Paper presented in

Seventh Biennial Conference

Indian Society for Ecological Economics (INSEE)

Global Change, Ecosystems, Sustainability

December 4-8, 2013

Host:
Tezpur University

Cohost:
OKD Institute of Social Change and Development

Seventh Biennial Conference of the Indian Society for Ecological Economics (INSEE) on"Global Change, Ecosystems, Sustainability

05.-08.12.2013

Institutions for Sustainable Governance of Forest Resources: Equity, Forest Preservation and Cross-scale Interactions in Mawlyngbna, Meghalaya, India

By Philipp Walter[1*], Christoph Oberlack[2], Joachim Schmerbeck[3] and B.K. Tiwari[4]

[*] Corresponding author: walter.philipp@googlemail.com
[1] University of Freiburg, Germany, Graduate Student, M.Sc. Forest Ecology and Management
[2] University of Freiburg, Germany, Chair of Economic Policy and Constitutional Economic Theory.
[3] TERI University, India, Department of Natural Resources.
[4] North-Eastern Hill University, India, Department of Environmental Sciences.

Abstract

Background: This paper examines how local forestry institutions and cross-scale interactions with the regional and state levels affect forest ecosystems and social equity in the community of Mawlyngbna in North-East India. In the tradition of the Bloomington school (E. Ostrom et al.) research on institutional design properties of sustainable resource governance has focused on the robustness and longevity of resource systems. In contrast, social equity has rarely been used in this epistemic community to conceptualize and assess sustainability of resource governance. Moreover, Ostrom's eight design principles have been criticized for being both incomplete and over-generalizing. This paper tests the validity of this criticism for the case of forest governance in Mawlyngbna, India, and extends her work to include social equity explicitly as a major dimension of sustainable governance.

Methods and Theoretical Concepts: Data were collected through 25 semi-structured interviews with key persons on the village, regional and state level and triangulated with information from participatory observation of community meetings, transect walks, informal discussions with villagers and public authorities, legal documents, two concurrent vegetation studies on biodiversity in the same study area, and scholarly literature about the region. We analyzed the data using Qualitative Content Analysis. Conceptually, the study is based on Ostrom's Institutional Analysis and Development (IAD) and Social-Ecological Systems (SES) framework.

Results and Conclusions: Results show that Mawlyngbna's tropical semi-evergreen forest is a major source of income and livelihood options for the local population. However, parts of the forest are overharvested and losing biodiversity. Moreover, inequities prevail among the villagers in terms of forest-related livelihood and participation options. The analysis provides narratives of mechanisms describing how the inequalities among villagers as well as the degradation of some parts of the forest arise from the present institutional setting in interaction with several non-institutional factors. Moreover, we describe how the current lack of cross-scale interactions with regional and state level actors impedes adaptations of local institutional arrangements to long-term, large-scale environmental and socio-economic changes. The paper concludes that institutional arrangements have to be carefully adapted to local socio-economic and biophysical conditions and that exchange of knowledge and capacity building through cross-scale interactions can be valuable mechanisms to adapt local institutions to large-scale challenges.

Introduction

In his review of common-pool resource (CPR) research of the 1980s and 1990s, Agrawal (2001) argues for the compilation of case studies which examine clearly defined variables and their causal relations in order to enable the creation of general CPR concepts. He criticizes that studies examining "factors important to sustainability, equity, or efficiency of commons" and "studies that connect the different variables they identify in causal chains or propose plausible causal mechanisms" are relatively uncommon (ibid. 2001: 1651). A decade later, the issue of such causal mechanisms has yet to be fully understood. Moreover, "we simply cannot confidently predict how equity, sustainability and livelihoods outcomes are related to each other systematically, or identify the underlying causal factors and processes" (Agrawal and Benson 2011: 207).

India is one of the countries which undertook major efforts in decentralization, letting local communities participate in the governance, management, and benefits of forests that are predominantly state-owned (Ghate and Ghate 2010). However, a unique situation is found in India's northeastern region (NER) where tribal people have controlled most of their forests for centuries that was even recognized in the Indian Constitution through exceptional rights for self-governance. Meghalaya, one of the northeastern states, is often cited as a special case of community forest management undisrupted by colonialism where communities have managed their resources traditionally for many generations. On the other hand, the state is frequently used as an example for insufficient community forest management, referring to the extensive environmental degradation through ruthless exploitation of resources such as timber, coal, and limestone (GoM 2005; Kumar, S. 2008).

A large portion of scholarly literature on community forestry in Meghalaya provides descriptive classifications of forest types, management practices, and traditional institutions (e.g., Sarma 2010; Tiwari et al. 2013; Tiwari et al. 2010). Few studies address causal mechanisms explaining sustainability, equity, or livelihood implications of the institutional arrangements applying to Meghalaya's forests (e.g., Kumar, S. 2008; Nongkynrih 2006; Poffenberger ed. 2007; Tiwari and Shahi 1995).

This case study analyzes such mechanisms in the small rural village of Mawlyngbna in the East Khasi Hills district of Meghalaya by trying to answer three central questions. a) What factors of Mawlyngbna's social-ecological system (SES) support forest preservation in some patches of the community forest and what causes forest degradation in the others?, b) What implications have the forest-related institutional arrangements on equity?, and c) What potentials and constraints do interactions have with actors from different levels such as the state government? With respect to these research questions, the following three hypotheses are proposed based on literature research and preliminary field visits:

1. Mawlyngbna's institutional arrangements result in the degradation of some parts of the community forest and the preservation of others.
2. The institutional arrangements lead to an inequitable distribution of forest resources and affluence amongst the members of Mawlyngbna's community.
3. Collaborations in forest governance and management carry considerable potentials for Mawlyngbna to cope with large-scale and long-term threats such as climate change effects and population growth.

The case study uses an interdisciplinary approach by drawing on the findings of two concurrent biodiversity studies (LaHaela *in progress*; Eck *in progress*) and adapting most recent CPR research tools. Ostrom's school (or "Bloomington school") of CPR concepts is currently reviewing its methodological tools in order to elaborate a diagnostic approach in CPR research and to find the relevant factors supporting successful CPR management. For example, the decades of scholarly work on the Institutional Analysis and Development (IAD) framework was adopted in a new framework to analyze social-ecological systems (SES) and Ostrom's (1990) design principles for successful CPR management was refined (e.g., Agrawal and Benson 2011; Cox et al. 2010; McGinnis and Ostrom *forthcoming*).

This study uses the most recent reviews of the SES framework and of the design principles in order to analyze Mawlyngbna's forest governance system. Defining central elements for the robustness and longevity of CPR governance systems such as monitoring and

sanctioning rules, the design principles guide the analysis of the ecological and social performance of Mawlyngbna's institutional arrangements. The study aims to explain the central mechanisms determining the sustainability and equity of Mawlyngbna's institutional arrangements as well as to identify potentials and constraints of cross-level governance interactions. Further, the study intends to critically evaluate the theoretical concepts of CPR research and to provide potential improvements.

The following section provides background information on the context of the study area. Subsequently, an overview over the conceptual basis and the methodology applied in this study is given. This is followed by the results and the discussion of the findings. The final section summarizes the key findings and provides an outlook for further research.

Context and Study Area

Location

The study area is located in the East Khasi Hills district in the center of Meghalaya (see figure 1). The district is one of 11 districts, is inhabited by 825,922 citizens and includes the state capital Shillong (Tiwari and Kumar 2008). The population growth rate of the East Khasi Hills district of about 25 % between 2001 and 2011 was one of the highest in India.

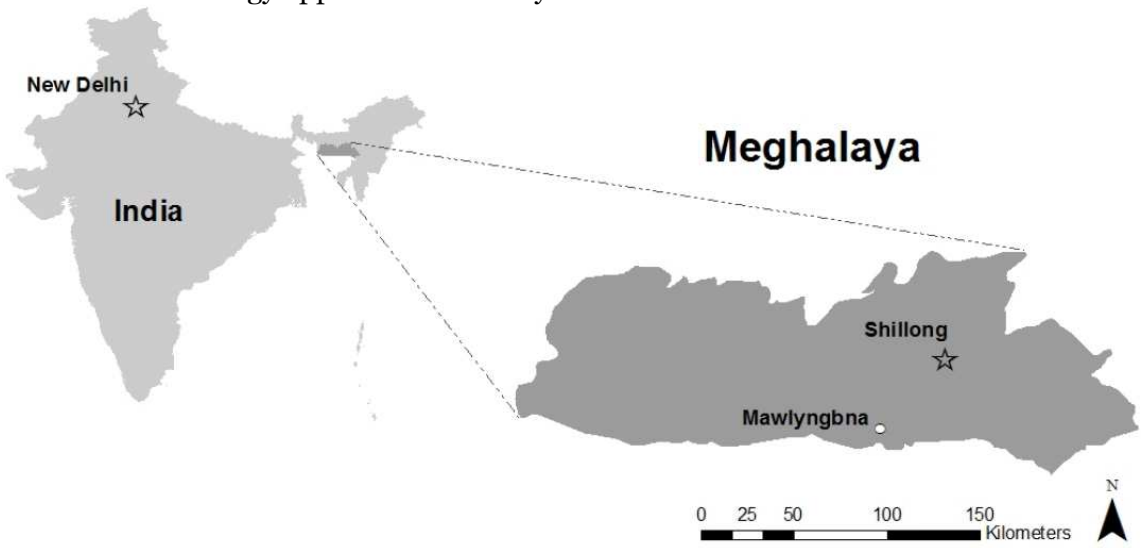

Figure 1: Location of the case study village Mawlyngbna (LaHaela in progress)

To Meghalaya's south, where the case study village is located, the Shillong plateau ends in a continuous escarpment of steep slopes leading into the plains of Bangladesh (Tiwari 2008; Nongkynrih 2002). The two settlements Cherrapunjee and Mawsynram (only a few dozen kilometers away from the case study village) receive the highest rainfall in the world with up to 11,436 mm per year.

Meghalaya is one of the few states where Christianity constitutes the predominant religion. Further, 89 % of its population has a tribal background of which more than half belong to the Khasi tribe. Khasi is also the predominant tribe in the study area (GoI 2001). The three tribes of Meghalaya (the Garo, the Jaintia, and the Khasi) follow the societal system of matrilineality in which descent is traced through the mother and maternal ancestors

Forest Resources

Meghalaya is part of the Indo-Burma biodiversity hotspot (Myers et al. 2000; Ravindranath et al. 2011). The variety in topographic, climatic, and edaphic conditions results in a vast diversity of vegetation in the forests of Mawlyngbna including, for example, rare orchid and medicinal plants species (Tiwari and Kumar 2008). However, in the period 2006 through 2009, the East Khasi Hills lost 15.5 % of its forest cover. The most recent India State of the Forest Report ascribes the losses mainly to land conversion and agricultural activities such as shifting cultivation (GoI 2011b). Further, scholars such as De (2011, January), Lyngkhoi (2006), and Kumar S. (2008) identified numerous additional relevant factors (e.g., population growth, mining activities, poverty, cultivation practices, livelihood pattern, consumption, remoteness of the area, family size).

Political System

In the Sixth Schedule of the Indian Constitution, some states of the NER are granted special rights and a high degree of autonomy compared to other states and union territories of India. The political system is structured into three tiers: the Legislative Assembly, the ADCs, and the local traditional institutions (Nongkynrih 2006). The Constitution of India assigns the Legislative Assembly as the central law-making body in Meghalaya whereas the ADCs control the traditional institutions by appointing and suspending local chiefs and headmen and by passing regulations such as the 'United Khasi-Jaintia Hills Autonomous District (Management and Control of Forests) Act' (1958). The case study village is located in one of the three districts under the jurisdiction of the Khasi Hills Autonomous District Council (KHADC).

