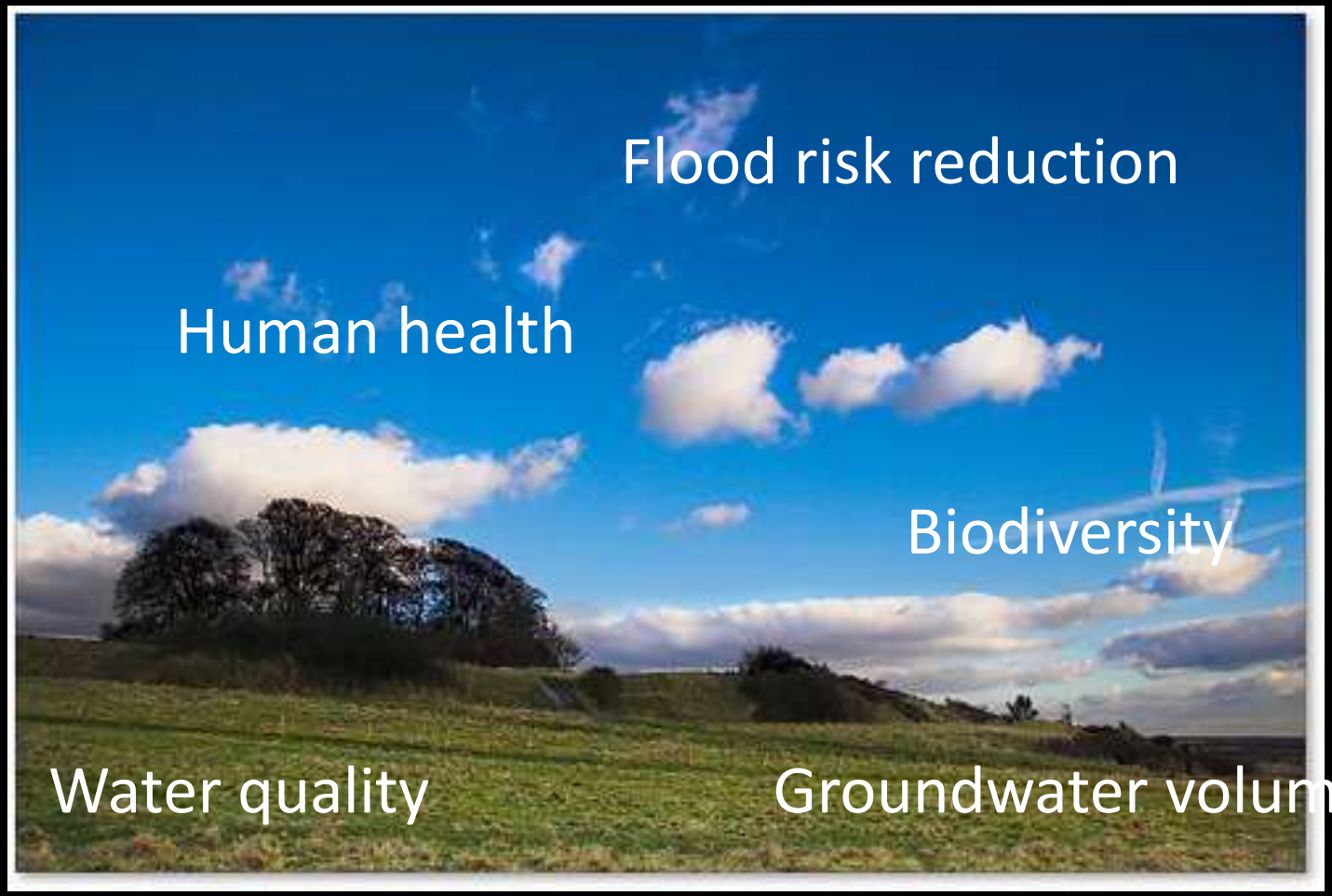
Conservation Return on Investment Analysis

Carbon storage

Conservation “Returns”



