



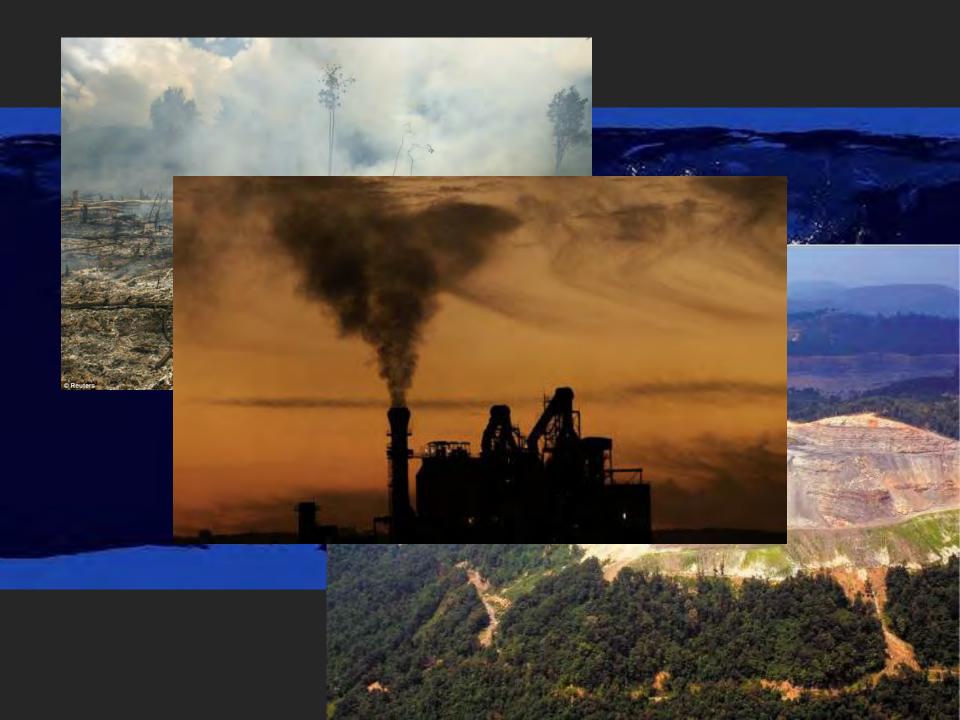
Mary Ruckelshaus, Steve Polasky, Gretchen Daily, Peter Kareiva, Taylor Ricketts, Jon Foley, Jon Hoekstra, Heather Tallis, Anne Guerry, Becky Chaplin-Kramer, Rich Sharp, Emily McKenzie, Liz Rauer, Brian Robinson, Gail Kaiser, Emily Goehring, Guy Ziv, Stacie Wolny, Brad Eichelberger, Yonas Ghile, Adrian Vogl, Lisa Mandle, Shan Ma, Leah Bremer, Joanna Nelson, Jodie Toft, Katie Arkema, Greg Guannel, Gregg Verutes, Spencer Wood, CK Kim, Joey Bernhardt, Jess Silver, Joe Faries, Rob Griffin, Suzanne Langridge, James Douglass, Martin Lacayo-Emery, Kathryn Glowinski, Doug Denu, Nic Chaumont, Derric Pennington, Nasser Olwero, Amy Rosenthal, Nirmal Bhagabati, Mike Anderson, Bonnie Keeler, Kris Johnson, Peter Hawthorne, Nathan Mueller.

Support from:

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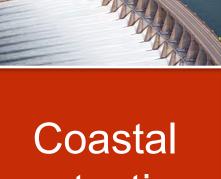
Private Individuals
TNC, WWF, Stanford, UMN

www.naturalcapitalproject.org

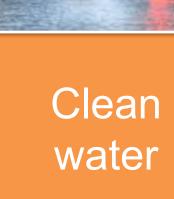




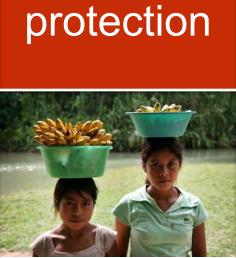












Recreation





people environment



Improve outcomes for people and the environment on which they depend.



