EFFECT OF JOINT FOREST MANAGEMENT PRACTICES ON NUTRIENT STATUS OF SOIL – A CASE STUDY

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Introduction

In the context of ensuring peoples participation in the protection and sustainable exploitation of forests and sharing of benefits, we come across frequent claims about the usefulness of the participatory forest management systems e.g. particularly, how it helps in the regeneration of degraded areas, etc. On the other hand a different school of thought always refutes such claims. In this state of affairs, only some logical analysis can prove any argument in favour of Joint or Participatory Forest Management (JFM or PFM). Forest are indicator of well being of any ecosystem. If JFM is successful in an area then it should be reflected in good health of other components of the system i.e. soil, water, air and wildlife etc. Soil is a very important component of forest ecosystem which on one hand provides growth and sustenance to trees on it and on the other hand gets enriched by falling leaves getting decomposed into humus, improved soil microbial activities under the cover of trees and root systems, less erosion by air and water due to protective effect of forests. Since JFM aims at better management of forest, hence as its logical corollary – the soil of those forest under JFM, should have richer nutrient status compared to areas not under JFM. The aim of the present study is to analyze the nutrient status of soil of area both under JFM and not under JFM and then compare the results.

Several advantages due to tree culture have been documented (Sreemannarayana *et al.*, 1994). Increase in fertility status of desert soils has been reported under 10 years old *P. cineraria* plantations (Agarwal and Lahiri, 1977). The wide variation in organic carbon status of soil under different tree species has also been reported by Lahiri (1984). The soil enrichment by woody legumes through gradual accumulation of mineral elements and incorporation of these into an enlarged plant-litter soil nutrient cycle mechanism was clearly evident in a study, as the trees contributed substantial amount of available P_2O_5 to soil pool over a period of time (Vediraj and Rudrappa, 1990).

Objectives

This study attempts to demonstrate whether the initiatives taken under JFM practices are ecologically appropriate. In JFM, there are many different users of the forest and therefore many objectives. This means that the same forest must yield multiple products – both manifest and latent. Productivity (which is dependent on nutrient status) of any land is dependent on management practices adopted on that land. Here for the forest, the various activities taken under programme 'Joint

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Forest Management' (JFM) have been evaluated to see their impact on soil nutrient status, if any.

The objective of present study was to estimate and compare the effects of Joint Forest Management on soil fertility status and thus Null Hypothesis (H_o) that the Joint Forest Management does not affect soil fertility, and the Alternative Hypotheses (H_1) Joint Forests Management affect the soil fertility were set up.

Material and Methodology

For the present study different pairs of nearby villages in Hazaribagh and Ranchi districts were selected namely Pawra, Banadag, Khairia and Jabra under JFM practice and their neighbouring villages Saketanr, Maheshpur, Rukka and Silwar not under JFM practices. The reason for selecting the neighbouring villages in pairs was to nullify the effect of physical distance between them as this could have attributed to very different physico-chemical properties of soils to start with. Hence the two villages in neighbourhood, one which is managed under JFM and other not managed under JFM were selected for study, in each pair.

District	Village under JFM	Village Not under JFM
Hazaribagh	Pawra	Saketanr
Hazaribagh	Khairia	Rukka
Hazaribagh	Jabra	Silwar
Ranchi	Banadag	Maheshpur

Ten samples, well scattered over in all corners and centre of the selected forest of each village forest falling under above two categories were collected. Samples were taken at the depth of 0-15 cm. Soil parameters, organic carbon, organic matter, Total (N), C/N-ratio, K_2O % and P_2O_5 % were tested and the analytical reports are recorded in Tables 1 to 4. Comparative study of each factor was done by Students 't' test statistics.

Statistical analysis has been shown in Tables 5 to 8.

The average values of organic carbon, organic matter, total (N), C/N-ratio, K_2O% and P_2O_5 % of samples of JFM and Non-JFM villages Pawra, Khairia, Rukka, Saketanr, Maheshpur, Banadag, Silwar and Jabra were analysed in Tables 5 to 8. The average difference of each soil Nutrient factor is significant, at 5% level of significance.

Since the calculated values of 't' exceed the tabulated value of 't' for each soil fertility factor of each village, the Null Hypothesis (H_0) was rejected and the alternative hypothesis (H_1) was accepted. In other words it can be said that the soil fertility is positively affected by the Joint Forest Management activities.

Results and Discussion

The difference among the average of soil parameter i.e. organic carbon, organic matter (N), C/N – ratio, K_2O % and P_2O_5 % under Joint Forest management village Pawra are respectively (0.375, 0.65, 0.09, 4.28, 0.22, 0.10) and for area managed under Non-Joint Forest Management practice (0.16, 0.30, 0.06, 2.11, 0.18, 0.08) of village Saketanr, District-Hazaribagh are significant at 5% level of significance. Similarly the difference amount the

Table 1

Characteristics of soils at Pawra Villge under JFM and at Saketanr (not under JFM)

