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Sustainable Land Management: Challenges, Opportunities Trade Off

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1 ABSTRACT

Land is the integrating component of all livelihoods depending on surface of the earth like: agricultural activity, forest land and water bodies (rivers, lakes, coastal marine) habitats. Due to varying political, social, and economic factors, the heavy use of natural resources to supply a rapidly growing global population and economy has resulted in the unintended mismanagement and degradation of land and ecosystems.

In the twenty-first century, the utmost need is to meet three major requirements: (a) adequately supplying safe, nutritious food for the growing population, (b) significantly reducing rural poverty by providing rural household incomes, and (c) reducing and reversing natural resource degradation, especially that of land. India is a developing country and it requires fast space quality infrastructure development, which is the need of current times. For any development, land is required. Accounting land parcel procedure is cumbersome. The assessment of land details are recorded in a system which is more than two hundred years old. The upcoming technologies such as Geographical Information System (GIS), data warehousing and web based information dissemination should be very helpful in land record management for decision making, strategy planning and predictive modelling.

The modern web integrates various kinds of advanced, dynamic, multi-layered, time series data and graphical information which transform the tedious data analysis job to a faster, dynamic and realistic exercise. Regular updating of information makes monitoring and management of land parcel in records a more transparent and realistic approach towards any development. This information system can be used as a tool to disseminate information and valuation of land on an open platform. It can also be a useful support system to conserve ecological fragile area.

Sustainable Land Management: challenges, opportunities, and trade-offs provides a strategic focus to the implementation of sustainable land management (SLM) components. SLM is a knowledge based procedure that integrates land, water, biodiversity, and environmental management to meet rising food and fiber demands while sustaining livelihoods and the environment. This paper, aimed at policy makers, project managers, and development organisations, articulates priorities for investment in SLM and natural resource management and identifies the policy, institutional and incentive reform options that will accelerate the adoption of SLM productivity improvements and pro-poor growth.

Keywords: data, trade off, opportunities, challenges, SLM

2 INTRODUCTION

In the twenty-first century, the utmost need is to meet three major requirements: (a) adequately supplying safe, nutritious food for the growing population, (b) significantly reducing rural poverty by providing rural household incomes and (c) reducing and reversing natural resource degradation, especially that of land. India is a developing country and it requires fast space quality infrastructure development, which is the need of current times. Land is required for any development. Government is acquiring land for public purpose. Acquisition of land for public purpose displaces people, forcing them to give up their home, assets and means of livelihood. The Government of India (GoI) recognises the need to minimise large scale displacement as much as possible, except where displacement is inevitable. Accounting land parcel procedure is cumbersome.

In India, details for the assessment of land are recorded in a system which is more than two hundred years old. This conventional system is not fulfilling the changing demands of time and adequate recording of space. The upcoming technologies such as Geographical Information System (GIS), data warehousing and web based information dissemination could be very helpful in land record management for decision making, strategic planning and predictive modelling. The use of these technological leverages can make land record management efficiently.

Since time immemorial, it has been a constant endeavour of human beings to pursue various aspects of life with ease. In the present era of high-end computing, this endeavour of simplifying things is achieved by an

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effective tool like GIS, when applied to as complicated a process as land acquisition. Unlike the conventional procedure of simultaneous handling of various maps, such as village maps, engineering drawings and layout plans etc., which are of different scale, GIS helps to prepare the maps and peruse the maps of multiple types at the same instance through registration of geographic coordinates. The concept of layer mechanism and subsequent superimposition of one above the other is used to store both non-spatial and spatial data in different thematic layers. For the planners this entire process is made available at the fingertips of Personal Computers (PCs) without unfolding the age old cloth maps.

3 WHAT IS SLM?

Sustainable Land Management (SLM) is defined as a knowledge-based procedure that helps integrate land, water, biodiversity, and environmental management (including input and output externalities) to meet rising food demands while sustaining ecosystem services and livelihoods. SLM is necessary to meet the requirements of a growing population. Improper land management can lead to land degradation and a significant reduction in the productive and service (biodiversity niches, hydrology, carbon sequestration) functions of watersheds and landscapes. In layman's terms, SLM involves:

- Preserving and enhancing the productive capabilities of land in cropped and grazed areas-that is, upland areas, down-slope areas, and flat and bottom lands; sustaining productive forest areas and potentially commercial and non-commercial forest reserves; and maintaining the integrity of watersheds for water supply and hydropower generation needs and water conservation zones and the capability of aquifers to serve farm and other productive activities.
- Actions to stop and reverse degradation or at least to mitigate the adverse effects of earlier misuse which is increasingly important in the uplands and watersheds, especially those where pressure from the resident populations is severe and where the destructive consequences of upland degradation are being felt in far more densely populated areas "downstream."
- Land parcels for infrastructure development are impetus to growth. Development unproductive land can be identified to facilitate balanced growth by proposing infrastructure need.