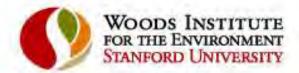
Scientific basis, policy & finance mechanisms lacking for integrating natural capital into natural resource decisions



Science & Tools

Evidence

Engage & Educate







ENVIRONMENT

University of Minnesota Driven to Discover

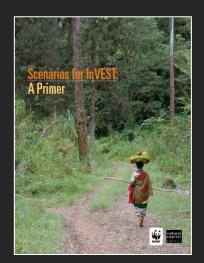
Free & open source tools www.naturalcapitalproject.org







integrated valuation of environmental services and tradeoffs

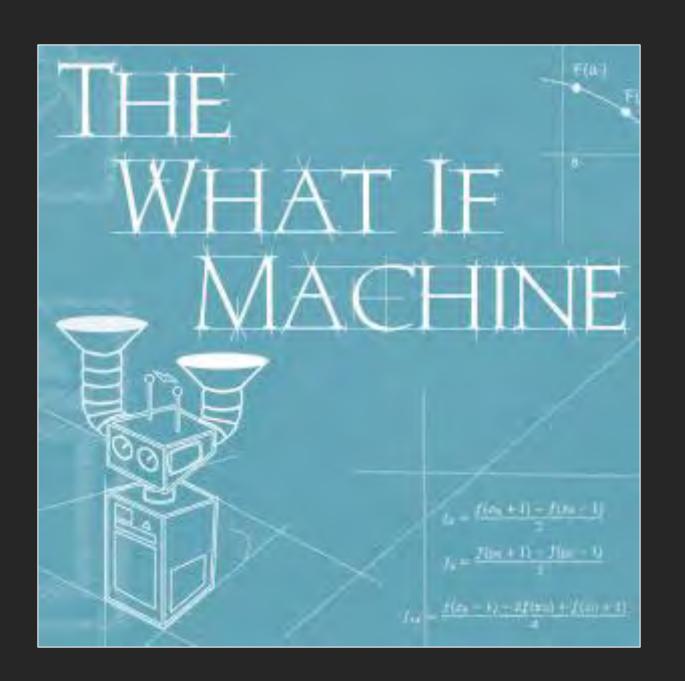


InSEAM

InVEST scenario modeler

Changes in ecosystems Changes in ecosystems Changes in values cosystem services Changes in values and benefits to people







Experience from 20+ decision contexts



Spatial Planning
(PES) Payment for Ecosystem Services
Climate Adaptation Planning
Development Impacts and Permitting
Restoration Planning
Corporate Risk Management



Ruckelshaus et al. in review

5,000

10,000 Kilometers



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(PES) Payment for Ecosystem Services
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Ruckelshaus et al. in review

5,000

10,000 Kilometers

What are the costs and benefits of alternative climate adaptation options?



What are the costs and benefits of alternative climate adaptation options?

'Green'



'Grey'



Integrated

Reactive

- Protection of coastal
 mangroves and littoral forest
- •Some restoration of mangroves
- Establishment of MPAs
- •Strategic construction of sea walls to avoid undeveloped and conservation areas and beaches that are used for tourism
- Construction of sea walls along all coastlines with development
- •Some protection of mangroves and littoral forest

ECOSYSTEM SERVICES & VALUES

SOUTH-CENTRAL PLANNING REGION ANNUAL RETURNS
(2025 - 2100)

NO INTEGRATED REACTIVE

Adaptation >> Scenarios

NO INTEGRATED F



Climate Scenarios

CATCH (thsd. pounds)

REVENUE (thsd. BZ\$)



VISTOR DAYS (# in thsd.)

EXPENDITURES (mil. BZ\$)



CARBON SEQ. (mil. tons)

VALUE (thsd. BZ\$)

