

Mapping and Valuing Ecosystem Services

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ECOSYSTEM SERVICES

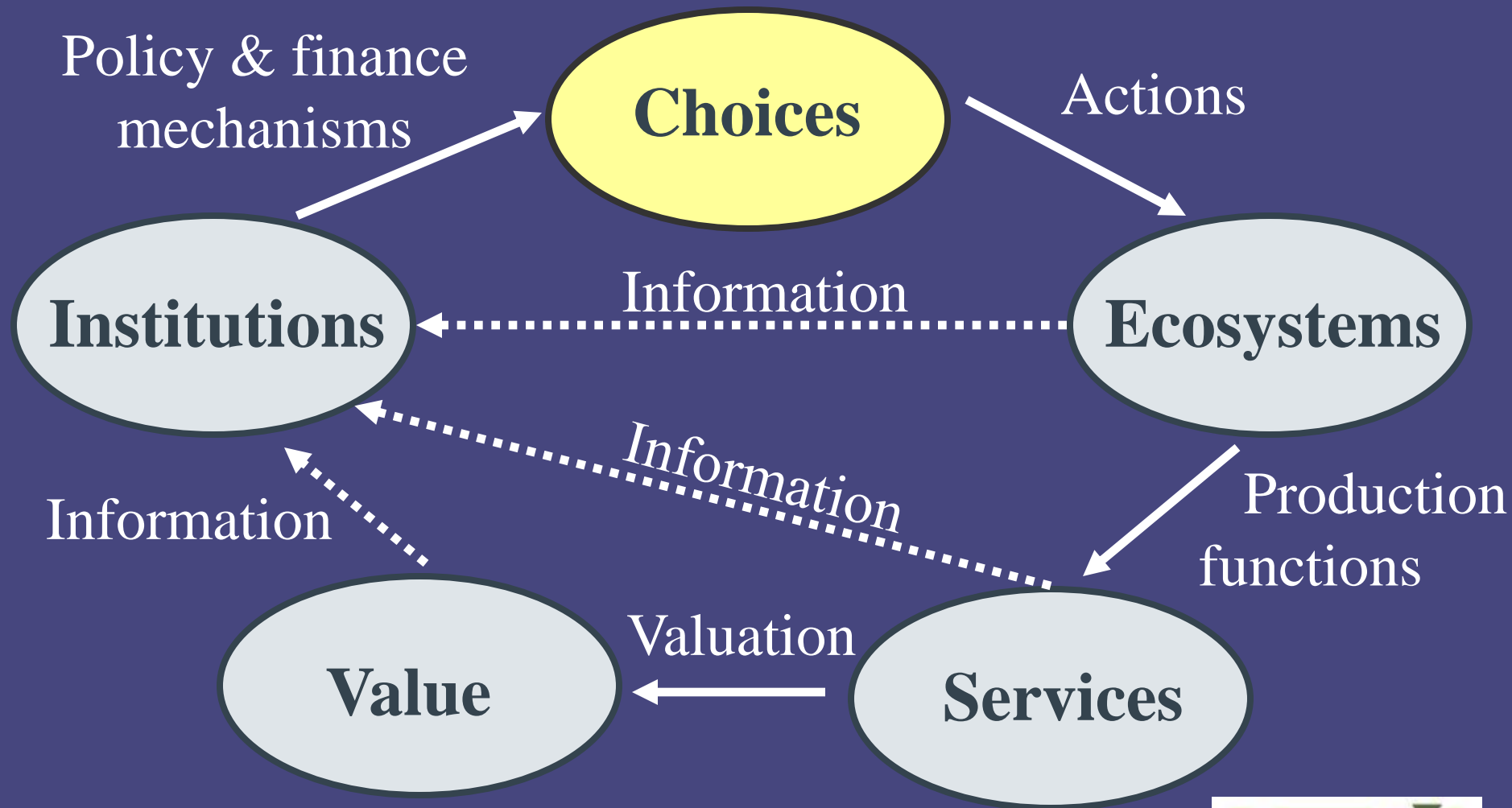


Ecosystem services

- Ecosystems provide a wide array of goods and services ***of value to people*** (ecosystem services)
- The provision of ecosystem services often not factored into important decisions
- Distortions in decision-making damage the provision of ecosystem services making human society and the environment poorer

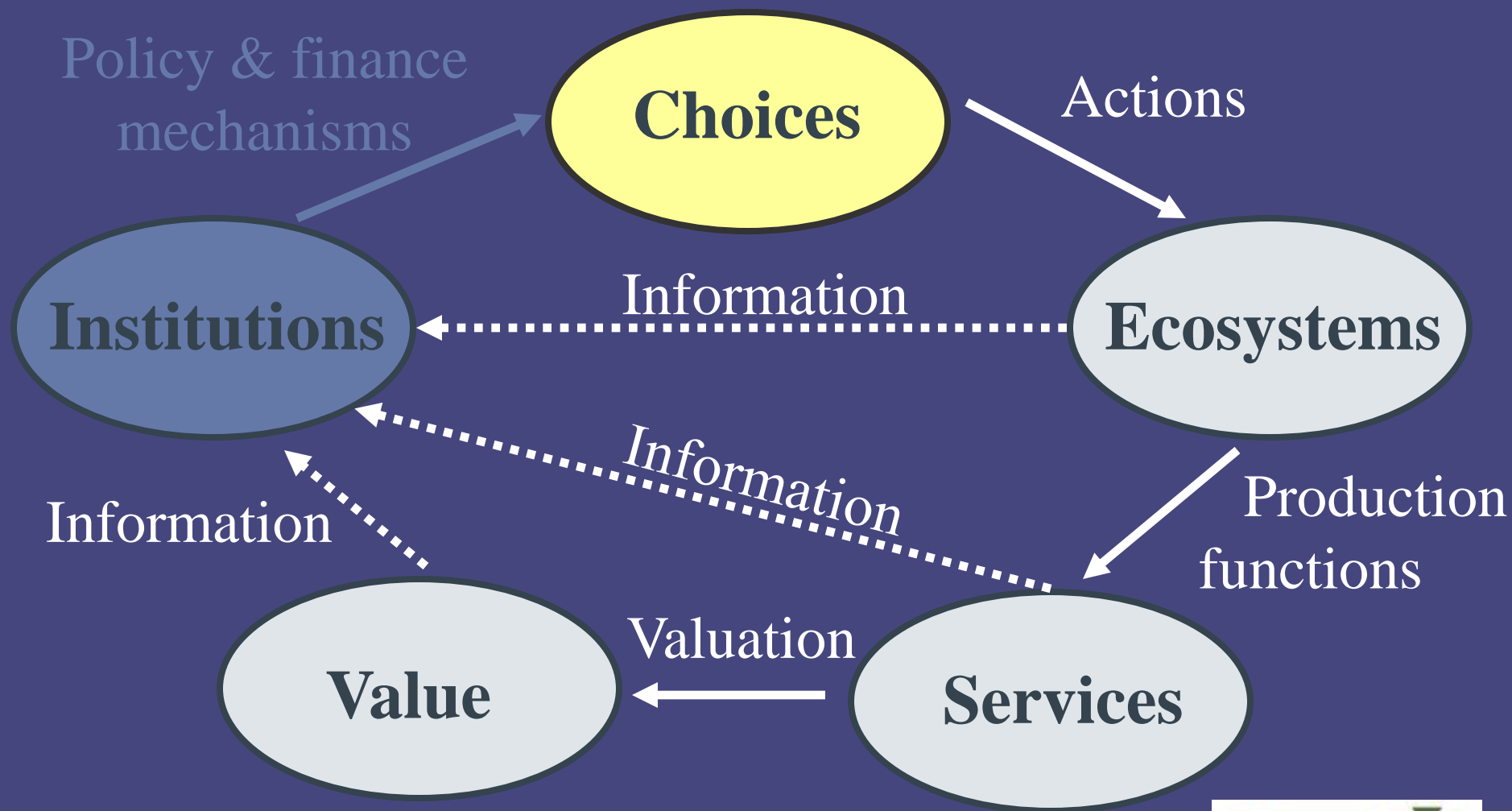
Natural Capital Project Goals

1. Generate an accounting of the value for the full set of goods and services from ecosystems under alternative management scenarios
2. Link this information to policy & management decisions – incentives to provide ecosystem services (“mainstream ecosystem services”)



Mapping and Valuing Ecosystem Services

- Focus in this session is on the first goal (mapping and valuing services)
- InVEST (Integrated Valuation of Ecosystem Services and Tradeoffs): set of tools for mapping and valuing ecosystem services



- Map at each table showing
 - Range for two species:
 - red-legged frog
 - tiger salamander
 - Currently protected areas
- Rules for exercise on each table

- Goals:
 - Protect
 - 43 squares tiger salamander habitat
 - 32 squares red-legged frog habitat
- Rules:
 - Edges are bad
 - Connectivity is good
 - All squares cost the same
 - Minimize total costs

- Inclusion of ecosystem services and biodiversity conservation
 - Carbon
 - Water quality
- Transparency giving areas of high priority for carbon and water quality

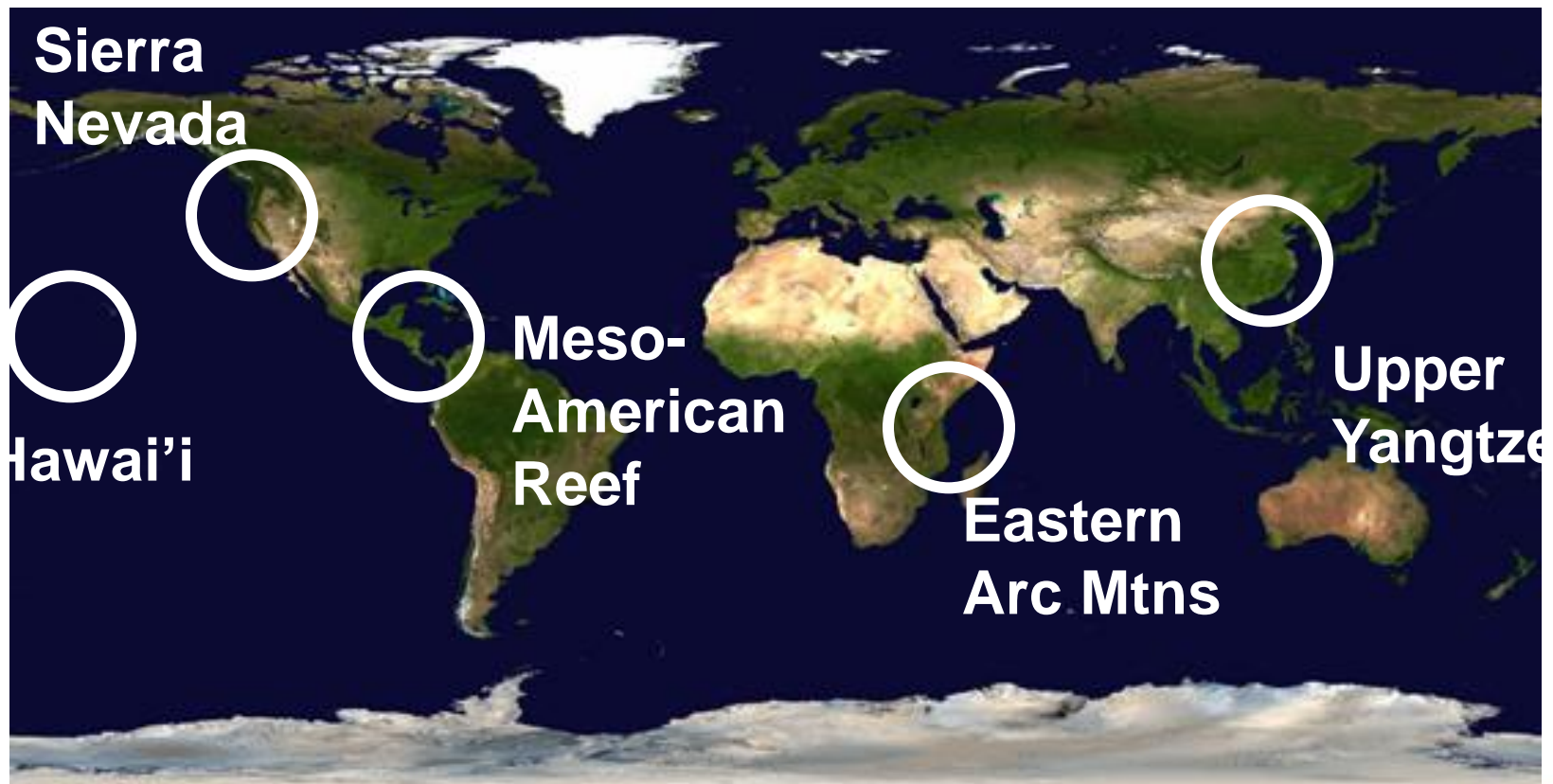
- Re-do site selection:
 - Can you reach same biodiversity goals and get more ecosystem services?
 - Water quality and carbon are equally valuable
- How well did you do?

