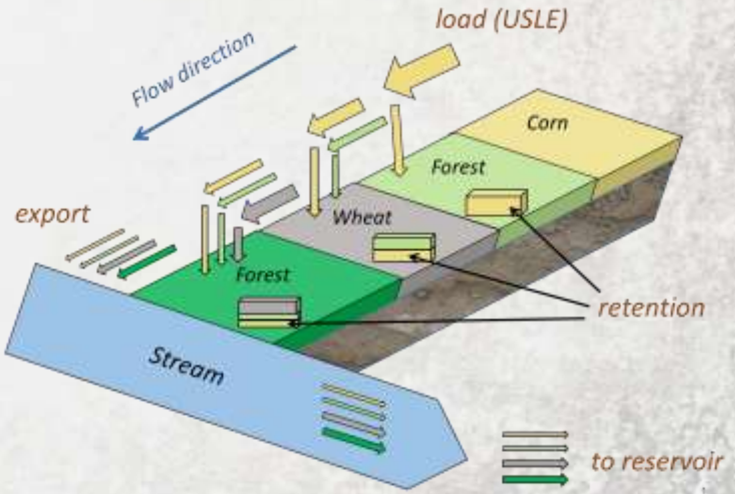
# WHAT'S NEW?? AT NATCAP

(Freshwater & Terrestrial Models)

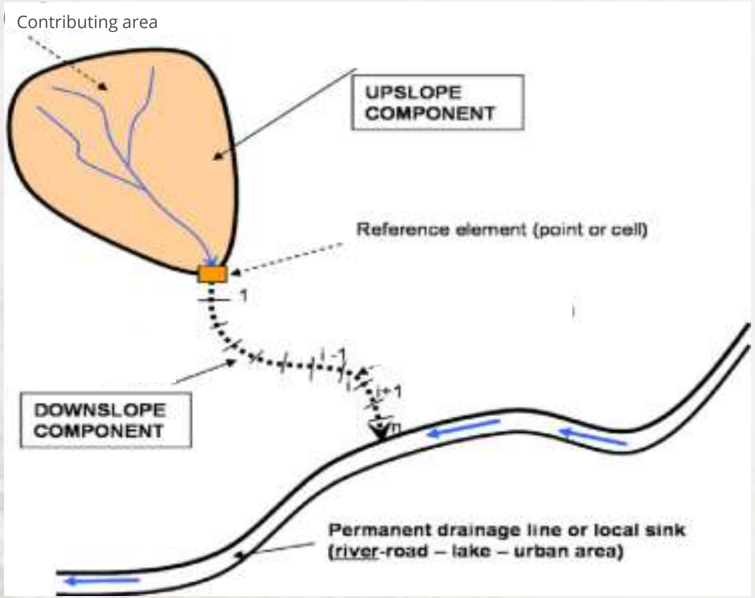
# NUTRIENT/SEDIMENT
## WHY (SLIGHTLY) CHANGE THEM?

- Model structure
  - values of retention depend on the cell size
  - overestimates retention (does not cap the retained nutrients)
- Processes:
  - difficult representation of instream processes
  - hydrologic sensitivity score?
- Parameter values:
  - poor guidance for retention values



# NUTRIENT/SEDIMENT

## PROPOSED MODELS (BEING TESTED)




(Borselli et al. 2008)

- Key characteristics:
  - Same **raster inputs**
  - Very **similar parameters** (more easily derived from literature)
  - **Increased flexibility** for the user (e.g. can choose to model nutrient leaching via a different flow path)
  - **Published** model (sediment)
  - Nutrient and sediment models have the **same structure**

