APN

Asia-Pacific Network for Global Change Research

Role of Institutions in Global Environmental Change

Final report for APN project 2005-02-CMY-Sonak

The following collaborators worked on this project:
Sangeeta Sonak, The Energy and Resources Institute, India,
ssonak@teri.res.in
Wasana Wijesurya, Rubber Research institute of Sri Lanka, Sri Lanka,
dirrri@tradenetsl.lk
Bigyan Acharya, Environment and Public Health Organization, Nepal,
bsacharya@ntc.net.np

Role of Institutions in Global Environmental Change

2

2005-02-CMY-Sonak

Final Report submitted to APN

Overview of project work and outcomes

Non-technical summary

The role of institutions in natural resource management is being increasingly recognized in the context of global environmental change. Institutions are defined as the set of rules actually used by a set of individuals to organize repetitive activities that produce outcomes affecting those individuals and potentially affecting others (Ostrom, 1992). Policy research and analysis of institutions related to global environmental change, that is ongoing worldwide, normally focuses on international or national mechanisms and programmes in place. While it is accepted that these programmes contribute significantly to causing and confronting global environmental changes, the role of local institutions cannot be ignored. Therefore, this project assessed the role of institutions, especially the environmental and resource regimes operating at local level, in global environmental change. The project investigated how the management of resources can be improved in the context of global environmental change by learning from a variety of management systems and their dynamics.   It also helped building capacity of the local communities to adapt to global change through capacity building programmes. A book volume titled 'Multiple Dimensions of Global Environmental Change', with papers on various aspects of environmental changes was published and disseminated to a wide audience.

Objectives

The main objective of the project was to study the role of institutions, especially environmental and resource regimes, operating at local level in global environmental change.
The specific objectives were:
1. Identify feedbacks that exist between human and ecological systems that contribute to global environmental change
2. Assess the impact of this global environmental change on local communities
3. Analyze the role that local institutions (formal and informal) play in causing and confronting (adaptation and mitigation mechanisms) global environmental change
4. Build capacity of local communities to adapt to global environmental change

Amount received for each year supported and number of years supported

Total amount received: USD 40,000 for two years.

Participating Countries

India
Sri Lanka
Nepal

Work undertaken

The following activities were planned
- Analyze existing data (participatory and laboratory) collected under the project INTEREST for each ecosystem in the context of global environmental change
- Identify data gaps and collect additional data that is required
- Conceptual frameworks showing feedback between human and ecological systems for each ecosystem
- Impacts of environmental changes on the local communities.
- Analysis of environment and resource management regimes existing for each ecosystem

- Evaluation of institutional set-up existing for all five ecosystems
- Synthesis of this information to extrapolate information.
- Publication of an edited volume
- Build capacity of local communities to adapt to global environmental change.

Specifically, the following activities were undertaken

1. The existing data has been analyzed; data gaps identified and additional data has been collected by all three teams. The additional data is being analyzed and papers for each ecosystem are being finalized, which can be organized into a special issue of any peer reviewed journal.
2. Two project meetings were held one from 17th to 19th January 2005 in Goa, India and the other from 13th to 15th Dec 2005 in Sri Lanka.
3. Following capacity building programmes were conducted during the course of the project:
   - Two workshops on Rainwater harvesting in Goa were organized one on 26th Dec 2004 and the other on 30th November 2005. Book published under the INTEREST project titled "*Khazans* in troubled waters" was disseminated in Divar, Goa. Screening of video documentary film was also done (copies of the book and the documentary film are attached).
   - In Karnataka, one day training programme was conducted on January 1st 2005 for paddy and vegetable cultivation, which involved interactive sessions of farmers, and agriculture experts on season wise care required for the paddy and vegetable cultivation.
   - A one-day training workshop for grass root level NGOs of Uttaranchal State of India was organized on 12th September 2005, in which role of various forest management regimes and institutions in combating forest degradation was discussed. A five-day (August 22-26, 2005) capacity building workshop on Climate Change and Forestry was organized for policy makers, focusing on vulnerability and adaptation, and forestry mitigation options.
   - Possible adaptation measures for rubber cultivation and harvesting of latex in Sri Lanka- A 3-day residential workshop was conducted for the smallholders in non-traditional rubber growing areas. Three 1-day workshops were done in intermediate & dry zone areas for rubber smallholders, estate owners, schoolteachers and agricultural officers. Booklets have been prepared and disseminated (copies attached). Exhibitions were also organized.
   - The project staff helped community forestry user groups in the study area conduct several meetings and organize a two-day long event on eco-tourism. This remained a marked event where approximately 5,000 people attended. In addition, the Machhindranath Community Forestry User Group organized Public Hearing and Public Audit, which has been found a very useful tool for participatory monitoring and evaluation of community forestry activities. The event has made the executive committee members and the group as a whole more accountable to their rights, roles and responsibilities.