Strategic Foci:

1. Developing new science, methods and tools
2. Applying new approaches in demonstration sites
3. Magnifying our impact



Test and apply tools in real-world conservation priorities



Integrated Valuation of Ecosystem Services and Tradeoffs

- Biodiversity and multiple services/sectors
- Driven by future scenarios
- Spatially explicit
- Biophysical and economic terms
- Flexible and transferable



InVEST Attributes:

- Biodiversity and multiple services/sectors



- Biodiversity
- Service modules
 - Carbon sequestration
 - Sediment retention
 - Water quality
 - Native pollination (for ag)
 - Commercial timber production
 - Flood control
 - Hydropower
 - Agricultural crop production
 - Irrigation water (for ag)
 - Non-timber forest products
 - Real estate value
 - Recreation and tourism
 - Cultural and aesthetic values

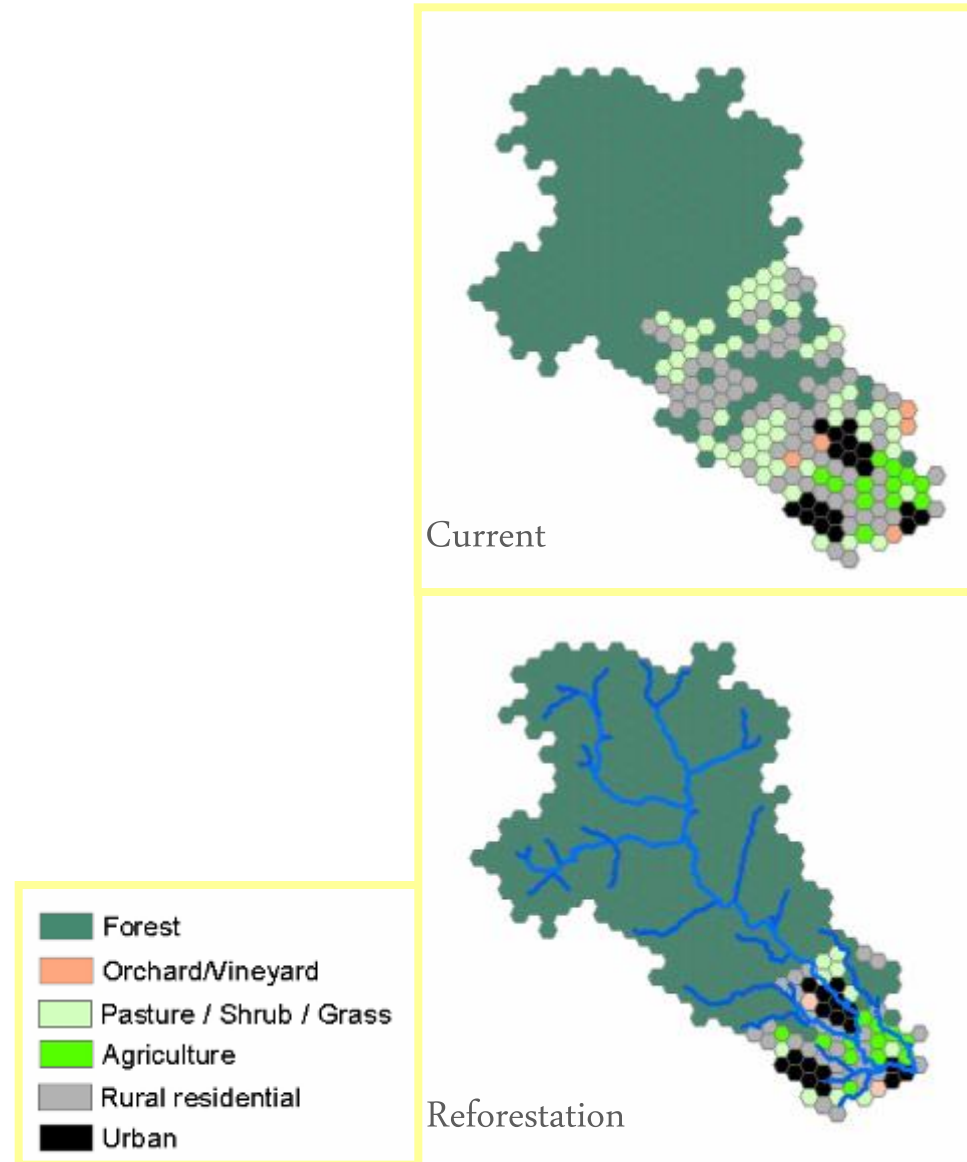


InVEST Attributes:

- Biodiversity and multiple services/sectors
- Driven by future scenarios (management choices and drivers)
- Spatially explicit



- Scenarios are maps
- Example:
 - Changes in land use or land cover resulting from management decisions
- Evaluate impact on:
 - Biodiversity
 - Carbon sequestration...



- Management
 - Water release schedule
 - Fertilizer application rate
- Climate Change
 - Land cover change
 - Precipitation and temperature
- Population Growth
 - Land cover change
 - Increased demand



InVEST Attributes:

- Biodiversity and multiple services/sectors
- Driven by future scenarios
- Spatially explicit
- Biophysical and economic terms



Stakeholder Engagement



Choices/Scenarios

Changes in Management, Climate, Population



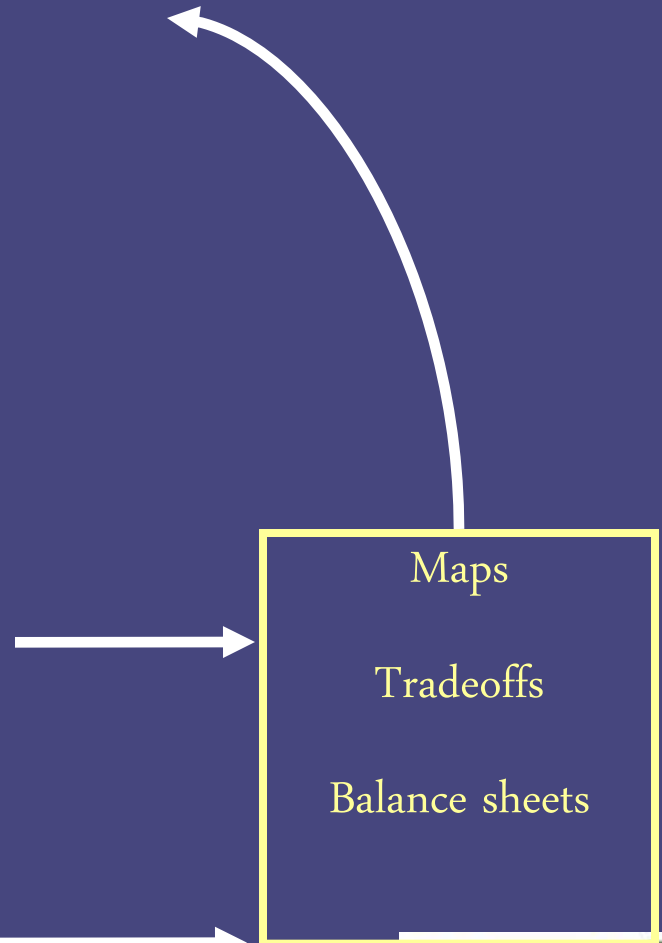
Biophysical Models

Ecosystem process/biodiversity
Ecological production functions (services)



Economic Models

Valuation

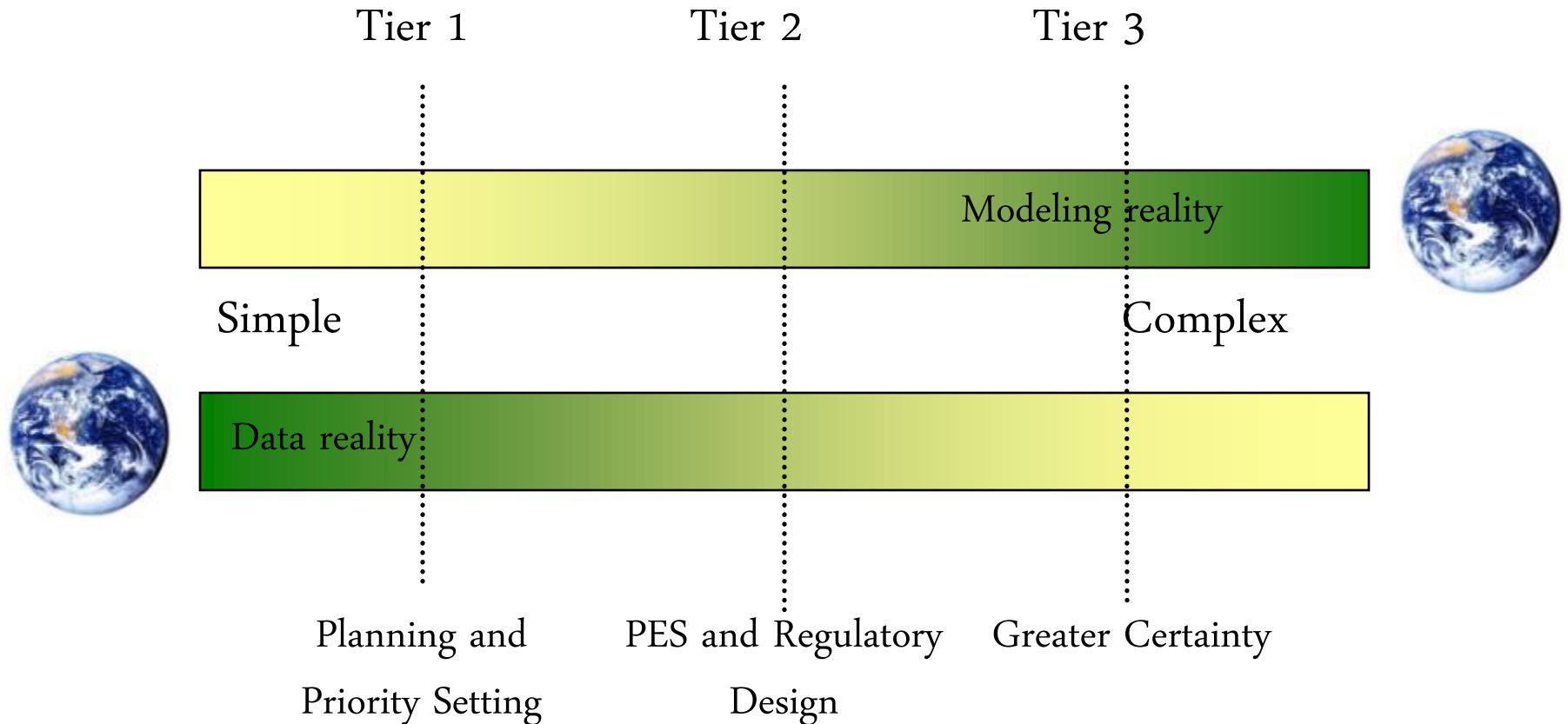


InVEST Attributes:

