

Integrated Valuation of Ecosystem Services and Tradeoffs (InVEST): A Tool for Hydropower Management

Heather Tallis, Steve Polasky, Peter Kareiva, Taylor Ricketts, Erik Nelson, Guillermo Mendoza, Jim Regetz, Rebecca Shaw, Robin Naidoo,
Kai Chan, Vic Adamowicz, Eric Lonsdorf, Dick Cameron, Neil Burgess, Andrew Balmford

Align Economic Forces with Conservation

Systematically

- Assess multiple ecosystem services today, and in the future (measure performance)
- Reduce risks and impacts
- Make land use and resource use decisions that provide multiple benefits

Current Planning



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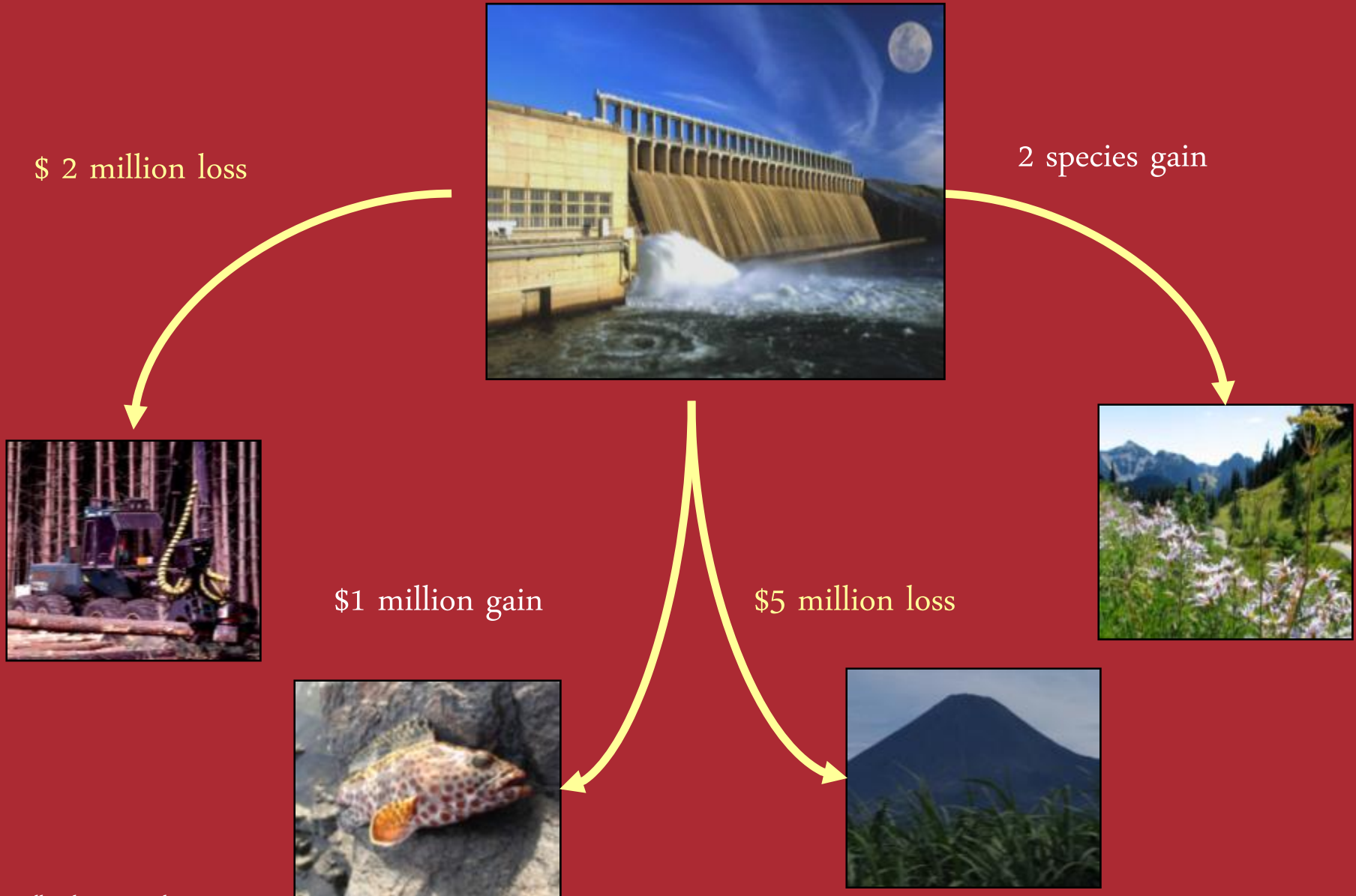


