HABITAT RISK ASSESSMENT

(HRA)

INTRODUCTION

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1

HUMAN ACTIVITIES

2

RISK TO HABITATS

3

ECOSYSTEM SERVICES AND VALUES

QUESTIONS
HRA MODEL CAN HELP ANSWER

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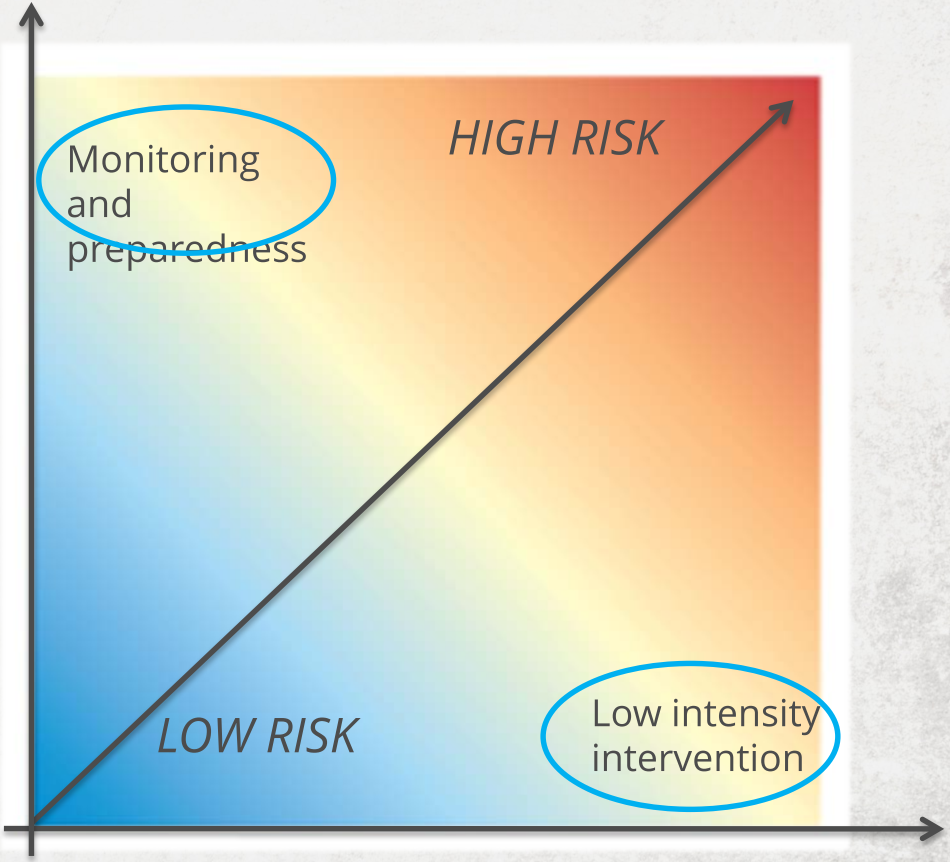
- Which habitats are most at risk and where?
- What types of management options may be useful for reducing risk?
- Which human activities pose the greatest risk now and in the future and how may that influence the delivery of ecosystem services?

MODEL THEORY
CALCULATING RISK

CONSEQUENCE
(e.g., Change in habitat area or structure, recovery potential)