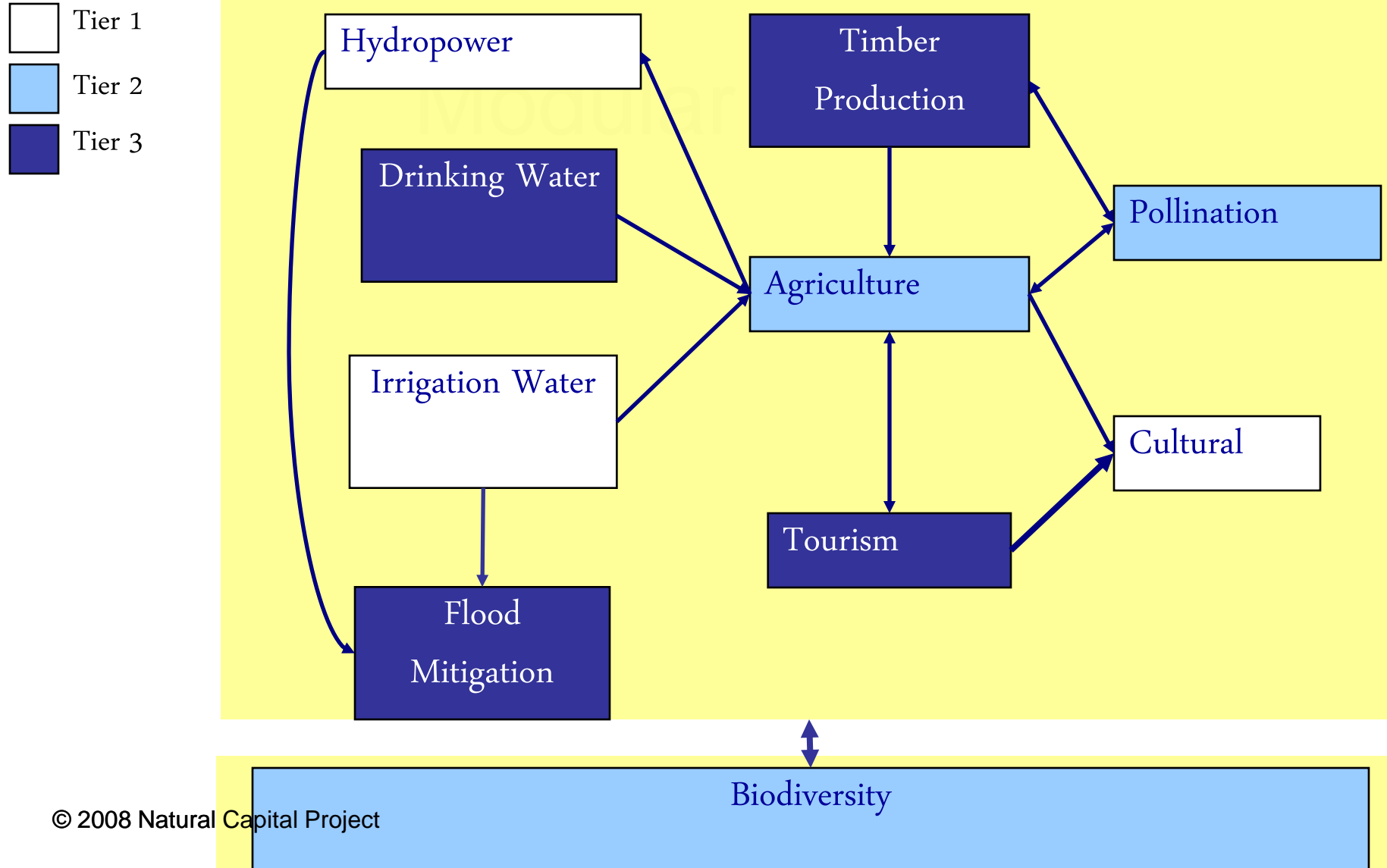
- Biodiversity and multiple services/sectors
- Driven by future scenarios
- Spatially explicit
- Biophysical and economic terms
- **Flexible and transferable**



Tiered Approach



Flexible Structure



- Hawai'i
- Amazon Basin
- Oregon
- Tanzania
- California
- China
- Colombia
- Future Work

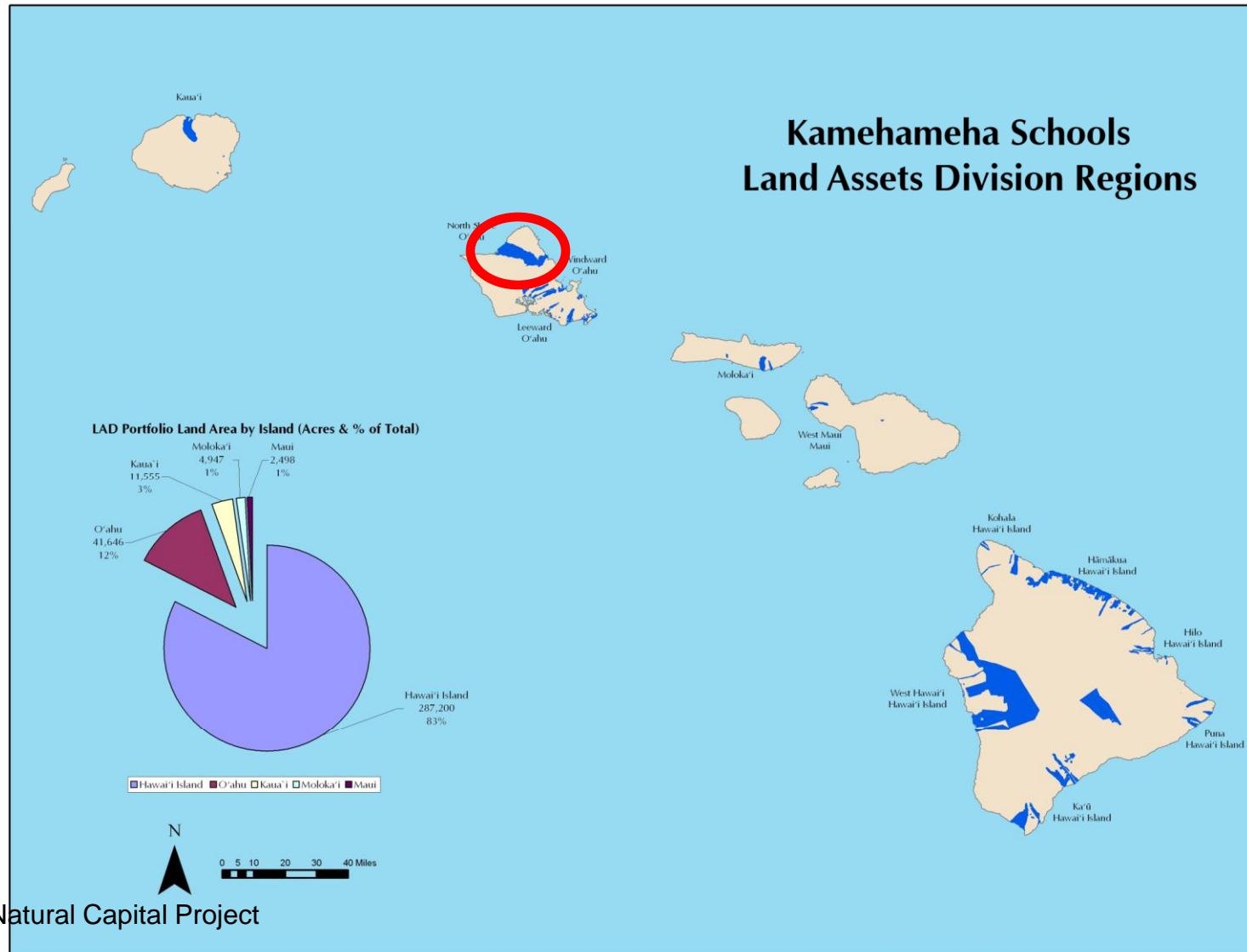


- Hawai'i
- Amazon Basin
- Oregon
- Tanzania
- California
- China
- Colombia
- Future Work

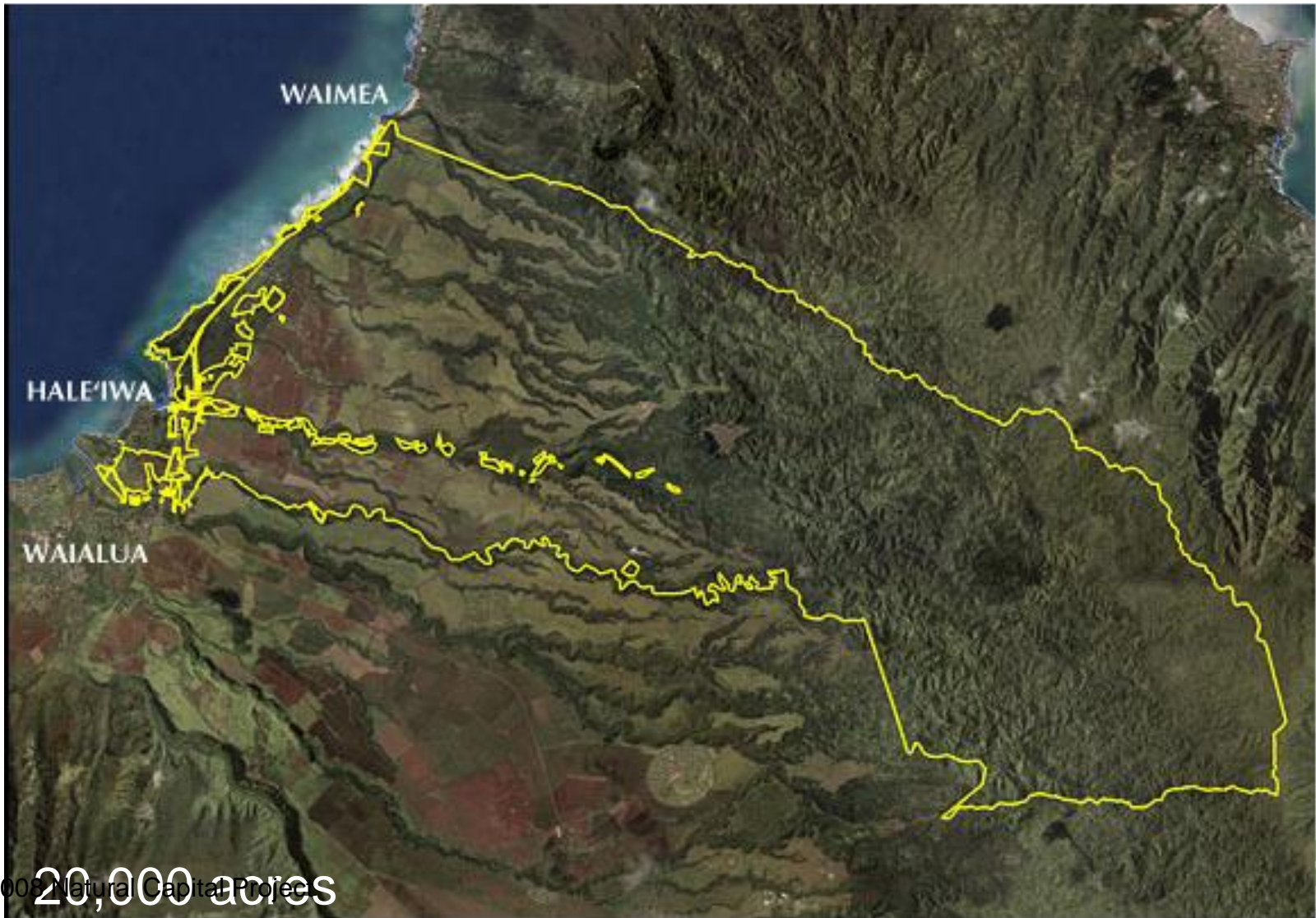


- Kamehameha Schools:
 - Large private land owner
- Objective: Multi-objective land planning and asset management
 - Income
 - Agriculture
 - Cultural and educational values
 - Carbon sequestration
 - NTFP harvest
 - Biodiversity

