Criteria and Indicator (C&I) approach for sustainable management of natural forests in India

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ABSTRACT

Forests of India have been managed scientifically since 19th century. Forest policy of India has been guiding the sector to manage natural forests of the country sustainably. During the early and mid twentieth century, forests were managed on the principles of sustainable yield management. In the later stages of the century, the sector adopted progressive yield management to meet the requirements of forest industries besides demands from railways and domestic sector. Forests of India have been losing its productivity due to many reasons. One of the known reasons is being the poor investment and non-participation of local community in the management, who have been the bonafide users of forests. Due to loss of forest productivity, non-continuous flow of goods and services, these local communities are losing their livelihood base. Ecological and economic aspects of forests have been addressed under the comprehensive forest division level plan (working plan). But the monitoring of various initiatives of forest development and societal benefit is found to be lacking in the current system of forest management. The current system of forest accounting is not reporting the true contribution of the sector to the national economic development. Looking to these gaps and requirement of a monitoring system, the country has initiated Criteria & Indicators (C&I) approach for managing the forests sustainably. The C&I framework developed, helps to enhance stakeholders participation and define the sustainability of the forests by them. When data are collected for these indicators, and analyzed, it provides the direction of change. At the same time, it also helps to identify those aspects of management which requires more input and additional efforts. The paper demonstrate the use of C&I framework with help of a case study. The study not only enhances our knowledge about the forest resources, but also achieving the goal of sustainable forest management in the country.

Key words: Criteria & Indicator, Sustainable Forest Management, Sustainability

I INTRODUCTION

Over the last several years, there has been considerable interest both in defining and in finding ways to measure sustainable forest management (SFM), as well as to adopt and verify managerial performance measures designed to achieve SFM on the ground. Forests are symbol of healthy nation and people's interaction with nature. Keeping in view all the pillars of sustainability i.e. ecologically resilient, socio-culturally acceptable management and economically viable forest resources and their management, the real challenge exists is involving stakeholders and defining the threshold values of sustainability and monitor them to arrive the direction of changes over the years. This will help the management for sustainable development of resources. Therefore sustainable management of forests has been the key issue of concern at national as well at global level particularly in reference to biodiversity conservation, climate change and subsequent ecosystem services of forest protected ecosystem. There is established fact that forest ecosystems have intrinsic values that underpin their social, cultural and economic importance. Thus the sustainable forest management deals with ecologically sound practices that maintain the forest ecosystem integrity, productivity, resilience and biodiversity. Therefore, the ecosystem-based forest management is an integrated management approach addressing the natural landscapes and watershed catchments, ecological processes, wildlife species and human activities. In light of these, the usefulness of Criteria and Indicators (C&I) as a tool to monitor and assess forest condition has been recognized world-wide and considerable initiatives have been taken up at various levels to promote sustainable forest management, which is also considered as an integral part of sustainable development. Present paper deals with the development of functional monitoring system for assessment of sustainable forest management by applying C&I framework at forest management unit level.

II C&I FRAMEWORK

India has developed a national generic set C&I framework to manage the natural forests of the country sustainably. The framework has evolved through multi stakeholder consultation, which includes grassroots and policy level institutions and eminent experts and academicians. The generic set was widely tested and revisited several time to accommodate the forest diversity of the country. Main conceptual tools for guiding the assessment of SFM are: Principles, Criteria & Indicators, norms and verifiers. The national generic set has three principles, 8 criteria and 37 indicators.

(a) Principle: It is defined as "a fundamental truth or law as the basis of reasoning or action". Principles are seen as providing the primary framework for managing forests in a sustainable fashion. Therefore, principles are general in scope & they outline the philosophy upon which the initiative/forest management standard is based.

(b) Criteria: Criterion is defined as "a standard that a thing is judged by" or "an identifiable element of sustainability against which forest management can be assessed". Criteria set out the key elements or dimensions that define and clarify each principle or a 'second order' principle, one that adds meaning and operationality to a principle without itself being a direct yardstick of performance.

