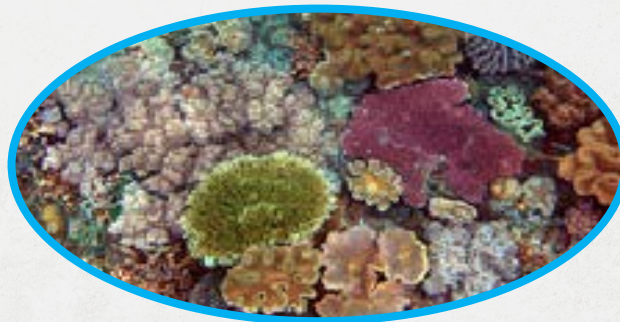


HABITAT RISK ASSESSMENT

(HRA)



INTRODUCTION

1

HUMAN
ACTIVITIES



2

RISK
TO
HABITATS



3

ECOSYSTEM
SERVICES
AND
VALUES



QUESTIONS

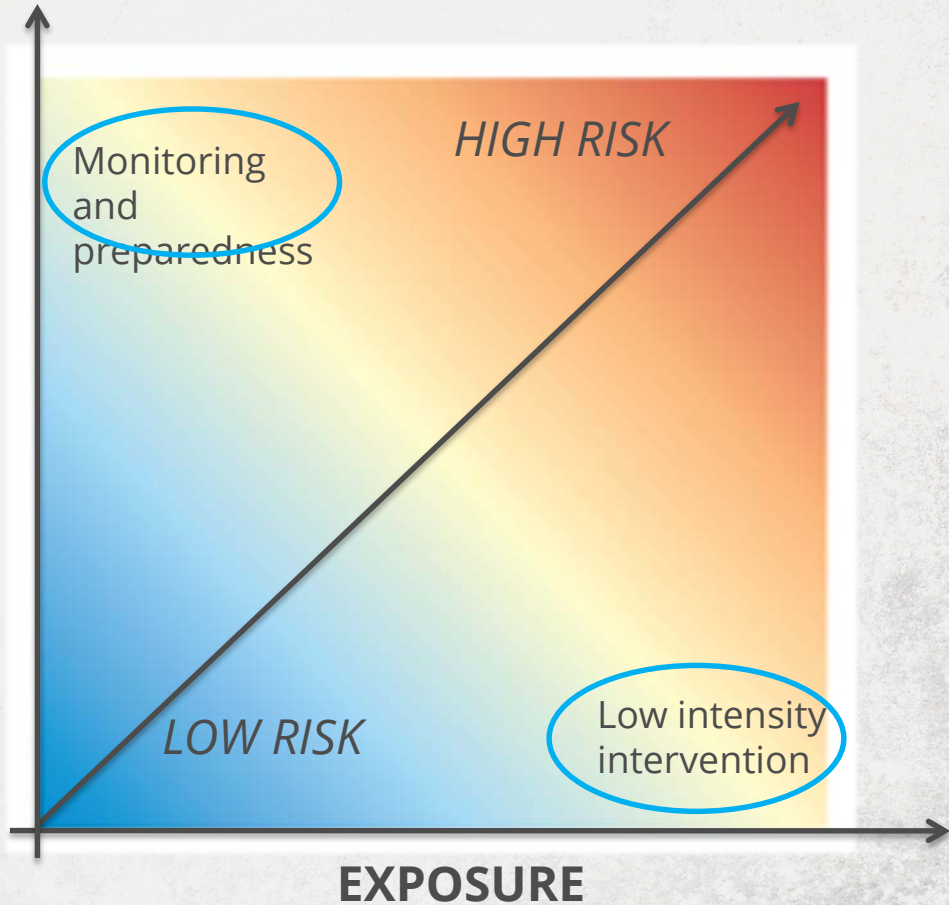
HRA MODEL CAN HELP ANSWER

- 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?