ECOSYSTEM SERVICES Kamehameha Lands

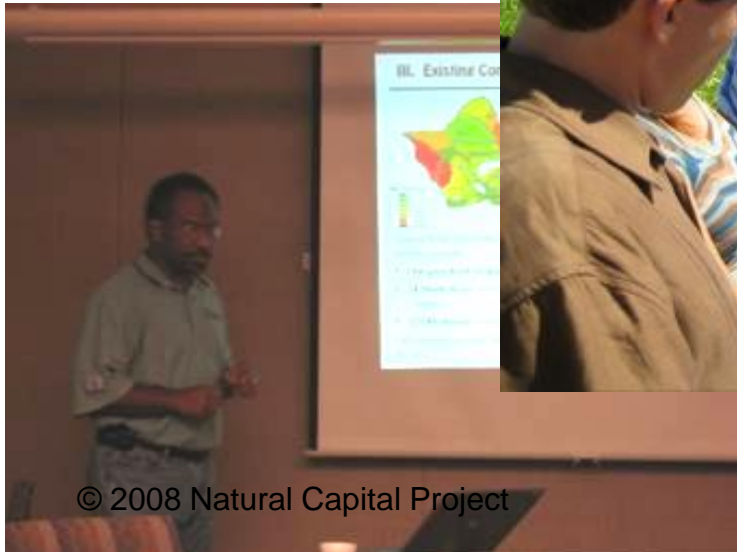


Kawailoa Property

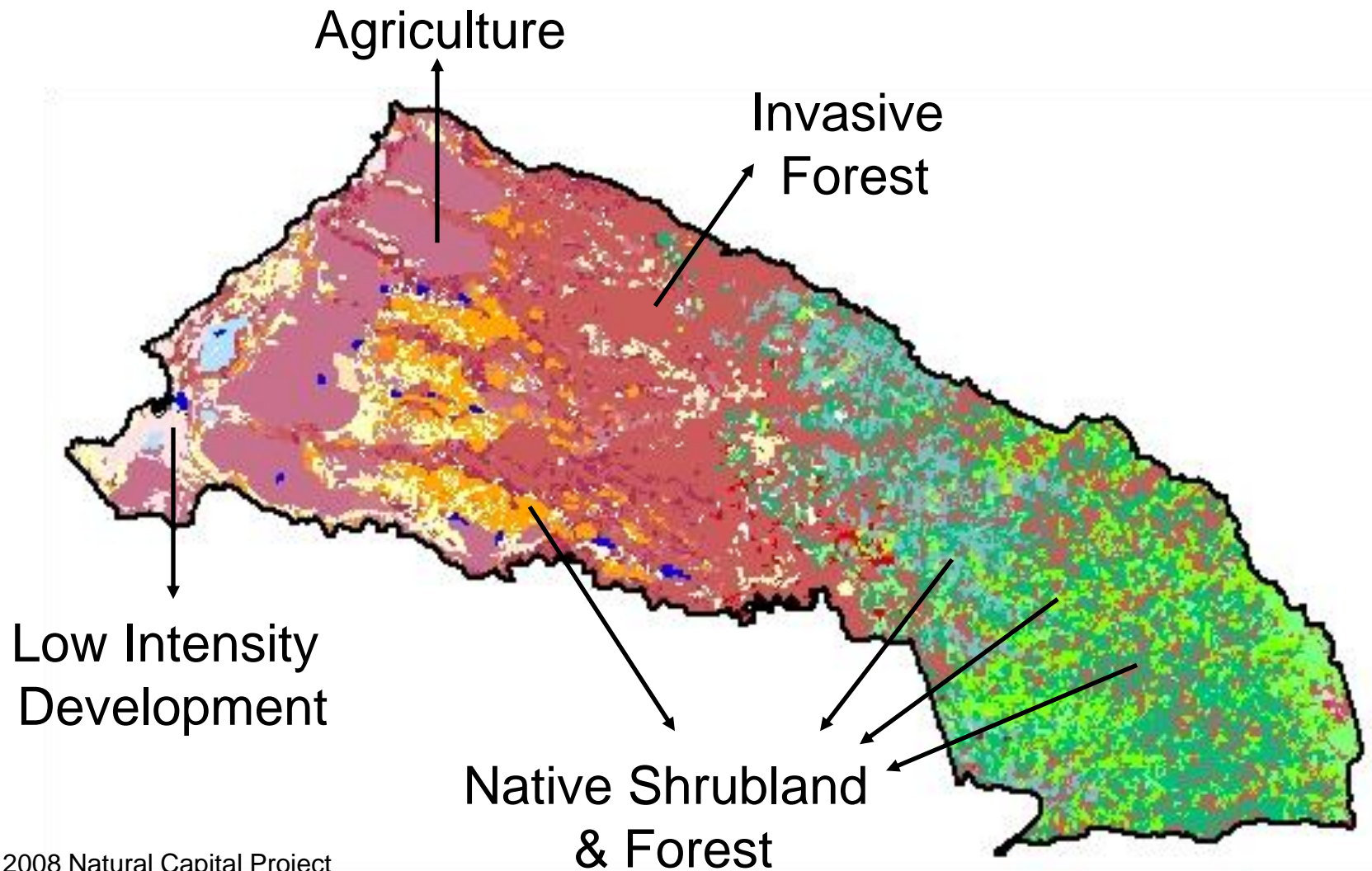


ECOSYSTEM SERVICES

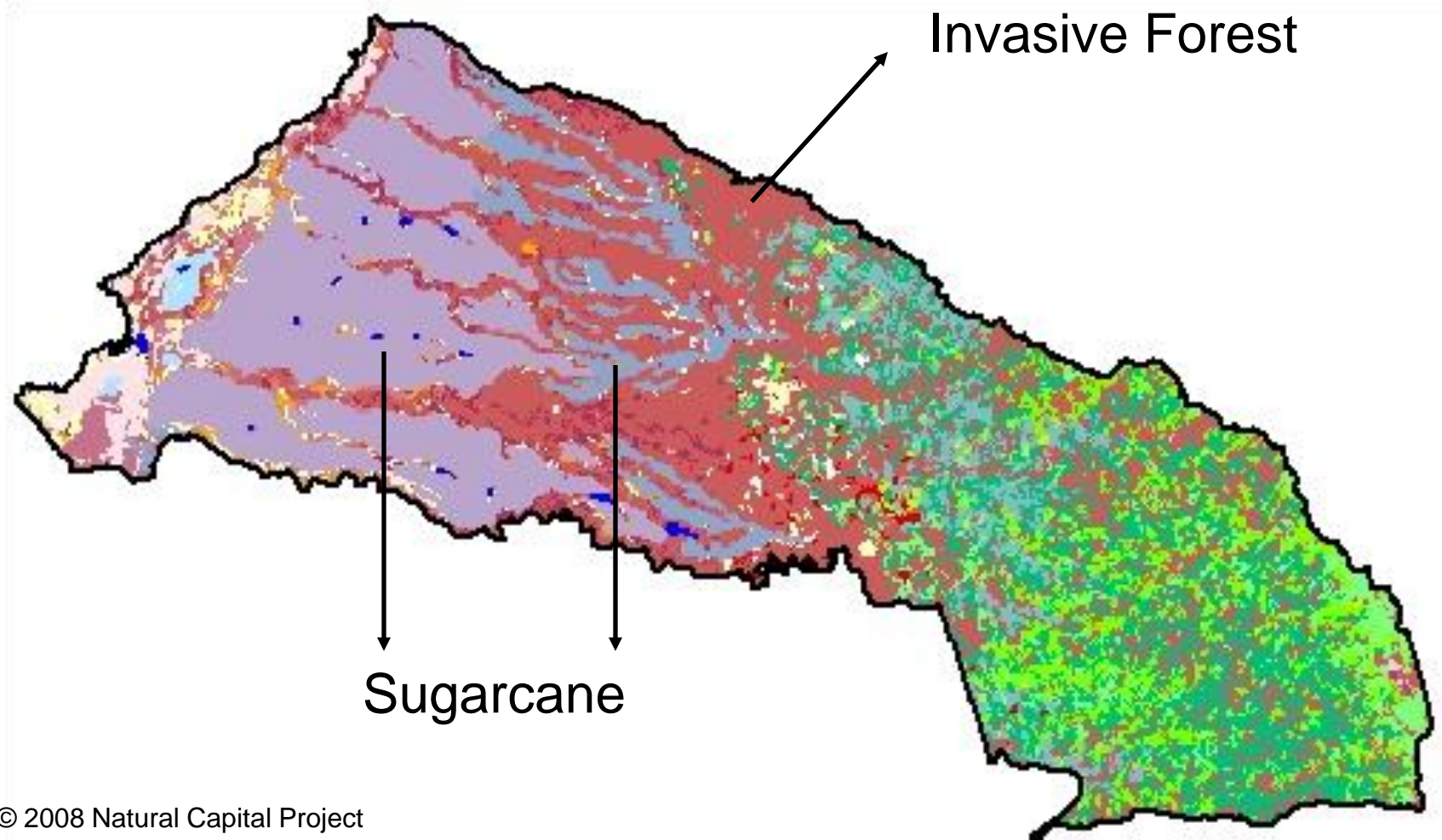
Kawailoa Property

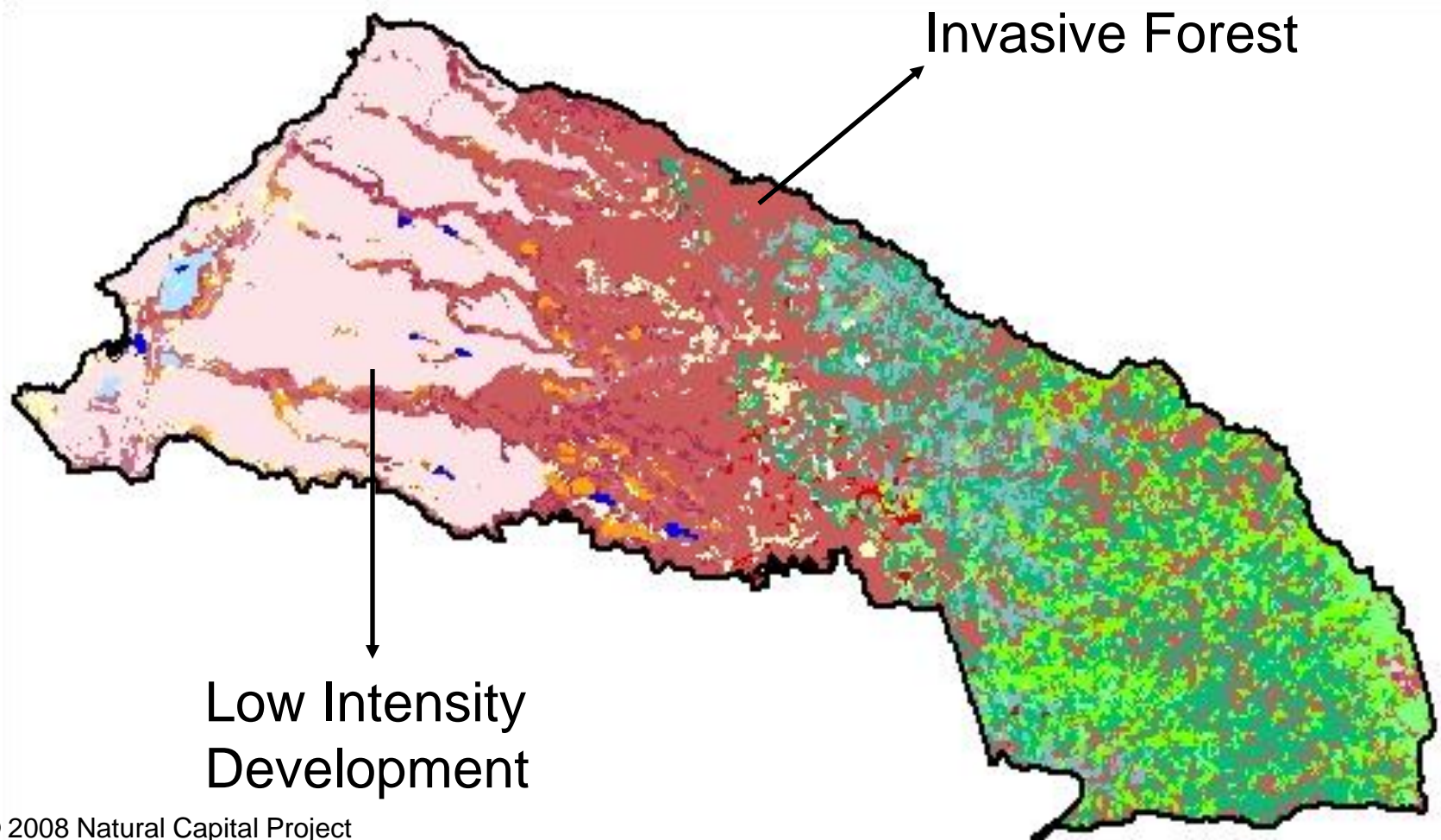


Current Landscape

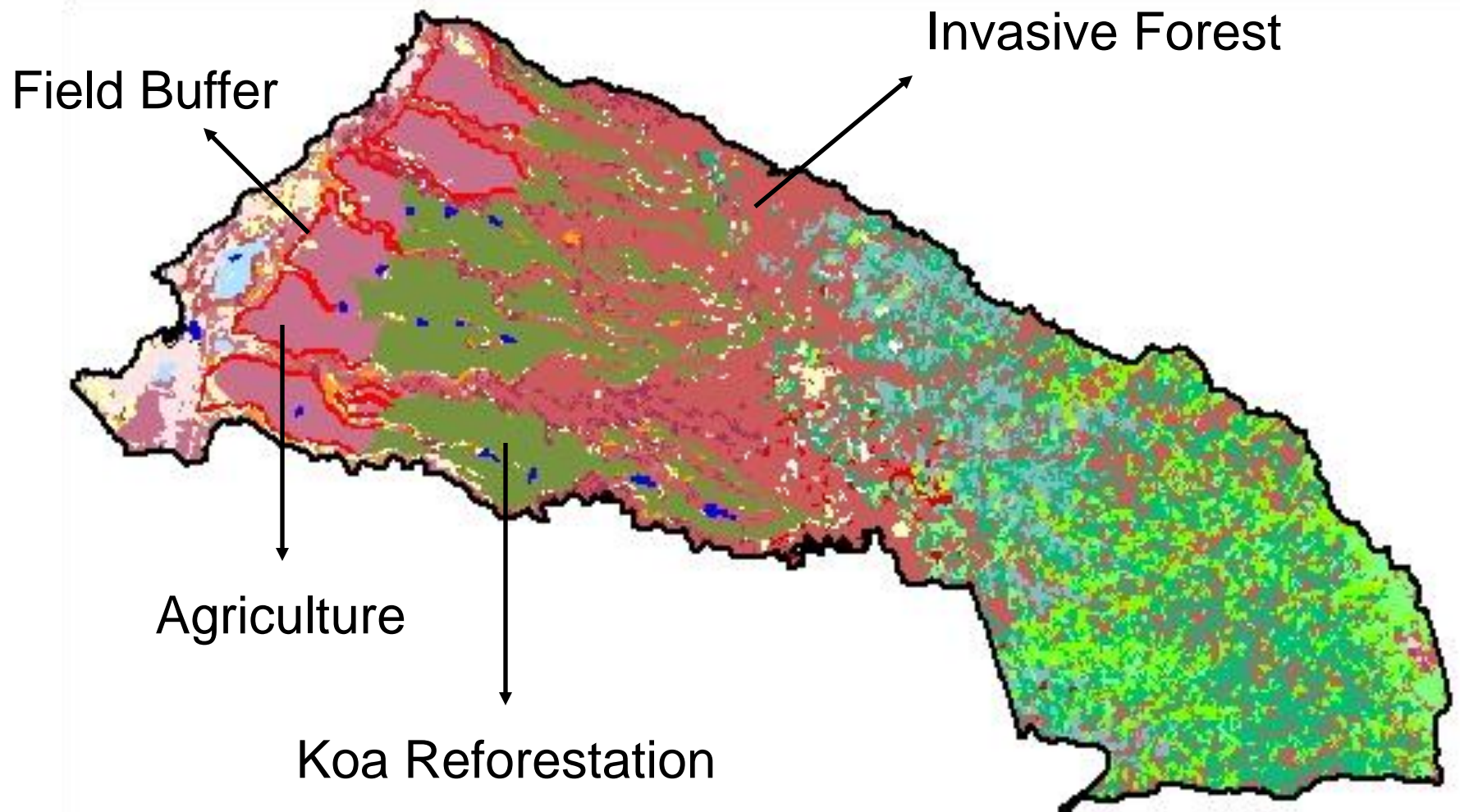


Biofuels Future