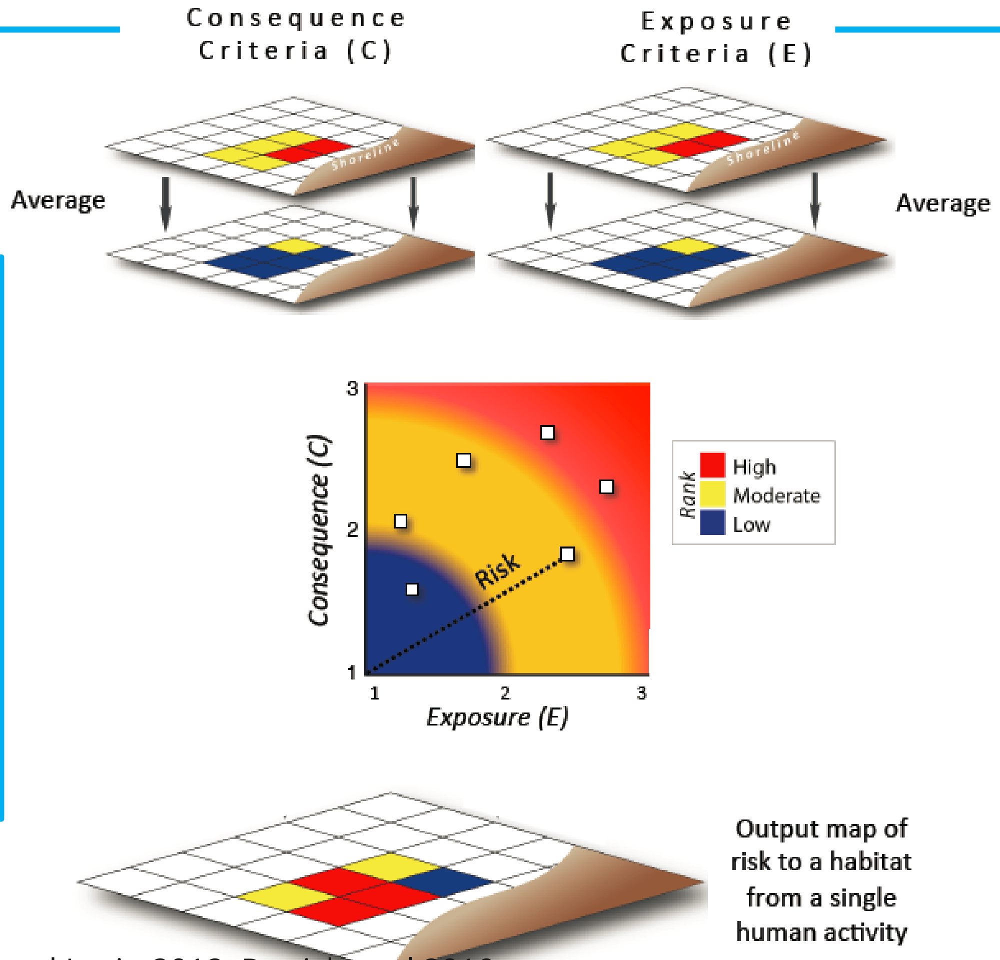
EXPOSURE
(e.g., Habitat-stressors overlap in time and space)

Change in habitat structure

Change in habitat area

Recovery potential of habitat:

- Frequency
- Natural mortality
- Recruitment
- Age at maturity
- Recover time
- Connectivity



Overlap between habitats and stressors in time and space:

- Intensity
- Management effectiveness

Arkema et al in press, Samhouri and Levin 2012, Patrick et al 2010

INVEST HABITAT RISK MODEL

INPUTS

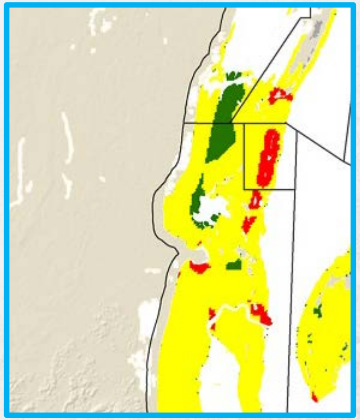
Habitats
Maps of relevant natural habitats

Stressors
Maps of human uses (e.g., coastal development, dredging, etc.)

Effect of stressor on habitat
Based on information from scientific literature and local knowledge

