





Co-funded by the Erasmus+ Programme of the European Union

# Resource Analysis, Resource Mapping and Natural Resources Information System (NRIS)

Prakash Tiwari Professor of Geography DSB Campus Kumaun University Nainital Email: pctiwari@yahoo.com/pctiwari@gmail.com

\*The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

# **Resource Analysis and Mapping**

- Resource Mapping: Plotting information on the natural, social, economic, cultural, political, legal and institutional aspects of natural resources on a map using various tool and techniques of mapping
- Resource Analysis: Analysis of the natural, social, economic, cultural, political, legal and institutional aspects of natural resources through collection, analysis and interpretation of data and mapping, surveying and measurement

# **Resource Analysis and Mapping**



## **Methods of Resource Analysis**



# **Methods of Resource Mapping**



### Natural Resources Information System (NRIS)

Comprehensive database (spatial and nonspatial) of natural, social, economic, cultural, political, legal and institutional aspects of natural resources supported by GIS software. The NRIS should have the following characteristics:

- Data Input
- Data Output
- Data Storage
- Data Updating

- Data Retrieval
- Data Integration
- Data Analysis
- Data Query

### **Natural Resources Information System**

	System Characteristics	Use
•	Updatable Data System	The most recent information about natural resources
•	Retrievable Data	The Information should be easily retrievable by users in various format
•	Display System	Data can be displayed visually
•	Data Query System	It should allow & respond query
•	Data Integration	Different types of data could be integrated
•	Decision Support	Should lead to logical decisions
	Currently Used Tools	Geographic Information System (GIS)

# **National Initiatives**

- National Natural Resources Information System (NNRMS) of Department of Space, Government of India
- Integrated Mission for Sustainable Development (IMSD) of Department of Space, Government of India
- The National Informatics Centers (NIC) at District Level
- Natural Resources Data Management System (NRDMS) of Department of Science & Technology, Government of India
- Disaster Management Information Support System (DMISS) and action plans for assessment disaster damage and management of disasters









# Basic Framework: Natural Resources Concept; Classification and Process of Natural Resource Development

\*The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

# The Earth

- A composition of Natural elements
- Natural components are the outcome of natural processes
- Natural processes are independent of human action but can be modified by man
- The natural elements & processes are interrelated
- The earth is a natural system



#### **Man: The Most Intelligent Species on The Planet**

- Has Needs & Aspirations
- Has mental abilities
- Has physical capabilities
- Has imagination
- Has Reasoning



Man's Interaction with Nature: Process of Natural Resource Development				
Appraisal:	Examination, Evaluation, Assessment, Analysis			
Decision:	To Transform Nature			
Transformation:	Transformation of Natural landscape			
Utilization:	Fulfillment of Needs			
Development:	Agriculture, Industries, Dairying, Infrastructure, Employment etc.			

### **Factors of Resource Development**

- Environmentally permissible
- Economically viable
- Technologically transformable
- Socially acceptable
- Legally allowable
- Politically favorable

#### **PROCESS OF NATURAL RESOURCE DEVELOPMENT**



Resource can no longer be conceived as a tangible object, but a functional relationship that exists between man's want, his abilities and his appraisal of his environment. Resources are a culturally defined abstract concept which hinges upon man's perception of the means of attaining certain socially valued goals by manipulating selected elements of the biophysical environment (Hunker, 1964, An Introduction to World Resources, Harper & Row, New York)

Resource is an attribute of the environment appraised by man to be of value overtime within constraints imposed by his social, political, economic and institutional framework (O' Riodran, 1971, Perspectives on Resource Management)

Neither the environment as such nor parts of the environment are resources until they are or are considered to be capable of satisfying mankind's needs. Resources are an expression of appraisal and represent entirely subjective concept. Availability for human use nor merely the physical presence is the chief criterion of resources. Availability in turn, depends upon human wants and abilities (Zimmermann, 1933, World Industries and Resources)

Natural Resources are dynamic, becoming available to man through a combination of increased knowledge and expanding technology as well as changing individual and societal objectives (*Zimmerman, 1951 World Industries and Resources*)

