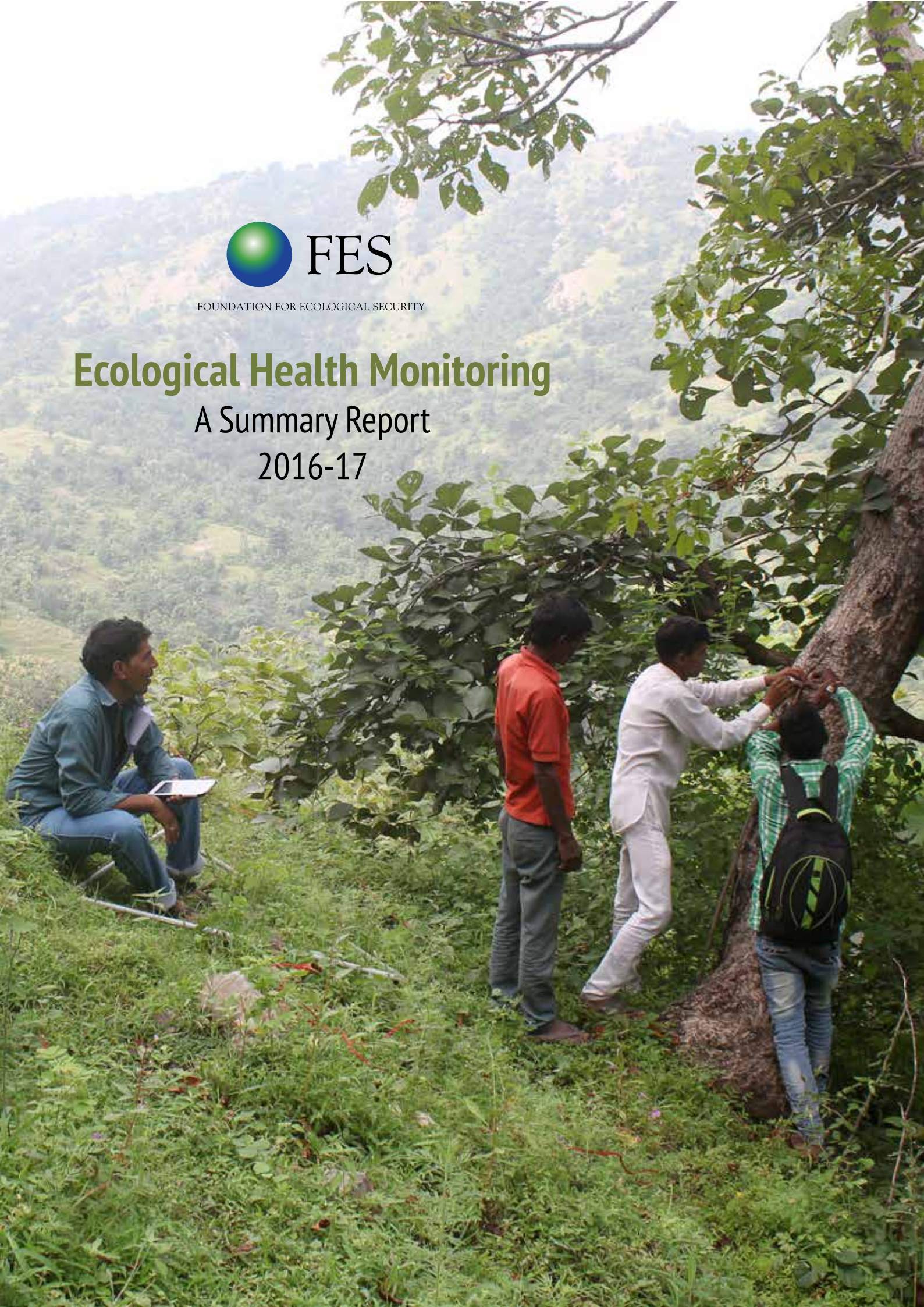

FES

FOUNDATION FOR ECOLOGICAL SECURITY

Ecological Health Monitoring

A Summary Report

2016-17

Contents

Introduction

To build good evidence across context of community led governance leading to better ecological and economic outcomes, FES has been using a comprehensive ecological monitoring framework to assess changes in ecological condition of common lands under community protection. The annual assessments primarily focus on understanding changes in biomass and vegetation density on community managed forest and other common lands in comparison to unmanaged common lands. In combination with deeper ecological assessments undertaken over different time period the assessments also provide understanding of changes in land use & land cover, biodiversity, carbon sequestration, hydrological regime and soil fertility. By improving the understanding of ecosystem structure, composition and function, and temporal and spatial changes these assessments helps in better analyzing the changes happening and aids local communities and decision makers in better governance of these common lands.