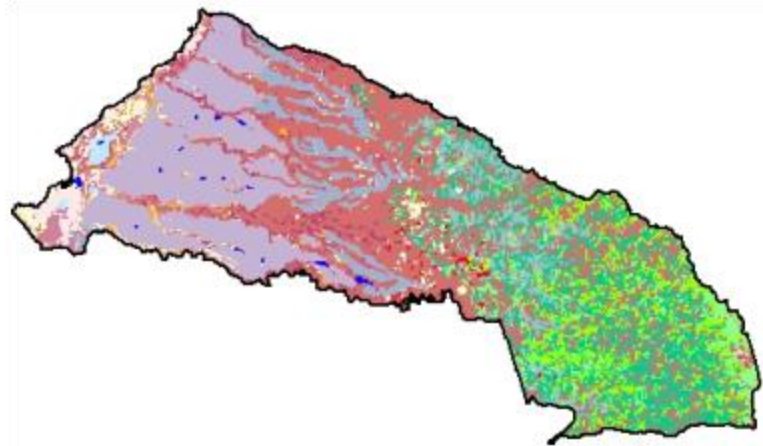


ECOSYSTEM SERVICES Sustainable Ag & Forestry Future

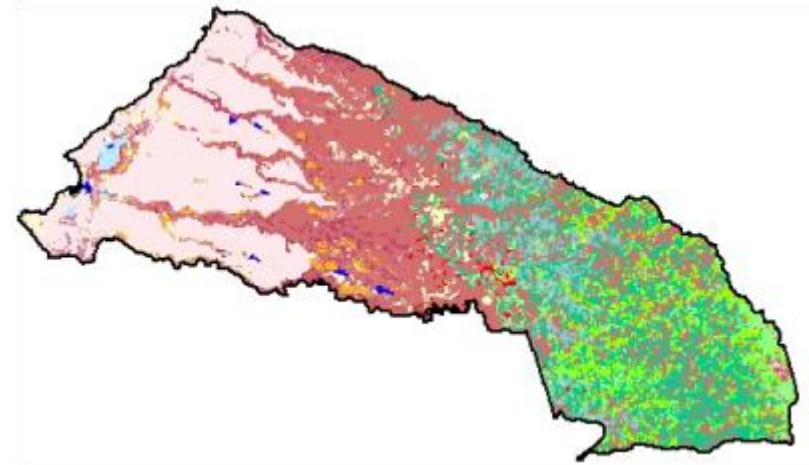


Scenarios

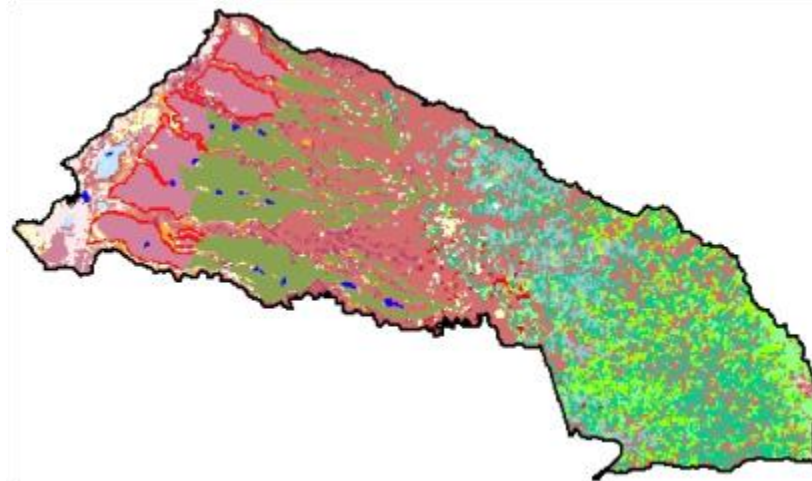
Biofuels



Subdivision



Sust. Agriculture & Forestry



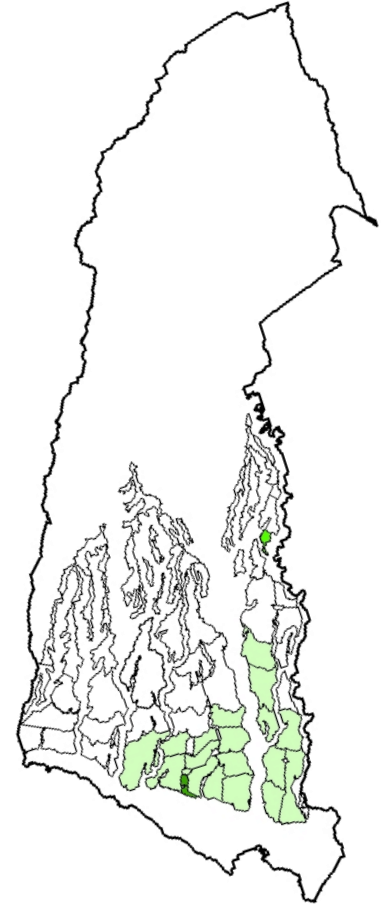
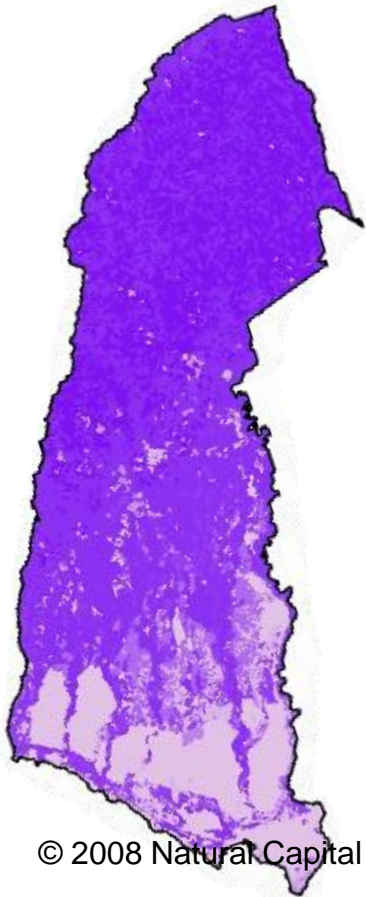
Current Landscape

Carbon Storage
(tC/ha)