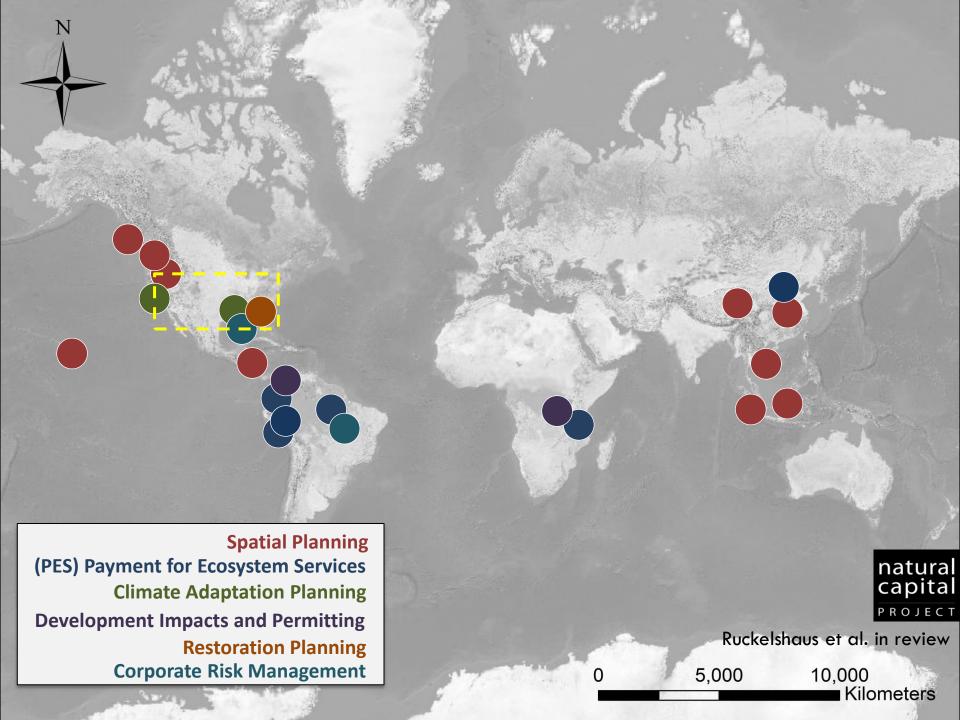
Integrated

\$275M greater net benefit

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Reactive

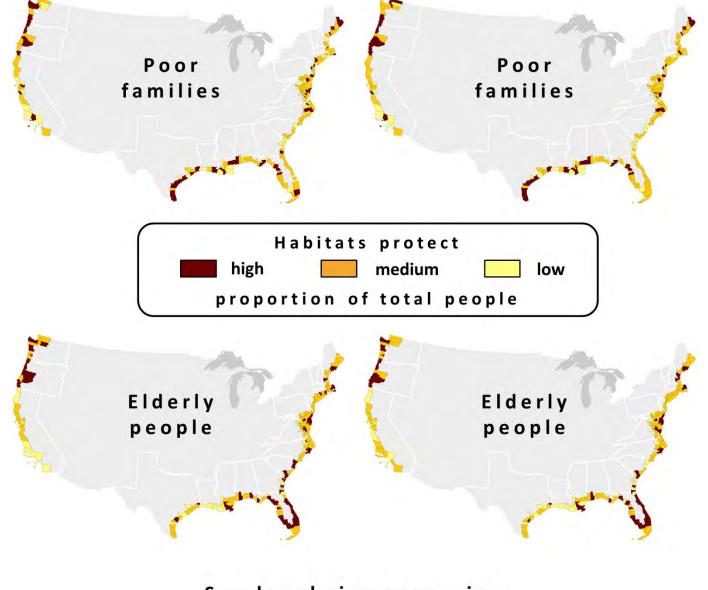
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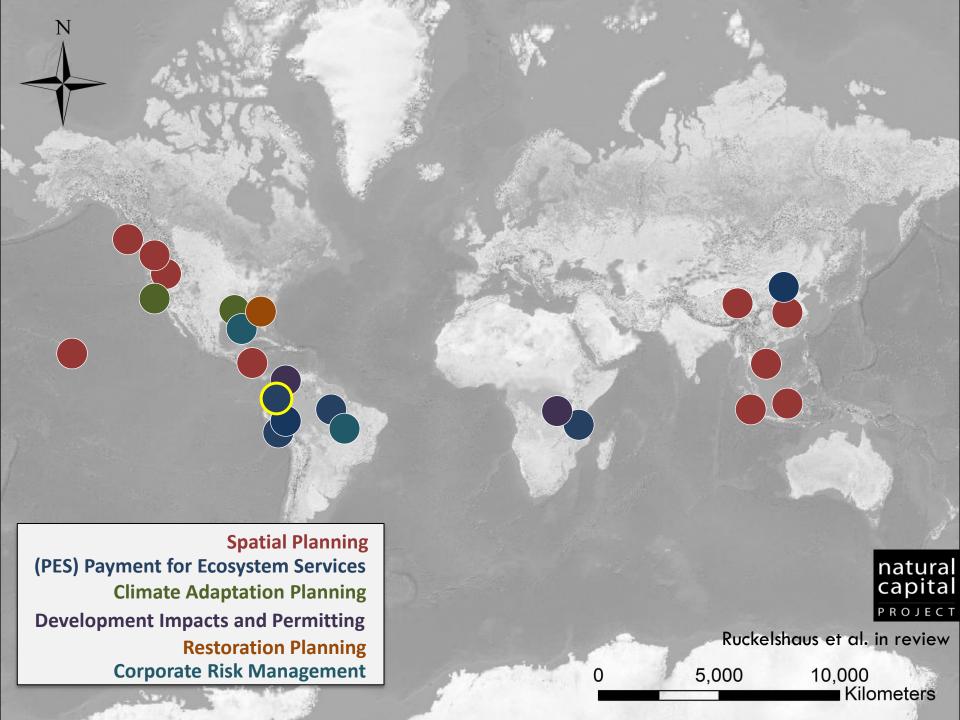
Where and to what extent do coastal ecosystems protect the most vulnerable human populations from sea level rise and storms?





