

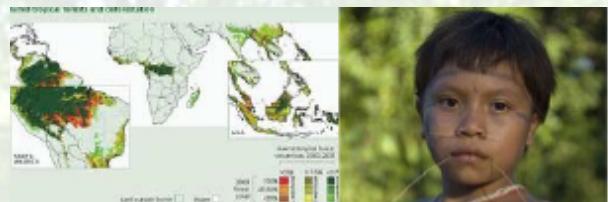
# Explaining multiple outcomes on forest commons: Livelihoods, carbon, & biodiversity

Arun Agrawal

Professor

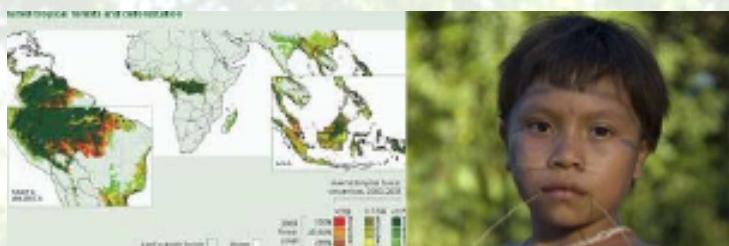
Univ of Michigan

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# The narrative

- The world is full of social *and* ecological processes that produce multiple outcomes
- Yet, we as analysts of social outcomes project a multi-consequentialist world on a mono-consequentialist screen: biodiversity, growth, equity, efficiency, productivity, rights, participation...
- AS IF, other outcomes do not matter, even when at some level we recognize THEY DO MATTER



# Major presentation goals

- Three objectives
  - Conceptual/theoretical
  - Empirical illustration/directions
  - Practical significance
- Focus on social-ecological systems (forest commons)
  - Provide benefits to hundreds of millions of households
  - reservoirs of biological diversity
  - store massive amounts of carbon
- Methodologically, an hypothesis building and testing approach to analyze *any number* of multiple outcomes for *any* social or socio-ecological process



# Why does the analysis of multiple outcomes matter?

- Social sciences dismissed moncausalism many decades ago as inadequate (although a focus on identifying single cause-effect relations is resurgent)
- But mono-consequentialism reigns across the social sciences – take a look at the disciplinary preoccupations as evident in nearly all major social science discipline journals
- Patently unsatisfactory – if the same social/ social-ecological/ institutional factors and processes influence multiple outcomes of interest, focusing on one leaves one ignorant about impacts on other outcomes;
- Actions to improve one outcome, similarly, may have adverse effects on other desired outcomes – without analysis of multiple outcomes, we will simply not know!



# How do multiple outcomes matter?

- To say that multiple outcomes occur is not to say that all outcomes matter
- Plethora vs. focus
- Focus on three – diversity, biomass/ carbon, livelihoods in the context of forest commons
- Choice of goals inevitably subjective, but in a context that permeates the subject





# What do we know about multiple outcomes in social-ecological systems (forest commons)?



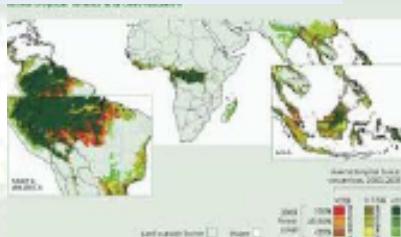
# Existing literature on multiple outcomes on forest commons (Biomass, diversity, livelihoods)?

	Empirical	Other	Totals
Explicit measures and analysis	5	3	8
Measures of outcomes and recognition of tradeoffs limited or absent	359	144	503
<b>Total</b>	<b>364</b>	<b>147</b>	<b>511</b>

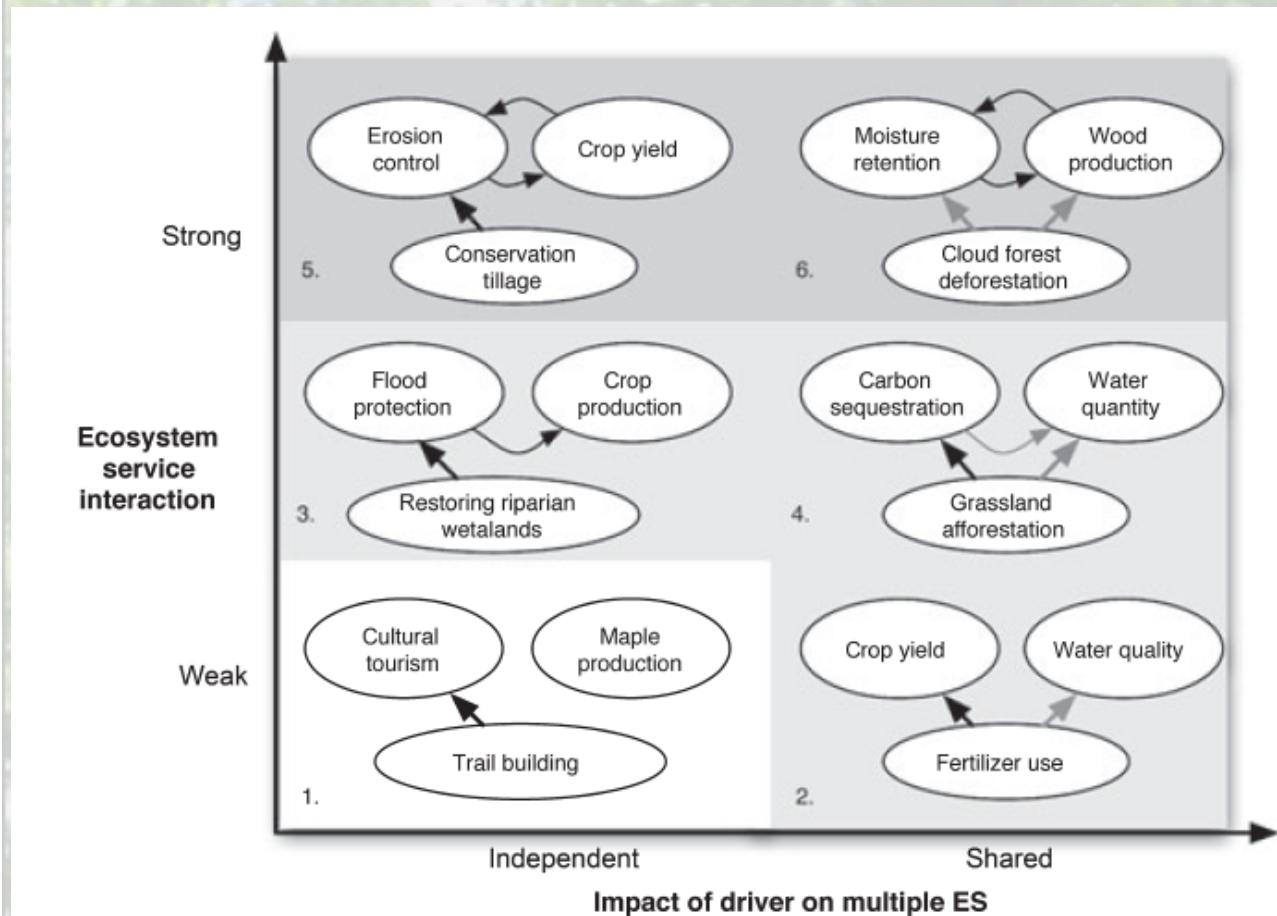
Looked at 511 published papers since 1980

Very little!

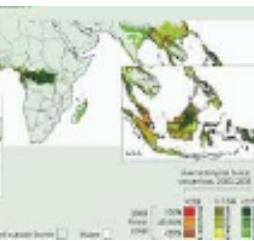
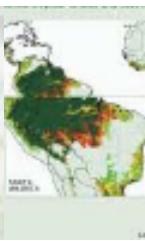
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# Ecosystem services...



- Basic questions of causality still treated illustratively; analyses of patterns in multiple outcomes and their drivers only starting



# Other Signifiers

- Growth/equity relationship in Economics (Kuznet's curve)
- Unintended consequences
- Livelihoods/ development vs ecology/ conservation (tradeoffs and synergies)
- What is missing: Theoretically driven predictions of outcome relationships and methodological approaches to help analyze outcomes and drivers





# Relationships among multiple outcomes?

**Tradeoffs:** (Tradeoff situation – where it is not possible to Improve one outcome without making at least another Worse)

Assertions of inevitability without evidence

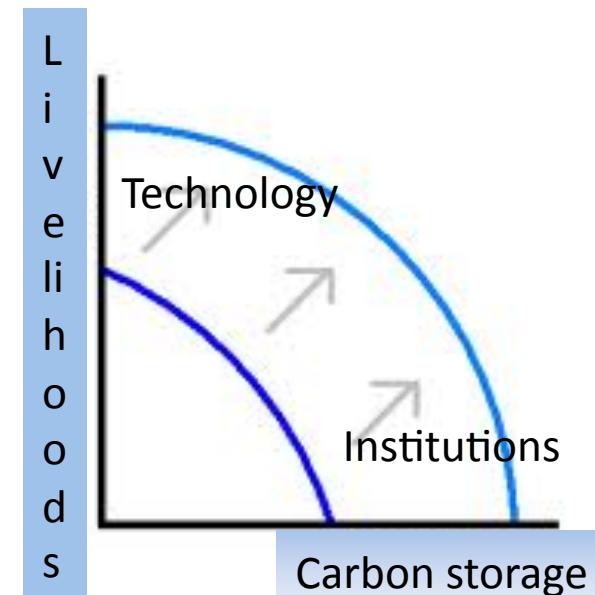
**Win-Wins:** (Win-Win situation – where it is possible to improve at least one outcome (preferably multiple outcomes) without making any other outcome worse)