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Current Planning



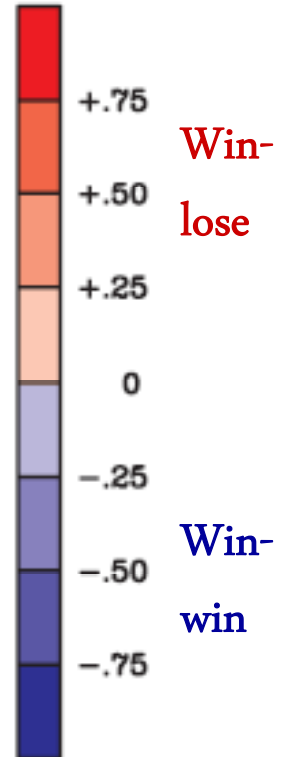
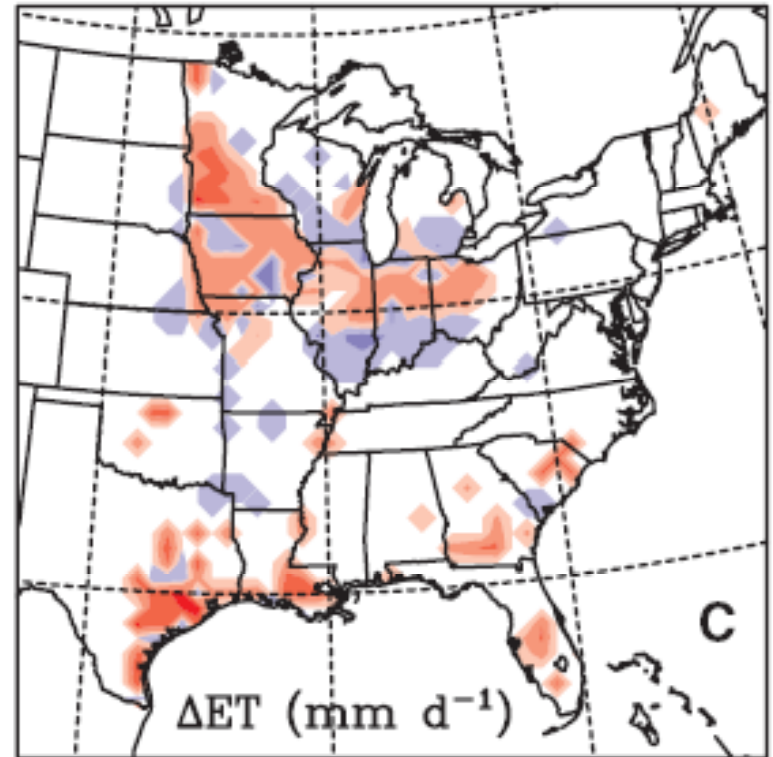
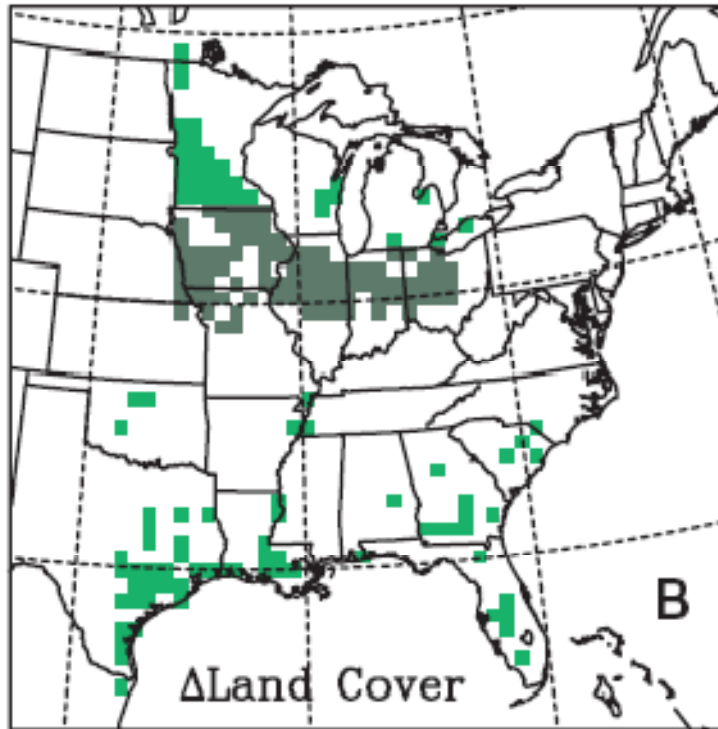


Tradeoffs

- Minimize risks or offsets

Carbon Sequestration

Water



Questions



- How does a proposed hydropower management plan affect hydropower production, biodiversity, water quality and recreation?
- Which parts of a watershed provide the greatest value to hydropower production through water yield and sediment retention?
- Where would reforestation or a new timber management plan achieve both the greatest timber production and value to hydropower production?