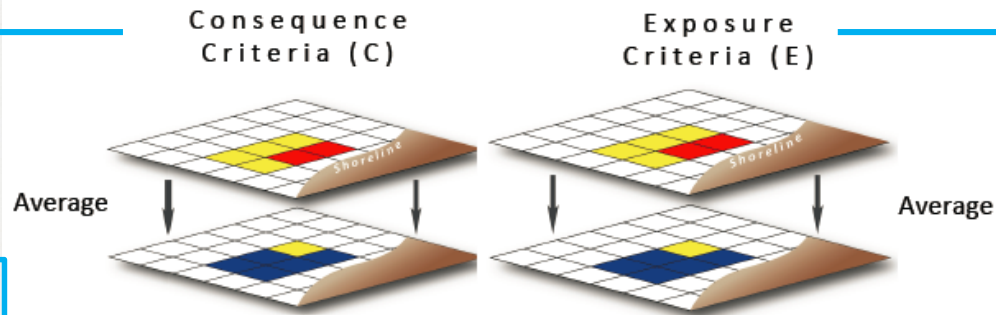
MODEL THEORY

CALCULATING RISK

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



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



Change in habitat structure

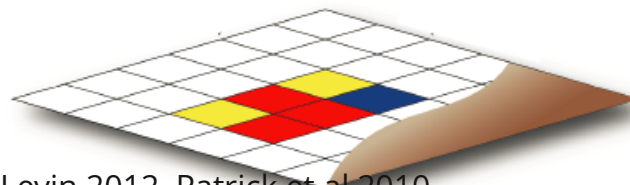
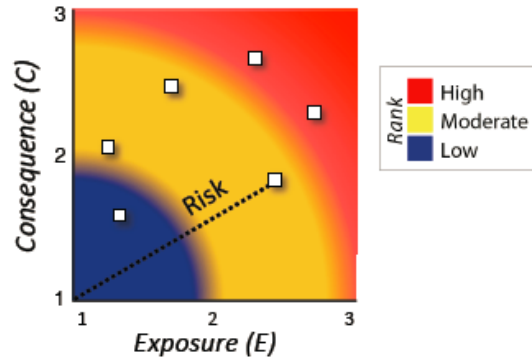
Change in habitat area