Results

The following outputs were produced

- Conceptual frameworks
- Impacts of environmental change on the local communities
- A report on the role of institutions, environment and resource management regimes in particular, operating at local level on global environmental change
- Publication of an edited volume
- Capacity-building programmes for local communities

Relevance to APN scientific research framework and objectives

The research was conducted under the APN priority theme 'human dimensions of global change'. It is a cross cutting issue, which addressed other issues such as climate change, changes in coastal zones and inland waters, changes in terrestrial ecosystems and biodiversity. It focused on a much-neglected issue i.e. the role of institutions operating at local level in causing and mitigating global environmental change. This issue, although deserves attention, is overshadowed by institutions operating at international level. The project threw light on issues such as traditional management of natural resources, indigenous knowledge, programmes of local government, community decision making in relation to the resource management and global change.

Self-evaluation

The project is successfully completed. All the deliverables have been produced. The main output of the project, an edited volume titled 'Multiple Dimensions of global environmental change' has been much appreciated by a wide audience. Five papers on the role of institutions in global environmental change are pending and will be submitted to a peer-reviewed journal, if possible, for a special issue. The project also helped build capacity of the local communities. The project work has been very satisfactory.

Potential for further work

A lot of data still exists, which can be analyzed and made available to the public in the form of a book on ecosystem management. There is ample scope for a book publication, if financial support is available.

Publications

1. *A volume entitled 'Multiple dimensions of global environmental Change' was published. The volume is 726 pages and contains 37 papers on various aspects of global environmental change. Copies have already been sent to APN and START.*

2. *Website: http://static.teriin.org/teri-wr/projects/apn.htm*

3. *One paper titled 'Why was traditional common property resource management system more successful in the coastal wetlands of Goa' has been selected for presentation at the IDGEC conference in Bali, Indonesia in December 2006.*

4. *Five papers are pending, which can be used alongwith some more papers for a special issue of a to peer-reviewed journal.*

References

Ostrom E (1992) *Crafting Institutions for Self – governing Institution Systems* Institute for Contemporary Studies Press, San Francisco

Technical Report

Preface

Most research on Global Environmental Change (GEC) till date focuses on climate change. While climate refers to the aggregation of all components of weather, environment is made up of the complex interactions between the physical, chemical and biological systems. In order to have a meaningful understanding of GEC, other environmental components such as land-use and land-cover, deforestation, biodiversity, fisheries etc and the cascading effects generated due to the changes in these components merit attention. However, current GEC research overlooks environmental issues other than climate change. Hence, this project presents some case studies on various aspects of environmental change.

Table of Contents

1.0 Introduction

Managing natural resources require efficient institutions at all levels i.e. local, national, regional and global. Institutions are defined as humanly devised constraints that structure human interaction (Berkes and Folke, 2000). Institutions, as defined by Young (1999), are systems of rules, decision-making procedures, and programs that give rise to social practices, assign roles to participants in these practices, and guide interactions among the occupants of the relevant roles. Institutions often figure prominently in efforts to solve or manage environmental problems (Young, 1999). The role of institutions in natural resource management is being increasingly recognized in the context of global environmental change.

Further, challenges involved in integrating research into policy necessitate a thorough understanding of the dynamics between the human actions at different scales. Current GEC studies follow either of the two approaches, cumulative or systemic. Turner *et al.* (1990) have described the two approaches in detail. According to them (Turner *et al.*, 1990), in the *systemic* approach, 'global' refers to the spatial scale of operation or functioning of a system. A physical system is 'global' in this sense if its attributes at any locale can potentially affect its attributes anywhere else, or even alter the global state of the system. On the other hand, in the cumulative approach, 'global' refers to the area or substantive accumulation of localized change. A change is 'global' in this sense if it occurs on a worldwide scale, or represents a significant fraction of the total environmental phenomenon or global resource. This implies that it replicates itself in

different parts of the world and accumulation of such changes in the different parts of the world becomes a global phenomenon.