# NUTRIENT/SEDIMENT
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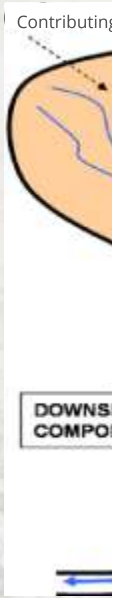


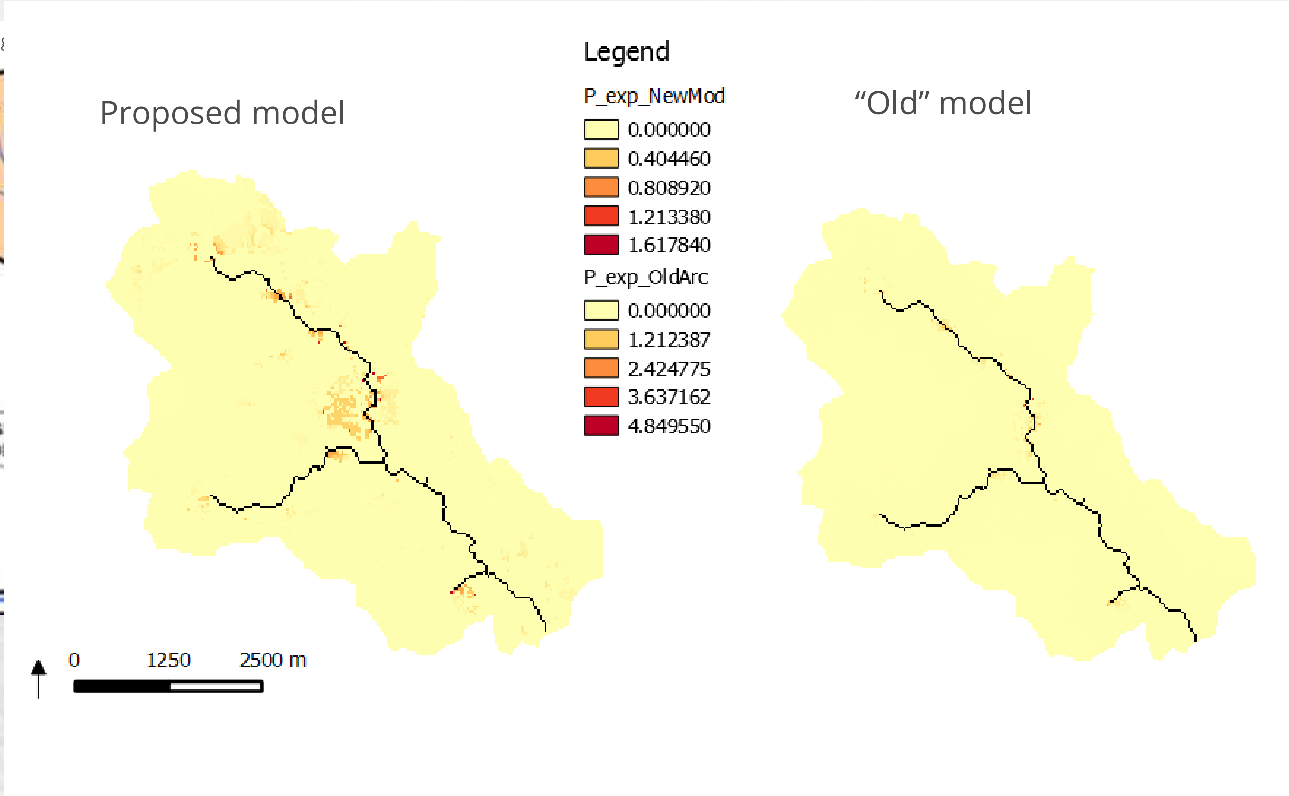


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literature)

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model nutrient
ent flow path)

sediment)

