Forest Governance for Multiple Benefits

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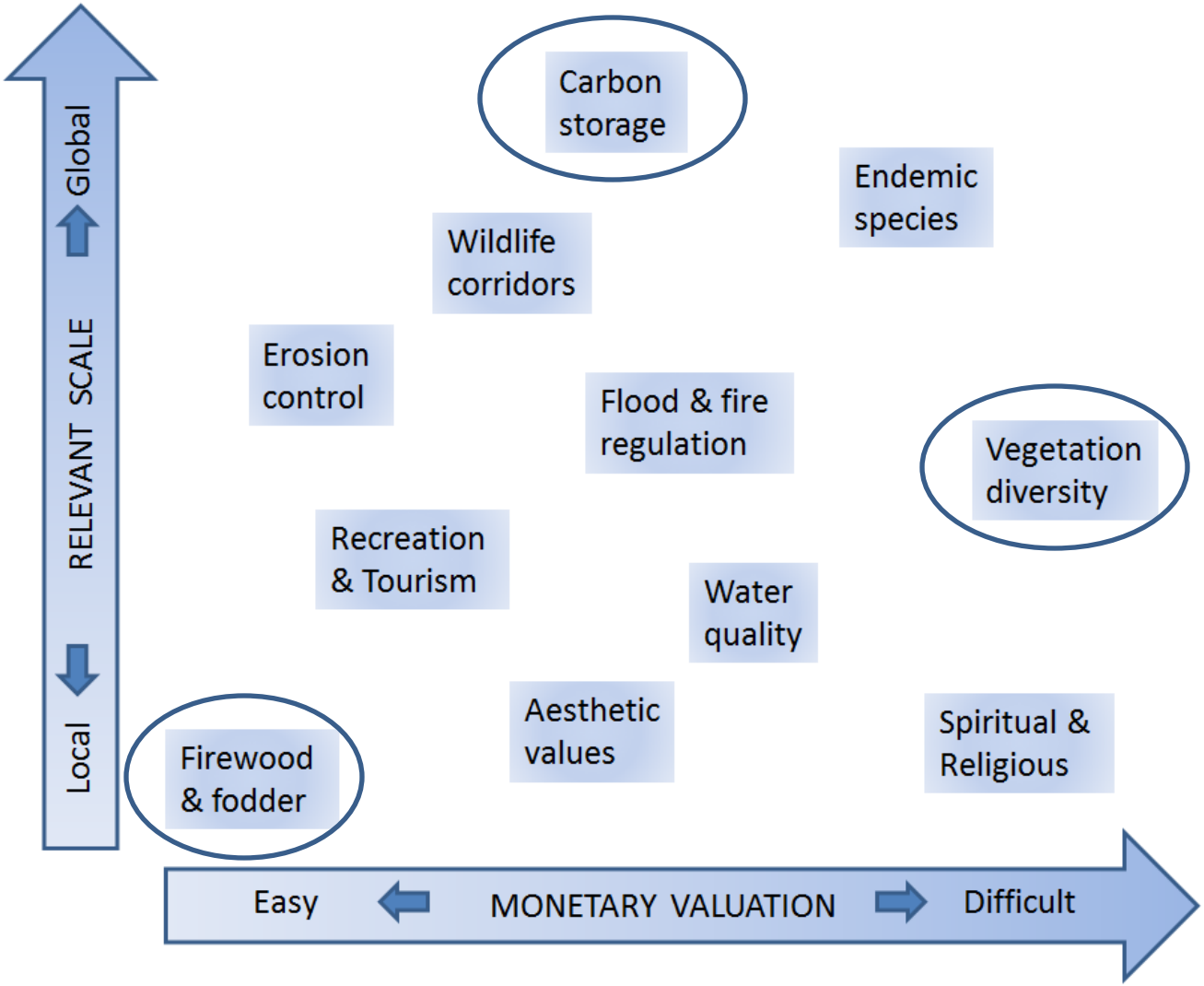
Forests at the intersection of three global debates:
Poverty, Biodiversity, and Climate Change



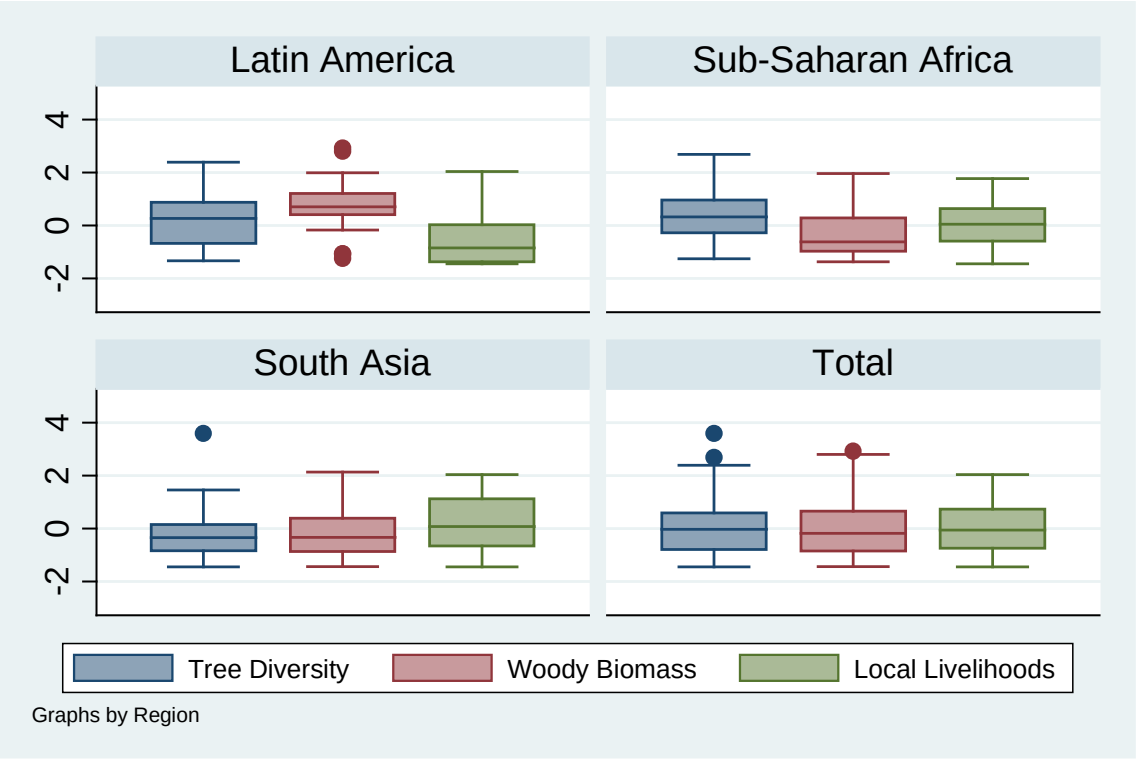
Tree Species Richness, Woody Biomass, and Forest-Based Livelihoods