Sustainable land management combines technologies, policies, and activities aimed at integrating socio-economic principles with environmental concerns so as to simultaneously maintain or enhance production, reduce the level of production risk, protect the potential of natural resources and prevent (buffer against) soil and water degradation, be economically viable, and be socially acceptable (Smyth and Dumanski, 1993).

These concepts span the scales of detail, application, and levels of integration with socio-economic data. Soil quality is the most restrictive component, followed by land quality and sustainable land management. Soil quality is effectively a condition of a site, and it can be studied using soil data alone. Land quality requires integration of soil data with other biophysical information, such as climate, geology and land use. Land quality is a condition of the landscape, i.e. it is a biophysical property, but includes the impacts of human interventions (land use) on the landscape. Sustainable land management requires the integration of these biophysical conditions, i.e. land quality, with economic and social demands. It is an assessment of the impacts of human habitation, and a condition of sustainable development.

These are more than simple differences in semantics; the concepts differ in the kinds and scale of the processes being described, the data used for input, and the amount and kinds of integration with other disciplines (Dumanski, et al., 1997). However, the concepts form a continuum over the landscape, and they must be applied to different types and scales of land use.

In general and particularly in developing countries, it is essential that scarce resources devoted to land management be used more cost-efficiently and that policy-makers have at least rough indicators of whether environmental conditions and land quality are getting better or worse. Land quality indicators, such as nutrient balance, loss of organic matter, land use intensity and diversity, and land cover are useful to managers and decision makers in monitoring and improving the performance of projects with respect to their socio-economic and environmental impacts, and to assess the trend towards or away from land use sustainability. While routine project performance indicators based on cost-benefit analyses (input-output factors, risk and economic performance indicators), are necessary to monitor the activities and components of a project, LQIs are required to evaluate the environmental impact(s). The quantitative assessment of physical impacts, such as depletion of soil nutrients, loss of organic matter, soil erosion, water contamination

etc. may appear to be costly and cumbersome during project implementation, but the long-term negative impact of reduced land quality, such as decreased efficiency of fertilisers, increased erosion, increased fuel consumption, increased pest infestation (nematodes, etc.), often result in rehabilitation costs that are much higher.

The LQI approach focuses on preventive maintenance rather than rehabilitation, and provides the methodology and the approach to integrate the socio-economic and biophysical information that are required for better informed sustainable land management strategies.

Core LQIs for managed ecosystems (agriculture and forestry) in the major agro-ecological zones (AEZs) of tropical, sub-tropical and temperate environments, and recommended for development in the short term include:

- Nutrient balance describes nutrient stocks and flows as related to different land management systems used by farmers in specific AEZs and specific countries
- Yield trends and yield gaps describe current yields, yield trends, and actual: potential, farm level yields for the major food crops in different countries
- Land use intensity describes the impacts of agricultural intensification on land quality; intensification may involve increased cropping, more value-added production, and increased amounts and frequency of inputs; emphasis is on the management practices adopted by farmers in the transition to intensification.
- Land use diversity (agro-diversity) describes the degree of diversification of production systems over the landscape, including livestock and agro-forestry systems; it reflects the degree of flexibility (and resilience) of regional farming systems, and their capacity to absorb shocks and respond to opportunities.
- Land cover describes the extent, duration and timing of vegetative cover on the land during major erosive periods of the year. It is a surrogate for erosion, and along with land use intensity and diversity, it will give increased understanding on the issues of desertification.

A second set of core LQIs were recommended for longer-term research. These are indicators which require further development of their theoretical base, or lack adequate data for immediate development. They include:

- Soil quality. likely to be based on soil organic matter turn-over, particularly the dynamic (microbiological) carbon pool most affected by environmental conditions and land use change.
- Land degradation (erosion, salinisation, compaction, organic matter loss): these processes have been much researched and have a strong scientific base, but reliable data on extent and impacts are often lacking.
- Agro-biodiversity. involves objectives of managing natural habitats and the co-existence of native species in agricultural areas, maintaining natural soil micro and meso biodiversity, and managing the gene pools utilized in crop and animal production.

Four additional sets of core LQIs were identified, but these were recommended to be developed through collaboration with the respective authoritative disciplines:

- Water quality
- Forest land quality
- Rangeland quality
- Land contamination/pollution.