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



Output map of risk to a habitat from a single human activity

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

INVEST HABITAT RISK MODEL

InVEST
integrated valuation of
environmental services
and tradeoffs

**natural
capital
PROJECT**

INPUTS

Habitats

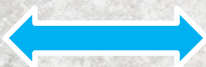
Maps of relevant
natural habitats

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

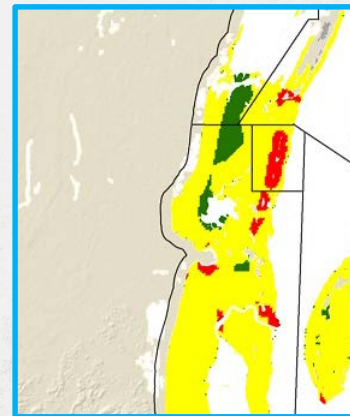
Risk plots

For each
habitat-stressor
interaction



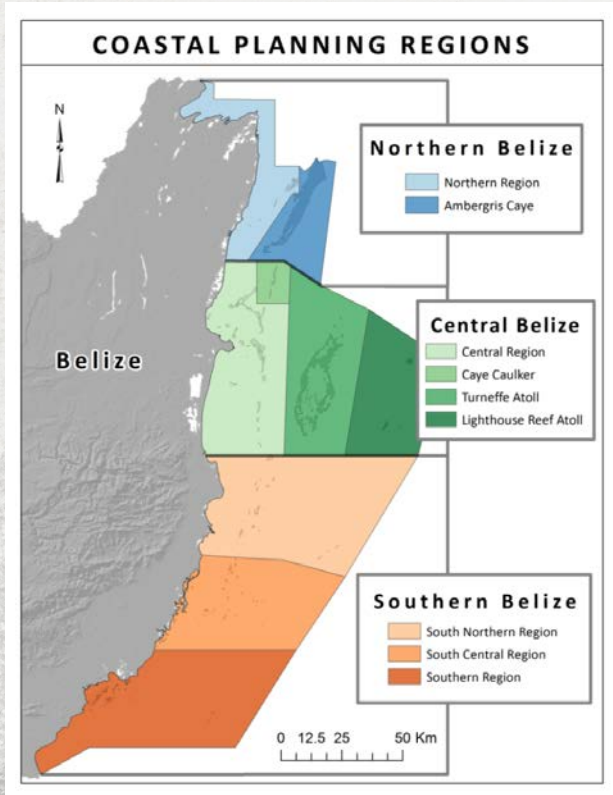
Maps of relative habitat risk

For each habitat



INTEGRATED COASTAL ZONE MANAGEMENT PLAN

natural
capital
PROJECT



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



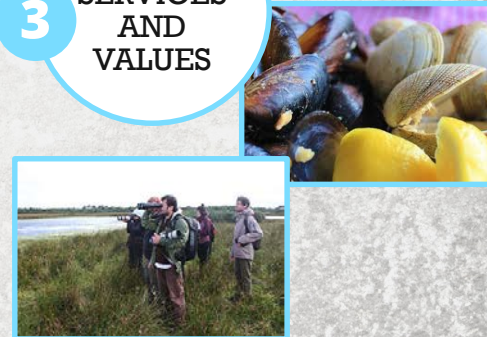
2

RISK
TO
HABITATS



3

ECOSYSTEM
SERVICES
AND
VALUES





HABITATS AND STRESSORS

Habitats

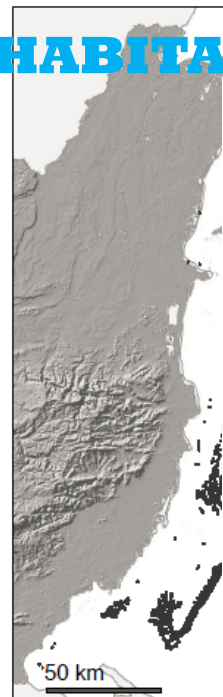
- Mangrove
- Seagrass
- Coral Reef

Stressors

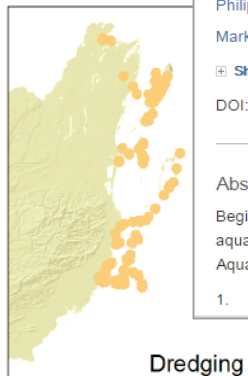
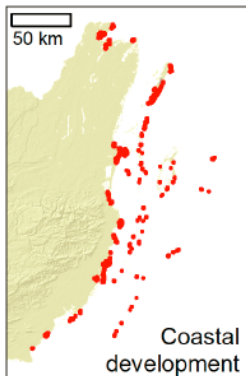
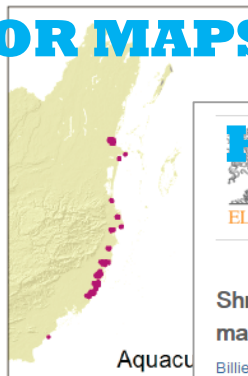
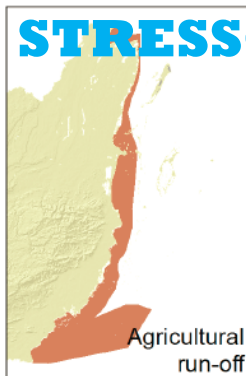
- Agricultural run-off
- Aquaculture
- Fishing
- Marine transportation
- Coastal development
- Dredging
- Oil exploration
- Marine recreation

HRA DATA INPUTS

HABITAT MAPS



STRESSOR MAPS



HABITAT-STRESSOR INTERACTIONS



Shrimp aquaculture, mangroves and

Billie R. Dewalt
Philippe Vergne
Mark Hardin*

Show more

DOI: 10.1016/0305-75

Abstract

Beginning in the early 1980s, aquaculture and became an important part of coastal development.

1. (a) destruction of

Volume 24, Issue 7, July 1996, Pages 1193-1208

Vol. 3: 167-180, 1980

MARINE ECOLOGY - PROGRESS SERIES
Mar. Ecol. Prog. Ser.