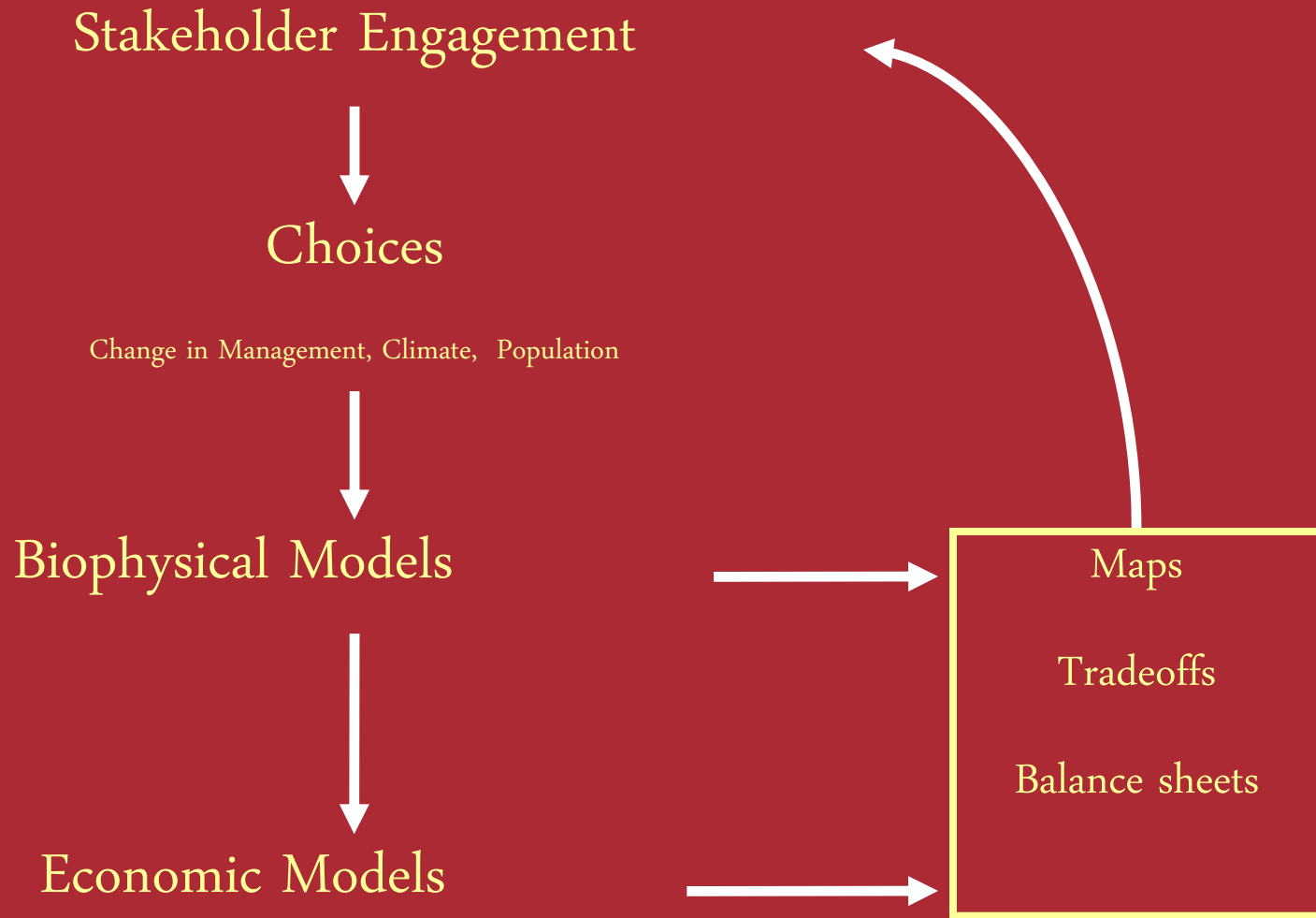


InVEST:

Integrated Valuation of Ecosystem Services and Tradeoffs

- Software package that
 - Feeds directly into planning
 - Ready to use, requires little data
 - General and transferable
 - Addresses multiple services (terrestrial and FW)
 - Uses common terms (\$\$)