The above are the biophysical components of sustainable land management. Although useful in their own right, they must still be complemented by indicators of the other pillars of sustainable land management, economic viability, system resilience, and social equity and acceptability. Considerable additional work is required to develop these pillars to the same level of detail as the land quality (biophysical) indicators.

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4 SLM PROGRAMME IN INDIA

The Sustainable land and Ecosystem Management (SLEM) Programme is a joint initiative of the Government of India and the Global Environmental Facility (GEF) under the latter's Country partnership Programme (CPP).

The objective of the SLEM Programmatic Approach is to promote sustainable land management and use of biodiversity as well as maintain the capacity of ecosystems to deliver goods and services while taking into account climate change.

The GEF programmatic approach can be defined as a long-term and strategic arrangement of individual yet interlinked projects aimed at achieving large-scale impacts on the global environment. It seeks to achieve these impacts by providing recipient countries, the GEF, and other GEF stakeholders synergies across the Focal Areas of the GEF within the framework of national and regional sustainable development; by catalysing action and replicating successes and innovations; by maximising and scaling up global environmental benefits; and by enabling donors and other partners to invest in additional and focused funding based on the scope of the programme.

In the 11th Plan document, the Government of India has placed a high priority on raising agricultural productivity to achieve annual growth of more than 4.1 %. The plan acknowledges that this target cannot be achieved in the face of ongoing shrinking and degradation of the country's natural resources; it therefore commits to conservation and to harnessing and developing the natural resource base.

The plan further acknowledges that in order to be effective, sustainable land and ecosystem management must contribute directly to poverty reduction at household and community levels, in addition to maintaining land quality and ecosystem integrity.

The Sustainable Land and Ecosystem Management Country Partnership Program (SLEM CPP) was developed to contribute to the implementation of the 11th Plan. The overall objective of the SLEM partnership is to contribute to poverty alleviation in India by promoting enhanced efficiency of natural resource use, improved land and ecosystem productivity, and reduced vulnerability to extreme weather events, including the effects of climate change. Specifically, the partnership will support:

(1) Prevention and/or control of land degradation by restoration of degraded (agricultural and forested) land and biomass cover to produce, harvest, and utilise biomass in ways that maximise productivity, as well as by carbon sequestration, biodiversity conservation, and sustainable use of natural resources;

(2) Enhancement of local capacity and institution building to strengthen land and ecosystem management;

(3) Facilitation of knowledge dissemination and application of national and international good practices in SLEM within and across states; and,

(4) Replication and scaling up of successful land and ecosystem management practices and technologies to maximise synergies across the UN Conventions on Biological Diversity (CBD), Climate Change (UNFCCC), and Combating Desertification (UNCCD) conventions.

The Desertification Cell, MoEF is the national executing agency for the SLEM programmatic approach. ICFRE, Dehradun has been designated as the Technical Facilitation organisation for the SLEM programme. All the 7 sub projects have a full fledged Project Management Unit with a Project Manager, Project Director (a senior government officer) and Project Steering Committee (chaired by a senior government officer). However, the responsibility of coordinating the SLEM programmatic approach as a whole and, to ensure SLEM principles are appropriately integrated into our national/ state level policies and programmes lies with MoEF.

SLEM NSC was constituted on 31st March 2009 with specific responsibilities and is chaired by additional Secretary, MoEF to ensure effective participation not only from the 7 sub projects but also by the concerned line Ministries of GoI and other institutions working in SLEM sector.

SLEM is a multiagency initiative supported by the World Bank, UNDP, and FAO, and is designed to engage national and state-level agencies. Through a combination of capital investments, policy and regulatory incentives, and public participation, the SLEM CPP aims to provide a critical mass of financial resources and technical knowledge to mainstream integrated and strategic approaches into investments in sustainable land and ecosystem management.

As a leading implementing agency, the World Bank brings to the partnership substantial IDA/IBRD resources under its ongoing lending programme for rural and agricultural development in India. The Government of India/ State Government's contribution to the programme is substantial, in the form of co-financing of all programme activities. As partnering agencies, UNDP and FAO will contribute with initiatives focusing on capacity building, knowledge dissemination, and promotion of best conservation practices that will be further scaled up through the partnership.