Published August 31

REVIEW

Effects of Oil Pollution

Y. Loy

Department of Zoology, The George S. Wise

ABSTRACT: This paper reviews our knowledge of oil pollution effects on marine life done since the last review on this subject by Johannes (1980). Octocorals and summarizes the small amount of work that there appeared to be no conclusive evidence that oil pollution continue to appear in the literature, growing evidence of communities. Laboratory experiments and long-term field studies of reef corals, such as complete lack of colonization by bryozoans, colony viability, damage to the reproductive system of coral polyps, fewer planulae per coral head and premature mortality of planulae and corals. Other data from the Caribbean, include lower growth rates, direct damage to tactile stimuli and normal feeding mechanisms, and eventual coral destruction. All investigators studying effects of oil pollution on marine life have found that the effects are often subtle and long-term.



Available online at www.sciencedirect.com

ScienceDirect

Marine Pollution Bulletin 52 (2006) 1553-1572



www.elsevier.com/locate/marpolbul

Review

Environmental impacts of dredging on seagrasses: A review

Paul L.A. Erftemeijer ^{a,*}, Roy R. Robin Lewis III ^b

^a WL | Delft Hydraulics, P.O. Box 177, 2600 MH Delft, The Netherlands

^b Lewis Environmental Services, P.O. Box 5430, Salt Springs, FL 32134, USA

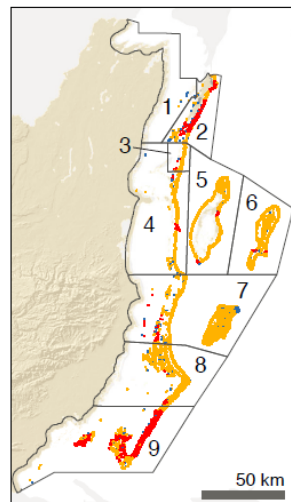
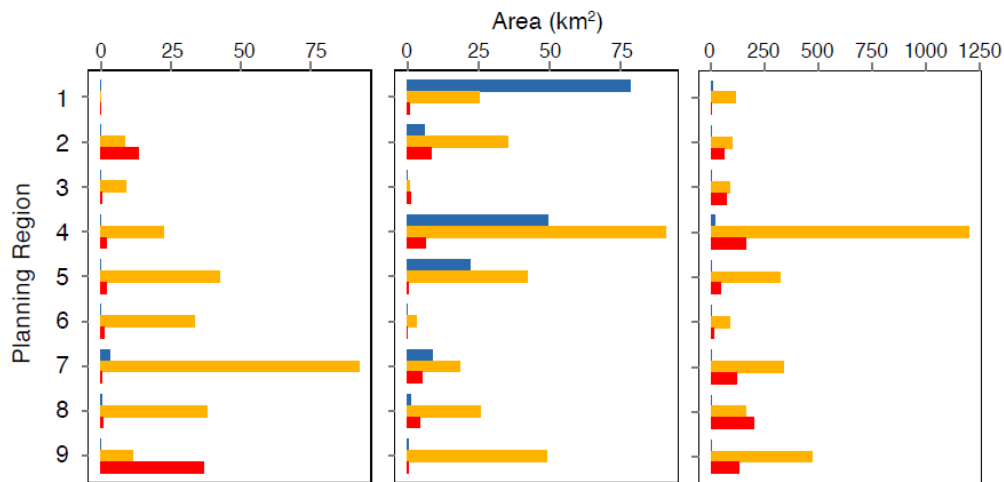
Abstract