Water Quality
(kg/ha)

Water Yield
(mm/yr)

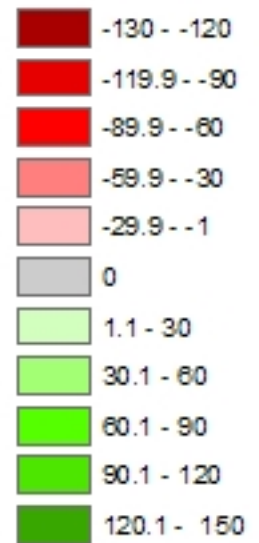
Plantation
Income
(\$/ac)



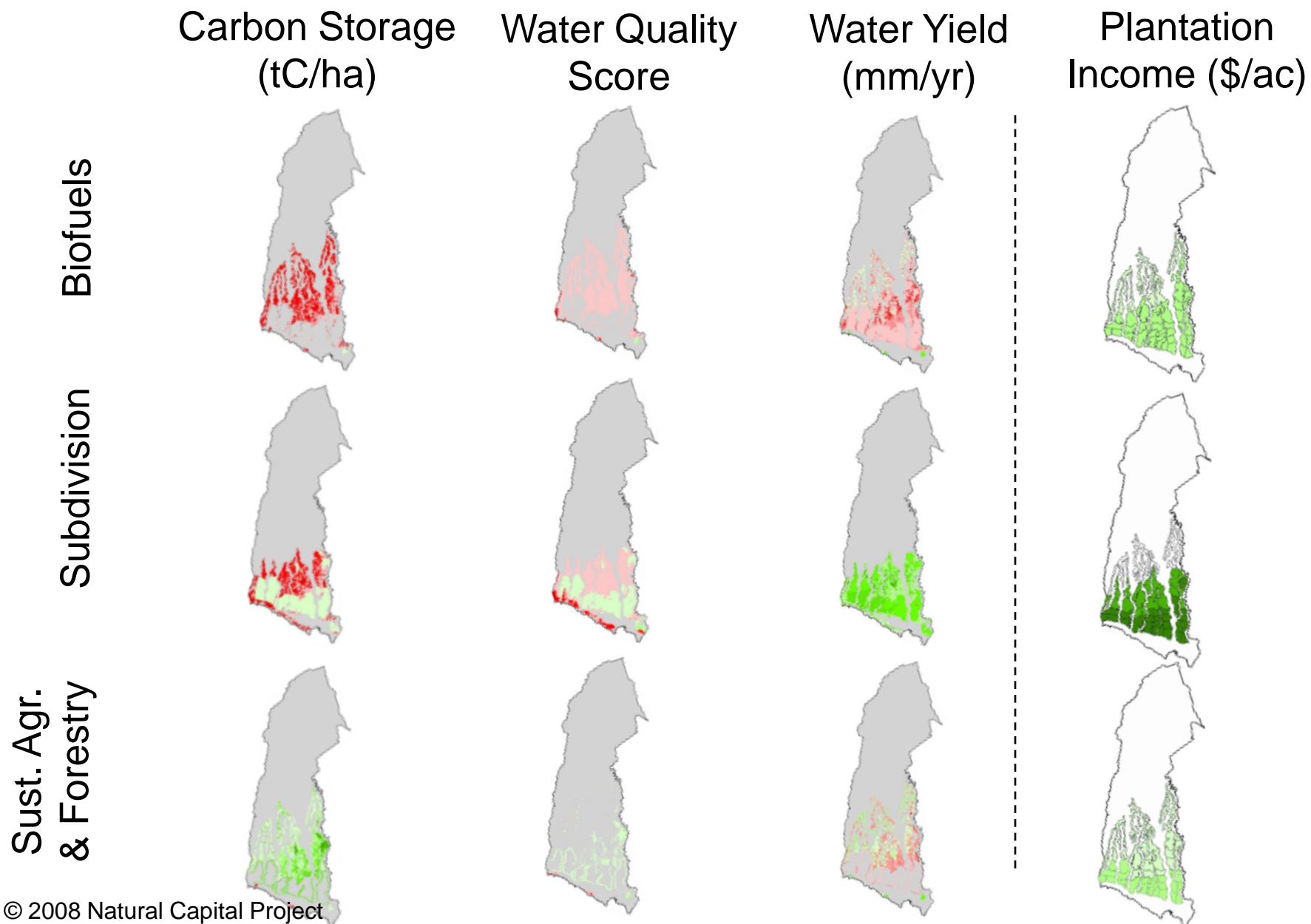
Future Carbon

Biofuels**Subdivision****Sust. Agr. & Forestry**




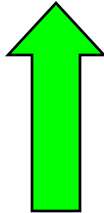


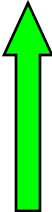
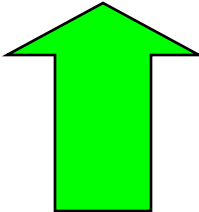
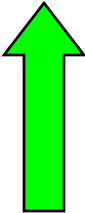
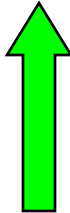

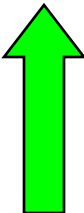
Change
(tC/ha)



Spatial Changes



General Changes

	Carbon Storage (tC/ha)	Water Quality Score	Water Yield (mm/yr)	Plantation Income (\$/ac)
Biofuels				
Subdivision				
Sust. Agr. & Forestry				

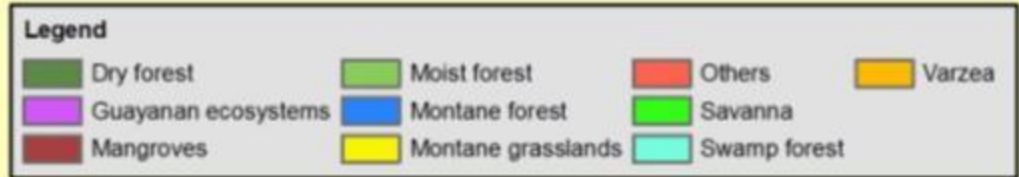
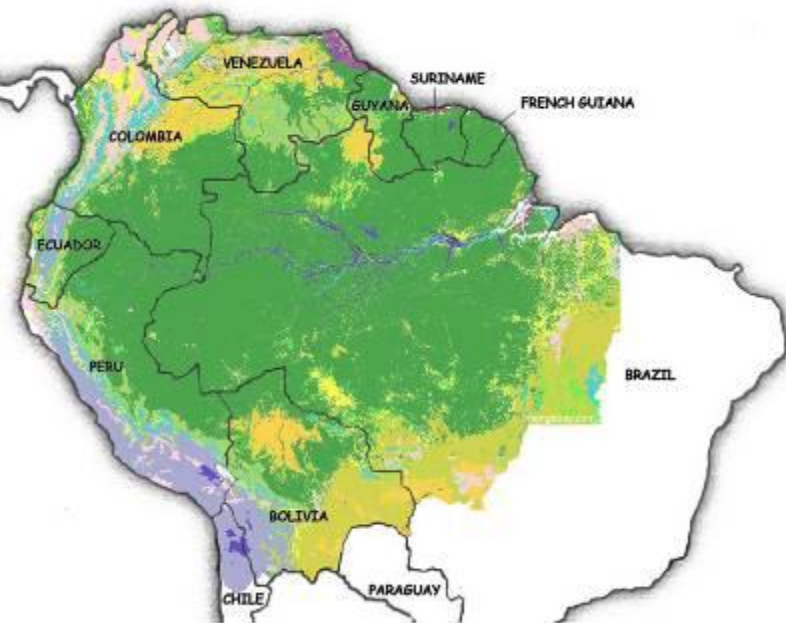
- Kamehameha Schools soon to decide on use of InVEST for assessment of all land holdings.
- Plantation income can increase alongside increased service provision (but not always!)
- Next steps:

- UK Department for International Development:
 - Development Donor
 - Granted £4.8 billion last year
- Special thanks to the Northern Tropical Andes Program and Silvia Benitez

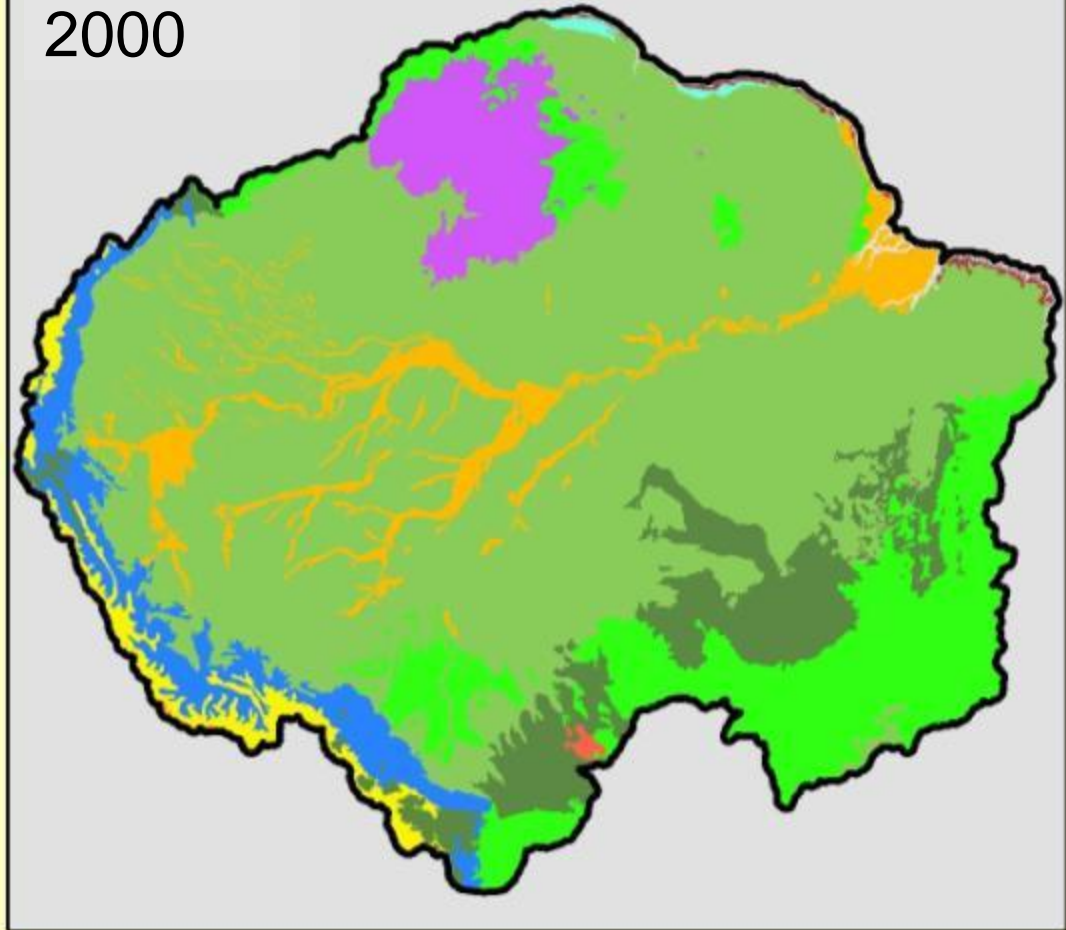
- Objective: poverty alleviation from PES
 - NTFPs
 - Carbon Sequestration
 - Tourism
 - Biodiversity
 - Water Services
- Examine current conditions and change in 2020