114 forests in 11 countries

Latin America – Mexico, Bolivia, Guatemala (22 cases)

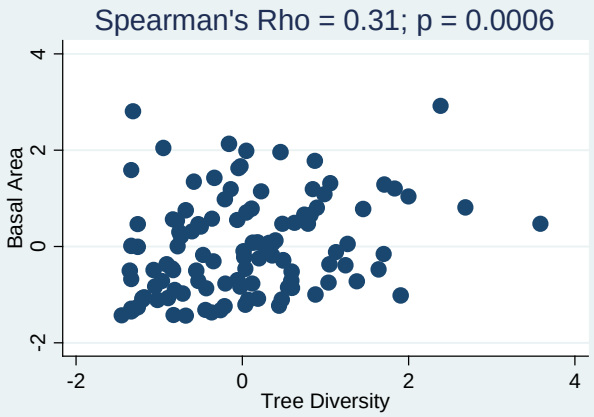
Sub-Saharan Africa – Kenya, Tanzania, Uganda, Madagascar (32 cases)

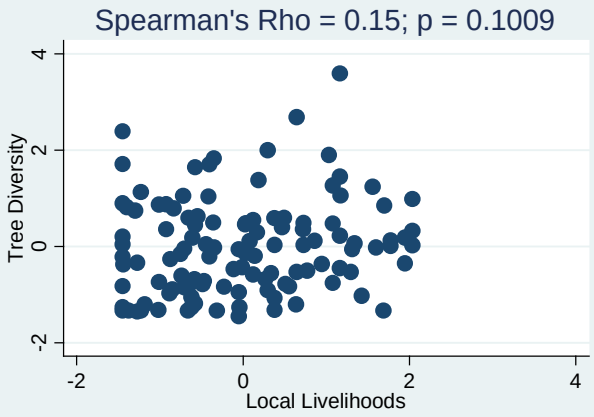
South Asia – Bhutan, Nepal, India (60 cases)