Main potential impacts on seagrasses from dredging and sand mining include physical removal and/or burial of vegetation and effects of increased turbidity and sedimentation. For seagrasses, the critical threshold for turbidity and sedimentation, as well as the duration that seagrasses can survive periods of high turbidity or excessive sedimentation vary greatly among species. Larger, slow-growing climax species with substantial carbohydrate reserves show greater resilience to such events than smaller opportunistic species, but the latter display much faster post-dredging recovery when water quality conditions return to their original state. A review of 45 case studies worldwide, accounting for a total loss of 21,023 ha of seagrass vegetation due to dredging, is indicative of the scale of the impact of dredging on seagrasses. In recent years, tighter control in the form of strict regulations, proper enforcement and monitoring, and mitigating measures together with proper impact assessment and development of new environmental dredging techniques help to prevent or minimize adverse impacts on seagrasses. Costs of such measures are difficult to estimate, but seem negligible in comparison with costs of seagrass restoration programmes, which are typically small-scale in approach and often have limited success. Copying of dredging cri-

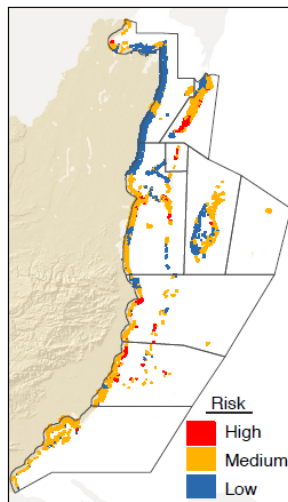
THREE



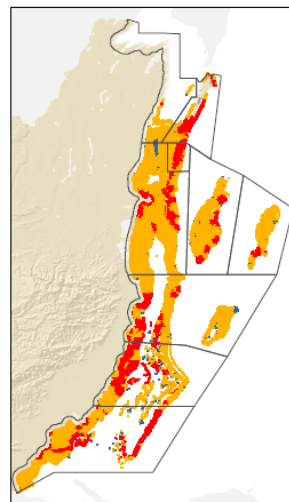
Coral



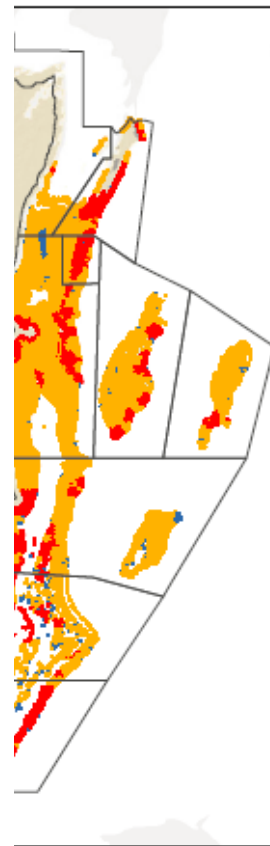
Coral reefs



Mangrove forests



Seagrass beds



Seagrass beds

COMPARISON TO EMPIRICAL DATA

- 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))