ent models
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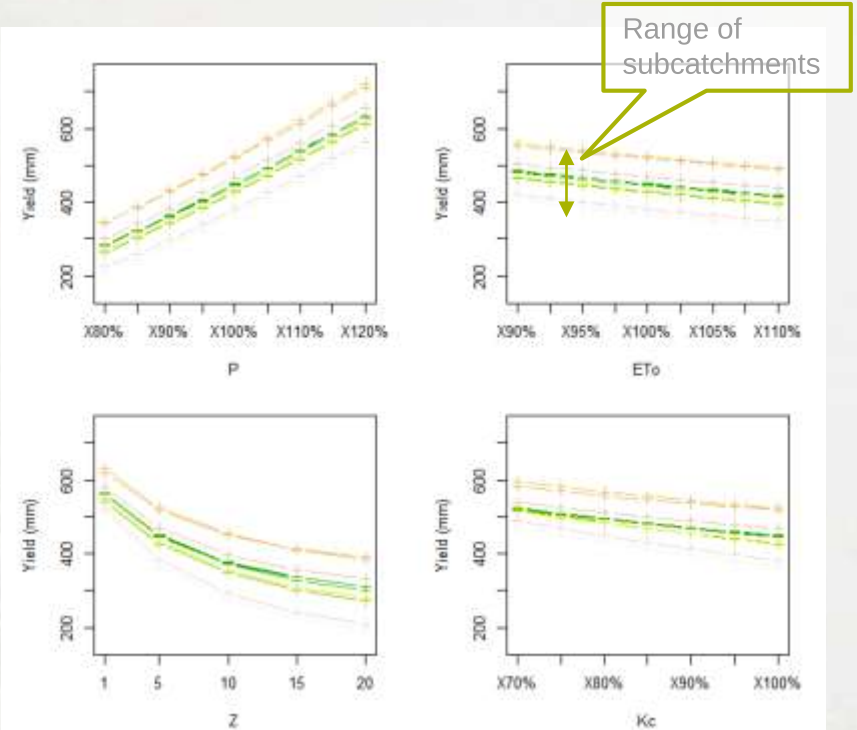
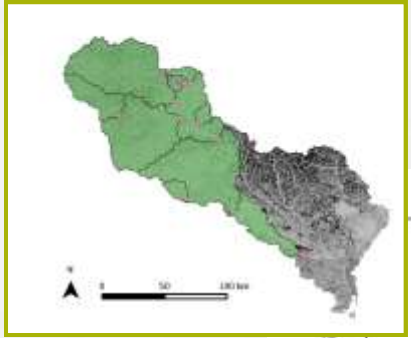
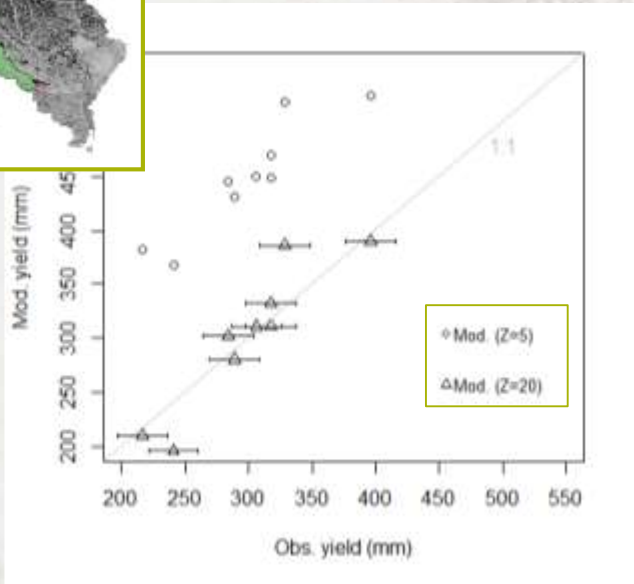
# Model Sensitivity, Calibration

## Batch runs (e.g. Water yield in Cape Fear, NC)




Sensitivity of the annual water yield model to main inputs






Calibration of the water yield model (error bars represent observations being corrected for groundwater withdrawals)

# Flood Model

- Challenges with flood modeling in InVEST
  - Land use and management -> runoff
  - Accumulate flow at different time steps -> identify peak time and magnitude
  - Predict flooded area at peak
  - Predict people/property at risk
  - Link vegetation management to impact on flood peak and flooded area

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- **What is the contribution of a particular patch of forest, cropland, etc. in downstream flooding costs?**

# FLOOD MODEL

## Key Questions

- Where is natural capital contributing to flood mitigation?
- What practices (management & green infrastructure) in upland areas can improve flood mitigation services?
- Where can green infrastructure in floodplain areas contribute to excess water storage during flood events?