(c) Indicator: Indicator may be of any variable or component of the forest ecosystem or the relevant management systems used to infer attributes of the sustainability of a resource and its utilization. Indicators present an aggregate of one or more data elements with certain established relationships and when periodically measured they give trend/ progress made by the natives.

(d) Norms/ Sustainability: Set or arrived in the context of decisions about, what type of system is to be sustained and over what spatio-temporal scale? Norm of an indicator can be arrived through consultation, or using the reference value or taking the average value of reference period, it can be even arrived based on scientific study or literatures (Adopted from Allen and Hoekstra, 1994).

(e) Verifiers: Verifiers may be data/ information, procedures needed to determine satisfaction of the conditions postulated in the indicator concerned. Verifiers provide specific details that would indicate or reflect a desired condition of an indicator; they may add meaning and precision. Some of the procedures needed to determine satisfaction of the conditions postulated in the indicator concerned (Means of verification), may need to be developed.

Annexure – II, provides the generic set of C&I for sustainable management of natural forests in India.

III MONITORING SFM

Application of C&I framework is done at forest management unit level. In India forest division is considered as forest management unit (FMU) due its operation. Working Plan is prepared and mobilized at division level and the fund allocation is made as per the working plan prescription. Therefore it is appropriate for the country to consider the forest division as FMU for monitoring the change and take appropriate decision to achieve the objective of sustainable development forest resources in the country. Collection of temporal data is done at FMU level with the participation of all stakeholders. There are few indicators requires the observation of the grassroots like Joint Forest Management Committee (JFMC) and their continued cooperation. The capacity developed at JFMC level will help to observe and report on those indicators. Looking to the heterogeneity in terms of units used for data sets and periodicity, a simple and robust method and having scientific base has been proposed to monitor the trend of SFM in India. Following are the stepwise approach of assessing the sustainability of forests at FMU level.

(a) Tabulation of data: Temporal data on identified indicators at the FMU level is reported in a simple data collection format and tabulated and entered in excel sheet. Annexure –II, provides an example of one of the FMU, i.e. South Seoni (Madhya Pradesh).

(b) Scoring of indicators: Performance of indicator is measured against the norm or sustainability of indicators, which have been arrived through multi consultation approach. The norms once decided will not be changed or re-defined frequently and should be maintained for one cycle of management. Therefore score of an indicator reflects the achievement made towards sustainability. This will be used to identify the gap in the intervention/ management made hence corrective measures is made in the future interventions.

(c) Assigning weightage to Criteria: Equal weightage was assigned to all the eight criteria, since these criteria are equally important to achieve the sustainable development of forests. Hence, all the criteria are assigned a weight of 12.5 to make total of 100.

(d) Assigning weightage to indicators: Each indicator is weighted as per its perceived importance within the criterion, which is specific to the FMU and community wisdom. Total of weight of indicators of each criterion was again fixed at 100 only.

(e) Developing Sustainability Index: Calculation of Sustainability Index **(SI)** was based on the following equation:

$$SI= \frac{\Sigma \{(WC_1 x C_1), (WC_2 x C_2),...(WC_n x C_n)}{\Sigma (WC_1, WC_2..WC_n)}$$

Where, SI – Sustainability Index, $WC_{n} =$ Weight of the nth criterion, $C_n =$ Score of the nth criterion Where C_n is calculated as

