

# INTRODUCTION TO INVEST

May 21, 2014

Stacie Wolny  
swolny@stanford.edu

*Free, open-source toolkit*

*Simple models*

**InVEST**

integrated valuation of  
environmental services  
and tradeoffs

*Relatively low  
data needs*

*Quantify, map and value the benefits provided by  
terrestrial, freshwater and marine systems*

# TYPES OF QUESTIONS INVEST CAN HELP ANSWER

Where would reforestation achieve the greatest downstream water quality benefits?

Which areas in a landscape provide the greatest carbon sequestration, habitat and tourism values?

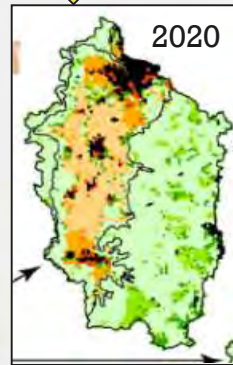
Where should payments for environmental services be targeted to be most cost-effective?

# INVEST WITHIN DECISION MAKING

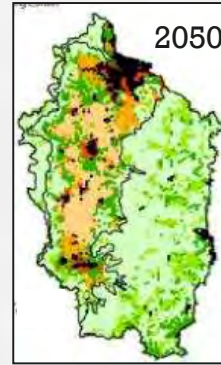


Stakeholders

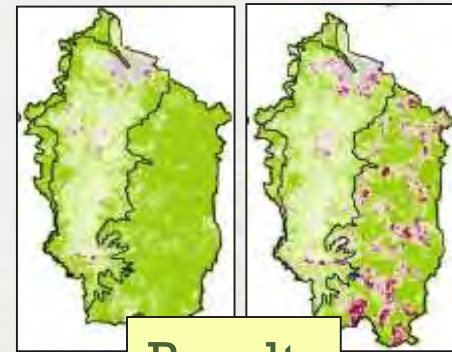
Policy input



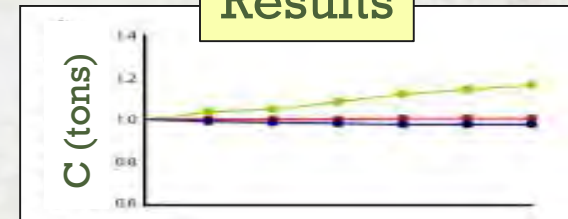
Scenarios



InVEST



Results



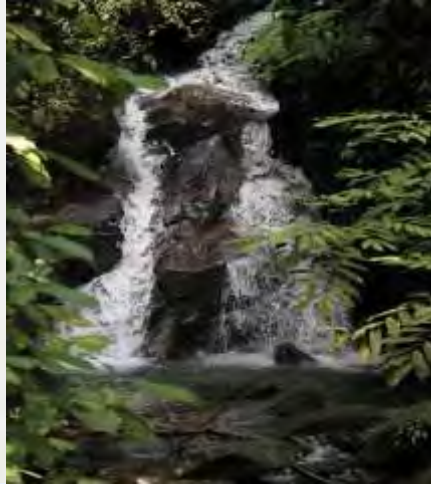
Policy implementation



# INVEST IS USED AROUND THE WORLD



# Guiding development and investment in Sumatra



## **Policy questions:**

How can sustainable spatial planning be implemented and financed?