# Flood Model - LUCI

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TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI
VICTORIA
UNIVERSITY OF WELLINGTON

CEH Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

## Introduction to the LUCI model:

## An ecosystem service modelling framework and GIS decision support tool

Bethanna Jackson, Bridget Emmett, David Cooper

# Underlying principles:

## Practical

1) Can be run using nationally available data; i.e. available everywhere so *relevant to national spatial planning*
2) Modular – can embed other models & aspects can be embedded in other models (LUCI is a *framework*)
3) Fast running to enable "real time" scenario exploration

## Conceptual

1) Operates at a spatial scale *relevant for field and sub-field level management decisions*
2) "Values" features and potential interventions by area affected, not just area directly modified
3) Addresses tradeoffs & searches for "win-win" solutions

Effects of tree planting at Pontbren post 1990

| Service | Actual area modified (%) | Area receiving benefit (%) |
|---|---|---|
| Broadleaved focal species | 6.8 | 28.5 |
| Runoff peak | 3.2 | 12.0 |

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# Services currently modelled by LUCI

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| Service | Method |
| --- | --- |
| Production | Based on slope, fertility, drainage, aspect, temperature |
| Carbon | IPCC Tier 1 – based on soil & vegetation |
| Flooding | Detailed topographical routing of water accounting for storage and infiltration capacity as function of soil and land use. |
| Erosion | Slope, curvature, contributing area, land use, soil type |
| Sediment delivery | Erosion combined with detailed topographical routing |
| Water quality | Export coefficients combined with water flow and sediment delivery models |
| Habitat (Approach A) | BEETLE – Forest Research's cost-distance approach to dispersal, examines connectivity of habitats |
| Habitat (Approach B) | Identification of priority habitat by biophysical requirements e.g. wet grassland |
| Tradeoffs/synergy identification | Various layering options with categorised service maps; e.g. Boolean, conservative, weighted arithmetic |