$$C = \frac{\Sigma \{(WI_1 x I_1), (WI_2 x I_2),, (WI_n x I_n)\}}{\Sigma (WI_1, WI_2...WI_n)}$$
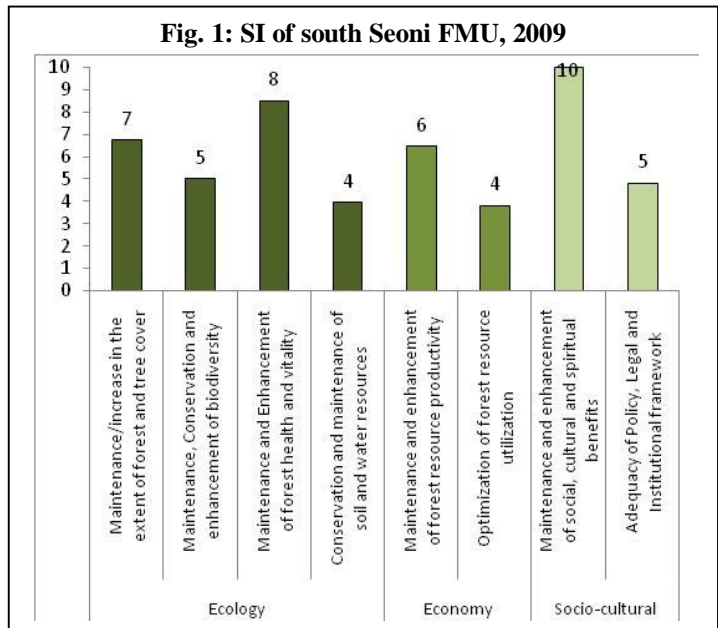
Where, WI_n = Weight assigned to nth indicator under the respective Criteria. I_n = Score of the nth indicator under the respective criteria.

The value of SI reflects forestry conditions, and higher value indicates the better situations. The lower value of the SI during the assessment year can be evaluated with the help of poor performing indicators. These poor performing indicators can be addressed with collective intervention to make it performing indicators.
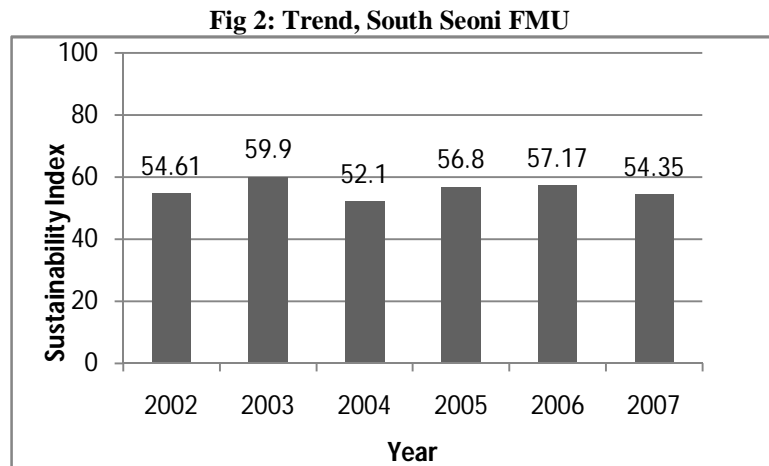
IV CONCLUSION

The indicators evolved at FMU level are of quantitative and qualitative in nature. Quantitative data were collected from department records, published data, and interaction with community and field observations. Whereas the qualitative data, which is also important looking to the social aspects attached with forest situation in the FMU were collected through community interaction. Periodicity of the data varies with the indicators. These are ranging from once in every year to 10th year. Variation is justified due to its gestation period and periodicity of such data collected and reported by the government agencies. In many cases the indicators evolved at FMU do not have adequate data. The qualitative data collection and reporting require a systematic approach in quantifying and use it in the SI calculations. Fig.1, indicates the performance of criterion in a particular year. Criteria 4 and 6 are performed poorly due to poor performance of identified indicators under the respective criterion.

It is also evident that few indicators are not observed at FMU level due to non-compliance and lack of man power to collect and report data during reported year. In the case of south Seoni FMU (Fig.

Fig. 1: SI of south Seoni FMU, 2009

2) it is evident that in the year 2004, 11 out of 32

Fig 2: Trend, South Seoni FMU

indicators performed below in comparison to the previous year and hence influenced the overall SI of the FMU. The SI is one of the best ways of communicating the sustainability of the forests at FMU level to policy makers to improve the efficiency.