As mentioned above, to generate the maximum benefits from such a multi-sectoral and multi-partner approach, the SLEM CPP has established a dedicated, programme-level management and coordination function in the form of a medium-size project (MSP) entitled Policy and Institutional Reform for Mainstreaming and Up-scaling Sustainable Land and Ecosystem Management in India. The sharing of lessons learned and emerging results tracked by an M&E mechanism will be an integral part of each component project included in the programme, as well as of the programme as a whole. The M&E functions will form the basis for the outreach, knowledge base, mainstreaming, and scaling up of successful policy initiatives. If the SLEM partnership meets its objectives, a follow-up grant from the GEF will be requested. Future plans also include expanding the partnership to include other international financial institutions and donor contributions, and eventually leveraging additional donor financing.

5 CHALLENGES

The Process of Land Records Management in India is very old. The Arthsastra is supposed to be the first Indian work to mention of the village officers known as "gopa" maintained records on village fields, transfers, due taxes, etc. but that was at a very rudimentary level. Attempt to reform the system was first made by Sher-Shah-Soori (Ruled from 1534-1545) whereby land was categorised, measured and a schedule of crop rates fixed. The system was reformed during Mughal King Akbar regime (Ruled from 1556-1605) by adviser Todar Mal. The subsequent colonial rule by the British implemented the system on scientific lines, whereby large scale cadastral surveys were conducted to demarcate the boundaries and extent of each individual landholding, and soil fertility to levy revenue from landholders of each and every village. A "Patwari or Revenue Officer" was responsible for collecting agricultural revenue, reporting the transfer or transition information, maintaining pedigree database and managing land records of the area of his jurisdiction that is known as a Patwar circle. After about 200 years the system retains the same character and only minor changes have been made according to the needs of the time.

The land record system is at a transition stage from a 200 year old land record system to more advanced computerisation systems now. The Computerisation of Land Records (CLR) was started in 1988-89 with the intention to remove the inherent flaws in the manual system of maintaining and updatiing Land Records. In 1997-98, the scheme was extended to 'tehsils' to start distribution of Records of Rights (ROR) to landowners on demand. So far the scheme has been extended to 582 districts and 3286 tehsils. Computerised copies of ROR are being issued to landowners from 1976 tehsil/taluks across the country. This project can safely claim to be the first successful initiative of e-Governance in India, at the grass-root level. The focus of the entire operation has always been to employ state of the art information technology (IT) to galvanise and transform the existing land records system of the country.

The Government of India has decided to implement the centrally-sponsored scheme in the shape of the National Land Records Modernisation Programme (NLRMP) by merging two existing Centrally-Sponsored Schemes of Computerisation of Land Records (CLR) and Strengthening of Revenue Administration and Updating of Land Records (SRA&ULR) in the Department of Land Resources (DoLR), Ministry of Rural Development. The integrated programme would modernise management of land records, minimise the scope of land/property disputes, enhance transparency in the land records maintenance system, and facilitate moving eventually towards guaranteed conclusive titles to immovable properties in the country. The major components of the programme are computerisation of all land records including mutations, digitisation of maps and integration of textual and spatial data, survey/re-survey and updating of all survey and settlement records including the creation of original cadastral records wherever necessary, computersation of registration and its integration with the land records maintenance system, development of core Geospatial Information System (GIS) and capacity building. The following is an outline of the components and activities to be taken up under the NLRMP.

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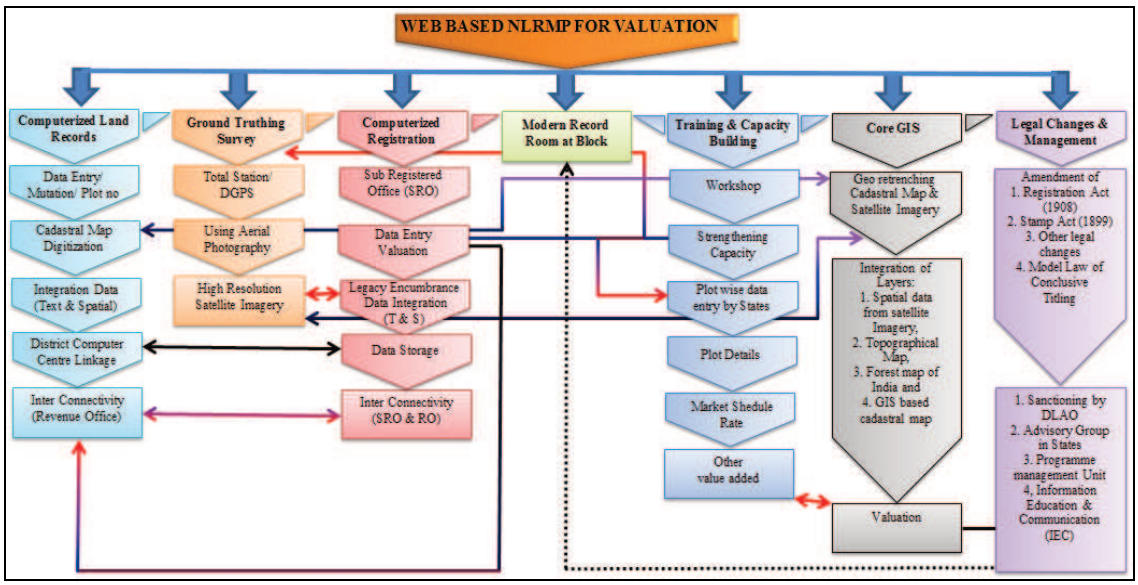