# LUCI – Focuses on Trade-offs & Synergies

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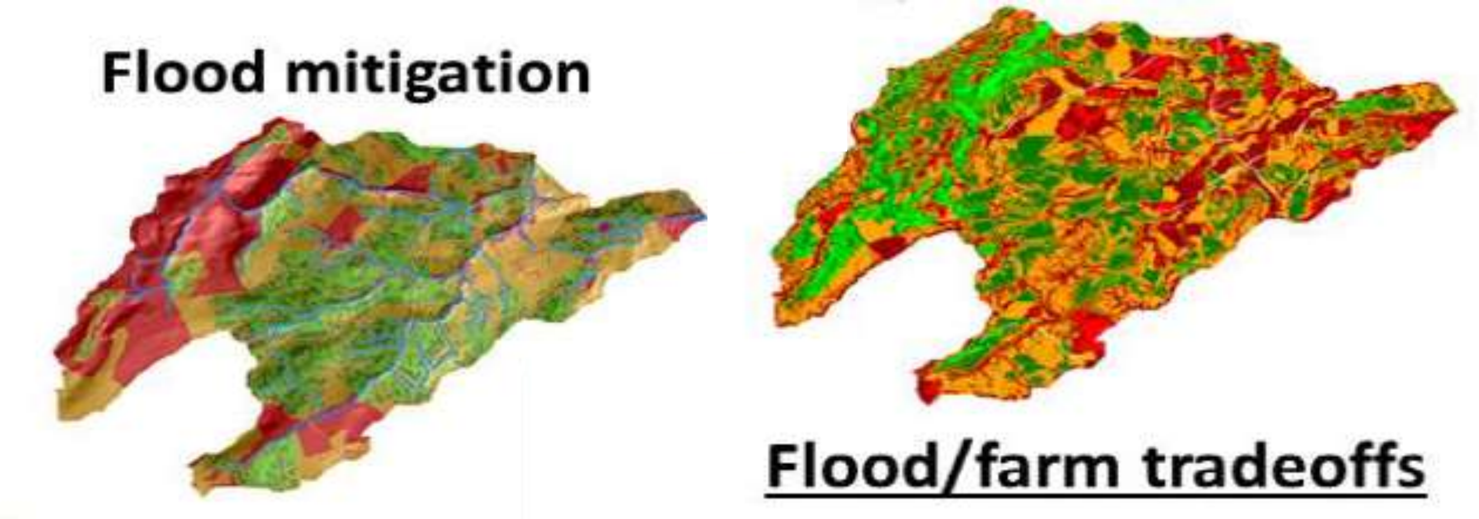
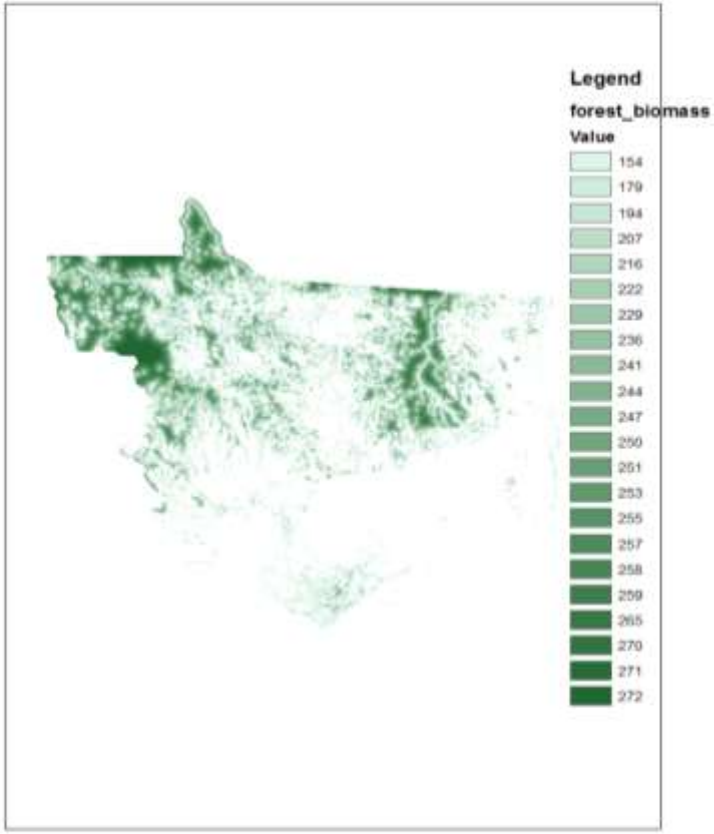
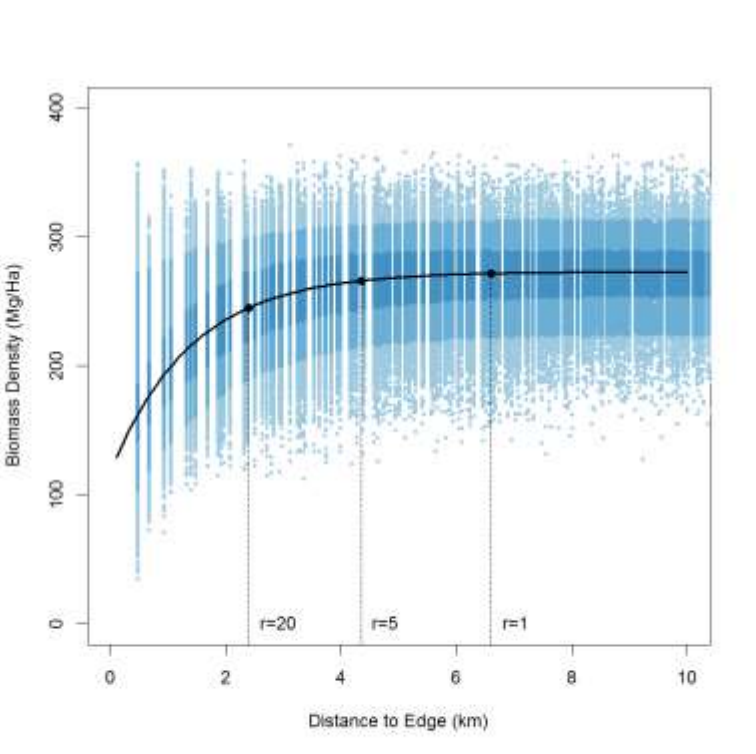