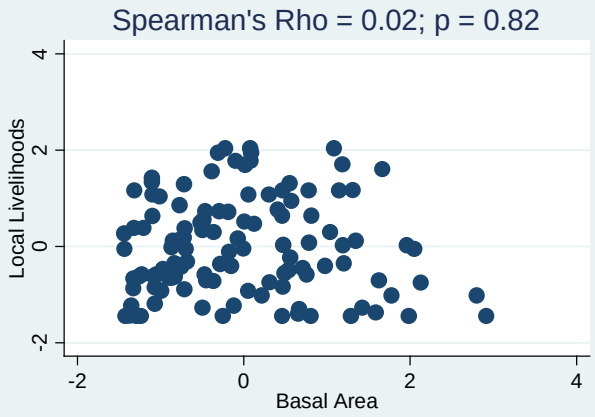


Bivariate Distributions

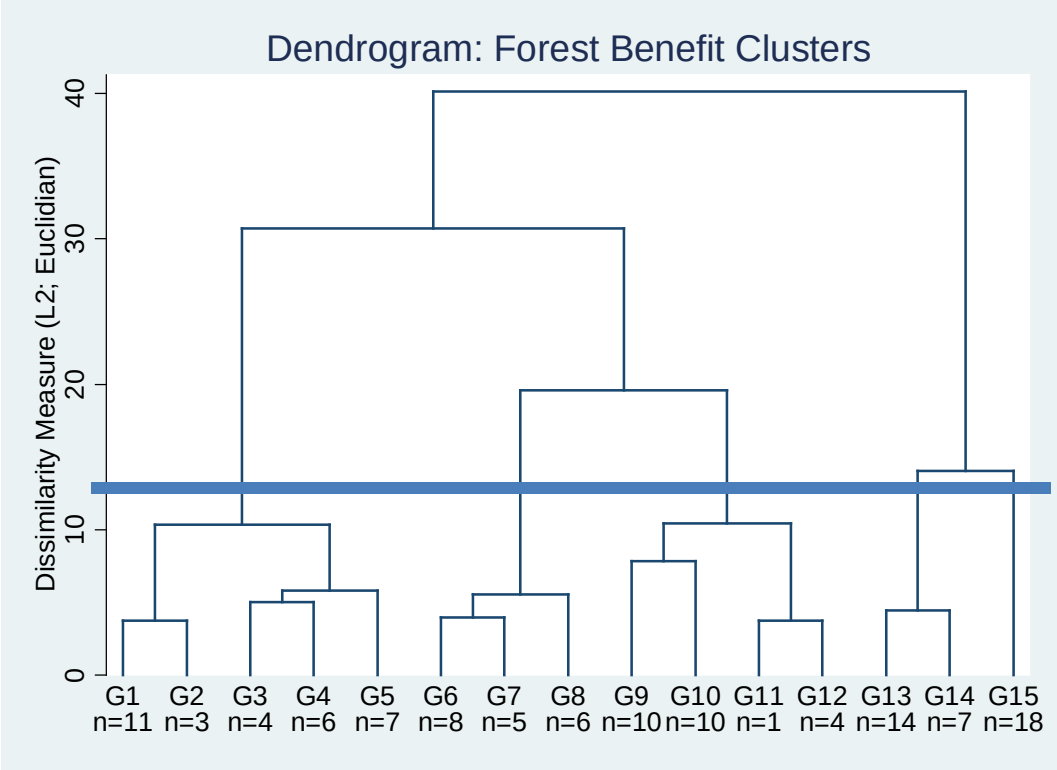
Low levels of bivariate correlations







Hierarchical Cluster Analysis

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Number of observations = 114
Statistic                      Value        F(df1,  df2)  =   F     Prob>F
-----------+-----------------------------------------------------
Wilks' lambda                  0.0554         12.0   283.4    46.85 0.0000
Pillai's trace                 1.8113         12.0   327.0    41.52 0.0000
Lawley-Hotelling trace         5.1545         12.0   317.0    45.39 0.0000
Roy's largest root             2.5097          4.0   109.0    68.39 0.0000
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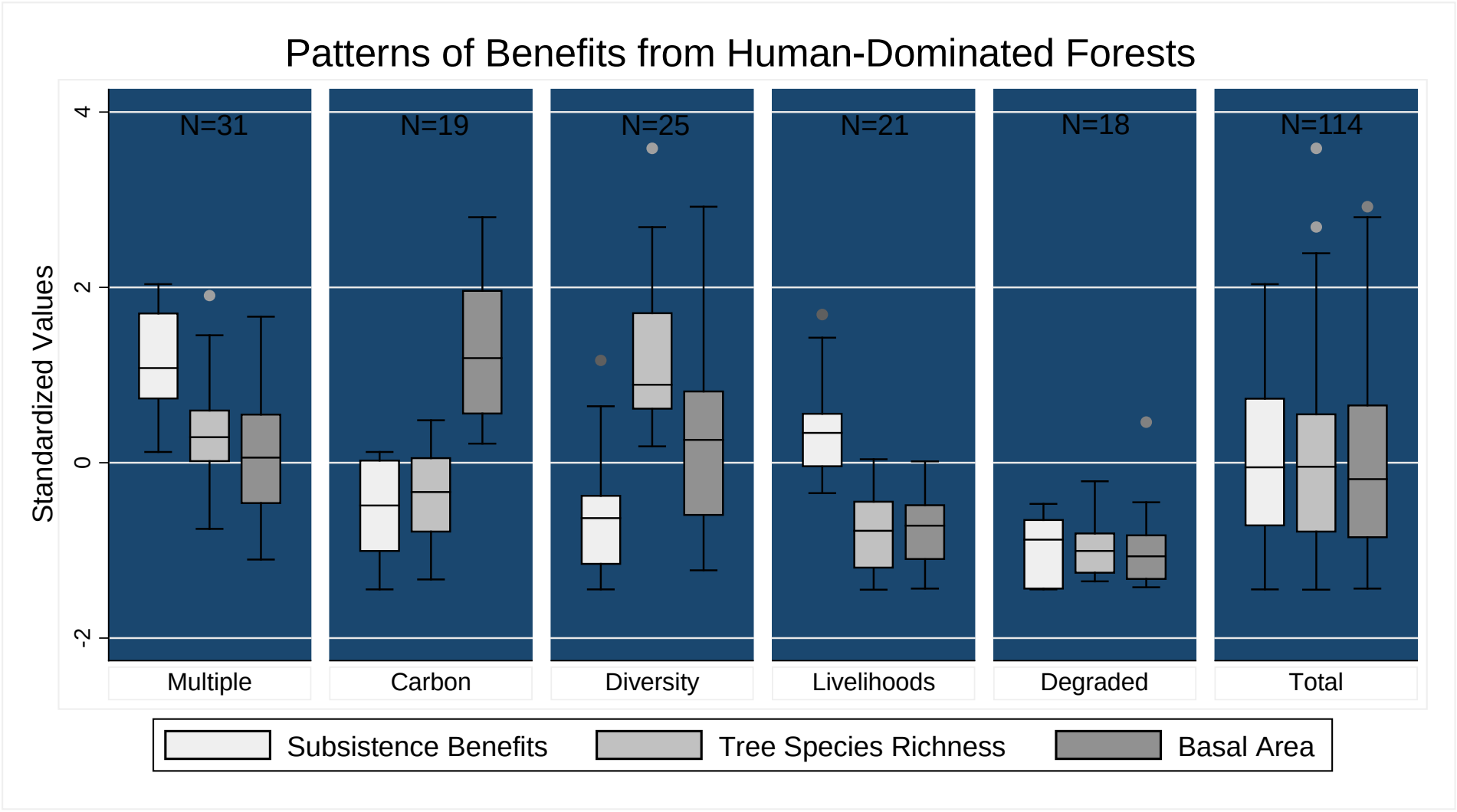

Patterns of Benefits from Human-Dominated Forests
Standardized Values
4
2
0
-2
N=31
N=19
N=25
N=21
N=18
N=114
Multiple
Carbon
Diversity
Livelihoods
Degraded
Total
Subsistence Benefits
Tree Species Richness
Basal Area

Avoiding Degraded Forests

Relative Risk Ratios	Carbon Forests	Diversity Forests	Livelihood Forests
Log of forest size		2.28 (.006)	
Level of Rule Compliance		0.28 (.014)	
Perceived strictness of access rules	0.28 (.027)		0.24 (.019)
Number of user groups		1.81 (.05)	
Log of number of individuals		0.4 (.001)	
Food self-consumption			0.8 (.003)
Distance to forest from habitation			0.15 (.001)

Promoting Forests with Multiple Benefits

Relative Risk Ratios	Carbon Forests	Diversity Forests	Livelihood Forests
Log of forest size	0.48 (.001)		0.64 (.013)
Rulemaking participation		0.29 (.039)	
Management interventions		0.44 (.008)	
Log of number of individuals	1.6 (.025)	0.64 (.024)	
Number of subsistence benefits	0.68 (.004)	0.62 (.001)	0.74 (.01)
Distance to forest	3.7 (.038)		

Future Directions

Multiple benefits produced simultaneously

Patterns: Clusters of benefits in multiple dimensions

Drivers: Process behind the patterns of clustering

Designing interventions intelligently

Thank you for your attention!