Traditional Institutions of the Khasi Tribe

There is remarkable diversity in traditional institutions of the Khasi tribal people varying with communities and locations within the Khasi territory. The territory is divided into states, or *Himas*, which are associations of villages constituted as limited monarchies. The traditional head of a Hima is the king, or *Syiem* who is appointed by the Syiem family of the state and controls the local village markets and the resource management of community land such as forests. The Syiem is responsible for conflict resolution and for the institutional arrangements applied on the Hima level. However, any decisions of importance require the consensus of the executive council, which consists of the ministers (*Myntries*). The heads of Meghalaya traditional territories such as the Syiems meet annualy in the Grand Council of Chiefs of Meghalaya. In their most recent meetings, the Council continued to demand more autonomy for the traditional institutions from the party-based political system (Shillong Times 27 May 2013). Under the Syiem are the village headmen, or *Rangbah Shnong,* who are elected by the village councils (*Dorbar Shnong*) (Gurdon 1975; Baruah 2004; Tiwari et al. 2013).

Although endowed with special importance through matrilineality, women are traditionally excluded from the local Khasi institutions such as the village councils (Baruah 2004; Nongbri 2000; Subba 2008).

Case Study Village

The case study village is located on the edge of the Shillong plateau facing the plains of Bangladesh. It is situated on a south-facing slope with a distance of about 20 km to the Indian-Bangladeshi border and 75 km south of the state's capital Shillong. Mawlyngbna is part of the Hima of Mawsynram with the Syiem being elected by the heads of four principal clans or in a people's vote in the case of an impasse (Gurdon 1975). The dominant vegetation type of the region is tropical evergreen/semi-evergreen (GoM 2005).

The village received public attention through government investments in infrastructure (e.g., a multi-purpose reservoir), through its natural features (e.g., natural springs and the occurrence of urchin (*Echinoidea*) fossils), and through the development engagement of the German Development Organization (GIZ) in the village (e.g., Northeast Today 4 March 2012; Shillong Times 12 November 2012; Times of India 30 January 2011). In their Climate Change Adaptation project, the GIZ selected Mawlyngbna as a model village and prepared an extensive Integrated Village Development Plan (Rathore *unpublished*; Shillong Times 12 November 2012). The plan assesses Mawlyngbna's socio-economic conditions and suggests several possibilities for the creation of livelihood opportunities through development investments.

Theory and Methods

Conceptual Framework

The conceptualization of the analysis is based on the SES framework (Ostrom 2009) which is the result of a continuing scientific effort to extend the Institutional Analysis and Development (IAD) framework (Ostrom 2005) as a holistic tool to analyze relevant variables of a common-pool resource (CPR) system. In the following, both frameworks and their relationships are outlined.

IAD Framework

The IAD framework puts an action situation in the center of the analysis. Ostrom (2005) defines an *action situation* as any situation in which two or more participants decide among a variety of action choices. They are influenced by the biophysical conditions, the attributes of the community, and by the rules-in-use.

Drawing on concepts of game theory, Ostrom (2005) identifies seven working parts of an action situation (see figure 2). The included *participants* are assigned to certain *positions*

that bear a set of possible *actions*. *Potential outcomes* of their actions are related to the available *information* and the extent of control over the linkage between action and outcome. The participants' decisions also depend on the resulting costs and benefits of an action. All of these working parts can be influenced by respective institutions leading to certain outcomes of the accumulated actions involved.

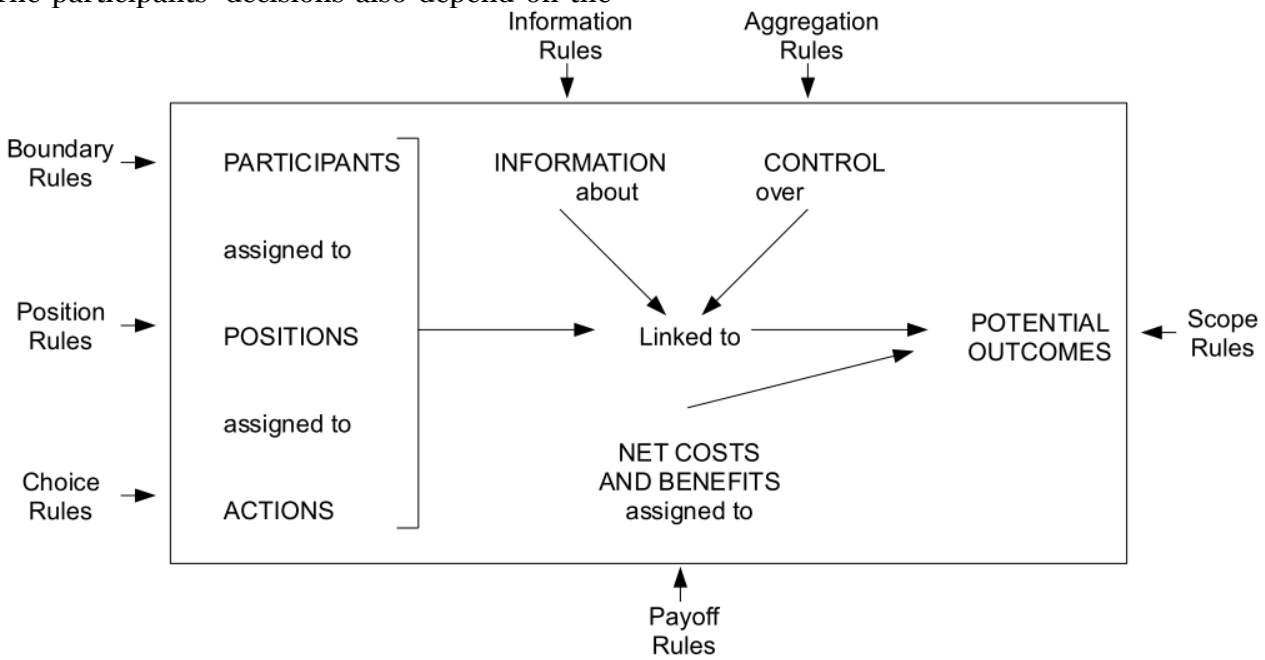

Figure 2: The action situation and the relationships between its elements and rule types (Ostrom 2005: 189)

The framework reflects fundamental differences to the "rational egoist" as the model for human behavior common in economics. Taking into account the complexity of common-pool resource systems, Ostrom (2005) acknowledges the actors' *bounded rationality* in terms of cognitive capacities to handle information, situation valuation, and action selection. That is, bounded rational actors are "goal oriented and try to be rational but face cognitive limits" (Ostrom 2005: 104).

The anthropogenic impact on natural resources or *outcome* depends on the *interactions* among participants and their interactions with the resource. The interactions are a result of action situations in which the participants decide between different options of action and are influenced by the prevailing biophysical conditions, the community attributes, and the rules-in-use (Ostrom 2010). The *biophysical conditions* refer to what choices of actions are physically possible, what outcomes are possible, what causal relations exist between actions and outcomes, and what the actor's information sets contain. If goods are involved in action situations, their characteristics (i.e., excludability, subtractability or rivalness, divisibility, and transferability) determine the decisions of an actor (Ostrom 2005).

Relevant institutions may exist both on the government and on the local level. Government institutions may apply directly on the focal action situation as well as indirectly by affecting local institutions. An implementation failure occurs if formally applicable institutions from the governmental level are considered only partially, erroneous, or not at all in local institutions (John 1998).

SES Framework

The SES framework is the result of a joint effort of scholars to examine the various relevant variables of CPR systems and their relations to the action situation in more detail. As a theoretical map of related variables, the SES framework enables researchers to collect, analyze, and compare data of complex case studies from all over the world (Ostrom 2010).

The multi-tier framework consists of four sets of subsystems on the highest tier: the resource systems, the resource units, the governance systems, and the actors. According to McGinnis and Ostrom (forthcoming) there are multiple sets of each top-tier subsystem with differing characteristics. For example, several governance systems may be deeply involved in

regulating a SES. In addition, the framework acknowledges potential relations with the social, economic, and political settings and with other ecosystems (McGinnis and Ostrom forthcoming). The conceptual structure of the SES framework is illustrated in figure 3.

Social, economic, and political settings (S)

S1 Economic development, S2 Demographic trends, S3 Political Stability, S4 Other governance systems, S5 Markets, S6 Media organizations, S7 Technology

Resource Systems (RS)

RS1 Sector
RS2 Clarity of system boundaries
RS3 Size of resource system
RS4 Human-constructed facilities
RS5 Productivity of system
RS6 Equilibrium properties
RS7 Predictability of system dynamics
RS8 Storage capacities
RS9 Location
RS10 History

Governance Systems (GS)

GS1 Organizations
- GS1.1 National level
- GS1.2 State level
- GS1.3 District level
- GS1.4 Regional level
- GS1.5 Village level
- GS1.6 Boundary organizations

GS2 Nongovernment organizations
GS3 Network structure
GS4 Property rights system
*GS5 Operational-choice rules
- *GS5.1 Community Reserve Forest
- *GS5.2 Private forest

GS6 Collective-choice rules
GS7 Constitutional-choice rules
*GS8 Monitoring and sanctioning rules
GS9 Conflict resolution rules

Resource Units (RU)

RU1 Resource unit mobility
RU2 Growth or replacement rate
RU3 Interaction among resource units
RU4 Economic value
RU5 Number of units
RU6 Distinctive characteristics
RU7 Spatial and temporal distribution

Actors (A)

*A1 Number of relevant actors
A2 Socioeconomic attributes
A3 History or past experiences
A4 Location
A5 Leadership/entrepreneurship
*A6 Norms (trust-reciprocity)/ social capital
A7 Knowledge of SES/mental models
A8 Importance of resource (dependence)
A9 Technology available

Action Situations: Interactions (I) ☐ Outcomes (O)

Interactions (I) (Activities and Processes):

I1 Same-level Interactions
- I1.1 Harvesting
- I1.2 Information sharing
- I1.3 Deliberation processes
- I1.4 Conflicts
- I1.5 Investment activities
- I1.6 Lobbying activities
- I1.7 Self-organizing activities
- I1.8 Networking activities
- I1.9 Monitoring activities
- I1.10 Evaluative activities
- I1.11 Rule Compliance

I2 Cross-level interactions
- I2.1 Financial transactions
- *I2.2 Information sharing
- I2.3 Deliberation processes
- *I2.4 Conflicts
- I2.5 Investment activities
- I2.6 Lobbying activities
- I2.7 Rule-making activities
- I2.8 Networking activities
- I2.9 Monitoring activities
- I2.10 Evaluative activities
- I2.11 Rule compliance

Outcomes (O) Criteria:

O1 Social performance measures
- O1.1 Equity
  - O1.1.1 Wealth distribution
  - O1.1.2 Livelihood Opportunities

O2 Ecological performance measures
- O2.1 Overharvested
- O2.2 Biodiversity
- O2.3 Trend in forest area

O3 Externalities to other SESs
O4 Cross-level performance measures
- O4.1 Institutional knowledge
- O4.2 Capacity building
- O4.3 Trust

Related Ecosystems (ECO)

ECO1 Climate patterns, ECO2 Pollution patterns, ECO3 Flows into and out of focal SES

Table 1: Coding Scheme (adapted from McGinnis and Ostrom forthcoming) *Asterisks: variables with explanatory power; underlined: added variables; greyed: unconsidered variables*