| | Key to single service maps | Key to trade-off maps |
|---|---|---|
| Red | High existing value | Multiple existing services |
| Dark red | Existing value | Some service(s) provided |
| Orange | Marginal value | Tradeoffs in service provision |
| Dark green | Opportunity to improve service | Opportunity to improve some service(s) |
| Bright green | High opportunity to improve | Opportunity to improve multiple services |

# CARBON MODEL
exploring edge effects



# Watershed and Coastal Planning for Multiple Benefits with the RIOS Planning Tool

# Linking Models

Adrian L. Vogl

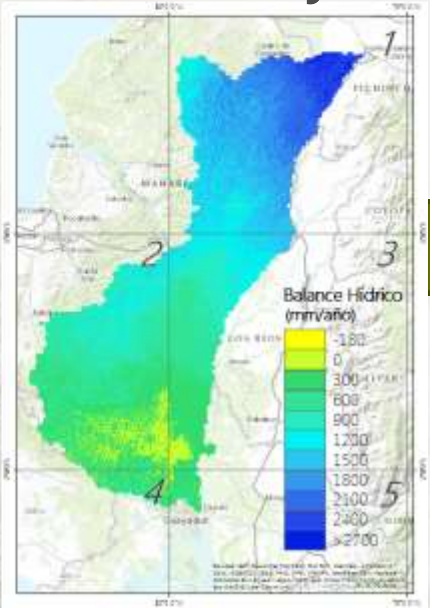
# RIOS + WaterWorld

## Test Case:

Investing in the Daule River Water Fund in Ecuador

## WaterWorld

**Sensitivity**




**Spatial Allocation**

RIOS

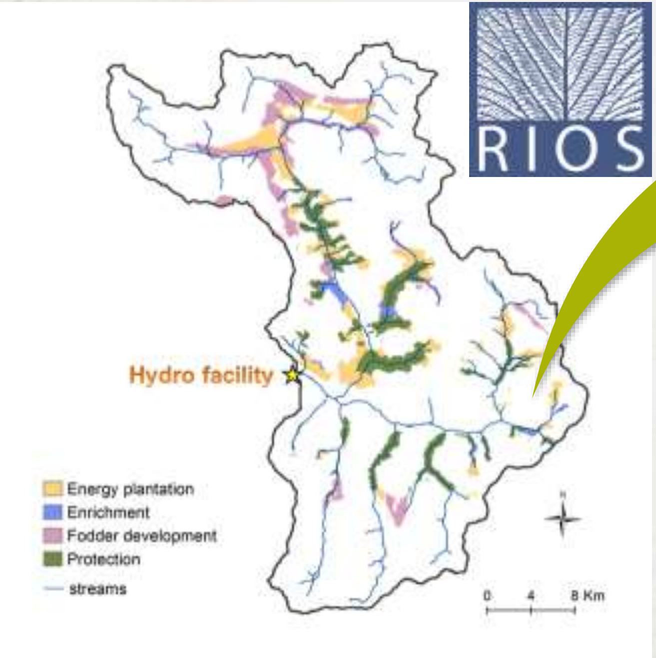
## WaterWorld

**Impacts on Services**

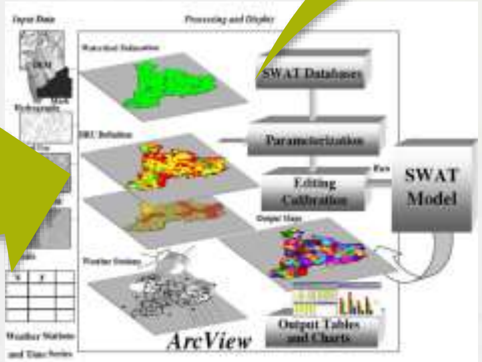
| | Scen1 | Scen2 |
|---|---|---|
| Soil erosion | + | − |
| Soil deposition | − | + |
| Water quality | − | + |