Woody Biomass as Carbon Storage

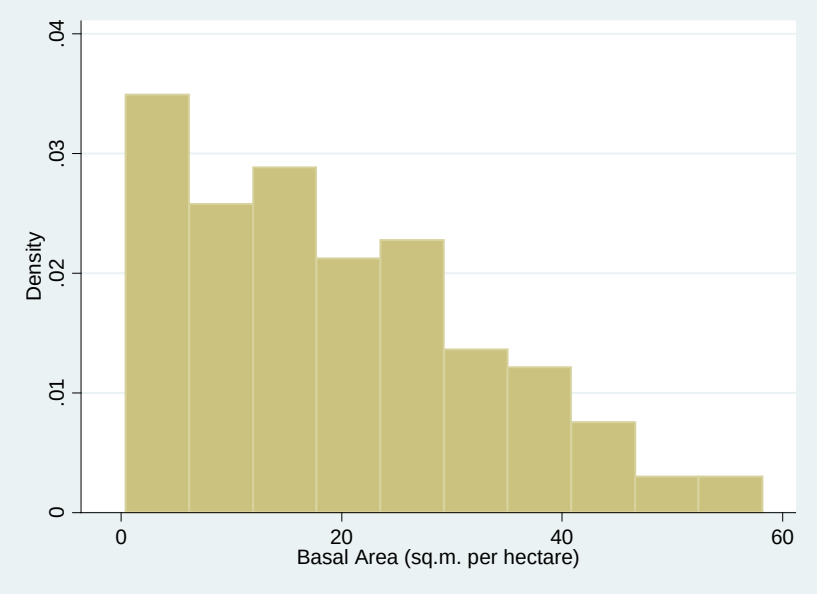
Basal area per hectare

Calculated from all stems>32cm girth at 137cm from ground level

Mean = 19.16 sq.m./ha; Median = 17.06

Four highest cases

- Bolivia (58.17)
- Mexico (56. 62)
- Bhutan (47.7)
- Nepal (46.64)



Tree Species Richness

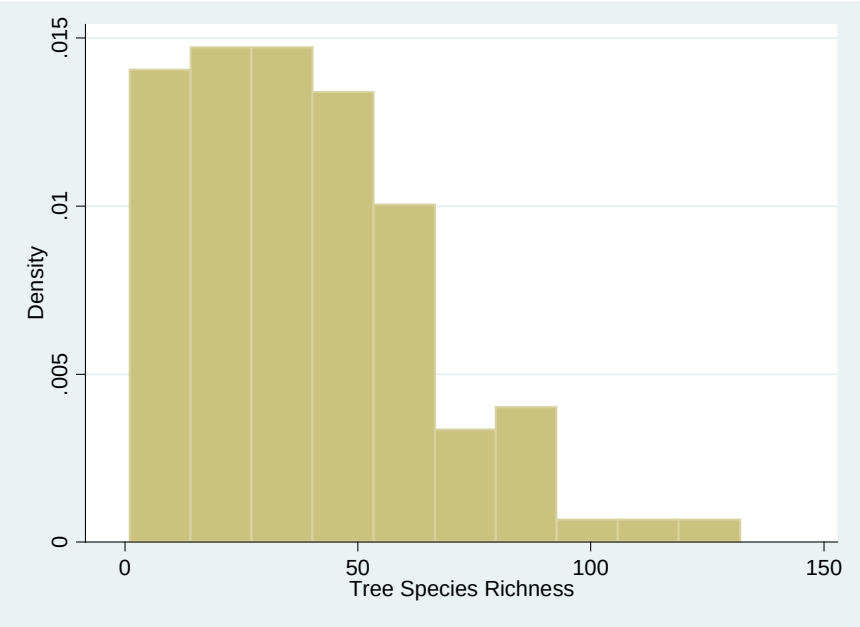
Non-parametric Chao-1 estimator

Mean # of tree species = 38.81;

Median # of tree species = 37.81

Three highest cases

- India (132 spp)
- Bolivia (108 spp)
- Madagascar (100 spp)



Contributions to Local Livelihoods

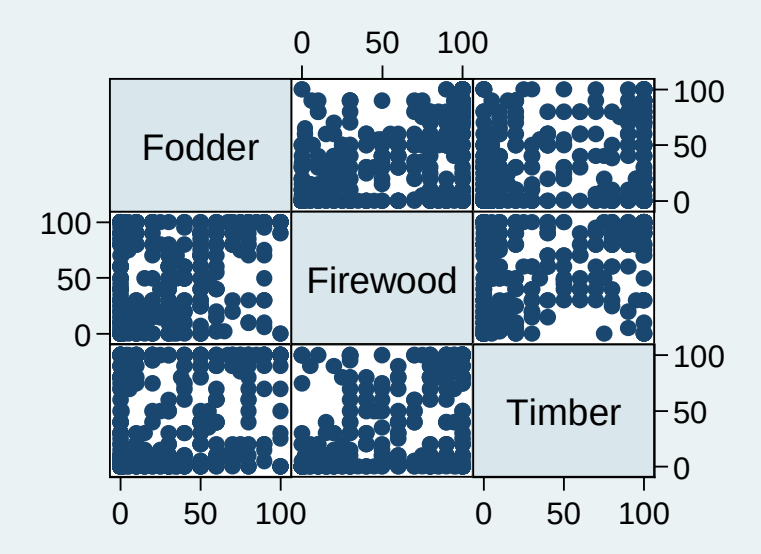
Proportion of fodder, firewood, and timber requirements met from the forest (last 5 years)