POSSIBLE FUTURE ZONING SCHEMES

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



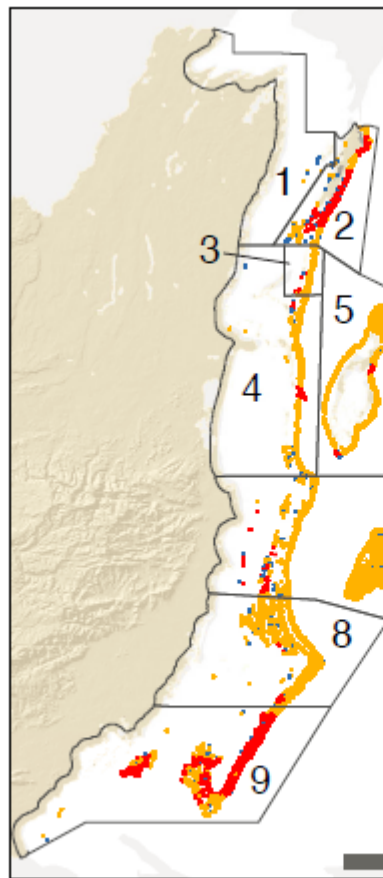
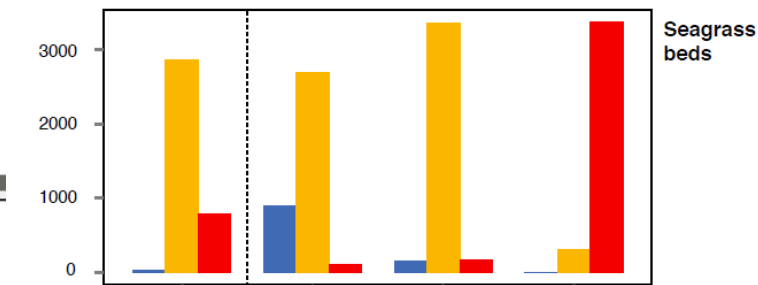
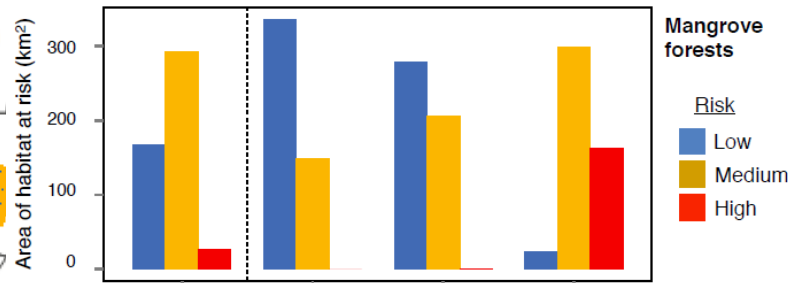
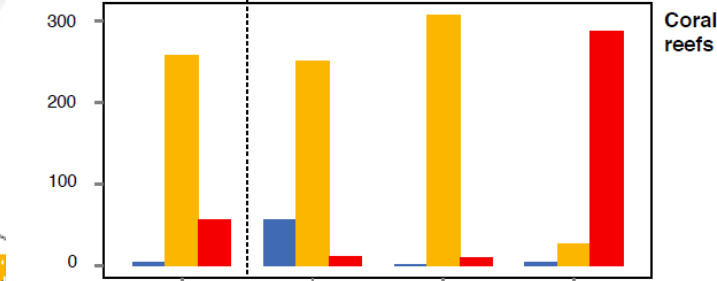
SCENARIOS:

Current
Year: 2010

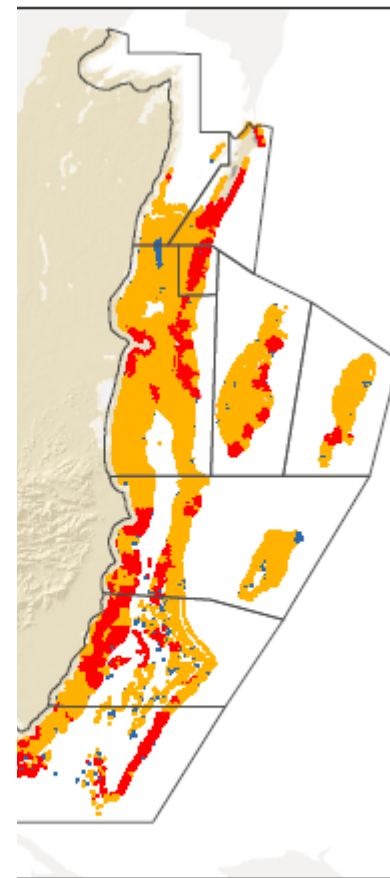
Conservation
2025

Informed
Management
2025

Development
2025

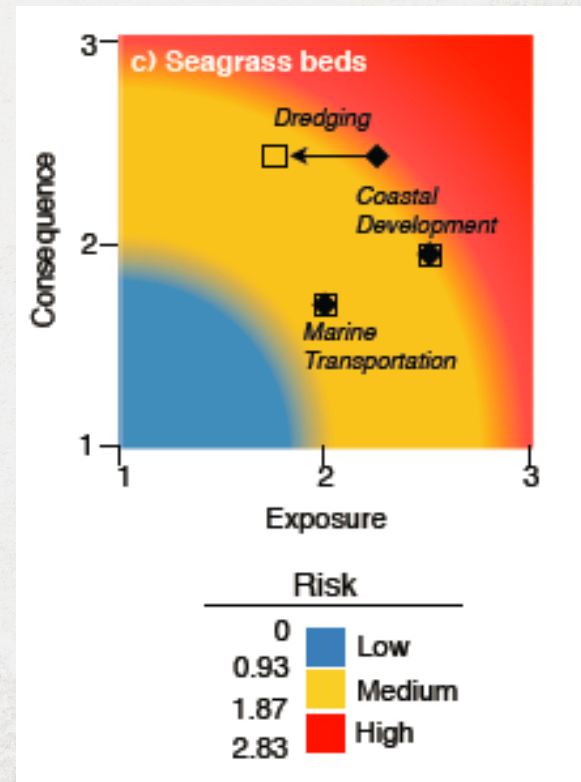
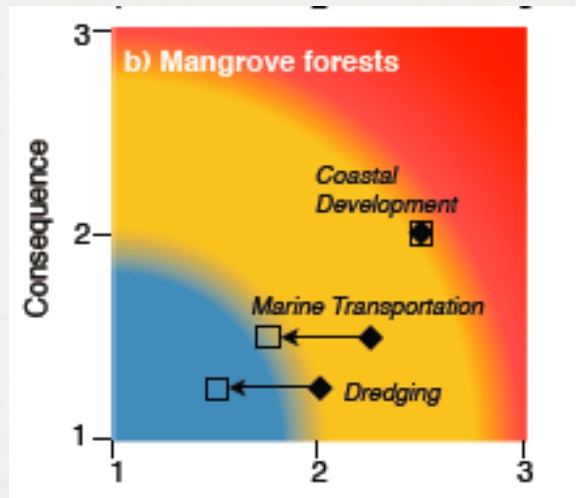
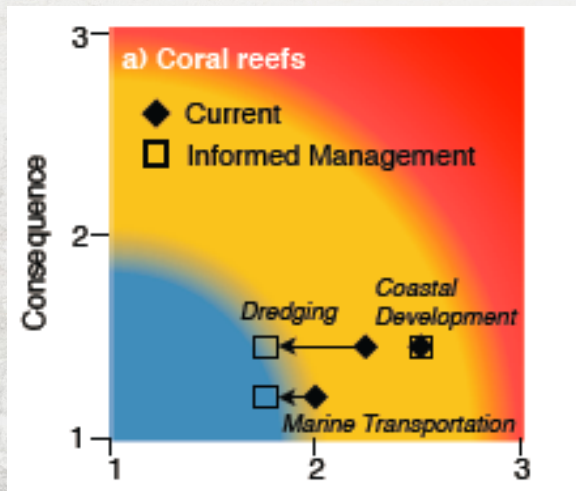


Coral reefs



Seagrass beds

RISK PLOTS





Most important benefits from nature



HRA AND LOBSTER IN BELIZE

1 ZONING SCHEME

HRA

2 RISK TO HABITATS

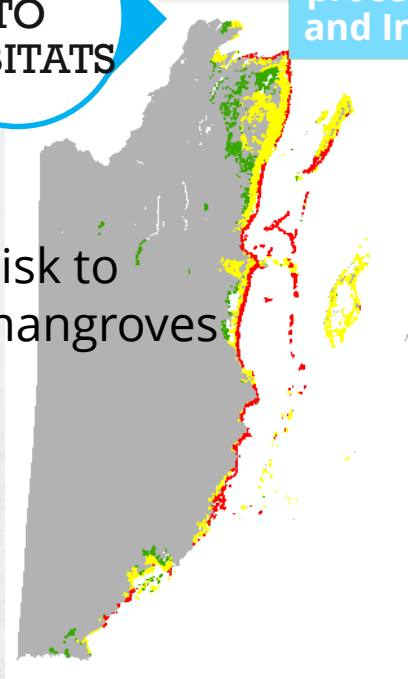
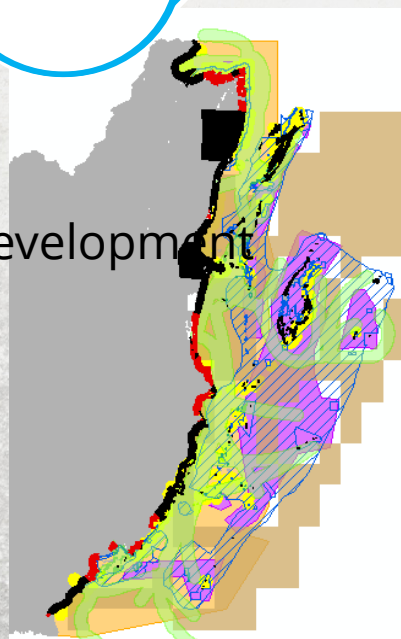
Post-HRA
processing
and InVEST