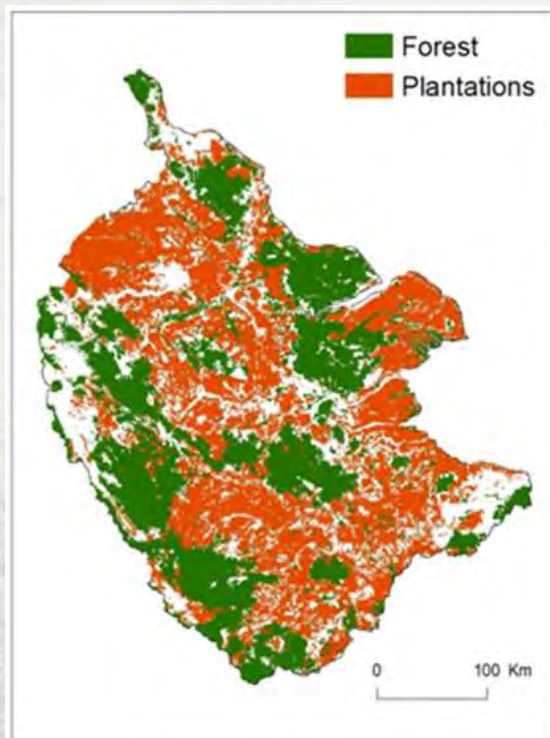
Where are cost-effective investments in ecosystem services advisable/possible?

**Audience:** District governments, investors

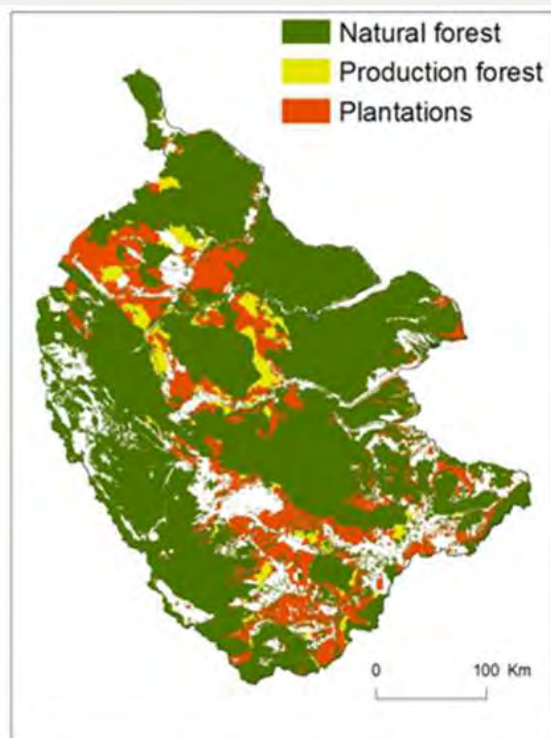
**Partners:** WWF-Indonesia, National and local Indonesian governments