Annexure – I: National generic Set of C&I for Sustainable Management of Natural Forests in India

Indicator	Norm/ Sustainability
Principle- I: Ecologically/ environmentally secured forests	
Criterion 1: Maintenance/increase in the extent of forest and tree cover	
1.1a: Area of forests under different legal classes (RF, PF, UF and others)	Entire forest area is notified as RF and PF
1.1 b: Forest area under different working circle/ management plan	Entire forest area is covered under WP/ Management plan
1.2 Percentage of forest with secured boundaries	Map showing forest boundary is available and boundary demarcation in the field
1.3 Change in area of forest cover	The base year status of forest cover is maintained or improved
1.4 Change in tree cover outside forest area	Documentation of ToF and appropriate recommendations made for further increase
Criterion 2: Maintenance, Conservation and Enhancement of Biodiversity	
2.1 Protected area network	Average 5% land area and 15% of forest area or as may be applicable in States
2.2 Species diversity	Base year documented species diversity is maintained or enhanced
2.3 Genetic diversity	Documented and maintained/ conserved
2.4 Status of Biodiversity conservation in forests	Implemented the state guideline/ strategic plan
2.5 Status of species prone to over exploitation	Sustainable and responsible management practices have been prepared and implemented
2.6 Status of non destructive harvest of wood	Stump size and finishing as per the silvicultural prescription
Criterion 3: Maintenance and Enhancement of Forest Health and Vitality	
3.1 Status of regeneration	As per the base year assessment or about 1500 seedling per ha in Dray area and not exceed 4500 seedling per ha in humid area
3.2 (a) Area affected by forest fire	Fire incidents have reported and appropriate measures have been taken and reported positive results
3.2 (b) Area damaged by natural calamities	Preparedness and mitigation strategy plan is available
3.3 Area protected from grazing	Regulated grazing as per the WP
3.4 Area infested by invasive weed species in forests	Plantation (AR/ANR) area are free from weeds
3.5 Incidences of pest and diseases	Appropriate action taken and controlled
Criterion 4 : Conservation and maintenance of soil and water resources	
4.1 Area treated under soil and water conservation measures	Soil erosion vulnerability assessment and intervened
4.2 (a) Duration of water flow in the selected seasonal streams	River flow pattern w.r.t annual rainfall has been improved
4.2 (b) Wetlands in forest areas	No reduction in wetland from the base year
4.2 (c) Water level in the wells in the vicinity, (up to 5 km) of forest area	Water level w.r.t annual rainfall has been improved
Principle- II: Economically Viable forests	
Criterion 5 : Maintenance and enhancement of forest resource productivity	
5.1 Growing stock of wood	No undue reduction in growing stock w.r.t Base year
5.1b: Growing stock of bamboo	Number of clump and clump size is maintained or increased w.r.t base year
5.2 Increment in volume of identified species of wood	MAI of important tree species is maintained or increased w.r.t base year
5.3 Efforts towards enhancement of forest productivity through quality plantation activities	About 10% of the total forest area should be brought under production forestry by raising quality plantation
Criterion 6: Optimization of forest resource utilization	
6.1 (a) Recorded removal of timber	Harvest should not exceed the accretion (growing stock/ MAI)
6.1 (b) Recorded removal of fuel wood	Quantified data on removals and sharing of with the community is available
6.1 (c) Recorded removal of bamboo	Quantified data on removals and sharing of with the community is available
6.2 Recorded removal of locally important NTFPs	NTFPs by all means should not exceed the annual yield or as indicated in the Working Plan