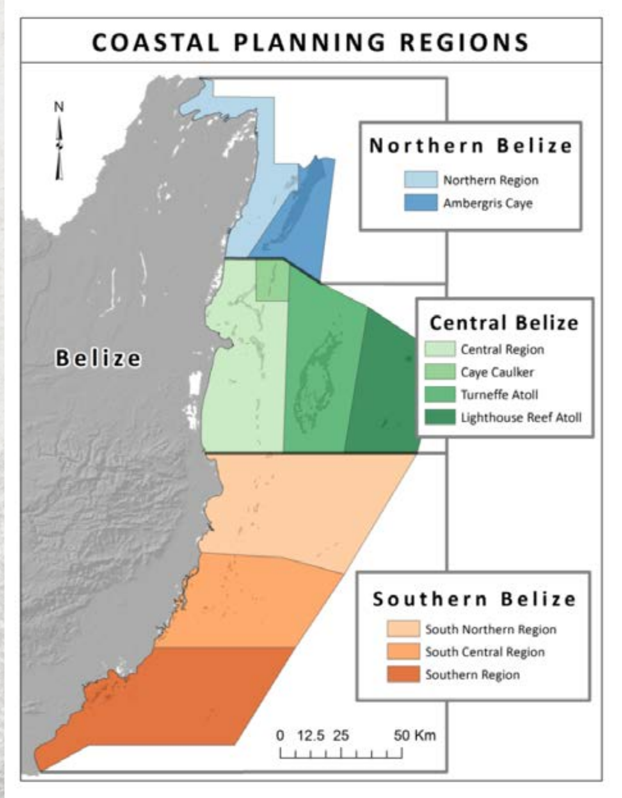
OUTPUTS

Risk plots
For each habitat-stressor interaction



Maps of relative habitat risk
For each habitat

INTEGRATED COASTAL ZONE MANAGEMENT PLAN



InVEST

integrated valuation of environmental services and tradeoffs

QUESTIONS
HRA MODEL IN BELIZE

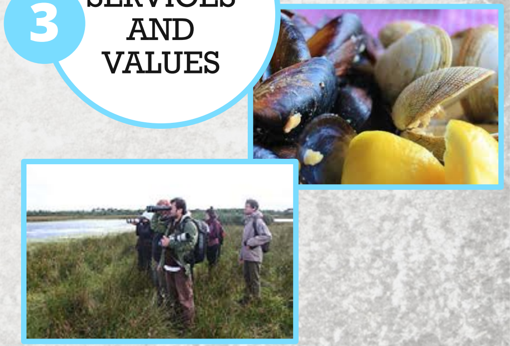
Coastal and marine spatial planning

- Where should we site coastal and ocean uses to reduce risk to marine ecosystems and enhance the benefits they provide to people?

1 HUMAN ACTIVITIES

2 RISK TO HABITATS

3 ECOSYSTEM SERVICES AND VALUES









MEXICO
Gulf of Mexico
CUBA
BELIZE
GUATEMALA
HONDURAS
Caribbean Sea
EL SALVADOR
NICARAGUA
COSTA RICA
PANAMA





HABITATS AND STRESSORS

Habitats

- Mangrove
- Seagrass
- Coral Reef

Stressors

- Agricultural run-off
- Aquaculture
- Fishing
- Marine transportation
- Coastal development
- Dredging
- Oil exploration
- Marine recreation