The report analyses the results from 80 monitoring sites covering a total area of 4,133 hectares across project locations in Rajasthan, Karnataka, Andhra Pradesh and Madhya Pradesh.

Methodology

1. Bio-physical assessments: Using a consistent set of protocols based on Ecological Health Monitoring and International Forest Resources and Institutions (IFRI) framework the vegetation assessments aims to understand the species composition of the area and how the composition is varying across the time and space. It also measures change in biomass of the different species growing across the various categories of vegetation. The vegetation was sampled through “Nested quadrats method”. Sampling was done using line transact method and the sample plots were placed on a transect at intervals of 150-200 meters. Data from more than

1200 sample points were collected in protected and unprotected common lands. Necessary care was taken while selecting the sample point in order to select representative sample.The sample plot size was set to 314sq. meter (10 meter radius) for trees having a girth above 15 cm at breast height (GBH). A sub-plot of 28 sq. meter was nestled within this sample plot to gather information on shrubs, saplings/regeneration (below 15 cm GBH (Modified Whittaker Method) whereas an additional 1 sq. meter (1m x 1m) sub-plot was set up for collecting data on grasses and herbaceous species.

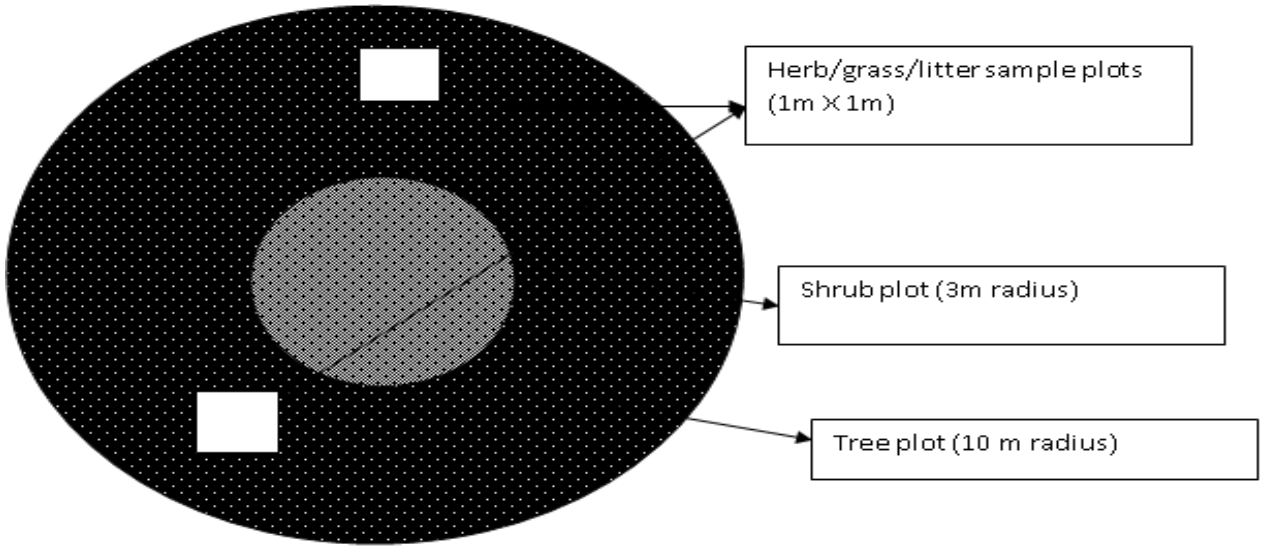

Figure 1: Layout of the sample plots for vegetation assessment

2. Biomass and Carbon stock calculations: Sample plots of 10 meter radius (minimum 8 sample plots were taken from a 20 ha of land and number of sample plots may increase depending upon the vegetation conditions and study area) were taken from community protected and unmanaged common lands for estimating the above-ground tree biomass (standing biomass) with the use of non-destructive methods. To estimate the standing biomass, the DBH (diameter at breast height) and height in meters of all the tree species within the selected plot were noted and then extrapolated for the entire study area. The equations developed by Brown et al (1997) were used for calculating the biomass for the tree species.

a. Tree Biomass(kg) = Exp^ (-2.134+(2.530*ln(D)) (Source: Brown et al,1997)

b. The Carbon stock was calculated at 45% of Biomass (Source: Indu K. Murthy et al, 2015)

Within the 10 meter radius plot, a 3 meter radius plot was marked and the maximum diameter and height of shrubs and saplings were recorded and biomass of each species was calculated.