Sea level rise scenarios

Arkema et al. in press, Nature Climate Change









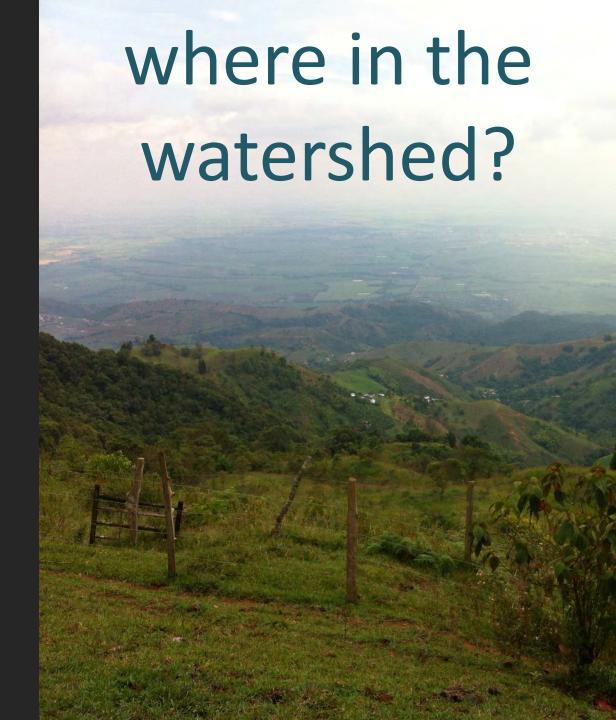


which activities?









Resource Investment Optimization System



- Identify places where benefits of activities are biggest
- An approach general enough to be adapted to local conditions
- Easy with available data
- Give standard outputs for freshwater services