HRA DATA INPUTS

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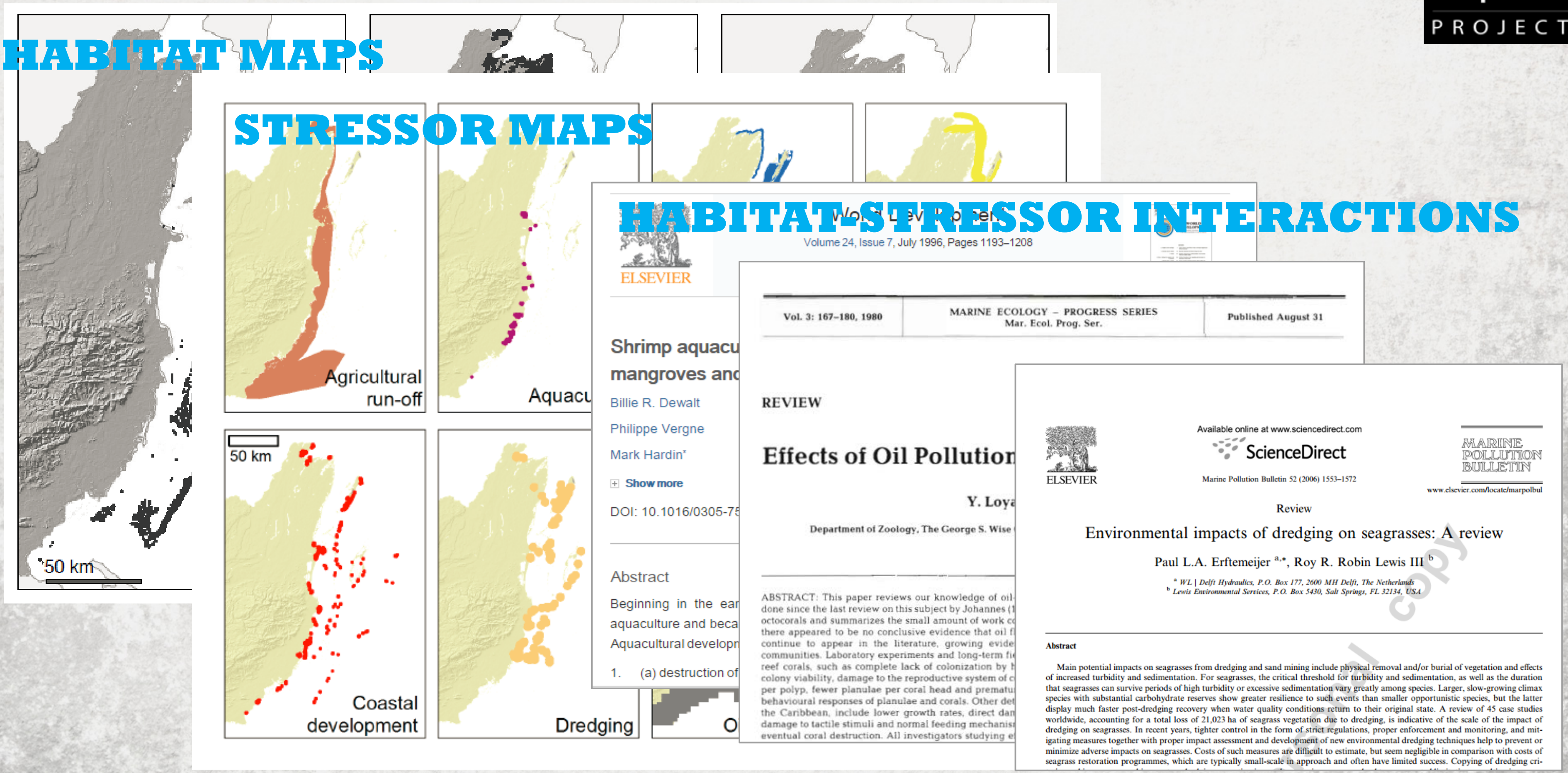
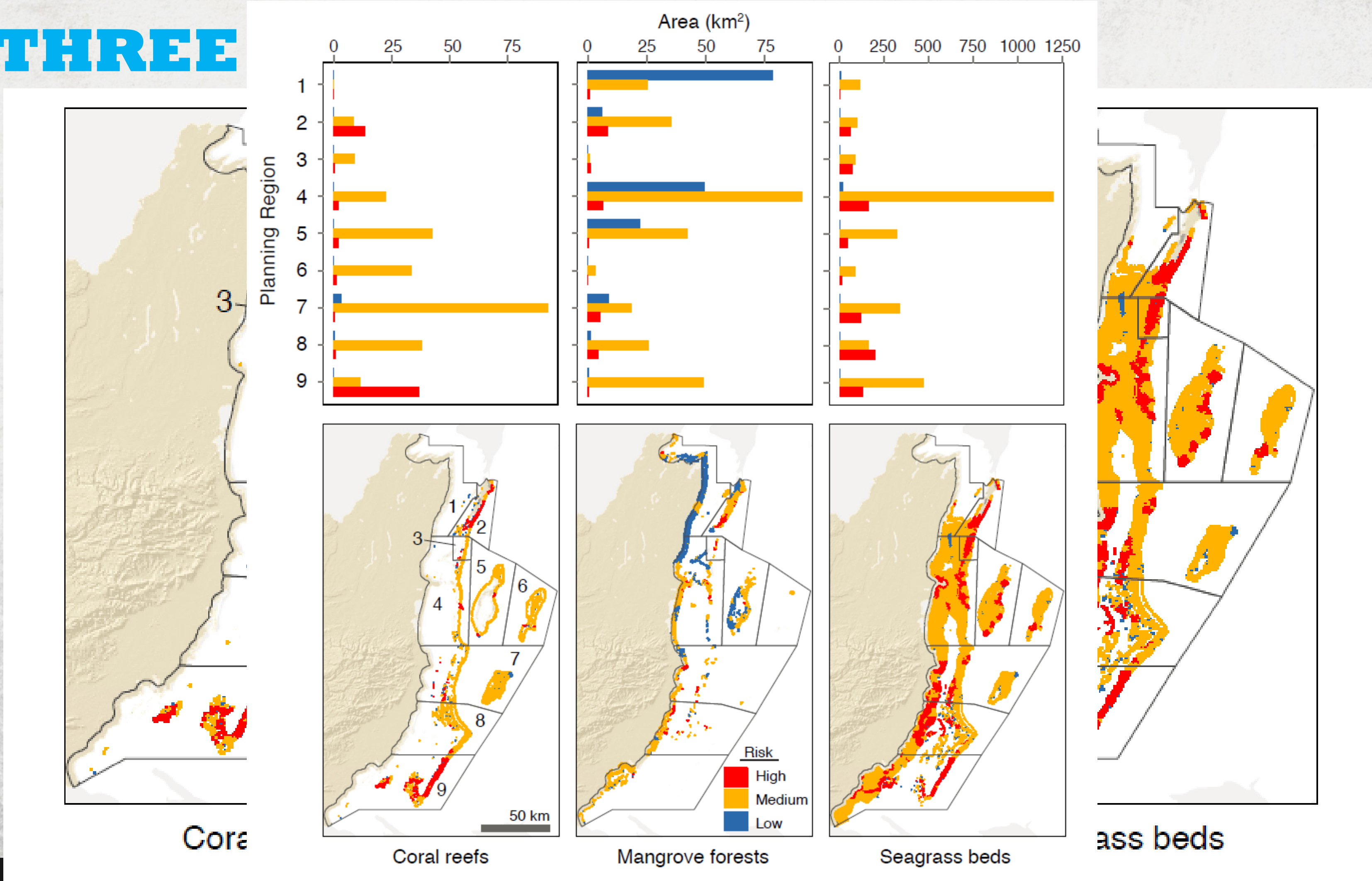
HABITAT MAPS

STRESSOR MAPS

HABITAT-STRESSOR INTERACTIONS



THREE



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Arkema et al
In press ERL

COMPARISON TO EMPIRICAL DATA

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- Empirical tests of the model are strong in Belize
- Corals

Three-quarters of the measured data for coral reef health lie within the 95% confidence interval of interpolated model data (approach = spatial statistics).