Habitat Types

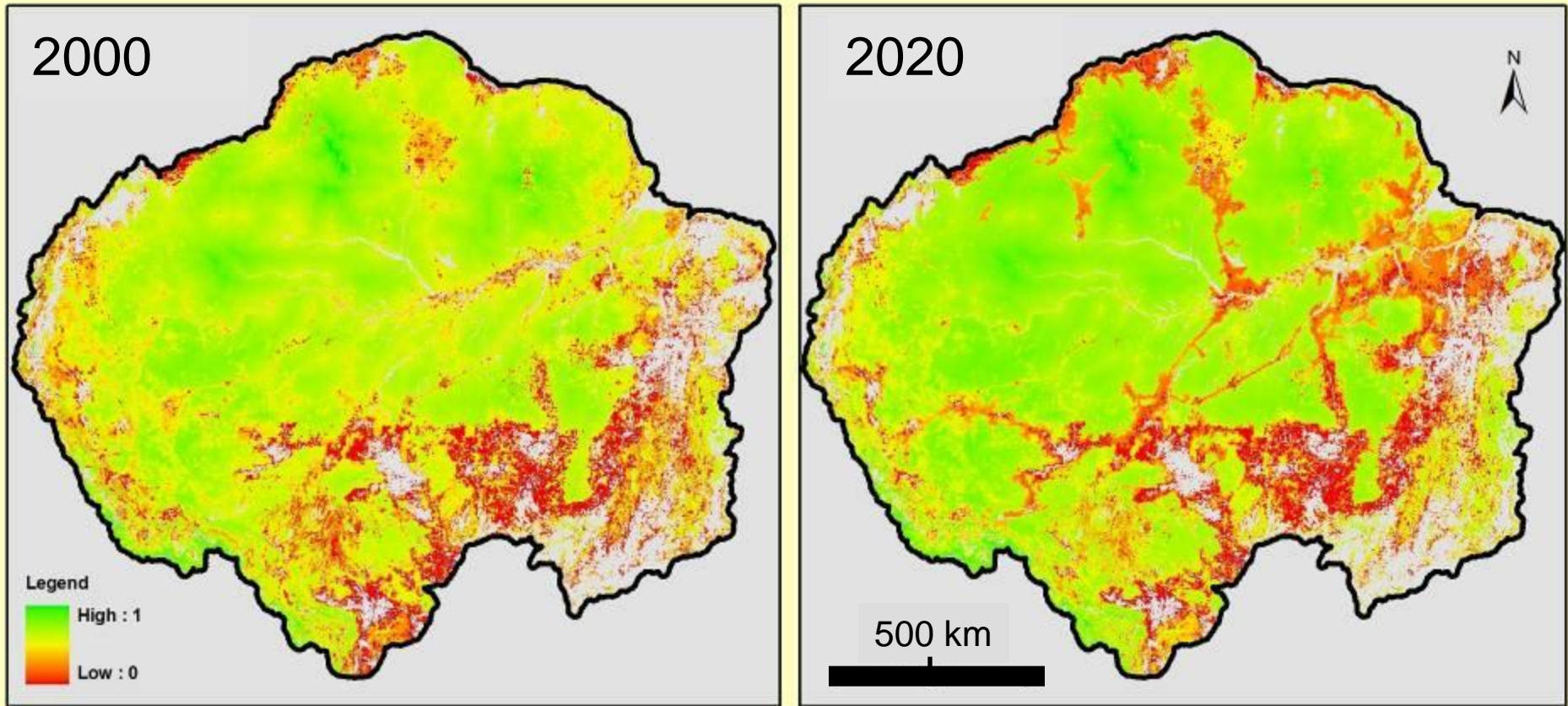
- 12.5 million km²



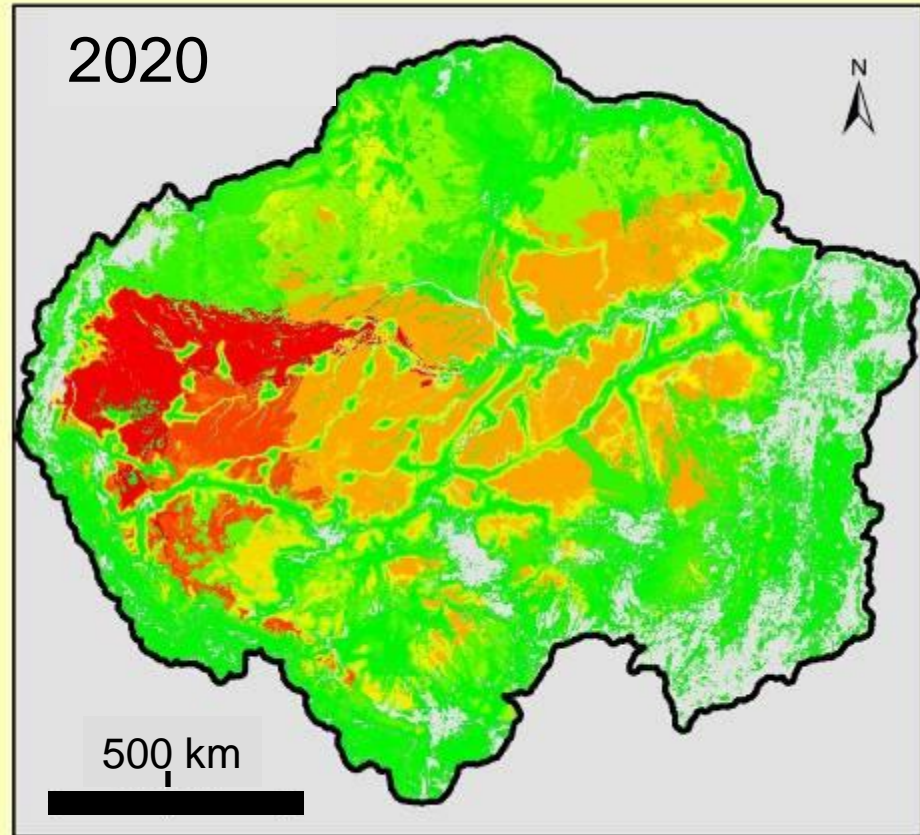
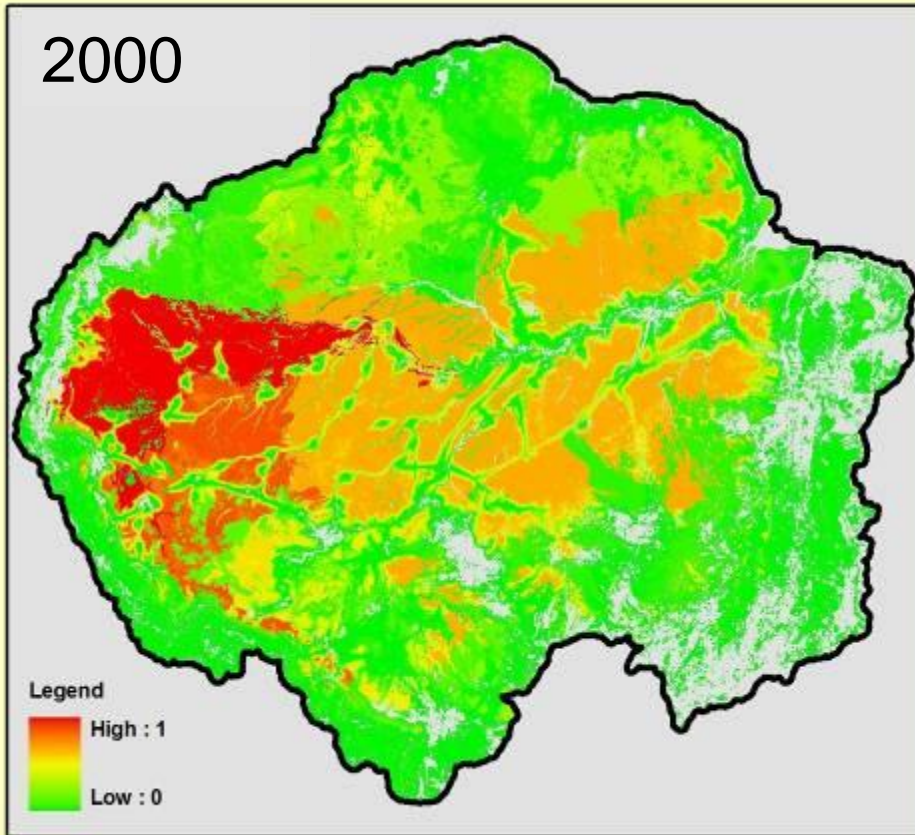
2000



Habitat Quality



Food Supply



- Protected areas largely ineffective at curbing losses
- Next: identify areas where poor people control ecosystem services, potential for PES
- Next: national – level mapping in Ecuador and Colombia

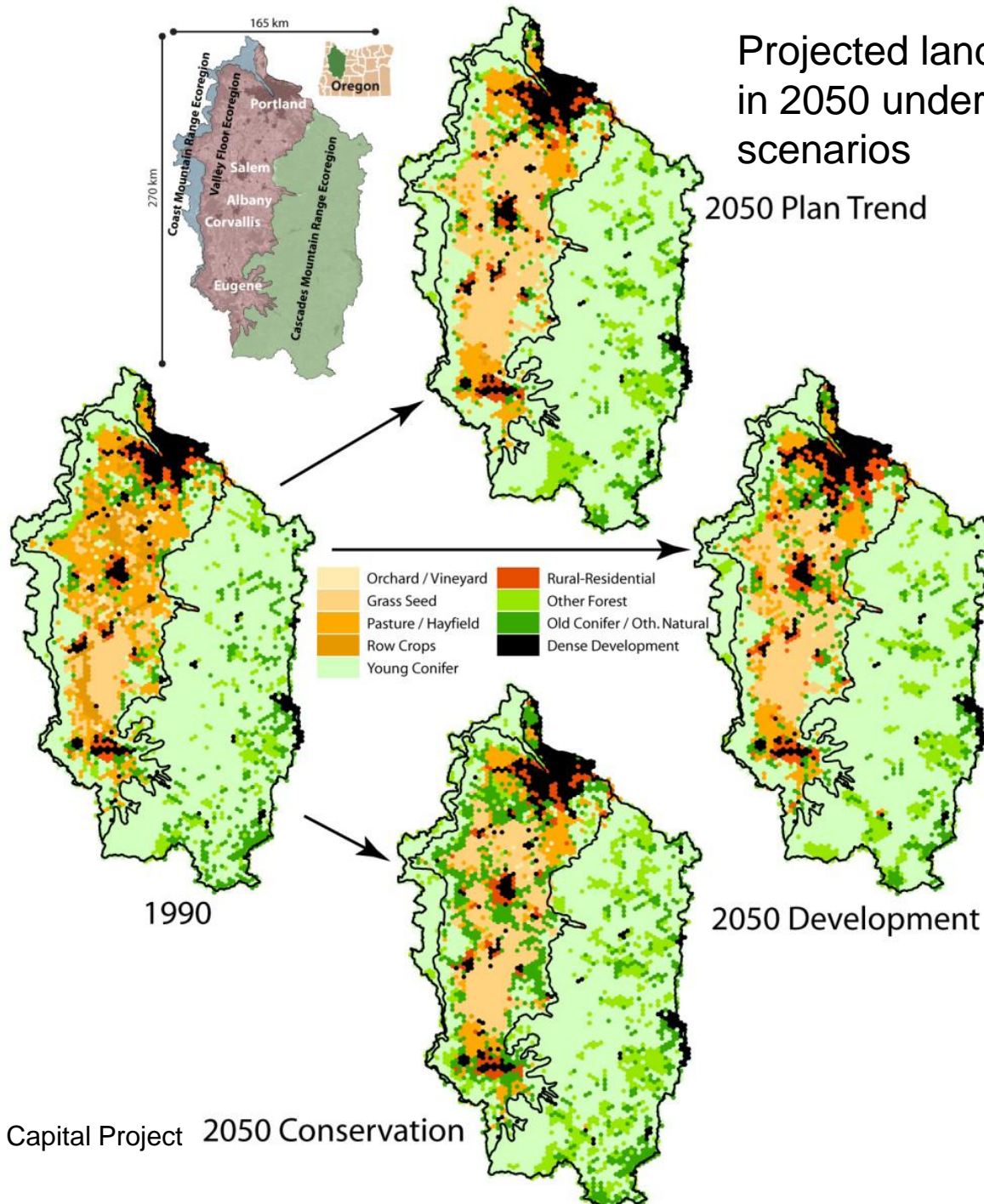
- Modeling multiple ecosystem services and tradeoffs at landscape scales
- Special thanks to the Oregon Chapter of TNC and Cathy MacDonald
- Nelson, et al. 2008. *Frontiers in Ecology and Environment*. In Press.