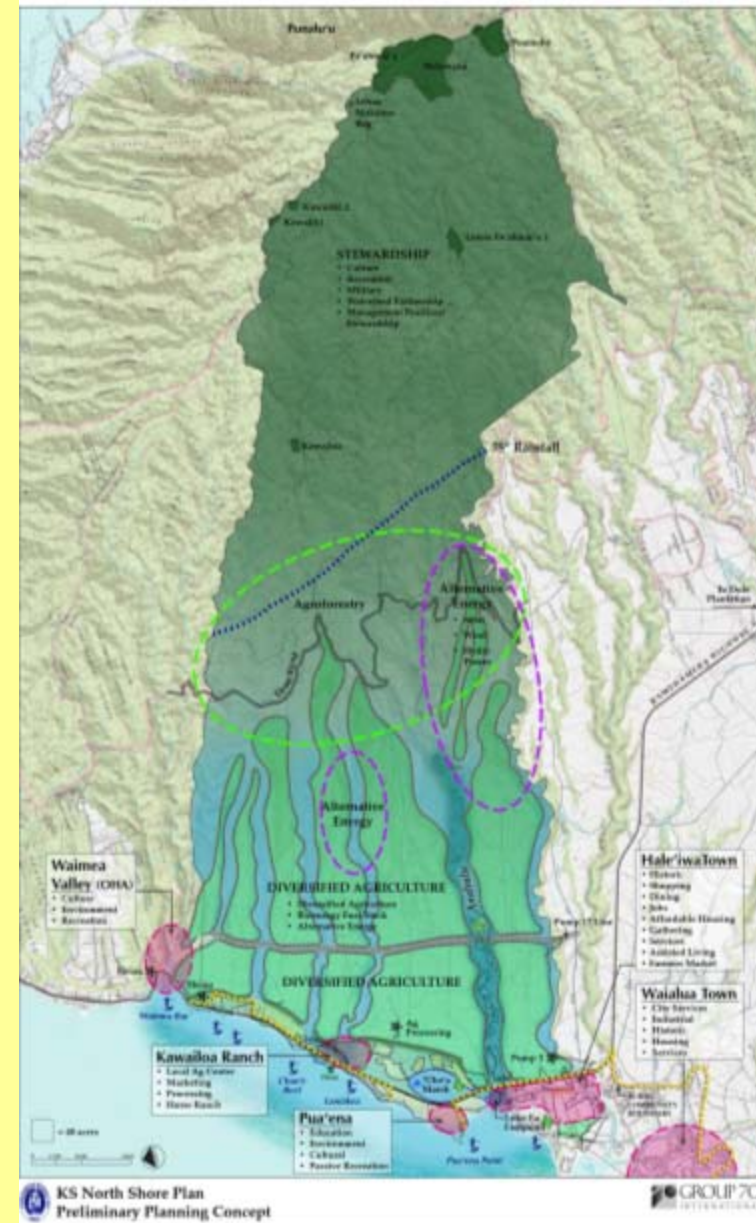




Turn choices into land use and cover

4 options for:

- agriculture
- irrigation
- cultural
- aquaculture
- biodiversity
- NTFPs



Scenario Drivers

- Dam management
 - Water release schedule
- Climate Change
 - Land cover change
 - Precipitation and temperature
- Population Growth
 - Land cover change
 - Increased demand