Economic “Returns” = the social value of these things

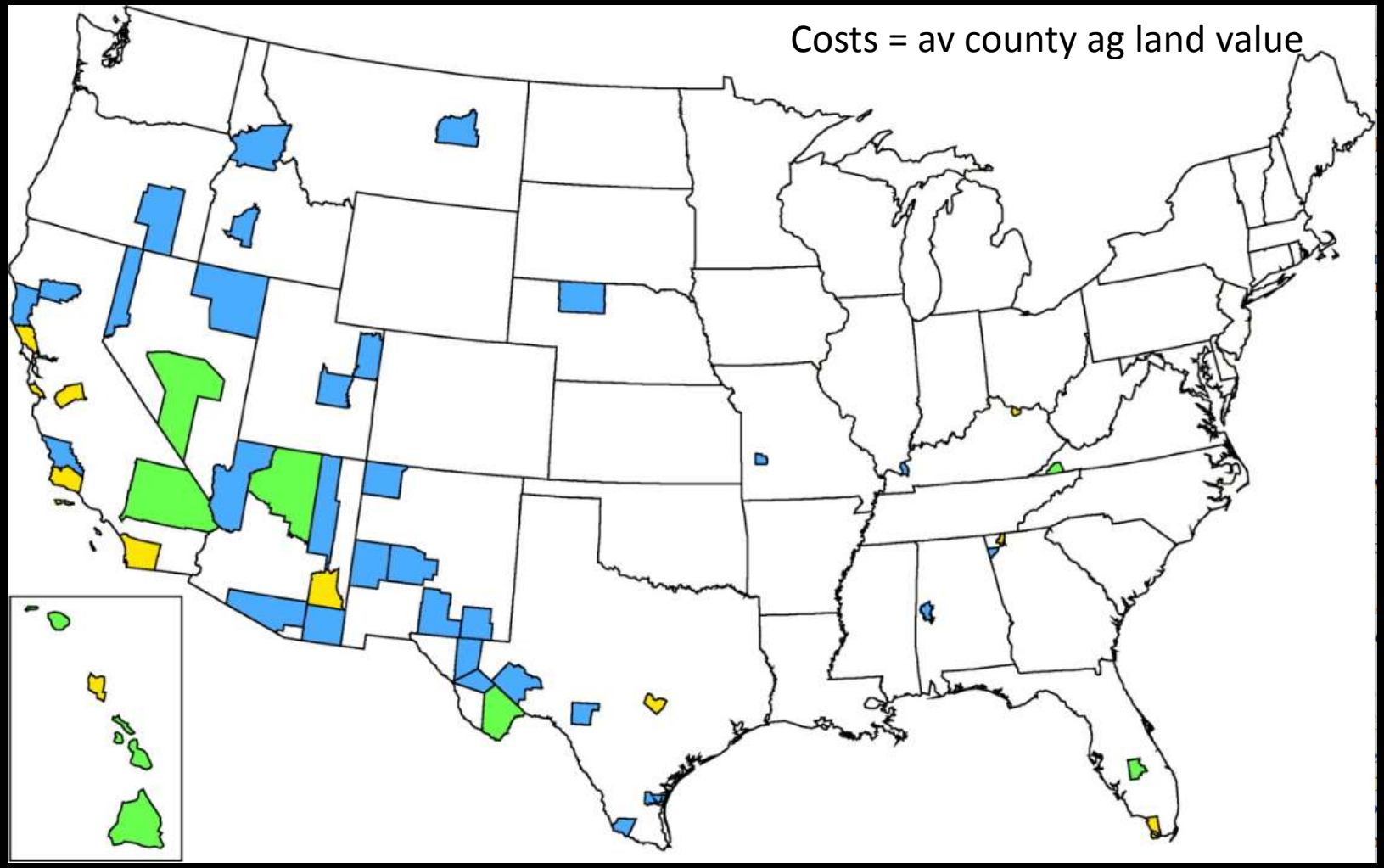
Why Do It?

- “Bang for buck”
- Given limited financial resources how do you get the most conservation gain

Protect as Much as You Can,
For God Sake

The Simplest Version of ROI

- A single objective taking costs into account
  - Biodiversity protection
  - Costs of that conservation



Selected sites for coverage of 453 species in the United States. Sites in the site-minimizing solution only are shown in yellow, sites in the costminimizing solution only are shown in blue, and sites in both solutions are shown in green.