- Mangroves

79% of predicted mangrove occurrences are associated with observed responses (approach = Receiver operating characteristic curves (ROC))

Arkema et al
In press ERL

POSSIBLE FUTURE ZONING SCHEMES

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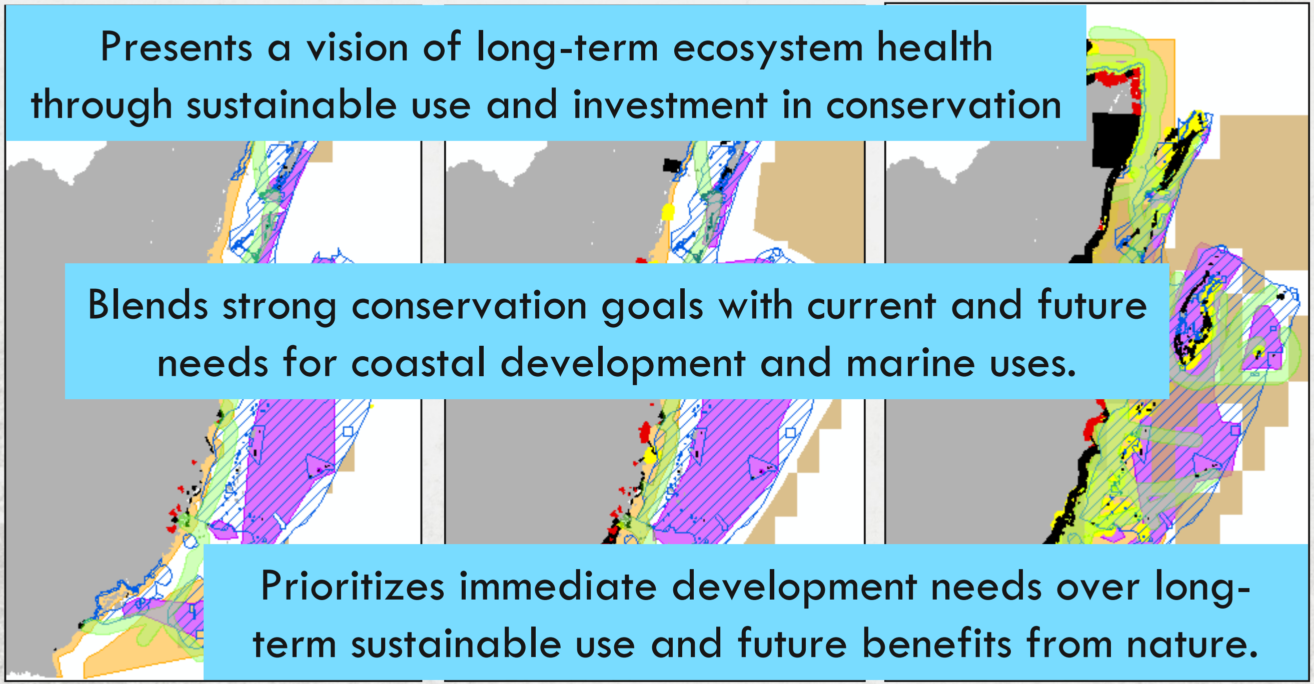
Current maps of uses, other planning efforts, stakeholder visions

CONSERVATION	INFORMED MANAGEMENT	DEVELOPMENT



Presents a vision of long-term ecosystem health through sustainable use and investment in conservation

Blends strong conservation goals with current and future needs for coastal development and marine uses.

Prioritizes immediate development needs over long-term sustainable use and future benefits from nature.

- Agricultural run-off
- Aquaculture
- Coastal Development
- Dredging
- Fishing
- Recreation
- Marine Transportation
- Oil exploration