Fig 1: Basic System Architecture towards NLRMP

6 OPPORTUNITIES

The above NLRMP land and resource management programmes have been successful; the following contributing factors have often been present:

(a) Improvement and maintenance of infrastructure;

(b) Sound macroeconomic management that does not discriminate against agriculture and natural resources;

(c) Local community participation in all aspects of the programme;

(d) Public support for private investment in soil and water conservation;

(e) Robust local capacity building by non-governmental organisations and other cooperative-type projects; and

(f) Consistent efforts over at least a decade by concerned governments to increase not only land productivity but also awareness of environmental problems and possible solutions at local levels.

Investing in research on how to better adapt current land management systems to cope with increasing climate variability and climate change and the associated shocks and stresses, such as drought, flood, pests, and soil salinity, will also result in improved adaptation to climate change. Geographic information systems (GIS), geo-spatial mapping, and remote sensing technologies are central to achieving a successful transition from traditional environmental and resource management practices to sustainable development because of their integrative quality (linking social, economic, and environmental data) and their place-based quality.

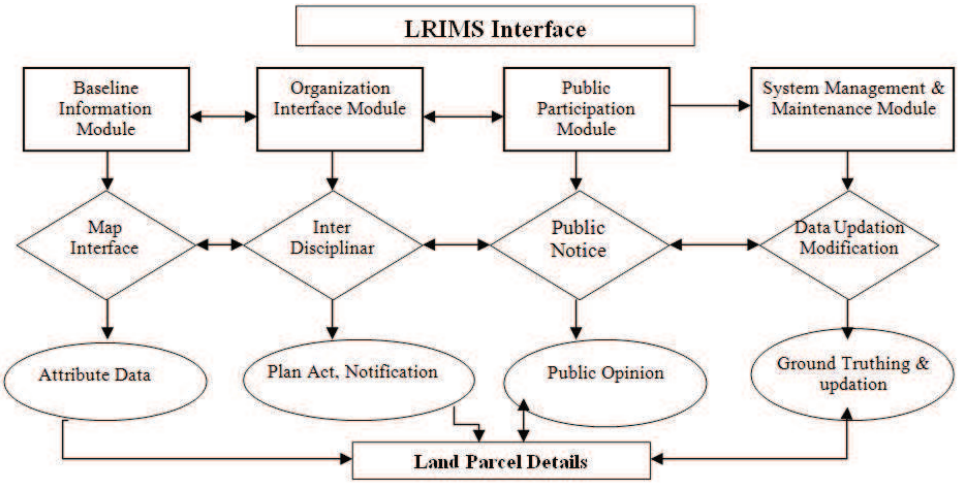

Figure 2: Land Records Information Management System

In a conventional system, query of land records is laborious, time consuming and revolves around a single person (Patwari). That is why integration of geographic data and their pertinent alphanumeric data is indispensable to develop and maintain a comprehensive Land Records Information Management System (LRIMS). The proposed system will not only be useful for the revenue department regarding information updating, query, reporting, customisation, leakage detection and predictive modelling but will also be beneficial for other system stakeholders regarding the identification of the legal precinct of their respective land. For the land acquisition plan for infrastructure development a man-machine interface model makes data capturing, ground truthing, plot details, land parcel details and acquisition plans more accurate and less time consuming. At present NRLMP is only used for land records and revenue collection, but through interface of different stakeholders it may play a pivotal role for decision making.