Optimistic possibilism with little careful analysis

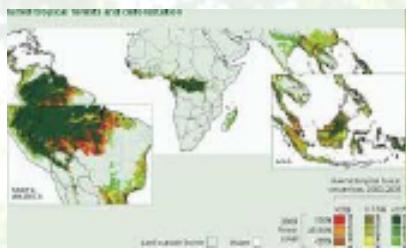


# But both occur empirically!

New technologies, new institutional relationships, changing social/biophysical context can all move the frontier of outcome relationships outward



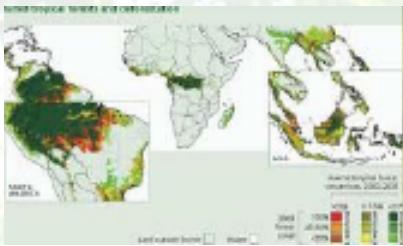
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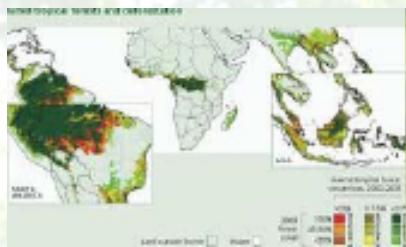
- Identify patterns in outcome relationships
- Examine the processes that lead to observed patterns and identify relevant analytical approaches
- Analyze drivers of observed patterns

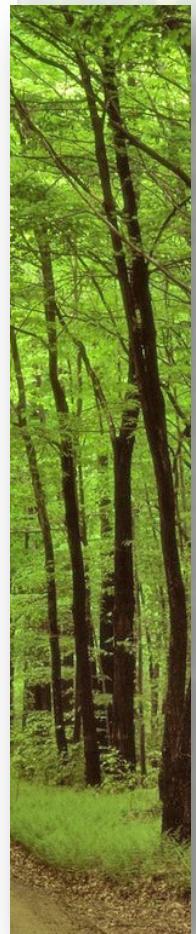




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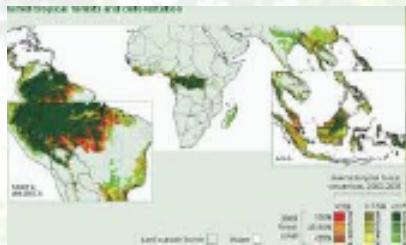
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# Why focus on forest commons?

- Why forests? Evidently produce multiple outcomes: all three outcomes critically important in forests
- Forest commons an instance where no specific outcome is highlighted - as in biofuel or commercial plantations, national parks, and logging concessions
- A unique dataset provides the empirical basis for illustrating the argument



A photograph of four men standing in a dense green forest. They are dressed in casual clothing, including t-shirts and caps. The man on the far left wears a white cap and a dark long-sleeved shirt. The man next to him wears a red cap and a light-colored t-shirt. The third man from the left wears a grey cap and a light blue t-shirt. The man on the far right wears a black cap and a light-colored t-shirt. They are all smiling and looking towards the camera. The background is filled with various green trees and foliage.

# The IFRI research program and community forests

Huanger Avilano

# What is IFRI?

A unique, interdisciplinary, international research network on local forest governance.

Established in 1992, currently has 11 Collaborating Research Centers as members in 10 countries (approximately 40 researchers)

A growing international database of cross-national, time-series information on forests, people, and institutions.



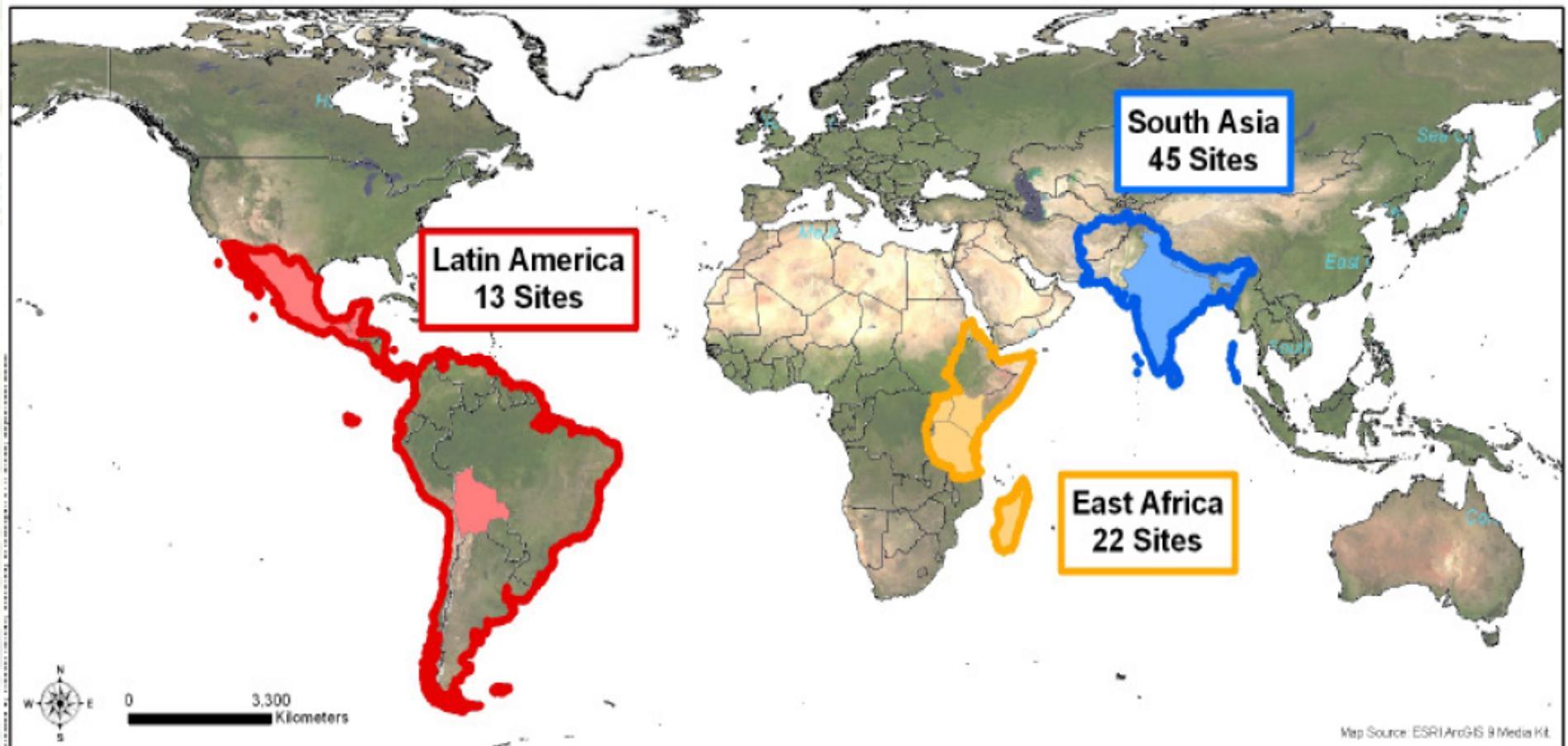
Recent photograph of IFRI researchers in Bogor, Indonesia (2006)

# Why is IFRI data useful for analyzing patterns and drivers or multiple outcomes?

- Multiple countries across continents
- Multiple outcomes – Biomass, Livelihoods (biodiversity)
- Associated factors – socio-political, economic, institutional, biophysical
- At present, cross-sectional rather than over-time data