Natural resources are not but they become (*Zimmermann, 1933, World Industries and Resources*)

Natural resources are defined by mankind's perception and attitude, wants, technological skill, legal, financial arrangement as well as political customs. What is natural resource in one culture may be neutral stuff in another culture (*Bruce Mitchell, 1979, Geography & Resource Analysis*)

### **Classification of Natural Resources**

Criteria of	Classification of Resources	Examples
Classification		
Nature	Biotic	Plants, Animals
	A-biotic	Minerals, Fossil Fuel
	Human	Human Resource
Utilization	Exhaustible (Non-renewable,	Iron Ore, Coal, Petroleum, Atomic Minerals
	Stock)	
	Inexhaustible (Renewable, Flow)	Water, Plants, Soil
	Continuous Resources	Solar Energy, Tidal Energy
Post Utility	Recyclable	Steel, Paper, Plastic
	Non-recyclable	Coal, Petroleum
Distribution	Ubiquitous	Air, Water
	Un-ubiquitous	Atomic Minerals, Petroleum
	Localized	Fasphorous
Ownership	Private	Agricultural Land
	State	Reserved Forests
	Common	Pastures
Availability	Finite	Water, Plants, Soil, Iron Ore, Coal, Petroleum,
	Infinite	Solar Energy, Tidal Energy
Stage of	Potential	Appraised and may be used in Future
Development	Reserved	Stock Resources will be used in Future
	Actual Resources	Being Utilized

#### Scientific Process of Resource Development

• Resource Appraisal:

#### **Resource Analysis:**

Analysis of physical parameters & socio-cultural determinants of natural resources

#### **Resource Mapping:**

Mapping of different physical and human aspects of natural resources

Currently used Tools: Remote Sensing

#### **Natural Resources Information System**

- Updatable Data System: The most recent information about natural resources
   Retrievable Data: The Information should be easily retrievable by users in various format
   Display System: Data can be displayed visually
- Data Query System:

It should allow & respond query

- Data Manipulation& Integration:
- Decision Support System:
- Currently Used Tools:

Different types of data could be integrated

Should lead to logical decisions

Geographic Information System (GIS)

## **Resource Management**

A framework/guideline/strategy/design/action plan/ for the justified and most rational utilization of natural resources based on the thorough appraisal of natural resources for region/s of varying spatial scale and physical and or cultural homogeneity (country/province/county/city/village/river) basin etc.)

#### **Resource Development**

Most justified and logical utilization of natural resources as per the framework/guideline/strategy/design/action plan evolved under the stage of resource management in a region

#### **Resource Conservation**

One of the main goal of resource management is to make possible the conservation of natural resources in the process of their utilization. The management of natural resources should allow the utilization of natural resources in such a manner that it must facilitate the conservation and protection of all natural resources, particularly the critical natural resources

#### **Sustainable Resource Development**

The other main objective of natural resource management is to allow the most judicious utilization of natural resources so that they are able to regenerate, purify, reproduce through natural cycling, and must ensure the availability of natural resources for the use of coming generations. Thus, the sustainable development of natural resources is a process which ensures the availability all types of natural resources on the earth for the times to come.







Natural Resource Management and Sustainable Development in Himalaya

[Concept and Approaches of Natural Resource Management; Community Based Natural Resource Management; Participatory Natural Resource Management; Natural Resources Management and Sustainable Mountain Development]