Leo Zurita, Beth-Sua Carvajal and Mark Mulligan (King's College London)
Silvia Benitez, Juan Sebastian Lozano, Jorge Leon (The Nature Conservancy)

# RIOS + SWAT + VALUATION




SWAT | Soil & Water Assessment Tool




VALUE

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## Test Cases:

Hydropower Production in India

Water Funds Return on Investment in Kenya

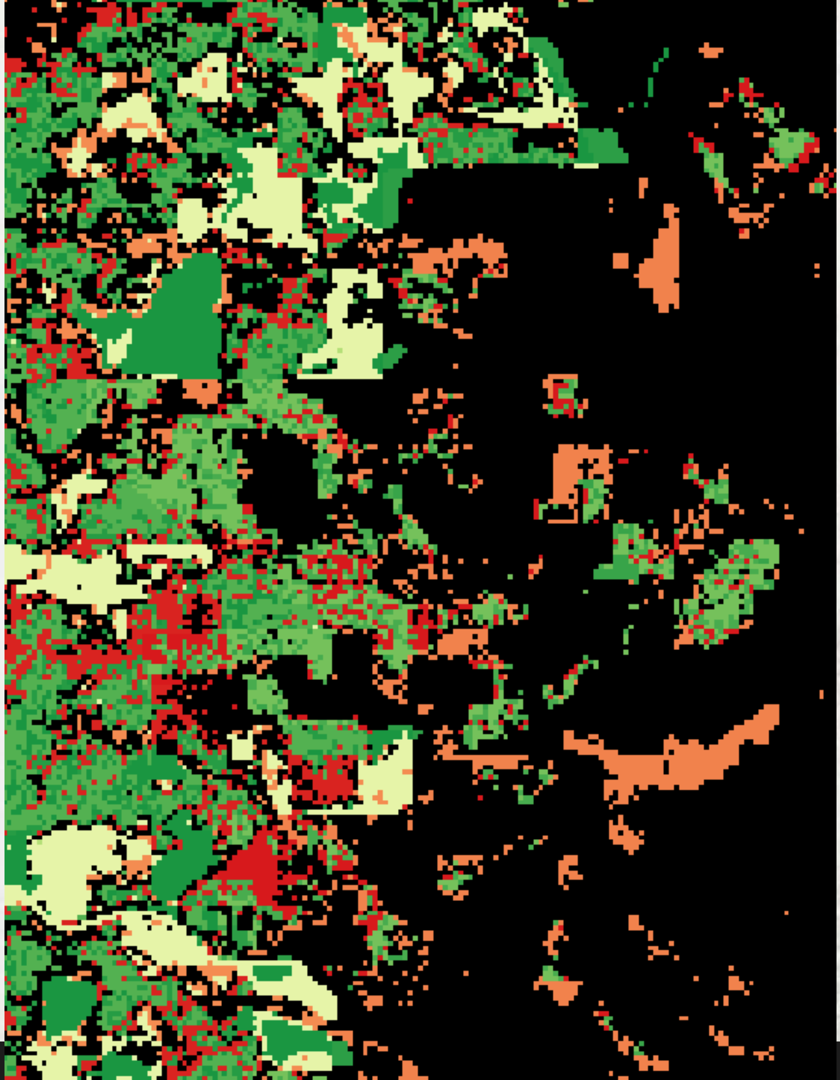
Stacie Wolny, P. J. Dennedy-Frank, Perrine Hamel, Justin Johnson, Martha Rogers, Johannes Hunink, Peter Droogers

# CARBON MODEL

Uncertainty analyses

# Carbon model

Confidence interval: 90%



# Carbon model

Confidence interval: 95%