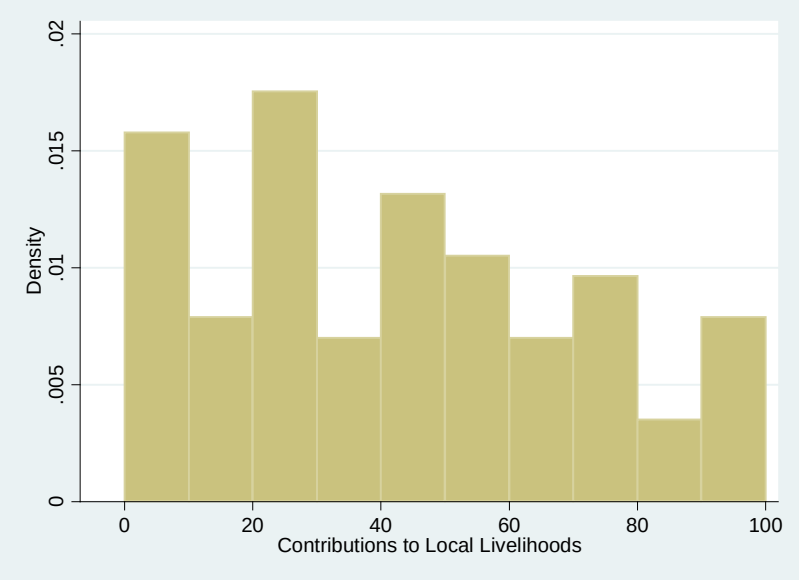
Averaged across user groups; weighted by population

Mean = 41%; Median = 40%

Three cases with 100% contributions to local livelihoods (Bolivia, India)

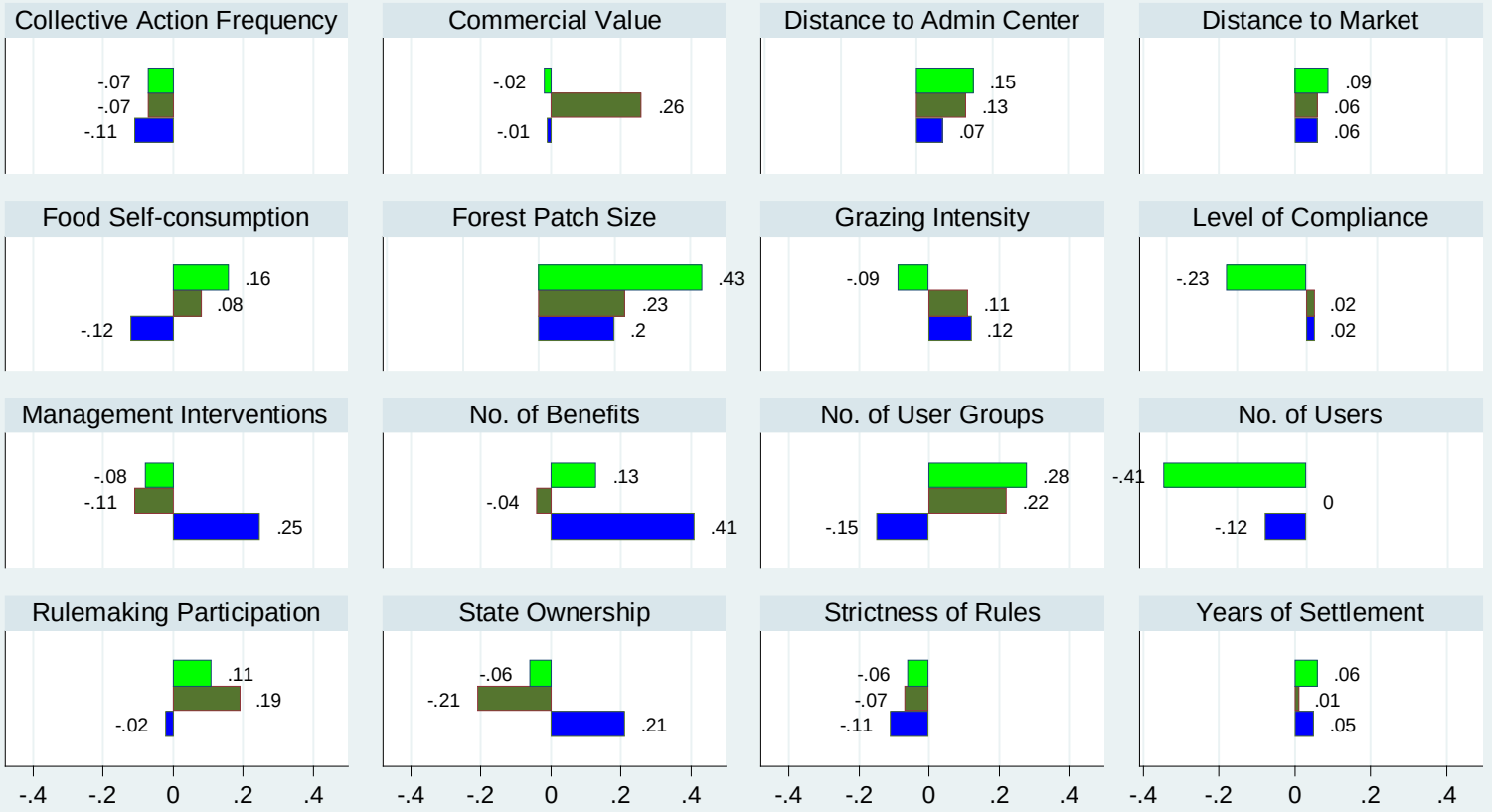
Nine cases with no contributions (Mexico, Bolivia, Tanzania, Kenya, Nepal)





Association with Known Drivers

Spearman's Rank Correlation



Graphs by Factors Associated with Forest Outcomes

Associations with Clusters

Demographic Factors

	Sustainable Forests	Plantation Forests	Conservation Forests	Livelihood Forests	Degraded Forests
Number of user groups	–	–	+ve	-ve	–
Number of households	–	+ve	-ve	–	–
Number of individuals	–	+ve	-ve	–	+ve