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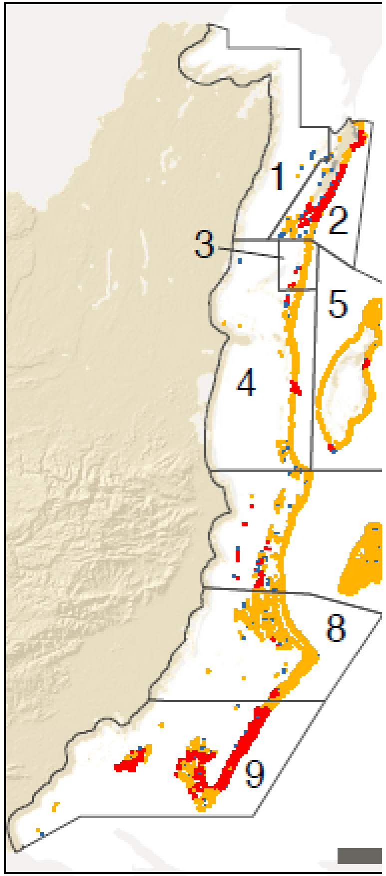
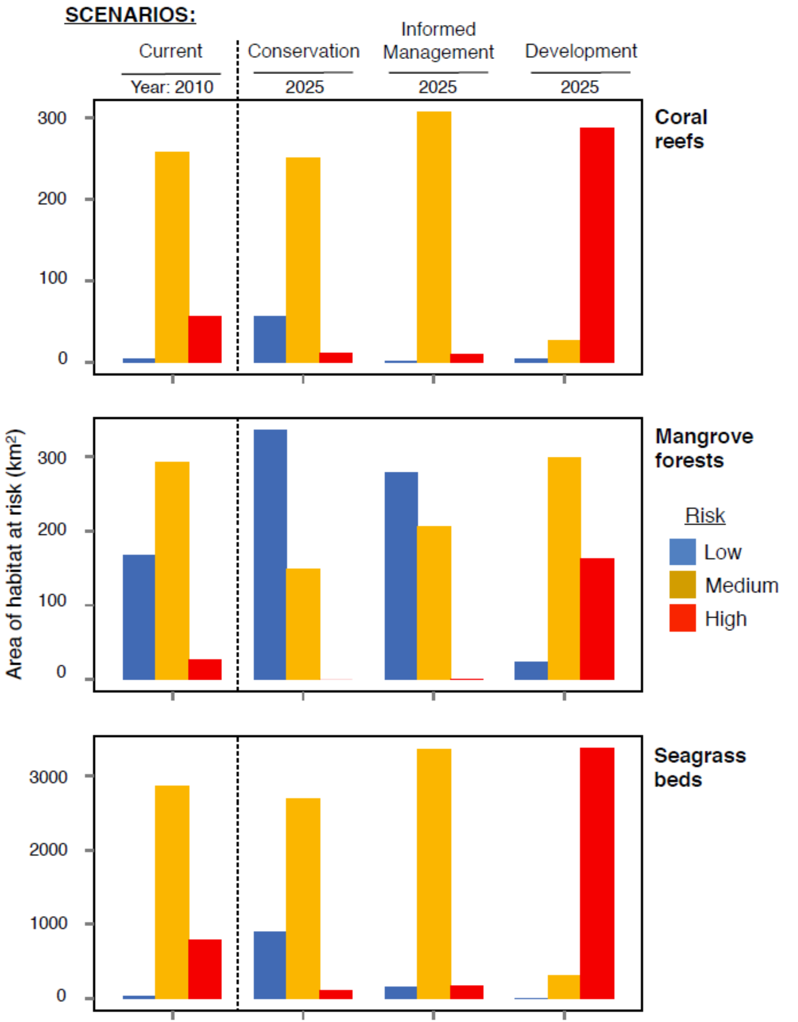
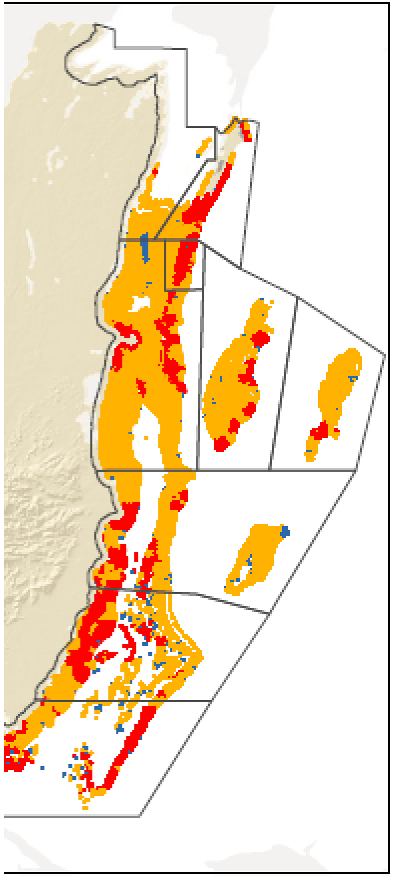