# Distribution of Studied Cases



Latin America:  
Bolivia, Guatemala, Mexico



East Africa:  
Kenya, Madagascar, Tanzania, Uganda

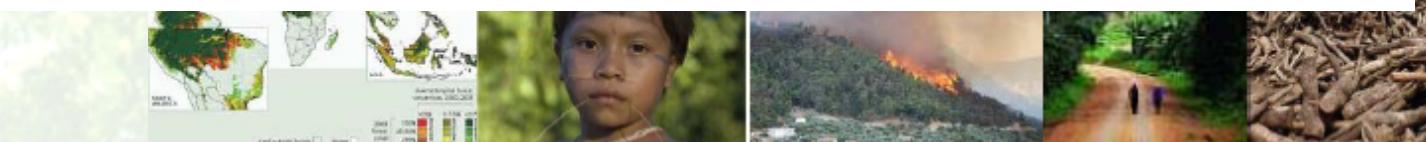
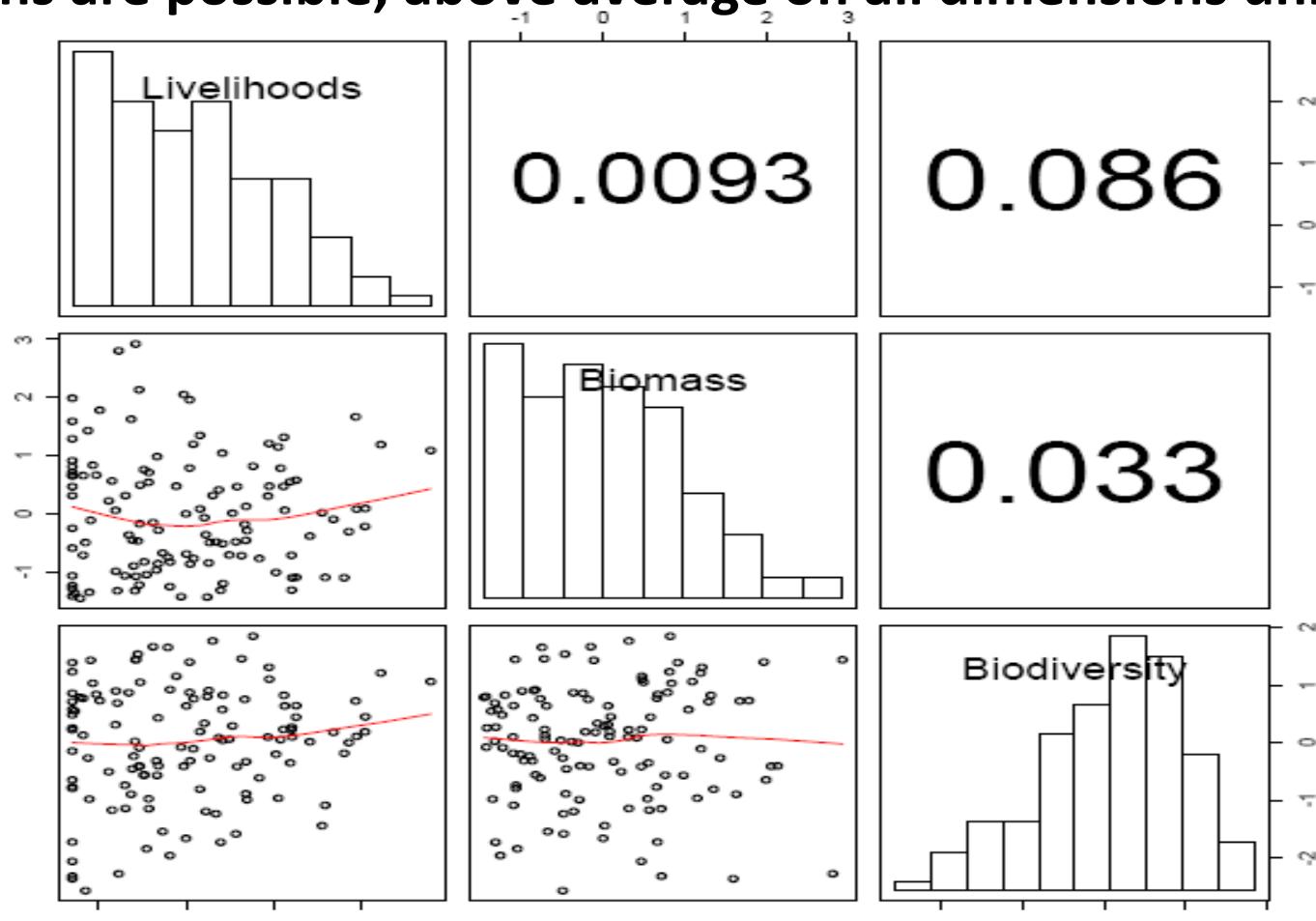


South Asia:  
Bhutan, India, Nepal;

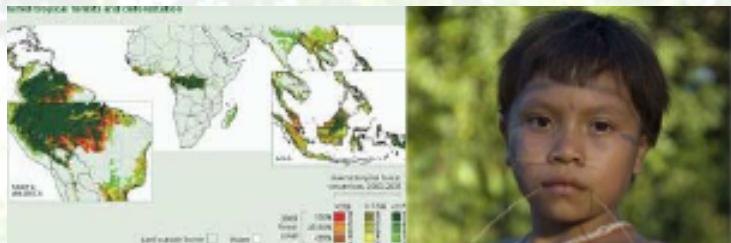
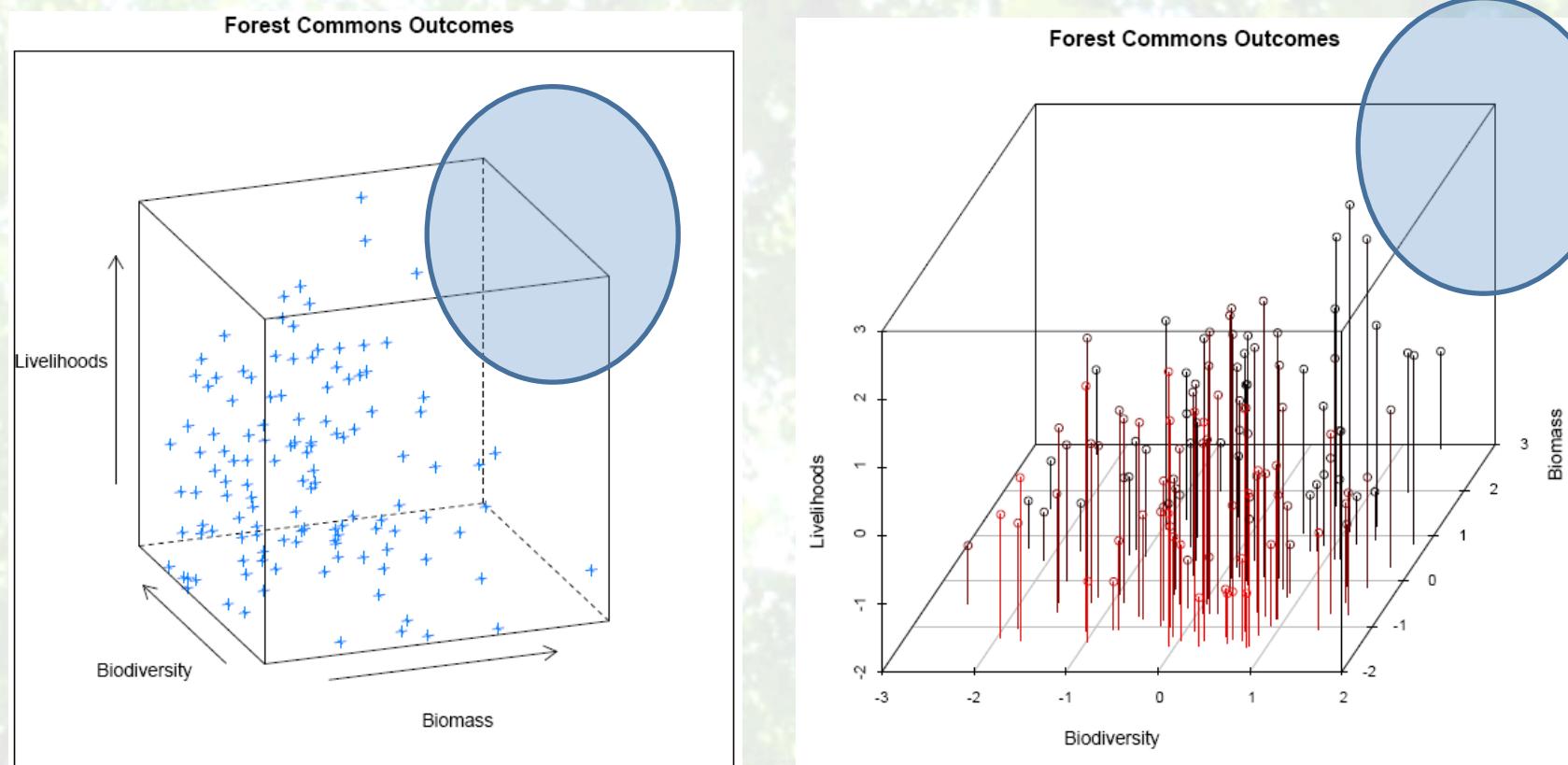


**Result 1: Almost no observed correlation among three outcome measures (livelihoods, biomass, diversity)**

**Implication: Tradeoffs as well as above average outcomes on two dimensions are possible, above average on all dimensions unlikely**