Demographic factors

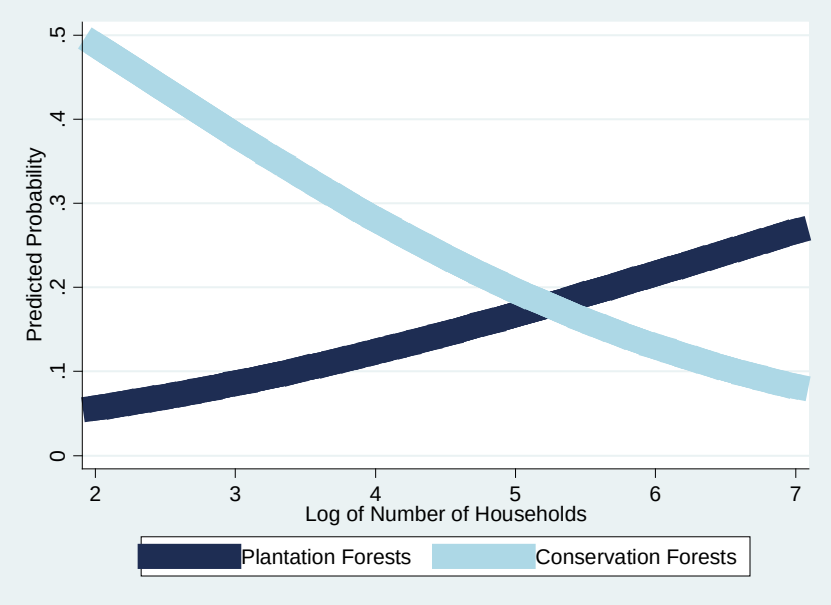
Households vs. individuals

Possible effects on tree diversity and woody biomass

Multiple pathways of influence

Plantation vs. Conservation Forests

Number of Households



Associations with Clusters

Institutional Factors

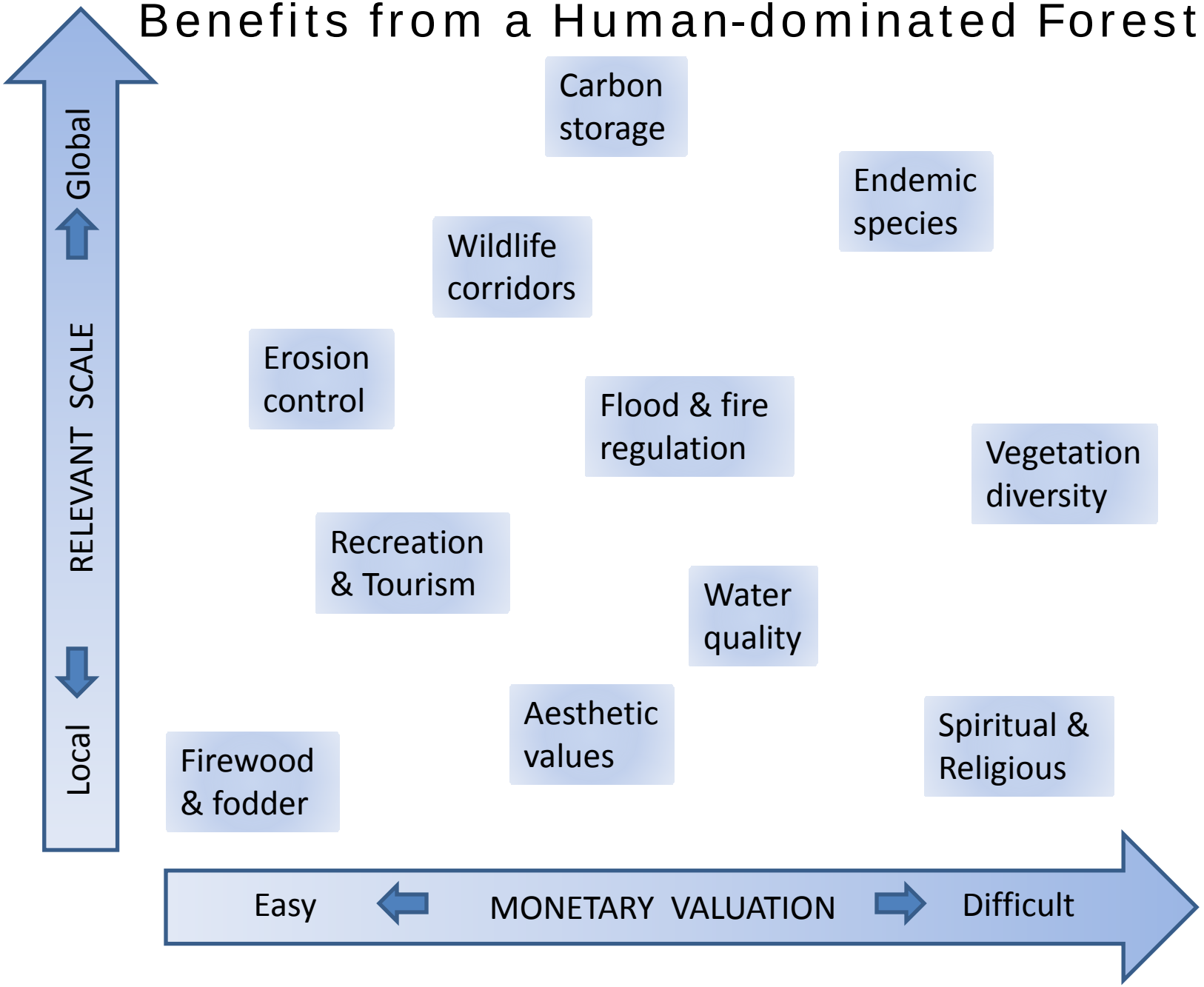
	Sustainable Forests	Plantation Forests	Conservation Forests	Livelihood Forests	Degraded Forests
Level of compliance with rules	–	–	**-ve**	–	–
Participation in rulemaking	–	–	–	**-ve**	–
No. of management interventions	**+ve**	–	**-ve**	**+ve**	–
Strictness of rules for access to forest	–	–	–	–	**+ve**