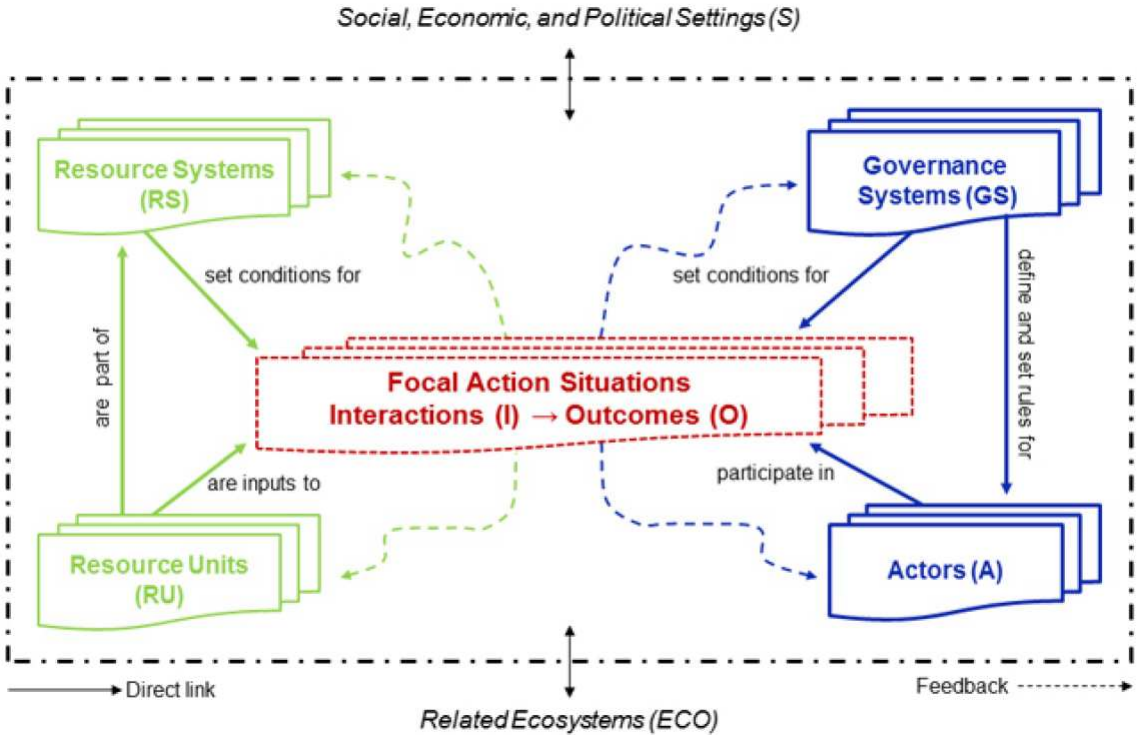

Figure 3: SES framework (McGinnis and Ostrom forthcoming)

The prediction of outcomes draws on the concepts of the IAD framework. Detailed information about the biophysical conditions, community attributes and the set of rules-in-use are provided through the second-tier variables with the particular relationships among the subsystems and the focal action situation being characterized by the SES framework. Interactions and outcomes are then conceptualized as in the IAD framework implicitly including the assumptions of bounded rationality determining human behavior (McGinnis forthcoming; McGinnis and Ostrom forthcoming).

In a mixed approach, the SES framework was adapted for this study. The second-tier variables proposed by McGinnis and Ostrom (forthcoming) were used as the basic structure of data analysis deductively. In a next inductive step, the SES framework was adapted considering the relevance of the particular variables for this case study. The main modifications were done in order to enable the conceptualization of the focal study emphasis on equity and cross-level interactions. Table 1 shows the adapted list of second-tier variables.

Ostrom's Design Principles

Based on the analysis of a multitude of studies investigating governance systems of CPR, Ostrom (1990) posited a set of eight guiding "design principles" as "an essential element or condition that helps to account for the success of these institutions in sustaining the [common-pool resource] and gaining the compliance of generation after generation of appropriators to the rules in use" (Ostrom 1990: 90). The principles received remarkable attention amongst other CPR scholars and were applied in a large number of studies across the globe. Cox et al. (2010) validated the principles in a meta-analysis of 91 such CPR studies and suggested a refined version as shown in table 2.

Principle	Description
1A	User boundaries: Clear boundaries between legitimate users and nonusers must be clearly defined.
1B	Resource boundaries: Clear boundaries are present that define a resource system and separate it from the larger biophysical environment.
2A	Congruence with local conditions: Appropriation and provision rules are congruent with local social and environmental conditions.

Principle	Description
2B	Appropriation and provision: The benefits obtained by users from a common-pool resource (CPR), as determined by appropriation rules, are proportional to the amount of inputs required in the form of labor, material, or money, as determined by provision rules.
3	Collective-choice arrangements: Most individuals affected by the operational rules can participate in modifying the operational rules.
4A	Monitoring users: Monitors who are accountable to the users monitor the appropriation and provision levels of the users.
4B	Monitoring the resource: Monitors who are accountable to the users monitor the condition of the resource.
5	Graduated sanctions: Appropriators who violate operational rules are likely to be assessed graduated sanctions (depending on the seriousness and the context of the offense) by other appropriators, by officials accountable to the appropriators, or by both.
6	Conflict-resolution mechanisms: Appropriators and their officials have rapid access to low-cost local arenas to resolve conflicts among appropriators or between appropriators and officials.
7	Minimal recognition of rights to organize: The rights of appropriators to devise their own institutions are not challenged by external governmental authorities.
8	Nested enterprises: Appropriation, provision, monitoring, enforcement, conflict resolution, and governance activities are organized in multiple layers of nested enterprises.

Table 2: List of Design Principles (Ostrom 1990; modified by Cox et al. 2010)

In this study, the design principles are used to analyze Mawlyngbna's forest SES in detail with regard to its general disposition to sustain in the long run. The foci of the principles ensure the evaluation of fundamental conditions that have to be met by the institutional arrangements in order to promote ecological and social sustainability. As such, the design principles can reveal implications central to the research questions of this study.

Case Study Method

The case study strategy was chosen for the present study that is usually used for the investigation of research units such as processes, activities, or programs that are temporally and topically distinct. The approach can combine various methodological tools in order to study all aspects the specific case (Creswell 2003). Yin (2009) assigns the case study approach to research dealing with "how" or "why" questions concerning contemporary complex social phenomena which enables very little control by the researcher over the events. These preconditions are fulfilled within the setting of this study. Following Yin's classification the form of the research question, the required control, and temporal focus excludes other methods such as the experiment, survey, archival analysis, or history.

Sources of Evidence

For this study, a combination of documentation, direct observation, and expert interviews was found most useful as sources of evidence. Documentation was assessed such as an "Integrated Village Development Plan" (Rathore *unpublished*) commissioned by the German Development Organization (GIZ) and general newspaper articles (e.g., The Shillong Times 12 November 2012) concerning the village. Addressing the limited data basis, documentation was used mainly for corroboration and refinement of information from other sources. In the broader sense of documentation, scholarly publications concerning forest management in Mawlyngbna were considered for triangulating findings.

Direct observation was a constant part of the total of seven weeks of fieldwork that took place from January through March 2013. The direct observations were not formalized as part of the case study protocol but enabled a continuous verification of information from other sources (e.g., attending meetings, harvests, community working days, forest walks, informal talks with

villagers). Being most common in anthropological research, participant-observation requires the active participation of the researcher in the social entity studied. Considering the required effort to become a participant and the remarkable risk of potential bias (Yin 2009), participant-observation was not suitable. Forest related physical artifacts encountered during fieldwork (e.g., forest roads, construction material, tree crops or other forest products), were taken into account in the analysis. However, information from artifacts was mostly useful for the verification of findings from other sources of evidence.

For this study a combination of in-depth and focused interviews after Yin (2009) with a focus on the latter was chosen.

Sampling Method

Bogner et al. (2009) and Gläser and Laudel (2006) suggest the interviewing of expert respondents. Snowball sampling through recommendations of other respondents was applied for selecting the experts (Littig 2009). Sampling focused on groups of villagers whose expertise in forest-related institutional arrangements could be assumed. Additionally, forest governance related actors from the regional, district, and state levels were selected.

The Interviews

In a deductive approach, a preliminary interview guideline was developed through the selection of relevant questions from the 10 forms provided in the field guide of the International Forestry Resources and Institutions (IFRI) research program which includes about 700 questions in total (IFRI 2007). The IFRI is a global research endeavor of 10 research centers that have been investigating for over two decades how institutional arrangements affect community forestry systems at the local level (Wollenberg et al. 2007).

Following the field guide of the IFRI (2007), the interviews were recorded with notes in a field notebook and were reviewed and transferred later into a digital file. This study followed the recommendation of the IFRI protocols (2007) not to voice record in order to avoid intimidating respondents.

Further, Participatory Rural Appraisal (PRA) techniques were used: A timeline elaborated with the villagers provided a historical background of the community forest and transect walks often accompanied by villagers allowed a geographic overview and direct observation of the village's forest resources (Scheyvens and Storey 2003; IFRI 2007). Additionally, in collaboration with the concurrent biodiversity studies the land use and land cover was of Mawlyngbna's forests mapped using GPS and GIS technology and the maps were reviewed with villagers.

Qualitative Content Analysis

The notes taken during the semi-structured expert interviews were analyzed using the Qualitative Content Analysis method. The method ensures compliance with the social science principles of openness for new information, traceability through a clear iterative procedure, and replication through the documentation of each interpretive operation. The analysis consists of four steps: the theoretical preparations, the extraction, the formatting, and the interpretation (Gläser and Laudel 2006).

Explaining Outcomes

Ostrom (2005) differentiates between strong and weaker inferences. The former is limited to action situations with precisely defined conditions of a situation (e.g., the specific information available to the actors) whereas the latter is likely in less constrained, more complex situations (e.g., interactions in CPR systems).

In an attempt to structure such weaker inferences in institutional analyses, Gibson et al. (2005) propose a logic model based on the working parts of an action situation. The manifestations of the second-tier variables contained in the resource systems, resource units, governance systems, and actor components define the context of an action situation resulting in a set of incentives to the relevant actors. In turn, the accumulated interactions determined by such incentives constitute patterns with distinct outcomes (see figure 4).

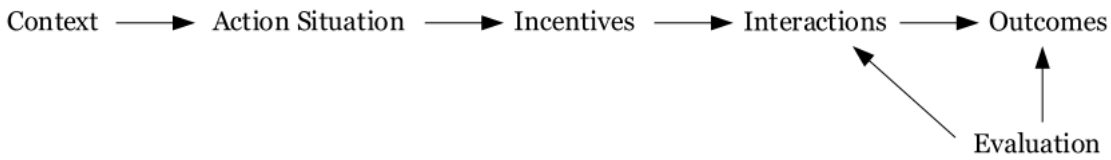

Figure 4: The Most General Elements of Institutional Analysis (adapted from Gibson et al. 2005)

The logic model is the dominant concept for the institutional analysis in this study. Interactions and outcomes were evaluated using criteria such as sustainability and equity respective to the research questions.

Results

Ecological Performance: Sustainability (H1)

Fulfillment of Ostrom's Design Principles

In the following, Mawlyngbna's forest-related institutional arrangements are tested using Ostrom's (1990) design principles.

Design Principle 1: Clearly Defined Boundaries

A) Users Boundaries

Access to forest resources is clearly defined by the requirement of Mawlyngbna residency (GS5).