However, policy research and analysis of institutions related to global environmental change, that is ongoing worldwide, normally focuses on international or national mechanisms and programmes in place. While it is accepted that these programmes contribute significantly to causing and confronting global environmental changes, the role of local institutions cannot be ignored. Therefore, it is necessary to study the role of institutions, operating at local level, in global environmental change and build capacity of local communities to adapt to these changes.

The project entitled 'Role of institutions in Global Environmental Change' is a collaborative effort between teams from three countries from the South Asia region i.e. India, Sri Lanka and Nepal. The main objective of the project is to study the role of institutions, especially environmental and resource regimes, operating at local level in global environmental change.
The specific objectives were:
1. Identify feedbacks that exist between human and ecological systems that contribute to global environmental change
2. Assess the impact of this global environmental change on local communities
3. Analyze the role that local institutions (formal and informal) play in causing and confronting (adaptation and mitigation mechanisms) global environmental change
4. Build capacity of local communities to adapt to global environmental change

2.0 Methodology

Using a case study approach, the project addressed the issue of unsustainability (i.e. resource depletion and degradation). Using five ecosystems as case studies, this project aimed to identify feedbacks that exist between human and ecological systems. Ecosystems studied under this APN project were traditional aquaculture systems in Goa, coastal peri-urban agriculture in Karnataka, bamboo forest of Haryana, rubber cultivation of Sri Lanka and the forest-watershed systems in Nepal. Local institutions studied were *comunidad* and tenant association involved in *khazan* ecosystem, family/society as an institution in agriculture, Joint Forest Management (JFM) in Haryana, community management of forest in Nepal and state policies and programmes in Sri Lanka.

A knowledge base was established in an earlier project 'Interactions between Environment, Society and Technology (INTEREST)', which was financially supported by the European commission. This project involved a study of five ecosystems viz. traditional aquaculture systems of Goa, coastal agriculture system of peri-urban Karnataka, bamboo forest system of Haryana (all three in India), smallholder rubber cultivation of Sri Lanka and forest-watershed system of Nepal. This project provided an understanding of the interactions between human and ecological systems. It posed new research questions related to a variety of management systems and their dynamics as well as its linkages to global environmental changes. Using the data and information from the project INTEREST, the present project focused on the global environmental changes and ways to combine local traditional and scientific resource management systems. The project, in particular, focused on the environmental and resource management regimes operating at the local level and their contribution (positive and negative) to global environmental change as well as adaptation (and mitigation) mechanisms against global environmental changes by the local communities and policy makers. It did not focus on

trade regimes. Further, the project investigated how the management of resources can be improved in the context of global environmental change by learning from a variety of management systems and their dynamics.

The selected ecosystems were different in characteristics and dynamics and included aquatic (1), terrestrial (2) and forest (2) ecosystems. The management systems also varied. The research focused on the various issues connected with global environmental change and studied the contribution of local formal and informal institutions in such global environmental changes and their response to these.

The global environmental issues that were studied are: Land use and land cover change, Overexploitation of resources, Biodiversity loss, Deforestation, Climate change (and changes in monsoon cycle/patterns/amount) and Pollution.
The project adopted an interdisciplinary approach combining knowledge from environmental sciences with social sciences. It used participatory methodology and deskwork to analyze the role of institutions in global environmental change. It adopted IDGEC (Institutional Dimensions of Global Environmental Change) framework (Fig 1)
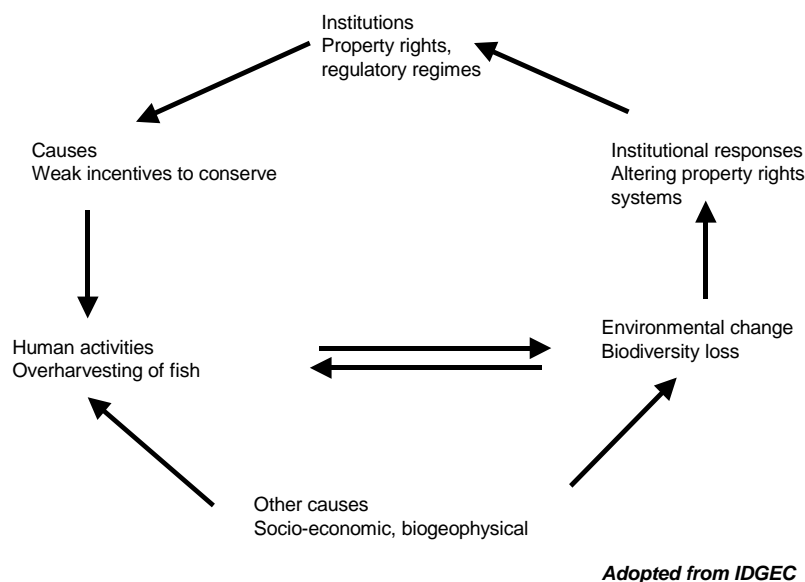