# Indeed, few examples of win-win-win outcomes

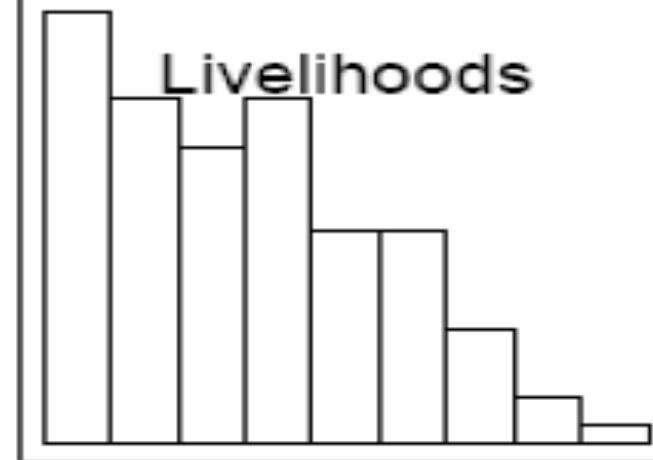


# Examining two outcomes together

- Example 1: Livelihoods dependency and carbon storage

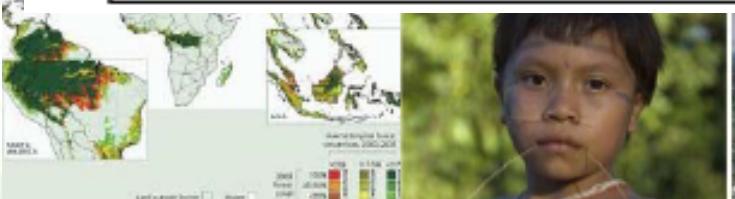
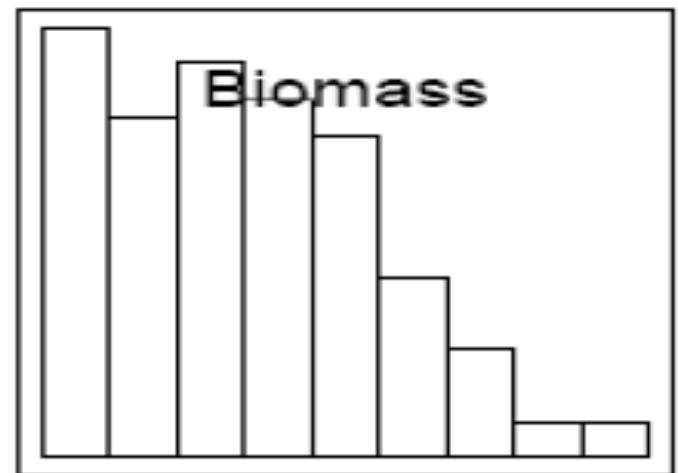
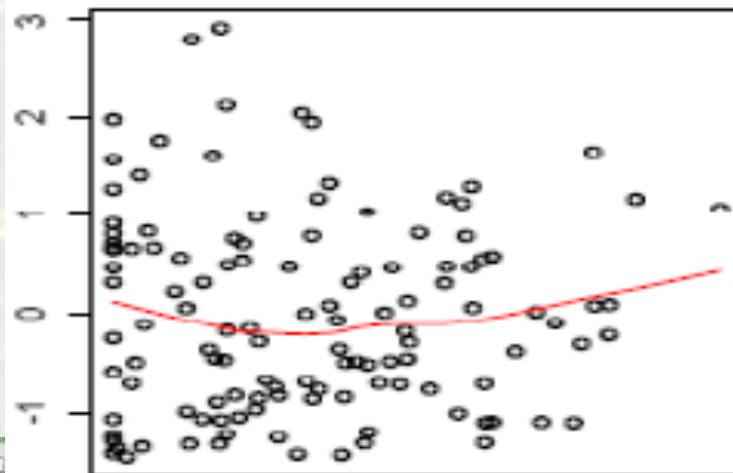


# Focus: Look at livelihoods and biomass

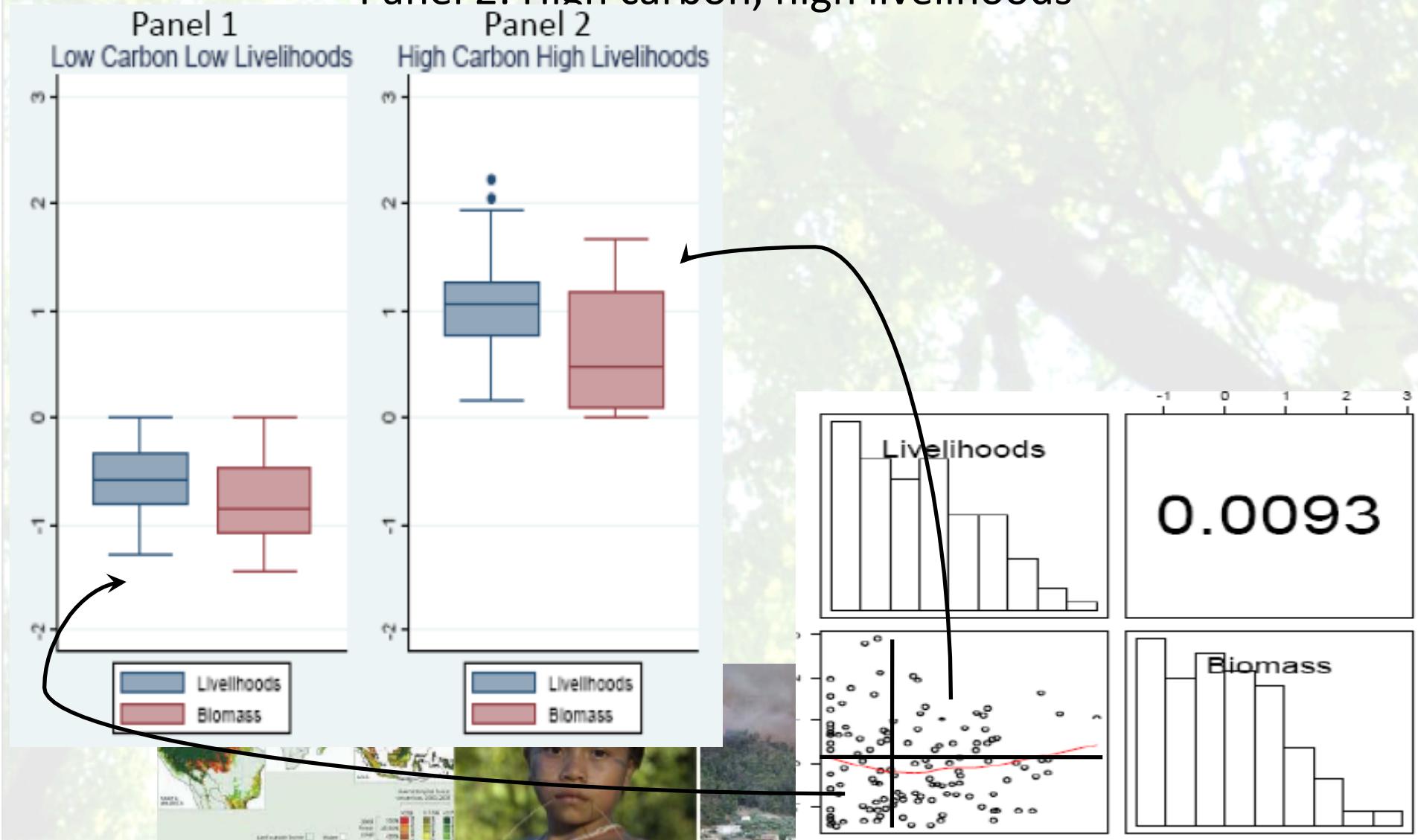


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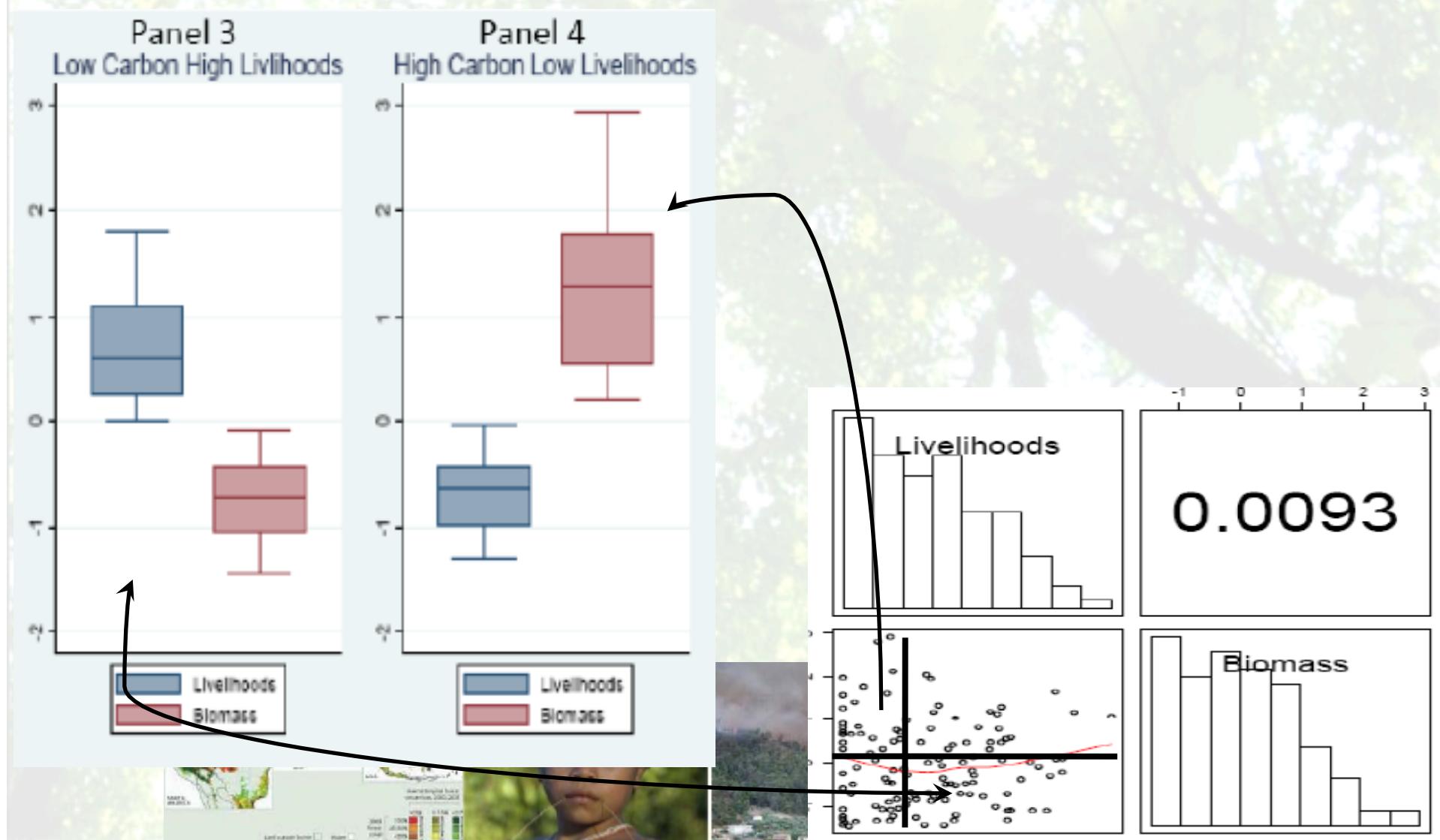
Two sets of outcomes with on carbon and livelihoods with a conceptually synergistic relationship  
Panel 1 Low carbon, low livelihoods  
Panel 2: High carbon, high livelihoods