B) Resource Boundaries

The boundaries of the CRF are clearly defined and well known according to the respondents. Although also defined and often marked (e.g., with rocks indicating the boundaries), the private forest patches are too numerous for the villagers to know the property right details for all of them (RS2).

Design Principle 2: Congruence

A) Congruence with Local Conditions

Mawlyngbna's forest related institutional arrangement was exclusively created by the local users addressing the specific requirements of the forest SES (GS5).

B) Appropriation and Provision

In terms of the CRF, minimal provision such as maintenance investments are required. The forest resources specified in the institutional arrangements can be extracted by every user equally. However, cutting live trees (e.g., for construction timber) is limited to certain user characteristics (GS5).

Congruence with the local ecological conditions is not ensured since the allowance to cut live trees is independent from the actual presence thereof (GS5).

Design Principle 3: Collective-Choice Arrangements

Only Mawlyngbna's male adults can directly participate in the creation and modification of forest related rules through involvement in the Village Council (GS6). However, it was reported that women raise their concerns indirectly through the activities of the Women's Organization and informally through discussions with their male family members.

Design Principle 4: Monitoring

A) Monitoring Users

As Mawlyngbna's users are the monitors themselves (GS8), the combination of strong norms (A6) and a wide distribution of solid institutional knowledge (I1.2) results in strong social control (I1.9).

B) Monitoring the Resource

No formal monitoring system is employed for controlling the state of Mawlyngbna's forest resources (GS5). Management is based solely on traditional knowledge and anecdotal observations.

Design Principle 5: Graduated Sanctions

Mawlyngbna's sanctioning rules are decided upon based on the circumstances and the severity of the particular incident of infraction. The magnitude of punishment is also graduated, depending on if a culprit repeatedly violates the rules (GS8).

Design Principle 6: Conflict Resolution Mechanisms

Similar to matters of sanctioning, the responsibility for conflict resolution also lies with the Village Headman in consultation with the Executive Committee (GS9). The court as part of the modern governance system was not mentioned for dispute settling (I2.4).

Design Principle 7: Minimal Recognition of Rights to Organize

The 6th schedule of the Indian Constitutional recognizes the right of self-governance for the tribal people listed in the amendment annex. This autonomy recognition was also reflected in the statements of higher level respondents

(GS1.2). In addition, tenure rights are secured in the long term through the traditional property rights system of the Syiemship (GS4).

Design Principle 8: Nested Enterprises

Mawlyngbna's forest governance system is embedded into a nested structure of governance levels (GS1). However, institutional dissonance (i.e. conflicting competences) and impeding factors such as mistrust among actors of different levels shows substantial shortcomings of the cross-level interplay (I2.4).

Explanatory Variables and Mechanisms

The phenomenon of analysis of hypothesis 1 is the ecological state of Mawlyngbna's forests for which the outcome variables "Overharvested" (O2.1) describing the level of disturbance, "Biodiversity" (O2.2), and "Trend in Forest Area" (O2.3) are used as indicators. The values of these variables in combination with the fulfillment of the design principles above allow for recommendations on the evaluative criteria such as the sustainability of Mawlyngbna's forest-related institutional arrangements.

In general, the outcome variables indicate a relatively intact ecological state in the CRF (LaHaela *in progress*). However, lower values for tree height and basal area in combination with increased signs of disturbance (e.g., cutting and grazing) in a comparable environmental context (e.g., similar slope, exposition, soil properties) imply higher rates of resource extractions in the private forest patches. As a result, private forests contain less quality construction timber (tall, large-diameter trees of certain species), less genetic resources (including valuable uses potentially discovered in the future), as well as lower effects of production diversification and risk reduction.

The focal action situation in this section is the villagers' interactions with their forest resources. As outlined above, its working parts are influenced more or less strongly by a variety of variables. Figure 5 shows the variables that are particularly influential in ecological performance and their relationship to the working parts of an action situation.

On the macro level, the outcome variables "Overharvested" (O2.1), "Biodiversity" (O2.2), and "Trend in Forest Area" (O2.3) as indicators of the ecological state of Mawlyngbna's forests are directly influenced by the amount and types of resources (RU5) being extracted from the sites through harvesting activities (I1.1).

The incentives leading to the state of Mawlyngbna's forests on the macro level through the cumulative actions directly depend on the set of outcomes a user potentially has to face as a result of his or her actions. The villagers' sound knowledge of the local institutional arrangements (A7) and of the forest boundaries (RS2) through effective information sharing (I1.2) ensures their informed decisions. The rule-enforcing mandatory presence (GS5) at the Village Council meetings might contribute effective information sharing at least amongst the Village Council members whereas nonmembers such as women or minors are informed in less formal ways (e.g., conversations at home).

The combination of strong norms (*A6) and a high degree of social control (*I1.9) make infractions in Mawlyngbna's forests potentially very costly both monetarily and in terms of delta parameters. Mawlyngbna's rules put the responsibility on every villager to monitor the other users and to report infractions to the headman (GS5). This responsibility might be supported by the level of trust in the efficiency of the monitoring and sanctioning setup (*A6). On the other hand, forest resources are of great importance for the villagers' livelihoods (A8) and resource extraction can substantially increase their income. Both incentives support the model of a cost-benefit ratio favoring actions in compliance with the rules while allowing for the promotion of resource extraction when and where it is allowed.

This reasoning implies that the difference in the values of the outcome variables for the CRF and the private forests are a result of the differences in harvest restrictions included in the institutional arrangements (GS5). Since the choices of harvesting actions in the CRF are substantially limited to certain forest resources (e.g., deadwood, fruits, approved amounts of construction timber) whereas there is hardly any restriction applied to the private patches, the incentives described above infer higher extraction activities in the latter. This inference matches LaHaela's (*in progress*) findings of a higher Shannon diversity index and a lower disturbance index in the CRF compared to the private forests.

Social Performance: Equity (H2)

Livelihood Opportunities and Wealth Distribution

The distribution of wealth (O1.1.1) was found to

be substantially channeled by the access to forest resources (O1.1.2). Forests provide resources such as fuel wood, timber, medicinal plants, and fruits that are essential to the villagers' livelihoods. Furthermore, on arable land of non-protected forests, income can be generated by cultivating cash crops such as broom grass (*Thysanolaena maxima*), bay leaf (*Cinnamomum tamala*) and areca nut (*Areca catechu*). Access to the CRF is a right that is equally inherent to every inhabitant of Mawlyngbna, whereas user rights to private forests have to be transferred through inheritance or acquisition. Whereas descent is regulated through the matrilineal system, forest acquisition has become possible only if patches are offered for alienation and if the compensation for the growing stock can be afforded. When user rights for private forests are held, the amount and size (RS3) of the patches define the quantity of the possessed forest resources (RU5).

An interesting institution implemented as an essential equity mechanism operates against the extensive exclusivity of the right to use private forests. By permitting all residents to quarry stones in all non-CRF irrespective of the land tenure of a particular patch, substantial additional forest-related livelihood opportunities were created that do not depend on the amount of private forests that the villager holds user rights for. However, despite its positive effect on equity, in its current form, the ecological impact of the institution is rather severe.

On the other hand, the CRF is equally accessible for every villager and its institutional arrangement entails a sort of redistribution mechanism by granting timber to specific groups of inhabitants (GS5.1). However, these groups include households that are not necessarily in special need. The broad criteria of *families* as legitimate applicants does not select by the wealth status or by the amount of private forest patches under their control. Moreover, as reported by the respondents the quantity of forest resources such as firewood or construction wood found in the CRF is determined to a great extent by the number of collectors (A1).

The reported increase in effort required for collecting forest products in the CRF emphasizes the importance of access to private forests. Figure 5 shows the mechanisms summarized above.

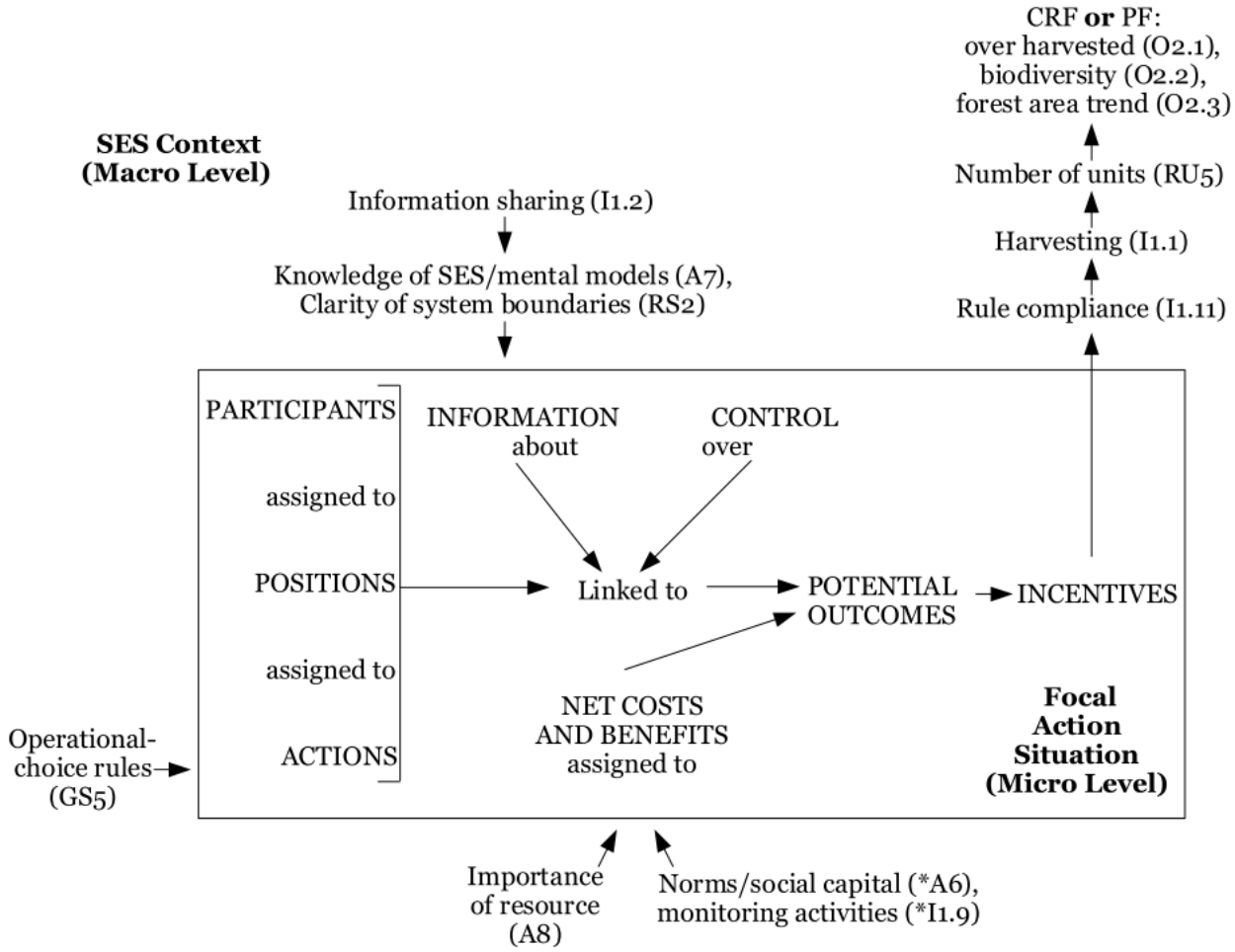

Figure 5: The action situation in Mawlyngbna's forest SES and the influencing variables.