Adopted from IDGEC

Fig 1 Framework for analyzing role of institutions in global environmental change

Each ecosystem was studied with specific focus on one particular question and general assessment with respect to other questions. This approach helped us to draw specific inferences for each ecosystem while simultaneously helping to generalize for other ecosystems as well as upgrade these at higher levels. In particular, the project tried to find answers to some of the questions IDGEC project seeks to answer.

- Why was *comunidad* system more successful in managing *Khazan* ecosystem than Tenant Association? (*Khazan* ecosystem of Goa, India)
- What is the role of social institutions in global environmental change? (Agriculture in Karnataka, India)
- Can we integrate environmental and resource regimes with livelihood issues of the community? (Bamboo forest in Haryana, India)
- What roles do state institutions play in causing and confronting global environmental change? (Rubber cultivation in Sri Lanka)
- What are the advantages/ disadvantages of creating new institutions? (Community forestry in Nepal)

The project also helped build capacity of the local communities through the training programmes.

Specifically, the following activities were undertaken:
1.The existing data has been analyzed; data gaps identified and additional data has been collected by all three teams.
2. The additional data is being analyzed and papers for each ecosystem are being finalized, which can be organized into a special issue of any peer reviewed journal.
3. Two project meetings were held; one from 17th to19th January 2005 in Goa, India and the other from 13th to 15th Dec 2005 in Sri Lanka.
3. Following capacity building programmes were conducted during the course of the project:

- Two workshops on Rainwater harvesting in Goa were organized one on 26th Dec 2004 and the other on 30th November 2005. Book published under the INTEREST project was disseminated in Diwar, Goa. Screening of video documentary film was also done.
- In Karnataka, one day training programme was conducted on January 1st 2005 for paddy and vegetable cultivation, which involved interactive sessions of farmers, and agriculture experts on season wise care required for the paddy and vegetable cultivation.
- A one-day training workshop for grass root level NGOs of Uttaranchal State of India was organised on 12th September 2005, in which role of various forest management regimes and institutions in combating forest degradation was discussed. A five-day (August 22-26, 2005) capacity building workshop on Climate Change and Forestry was organised for policy makers, focusing on vulnerability and adaptation, and forestry mitigation options.
- Possible adaptation measures for rubber cultivation and harvesting of latex in Sri Lanka- A 3-day residential workshop was conducted for the smallholders in non-traditional rubber growing areas. Three 1-day workshops were done in intermediate & dry zone areas for rubber smallholders, estate owners, schoolteachers and agricultural officers. Booklets have been prepared and disseminated. Exhibitions were also organized.
- The project staff helped community forestry user groups in the study area conduct several meetings and organize a two-day long event on eco-tourism. This remained a marked event where approximately 5,000 people attended. In addition, the Machhindranath Community Forestry User Group organized Public Hearing and Public Audit, which has been found a very useful tool for participatory monitoring and evaluation of coommunity forestry activities. The event has made the executive committee members and the group as a whole more accountable to their rights, roles and responsibilities.

3.0 Results & Discussion

Using a case study approach, the project tried to address the issue of unsustainability (i.e. resource depletion and degradation). Using five ecosystems as case studies, this project aimed to identify feedbacks that exist between human and ecological systems. As stated earlier, ecosystems studied under this APN project are traditional aquaculture systems in Goa, coastal peri-urban agriculture in Karnataka, bamboo forest of Haryana, rubber cultivation of Sri Lanka and the forest-watershed systems in Nepal. Local institutions that were studied are *comunidad* and tenant association involved in *Khazan* ecosystem, family/society as an institution in agriculture, JFM in Haryana, community management of forest in Nepal and state policies and programmes in Sri Lanka.