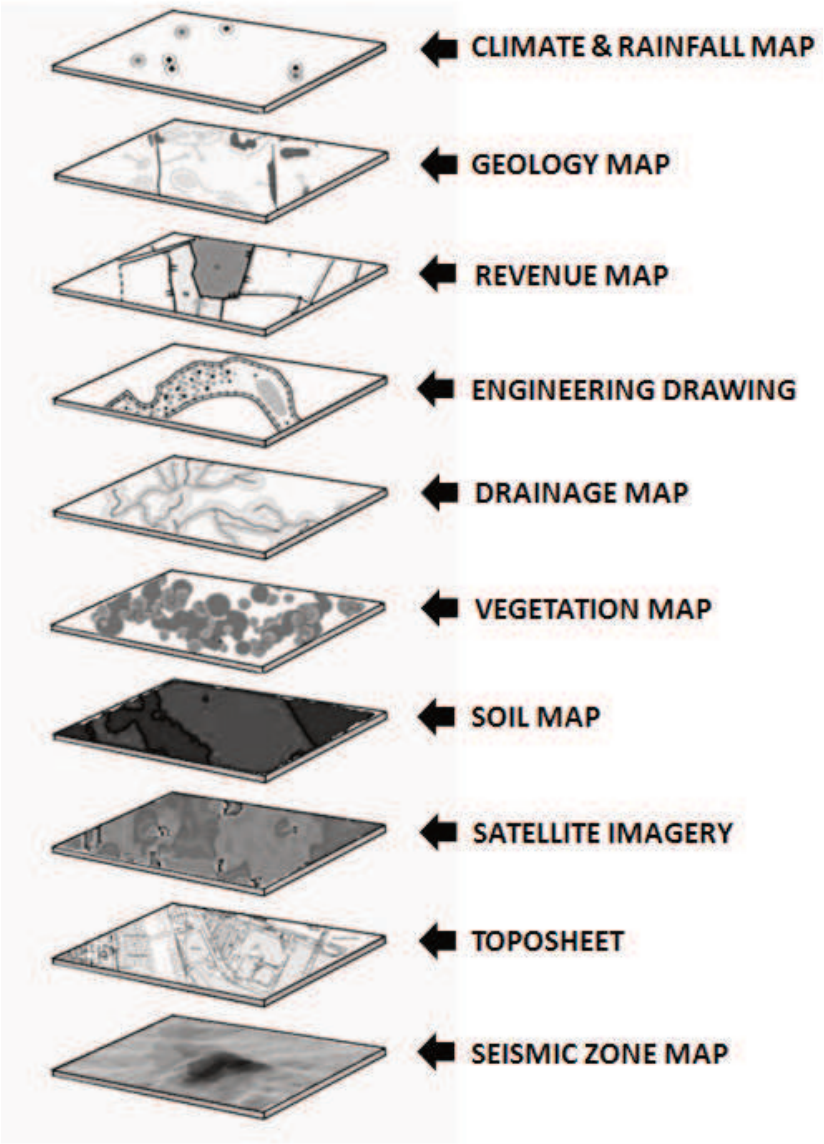

Figure 3: Baseline Information Mapping

Base Line information Module: The base line information module basically comprises a map, graphic, raster image, base line information, attribute data related to spatial information in one platform i.e. Geographic Information system (GIS). The module will have the capability of querying building, and presentation of the result of the query in both graphical and tabular presentation through overlay analysis. The information system will have zooming facilities starting from 1:1or 2 million scale and zooming up to 1: 500 scale depending on the resolution imagery and the level of study (Figure:3). The information content of this module will be a cadastral map showing details of each land parcel with physiography, demography, landuse, physical and social infrastructure, sensitive location, housing, open areas, transportation (road, rail, waterways), utilities (water supply, electricity), hot spots, location of monuments, polluted stretches,

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problem areas, tourist spots, pilgrim areas, tribal settlements, earth quack prone areas, their environmental status and their details etc.

Organisational Interface Module: Broadly speaking in the Indian scenario the development, management and decision making bodies are government organisations, development agencies, private developers, engineering firms and NGOs. But these bodies are separate. This module will have three sub modules focusing on highways, state roads and others roads. This module will contain alphanumeric data like Jamabandi, Khasra Girdawari, Pedigree Sheet. The basic booklet to be incorporated in this module will be government notifications, norms, infrastructure development standards various gazetteer, guidelines and directions published by government.

Public Participation Module: Public participation is one of the major tasks of the land acquisition process. The module will act as a platform for sharing the plan and progress of land acquisition in this computerised interface. This module will contain land parcel details, status of acquisition process, disbursement of compensation and public grievances.

The system management and maintenance module: This module deals with the maintenance and management of the LRIMS in the land acquisition system itself. It is basically a user management module. It deals with the various authorisations for access, viewing, updation, modification of data, information etc. The user management function may add and delete users of the system and the module-wise authorisation will also vary. The data, graphic and map updating may be authorised to different users to update the baseline and other information. The system management will be at block level, district level and state level. The average users will only be able to use data, analyse and compare the data but are not able to revise, add, delete or modify it.