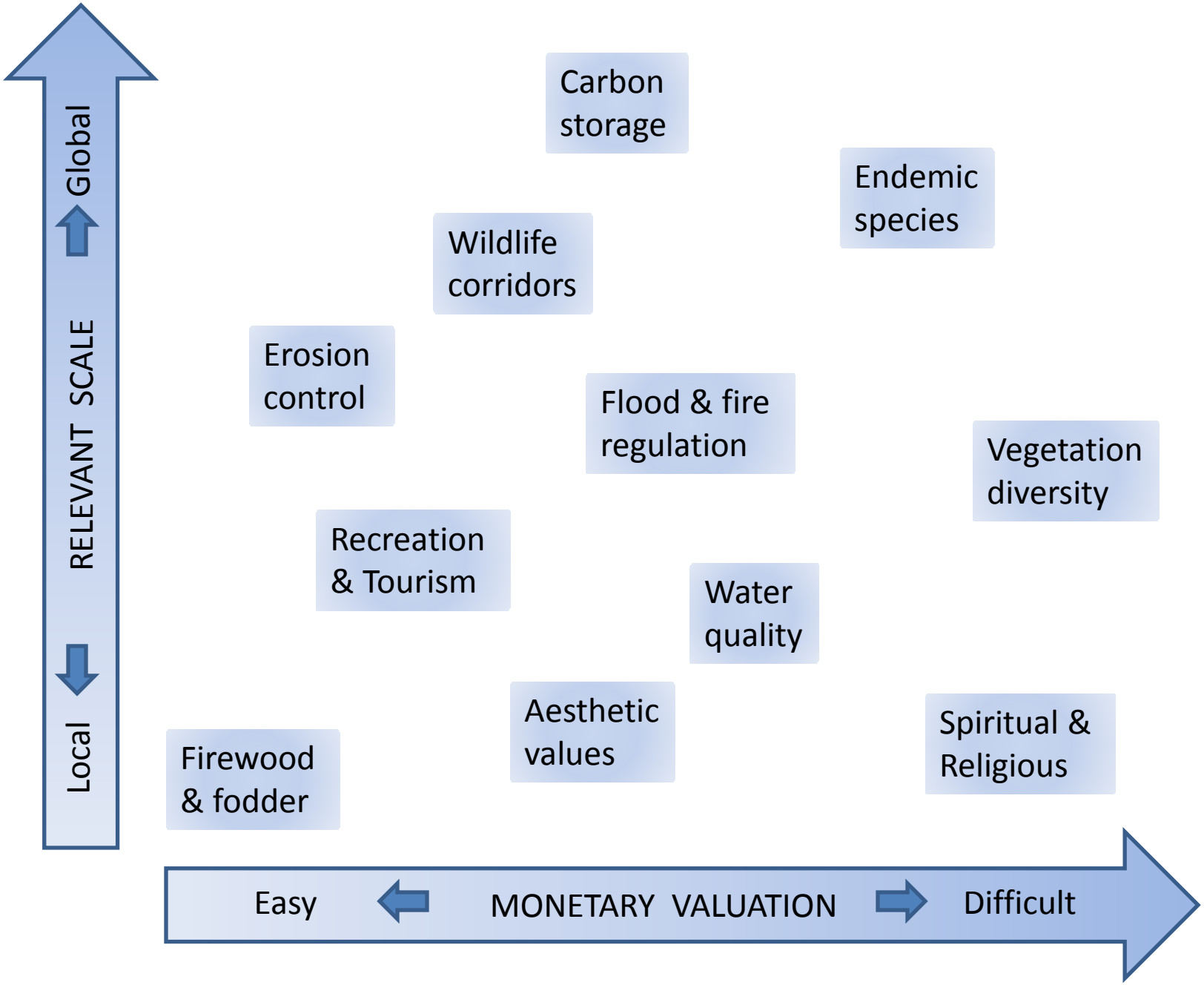
Associations with Clusters

Socio-economic Factors

	Sustainable Forests	Plantation Forests	Conservation Forests	Livelihood Forests	Degraded Forests
No. of subsistence benefits	**+ve**	**–**	**-ve**	**–**	**–**
Food self-consumption	**–**	**–**	**+ve**	**-ve**	**–**
Distance to forest from villages	**–**	**+ve**	**–**	**-ve**	**+ve**
Distance to admin. center	**–**	**–**	**+ve**	**–**	**-ve**

Benefits from a Human-dominated Forest

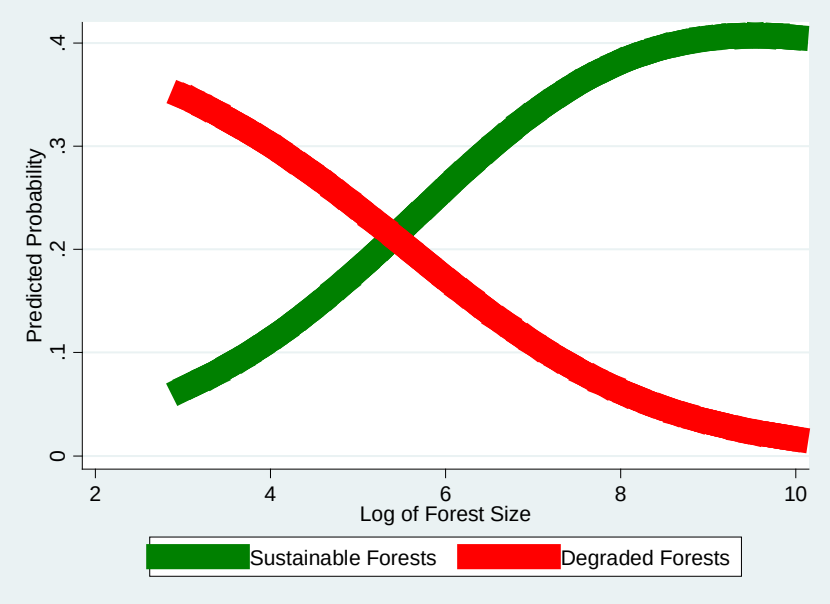



Global
RELEVANT SCALE
Local
Carbon storage
Endemic species
Wildlife corridors
Erosion control
Flood & fire regulation
Vegetation diversity
Recreation & Tourism
Water quality
Aesthetic values
Spiritual & Religious
Firewood & fodder
Easy
MONETARY VALUATION
Difficult