# Two tradeoff outcomes on carbon and livelihoods

Panel 3 Low carbon, high livelihoods

Panel 4: High carbon, low livelihoods



Analysis of data (Mlogit estimation)  
Findings relate to role of the following in  
likelihood of win-win/lose-lose or tradeoffs for  
carbon and livelihoods :

- 1) community forest size,
- 2) community autonomy in forest management
- 3) Community forest land ownership

**Essentially hypotheses to inform future, better data-based studies**

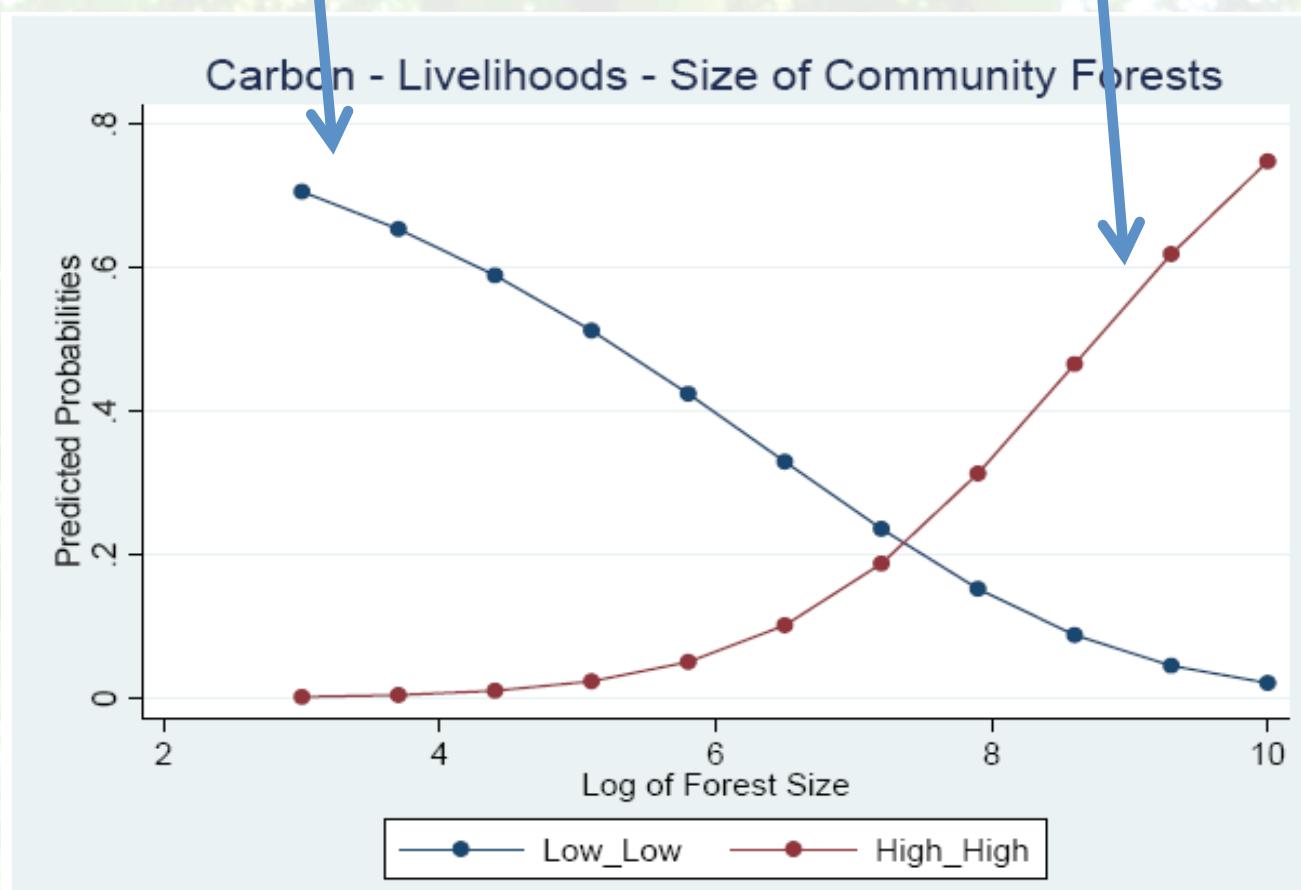


## Finding 1: Controlling for effects of other factors, as size of community forests increases:

the likelihood of below average outcomes on carbon and livelihoods becomes lower,

likelihoods of above average outcomes becomes greater.

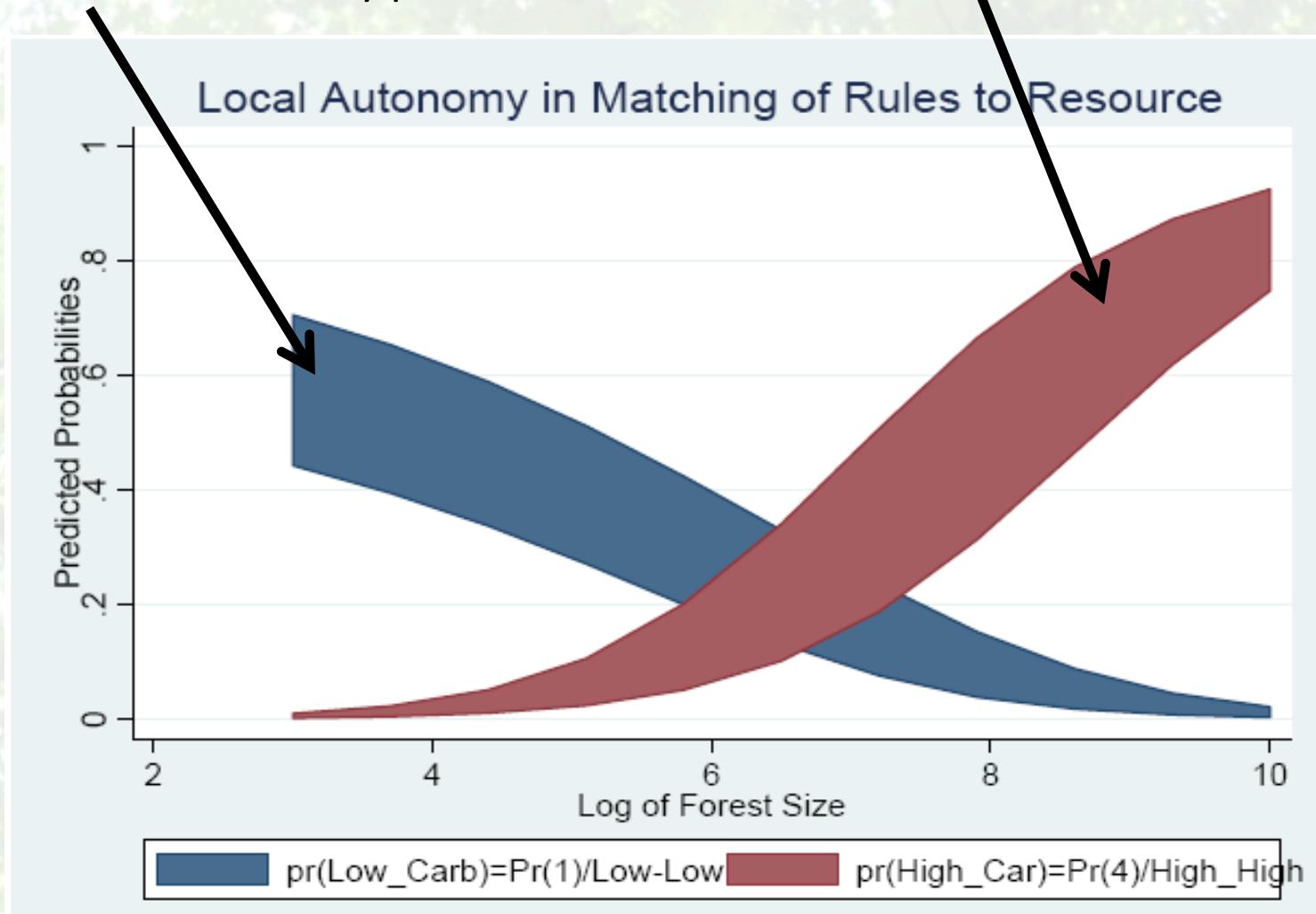
Implication –  
Recognition of  
community rights  
over larger forest  
areas is likely to lead  
to win-win outcomes  
for carbon and  
livelihoods