6.3 Direct employment in forestry activities	Forest dwelling community benefited due to wage generation from forestry and allied activities
6.4 Demand and Supply of Timber and important Non-Timber Forest Produce	Assessed and evolved mechanism to meet the demand
6.5 (a) Import and Export of wood and wood products	Efforts made to increase the export and reduction in the import
6.5 (b) Import and Export of NTFPs	- do -
6.6 Value and percentage contribution of forestry sector to Gross Domestic Products (GDP)	Progressive and increase in the share
Principle- III: Socio-culturally acceptable and Institutional measures are helping sustainable management of forests	
Criterion 7: Maintenance and enhancement of social, cultural and spiritual benefits	
7.1 (a) Number of JFM committees and area (s) protected by them	Should match the JFM resolution or minimum 50% of the forest area should be under JFM
7.1 (b) Status of empowerment of JFMCs	Regular meetings and participation of average 60 percent members
7.1(c): Labour welfare	Welfare means are in place and followed
7.1d: Status of compliance of Forest Right Act (FRA)	Registration of all the claims and settled the genuine claims
7.2 Use of indigenous knowledge	Documented the ITK and incorporated in the microplan
7.3 Extent of cultural/sacred groves	Documented and interventions to conserve them
Criterion 8: Adequacy of Policy, Legal and Institutional framework	
8.1 (a) Existence of policy and legal framework	Adequate legal framework for sustainable management of forests
8.1 (b) Status of approved working plan	Regular working plan revision and valid reason for deviation of implementation of the plan
8.2 Number of forest offences	All the cases booked and taken to court of law
8.3 Status of Research and Development	All the problems addressed with appropriate of transfer of technology to field
8.4 Human resource capacity building efforts	About 60 percent of the staff are trained
8.5 (a) Forest Resource Accounting (FRA)	All tangible benefits have been reported and progressive and positive
8.5 (b) Budgetary allocations to the forestry sector	Regular budgeting and submitted for the approval
8.6 Existence of Monitoring and Evaluation mechanisms	M&E is in practice for all the development projects
8.7 Status of data collection, information, utilization and dissemination	FMIS is in operation
8.8 Adequate manpower in FMU	Deficit of employees is not exceeding 1/3rd of the sanctioned man-power

Annexure - II: Data on identified Indicators of the FMU (South Seoni)

Indicators	2002	2003	2004	2005	2006	2007
Criteria 1: Maintenance/increase in the extent of forest and tree cover						
1.1 Total Forest Area (ha)	-	119327.39	119327.39	119327.39	119327.39	119327.39
Reserved forest	-	93673.49	93673.49	93673.49	93673.49	93673.49
Protected forest	-	25653.90	25653.90	25653.90	25653.90	25653.90
Unclassified forest	Nil	Nil	Nil	Nil	Nil	Nil
1.2 Area under various Forest types						
Teak	33899.52	31868.57	31868.57	31868.57	31868.57	31868.57
Bamboo	32010.90	34003.72	34003.72	34003.72	34003.72	34003.72
Miscellaneous	60661.55	50966.67	50966.67	50966.67	50966.67	50966.67
Others	6769.36	15705.56	15705.56	15705.56	15705.56	15705.56
1.3: Forest area under encroachment	51.49	51.49	51.49	51.49	51.49	51.49
1.4 Percentage of forest with secured boundaries No. of boundary pillars	1423	1524	1615	2122	2122	2122
1.5 Change in area of forest cover - dense, open and scrub forests, pastures and deserts						
Dense Forest (ha)	-	82835.24	82835.24	82835.24	82835.24	82835.24