Privatization and Commercialization

A development in Mawlyngbna's property rights system, which might be most accurately termed "privatization", had a major impact on equity in the village. Over time, increasing amounts of arable land (that was initially mostly forested) was claimed through cultivation or through other investments as private patches for which the institutional arrangements grant exclusive user rights to the claimant. Respondents stated that population increase (A1) was a major driving force in this development. The "three-year-rule" promoted the long-term claim of such land and the overall consolidation of the land distribution.

As increasing areas of land were taken under exclusive cultivation, abandonment of such patches decreased and the "three-year-rule" lost its relevance. At some point (the respondents' time specifications vary between 45 and 60 years ago) all arable land was claimed and, ever since, if a villager needed space to cultivate, it could only be acquired through the transfer of user rights. If not inherited, such transfers usually include a compensation for the crops growing on the alienated sites implying monetary valuation (i.e., the commercialization of arable land). The mechanism is illustrated in figure 6.

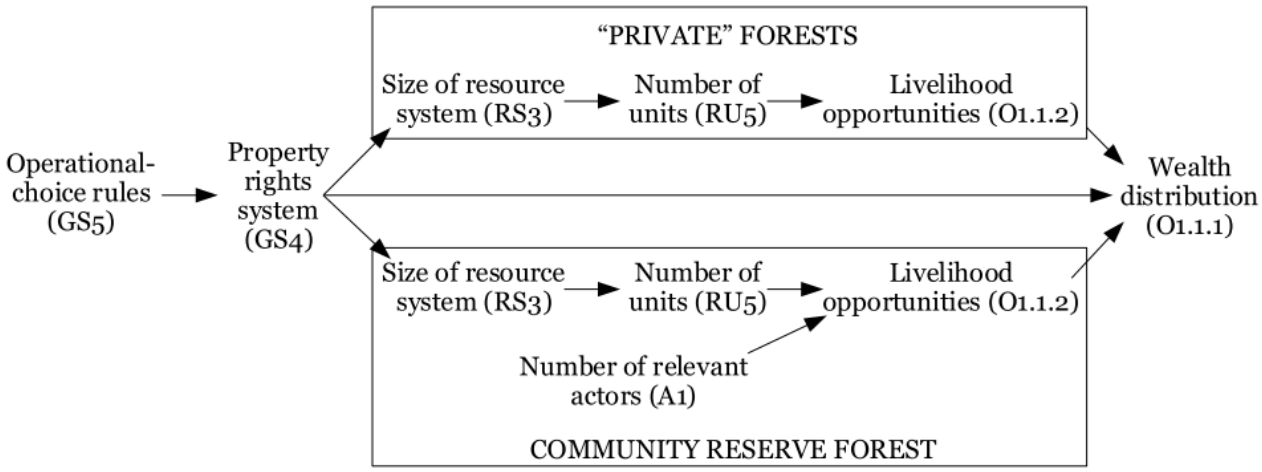

Figure 6: Mechanisms influencing equity.

Deprivatization

In contrast to the mechanisms above, an area of 7.4 ha of private forest was annexed to the CRF. The patches that are located along the eastern boundary of the CRF were used as cemeteries and as bay leaf cultivation grounds. The prior users are allowed to harvest their crop trees until they died off. However, no further management is permitted.

Through the mechanism, although only used marginally so far, access to prior exclusively used forests are made available to all villagers. The deprivatization mechanism restores forest area as CPR which increases equal livelihood opportunities (O1.1.2). The mechanism is illustrated in figure 7.

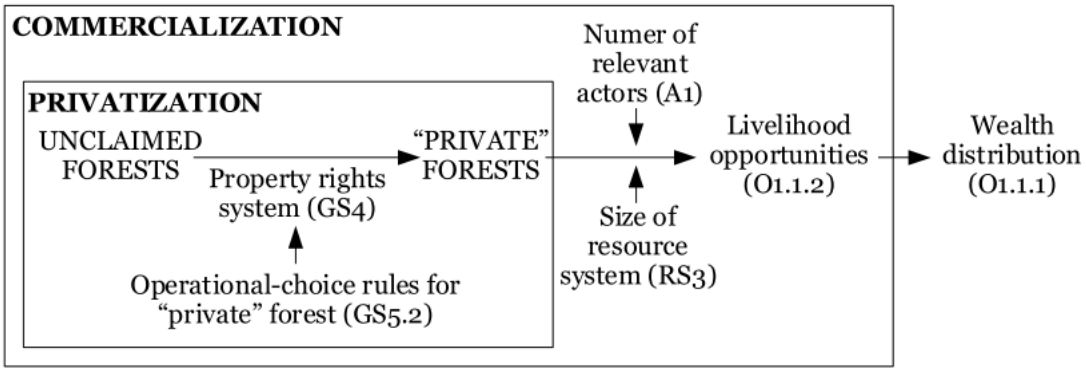

Figure 7: Privatization and commercialization mechanism.

Gender-related Equity

Political equity is constrained by the traditional custom of male dominance in the collective-choice processes. Although women participate indirectly through networking activities by the Women's Organization, final decisions are made by the male villagers. However, female respondents expressed their acceptance of this traditional custom.

Performance of Cross-Level Interactions

As a village of exceptional social and natural features, Mawlyngbna came into the focus of various actors on the state government level. The village became a model for local development efforts and government programs invested comparatively large amounts of money in its infrastructure such as irrigation and water facilities as well as in the distribution of solar lights. However, in terms of forest management, minimal interactions were found between the village and governance organizations of other levels.

There are some noteworthy efforts to enhance the forest-related, cross-level interplay by organizations of higher levels. Examples include the FED's endeavor to provide remote-sensing based inventory data in order to support communities in implementing a working scheme (I2.2), allegedly successful JFM enterprises, and the forest registration and rule codification process by the KHADC (I1.2). Yet, only some consultation meetings with the KHADC and a regional forest plan by the Syiem were found in Mawlyngbna and there appears to be minimal influence on the forest

governance system by actors from other levels (I2). The various levels and their relationships are illustrated in figure 8.

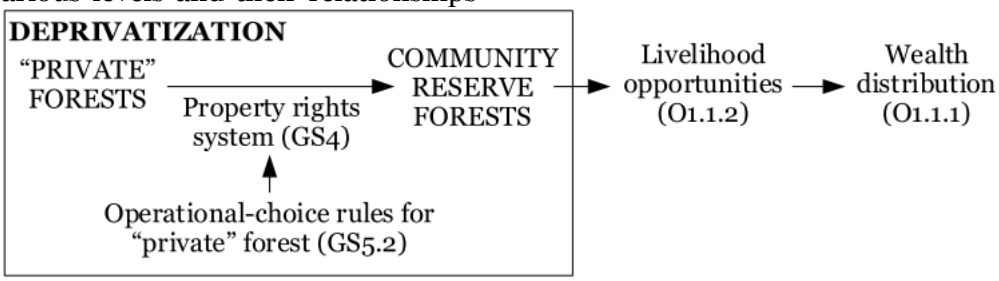

Figure 8: Deprivatization mechanism.

This is reflected in the outcome variables O4.1 and O4.2. Forest-related institutions enacted from other levels were almost completely unknown and cross-level capacity building activities were not found. At the same time, the villagers' statements show both hopes and reservations towards cross-level interactions. The villagers voiced strong *concerns* about potential encroachment on their autonomy and independence. Interviewees from higher levels mentioned constraints resulting from the abundant illiteracy among rural people which inhibits administrative processes. They also confirmed the villagers' suspicion that the motives of government authorities can be sometimes corrupted by their party political and power interests. In addition, corruption on the government side and the often disproportionate demands raised by the communities undermine the sincerity in cross-level interplay. A rather structural constraint was mentioned in terms of the state government's capacities. Cross-level interactions (e.g., law enforcement at the Indo-Bangladesh border to prevent timber smuggling, hearing of forest related cases at the courts, or constitution of new JFM committees) are limited by financial and staffing constraints.

However, the respondents articulated *potential benefits* from forest related cross-level interactions. Capacities to deal with large-scale hazards such as diseases and climate change impacts can be effectively built with help from professional organizations of other levels. Furthermore, investments such as infrastructure facilities often exceed the financial capacities of communities which makes cross-level funding necessary. Table 4.4 summarizes both the potentials and the constraints of cross-level interactions as stated by the respondents.

Potentials	Constraints
Source of funding	Concerns about losing autonomy
Access to scientific knowledge	Focus on politics/power by government actors
Capacity building	Corruption
Coping with large-scale hazards	Disproportionately high demands by communities
	Illiteracy
	Limited staff capacities of government actors

Table 4.4: Potentials and constraints of cross-level interactions as perceived by the respondents

The villagers showed interest in the potential benefits of cross-level interactions. However, they would continue to refuse such interactions unless agreements (with the uncorrupted intension of mutual benefits) are found with trustworthy partners.

Discussion

CPR Research Tools: Including the Focus on Social Sustainability

Conceptual Framework and Design Principles

As expected in social-ecological systems (SES), data collection and data analysis was characterized by substantial diversity and complexity of variables and relations (Ostrom 2009). In this case study, the SES framework proved to be a strong tool for both structuring

the diversity of data and making findings comparable to other studies in often disparate contexts through a "common conceptual language" (McGinnis and Ostrom forthcoming). The framework fulfilled its initial purpose of promoting a more diagnostic approach as against common "blue print" or "panacea" solutions (Ostrom 2007). However, in order to address the specific foci of the research questions, some modifications were required. On the one hand, some variables were left unaddressed because of their minor relevance (e.g., RU6 "distinctive characteristics", ECO2 "pollution patterns") or because no solid base of evidence could be found (e.g., S3 "political stability", RS6 "equilibrium property").

On the other hand, the provided set of variables was insufficient for the detailed analysis of central common-pool resource (CPR) issues such as equity and cross-level interactions. Additional variables were required to cope with the numerous organizations of multi-level governance systems (e.g., differentiated GS1 variables), with cross-level interactions (e.g., cross-level information sharing), and with the specific outcomes (e.g., trust among actors from different levels). Similarly, analyzing equity implications requires clearly defined outcome variables such as the observed wealth distribution or livelihood opportunities (see table 4.2).

The integration of concepts from the Institutional Analysis and Development (IAD) framework such as the action situation and its working parts, added to the analytical power of this institutional analysis. However, further theoretical research is required at the interfaces of both frameworks. For instance, which SES second-tier variables are related to the particular working parts of the action situation and how are these relations characterized?

Ostrom's Design Principles

In a recent meta-analysis of 91 studies including 77 cases, Cox et al. (2010) confirmed the power of Ostrom's design principles by explaining the success or failure of CPR activities. The present case study also supports these findings. The forest SES of Mawlyngbna fulfills most of the design principles to a remarkable degree. However, the present study also shows two noteworthy shortcomings of the institutional analysis based on the design principles.

First, the design principles do not explicitly address long-term, large-scale environmental and socio-economic challenges such as climate change or unprecedented population growth as a potential threat to CPR systems. Building resilience against such threats requires proactive, adaptive governance and potential collaborations with external actors and organizations. In their study, Folke et al. (2002) provided three central policy implications when aiming for resilient SES management: 1) to promote awareness of the human-environmental interdependencies, ecological thresholds, and uncertainty, 2) to establish realms for multi-level governance collaborations enabling a diversity of adaptation options through learning and capacity building processes, and 3) to encourage the implementation of indicator and early warning systems in order to detect and react upon resilience loss and threshold effects in time.

