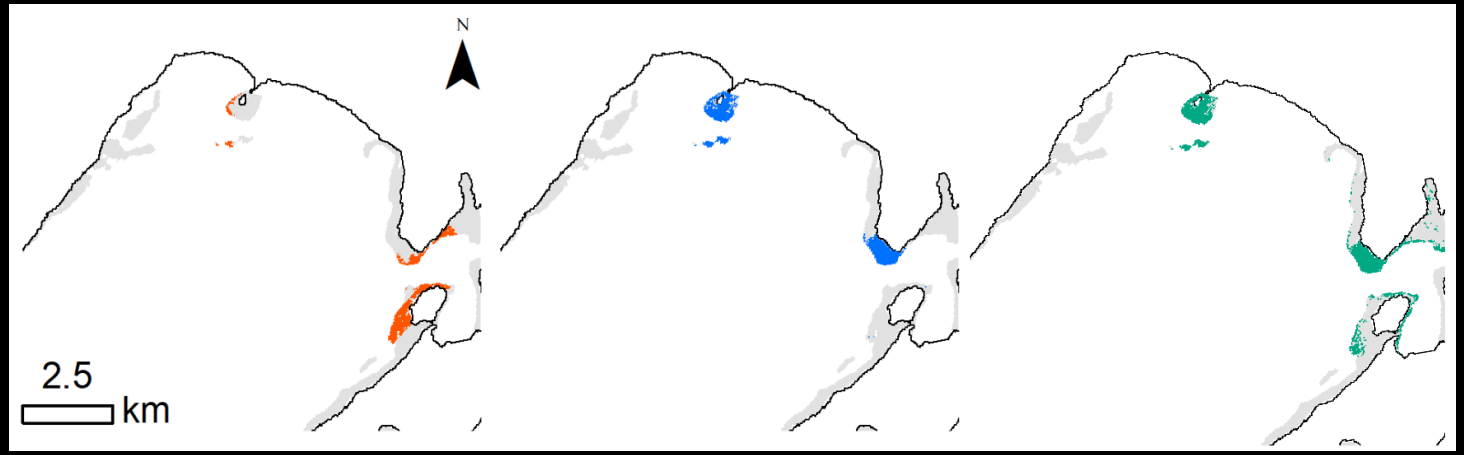


+ 5,180 t/yr



Urbanization scenario

+Marine closure



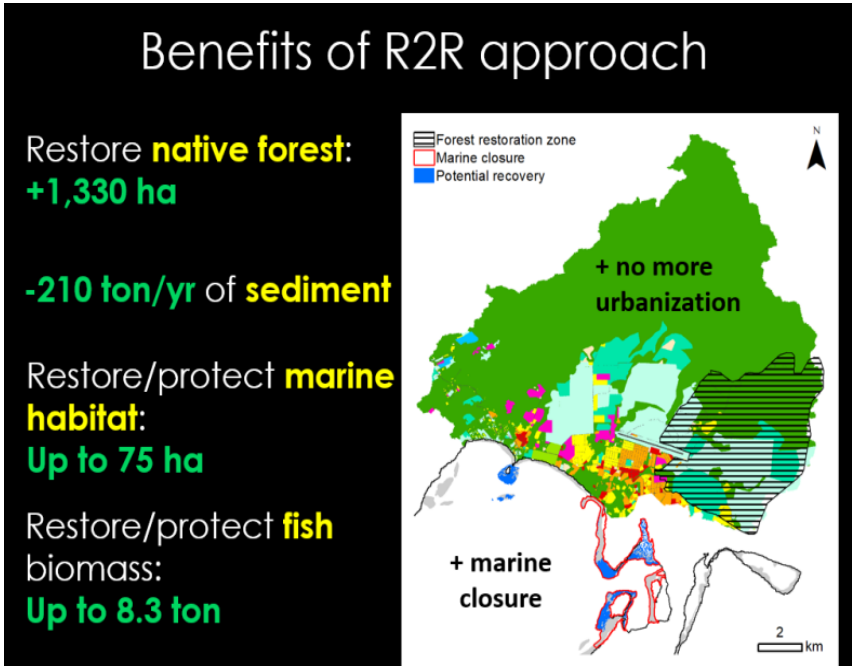
Habitat quality
75 ha
-7% coral
+2% macroalgae

Fish biomass
-6.7 tons

Fish biomass
-5 tons

Benefits & Implications

- Use existing data to define criteria and identify national level priority sites or target areas - diagnostic analysis stakeholder workshops or simply reporting back to communities in targeted demonstration project sites.
- Use the results to support future upscaling R2R investments and national planning for ICM.