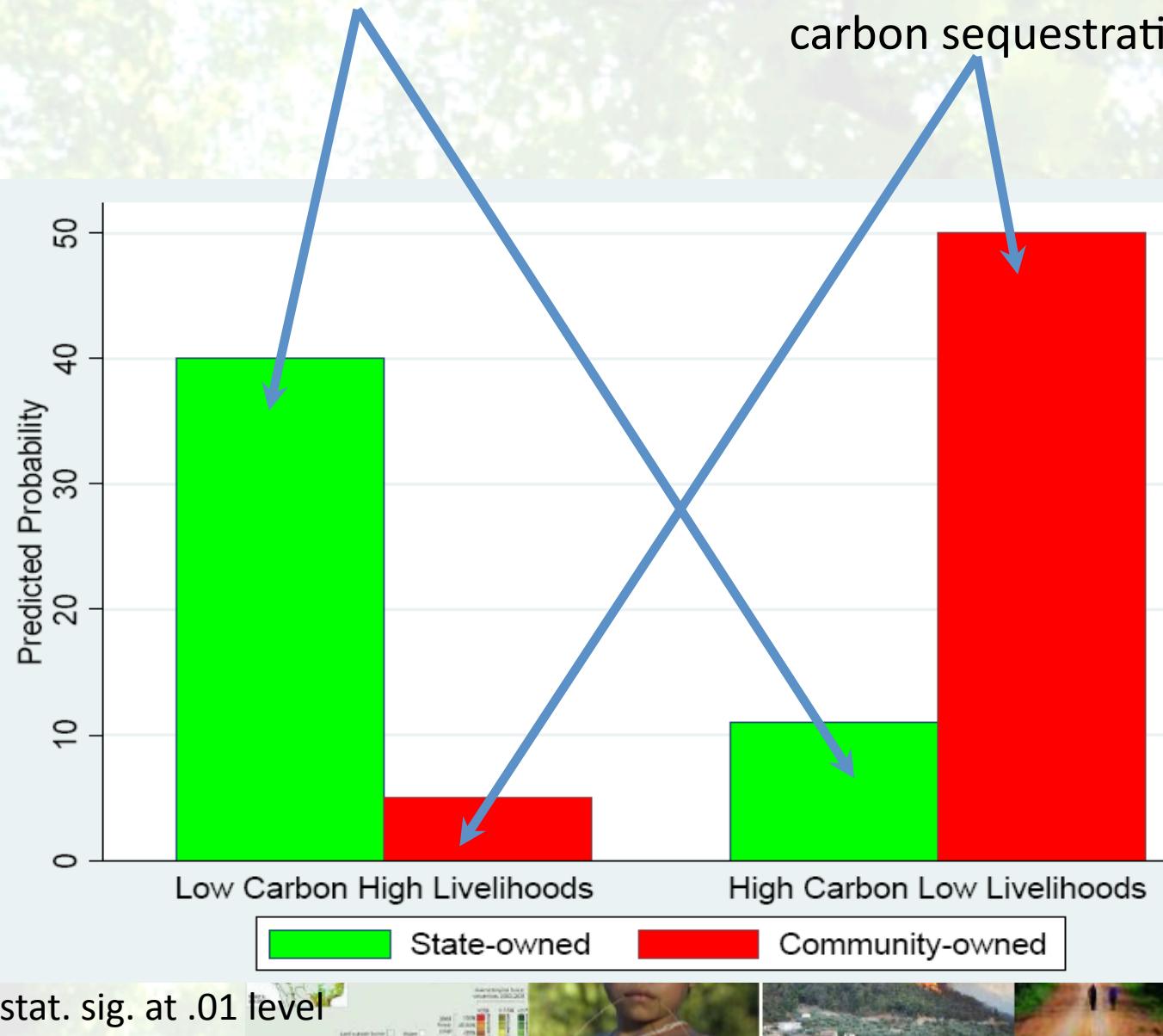
Finding 2: Controlling for effects of other factors, as communities have greater autonomy in managing their forests, below average outcomes on carbon and livelihoods less likely, and above average outcomes more likely.

The area under the blue and red curves is the area of win-win that greater local autonomy produces

Implication – policies giving more autonomy to communities likely to yield Win-Win outcomes on carbon and livelihoods



Finding 3a: when community forest land is owned by the state, communities overuse



Finding 3b: When community forest land is owned by communities, communities conserve (and increase carbon sequestration)

Speculation:  
New institutional design will be needed to compensate communities for reducing use of state-owned forests and create incentives to conserve the biomass and carbon on such forests – Revisit incentive design.



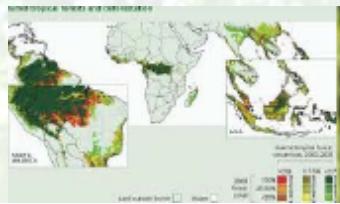
# Implications for climate emissions and livelihoods

- Little available research for both outcomes across multiple countries with systematic data
- Communities with rights to larger forests more likely to have positive carbon and livelihoods outcomes
- Communities with more autonomy likely to improve both carbon and livelihood outcomes
- Win-win outcomes are possible!!!



# Examining two outcomes together

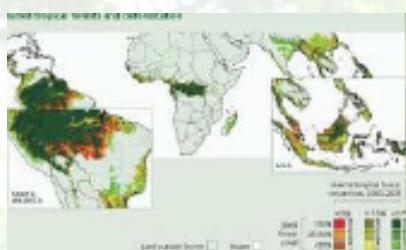
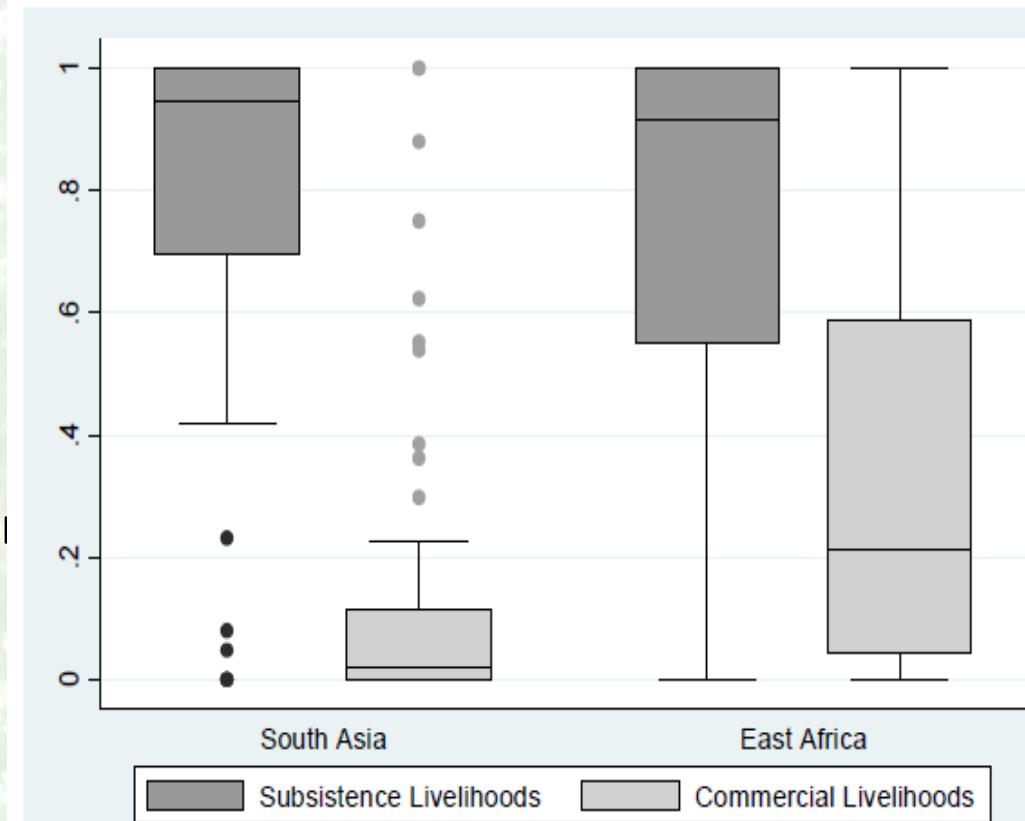
- Example 2: livelihoods and diversity