Same # of species protected at 30% of the cost

Or, For a Given *Budget*

- Consideration of conservation costs leads to
  - "Protection of between 32 and 69 percent more species"
  - "3X more threatened and endangered species"
  - "A 66 percent gain in African vertebrates"

More bang for the buck

(From studies cited in ROI reading)

Important Note

- The only “economics” in this version of ROI is the consideration of costs
  - The outcome measure is “species protected”
  - Not the $ value of those species
    - Assumes all species are of equal value
- Also, important ecological assumptions in (any) ROI analysis
  - Species-area relationships
  - Species-species relationships
  - Contiguity-connectivity issues etc

Variations

- *Ex ante vs. Ex post*
  - *Ex ante* to plan & target investment
  - *Ex post* to evaluate performance
- Single investment *vs.* portfolio
  - Single to communicate, motivate, finance
  - Portfolio to plan & target
- Single objective vs multiple "returns"
  - Biodiversity
  - Biodiversity + other ecosystem benefits

The Complicated Version

A Concrete Decision Question

- Where should TNC and Mexico target $30M in forest investments to achieve 3 “returns:”
  - Carbon sequestration
  - Biodiversity protection
  - Water availability

What Would You Like to Know?

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- What conservation options are in play?
  - Protect forests from conversion
  - Manage forests differently
    - A policy question
- What does protection cost?
  - What is the benefit foregone by conservation (e.g. ag or other development benefits)
    - Land prices
    - Land profit analysis (revenues and production costs)

What Would You Like to Know?

- What does conservation *deliver*?
  - C sequestration Δ (a biophysical lift)
  - Water quantity and quality Δ
  - Biodiversity Δ
- What is the social benefit of those Δs?
  - Economic (usually non-market) valuation and $ values
    - See Pete's talk

What Determines the Δs?

- Ecological production
  - Compare “forest” to “no forest” C, H20, biodiversity outcomes
  - These are entirely natural science issues
    - Biophysical production functions, landscape ecology

But wait, there’s more…

Economics and the Δs

- Forest may stay forest even without conservation
  - Need to estimate the probability of forest conversion *absent conservation*
    - Model based on demographic, infrastructure, economic, soils, slope, policy variables
    - Conversion prob = *f*(x, y, z)
- Conservation may lead to increased conversion of *other* forests
  - Need to estimate "leakage" to other forest areas

Statistical, geospatial analysis

Just Conserve the Cheapest Land?