Prakash C. Tiwari Professor Department of Geography



Kumaun University, Nainital Uttarakhand, India Email: pctiwari@yahoo.com

\*The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

### **Natural Resource Management (NRM)**

- Natural resource management involve the management of different components of natural system as all these are dynamic and inter-related. A change in one of them may have far reaching and long term impacts which may even be irreversible. In addition to the natural systems, natural resource management also has to manage various stakeholders and their interests, policies, politics, geographical boundaries, economic implications etc. It is often very difficult to satisfy all aspects at the same time, and this results in conflicting situations in natural resource management process
- Natural Resources Management (NRM) refers to the sustainable utilization of major natural resources, such as land, water, air, minerals, forests, fisheries, and wild flora and fauna. NRM should also contribute towards *poverty alleviation*, and that natural resources should be used in a sustainable manner to enhance human welfare
- Resource Management involves either the management of production from a specific resource (a forest) or the overall planning of the development and use on natural resources (a watershed) (*Bruce Mitchell, Geography and Resource Analysis, 1979*)
- Resource Management may be defined as the process of decision making whereby resources are allocated over space and time according to the needs, aspirations and desires of people within the framework of their technology, political and social institutions and legal and administrative arrangements (T. O' Riodran, Perspectives on Natural Resource Management, 1971)
- Resource Management is concerned with the protection and enhancement of environmental quality and the establishment of new guidelines for the use of natural resources (T. O' Riodran, Perspectives on Natural Resource Management, 1971)

### **Integrated Natural Resource Management (INRM)**

A process of managing natural resources in a systematic way, which includes multiple aspects of natural resource use (biophysical, social, economic and political), meets production goals of producers and other direct users (e.g., food security, profitability as well as goals of the wider community (e.g., poverty alleviation, welfare of future generations, environmental conservation). It focuses on sustainability and at the same time tries to incorporate all possible stakeholders from the planning level itself, reducing possible future conflicts.

## Food and Agricultural Organization of United Nation's View on NRM

- Land, water, climate and biological diversity form the natural base of agriculture, essential to rural development and sustainable livelihoods. The growing demand for food, water, fibre and energy is disrupting agro-ecosystems, eroding biodiversity and depleting land and water. Those impacts will be exacerbated by climate change
- Natural resources must be used in a way that meets today's needs, while conserving them for future generations. That will require action to develop capacities, from global to farm level, for their sustainable management and regulation
- FAO's strategy for sustainable management of natural resources calls for a variety of measures: improved water productivity in farming systems, conservation and sustainable utilization of agricultural biodiversity, and responsible governance of access to land

## **Aspects of Natural Resource Management**



#### **Components of Natural Resource Management**



#### **Approaches to Natural Resource Management**

Preservative Approach	Emphasis on Conservation
Conservative Approach	Focusing on Conservation with Development
> Sectoral Approach	Element-wise Separate Management (Forest)
	Management at Different Scales (Watershed)
	Creation of Livelihood Opportunities
→ Ecosystem Approach	Management Integrating Natural Components
-> Integrated Approach	Integrating Natural & Socio-economic Components
$\xrightarrow{>}$ Adaptive Approach	Management Focusing on Projected Vulnerabilities
Participatory Approach	Participatory Natural Resource Management
	From Higher to Lower Spatial Level
Bottom Up Approach	From Lower to Higher Spatial Level
	Attaining Gender Equity Through NRM
> Economic Approach	Productivity Based Natural Resource Management
Interdisciplinary	NRM Using Knowledge of Different Streams

### Integrated Approach: Integrated Natural Resource Management (INRM)



## **Sectoral Approach of Natural Resource Management**



#### **Ecosystem Approach of Natural Resource Management**



#### Top Down and Bottom Up Approaches of Natural Resource Management



#### **Social Perspectives in Natural Resource Management**



#### **Economic Perspectives in Natural Resource Management**



## **Community Based Natural Resource Management** (CBNRM)

- CBNRM is the management of natural resources under a detailed plan developed and agreed to by all concerned stakeholders. The approach is community-based in that the communities managing the resources have the legal rights, the local institutions and the economic incentives to take substantial responsibility for sustained use of these resources. Under the natural resource management plan, communities become the primary implementers, assisted and monitored by technical services
- Besides focussing on sustainable development of natural resources it must include the aspects of community participation in decision making process related with resource management, livelihood improvement, income generation, poverty reduction, empowerment of women (gender mainstreaming) and other marginalized sections of society, inclusive development and equity of access

#### **People's Participation in Natural Resource Management**

- Manipulation: Non participation Stage.
- Therapy: The aim is to cure or educate the participants
- Informing: A most important first step to legitimate participation
- Consultation: Again a legitimate step attitude surveys, neighborhood meetings and public enquiries
- Placation: Inviting selected people onto committees. It allows citizens to advise or plan but retains for power holders the right to judge the legitimacy or feasibility of the advice
- Partnership: Power is in fact redistributed through negotiation between citizens and power holders and planning and decision-making responsibilities are shared e.g. through joint committees
- Delegated power: Citizens holding a clear majority of seats on committees with delegated powers to make decisions. Public now has the power to assure accountability of the programme to them
- Citizen Control: Have-nots handle the entire job of planning, policy making and managing a programme e.g. neighborhood corporation with no intermediaries between it and the source of funds



