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INTEGRATION OF TECHNOLOGY WITH ECONOMICS & ECOLOGY TO ENSURE INTEGRITY OF FOREST ECOSYSTEMS

It may seem farfetched, but it has all the scientific backing that sustainability of forest is synonymous with 'ecosystem approach in its management'. The famous ecologist Odum [1] defined ecosystem approach in forest management as integration of ecology with economics. The author of this paper took Odum's definition further by stating that ecosystem approach in forest management lied in integrating ecology with economics as well as with technology [2]. This paper examines the role of technology in maintaining ecosystem integrity.

Keywords: Ecosystem, Sustainability, Ecology, Economics, Technology

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Інтеграція технології, економіки та екології – гарантія цілісності лісових екосистем

Сталий розвиток лісового середовища є синонімом екосистемного підходу в лісовому господарюванні – це твердження може здаватися надуманим, але водночас воно має наукове підґрунтя. Знаменитий еколог Одум [1] визначив екосистемний підхід в лісовому господарюванні як інтеграцію екології та економіки. Автор статті трактує визначення Одума, що екосистемний підхід в лісовому господарюванні полягає в інтеграції екології, економіки, а також і технології. Окреслюється роль технології в сталому розвитку екосистеми.

Ключові слова: екосистема, сталий розвиток, екологія, економіка, технологія

Introduction

Forest management, be it natural forests, or plantations, is a multidimensional process. The dimensions are: ecological, technical (including silvicultural), social, economic, and institutional. The primary goals in management, again be it natural forests or man-made, are three: *stability* and *productivity* of the physical environment, and *equity* in social environment. The dimensions and goals form a vital matrix. The sustainability of forests depends on balanced functioning of the matrix.

In India, as many as 13 million hectares of natural forests were lost in last 5 decades. The rate of deforestation works out at 2,60,000 hectares per annum [3]. The basic reason of deforestation is overemphasis on one or the other dimension of the management, and neglect of the other.

In India, the plantation forestry in India, has been more impressive in quantity than in quality. The inadequate success in plantation forestry is again because of neglect of technical dimension.

Ecosystem: Spatial and Temporal Definition

No ecologist has attempted to give a spatial or temporal definition to 'ecosystem'. But if we try to give a spatial definition to ecosystem at an operational level, considering the dimensions of economics and technology in addition to ecology, a micro watershed would be the outcome [2]. We should consider a micro-watershed as the spatial definition of an ecosystem.

A practical temporal definition would be that which incorporates the perceivable past and the foreseeable future. The experience tells us that a past cannot be perceived, and a future cannot be foreseen beyond 3 generations. So a 7 generation concept would be an useful temporal definition of an ecosystem.

The Enigma of Sustainable Forestry

Sustainability is the key issue in forest management, be it natural forest, or man-made, be it India, or any other part of the globe. Unfortunately, so far, no scientifically sound, but operational definition of sustainability has been evolved for universal application in forest management. Nevertheless, it could be said on an empirical basis that sustainable forest management (SFM) lies in attaining three basic goals; first, maintaining the stability of the physical environment, secondly, maintaining, and if necessary, improving the biological productivity of the resource, and, thirdly, ensuring equity in distribution of quantitative and qualitative benefits generated by the resource. The goals are to be attained not at any given point of time, but in perpetuity. Perpetuity will have to be defined though. It may be 'seven generation concept' as suggested in the earlier paragraph, which was also propounded by one of the first nations in Canada.

Also, SFM is a multi-dimensional process. The major dimensions of the process are: ecological, technical (including silviculture, and the disciplines of genetics and biotechnology), social, economic, and institutional. All the dimensions are equally important, and neglect of any can mar the sustainability of management.

Goal – Dimension Matrix

If we consider the goals and dimensions of forest management together, we obtain the following matrix:

Goals	Stability	Productivity	Equity
Dimensions			
Ecological			
Technical			
Social			
Economic			
Institutional			

Perhaps, sustainable forest management would mean that all the three goals, and all the four dimensions are in proper focus, and in the management process, no box in the matrix has a negative value [4].

The Tragedy of the Forestry in India

The tragedy of forestry in India has been that at any given point of time only one dimension of management was emphasized. If it was economic in nineteen-seventies, ecological in nineteen-eighties, and institutional in nineteen-nineties. The technical dimension was by and large ignored. There have been little, or no technical innovations either in the direction of increasing production, or in the way of more efficient use of forest products. Improvement in tending and harvesting operations has virtually been not attempted.

The situation in regard to identification of goal has been rather nebulous. Till nineteen-seventies, the goal was substantially the increasing of productivity. In nineteen-eighties it shifted towards stability of environment, or call it 'conservation'. In nineteen-nineties it was exclusively 'equity'.

Conclusions

In forestry, if it is not wise to overlook ecology, it is equally unwise to discard economics, or ignore technology. In our overzealousness, if we chose forestry practices which aimed only at ecological stability, and ignored productivity, we would secure neither. Our goal is to have an environment which is both stable, and productive, and that environment results from combined functioning of ecology, economics, and technology. To keep the environment safe, and at the same time to meet the demands of a rising population, we will have to evolve super trees, and to extend the fundamental equation,

$$\begin{aligned} \text{Phenotype} &= \text{Genotype} + \text{Environment}, & \text{to} \\ \text{Supertype} &= \text{Phenotype} + \text{Technology}. \end{aligned}$$

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CIRITERIA AND INDICATORS FOR SUSTAINABLE FOREST MANAGEMENT AND BIODIVERSITY CONSERVATION IN ARUNACHAL PRADESH, INDIA

This paper aims to suggest criteria and indicators for management of forests in Arunachal Pradesh which is the largest forest rich state in the northeastern part of India. Keeping in view the rich biodiversity of this region, its status as a hot spot and close association

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