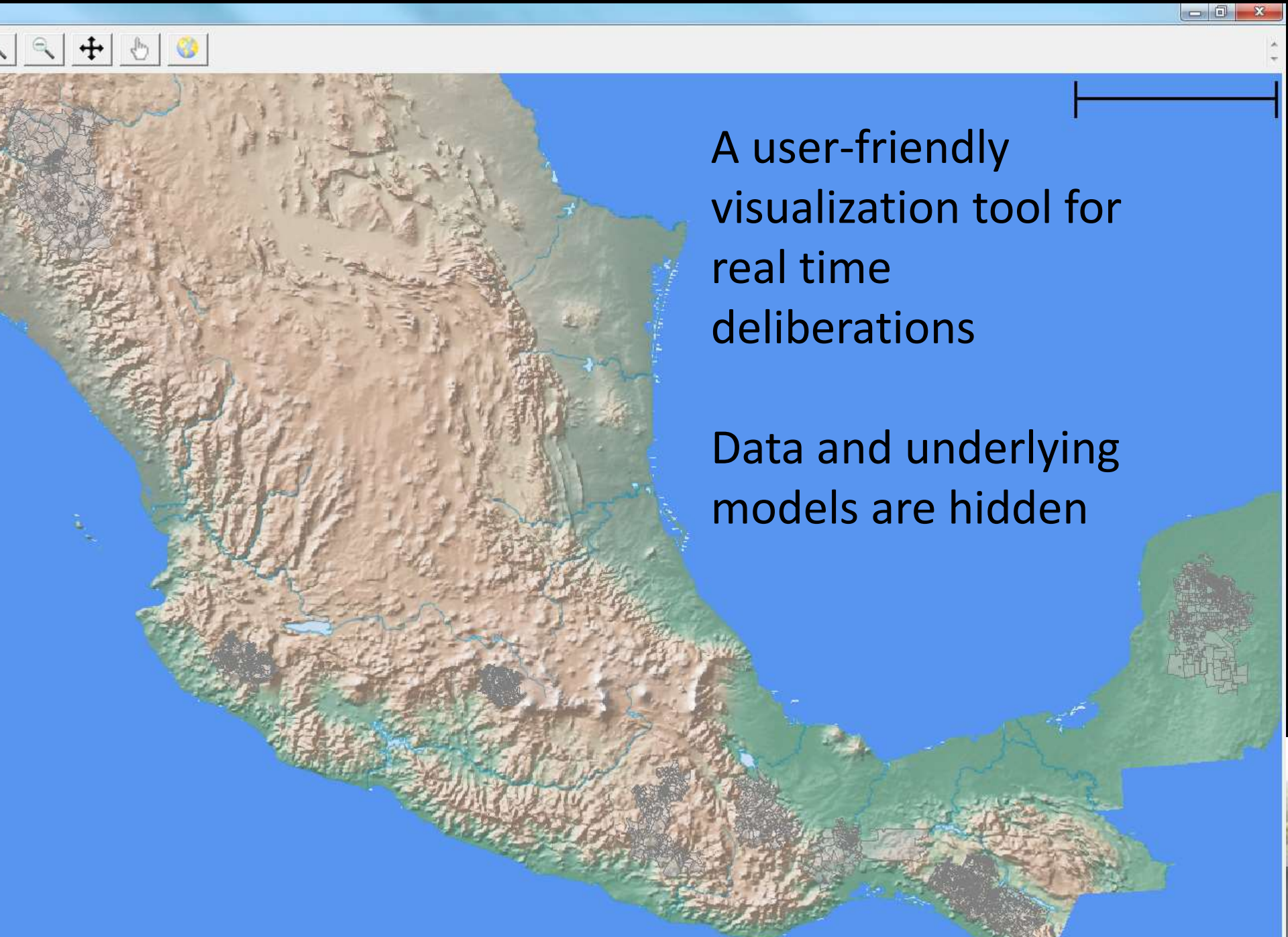
- No!
  - Biodiversity has +correlation with high land values (e.g., coastal lands)
  - Cheap lands tend to be those at least risk of conversion to agriculture or development

That Concrete Question

- Where should TNC and Mexico target $30M in forest investments to achieve:
  - Carbon sequestration
  - Biodiversity protection
  - Water availability

Three Outcomes

- How do we “jointly maximize” the return?
  - Apples and oranges and strawberries
  - Discuss…
  - Convert benefits into a common metric that reflects the weighting
- Calculate or *tell* TNC/Mexico the relative value of C, H20, species
  - Or empower them to explore their own values?