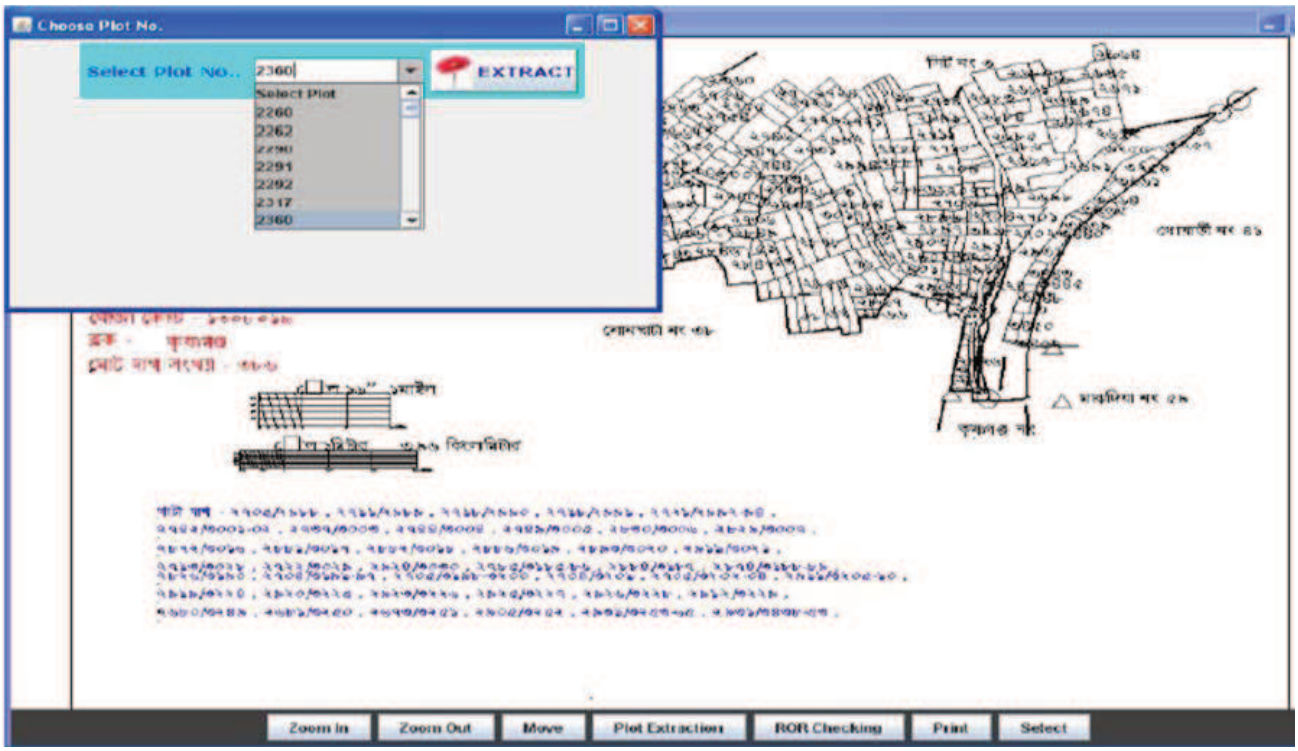

Fig 4: Public participation Module

7 TRADE-OFFS AND ITS OPTIONS

Though the specifics will vary from country to country and region to region, a comprehensive strategy for facilitating sustainable land and natural resource management contains four main components. They are:

- Policy and Sector Work: Further empirical work is necessary to clarify the private and social costs and benefits of alternative land use systems. Tradeoffs and synergies need to be identified and quantified where possible. Policy makers need such information when deciding on the relative priorities for the alignment of producer and consumer price incentives, fiscal and financial subsidies,

licensing fees and taxation, and the structure of protection in the context of a country's environmental and social policy objectives.