Following assumption were made for calculation of biomass of regeneration and shrub species, and fodder.

- Shrub biomass: It can be estimated through estimation of green weight/ Maximum diameter and height.
- Grass (fodder) biomass- Yield (kg/ha) = Dry weight of grass in quadrat (in kg) * 10= x kg / ha

To estimate the fuelwood biomass derived from the patch of common land the mean annual increment (MAI- 2.86% per year of standing biomass) has been used. (Source: Ravindranath et al., 1997)

3. Monetary valuation of fodder, fuelwood, standing biomass and carbon

To estimate the monetary value of fodder and fuelwood derived from community managed common lands a conservative market price was used to arrive at the total value. It was further divided by the number of households to arrive at per household value. In case of fodder the green fodder was sun dried and the value was calculated for the dry weight.

a. Vale of fodder biomass - Standard rate of fodder at the rate of Rs.5/- per kg (dry fodder) has been used to estimate the value of grass biomass.

b. Fuelwood – For valuation of fuelwood, proportion of standing biomass (increase 2.86% of standing biomass /year) is taken into consideration. Standard rate of fuelwood at the rate of Rs.3/- per kg has been used to estimate the value of mean annual increment in fuelwood due to improved standing biomass.

To estimate the value of standing biomass standard rate of fuelwood at the rate of Rs.3/- per kg has been used to estimate the standing biomass. Though this doesn't takes into account the timber value, it provides an estimate of monetary value per hectare.

The value of carbon sequestered is calculated as per the method prescribed in the 'Landowners Guide to Carbon Sequestration Credits'. The carbon credit price as per this method is Rs.272/- per metric ton of carbon stock.

Results

a. Biomass Change

Table 1 describes the change in biomass on community managed commons and control plots (ungoverned commons). On an average the results show improved standing biomass, carbon stock, fuelwood and fodder availability on common lands under village governance in comparison to open-access or commons under government ownership. In comparison to open access or ungoverned commons, the standing biomass per hectare on an average was 2.6 times higher on common lands under community control (19.4 tonnes per ha in comparison to 7.6 tonnes per hectare and increase in fodder availability per hectare by 2.4 times (1.7 tonnes per hectare in comparison to 0.7 tonnes per hectare).

Table 1 Biomass and carbon stock on community managed and unmanaged common lands

S.N.	Particulars	Community managed	Control/ Ungoverned commons
1.	Standing Biomass (tonnes/ha)	19.4	7.60
2.	Carbon Stock (tonnes/ha)	8.73	3.44
3.	Fodder Biomass (tonnes/ha)	1.70	0.70
4.	Improvement in fuelwood biomass	2.30	0.90

b. Monetary Values

The improvements in resource base provides on an average Rs. 19,800 per household as per conservative market prices, enabling households to benefit from improved incomes through livestock production and saving costs on purchase of fodder, fuelwood and other biomass requirements. The value of standing biomass is on an average Rs. 58,200 per hectare on community managed common lands in comparison to Rs. 22,944 per hectare on unmanaged common lands. With improvement in standing biomass the value of carbon sequestered on common lands was Rs. 2,374 per hectare.

Table 2 Value of Biomass, Carbon, Fodder and Fuelwood

S.N.	Particulars	Community managed	Control/ Ungoverned commons
Ecosystems Benefits			
1.	Standing Biomass/ha (in INR)	58,200	22,944
2.	Carbon Stock/ha (INR)	2,374	936
Direct Benefits to community			
3.	Available fodder Biomass/household (INR)	9,152	3,991
4.	Improvement in fuel -wood biomass/ household (INR)	10,684	3,829

c. Changes in Biodiversity

A total of 166 plant species was recorded during the study. Among the globally threatened plant species (as per IUCN red list)– Pterocarpus santalinus (endangered), Tephrosia purpurea (endangered),Chloroxylon swietenia (vulnerable), Wrightia tinctoria (least concern) Woodfordia fruticosa (least concern), Cissus hamaderohensis (least concern) and Gardenia gummifera (least concern) were recorded from the study sites. Some other important plant species which are

under threat locally i.e. Boswellia serrata, Sterculia urens, Anogeissus latifolia and Buchanania lanzan were also recorded from the study sites. The study show improved biodiversity on common lands under village governance in comparison to open-access or commons under government ownership. Total Shannon diversity index of the common lands under community control was 3.9 where as it was 2.6 for the open access or ungoverned commons.