3.1 Traditional aquaculture systems in Goa

Traditional aquaculture systems in Goa are practiced in coastal lands, which are reclaimed mangrove areas. These lands are locally *called* as '*Khazans*'. The *Khazans* are traditionally community managed, integrated agro-aqua ecosystems found in coastal lands of Goa. *Khazan* technology protects agricultural fields and villages from tidal ingress through a system of bunds (embankments), sluice gate and *poiem* (depression in the field). Long years ago, traditional communities in Goa formed guilds for management of resources. These self-governing institutions were called '*gaunkaris*'. The land in the village was owned collectively and the profit was shared among '*gaunkars*'. *Khazan* lands then belonged to these self-governing village institutions i.e. '*gaunkaris*'. The foundation of '*gaunkari*' institution was based on the collective management of property and resources. During Portuguese rule in Goa (1510-1961) they were renamed as '*comunidades*'. '*Comunidades*' maintained *Khazan* ecosystem through '*bhaus*' system (association of farmers). A number of changes in the maintenance system took place during the colonial regime. The state placed itself above the *comunidad* legally as sale or purchase of rights into the community was now possible only if the State granted permission. With forced religious conversions from Hinduism to Christianity, religion played a major role in decision-making, including those for natural resources. Post 1960s, witnessed merger of Goa in the Indian Union. New laws were applicable to the State of Goa. The management of *Khazans* became the responsibility of the tenants' association. With changes in the property right systems, '*gaunkars*' ceased to cultivate and manage lands collectively. The state government controlled functioning of the '*comunidades*'. Over the last few decades, *Khazans* are being degraded. A number of factors affect the *Khazan* ecosystem. Changes in institutional set-up are reported as a prime reason for the degradation. The project provided insights into these changes and tried to reason out why was *comuninad* more successful than Tenant Association (TA). Following factors were found to be responsible for the success of *comunidad* over tenant association:

- Reduced revenue to TA
- Reduced strength of the association
- Assigned responsibilities by *comunidad*
- Paid employees in *comunidad* for maintenance and supervision
- Change from collective ownership to individual ownership
- Changes in supervision from within to outside
- Shift in rule enforcement from within to outside
- Weak (non) enforcement of rules by the state resulting in fallow lands
- Community participation in decision-making in *comunidad* compared to imposed state polices in TA
- Dependence on government machinery for funds and technical advise
- Government machinery ridden with bureaucracy and delay

In sum, abolition of the *bhaus* system was the main reason, pointed out by locals, for improper maintenance. Changes in property rights, Changes in functionaries, corruption, and weak enforcement of rule also contributed to the degradation. The interference of the state coupled with the delays in functioning and decision-making significantly contributed to the degradation of *Khazan* fields.

Details are provided in the paper titled " Factors affecting land-use and land-cover changes in the coastal wetlands of Goa". (See attachment APP1 Goa case study in Annex D).

3.2 Agriculture in Karnataka

Agriculture is a part of livelihood of most of the rural households in India. Although a number of studies have been conducted on resource use and agricultural land degradation, few examine changes in society and its structure and their impacts on agricultural land degradation in India. It is clear from our study that much of the agricultural degradation in the study area is linked to the changes in society and its structure over the years, poverty and population growth. This component of the project examined the role of informal institutions in the society on the land use and land cover changes. The main changes observed in society and societal structure over the years are:

1. Continuous decrease in financial returns from agriculture
2. Fragmentation of families: Change from Joint family system to nuclear families, thus increasing the need for more houses and built land
3. Migration related to increased literacy and seasonal nature of employment
4. Changes in attitude of people such as attraction of short-term gains
5. Competing land uses that serve as push factor
6. Poverty and forced selling of land
7. Cultural restrictions
8. International subsidies
9. Lack of information

These changes in the social organization, in turn, have high impact on the agriculture ecosystem and land use and cover change. The main impacts evident from our study are

1. Changes in crops and cropping pattern
2. Changes in seeds from traditional to High Yielding Variety (HYV) leading to increased intensity of resource use.
3. Shift from organic manure to chemical fertilizers
4. Fragmentation of agricultural land
5. Land use change from fields to built land and to clay pits

The study has also emphasized biodiversity loss of traditional crop varieties.

An abstract and presentation is provided in the (abstract attachment APP2 Abstract_LUCC in Karnataka in Annex D and presentation in Annex D/(ii) PowerPoint slides).

3.3 Bamboo forest of Haryana

In India there are 125 indigenous as well as exotic species of bamboo belonging to 23 genera. Bamboo forests occupy an area of 10.03 million hectare, roughly 12.8% of the total forest area in the country. As a resource, bamboo is used extensively as a source of livelihood in many parts of the country.