- Research and Technology: Rrevitalisation of investment in infrastructure will be needed to undertake SLM strategies and programmes at the country and ecological zone levels. Emphasis must be given to the adaptation and improvement of technologies associated with agricultural intensification, the management and rehabilitation of forest cover in sensitive watersheds, and more effective water management (to avert salinisation and mitigate flooding) on irrigated and bottom land.
- Information Management System and Its Implementation: Integration of Field Measurement Books (FMB) and alphanumeric data are indispensable to have a fully-fledged LRIMS. The technologies like GIS, spatial data warehousing and the web are very helpful to generate a complete LRIMS. All Block offices will have the right to update information as well as to keep track of ownership, crop yield and revenue, as well as land acquisition status on it. With the aid of these recent technologies all land record information will be under a fingertip (click of mouse). The implementation of this interface will help:
- A gateway to dynamic planning: A developing country like India which is in the transition stage of office automation this information system will act as a platform of integration of the traditional data and information system with the modern and dynamic GIS based information system.
- Efficient data management: Land acquisition needs a wide range of data and information. In the GIS platform data and information are stored at different coverage levels. This assists integration and differentiation of graphic and data base information with the data table and text.
- Tools for data analysis: This information system has the capability of performing user - based data queries. The types of data analyses used by infrastructure planners, developers, decision makers, land owners will be different from the that of academics and the general public. All users will retrieve, plot, and analyse the data according to their requirements.
- Transparent planning: With the dynamic nature of the information flow planning, monitoring and management will be more transparent.
- Active public participation in planning: The proposed information system will be web based, not software biased so that information technology can be opened with any operating system. As all the information is easily available people will be able to take active part in the land acquisition and developmental activity.

For instance, there is growing recognition by decision makers that problems at the intersection of agriculture and environmental management, climate-change, and land vegetative cover change, with their related social and economic consequences, will be at the forefront in the new century. Technological advances in GIS fostering the integration of satellite imagery with other data (such as socio-economic or health data) are opening new ways to synthesise complex and diverse geographic data sets, thus creating new opportunities for collaboration among natural and social scientists and decision makers at all levels.

- Knowledge Sharing and Extension: For improved land management practices, it will be important to build innovation into national extension programmes under natural resource management initiatives. A major advantage of these innovations is that they are site-specific and often are readily acceptable to locals. The incorporation of an innovative within a systematic approach can significantly improve the performance of natural resource conservation.
- Incentive Priorities and Financing: SLM practices are likely to be adopted where agriculture is important for rural livelihoods, where agricultural land is in short supply, and/or where SLM has the potential to increase yields of high-value crops or to identify environmental fragile areas. Policies to facilitate SLM are more likely to be successful if they provide tangible benefits to individual households or communities by emphasising enhanced agricultural productivity, food security, and income, rather than by controlling land degradation. In this context, a policy framework which provides for market access and attractive producer prices is essential to SLM. In addition to offering policy incentives, normally operating at price and cost margins sufficient to redirect the private sector's utilisation of resources in directions deemed socially desirable, achieving SLM will require

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additional investment in research and technology generation, knowledge dissemination, and the integration of knowledge and policies at appropriate spatial and temporal levels.

The costs of these investments can be considerable in areas where severe degradation has already taken place, often over decades and even centuries, as well as in those areas that will be hard hit by increasing climate variability and eventual climate change. Thus governments will need to (a) realistically assess the availability of resources; then (b) prioritise investments to rehabilitate the most egregiously damaged lands and soils (as measured, primarily, by the opportunity costs of taking no action); (c) develop a realistic phasing of investments; (d) set forth financing plans; and (e) seek agreements with likely beneficiaries in the private sector and civil society, for them to participate in programme implementation and to share a portion of the costs in accordance with agreed mechanisms.

8 CONCLUSIONS

A large area of formerly productive land has been rendered unproductive due to natural or man- made activities or government policies. Caution is required in interpreting the extent of land degradation. However, there is a general consensus that it is far less expensive to prevent land degradation via the application of good management, based on both cultural and scientific knowledge than to rehabilitate degraded land, and that where land is truly degraded, significant production and ecosystem service benefits can result from the rehabilitation of degraded lands. Given the scale of potential benefits and negative effects, it is essential for problem diagnosis, assessments of resource use alternatives, and cost-benefit analyses to be conducted at appropriate spatial and temporal levels. More emphasis needs to be placed on planning and implementation. Given the transboundary effects of land, water, and other resource management costs and benefits, equitable regional arrangements and treaties will need to be considered and revised as necessary. Property rights to resources such as land, water, and trees have been found to play a fundamental role at the nexus of poverty reduction, resource management, and environmental management. The property rights held by poor people represent key household and community assets that may provide income opportunities, ensure access to essential household subsistence needs (water, food, fuel, and medicines), and insure against livelihood risk. Poorer groups tend to rely more heavily on customary or informal rights. It is unlikely that SLM can be achieved in the absence of explicit attention to property rights.To stimulate the involvement of local to private investors in land-friendly commercial activities would relieve pressures on the budget for adequate programme finance while bringing to bear some of the flexibility and responsiveness needed to address the physical and financial contingencies associated with the kinds of investments required. The use of risk reduction or guarantee funds or the provision of insurance, partially underwritten by government, might prove sufficient to induce a strong private sector response. Overall SLM will act as a tool for decision making.

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