Coral reefs

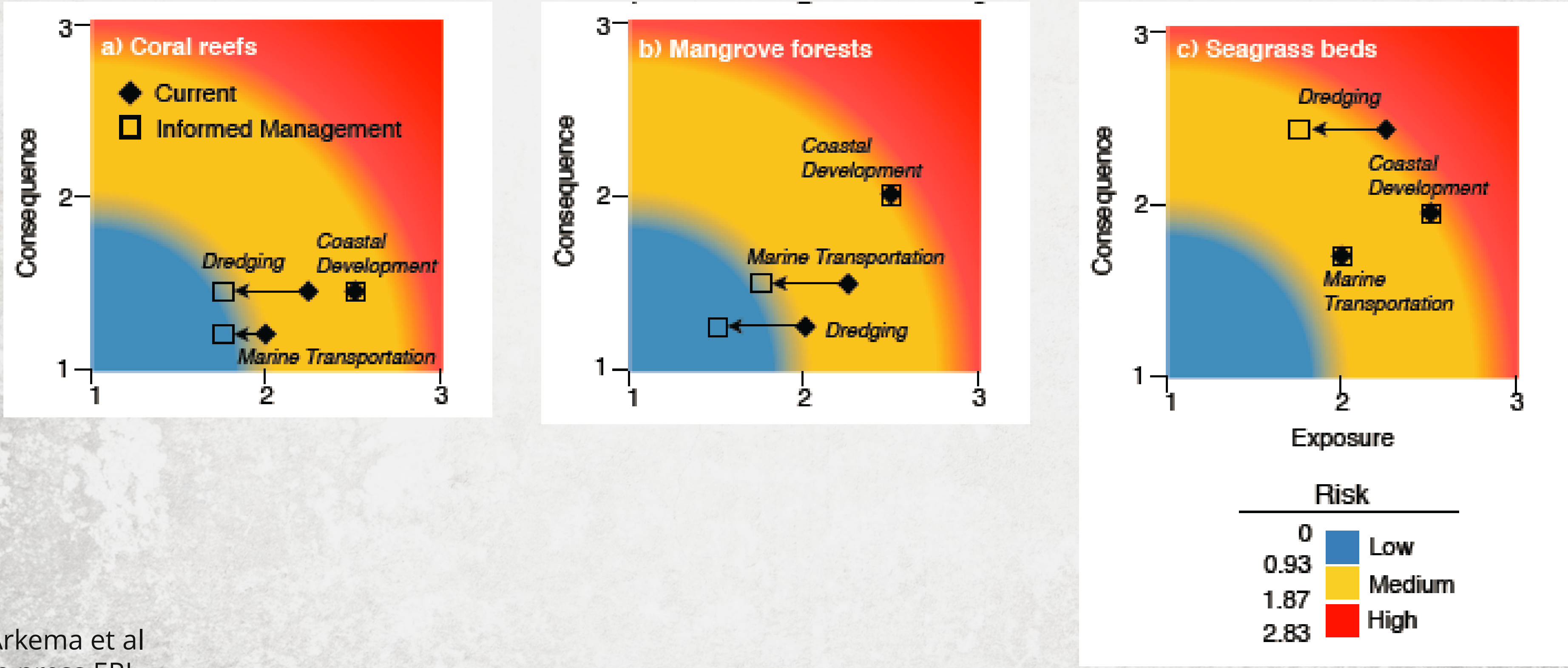




Seagrass beds

Arkema et al
In press ERL

RISK PLOTS



Arkema et al
In press ERL

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Most important benefits from nature