Bhanjdas, the basket making community of Haryana, live mostly in the northern part of the State in the hilly belt of the Shivaliks. This community is solely dependent on bamboos from the forest areas for making baskets for their sustenance and employment. After the formation of the State of Haryana, the Haryana Forest Department (HFD) has been issuing permits for bamboo extraction to the *Bhanjda* settlements in Bar, Kalka and Bowana to assist the development of these *Bhanjdas*. However, increasing population pressure coupled with economic growth and the growth of market economy jeopardized the ecological sustainability of the bamboo ecosystem in this area.

Under the joint forest management programme in Haryana Shivaliks, Hill Resource Management Societies (HRMS) were formed comprising the *Bhanjdas* communities of Bar and Kalka districts. An MoU was signed between the HRMS and the HFD for

protection and management/regeneration of degraded forests in lieu of sharing the forest resources. Studies done on assessing the impact of this unique model of joint management, reveal that there has been marked improvement in the socio-economic conditions in those areas where HRMS has been formed. The bamboo forest areas under joint management of the society are better worked and can sustain the supply of bamboos to *Bhanjdas* in future. This unique system of management of bamboo resources in the Shivaliks involves a dynamic process of change, social, economical and environmental as well. Livelihood issues of local communities are primarily integrated in the joint forest management policies. However, land tenurial issues are not fully settled and create insecurity among communities. Power relations and equity issues still exist among various sections of the community as well as between community and government officials. Hence there is a need for capacity building of local communities and a need for a management structure, which will be based on equity.

PowerPoint presentations are provided in Annex D ((ii) PowerPoint slides/ (a) Goa meeting presentations/Bamboo forests and (ii) PowerPoint slides/ (b) Sri Lanka meeting presentations/Bamboo forests).

3.4 Rubber cultivation in Sri Lanka

In Sri Lanka rubber production on 155,000 small-holdings of less than 4 ha each accounts for about 33% of the nation's rubber production. Associated with these are small industries such as smoke houses, scrap crepe factories, village dealers and larger industries such as rubber wood factories, and mattress factories. The level of output from the small-holdings had declined apparently due to a fall in the local price of rubber. But associated with this economic pressure are a number of other technological, social and environmental pressures. Wastewater from processing plants creates pollution. Three districts are being addressed having several thousand small-holders in each. The aim is to understand the social, environmental, economic and technological issues involved in the interactions between the small-holders and the small and large scale industries and the reasons for the decline in output of rubber.
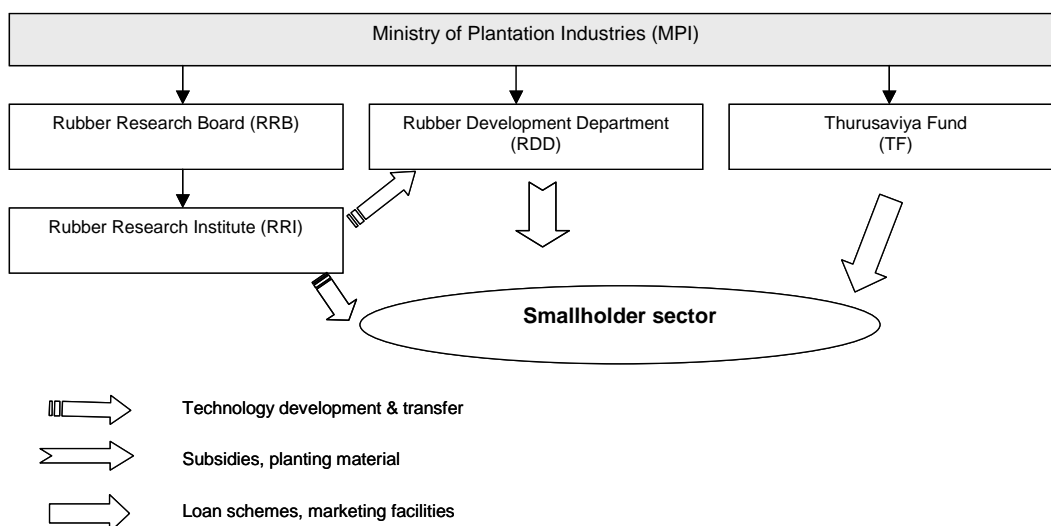

Fig 2 Institutional framework operating in the smallholder rubber sector in Sri Lanka