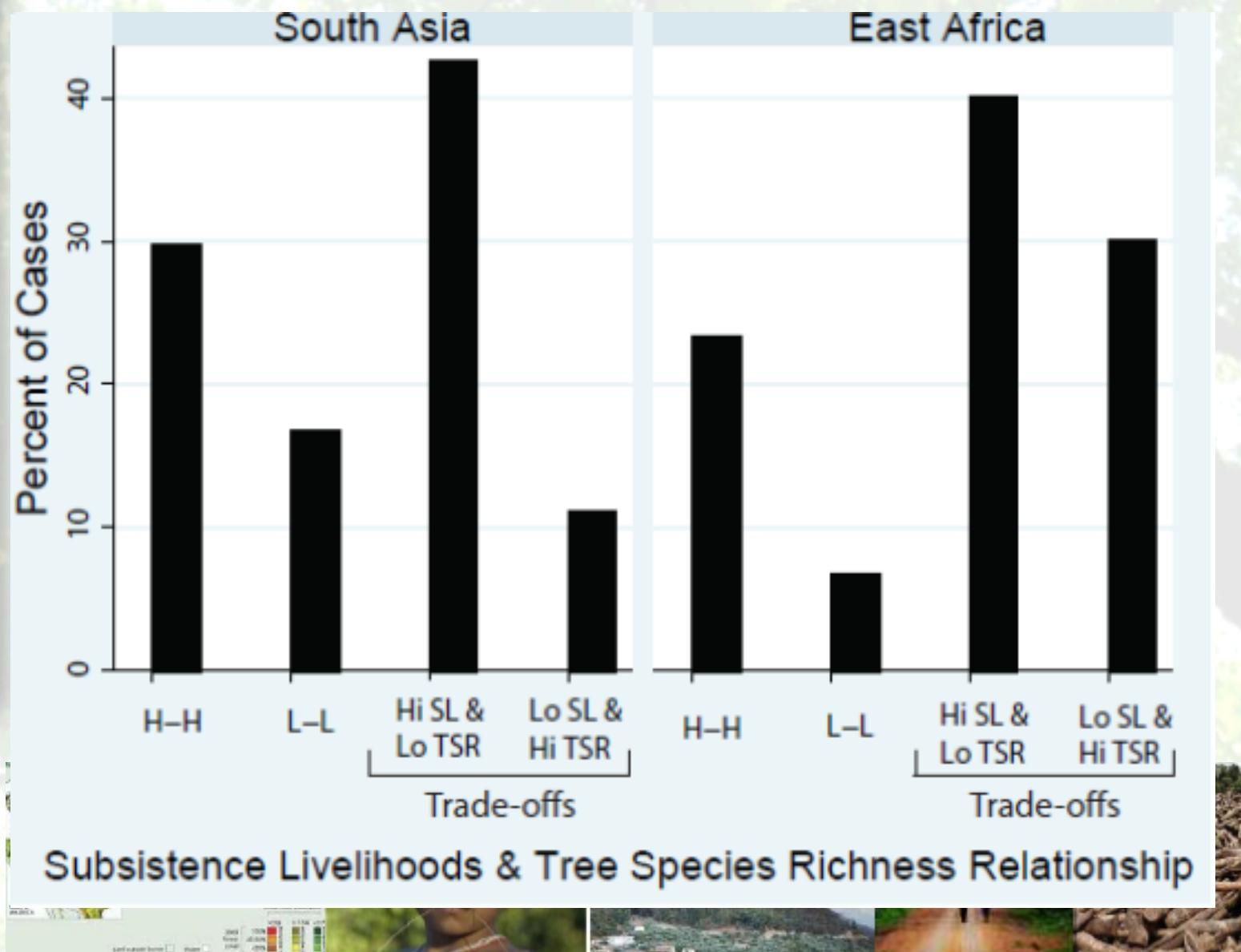
# Examining diversity and livelihoods

- 84 cases of forest commons from 6 countries in South Asia and East Africa
- Broadly similar; somewhat larger forests in E. Africa, somewhat greater pop density in S. Asia; lower dependence in S. Asia for commercial benefits

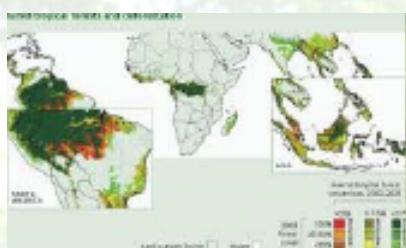
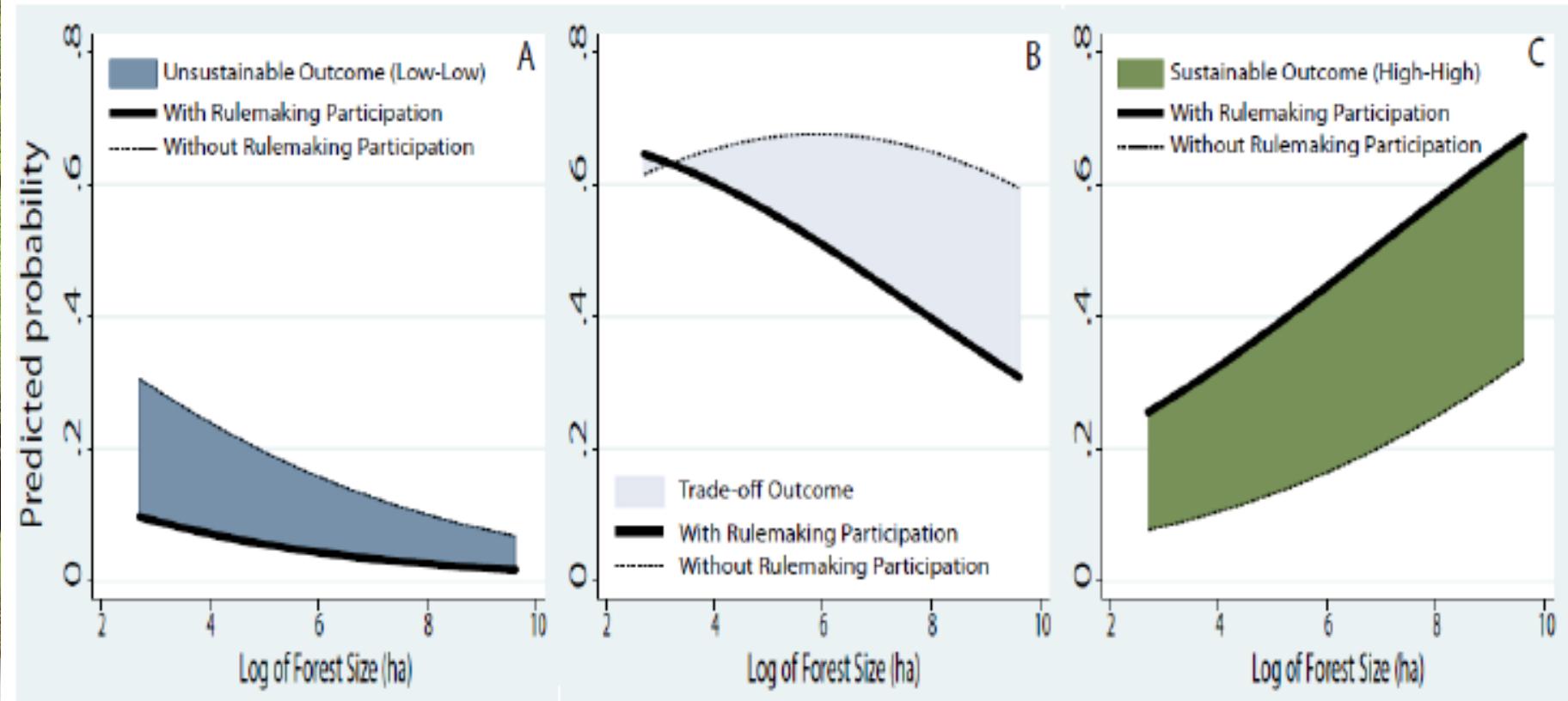
Figure S2. Distribution of household dependence on forest products for a significant contribution to subsistence and commercial livelihoods, across South Asia ( $n = 54$ ) and East Africa ( $n = 30$ ) cases.



# Relationship between livelihoods and tree species richness: 3 outcome categories



# Participation, livelihoods, and diversity (gologit estimation)





# Examining three outcomes together

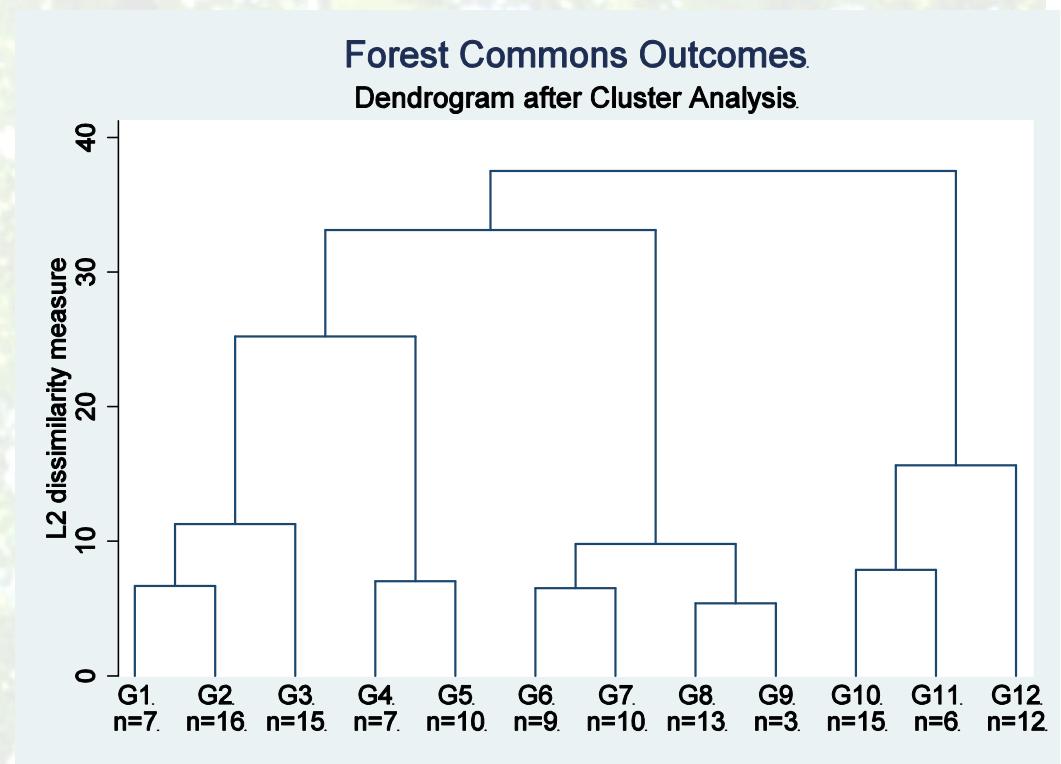
- The 2X2 approach does not have sufficient traction on many outcome and many levels/categories
- One possible approach: employ cluster analysis to identify groups of outcomes where similar cases are placed in the same category, and cross-category differences are maximized



