Supporting Information

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SI Text

The International Forestry Resources and Institutions (IFRI) Research Program: Approach, Data, and Methods. Founded in 1992, the IFRI research program is a network of 11 collaborative research centers in 10 countries. The networked research centers focus on local forest governance and forest resource outcomes in diverse socio-political, ecological, and institutional contexts. Their goal is to use the data they have collected to understand the factors that shape long term sustainable management of forest commons. The 10 collaborating research centers are located in East Africa in Kenya (KEFRI, Kenya Forestry Research Institute), Tanzania (CRC-TZ, Department of Forest Mensuration, Forestry and Nature Conservation, Soikoine University of Agriculture), and Uganda (UFRIC, Uganda Forestry Resources and Institutions Center, Makerere University); in Latin American in Bolivia (CERES), Guatemala (Universidad del Valle de Guatemala), and Mexico (UNAM, Instituto de Investigaciones Sociales Universidad Nacional Autonoma de Mexico); in Asia in India (SHODH, The Institute for Research and Development), Nepal (NRDC, Natural Resource Research and Development Center), and Thailand (Asian Institute of Technology, School of Environment, Resources and Development); and in the United States at Indiana University. The University of Michigan coordinates the research relationships among these centers.

Researchers associated with IFRI program developed their research methods in 1992–1993 based on the Institutional Analysis and Development (IAD) framework advanced by Elinor Ostrom and her colleagues at Indiana University (Ostrom 2005). With the IAD framework providing an overarching set of principles to guide research, IFRI scholars have created a standardized methodology for fieldwork based on approximately 700 questions organized in 11 data collection instruments [Supporting Information (SI) Fig. S1]. IFRI's data collection instruments and an instruction manual for conducting field work and completing data entry are available at www.umich.edu/~ifri.

The different data collection instruments mentioned in Fig. S1 allow the following general kinds of data to be collected:

- Site overview: site overview map, local wage rates, local units of measurement, exchange rates, recent policy changes, interview information
- Forest: forest size, ownership, internal differentiation, products harvested, uses of products, master species list, changes in forest area, appraisal of forest condition by forester and members of user group, spatial location of forest
- Forest plot: tree, shrub, and sapling size, density, and species type within 1, 3, and 10 m circles for a random sample of plots in each forest and general indications regarding forest condition, spatial location of plots
- Settlement: socio-demographic information, relation to markets and administrative centers, geographic information about the settlement
- User group: size, socioeconomic status, attributes of specific forest user groups.
- Forest-user group relationship form: products harvested by user groups from specific forests and their uses
- Household: income, wealth, social status, assets, livestock holdings, social connections, forest use patterns and benefits, views about forests and environment, spatial location of households
- Forest products: details on 3 most important forest products (as defined by the user group), temporal harvesting patterns, alternative sources and substitutes, harvesting tools and techniques, and harvesting rules
- Forest association: Institutional information about forest association (if one exists at the site), including association's activities, rules structure, membership, record keeping
- Non-harvesting organization: information about organizations that make rules regarding forest(s) but do not use the forest itself, including structure, personnel, resource mobilization, and record keeping
- Organizational inventory: information about all organizations (harvesting or not) that relate to a forest including harvest and governance activities

The data collected in the field are fed into a computerized relational database currently housed at the University of Michigan and Indiana University. A training seminar for researchers interested in using IFRI methods is offered each year to ensure a common understanding of the IFRI approach and principles and also to improve rigor in the application of IFRI methods. The IFRI Coding Manual describes the IFRI research instruments and explains how different variables are to be interpreted.

IFRI field research teams comprise at least 1 forester and 1 social scientist, but frequently include 4 to 6 researchers with different disciplinary backgrounds. Data are typically collected in a site during a 2-to-4 week period, depending on the size and accessibility of the site and the diversity of vegetation in the local forests. To collect social, economic, institutional, and demographic data related to forests, IFRI researchers use group participatory processes during the day and complete the IFRI research instruments collectively at night, after having collated the data gathered through individual interviews, group conversations, and secondary materials. For ecological data, IFRI researchers locate forest plots at random in the local forests and collect forest mensuration data on trees, shrubs, and ground cover.

The dataset on the variables used for the statistical analysis in the paper has been generated from the IFRI database. The dependent variable is categorical, based on direct responses from respondents and the research team's forester's assessment in response to a question that asks whether the condition of the forest has degraded, remained the same, or improved in the past 10 years. For the independent variables (level of enforcement, size of forest commons, collective action, user group size, firewood supplied from the forest for household consumption, and commercial value of forest) data were collected from village residents in group interviews.

- Level of enforcement has been coded as a categorical variable with value 1 (low) to 5 (high) based on direct responses during the focus group discussions.
- Size of forest common is measured in hectares.
- Collective action is a binary variable represented by presence or absence of improvement activities in the forest as reported during focus group discussions.
- User group size is represented by the number of households in a user group.
- Firewood supplied from the forest for household consumption is the proportion of firewood needed by the user group as a whole that is supplied by the forest as reported by focus group discussion members.
- Commercial value of the forest is a categorical variable ranging from 1 (low commercial value) to 5 (high commercial value) as reported during the focus group discussions.