Modeling multiple services under alternative scenarios

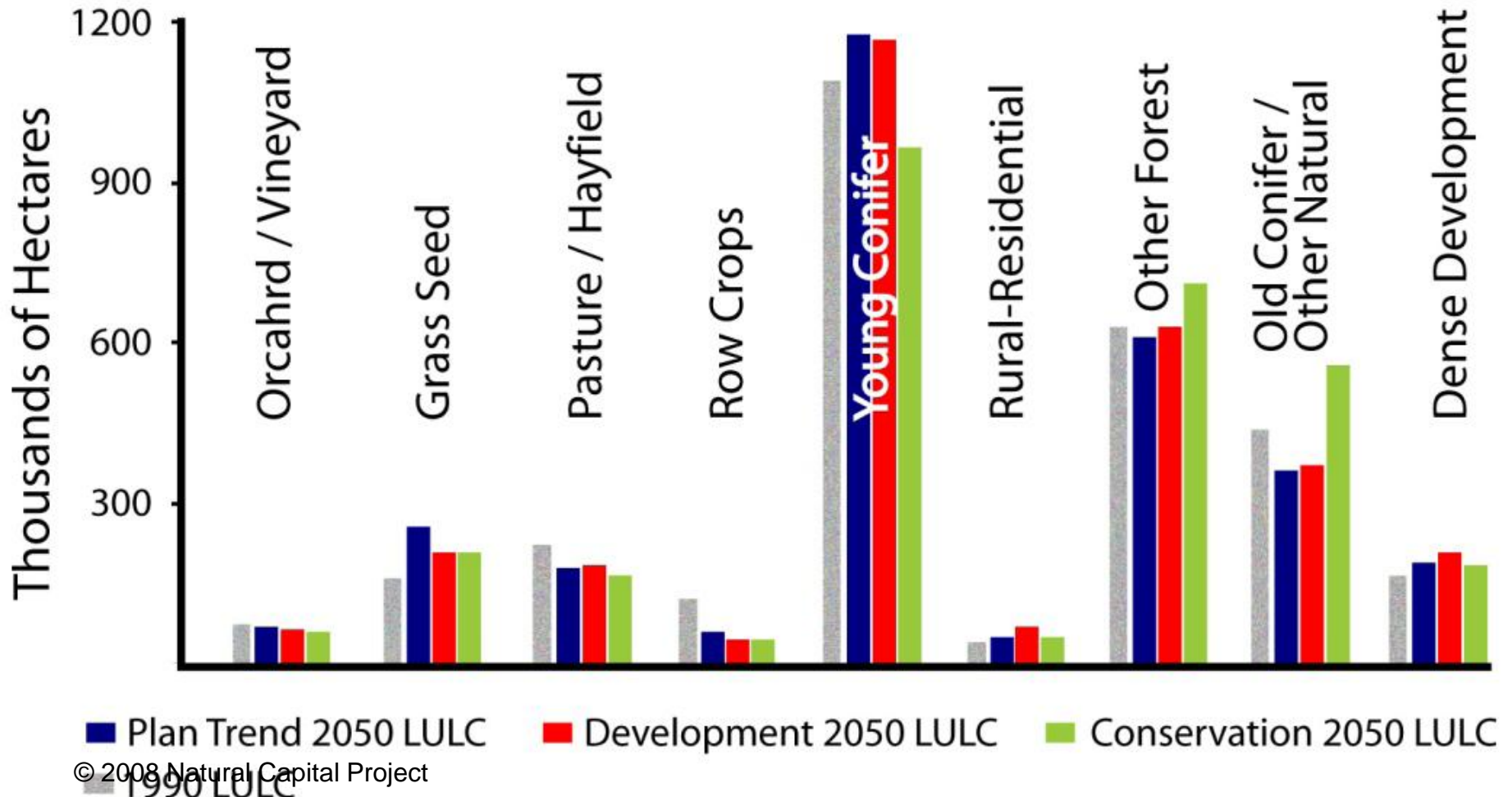
- Three scenarios of land use / land cover change for the Willamette Basin developed by the Pacific Northwest Ecosystem Research Consortium for 1990 – 2050

Modeling multiple services under alternative scenarios

- Model outputs: service provision and biodiversity
 - Water quality
 - Storm peak mitigation
 - Soil conservation (sediment retention)
 - Climate stabilization (carbon sequestration)
 - Biodiversity (species conservation)
 - Market returns to landowners (agricultural crop production, timber harvest and housing values)

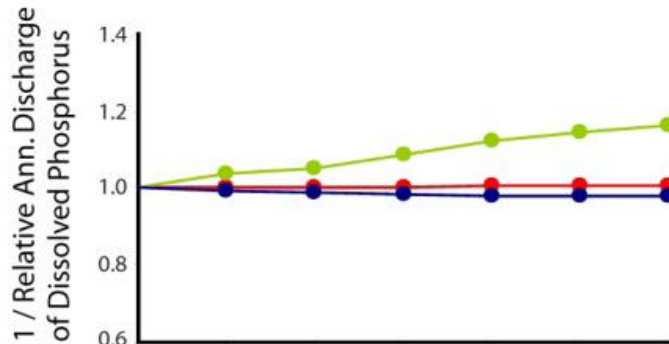


Land use by category for the three scenarios and the 1990 landscape

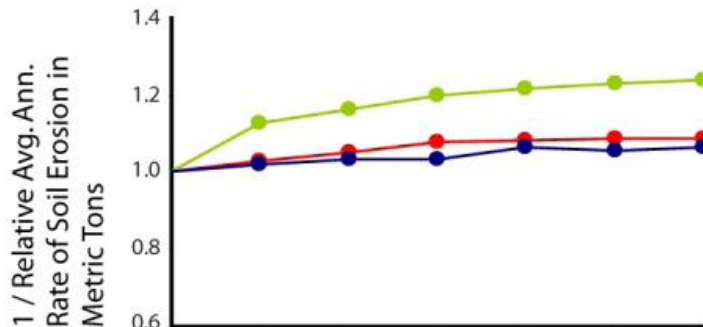


Outputs Through Time

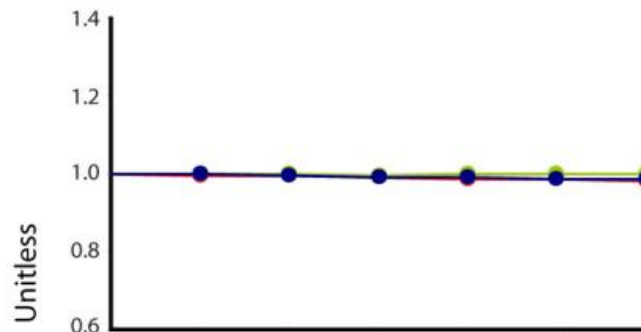
Water Quality



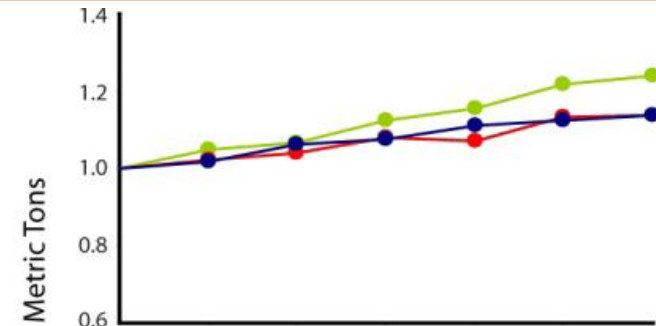
Potential Soil Conservation



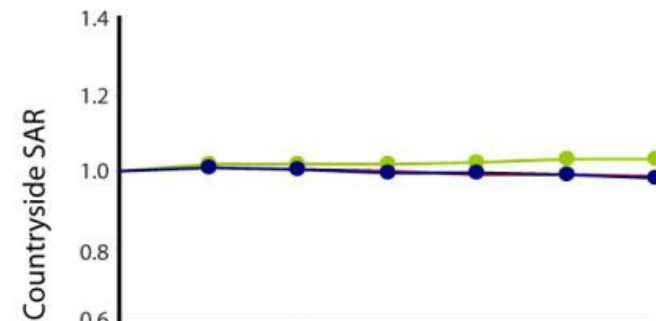
Storm Peak Management



Carbon Sequestration



Biodiversity



Market Value



1990 2000 2010 2020 2030 2040 2050

Water Quality

Potential Soil Conservation

Storm Peak Management

Carbon Sequestration

Biodiversity

Market Value

1 / Relative Ann.
Discharge of Dissolved
Phosphorus per Hex.

1 / Relative Avg. Ann.
Rate of Soil Erosion in
Metric Tons per Hex.

Unitless

Metric Tons
per Hex.

2050 RMBV
per Hex.

Constant Year 2000
Dollars per Hex.

Plan Trend

Development

Conservation

Loss

Gain

Balance Sheet

Total discounted economic value of commodities and carbon sequestration produced in the Basin from 1990 to 2050 under the three scenarios
(values in billion \$)

	Plan trend	Development	Conservation
Market commodity production	\$15.29	\$15.29	\$14.80
Carbon sequestration	\$0.90	\$0.80	\$1.60
Total	\$16.19	\$16.09	\$16.40

ECOSYSTEM SERVICES Lessons & Next Steps

- Inclusion of value of ecosystem services can shift planning outcomes towards conservation
- Next: inclusion of a wider range of services
- Next: link to specific policy and management questions

Tier 1 Version 1.0 AVAILABLE NOW!

- See our Toolshed Booth
- Modules contained
 - Water pollution
 - Managed timber
 - Carbon
 - Pollination
 - Biodiversity (habitat quality & rarity)



– Modules

- Flood mitigation
- Hydropower production
- Irrigation
- Agricultural production
- Open Access Timber & Non-Timber Forest Products

– Marine InVEST in development



Software available on the web:

<http://invest.ecoinformatics.org>


Requires ArcGIS 9.2





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by [admin](#) — last modified 2008-10-10 12:21

A collaboration area for the Integrated Valuation of Ecosystem Services and Tradeoffs tool.

If you are a registered user, use the navigation links on the left to explore content folders or enter the discussion board ('Discuss'). Although most directories are read-only, *all* registered users can upload files to the 'Shared' folder. Feel free to use 'preferences' link in the top bar to flesh out your user information -- and add a portrait!

New user? Click on the join link above, or on the New User link below on the left.

DOWNLOADING InVEST

InVEST, a.k.a. Integrated Valuation of Ecosystem Services and Tradeoffs, is a suite of models and software tools under development by the Natural Capital Project. InVEST aims to provide a consistent methodology for measuring and comparing the value of multiple ecosystem services across real landscapes. For more information, visit the [Natural Capital Project website](#).

[Download InVEST 1.0 Beta here!](#)

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Account details

Login Name

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Password

Case sensitive, make sure caps lock is not enabled.

InVEST



InVEST and Ecoregional Planning



- Would adding ecosystem service priorities change TNC's ecoregional plan?
- What ecosystem services will be gained if TNC acquires and restores all the sites in its current ecoregional plan?

What About You?

- How would you use InVEST in your work?
- Your application here...



Collaborators

Gretchen Daily	Chris Colvin
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Heather Tallis	Driss Ennaanay
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Funders

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V. and R. Sant
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The Winslow Foundation
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The Nature Conservancy

Thank you for your attention

Questions?

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