Annexures

1. Papagni Region (Karnataka and Andhra Pradesh)

A) Biomass and carbon stock on community managed and unmanaged common lands

S.N.	Particulars	Community managed	Control/ Ungoverned commons
1	Standing Biomass (tonnes/ha)	19.8	7.7
2	Carbon Stock (tonnes/ha)	8.9	3.5
3	Fodder Biomass (tonnes/ha)	1.7	0.8
4	Improvement in fuelwood biomass (tonnes/ha)	1.6	0.6

B) Value of Biomass, Carbon, Fodder and Fuelwood

S.N.	Particulars	Community managed	Control/ Ungoverned commons
Ecosystems Benefits			
1	Standing Biomass/ha (in INR)	59400	23100
2	Carbon Stock/ha (INR)	2424	942
Direct Benefits to community			
3	Available fodder Biomass/ household (INR)	9344	5160
4	Improvement in fuel -wood biomass/ household (INR)	7208	2717

Sajupalli, Karnataka

August 2004

October 2017

By framing collective rules and regulations for provisioning and appropriating from common resources, Sajjupalli and three adjoining villages have gradually restored 1,380 acres of boulder-strewn common land. The area now supports the livestock needs of 12 villages, and is home to rich wildlife and flora, including threatened floral species called Eastern Satin Wood.

2. Southern Rajasthan (Bhilwara, Pratapgarh and Udaipur)

A) Biomass and carbon stock on community managed and unmanaged common lands

S.N.	Particulars	Community managed	Control/ Ungoverned commons
1	Standing Biomass (tonnes/ha)	13.2	5.3
2	Carbon Stock (tonnes/ha)	5.9	2.4
3	Fodder Biomass (tonnes/ha)	1.6	0.9
4	Improvement in fuelwood biomass (tonnes/ha)	2.4	0.9

B) Value of Biomass, Carbon, Fodder and Fuelwood

S.N.	Particulars	Community managed	Control/ Ungoverned commons
Ecosystems Benefits			
1	Standing Biomass/ha (in INR)	39600	15900
2	Carbon Stock/ha (INR)	1616	649
Direct Benefits to community			
3	Available fodder Biomass/ household (INR)	12177	4768
4	Improvement in fuel -wood biomass/ household (INR)	17836	6266

Dindorkheda, Rajasthan

May 2006

September 2017

What started as a collective effort to restore their village tank in 2006 was extended by the tribal village to protect and restore 75 acres of degraded forestland. Influenced by their efforts towards evolving collective arrangements to manage common waterbodies and forestlands, two neighbouring villages have restored another 527 acres of forestland.

3. Mandla, Madhya-Pradesh

Biomass and carbon stock on community managed and unmanaged common lands

S.N.	Particulars	Community managed	Control/ Ungoverned commons
1	Standing Biomass (tonnes/ha)	29.9	11.9
2	Carbon Stock (tonnes/ha)	13.5	5.4
3	Fodder Biomass (tonnes/ha)	1.7	0.2
4	Improvement in fuelwood biomass (tonnes/ha)	3.6	1.4

B) Value of Biomass, Carbon, Fodder and Fuelwood

S.N.	Particulars	Community managed	Control/ Ungoverned commons
Ecosystems Benefits			
1	Standing Biomass/ha (in INR)	89700	35700
2	Carbon Stock/ha (INR)	3660	1457
Direct Benefits to community			
3	Available fodder Biomass/household (INR)	2186	178
4	Improvement in fuel -wood biomass/ household (INR)	1342	516

Indravan, Madhya Pradesh

April 2013

September 2016

Overcoming boundary disputes, the village of Indravan restored 37 acres of grassland by removing *Lantana camara*, an extremely invasive weed species, and promoting local grass species. Through protection measures and sharing of collectively-evolved mechanisms, fodder availability has improved 16 times, sufficiently serving 148 households for a period of three months.

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