The second shortcoming is that mechanisms leading to inequitable resource access among the users are not tackled by the design principles. In their short discussion of the second principle (i.e., congruence between appropriation and provision rules and local conditions), Cox et al. (2010) require the relativity of equity perceptions to the resource abundance. However, as found in the present study, equitable resource distribution can depend substantially on access rules constituted in the property rights system. To actually be able to both provide input and gain benefits from a CPR, equitable access rights are necessary (Poteete 2004, August). It can be argued, in the case of Mawlyngbna, if the private patches can be still considered as a part of the CPR and thus if the design principles apply to these forests at all. However, Ostrom's (2005) definition of high subtractability and high difficulty to exclude potential users is also valid in the private patches. The distributional authority of the Syiemship and the instances of expropriation show that the "owners" of private patches do not hold the full bundle of ownership rights (Alston and Mueller 2005). As a result, although CPR systems that fulfill the design principles may exist for a long period of time and efficiently sustain the resources, such systems may still cause substantial equity discrepancies.

Both constraints mentioned above can substantially impair social and ecological

sustainability.

Sustainable Forest Governance: The Role of Norms and Resource Monitoring

Based on the results outlined in section 4.2, hypothesis 1 is retained. Mawlyngbna's forest-related institutional arrangements safeguard to a high degree the forest resources in the long term. However, considerable constraints were also found. In the following, implications of these constraints and potential solutions are discussed.

Evaluated by Ostrom's design principles (1990), Mawlyngbna's institutional arrangements constitute a solid basis for sustainable forest management. However, as shown in section 4.2.1, some shortcomings are worth mentioning.

As the cutting limit of a maximum of 50 live trees per applicant and year is not based on a system of monitoring the CRF's capacity to provide such resources (principle 4B), the congruence of appropriation with the local conditions (principle 2A) is not likely. The respondents already report increasing difficulties in finding certain resources in the CRF which may indicate the first consequences of such incongruence. In the long run, it may lead to the depletion of CRF resources and at the same time increase pressure on the private forests.

The rule allowing stone quarrying all over Mawlyngbna's non-protected forests may offer considerable livelihood opportunities. However, anecdotal observation on transect walks during the fieldwork period led to the conjecture that the impact of the institution in its current form is rather severe. Substantial areas of forest were cleared of vegetation and soil and left prone to further degradation, namely erosion. However, further research efforts are required to confirm these assumptions.

Considering the importance of forest resources for the villager's livelihoods, principle 4A (monitoring users) appears to be remarkably well fulfilled in Mawlyngbna. It seems that the conservational wisdom inherited by the forefathers in combination with a strong consciousness of traditional values in general has created a solid set of norms as the main pillars of Mawlyngbna's forest governance system.

The wide autonomy of Mawlyngbna's governance system from actors of other levels (principle 7) appears to support the identification of the villagers with their governance system by creating a sense of responsibility for the resources within the village boundaries.

Ostrom's (1990) stipulation of nested organizational forms as a necessary prerequisite for successful CPR management (principle 8) appears to be the least fulfilled principle.

Privatization and Commercialization: Undermining Common-property and Equity

Based on the results outlined in section 4.3, hypothesis 2 is retained. Mawlyngbna's institutional arrangements promote inequitable distribution of forest resources over the long term. The days when villagers were able to satisfy their subsistence needs simply by finding and cultivating a free piece of forest are over. Population growth may have caused the limited resource area to be claimed by increasing numbers of villagers. An additional mechanism of explanatory power in this respect was reported by George and Yhome (2008, July), by S. Kumar (2008), and by Lyngkhoi (2006). Increasing importance of new consumer goods (e.g., mobile phones, television sets) that are being introduced with progressing economic development creates a need for income that exceeds self-sufficiency. To be able to afford the new means for a higher standard of living, more land, additional to those needed for subsistence living, must be claimed for the cultivation of cash crops. As a consequence, not only are there more people requiring land, but also additional land is being claimed and used for cash crops.

For various reasons, access to arable land became a scarce good and, on the basis of Mawlyngbna's property rights system the right to use non-protected forest became not only exclusive but also inequitably distributed amongst the families of the village. Thus, notable implications of livelihood opportunities and wealth distribution emerged. Similar mechanisms were reported all over the state for example by Tiwari and Shahi (1995) and S. Kumar (2008). In the evaluation of indigenous resource distribution systems in Meghalaya, Nongkynrih (2006) emphasizes that resource distribution is perceived as equitable or “fair” if it considers the particular situation of the participating users. Additionally, Poteete (2004, August) states that “only those who have the

means [to contribute] can contribute", arguing that resource distribution only based on the users' contributions often fails to be equitable. Mawlyngbna's property rights system appears to fall short of such considerations in its distribution of access rights to private forests.

This case study also supports Poteetes (2004, August) argument that participation is not a guarantee for equity. The shortcomings of Mawlyngbna's forest-related institutional arrangements exist despite the fact that all male adults are members of the Village Council.

The improvement of political equity through integration of women into the governance process offers major potentials in Mawlyngbna. Several studies showed the positive effects on the forest condition when women participate in the legislative bodies such as the village councils (Agarwal 2010; Pandolfelli et al. 2007). As shown in this study, through their central involvement in the collection of firewood and non-timber products, Mawlyngbna's women are important actors and bear essential knowledgeable about the state of the forest resources. Their integration into the Village Council could not only institutionalize the women's opportunities to voice their concerns, it could also expand the scope of forest management decisions through the integration of their perspective as forest users. For example, as women appear to be traditionally more involved in the collection of firewood, management and governance decisions concerning this resource might gain in congruence with the actual conditions. Furthermore, support of the Village Council's collective-choice decisions and the information flow about thereof might increase with the women's involvement.

Re-establishing Common Property

Although only a small area of private forest was expropriated and re-established as CRF, it still indicates a remarkable realization process of the importance of CPR. Similar processes were only rarely observed in other studies (e.g., Tiwari et al. 2010). Considering the importance of forests as CPR for people's livelihoods, biodiversity, water supply, carbon sequestration, and so forth, this decision by the Mawlyngbna villagers is most likely a step forward and can pose as a model for other villages.

Cross-Level Interactions: Building Trust and Capacities

Although cross-level interactions were reported in many other respects, collaborations with actors from other levels concerning forest affairs were marginal. At the same time, Mawlyngbna's forest management faces large-scale, long-term challenges which require new strategies and capacities to be tackled.

Mawlyngbna's inhabitants managed their forests sustainably for at least a century on the basis of traditional knowledge. The question is, can Mawlyngbna's traditional forest management system cope with relatively new, large-scale, long-term challenges such as effects of climate change on the local ecosystem or substantial growth of the village's population? Tiwari et al. (2013) argue that the answer is affirmative if traditional governance systems adapt to such changes. For instance, sustainable forest management planning can constitute an effective means in tackling the issue of changing resource demands (Singh 2008). However, such measures require solid and detailed knowledge about the state of Mawlyngbna's forests as well as efficient data collection and planning techniques. Collaborations with experienced partners can help to build capacities by providing skills and resources.

There are a variety of organizations in Mawlyngbna supporting communities in forest management. In the following, a selection (though without the pretension of being complete) of such organizations are discussed. Potential partners include both government bodies and non-government organizations (NGOs) and are illustrated in table 5.1.

Possible Partner	Potentials	Constraints
Forest & Environment Dept.	High funding capacities	Low level of trust
	High professional capacities	Legal preconditions
	Legal timber sale through 'forest	Potential dependence and

Possible Partner	Potentials	Constraints
	working plan'	autonomy constraints
		Party politics-driven
Khasi Hills Autonomous District Council	High level of trust	Low funding capacities
	Contacts to FED	Party politics-driven
		Limited political influence
NGOs (e.g., Bethany Society, FES, Community Forestry International, IFAD)	Politically independent	Low political influence
	Potentially high level of trust	
	High professional capacities	

Table 5.1: Potentials and constraints of possible collaboration partners for Mawlyngbna's forest governance system

The Forest and Environment Department (FED) is the central forest authority in Meghalaya. It employs about 1,500 staff members who are responsible for the entire state, bears assistance of major technical facilities such as remote-sensing capacities, and has direct access to state and national forest-related budgets distributed through programs and schemes[1]. Further, the joint elaboration of a 'forest working scheme' allows the legal sale and export of timber across the village boundaries. On the other hand, mistrust against the FED appears high among the villagers and scholars warn that the government's notion of development undermines the conservation of tribal institutions and the communities' self-governance (Kumar, S. 2008). It is feared that collaborations would lead implicitly or explicitly to dependencies or restraints of the village's forest self-governance autonomy. The emphasis of government authorities on party political and power considerations is looked upon with great suspicion.

However, the suspicion appears mutual as the State of the Environment Report 2005 of Meghalaya states that "the communities in general, the land owning clans/communities, private forest owners, and the management systems in place for the management of these forests are to be blamed for such a decline in quantity and quality of the forests of the state, as the government do not have any interference in the management of community forests." (GoM 2005: 49 f.).

The Joint Forest Management (JFM) program in Meghalaya may provide a promising setting for a community-government co-management endeavor (Ghate and Ghate 2010). For example, beside the related funding opportunities for afforestation projects, the partnership might build capacities such as technical and scientific knowledge. Further, Roy and Mathur (2003) suggest an integrative power of the JFM endeavors in terms of gender-related participation by promoting the women's participation in self-governance bodies such as the village councils. However, although comments both by respondents and by the press (e.g., The Telegraph 29 May 2013) as well as experiences of similar approaches in other countries (Gautam and Shivakoti 2005) appear promising, there is also major criticism (e.g., Poffenberger ed. 2007) and scholarly evaluations of the JFM activities in Meghalaya are very rare (e.g., Kumar, S. 2008).

The Mawlyngbna inhabitants appear to have a higher level of trust with the KHADC. Though bearing limited staff and technical capacities, the KHADC can represent the villager's interests with the FED. Similarly to the FED, however, its members are elected from parties and hence are also politically motivated. Additionally, through demarcation disputes with the state government level, the political

[1] Website of the Forest and Environment Department: http://megforest.gov.in/megfor_orgn_persnl_strength.htm, retrieved 07/26/13.

influence of the KHADC is limited (Kumar, S. 2008).

NGOs may constitute potential partners with a high level of mutual trust considering their wide independence from political bodies. Even though they are often also limited in staff and technical capacities, such organizations can provide substantial knowledge and technical know-how. Promising results were reported from such community-NGO collaborations in the neighboring Hima Mawphlang (Poffenberger 2012).

Besides its constitutional responsibility to control and support traditional Khasi institutions and positions such as the Village Headmen or the Syiems, the KHADC was perceived by their interviewed representatives as a protector for the Khasi culture and traditions and as an advisory body in regards such as the environment.

Considering the large-scale, long-term challenges for Mawlyngbna's forest resources on the one hand and the potentials in cross-level collaborations on the other, hypothesis 3 is retained. Organizations from other levels can contribute remarkably to the robustness of Mawlyngbna's forest governance system.

Conclusions

This study analyses a unique institutional setting that is interesting in many aspects. The degree of the autonomy of tribal peoples in terms of forest governance and the proportion of forest area under community forest management in India's North Eastern region – particularly in Meghalaya – are outstanding. What is further interesting is the study area being part of a global biodiversity hotspot and receiving some of the highest rainfall in the world.

The present study's methodology proved to be effective in analyzing Mawlyngbna's institutional arrangements. However, the reviewed versions of both the social-ecological systems (SES) framework and the design principles required modifications in order to address the study's foci. Additional variables are needed in order to include the analysis of equity and cross-level interplay in the SES framework. Similarly, equity questions concerning the local users' livelihood opportunities through resource access and implications on social sustainability are not tackled by Ostrom's (1990) design principles on arrangements of collective action for the management of common-pool resources (CPR). Also, the proactive adaptation of institutional arrangements to challenges evolving over the long term and affecting systems on a large scale is not considered.

