

MANAGEMENT OF NATURAL RESOURCE AND ITS CONSERVATION APPROACHES: AN ANALYSIS

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Abstract :

Historically, management theory has ignored the constraints imposed by the biophysical (natural) environment. Community natural resource management (CNRM) has been extensively promoted in recent years as an approach for pursuing biological conservation and socioeconomic objectives. It remains a popular policy with many international funding institutions. Natural resource management deals with managing the way in which people and natural landscapes interact. It brings together land use planning, water management, biodiversity conservation, and the future sustainability of industries like agriculture, mining, tourism, fisheries and forestry. A learning approach to NRM applies principles and theories of adult, organizational and social learning. It is underpinned by three core elements: systems thinking, negotiation and reflection. The main objective of the study is to evaluate the management of different kind of natural resources. The detailed analysis of the study has been given in the full paper.

Keywords: Natural resource management, sustainable development, planning

Introduction

Natural resource management refers to the management of natural resources such as land, water, soil, plants and animals, with a particular focus on how management affects the quality of life for both present and future generations'. Natural resource management deals with managing the way in which people and natural landscapes interact. It brings together land use planning, water management, biodiversity conservation, and the future sustainability of industries like agriculture, mining, tourism, fisheries and forestry. It recognizes that people and their livelihoods rely on the health and productivity of our landscapes, and their actions as stewards of the land play a critical role in maintaining this health and productivity.^[1] Natural resource management specifically focuses on a scientific and technical understanding of resources and ecology and the life-supporting capacity of those resources is also similar to natural resource management..

Natural resource Approach

Natural resource management issues are inherently complex as they involve the ecological cycles, hydrological cycles, climate, animals, plants and

geography etc. All these are dynamic and inter-related. A change in one of them may have far reaching and/or 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 and the list goes on. It is very difficult to satisfy all aspects at the same time. This results in conflicting situations.

After the United Nations Conference for the Environment and Development (UNCED) held in Rio de Janeiro in 1992, most nations subscribed to new principles for the integrated management of land, water, and forests. Although program names vary from nation to nation, all express similar aims

Land Resource Characterization, Management & Land Use Planning

- Prepared soil maps of the country (1:1 million scale), states (1:250,000 scale) and several districts (1:50,000 scale).
- Twenty agro-ecological regions and sixty agro-ecological sub-regions of the country have been delineated and mapped on 1:4.4 million scale.
- Prepared soil degradation map of the country (1:4.4 million scale) and soil erosion maps for states (1:250,000 scale) for effective resource conservation planning.
- Estimated degraded land area in the country after harmonizing the database available with ICAR, Department of Space, NRSC, Rainfed Area Authority, DAC and SLUSI.
- The soil carbon stocks under different land use systems of the country documented.
- A New Approach of Participatory Land Use Planning (PLUP) developed and validated through a case study in Kokarda and Kaniyadol villages, Nagpur, Maharashtra.

Water Management

- Developed micro level water resource through rainwater harvesting in tank cum well system for plateau region. (Rs. 30,000 extra gross income /year with additional employment generation of 115 man days/ ha)

- Sub surface water harvesting structure (SSWHS) and micro-tube well technology in coastal waterlogged areas. (Net income Rs. 77646/ha with benefit: cost ratio 1.78.)
- Devised drip and sprinkler irrigation systems saving water (30-50%), labour (50%), fertilizer (30-40%) and increasing yields (12-76%).
- Gravity and pressurized irrigation systems namely low energy water application (LEWA) device designed, evaluated and popularized.
- A pressurized irrigation system fed through a reservoir in adjunct to the canal system for irrigation either by pumping or by gravity was developed with benefit-cost ratio of 2.6.
- Devised recharge filters for sediment free runoff water in open wells and tube wells. Design parameters of runoff recycling based irrigation system have been developed and evaluated.

Soil Health & Nutrient Management

- Digitized soil fertility maps (Macro & micronutrients) for different states prepared.
- Developed ready reckoners for soil test based fertilizer recommendations.
- Launched soil test based on-line fertilizer recommendation system for different cropping systems.
- Documented integrated nutrient management packages for major cropping systems of the country to promote balanced fertilization.
- Developed biofertilizer technology for mass multiplication and adoption by the farmers.
- Standardized Vermi/enriched-composting technology.
- Identified fungi (*Aspergillus terreus/flavus/heteromorphu* and *Rhizomucor pusillus*) for rapid composting within 75 days of segregated municipal solid wastes.
- Developed liquid biofertilizer formulations and a quality control kit for testing the biofertilizers based on genetically marked strains.

Soil and Water Conservation- Watershed Management

- A network of 47 model watersheds developed, making a basis for the National Watershed Development Programme for Rainfed Areas (NWDPPRA).
- Location specific bio engineering measures for different degraded lands including mine spoils developed reducing runoff and soil loss to a great extent.
- Rainfall intensity duration and return period equations and nomographs for 42 stations in different rainfall zones of India were developed. Nomographs for estimation of peak discharge by various methods have been evolved for field workers.
- The annual and seasonal erosivity index EI30 and EI1440 maps were prepared using 50 recording rain gauge stations and 400 rainfall stations, respectively.

Crop diversification

- Developed efficient alternatives to rice-wheat system at 13 locations with productivity ranging from 12-43 t/ha/year.
- In arid-ecosystem, efficient alternatives as identified are cotton-wheat (Hisar), cotton-groundnut (S.K.Nagar), pearl millet-potato –clusterbean (Bichpuri), soybean-checkpea (Rahrui) and pearl millet-barly-vegetable guar (Durgapura) with yield potential of 12-29 t/ha/year.
- Identified efficient alternatives to rice-rice system of humid and coastal ecosystem with potential productivity of 12-21 t/ha/year.
- Crop diversification in drought prone areas in rainfed upland with average rice equivalent yield of 7.5 t/ ha identified to replace traditional rice only 1.9 t/ha yield.