# Cluster analysis of the three outcome dimensions



- Multivariate Analysis of Variance of Biomass, Biodiversity, and Livelihoods on four clusters is highly statistically significant
- Suggests a clear demarcation of clusters



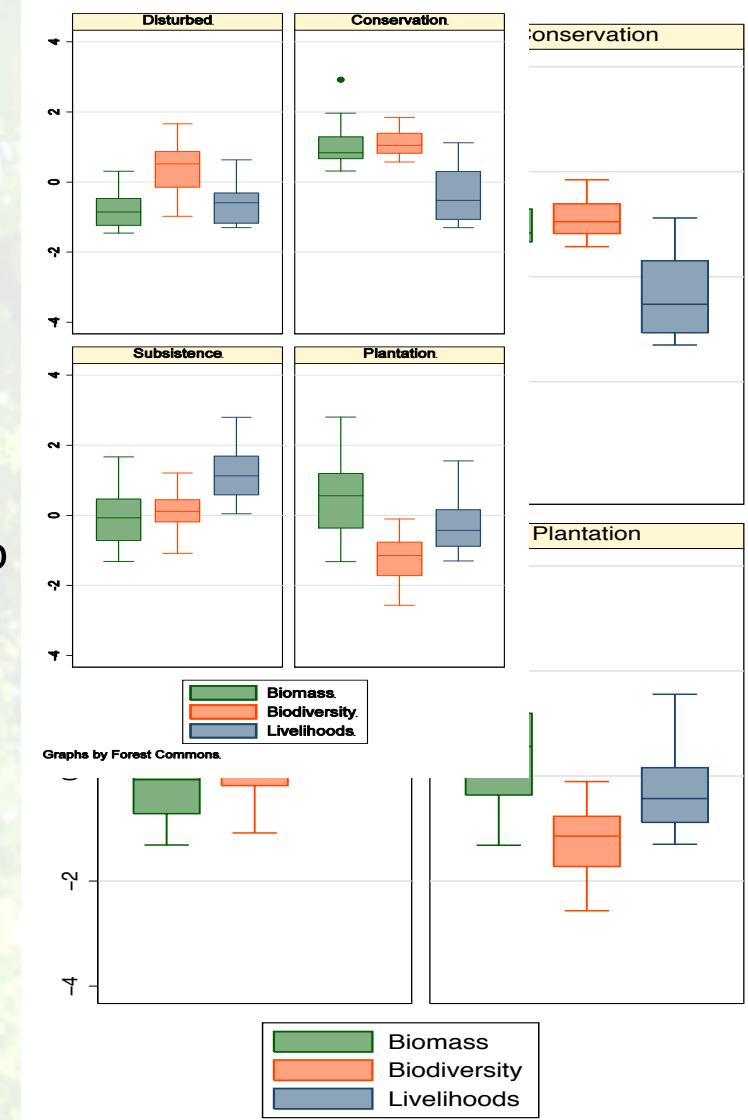
Wilks' lambda = 0.0761, F = 59.56, Prob>F = 0.0000; Lawley-Hotelling trace = 4.523, F = 58.13, Prob>F = 0.0000)



# Characteristics of forest commons clusters

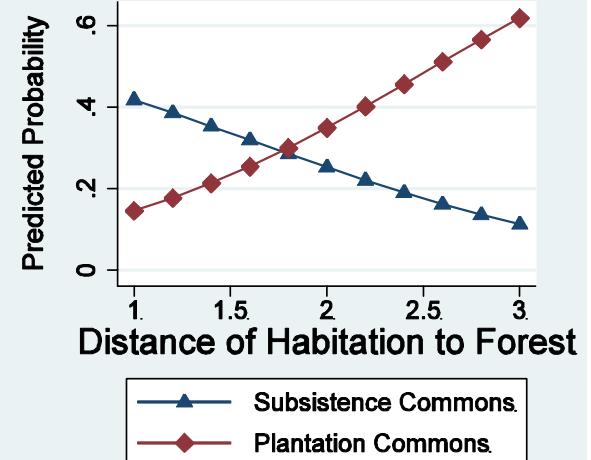
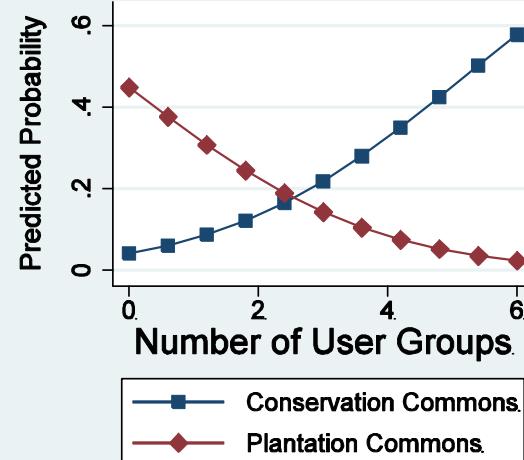
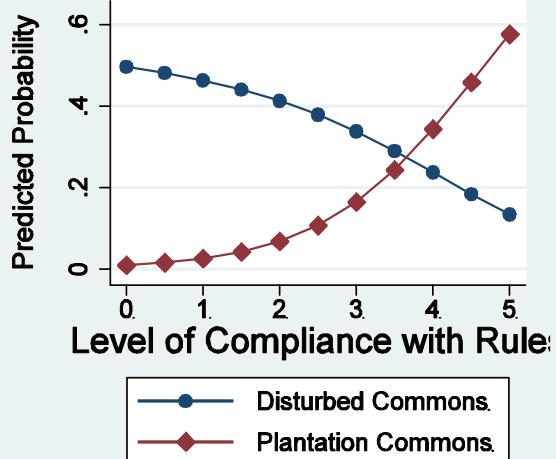
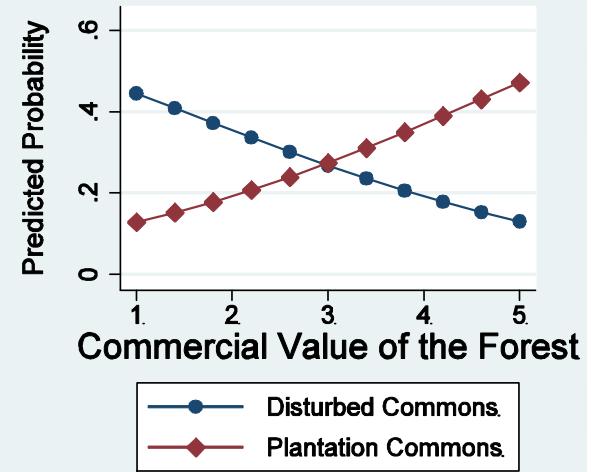
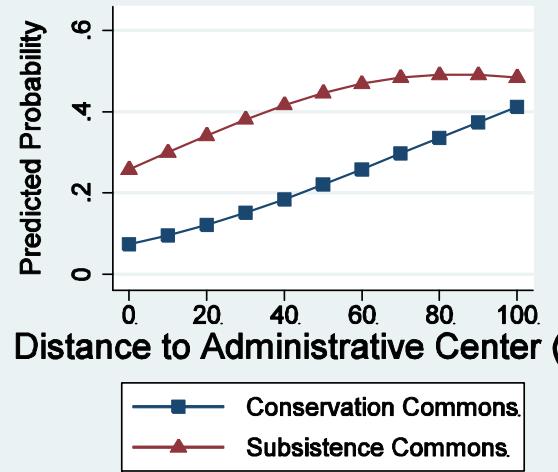
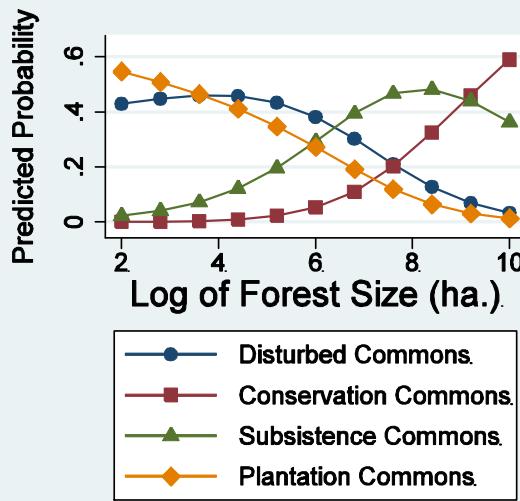


- **Disturbed Commons** have low biomass and contribute little to livelihoods, but have higher than average tree diversity.
- **Conservation Commons** make small contributions to rural livelihoods, but make higher than average contributions to biomass and diversity.
- **Subsistence Commons** provide high contributions to livelihoods, and have average biomass and biodiversity.
- **Plantation Commons** have high biomass on average but low diversity, and provide below average livelihoods benefits.



Box plots of Livelihoods, Biomass, and Biodiversity benefits in the four clusters

# Bivariate associations with cluster membership



# Conclusions

- Possible and necessary to examine multiple outcomes together when investigating social ecological systems
- Debates over tradeoffs and win-win relationships are sterile and need to be jettisoned
- Because multiple outcomes exist all around us, it is more important to analyze the drivers of outcome relationships and develop better data, methods, and theories of such relationships
- A vast, underexplored continent of scholarly research, insights, and new findings awaits those willing to undertake this necessary and important task – I welcome you to it





# THANK YOU

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Coauthors: Ashwini Chhatre, and Lauren Persha