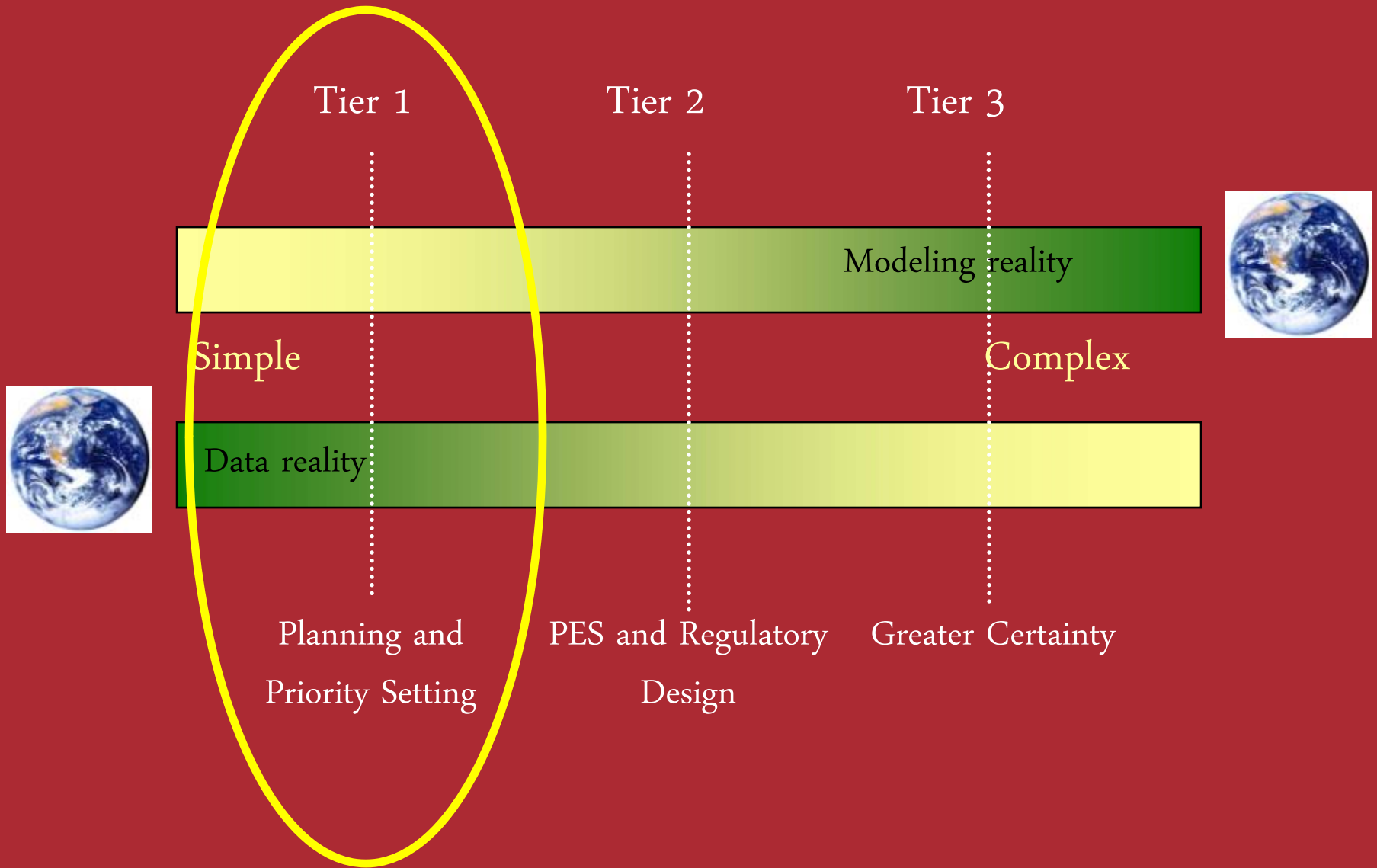


Multi-service, Multi-sector

- Ecosystem services
 - Hydropower (yield, sediment)
 - Drinking water (yield, quality)
 - Flood control
 - Irrigation water (for ag)
 - Recreation and tourism
 - Carbon sequestration
 - Commercial timber production
 - Cultural and aesthetic values
 - Real estate value
 - Non-timber forest products
 - Native pollination (for ag)
- Biodiversity



Tiered Approach



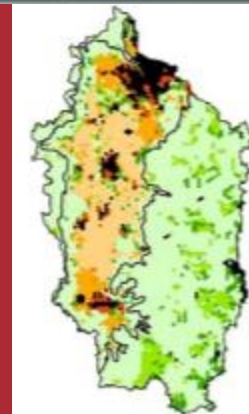
Willamette Basin



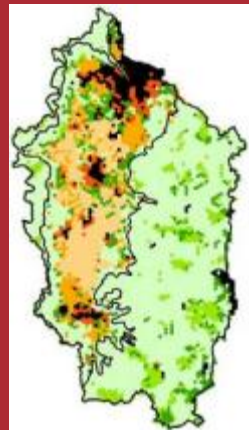
Key Benefits

- Flood control
- Pollination and irrigation for agriculture
- Carbon sequestration
- Timber production
- Real estate
- Biodiversity