HRA AND LOBSTER IN BELIZE

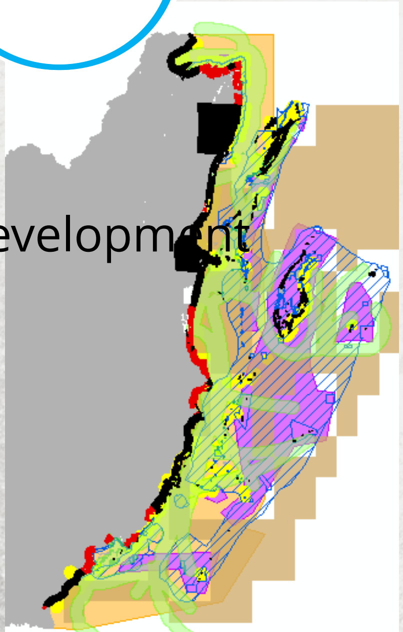
1 ZONING SCHEME

HRA

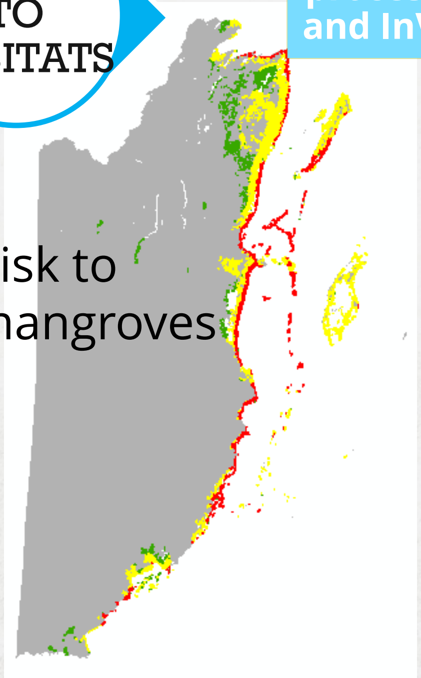
2 RISK TO HABITATS

Post-HRA processing and InVEST

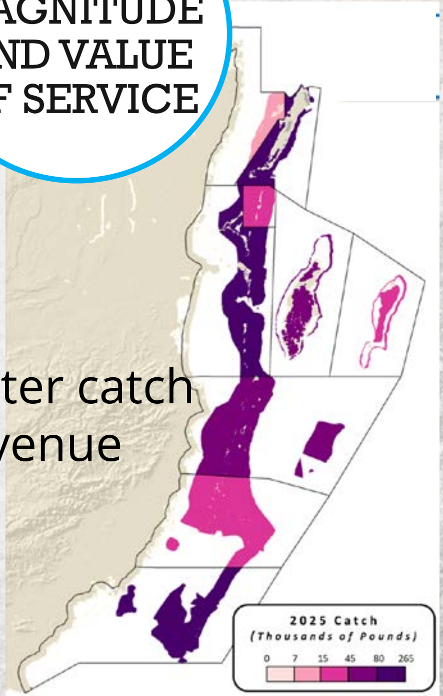
3 Changes to MAGNITUDE AND VALUE OF SERVICE



Development



Risk to mangroves



Lobster catch & revenue

BELIZE SYNTHESIS HABITAT AND SERVICES

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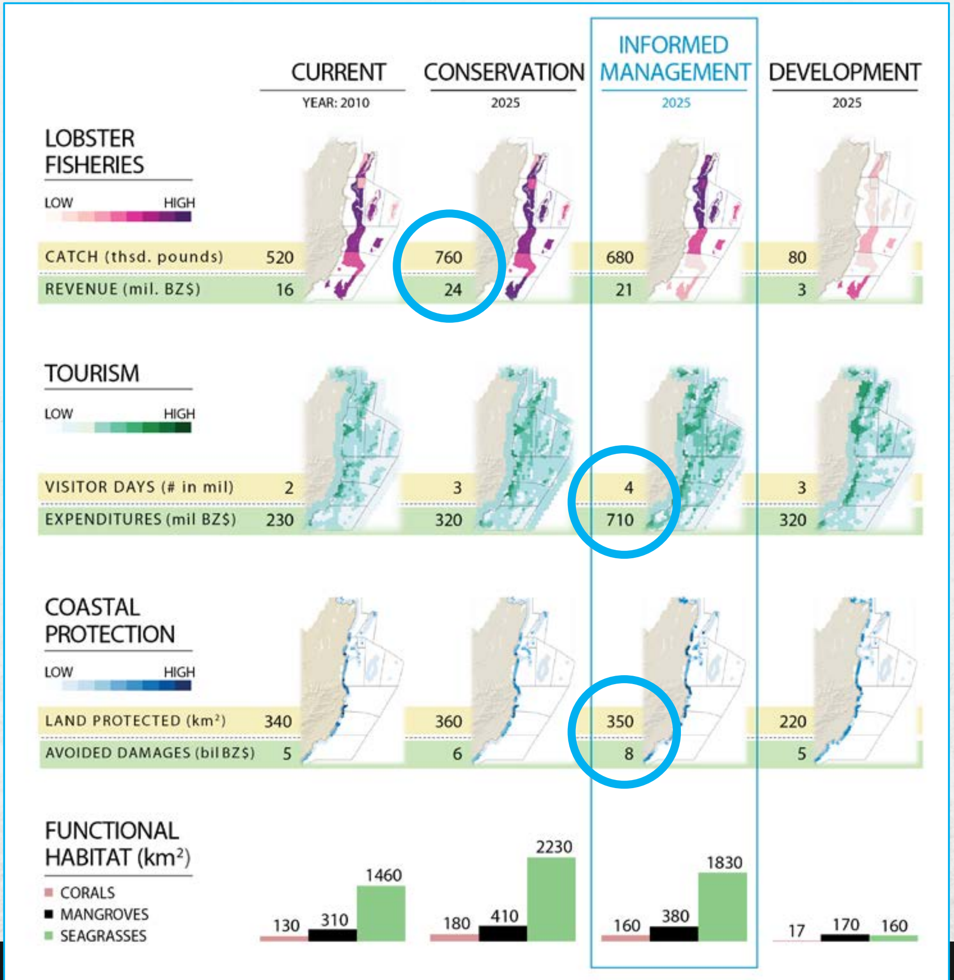

Arkema et al.,

accepted PNAS