Overall, the design principles are met to a large extent by Mawlyngbna's forest governance system. The user and resource boundaries are clear and the rules are congruent to a large extent with both local conditions and in terms of the ratio between input and benefits. The decisions and rules are results of collective-choice processes and efficient user monitoring is in place resulting in potentially costly infractions through a system of graduated sanctions. Further, conflict resolution mechanisms are provided and the right to self-govern the resource system is acknowledged to a remarkable extent by government authorities. However, major discrepancies are present in the lack of systematic resource monitoring, the exclusion of women from collective-choice, and the extensive segregation from other governance levels.

Mawlyngbna's forest-related institutional arrangements were found to be built to a large degree on the villagers' devoted identification with ancestral values resulting in strong intrinsic motivation to protect the forest by obeying and enforcing the rules. In addition, the extensive autonomy was found to promote the villagers' sense of responsibility for their forest governance system and may support congruence of the institutional arrangements with local conditions. However, the community reserve forest (CRF) and the private forest patches showed differing ecological states that were found to result from two different sets of rules. Whereas the institutional arrangement applying to the CRF creates incentives to restrict the use of the forest resources, the rules applying to the private patches result in incentives less restrictive. Accordingly, several structural parameters such as average basal area, height, and diversity are higher in the CRF. These higher parameter values support the concept that structural complexity, as an indicator for biodiversity, is markedly higher in the CRF (LaHaela *in progress*).

Constraints of Mawlyngbna's forest-related institutional arrangements were found in terms of both economic and political equity. Whereas the CRF offers equitable resource access for all villagers, mechanisms of privatization and

commercialization were found to impede equitable livelihood opportunities in the private forest patches. However, some institutional efforts addressing the equity issue were found such as the permission of stone quarrying in all non-protected forests irrespective of "ownership" and incidents of deprivatization. On the other hand, equity is imbalanced by the exclusion of women from collective-choice arenas of the village, a practice that appears enrooted in the Khasi culture resulting in marginal direct influence of female community members.

In terms of Mawlyngbna's forest governance system, cross-level interactions were found to be minimal. Consultations in matters of forest management with actors from the regional, district, and state level were limited to occasional and informal meetings. As an explanation, several constraints of cross-level interactions were identified. The respondents from Mawlyngbna expressed a lack of trust in actors from the government level and feared collaborations could compromise the village's autonomy in forest-related decisions. Additionally, respondents from all levels reported the risk of community-government interactions to be undermined by party political and power interests as well as corruption. Furthermore, limited financial and personnel capacities restricts such collaborations. On the other hand, a variety of possible partners were identified offering remarkable potentials for Mawlyngbna's forest governance system. Besides funding opportunities and technical support, cross-level collaborations might improve the capacity of the villagers to adapt the forest-related institutional arrangements to large-scale and long-term threats such as climate change and population growth.

In summary, this case study provides several contributions to the current scholarly literature on design properties of CPR governance and on community forest management in Meghalaya. First, Mawlyngbna constitutes a case of remarkably strong traditional institutions in the unique situation of a state in which communities enjoy major autonomy of their natural resource management. In an interdisciplinary approach, this study uses various sources of evidence for a detailed analysis of how Mawlyngbna's institutional arrangements can be an effective means to conserve forest resources in such a setting.

Further, the study confirms some of the recent scholarly criticism about the design principle approach (Ostrom 1990) calling for the integration of social sustainability aspects such as equity into institutional analyses and for intensified diagnostic efforts (Agrawal and Benson 2011; Cox et al. 2010; Ostrom 2007; Young 2002).

Moreover, this study adds to the few scholarly insights into the causal mechanisms of forest resource distribution within the traditional community governance systems of Meghalaya and emphasizes the importance of equity considerations. Finally, in order to cope with large-scale, long-term challenges to local CPR systems, scholars such as Andersson (2013); Berkes (2002), Cash et al. (2006), and Ostrom (2005) argue for the potentials of cross-level institutional linkages. There is little literature on such interactions in Meghalaya, often limited to evaluations of the relatively small amount of Joint Forest Management (JFM) co-management partnerships (Kumar, C. 2008 July; Kumar, S. 2008; Malhotra et al. 2004; Poffenberger ed. 2007). This study analyzes potentials and constraints of cross-scale forest governance interactions in the case of Mawlyngbna.

References

Agarwal, B. (2010): *Gender and Green Governance: the Political Economy of Women's Presence Within and Beyond Community Forestry*. Oxford University Press, New York.

Agrawal, A. (2000): *Small Is Beautiful, but Is Larger Better? Forest-Management Institutions in the Kumaon Himalaya, India*. In: People and Forests – Communities, Institutions, and Governance. Edited by Gibson, C.; M.A. McKean, and E. Ostrom. MIT Press, Cambridge.

Agrawal, A. (2001): *Common property institutions and sustainable governance of resources*. World development, 29(10), 1649-1672.

Agrawal, A., & Benson, C. S. (2011): *Common property theory and resource governance institutions: strengthening explanations of multiple outcomes*. In: Environmental Conservation, 38(2), 199-210.

Agrawal, A., & Ostrom, E. (2001): *Collective action, property rights, and decentralization in resource use in India and Nepal*. Politics & Society, *29*(4), 485-514.

Alston, L. J., & Mueller, B. (2005): *Property rights and the state*. In Handbook of new institutional economics (pp. 573-590). Springer US.

Andersson, K. (2013): *Local Governance of Forests and the Role of External Organizations: Some Ties Matter More Than Others*. World Development. Vol. 43, pp. 226–237.

Baruah, A.K. (2004): *Ethnic Conflicts and Traditional Self-Governing Institutions: A Study of Laitumkhrah Dorbar*. Crisis States Programme. DESTIN. Working papers series no. 1. Working paper no. 39.

Berkes, F. (2002): *Cross-scale institutional linkages: perspectives from the bottom up*. In: The drama of the commons, 293-321.

Bogner, A.; B. Littig, and W. Menz (2009): *Interviewing Experts*. Palgrave Macmillan, Hampshire.

Bujarbarua, P., & Baruah, S. (2009, February): *Vulnerability of fragile forest ecosystem of North East India in context with the global climate change: an ecological projection*. In IOP Conference Series: Earth and Environmental Science (Vol. 6, No. 7, p. 072016). IOP Publishing.

Cash, D. W., Adger, W. N., Berkes, F., Garden, P., Lebel, L., Olsson, P., and Young, O. (2006): *Scale and cross-scale dynamics: governance and information in a multilevel world*. Ecology and Society, 11(2), 8.

Cox, M. (2010): *Exploring the dynamics of social-ecological systems: the case of the Taos valley acequias* (Doctoral dissertation, Indiana University).

Cox, M.; G. Arnold, and S. Villamayor-Tomás (2010): *A Review and Reassessment of Design Principles for Community-Based Natural Resource Management*. Unpublished.

Creswell J.W. (2003): *Research Design – Qualitative, Quantitative, and Mixed Methods Approaches*. SAGE, Thousand Oaks | London | New Delhi.

Cropper, M., & Griffiths, C. (1994): *The interaction of population growth and environmental quality*. The American Economic Review, 84(2), 250-254.

Das, A., Ghosh, P. K., Choudhury, B. U., Patel, D. P., Munda, G. C., Ngachan, S. V., & Chowdhury, P. (2009, December): *Climate change in North East India: recent facts and events–worry for agricultural management*. In Proceedings of the Workshop on Impact of Climate Change on Agriculture (pp. 32-37).

Dasgupta, J., & Symlieh, H. J. (2006): *Trends in tenure arrangements for forest, and their implications for sustainable forest management: the need for a more unified regime*. People and forests. FAO participatory forestry publications. Available online: http://www.treesforlife.info/fao/Docs/P/J8167e/j8167e04.pdf. Retrieved 16/05/2013.

De, U.K. (2011, January): *Livelihood Pattern, Dependence on Forest and Causes of Degradation in Meghalaya*. Available at SSRN: http://ssrn.com/abstract=1810440

Eck, J. (*in progress*): *Abundance and Regeneration of Use-Important Trees under Different Management in Mawlyngbna, East Khasi Hills, Meghalaya*. Bachelor Thesis. Albert-Ludwigs-Universität Freiburg, Germany.

FAO (Food and Agriculture Organization of the United Nations (2001): *State of the World's Forests 2001*. Rome, Italy.

FAO (Food and Agriculture Organization of the United Nations (2010a): *Global Forest Resources Assessment 2010 – Main Report*. Rome, Italy.

FAO (Food and Agriculture Organization of the United Nations (2010b): *Terms and Definitions*. Forest Resources Assessment Working Paper 144/E. Rome, Italy.

FAO (Food and Agriculture Organization of the United Nations (2012): *State of the World's Forests*. Rome, Italy.

Folke, C., Carpenter, S., Elmqvist, T., Gunderson, L., Holling, C. S., and Walker, B. (2002): *Resilience and sustainable development: building adaptive capacity in a world of transformations*. AMBIO: A journal of the human environment, 31(5), 437-440.

Gautam, A. P. and G. P. Shivakoti (2005): *Conditions for successful local collective action in forestry: some evidence from the hills of Nepal*. Society and Natural Resources, 18(2), 153-171.

Geist, H. J., & Lambin, E. F. (2001): *What drives tropical deforestation?. LUCC Report series*, *4*, 116.

George, J., & Yhome, K. (2008, July): *Community Forest Management: A Case Study of Nagaland, India*. In Governing Shared Resources: Connecting Local Experience to Global Challenges, 12th Biennial Conference of the International Association for the Study of Commons, Cheltenham (pp. 14-18).

Ghate, R. S., & Ghate, S. (2010). *Joint forest management, role of communication, and harvesting behavior: evidence from field experiments in India*. South Asian Network for Development and Environmental Economics.

Gibson, C.C.; M.A. McKean, and E. Ostrom (2000): *Explaining Deforestation: The Role of Local Institutions*. In: People and Forests – Communities, Institutions, and Governance. Edited by Gibson, C.; M.A. McKean, and E. Ostrom. MIT Press, Cambridge.

Gläser, J., and G. Laudel (2006): *Experteninterviews und qualitative Inhaltsanalyse [Expert Interviews and Qualitative Content Analysis]*. Verlag für Sozialwissenschaften, Wiesbaden.

Glaser, B.G., and A.L. Strauss (2012): *The discovery of grounded theory: strategies for qualitative research*. AldineTransaction, Chicago.

Gibson, C.C.; Andersson, K.; Ostrom, E., and Shivakumar, S. (2005): *The Samaritan's dilemma: the political economy of development aid*. Oxford: Oxford University Press.

GoI (Government of India) (2001): *Census of India 2001*. Registrar General & Census Commissioner, Census of India.

GoI (Government of India) (2011a): *Census of India 2011 – Provisional Population Totals, Paper 1*. Registrar General & Census Commissioner, Census of India.

GoI (Government of India) (2011b): *India State of Forest Report 2011*. Ministry of Environment & Forests, Forest Survey of India.

GoM (Government of Meghalaya) (2005): *State of the Environment – Meghalaya – 2005*. Department of Environment and Forests (DEF). Shillong, Meghalaya.

GoM (Government of Meghalaya) (2005): *Meghalaya – Human Development Report – 2008*. Department of Environment and Forests (DEF). Shillong, Meghalaya.

GoM (Government of Meghalaya) (2013): *State Action Plan on Climate Change – Meghalaya*. Department of Environment and Forests. Shillong, Meghalaya.