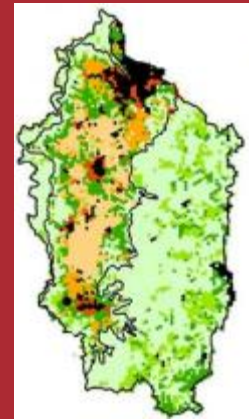
PLAN



DEVELOPMENT



CONSERVATION



Outputs

Water Quality

Potential Soil
Conservation

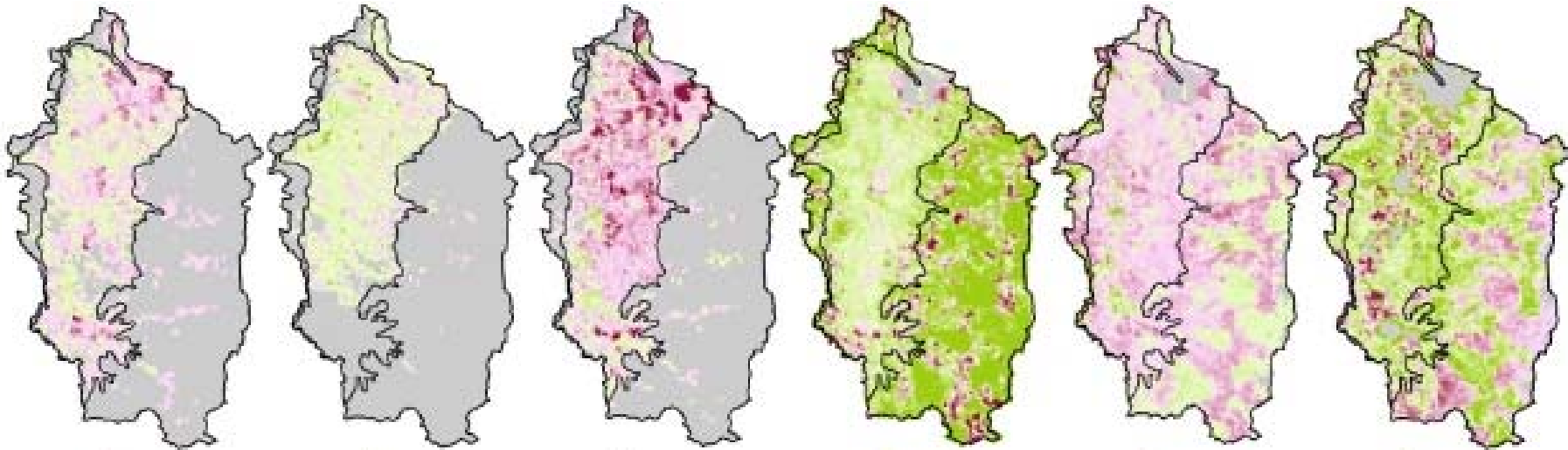
Storm Peak
Management

Carbon
Sequestration

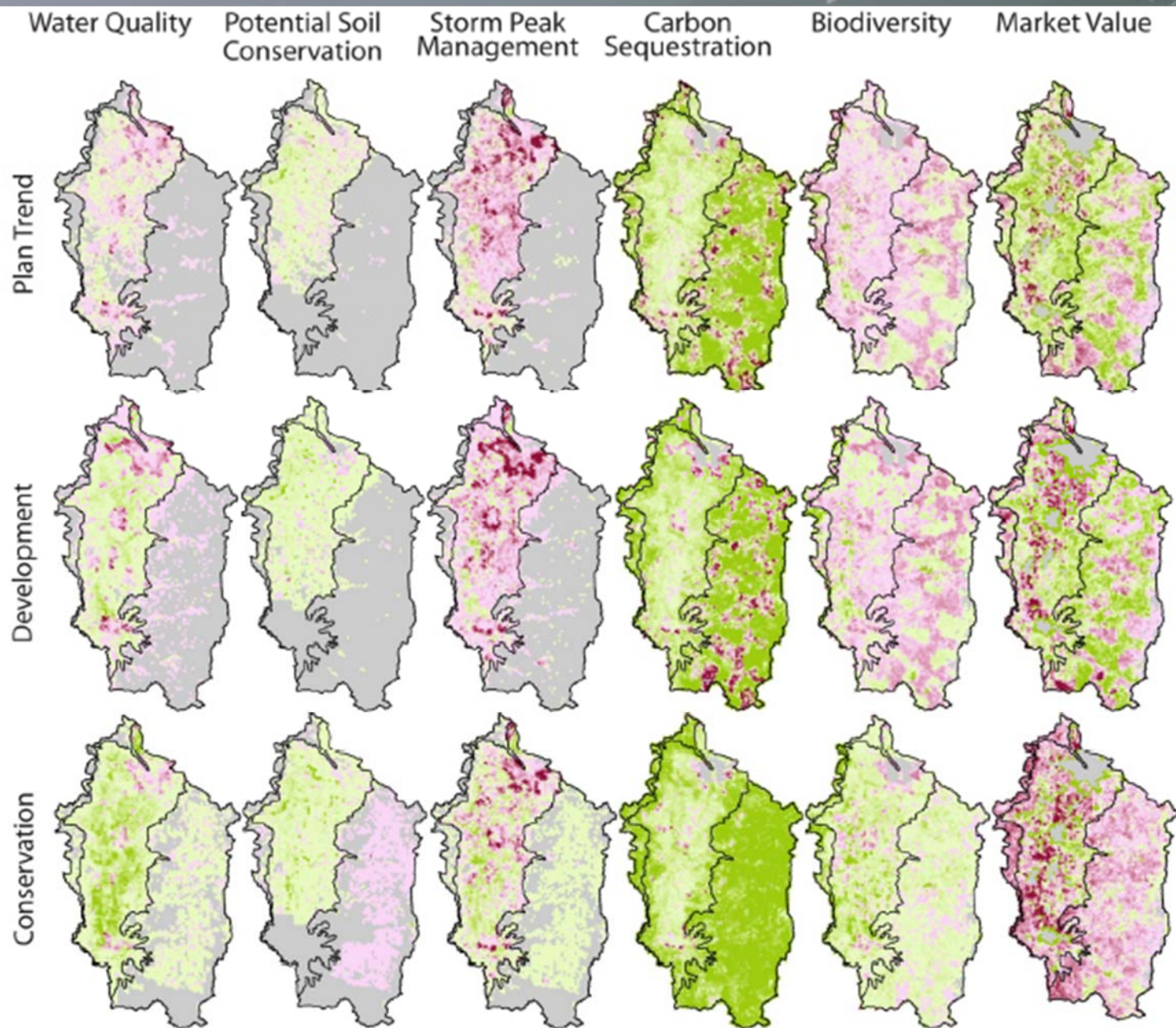