Targeting Investments

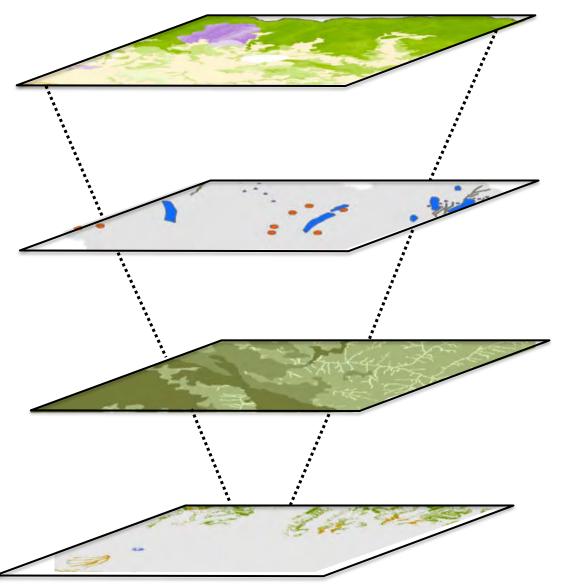
Biophysical effectiveness

Feasible activities

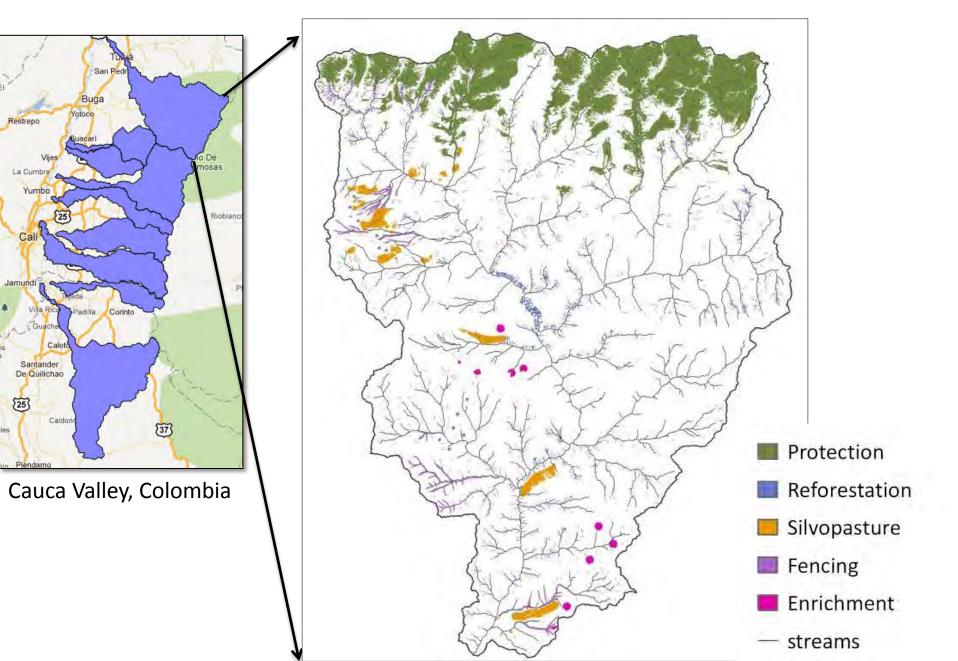
Stakeholder preferences

Cost data & Budget

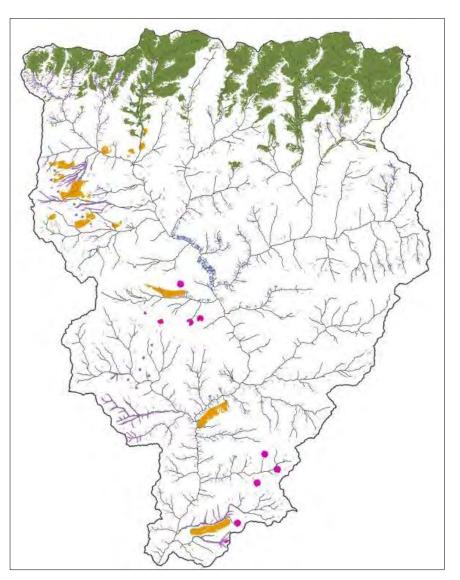
Investment Portfolio

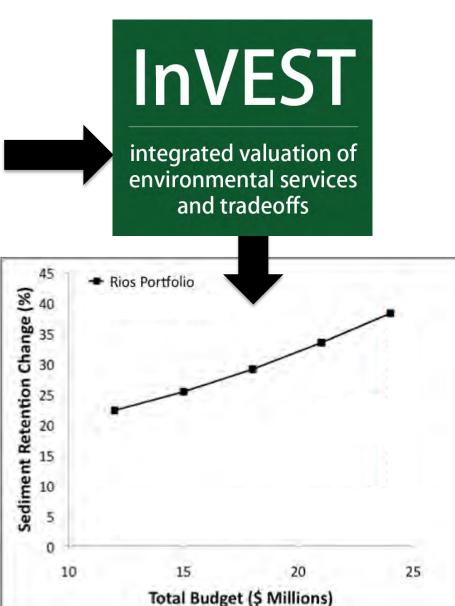


Investment Portfolio

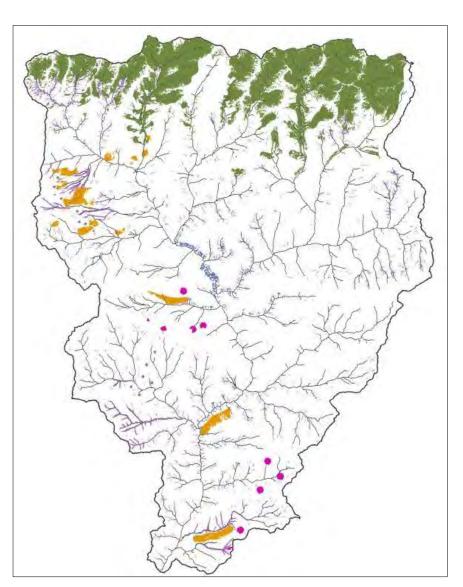


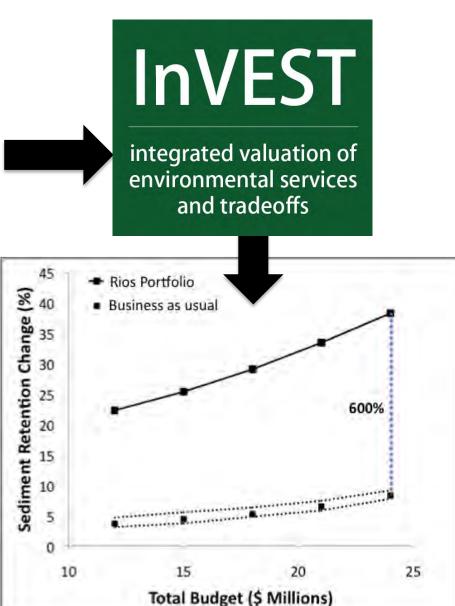
What is the return on investment?





What is the return on investment?



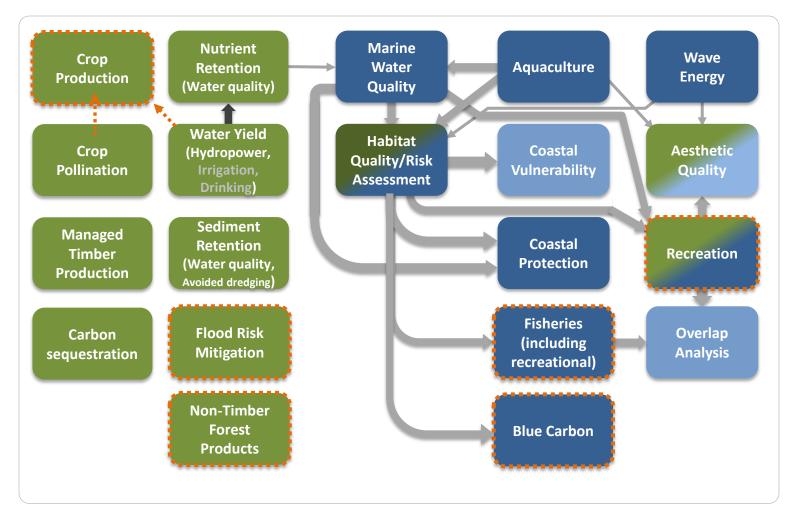