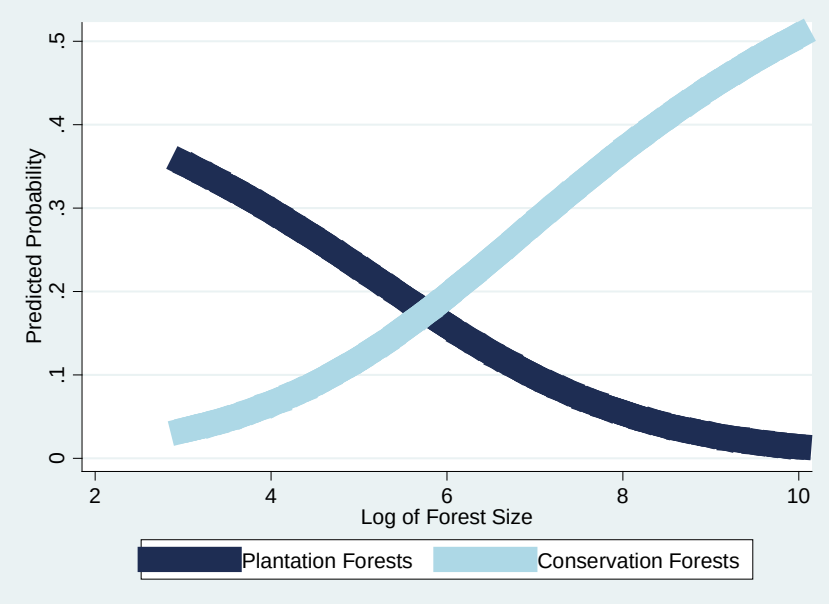
Associations with Clusters

Size of forest patches

Sustainable vs. Degraded Forests



Plantation vs. Conservation Forests

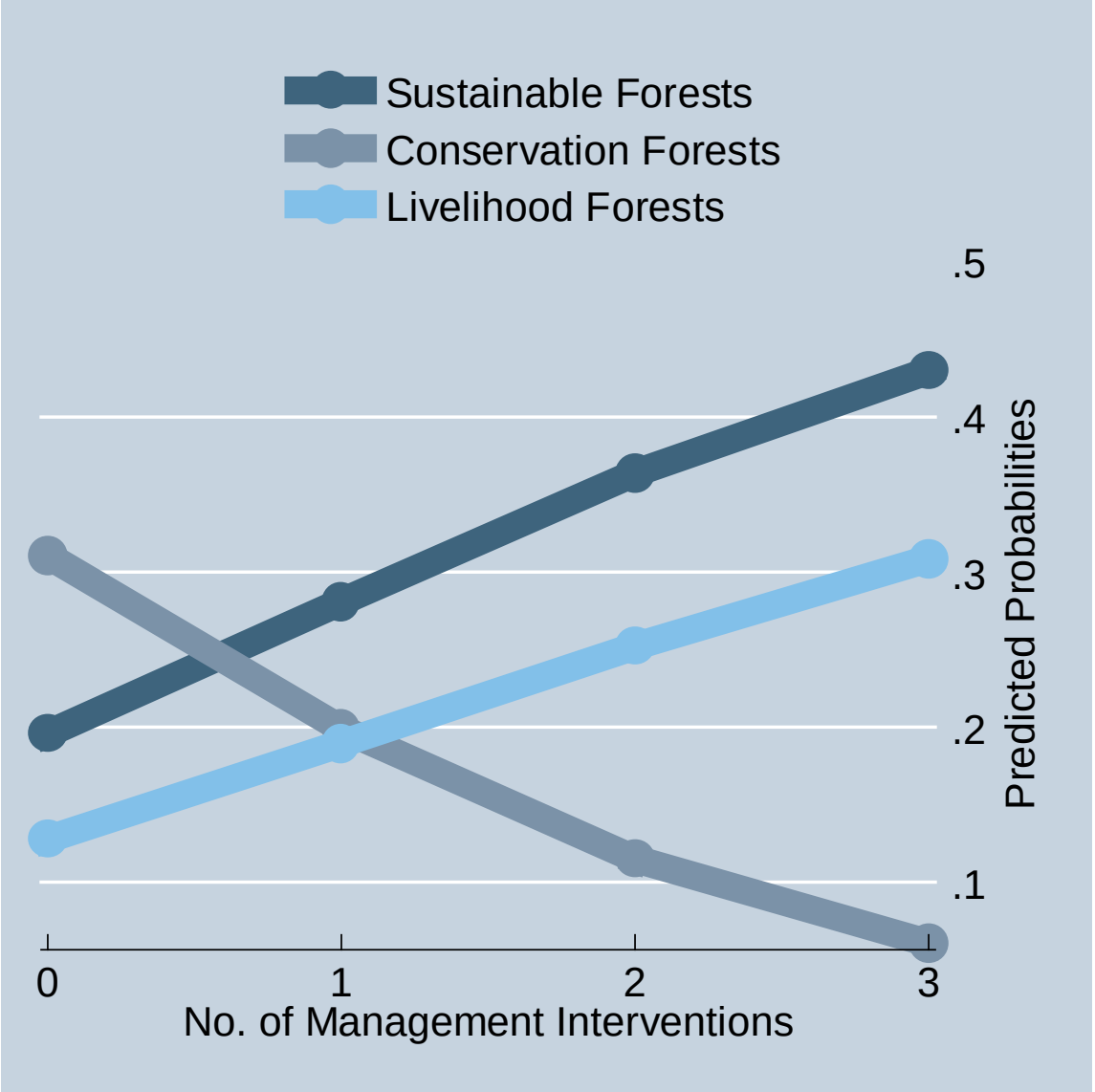


Number of Different Management Interventions by Local Communities

Plantation activity in the Forest in the last ten years

Spatial division of forests into management units

Other improvement activities: Thinning, weeding, fencing, etc.



Factors associated with Sustainable Forests

1. The number of different subsistence benefits derived from the forest
2. The size of the forest patch
3. Number of different management interventions