Pollution from wastes released from smoke houses where sheet rubber is produced which is the main product from smallholders' lands create harmful effects, as treatment facilities

are not economically feasible. The wastes are released to the nearby water streams. Change in monsoon patterns due to climate change has been reported. These changes affect rubber cultivation. It was revealed during the informal discussions that the rubber society, which was in operation before failed as it was a political issue. Lack of awareness of farmers towards technical recommendations is a prime reason for the decline in output of rubber. Under the present project, Government research institutes worked towards creating awareness of good practices. Several training programmes were conducted to create awareness, and to train farmers to take effective measures to enhance production. Subsidies were offered by the state for production of rubber. Protection against erratic rains and draught conditions, promotion of group activities, and pollution control measures were some of the activities taken up during training   programmes for the local farmers. It was found that the awareness of the farmers increased after the training programmes and they were better equipped for adaptation to the erratic rains. Rubber market is highly volatile and the impacts are immediately seen on rubber production as well as on the area under cultivation.

Paper titled "Responsibilities of local institutions in confronting environmental changes" provides the detail (attachment APP3 RRISL paper in Annex D).

3.5 The forest-watershed systems in Nepal

Some years ago, this forest was government managed, people had free access and the resources were being depleted. The Nepal Coppice Reforestation Project was under pressure to reorganize the management responsibility so that the local community could manage the forest. The forest is 19.25 hectares in area and associated with it there are 278 households. An Executive Committee was established and formulated a plan to control use of the forest and this has evolved over the years. The forest is mainly used for fodder by the household members but it is not able to supply enough and the users have other occupations including farming their own land, and off-farm activities such as stone crushing and construction, tenant farming and running shops and tea shops. This component of the study aimed to determine whether and how the use of the forest has changed since it was government managed and whether livelihoods are now sustainable.

A review of the institutional transformation in the history of forest management in Nepal has been carried out. The review shows that in Nepal, changes in forestry institutions were guided by several factors and assumptions. Over the past 50 years, the devolution of forest management in Nepal took place from centralized government, through decentralized government, to local user groups.

Before 1957, the Nepalese government's focus was on conversion of forestlands to agriculture for revenue generation. After the nationalization of 'private forest' in 1957, local people were blamed to be a part of the problem that caused deforestation. As a solution, legislation permitted central control over the local forest resources and the bureaucracy was expanded. A two decade long unsuccessful experiment (1957–76) proved that without people's participation, forests couldn't be managed effectively. Since 1978, community forestry has gradually evolved from protection forestry to organized and legitimized self-governing-user-group managed forestry. This was feasible because of the participatory actions, adaptive learning, refining, and legitimizing community forestry practices over time. Community forestry is a dynamic, adaptive, and evolving process. It is not free from challenges. Despite clearly defined forest policies and legislation in place, a number of ad hoc policy decisions exist at the national level, which have created confusion. It has been felt that there is a need to improve communication,

coordination, and network of users to make their voice heard in policy considerations. To move community forestry forward, 'second generation issues' need to be addressed.

Paper titled "Fifty years of forest management in Nepal: a review of institutional transformation" provides the detail (attachment APP 4 Nepal forest case study in Annex D).

3.6 Conceptual frameworks

Conceptual frameworks connecting institutions and environment have been worked out. For example, in fig.3, a conceptual framework showing relationship between institutional set-up and *khazan* ecosystem has been provided.
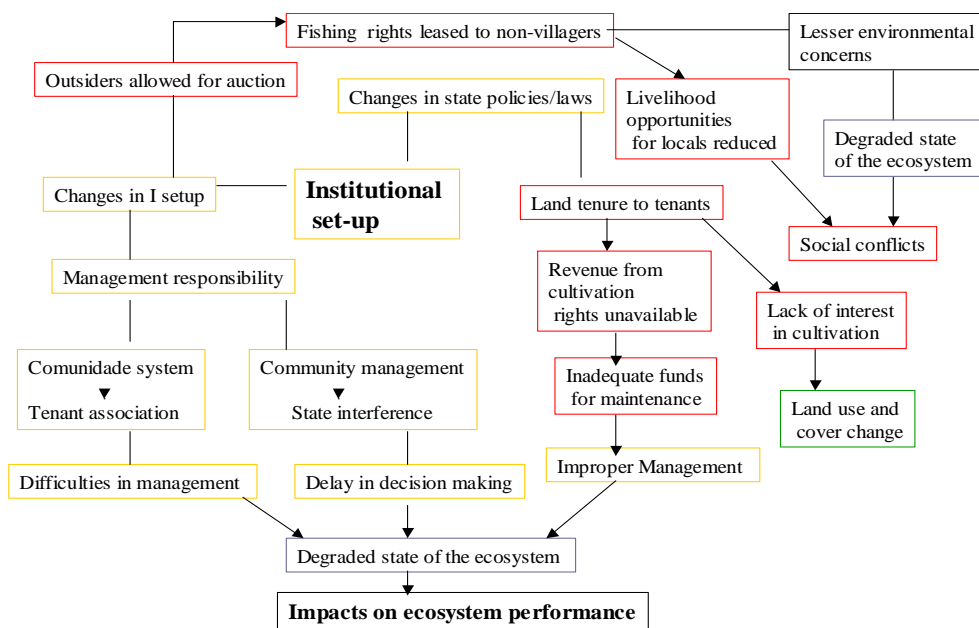