Open forest (ha)	-	29226.11	29226.11	29226.11	29226.11	29226.11
Blank forest (ha)	-	2350.54	2350.54	2350.54	2350.54	2350.54
1.6 Change in tree cover outside forest area	589910	616410	616410	616410	616410	616410
Criterion 2: Maintenance, conservation and enhancement of biodiversity						
2.2 Species diversity						
(a) Number of animal species	430	430	430	430	430	430
(b) Number of plant species	1123	1123	1123	1123	1123	1123
2.2 (a) Status of locally representative animal species	*Hystrix indica, Petaurista petaurista, Panthera pardus, Panthera tigris tigris and Muntiacus muntjak.*					
(b) Status of locally representative plant species	*Annona squomosa, Anogeisus latifolia, Butea monosperma, Chloroxylonswietenia, Emblica officinalis, Terminalia arjuna, Adina cordifola, Aegle marmelos, Bauhinia racemosa, Boswellia serrata, Buchanania lanzan, Cochlospermum religosum, Dalbergia latifolia, Emblica offcinalis, Kydia calycina, Nyctanthus arbortristis, Ougeinia oogeinis, Semecarpus anacardium, Soymida febrifuga, Sterculia urens* and *Strychnos nux-vomica*					
Criterion 3: Maintenance and Enhancement of forest health and vitality						
3.1: Status of regeneration						
Established seedlings (Avg. no./ha)	-	1179.96	3304.19	1679.91	1416.91	1416.91
3.2 a. Area affected by forest fire (ha)	345.08	110.31	437.63	Data not available	Data not available	243.85
3.3 Area protected from grazing (ha)	82572.39	79414.39	79110.39	79110.39	79110.39	79110.39
Criterion 4: Conservation and maintenance of soil and water resources						
4.1 Area treated under soil and water conservation measures	Data not available					
4.2 (a) Duration of water flow in the selected seasonal streams (Months)	9	9.5	9.5	9	9	9
(b) Water level in wells in the vicinity, (up to 5 kms) of forest area (mtr) in summer	23	25.3	24.5	23	23	23
Criterion 5: Maintenance and enhancement of forest resource productivity						
5.1 Growing stock of wood						47.302 m^3/ha
5.3 (a) Efforts towards enhancement of forest productivity area brought under Hi-tech plantations. (ha)						
Forest Plantation (ha)	380	185	391	215	50	90
Criterion 6: Optimisation of forest resource utilization						
6.1 (a) Recorded removal of timber Timber (m^3) • Utilisation of wood	21279	24293	9090	9320	6605	Data not available
Timber (Poles in no.)	33039	51803	20815	21117	29920	Do
Fuel wood	11575	13883	8354	8547	11428	Do
Bamboo (Number)	1069424	1267723	1210323	1230408	1762529	Do
(b) Recorded removal of fuel wood (no. of stacks)	24535	25335	10326	12533	11899	Do
Utilisation of fuelwood	11575	13883	8354	8547	11428	Do
(c) Recorded removal of bamboo • Bamboo harvested						

Commercial	5416	7059	7359	9433	8110	Do
Industrial	5622	9770	9171	9296	9815	Do
Total (NT)	11038	16829	16530	18729	17925	Do
• Utilisation of Bamboo (Nistar)	1069424	1267723	1210323	1230408	1762529	Do
6.2 Recorded removal of locally important NTFP.						
Production and harvest of non-wood forest products Tendu Leaf (Std. bags)	40794.93	46565.21	58750.82	28540.52	40727.11	Do
6.7 Contribution of forests to the income of forest dependent people (%)	11.8	11.8	11.8	11.8	11.8	11.8
Criterion 7: Maintenance and enhancement of social, cultural and spiritual benefits						
7.1 (a) Number of JFM committees and area(s) protected by them						
Number of JFMCs	524	524	524	524	524	524
Area protected (ha)	123304.28	123304.28	123304.28	123304.28	123304.28	123304.28
(b) Status of people's participation in management and benefit-sharing						
Participation of members in JFM meetings (%)	48.6	51.75	51.75	51.75	51.75	51.75
7.3 a. Extent of cultural/sacred groves						
No of tree species traditionally/religiously protected	12 Numbers: Mahua (*Madhuca indica*), Achar (*Buchanania lanzan*), Bhilva (*Semecarpus anacardium*), Sitaphal (*Annona squamosa*), Peepal (*Ficus religiosa*), Neem (*Azadirachta indica*), Amla (*Emblica offcinalis*), Bahera (*Terminalia bellirica*), Harra (*Treminalia chebula*), Saaj (*Terminalia tomentosa*), Salai (*Boswellia serrata*) and Goolar(*Ficus glomerata*).					
Criterion 8: Adequacy of policy, legal and institutional framework						
8.1 (a) Existence of policy and legal framework	Yes					
(b) Status of approved working plan	Yes	Yes	Yes	Yes	Yes	Yes
8.2 Number of forest related offences (Nos)	1560	1257	2235	1631	1839	Data not available
8.4 Human resource capacity building efforts (Nos)	1002	2020	1212	3668	Data not available	Data not available
8.5 (a) Forest Resource Accounting Net benefit (INR)						
Recorded						9534853
Unrecorded						23206926
All						32741779
(b) Budgetary allocations to the forestry sector						
Total budget of FMU (Rs. in lakhs)	7429000	6476000	9988000	6956800	1274160	Data not available
Allocation of fund for forest protection (INR)	371450	323800	499400	347840	63708	Data not available

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