Gurdon, P.R. (1975): *The nature Races of India: The Khasis*. Cosme Publication, New Delhi.

IFRI - International Forestry Resources and Institutions Research Program (2007): *Field Manual*. Center for the Study of Institutions, Population, and Environmental Change, Indiana University. Version 14. Revised December 2011.

Jha, S., & Bawa, K. S. (2006): *Population growth, human development, and deforestation in biodiversity hotspots*. Conservation Biology, *20*(3), 906-912.

John, P. (1998): *Analysing Public Policy*. Continuum, New York.

Kromrey, H. (2009): *Empirische Sozialforschung - Modelle und Methoden der standardisierten Datenerhebung und Datenauswertung*. Stuttgart, Lucius & Lucius Verlagsgesellschaft mbH. 552 S.

Kumar, C. (2008, July): *Institutional dissonance in forest management in Meghalaya, India*. In Twelfth Biennial Conference of the International Association for the Study of Common Property.

Kumar, S. (2008): *Empowering community or the State: Policy discourses and experts in the community self management of forest in Meghalaya, a state of India*. In Environmental and Forest Governance – The Role of Discourses and Expertise. Ed. M. Böcher, L. Giessen, and D. Kleinschmit, 139-160.

LaHaela, K. (*in progress*): *Community Forests of Meghalaya, India: How Management Affects Tree Structure and Composition*. Albert-Ludwigs Universität, Freiburg im Breisgau, Germany.

Littig, B. (2009): *Interviewing the Elite – Interviewing Experts: Is There a Difference?*. In: Interviewing experts. Bogner, A., Littig, B., & Menz, W. (Eds.). Palgrave Macmillan.

López-Carr, D., & Burgdorfer, J. (2013): *Deforestation Drivers: Population, Migration, and Tropical Land Use*. In: Environment: Science and Policy for Sustainable Development, 55(1), 3-11.

Lyngdoh, B.W.B (2006): *The Nexus of Environment and Poverty: Analysing of the implications of the Logging Ban on Rural Household Strategies in Meghalaya, India*. PhD Dissertation. Intercultural Open University Foundation, Opeinde, Netherlands.

Lyngkhoi, W. (2006): *Population, Poverty and the Degradation of Forests: A Contemporary Analysis of Meghalaya*. Unpublished Ph.D. Thesis. North-Eastern Hill University, Shillong.

Malhotra, K. C. (2012): *Joint forest management in North-East India: A trainers' resource book*. Regional Centre of the National Afforestation and Eco-Development Board. North-eastern Hill University, Shillong, India.

McGinnis, M.D. (*forthcoming*): *Updated Guide to IAD and the Language of the Ostrom Workshop: A Simplified Overview of a Complex Framework for the Analysis of Institutions and their Development*. Version 2 – Revised August 9, 2012. Available online: http://php.indiana.edu/~mcginnis/iad_guide.pdf. Retrieved 18/06/13.

McGinnis, M. D., & Ostrom, E. (*forthcoming*): SES Framework: Initial Changes and Continuing Challenges. In *Bloomington, IN: Workshop in Political Theory and Policy Analysis, Department of Political Science, and School of Public and Environmental Affairs, Indiana University*.

Myers, N., Mittermeier, R. A., Mittermeier, C. G., Da Fonseca, G. A., & Kent, J. (2000): *Biodiversity hotspots for conservation priorities*. Nature, 403(6772), 853-858.

Nongbri, T. (2000): *Khasi women and matriliny: transformations in gender relations*. Gender, Technology and Development, 4(3), 359-395.

Nongbri, T. (2001): *Timber ban in North-East India: Effects on livelihood and gender*. Economic and Political Weekly, 1893-1900.

Nongkynrih, A.K. (2006): *Who is in? Who is out? - Equity and Customary Community Forest Management in Meghalaya, India*. In: Hanging in the Balance: Equity in Community-Based Natural Resource Management in Asia. Edited by S. Mahanty, J. Fox, M. Nurse, P. Stephen and L. McLees. RECOFTC and East-West Center. Bangkok.

Nongkynrih, A.K. (2002): *Khasi Society of Meghalaya – A Sociological Understanding*. Indus Publishing.

Northeast Today (2012, March 12): *Pariat Inaugurates Multi-Purpose Reservoir at Mawlyngbna*. Retrieved online: http://www.northeasttoday.in/our-states/meghalaya/pariat-inaugurates-multi-purpose-reservoir-at-mawlyngbna/, 01/07/13.

Ostrom, E. (1990): *Governing the Commons: the evolutions of institutions for collective action*. Cambridge University Press, Cambridge.

Ostrom, E. (2005): *Understanding Institutional Diversity*. Princeton University Press, Princeton.

Ostrom, E. (2007): *A diagnostic approach for going beyond panaceas*. Proceedings of the National Academy of Sciences, 104(39), 15181-15187.

Ostrom, E. et al. (2009): *A General Framework for Analyzing Sustainability of Social-Ecological Systems*. Science, Vol 325: 419-422.

Ostrom, E. (2010): *Beyond Markets and States: Polycentric Governance of Complex Economic Systems*. American Economic Review, 100 (June 2010): 1-33.

Ostrom, E. (2011): *Background on the institutional analysis and development framework*. Policy Studies Journal, *39*(1), 7-27.

Pandolfelli, L., Meinzen-Dick, R. S., & Dohrn, S. (2007): *Gender and collective action: A conceptual framework for analysis* (No. 64). International Food Policy Research Institute (IFPRI).

Poffenberger, M. (2012): *Land Tenure and Forest Carbon in India A Khasi Approach to REDD+ Project Development*. In: Lessons about Land Tenure, Forest Governance and REDD+ Case Studies from Africa, Asia and Latin America. Ed. L. Naughton-Treves and C. Day. USAID: www.rmportal.net/ landtenureforestsworkshop. Retrieved: 26/07/2013.

Poffenberger, M., Barik, S. K., Choudhury, D., Darlong, V., Gupta, V., Palit, S., ... & Upadhyay, S. (2007). Indigenous forest stewards of northeast India. *Community forestry alliance for northeast India*. Available online: http://www.communityforestryinternational.org/pdfs/indigenous_forest_stewards_of_ne_india.pdf. Retrieved: 23/02/13.

Poteete, A. R. (2004, August). *Is Decentralization a Reliable means of increasing equity?*. Indiana university. Digital library of the commons (DLC). Paper prepared for the Tenth Biennial Conference of the International Association for the Study of Common Property (IASCP), 9 – 13 August 2004, Oaxaca, Mexico

Rathore, N.S. (*unpublished*): *Integrated Village Development Plan – Village Mawlyngbna, Block Mawsynram, District East Khasi Hills, Meghalaya*. Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ). Unpublished consultancy report.

Ravindranath, N. H., Rao, S., Sharma, N., Nair, M., Gopalakrishnan, R., Rao, A., ... & Govindasamy, B. (2011). *Climate change vulnerability profiles for North East India*. *Current Science*, *101*(3).

Ribot, J. C., Agrawal, A., & Larson, A. M. (2006): *Recentralizing while decentralizing: how national governments reappropriate forest resources*. World Development, *34*(11), 1864-1886.

Roy, P. and S. Mathur (2003): Foreword. In: *Local forest management: The impacts of devolution policies,* Edmunds, D. and E. Wollenberg, (Eds.). Routledge.

Sarma, K. (2010): *Land ownership, administration and status of forests of Khasi Hills Autonomous District Council of Meghalaya*. NeBIO (2010) Vol. 1(3)

Scheyvens, R.; D. Storey (2003): *Development Fieldwork – A practical guide*. Sage. New Delhi.

Sharma, M. (*working paper*): *Critically assessing traditions: the case of Meghalaya*. Crisis States Programme – Working Papers. Available online: http://eprints.lse.ac.uk/27971/. Retrieved: 03/08/13.

Shillong Times (2012, November 12): *Mawlyngbna village an example of judicious forest conservation*. Retrieved online: http://www.theshillongtimes.com/2012/11/12/mawlyngbna-village-an-example-of-judicious-forest-conservation/.Retrieved: 01/07/13.

Shillong Times (2013, May 27): *Constitutional space demanded*. Retrieved online: http://www.theshillongtimes.com/2013/05/27/constitutional-space-demanded/, 6/19/13.

Singh, P. P. (2008). Exploring biodiversity and climate change benefits of community-based forest management. *Global Environmental Change*, *18*(3), 468-478.

Subba, T. B. (2008). *Matriliny, reproductive health and reproductive rights an essay on the Khasis of Meghalaya, Northeast India*. European Bulletin of Himalayan Research, vol. 32, pp. 50-65.

Telegraph (29 May 2013): More forest cover in Meghalaya's fringe villages. Available online: www.telegraphindia.com/1130530/jsp/northeast/story_16950075.jsp#.UfJLpos2bng. Retrieved 26/07/13.

Times of India (30 January 2011): Let there be light in villages, too. Available online: 2http://articles.timesofindia.indiatimes.com/2011-01-30/guwahati/28361970_1_solar-lanterns-societies-solar-energy. Retrieved: 22/10/12.

Tiwari., B.K. and Shahi., S.K. (1995) Land ownership pattern in Meghalaya In: (Tiwari., B.K. and S. Singh Eds.) *Ecorestoration of Degraded Hills*. p. 79-93: Kaushal Publication, Shillong.

Tiwari., B.K., Barik., S.K. and Tripathi., R.S. (1998a) Biodiversity Value, Status and Strategies for Conservation of Sacred Groves of Meghalaya, India. *Ecosystem Health*, 4: 20-32

Tiwari., B.K. Barik., S.K. and Tripathi., R.S. (1998b) Sacred Groves of Meghalaya. In: (Ramakrishnan, P.S. *et al* Ed.) *Conserving The Sacred for Biodiversity Management* p. 253-262, UNESCO, Oxford IBH, New Delhi

Tiwari, B.K., S.K. Barik and R.S. Tripathi (1999): *Sacred Forests of Meghalaya – Biological and Cultural Diversity*. Regional Centre, National Afforestation and Eco-Development Board. North-Eastern Hill University, Shillong.

Tiwari, B.K. and C. Kumar (2008): *Forest Products of Meghalaya – Present Status and Future Perspective*. Regional Centre, National Afforestation and Eco-development Board. North-Eastern Hill University, Shillong.

Tiwari, B. K., Tynsong, H., & Lynser, M. B. (2010). Forest management practices of the tribal people of Meghalaya, north-east India. *Journal of Tropical Forest Science*, *22*(3), 329-342.

Tiwari, B.K., H. Tynsong, M.M. Lynrah, E. Lapasam, S. Deb, and D. Sharma (2013): *Institutional arrangement and typology of community forests of Meghalaya, Mizoram and Nagaland of North-East India*. Journal of Forestry Research, 24(1), 179-186.

Tynsong, H., Tiwari, B. K., & Dkhar, M. (2012). Contribution of NTFPs to cash income of the War Khasi community of southern Meghalaya, North-East India. *Forestry Studies in China*, *14*(1), 47-54.

Wollenberg, E., L. Merino, A. Agrawal, and E. Ostrom (2007): *Fourteen years of monitoring community-managed forests: learning from IFRI's experience*. International Forestry Review, *9*(2), 670-684.

Yin, R.K. (2009): *Case Study Research – Design and Methods*. SAGE, Thousand Oaks | London | New Delhi.

Young, O. R. (2002): *The institutional dimensions of environmental change: fit, interplay, and scale*. MIT Press, Cambridge.