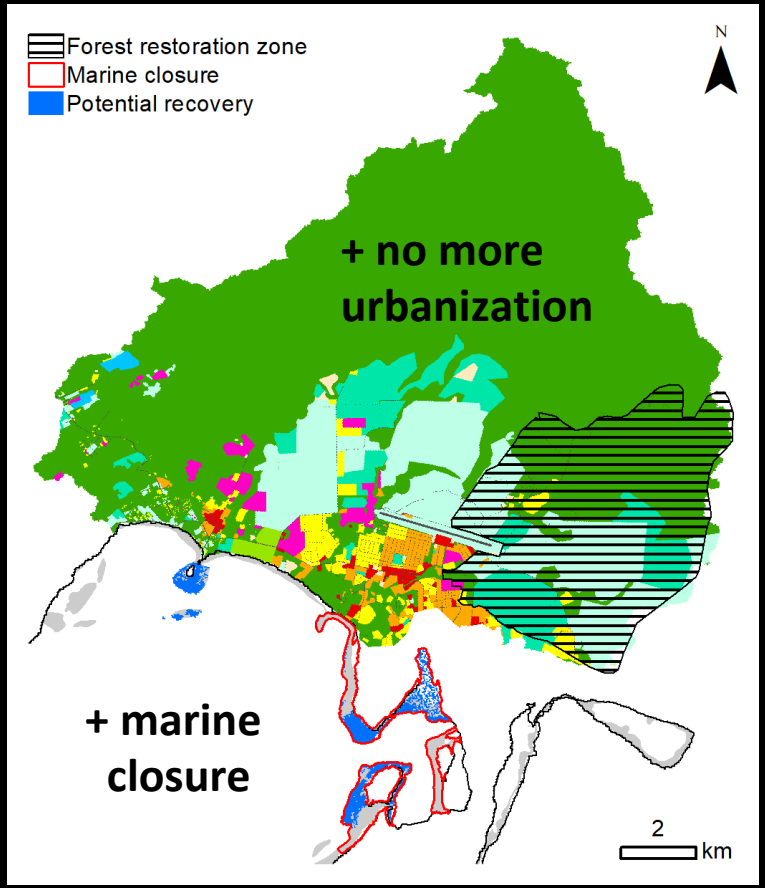
Benefits of R2R approach

Restore **native forest**:
+1,330 ha

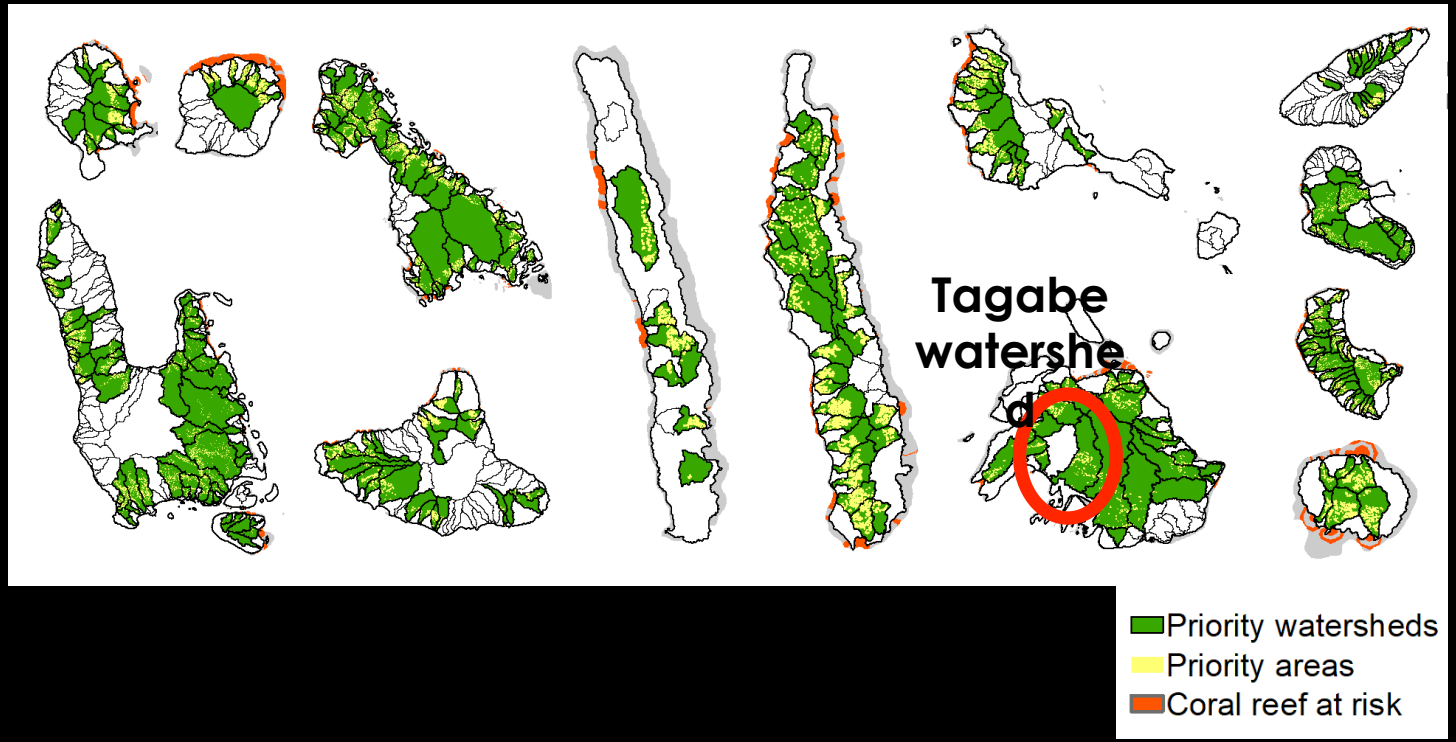
-210 ton/yr of **sediment**

Restore/protect **marine habitat**:
Up to 75 ha

Restore/protect **fish** biomass:
Up to 8.3 ton



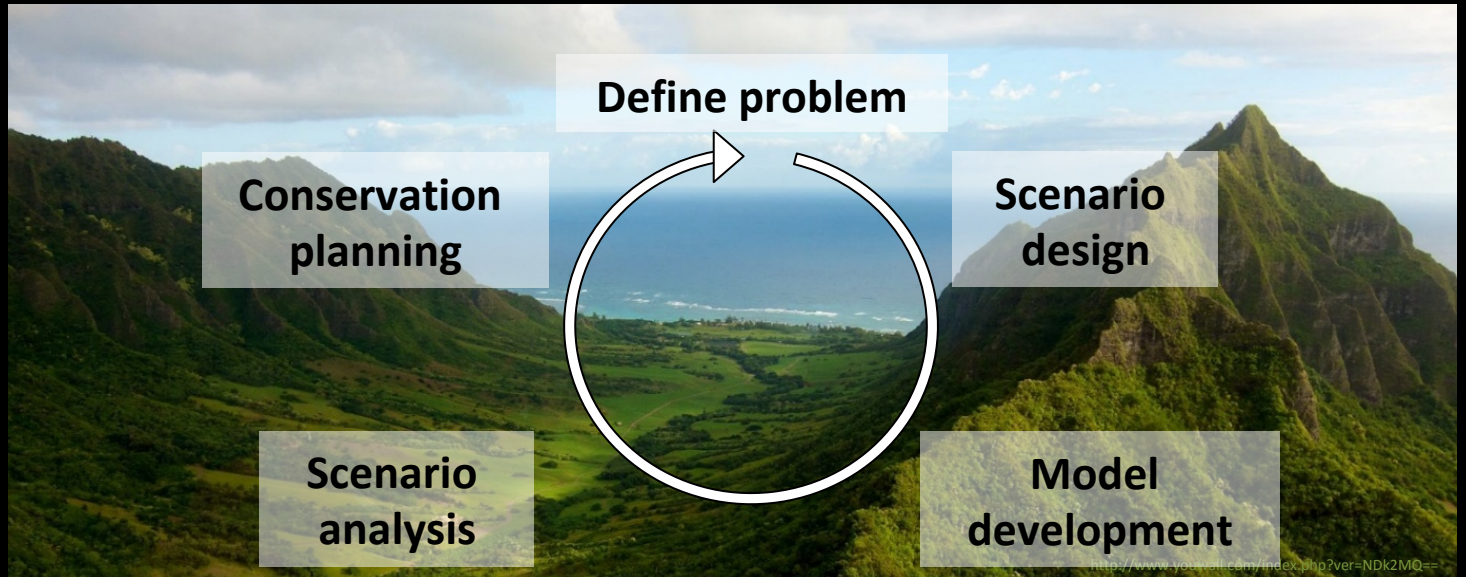
Social & economic drivers



Collaborative management

1. Provide **information** to foster **dialogue** between **decision-makers**

2. Can be applied as part of an **iterative** decision-making **process**



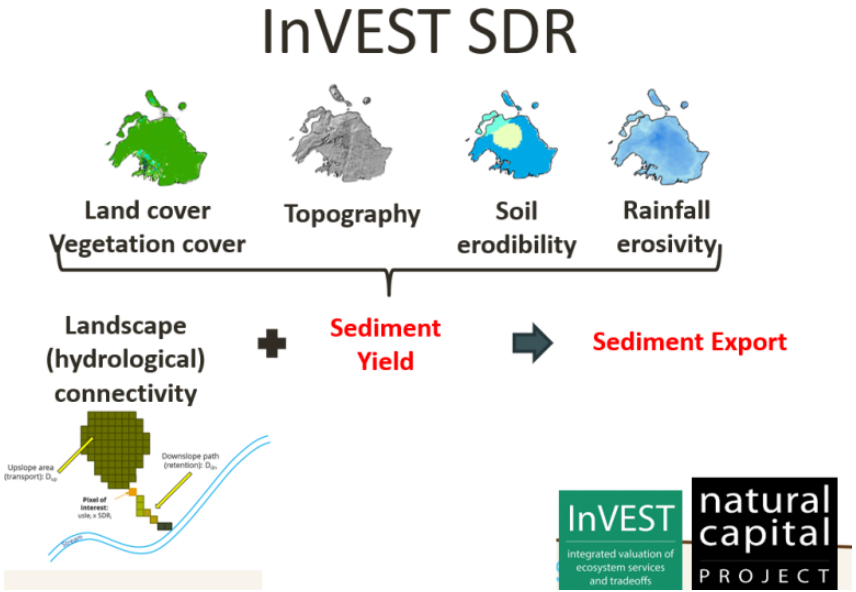
Support decision making

1. Prioritize **conservation areas** at the **national-scale** that can **benefit** both **terrestrial** & **marine** environments

2. Support **local** decision-making by testing **policy actions** & estimating potential **outcomes** prior implementation

Key Challenges

- Spatial data & data gaps for land-sea modelling
- SPC GEM spatial datasets
- Freely available software packages (InVEST SDR & R)
- Open access QGIS



Decision support tool in data poor regions

- Resolution of input foundational layers (soils, currents)
- Decision support tool relies on static modelling
  - R2R framework can give an idea where may degrade or recover but not a dynamic model where possible to see impacts through measuring indicators
- Suggested approach to address challenges (para. 33)

(i) Reflect on the design, clarity and relevance of the R2R spatial prioritization and planning procedures noting the outcomes of its trials in Vanuatu; and

(ii) Discuss and approve the practical application of the guidelines to implement the spatial prioritization and planning procedures to identify conservation areas in future upscaling R2R investments and ICM planning in PICs.

- Thank you…