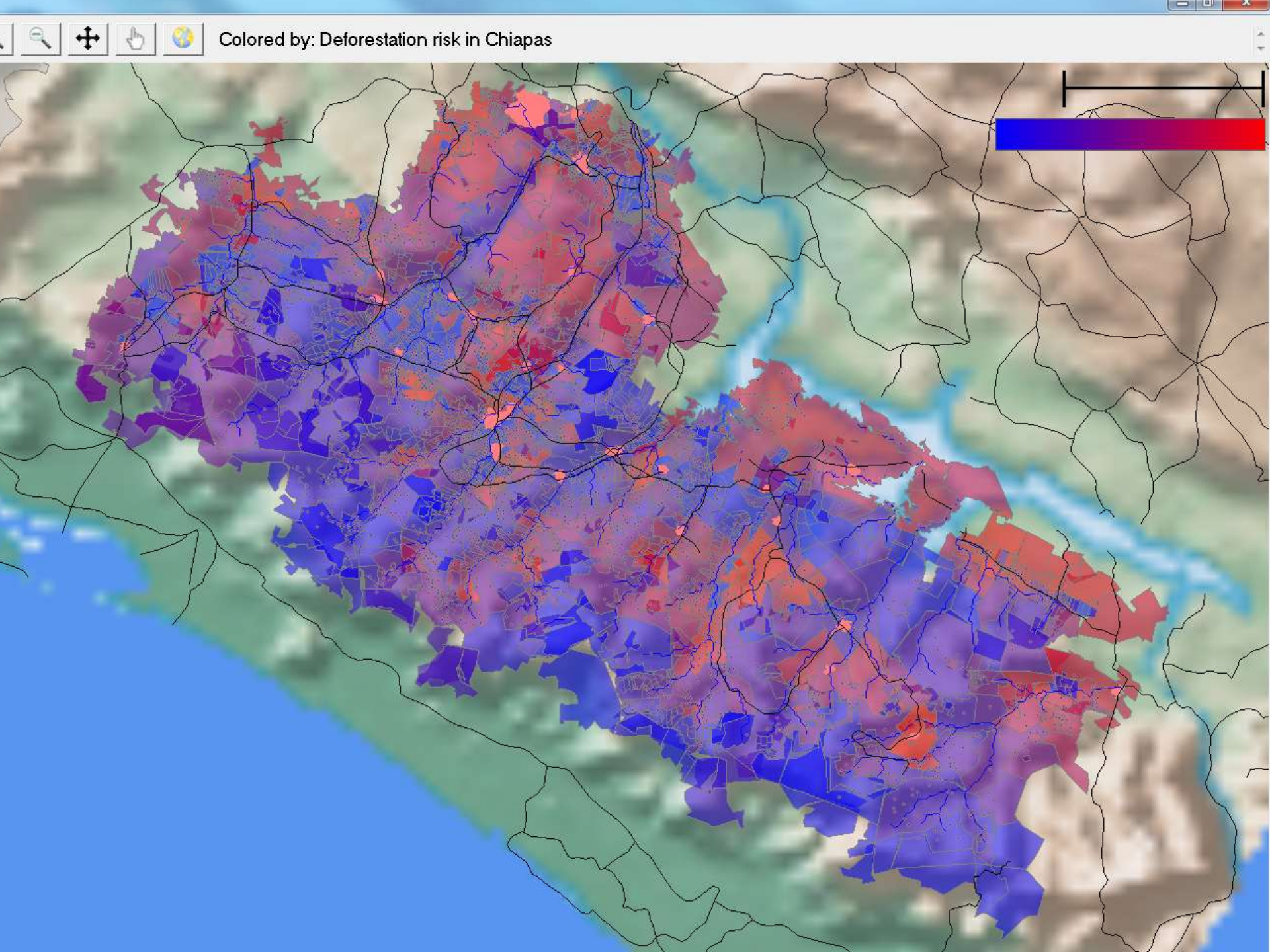

A user-friendly visualization tool for real time deliberations
Data and underlying models are hidden