Biodiversity

Market Value

Plan Trend



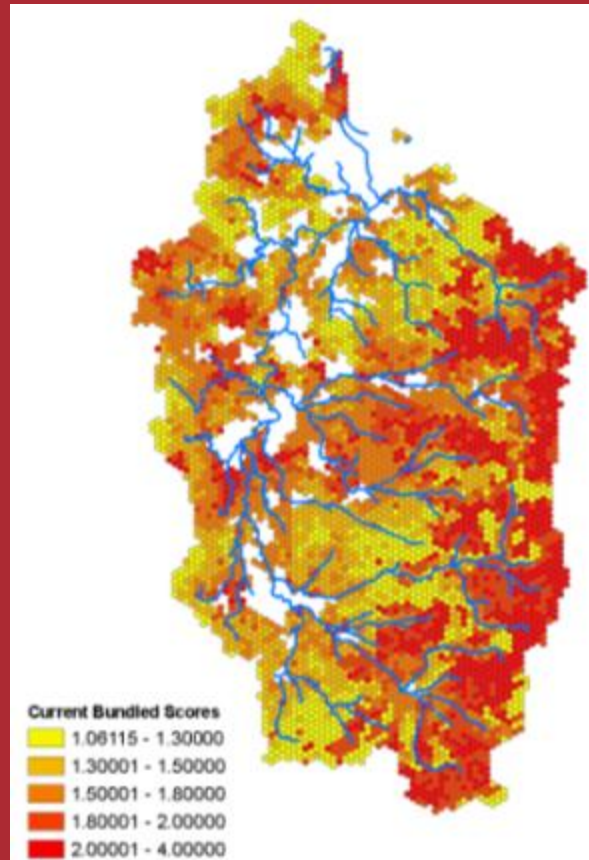
Outputs



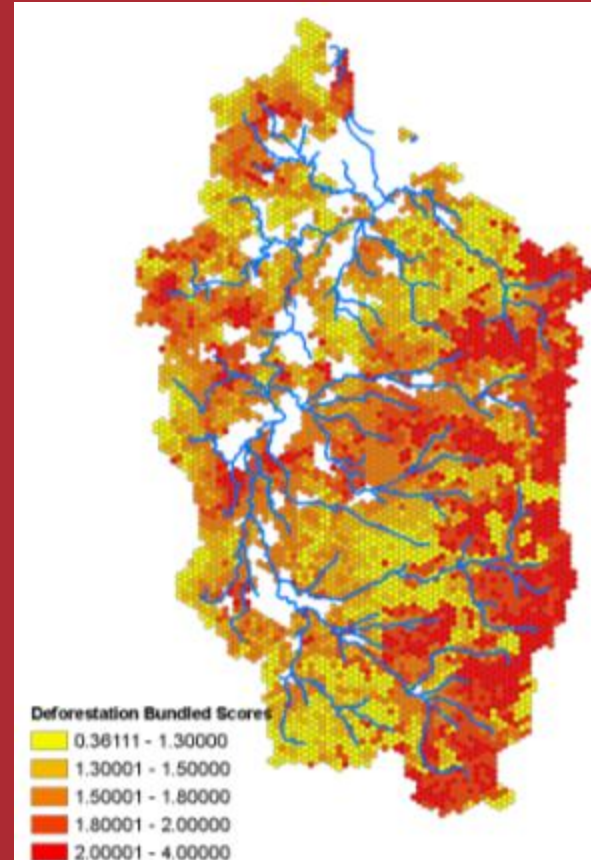
Outputs: Multiple Services

Biodiversity, Water quality control, Pollination, Carbon sequestration,
Flood mitigation