Putting ecosystem services into action



- Ecosystem services approach useful in diverse decision contexts
- Linking science, policy and finance is critical to success
- Partnerships are key for maximizing impact



Terrestrial/freshwater model: Tier 0

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Marine model: Tier 1

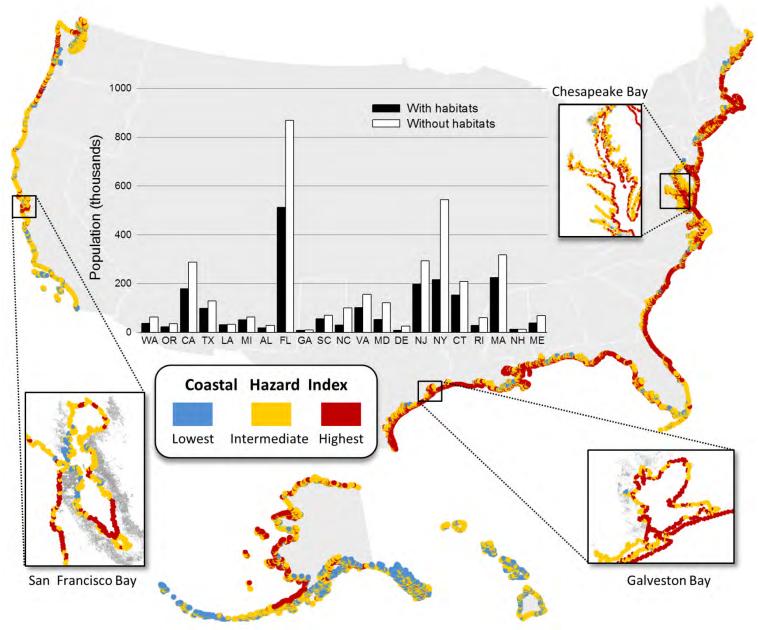
Marine model: Tier 0

Model coming soon!

Optional model linkage

Required model linkage





Arkema et al. in press, Nature Climate Change