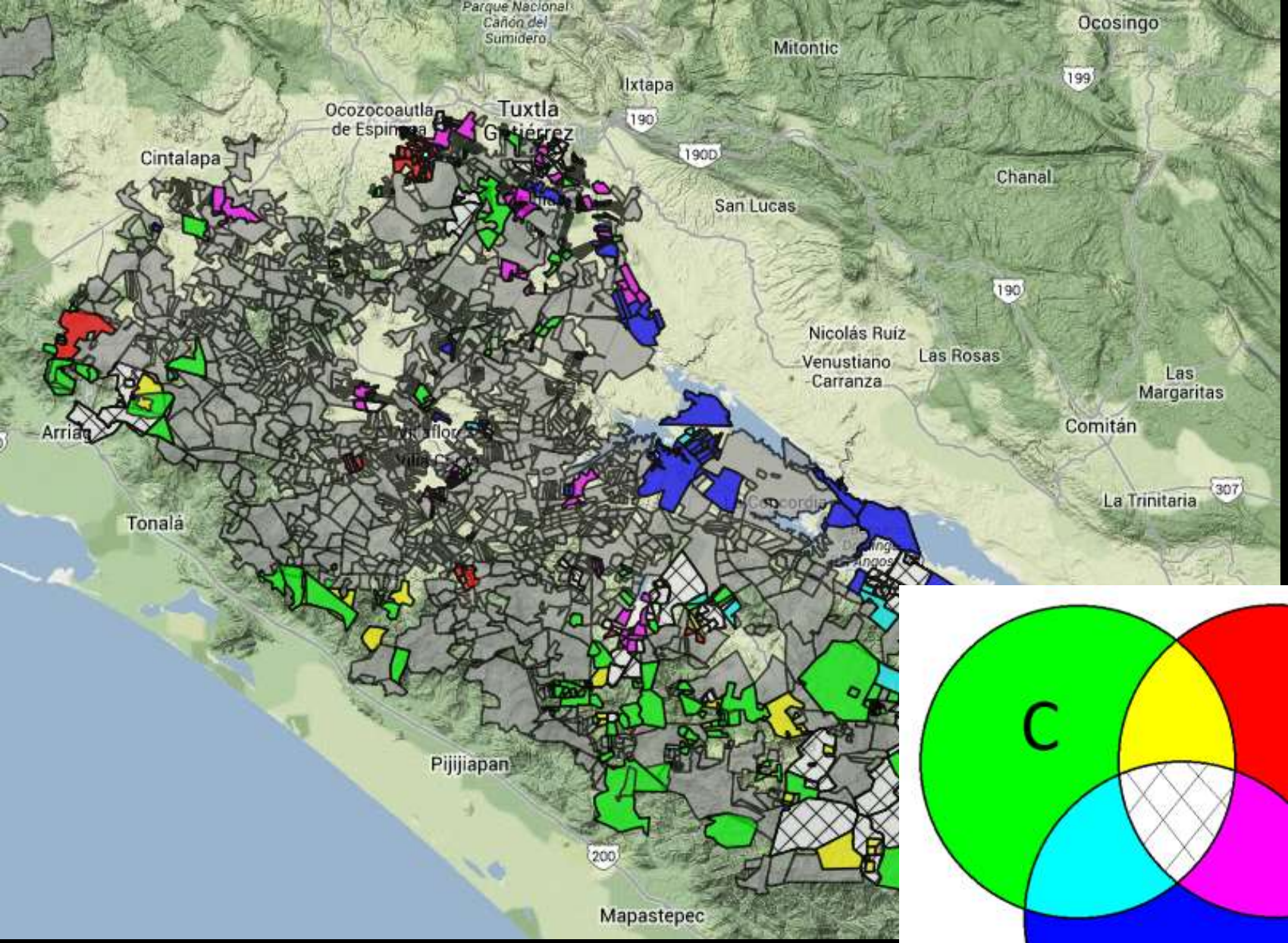
“Under the hood”

- Opportunity costs of land
  - Ejido-scale data
  - Empirically estimated costs
- Deforestation risk
  - Modeled as function of economic activities, infrastructure, land features
- The 3 forest-outcome relationships
  - Forest cover’s impact on
    - Carbon sequestration (C = *f(*land cover type))
    - Biodiversity (species richness measure)
    - Water (“WaterWorld” physical/hydro/land model)

The Tool

- User-controlled planning
  - Geographic planning boundary
  - Budget constraint
  - The relative weights given to C, H20, Biodiversity
- Decision Informed: Where should you invest?
- Note: the tool deliberately does not put $ values on the 3 outcomes