Fig.3 A simple framework connecting institutional set-up to ecosystem performance of *Khazan* system

4.0 Conclusions

The project investigated how the management of resources can be improved, in the context of global environmental change, by learning from these different management systems and their dynamics. It is commonly observed that environmental signals that relate to the **function of the ecosystem** are normally ignored until those that relate to the **function for the humans** are affected. Some of the common factors that emerge through this project are:

- Integrating community concerns in decision making is necessary
- Involvement of community in natural resource management is essential
- Market is the driving force for changes in human-environment relationship.
- Institutions with good support from concerned organizations perform better
- There is a need for capacity building of concerned organizations
- Periodical review of performance helps in increasing responsiveness of institutions

An attempt was made to answer some of the questions to which IDGEC seeks answers. The following findings emerge from the synthesis of the research for five ecosystems, which were selected as case studies,

4.1 What environmental signals are attended to or ignored?
Environmental signals that relate to the function of the ecosystem are normally ignored until those that relate to the services for the humans are affected

4.2 Why are some institutions more successful than others?
➢ *Determining factors*

- Property rights, land tenure
- Defined responsibilities and clear jurisdictions
- Sufficient revenue and adequate manpower
- Community involvement and participation in decision-making
- State interventions may be unproductive, but state support is necessary
- Strict enforcement of the rule
- Integrating livelihood issues in policies
- Access to technology (good practices) and communication of information to relevant stakeholders
- Environmental awareness among community

4.3 What are the criteria for (re) designing institutions to confront environmental challenges?
➢ *Institutions need to be*

- Responsive to
  - Changing social conditions
  - State of environment
  - Market fluctuations
- Sensitive to
  - Issues of the scale: macro, meso and micro.

4.4 How can we structure institutions to maximize their performance?
The following measures may help to maximize the performance of institutions
- Right incentives to the relevant actors
- Institutions with good support from concerned organizations
- Capacity building (technical and rule enforcement) of concerned organizations
- Capturing, transmitting and incorporating signals from local level to higher levels
- Restructuring of organizations with clearly defined responsibilities and jurisdictions
- Periodical review of institutional performance helpful

4.5 How can we define institutional resilience?
Institutional resilience is intimately associated with the regulation of resources. In case of environment management regimes, institutions must be resilient enough to be able to cope with changing social and economic conditions and yet manage resources effectively. Hence, **institutional resilience may be defined as the ability of institutions to absorb perturbation from human systems before these adversely affect their ability to regulate resources**.

Characteristics of resilient institutions can be considered as
- Rule compliance by relevant players,
- Efficient resource management and
- Long-term social and ecological sustainability.

Similarly, criteria that make institutions resilient appear to be
- Right incentives to relevant actors,
- Existence of social cohesion,

- Equitable sharing of benefits,
- Perception of fair and just approach by community and
- Adequate conflict resolution mechanisms.

5.0 Future Directions

A lot of data still exists, which can be analyzed and made available to the public in the form of a book on ecosystem management. There is ample scope for a book publication, if financial support is available.

References

Berkes F and Folke C (2000) Linking Social and Ecological systems Cambridge University Press, U.K pp 459.

Turner B.L., Kasperson R E., Meyer W. B., Dow K M., Golding D, Kasperson J. X., Mitchell R C. and Ratick S. J. (1990) Two types of global environmental change Definitional and spatial-scale issues in their human dimensions Global Environmental Change: 14-22.

Appendix

Please see attachment.