Rainfed/Dryland Farming

- Characterized and delineated dryland/ rainfed areas including drought prone areas of the country.
- Developed contingent cropping strategy for major rainfed agro eco-zones of the country to cope up with delay in monsoon and mid season droughts
- Developed crop weather relationships and climate based crop planning to issue regular agro-advisories
- Identified location specific cropping systems that optimally use the land and rainfall effectively and provide stable income to the farmers
- Developed location specific in-situ and ex-situ moisture conservation practices for major rainfed agro-ecological regions of the country.
- Assessed the water harvesting potential of different agro-ecological zones, optimized the design of farm ponds and identified water efficient cropping systems for supplemental irrigation.
- Developed GV technology for castor semi-looper and microbial inoculants for heat stress tolerance in plants.
- Developed web based DSS for drought monitoring for Andhra Pradesh.
- Evolved innovative models of convergence at village level for water harvesting interventions through NREGA under NAIP
- Designed and popularized large number of farm implements for timely sowing and harvesting of rainfed crops and resource conservation.

Agroforestry Management

- Agroforestry models developed for bio-amelioration of salt-affected lands.
- A comprehensive on-line database on agro-forestry entitled "Agro-forestry BASE" generated.
- Standardized different agro-forestry modules linking to paper, pulp wood and herbal medicines based industries for marginal rainfed lands.

- Developed Gmelina with Turmeric Sapota-Teak based Agroforestry System for hilly zone of Karnataka and Lac based agro-forestry system for Bundelkhand region.
- Intercropping of Aloe vera , a medicinal plant, in ber orchards promised additional returns of Rs. 26,000/ha in arid regions.

Weed Management

- Developed National database on weeds.
- Appropriate weed management practices developed for different agro-ecological situations of the country.
- Developed biological control of water hyacinth using *Neochetina* weevils
- Control of *Parthenium hysterophorus* using bio-agent Mexican beetle *Zygogramma bicolorata*
- Pinoxaden, a new weedicide, found effective for controlling grassy weeds especially *Avena ludoviciana* and *Phalaris minor* in wheat.
- A safe rust bio-agent (*Puccinia sp.* isolate NRCWSR-3) was identified for the control of exotic weed Velvet bush (*Lagascea mollis*) spreading fast on cropped and non-cropped lands in India.
- A weed collector unit was developed for engine-operated aquatic weed cutter / harvester.
- Two hair care products (Aloe Shampoo and Aloe Hair Cream) and two skin care products (Aloe Moisturizer and Aloe Crack Cream) developed from the Aloe vera juice.
- The tropical mushroom (*Calocyle indica*) cultivation has been introduced in summer months in addition to oyster mushroom in winter months.
- Superior karonda cultivars CZK 2001-17 and CZK 2000-1 developed.
- Thorn less Cactus (*Opuntia Ficus Indica*) - an unconventional feed source for arid region livestock identified.
- Prepared value -added products like peelu squash and peelu jam from *Salvadora oleoides* fruits.
- Developed an improved 3-in-1 compact integrated device to serve as solar water heater, cooker and dryer.
- Developed a solar PV mobile unit for domestic and small agricultural applications in arid region.
- Developed aromatic coffee powder and biscuits from the pods of thorn less variety of vilayati babool (*Prosopis juliflora*).

Integrated Farming Systems

- Developed integrated Farming systems involving crops, horticulture, agroforestry, fisheries, poultry, piggery, mushroom cultivation and bee-keeping etc. with potential to increase productivity by 2-7 times.
- Developed crop-dairy based farming system for small farm families of Bihar having 1 acre of irrigated land and 4 crossbred cows.
- Developed watermill based integrated farming system for north western Himalayas.
- Fish trench cum raised bed based horticulture-fish farming system generated for seasonally waterlogged areas of Bihar.
- Developed multi enterprise farming system model for reclaimed sodic land.
- Rice, coconut and rabbit based integrated farming system packages developed for Western Ghats region.

Arid Land Management (Hot and Cold deserts)

- Developed desertification and wind erosion maps.
- Developed techniques of sand-dune stabilization and shelter-belt plantation for arid zone.
- Developed CAZRI Moth-3 variety giving higher yield of 4.4 q/ha without any fertilizers and seed treatment and benefit : cost ratio of 3:1.
- Developed eco-friendly low cost animal shelter capable of alleviating environmental stress situations of hot summer and cold winter in desert eco system.
- Castor with green gram intercropping proved highly remunerative under delayed onset of monsoon in south-eastern Rajasthan.

Conclusion

Sustainable management of natural resources is vital as agricultural development with positive growth and long term sustainability cannot thrive on a deteriorating natural resource base. We are today; confronted with widespread land degradation, ground water imbalances, impaired soil health and contamination of food and environmental pollution etc. The situation is getting further compounded with the recent climate change impacts on agriculture. To have a holistic solution to these emerging problems, the division has set future priority research on abiotic stress management (droughts, cold waves, floods, salinity, alkalinity, acidity and nutritional disorders etc), climate resilient agriculture, conservation agriculture including organic farming, bioremediation of contaminated soils and water, biofortification, bio fuels, bio-industrial watersheds and development of decision support systems for micro level land use planning etc.

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