3 Changes to MAGNITUDE AND VALUE OF SERVICE

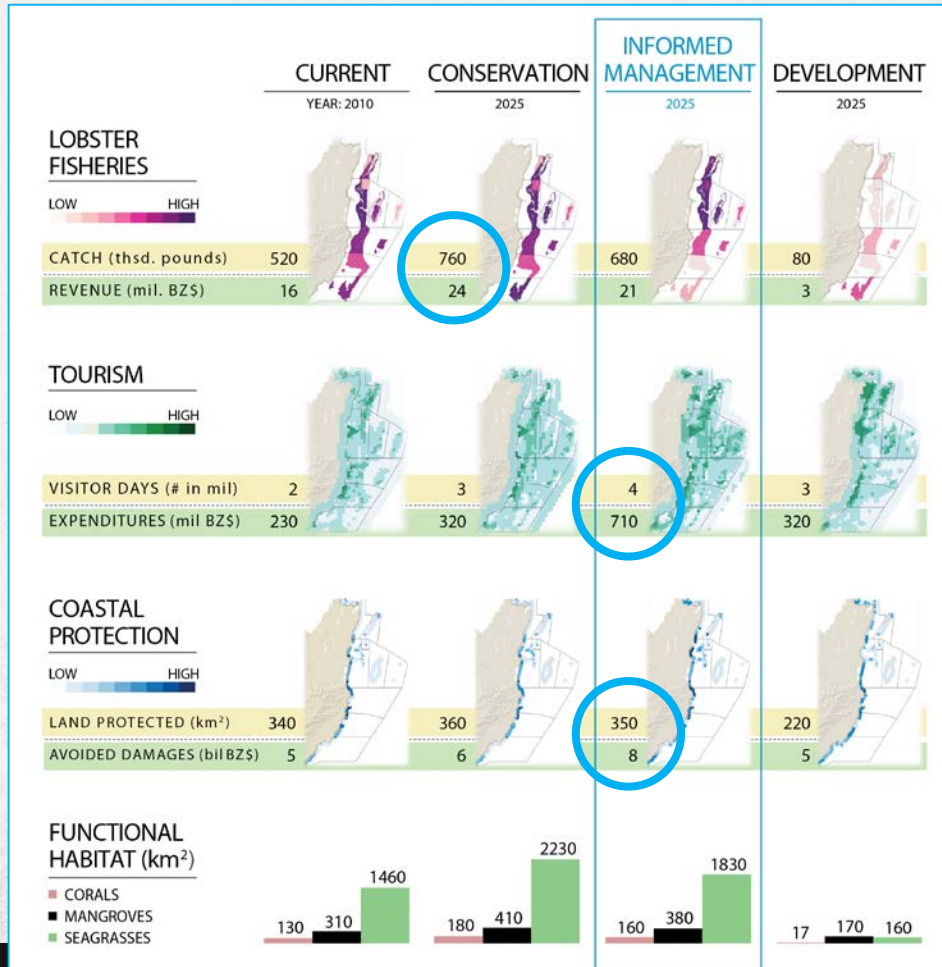
Development

Risk to
mangroves

Lobster catch
& revenue



BELIZE SYNTHESIS HABITAT AND SERVICES



Arkema et al.,
accepted PNAS