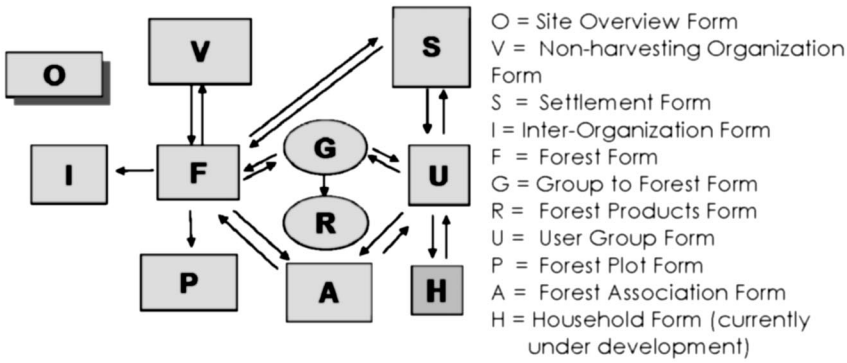

Fig. S1. IFRI's research protocols and their conceptual relationships: O = Site Overview Form; V = Non-harvesting Organization Form; S = Settlement Form; I = Inter-Organization Form; F = Forest Form; G = Group to Forest Form; R = Forest Products Form; U = User Group Form; P = Forest Plot Form; A = Forest Association Form; H = Household Form (currently under development).

Table S1. Variable descriptions and summary statistics

Variable	Minimum	25th percentile	Median	Mean	75th percentile	Maximum
Change in forest condition (Degradation = 1, No change = 2, Regeneration = 3)	1	1	2	1.901316	3	3
Log of size of forest (hectares)	0	3.478273	4.993823	5.151179	6.609745	10.03012
Improvement activities in the forest (Yes = 1)	0	0	1	0.5197368	1	1
Log of number of college graduates among users	0	0	1.098612	1.524371	2.995732	7.025538
Commercial value of the forest (Very low value = 1, Very high value = 5)	1	3	4	3.467105	4	5
Number of users owning private land among users	0	8.5	51.5	142.0987	116.5	2,818
Number of subsistence users of the forest	0	31	158.5	771.9737	637.5	7,298
Percent fuelwood provided by the forest	0	15	50	49.20614	87.125	100
Level of enforcement (No enforcement = 0, Very low enforcement = 1, Strict enforcement = 5)	0	2	4	3.611842	5	5
Fines as the principal mechanism of enforcement (Yes = 1)	0	0	0	0.1776316	0	1
Steepness of the forest—Average across 30 plots of 10m radius (Degrees)	0	2.816667	17.71667	18.62611	30.25806	63.23809

Table S2. Multinomial logistic regression results: Coefficients and marginal effects

	Eq. **1**: Degradation			Eq. **2**: Regeneration		
Variable	Coefficient	Marginal effects (at mean)	Marginal effects (at median)	Coefficient	Marginal effects (at mean)	Marginal effects (at median)
Log of size of forest	−0.230 (0.19)	0.0418 (0.036)	0.0264 (0.029)	−0.413** (0.19)	−0.0480 (0.036)	−0.0574* (0.033)
Improvement activites in the forest	−0.579 (0.73)	−0.285** (0.12)	−0.258** (0.11)	0.618 (0.68)	0.285** (0.11)	0.263** (0.11)
Log of number of college graduates	−0.827*** (0.26)	−0.0708 (0.049)	−0.0708* (0.040)	−0.566** (0.23)	0.0574 (0.048)	0.0136 (0.044)
Commercial value of the forest	0.834** (0.37)	0.0675 (0.066)	0.0684 (0.059)	0.587* (0.35)	−0.0538 (0.065)	−0.00983 (0.063)
Number of users owning private land	0.0126** (0.0054)	0.000588 (0.00043)	0.000710* (0.00040)	0.0107** (0.0053)	−0.000363 (0.00043)	0.000282 (0.00052)
Number of subsistence users	0.00248** (0.0010)	−0.00000241 (0.000059)	0.0000513 (0.000058)	0.00259** (0.0010)	0.0000512 (0.000058)	0.000173* (0.000091)
Percent fuelwood provided by the forest	0.0223** (0.0098)	0.00301* (0.0018)	0.00274* (0.0015)	0.0107 (0.0095)	−0.00269 (0.0018)	−0.00146 (0.0017)
Level of enforcement	−0.397* (0.20)	−0.123*** (0.041)	−0.101*** (0.034)	0.1000 (0.20)	0.120*** (0.040)	0.0953*** (0.037)
Fines as principal mechanism of enforcement	−0.0839 (0.83)	0.250* (0.15)	0.198 (0.16)	−1.205 (0.81)	−0.262* (0.14)	−0.277* (0.14)
Steepness of the forest	−0.113*** (0.030)	−0.0245*** (0.0055)	−0.0208*** (0.0054)	−0.0161 (0.026)	0.0232*** (0.0054)	0.0165*** (0.0053)
Constant	1.856 (1.97)			−0.0563 (1.86)		

Table S3. Model predictions

	Model predictions				
Change in forest condition	Degradation	No change	Regeneration	Unable to predict	Total
Degradation	58	1	9	4	72
No change	2	10	7	4	23
Regeneration	16	4	33	4	57
Total	76	15	49	12	152

Pearson $\chi^2(4) = 81.9712$ Pr = 0.000; Likelihood-ratio $\chi^2(4) = 73.3670$ Pr = 0.000; Cramér's V = 0.5411; Gamma = 0.7102 ASE = 0.074; Kendall's tau-b = 0.5166 ASE = 0.071; Fisher's exact = 0.000.

Other Supporting Information Files

Dataset S1 (ZIP)