Colored by: Deforestation risk in Chiapas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Chanal
San Lucas
190
Nicolás Ruíz
Venustiano
Carranza
Las Rosas
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Margaritas
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Arriaga
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La Trinitaria
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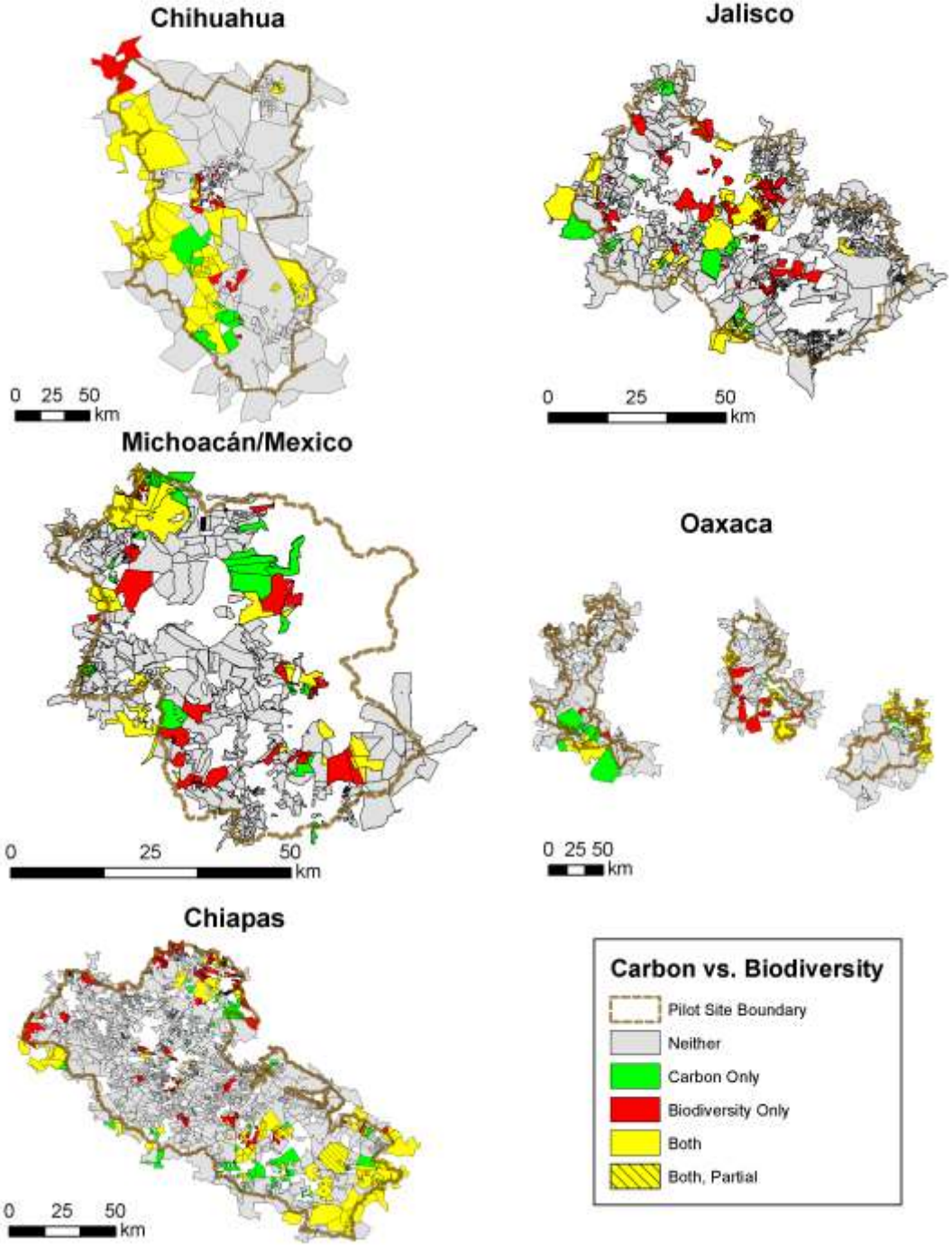
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Michoacán/Mexico
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Oaxaca
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Chiapas
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Carbon vs. Biodiversity
Pilot Site Boundary
Neither
Carbon Only
Biodiversity Only
Both
Both, Partial

Limitations/Weaknesses

- The biophysical relationships
  - Biodiversity outcome measure is crude
  - H20 outcome is disturbingly fancy
- Spatial social outcomes are crude
  - The water and species *move*
- Dynamics
  - Climate change
  - ROI is *path dependent*