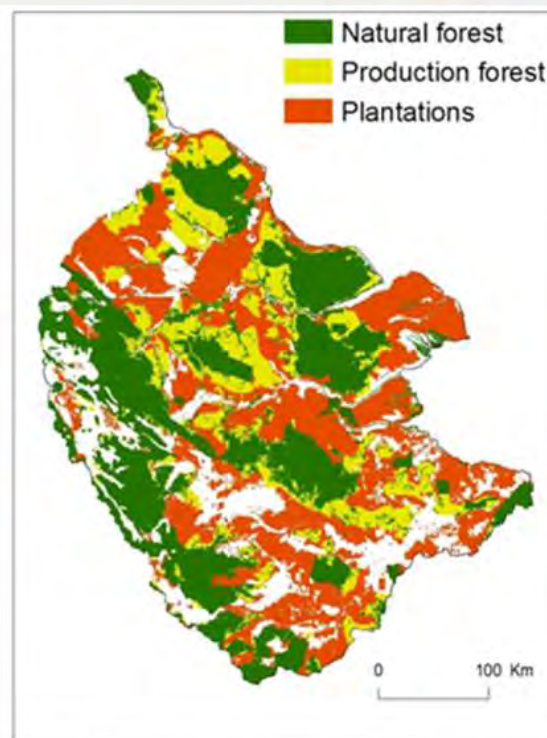
# SCENARIOS



(a) 2008 land cover

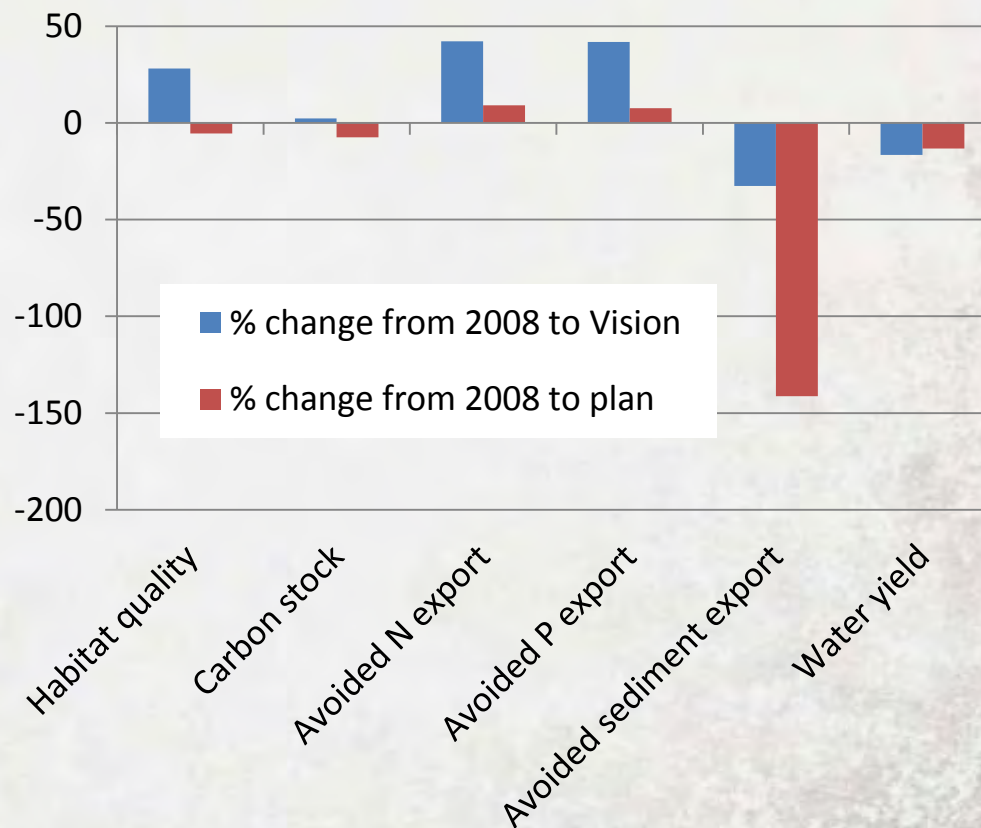


(b) Sumatra ecosystem Vision



(c) Government spatial plan

# CHANGE IN SERVICES





# INVEST TOOLSET

Aquaculture

Fisheries

Coastal Protection

Coastal Vulnerability

Wave Energy

Offshore Wind Energy

Aesthetic Quality

Marine Water Quality

Recreation



Water Purification

Water Yield

Sediment Retention

Crop Pollination

Carbon Sequestration

Timber Production

Habitat Risk

Habitat Quality

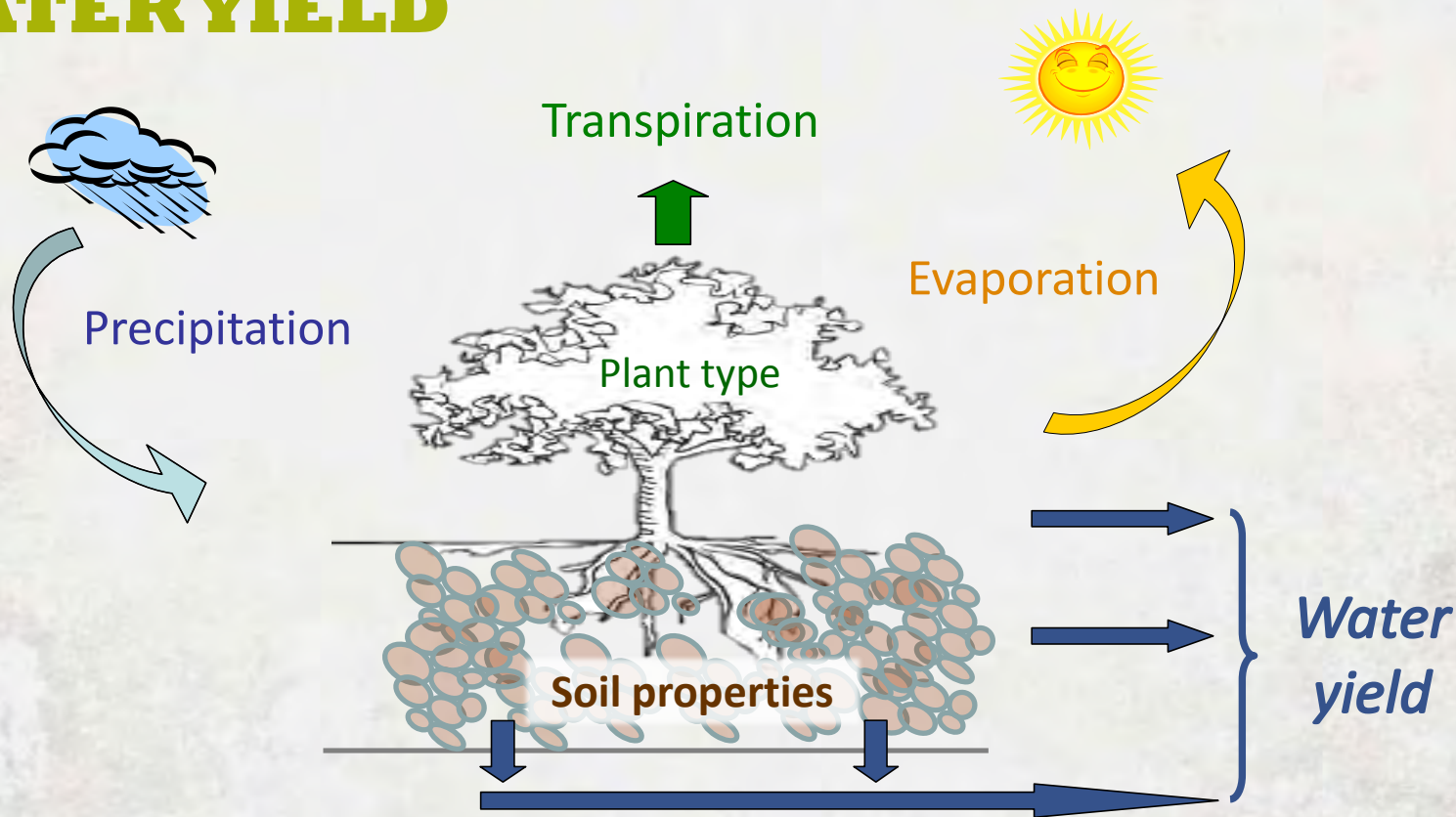
Overlap Analysis

An aerial photograph of a large dam and reservoir. The reservoir is a dark, winding body of water that fills much of the upper left and center of the frame. The dam is a long, light-colored structure that spans across the middle of the image, with water cascading over it. To the right of the dam, there is a large, rectangular area that appears to be a reservoir or a large pond. The surrounding landscape is covered in dense, green forest. There are some small, white, cloud-like patches scattered throughout the forested areas. The overall scene is a mix of natural beauty and human engineering.