# Meeting of Community Forestry Members Pokhra, Nepal 11 December 2018



## **Gender and Natural Resource Management**

- Women manage natural resources, they are responsible for growing crops, have unique knowledge of local crop species and natural environment. Rural women walk long distances to collect fuel wood, fodder and water. Despite their reliance on natural resources, women have less access to and control over them than men. Usually it is men who put land, water, plants and animals to commercial use, which is often more valued than women's domestic uses
- Gender inequality is most evident in access to land. Custom prohibits women from owning land in many countries. Frequently women have only use rights, mediated by men, and those rights are highly precarious. Landless rural women often depend on common property resources for fuel wood, fodder and food. In many countries, overuse of those resources poses a serious threat to rural livelihoods and food security
- Without secure land rights, farmers have limited access to credit and little incentive to invest in improved management and conservation practices. Women and men are more likely to make environmentally sound land management decisions when they have secure ownership and know they can benefit
- To protect their natural resources, rural women and men must be empowered to participate in decisions that affect their needs and vulnerabilities. Addressing the gender dimensions of natural resources management will help policy makers formulate more effective interventions for their conservation and sustainable use

#### Our Common Future (World Commission on Environment and Development)

Those who are hungry will often destroy their environment in order to survive. They will cut down forests. Their livestock will overgraze grasslands. They will overuse marginal lands. In growing numbers they will crowd into congested cities.

> ('Our Common Future' Report of the World Commission on Environment & Development -also known as Brundtland Commission after Gro Harlen Brundtland then Norwegian Prime minister & chair of the Commission), 1987, Page 28)

#### **Natural Resource Management and Livelihood**

- Livelihood comprises the capabilities, assets (stores resources, claims and access) and activities required for a means of living: a livelihood is sustainable which can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, and provide sustainable livelihood opportunities for the next generation; and which contributes net benefits to other livelihoods at the local and global levels and in the short and long term." (Chambers and Conway, 1992)
- United Nation's Development Programme (UNDP) conceptualizes livelihoods as the means, activities, entitlements and assets by which people make a living. Assets, are defined as: natural/biological (i.e. land, water, common-property resources, flora, fauna); social (i.e. community, family, social networks); political (i.e. participation, empowerment sometimes included in the 'social' category); human (i.e. education, labour, health, nutrition); physical (i.e. roads, clinics, markets, schools, bridges); and economic (i.e., jobs, savings, credit)

## Sustainable Livelihood

- A livelihood is environmentally sustainable when it maintains or enhances the local and global assets in which livelihoods depend, and has net beneficial effects on other livelihoods
- A livelihood is socially sustainable which can cope with and recover from stress and shocks, and contribute towards social development
- An economically sustainable livelihoods provides viable means of income generation and poverty reduction

## **Sustainable Resource Development**

- Sustainable development as development that 'meets the needs of the present without compromising the ability
  of future generations to meet their own needs'. In other words sustainable development means that the well
  being of the people should at least be increasing over-time (World Commission on Environment and Development
  1987)
- A Process of Development where resources are used to maximize the benefits of economic development for the present generation without harming the prospects of maintaining or improving the living standard of the future generations (World Commission on Environment and Development, 1987)
- For sustainable development to take place it is necessary that "the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are all in harmony" (World Commission on Environment and Development, 1987).
- The notion of sustainability is based on two fundamental principles known as "quantity and quality of sustainability". The former requires that the quantity of natural resources should not decline over-time as this may reduce their total supply. It requires that natural resources should not be used at a rate which exceeds their rate of replenishment. The latter principle of sustainability requires that the quality of natural resources should not decline over-time as should not decline over-time as this may reduce their value (Pearce et al, 1994).

#### **Natural Resource Management**