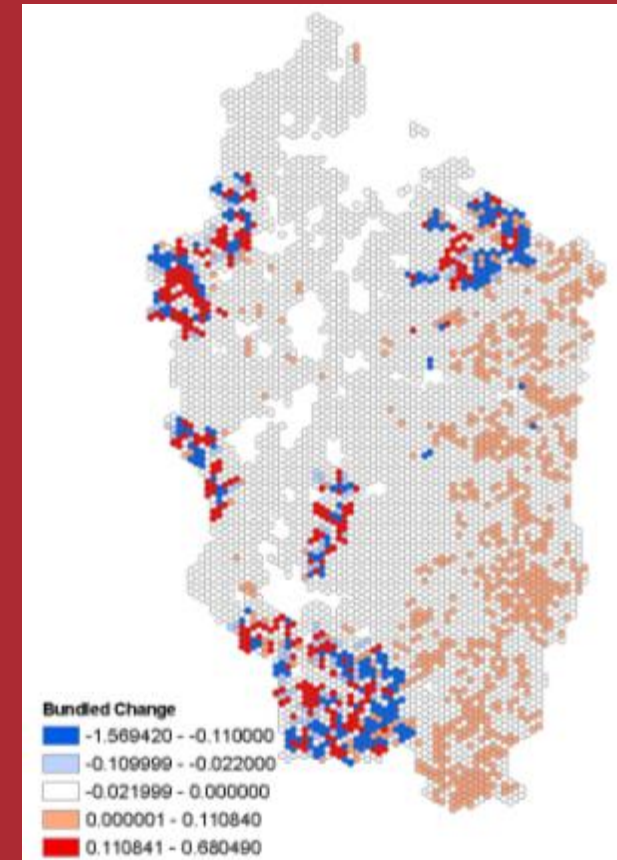
Current



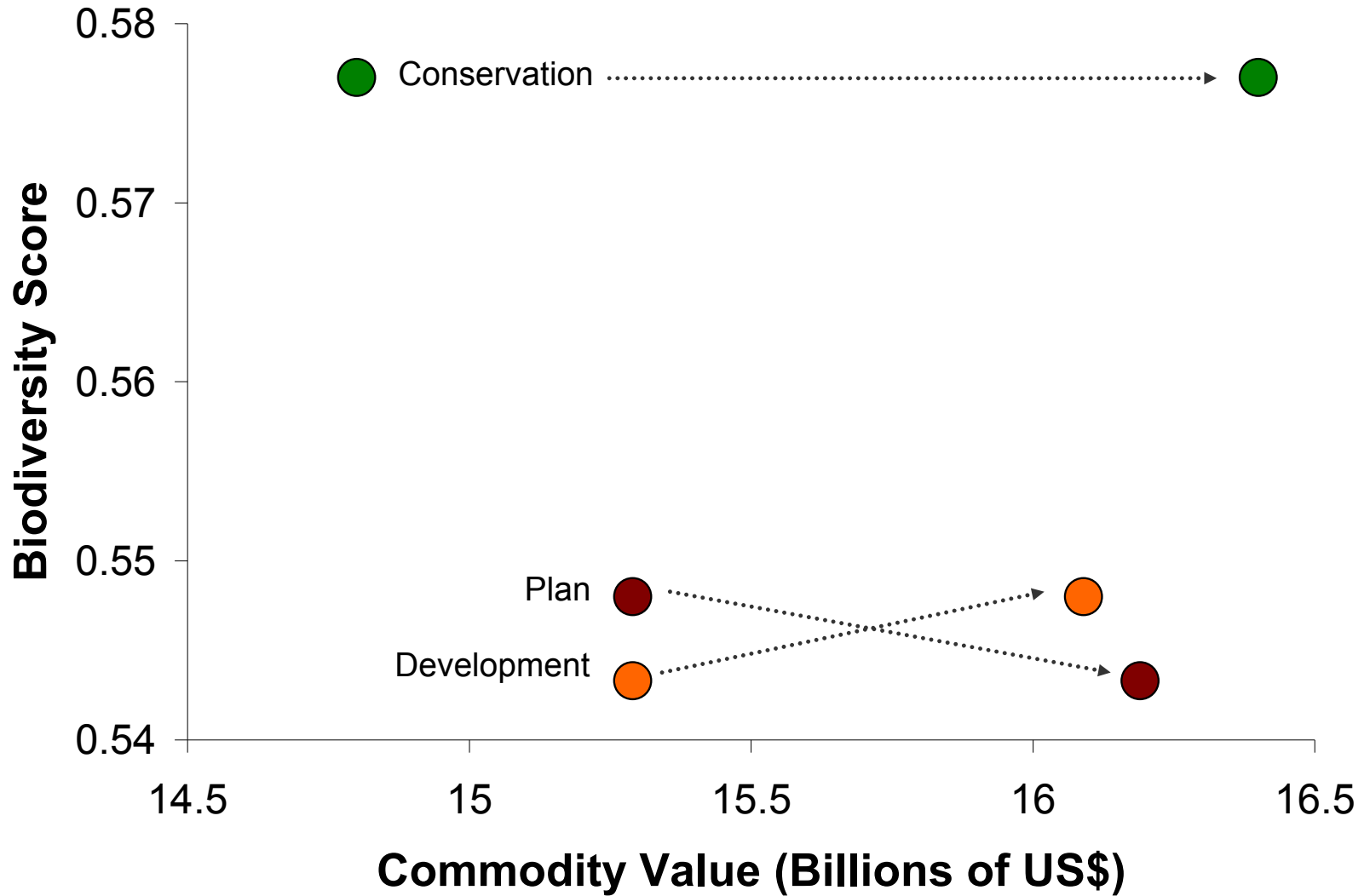
Timber Harvest



Change



Tradeoff Curves



- Sample Balance Sheet

Choice	Hydropower (Billion \$)	Forestry (Billion \$)	Cultural Sites (% intact)	Biodiversity (# of Species)
Plan	12	15	0	2
Conservation	11	15	5	11
Development	12	14	8	6



China

- Identify key areas for flood control, water provision, sediment retention, and water quality control
- Protect these services AND harvest timber

Ecuador

- Identify watersheds to protect, ways to manage and people to pay for water quality

Tanzania

- Produce power and clean water, irrigate crops, slow erosion, protect biodiversity (forests)



- **Hawai'i**
 - Optimize land management for irrigated agriculture, real estate value, cultural values and biodiversity protection
- **California**
 - Predict climate change effects on six ecosystem services across the state
- **Colombia**
 - Guide all major sector permitting and licensing around priority areas for groundwater recharge, carbon and biodiversity
 - Set levels of offsets and identify places for mitigation

- InVEST
 - User friendly
 - Few data requirements
 - General and transferable
 - Assess real choices – in space
 - Multiple services