# INVEST HYDROPOWER/ WATER YIELD



# WATER YIELD



$$\text{Water Yield} = \text{Precipitation} - \text{Evapotranspiration}$$



# MODEL INPUTS



## Climate

Precipitation, Potential  
Evapotranspiration



## Soils

Soil depth, Plant  
Available Water Content



## Land Use/Land Cover

Root depth,  
Evapotranspiration coefficient



## Watersheds

Main and sub-watersheds  
for point of interest



## Water demand

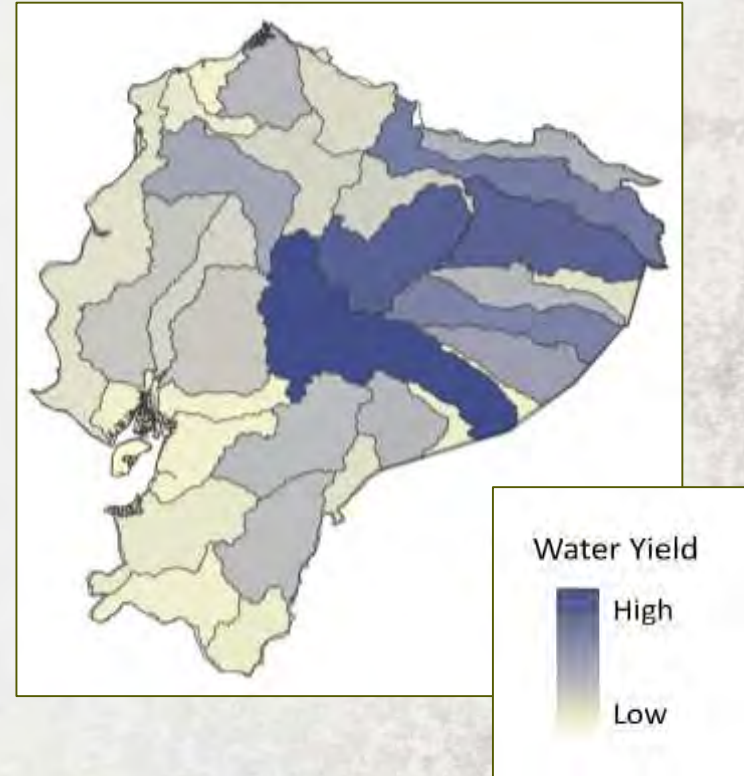


## Economic

Hydropower plant data,  
price of energy

# MODEL OUTPUTS

- **Actual Evapotranspiration**  
mm/year
- **Water yield**  
mm/year
- **Water supply**  
m<sup>3</sup>/year
- **Energy/value for hydropower**  
Kw/currency over timespan





An aerial photograph of a river delta system, showing a large, light-colored, branching river channel that splits into numerous smaller, winding channels. The surrounding landscape is a mix of green and brown, indicating a combination of vegetation and exposed sediment. The text "INVEST SEDIMENT RETENTION" is overlaid in the upper right corner in a bold, yellow, serif font.

# INVEST SEDIMENT RETENTION



# SEDIMENT RETENTION

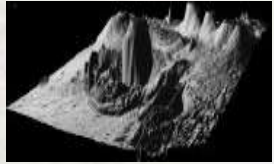
- Based on the Universal Soil Loss Equation (USLE)
  - Includes geomorphology and climate
  - Potential erosion on a parcel
- Enhanced by hydraulic connectivity
  - What happens as the parcel's sediment moves downslope?
  - Influence of intervening landcover
- Sediment retention valued as ecosystem service



# MODEL INPUTS



**Land use/Land cover**  
Vegetation retention, land practice and management



**Topography**  
Digital elevation model



**Erosivity**  
Intensity of rainfall



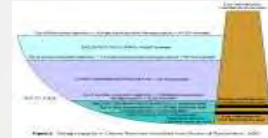
**Erodibility**  
Soil detachment due to rainfall



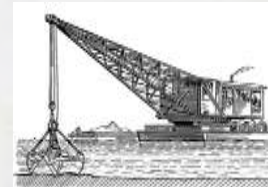
**Streams**  
Used to determine where sediment flows to



**Watershed Areas**  
Catchments flowing into reservoirs



**Reservoir Features**  
Dead volume, lifetime of reservoir, allowed load



**Economic data**  
Reservoir dredging or water quality filtering costs

# MODEL OUTPUTS

- **Potential soil loss (USLE)**  
tons/year
- **Sediment retained**  
tons/year
- **Sediment exported**  
tons/year
- **Value of sediment removal**  
For drinking water and/or dredging