Sl. No.	Organic Carbon		Organic Matter		Total 'N'		C/N ratio		K_2O%		P_2O_5%	
	JFM	Non-JFM	JFM	Non-JFM	JFM	Non-JFM	JFM	Non-JFM	JFM	Non-JFM	JFM	Non-JFM
1	0.19	0.16	0.34	0.30	0.09	0.09	2.41	1.80	0.21	0.18	0.11	0.08
2	0.45	0.21	0.79	0.36	0.09	0.07	5.18	3.00	0.23	0.17	0.08	0.07
3	0.38	0.14	0.66	0.24	0.10	0.07	3.90	1.80	0.24	0.17	0.09	0.08
4	0.33	0.01	0.57	0.21	0.09	0.07	3.80	0.17	0.22	0.18	0.08	0.07
5	0.33	0.07	0.57	0.12	0.09	0.07	3.50	0.97	0.24	0.18	0.11	0.08
6	0.31	0.22	0.54	0.38	0.07	0.06	4.20	3.30	0.24	0.18	0.09	0.08
7	0.35	0.13	0.60	0.23	0.09	0.08	3.70	1.60	0.24	0.18	0.11	0.09
8	0.42	0.19	0.72	0.33	0.08	0.07	5.30	2.50	0.24	0.16	0.10	0.06
9	0.45	0.25	0.77	0.42	0.09	0.08	4.90	2.90	0.17	0.19	0.10	0.09
10	0.54	0.24	0.93	0.41	0.09	0.08	6.20	3.10	0.21	0.19	0.10	0.07
Total	3.75	1.62	6.49	3.00	0.88	0.64	42.79	21.14	2.24	1.78	0.97	0.77
Mean	0.38	0.16	0.65	0.30	0.09	0.06	4.28	2.11	0.22	0.18	0.10	0.08

Table 2

Characteristics of soils at Khairia Villge under JFM and at Rukka (not under JFM)

Sl. No.	Organic Carbon		Organic Matter		Total 'N'		C/N ratio		K_2O%		P_2O_5%	
	JFM	Non-JFM	JFM	Non-JFM	JFM	Non-JFM	JFM	Non-JFM	JFM	Non-JFM	JFM	Non-JFM
1	0.90	0.27	1.53	0.46	0.07	0.04	12.80	7.14	0.10	0.09	0.29	0.17
2	0.39	0.16	0.67	0.27	0.08	0.04	5.06	3.84	0.11	0.07	0.26	0.17
3	0.82	0.30	1.41	0.52	0.07	0.04	11.60	9.60	0.12	0.08	0.23	0.17
4	0.38	0.30	0.66	0.52	0.06	0.06	6.09	5.10	0.10	0.09	0.27	0.18
5	0.56	0.18	0.97	0.31	0.08	0.05	7.32	5.60	0.11	0.09	0.27	0.17
6	0.39	0.54	0.67	0.23	0.08	0.05	5.06	1.50	0.11	0.08	0.27	0.15
7	0.44	0.40	0.76	0.76	0.07	0.04	6.60	2.90	0.11	0.07	0.25	0.17
8	0.71	0.10	1.23	0.16	0.07	0.03	9.62	1.10	0.11	0.08	0.25	0.15
9	0.97	0.25	1.67	0.42	0.08	0.02	12.85	1.30	0.14	0.07	0.25	0.17
10	0.94	0.24	1.62	0.41	0.07	0.03	14.31	7.60	0.12	0.06	0.25	0.15
Total	6.50	2.74	11.19	4.26	0.67	0.40	91.37	45.68	1.13	0.78	2.59	1.65
Mean	0.65	0.27	1.12	0.43	0.07	0.04	9.14	4.57	0.11	0.08	0.26	0.17

Table 3

Characteristics of soils at Banadag Villge under JFM and at Maheshpur (not under JFM)

Sl. No.	Organic Carbon		Organic Matter		Total 'N'		C/N ratio		K_2O%		P_2O_5%	
	JFM	Non-JFM	JFM	Non-JFM	JFM	Non-JFM	JFM	Non-JFM	JFM	Non-JFM	JFM	Non-JFM
1	0.16	0.64	0.28	1.10	0.08	0.10	1.5	6.3	0.09	0.19	0.19	0.24
2	0.21	0.64	0.36	1.10	0.08	0.10	2.8	6.4	0.06	0.19	0.19	0.21
3	0.14	0.66	0.24	1.14	0.08	0.07	1.8	8.8	0.08	0.17	0.16	0.20
4	0.07	0.69	0.12	1.19	0.07	0.09	13.7	7.9	0.07	0.18	0.18	0.21
5	0.01	0.68	0.21	1.14	0.08	0.09	1.5	7.0	0.06	0.16	0.18	0.22
6	0.35	0.68	0.60	1.17	0.04	0.09	14.9	7.8	0.08	0.18	0.18	0.20
7	0.22	0.68	0.38	1.18	0.03	0.10	6.3	7.0	0.07	0.15	0.18	0.21
8	0.13	0.68	0.23	1.18	0.06	0.09	2.3	7.2	0.07	0.15	0.17	0.20
9	0.05	0.68	0.08	1.18	0.04	0.07	1.2	9.2	0.10	0.21	0.18	0.20
10	0.19	0.65	0.33	1.13	0.04	0.09	5.0	7.0	0.05	0.17	0.12	0.17
Total	1.53	6.68	2.83	11.51	0.60	0.89	41.0	74.6	0.73	1.60	0.73	2.12
Mean	0.15	0.67	0.28	1.15	0.06	0.09	4.1	7.5	0.07	0.16	0.17	0.21

Table 4

Characteristics of soils at Jabra Villge under JFM and at Silwar (not under JFM)

Sl. No.	Organic Carbon		Organic Matter		Total 'N'		C/N ratio		K_2O%		P_2O_5%	
	JFM	Non-JFM	JFM	Non-JFM	JFM	Non-JFM	JFM	Non-JFM	JFM	Non-JFM	JFM	Non-JFM
1	0.66	0.10	1.14	0.18	0.08	0.03	8.1	3.3	0.18	0.05	0.18	0.06
2	0.67	0.05	1.16	0.09	0.09	0.02	7.6	2.0	0.24	0.03	0.21	0.06
3	0.65	0.41	1.11	0.71	0.08	0.03	7.5	12.0	0.24	0.05	0.17	0.06
4	0.64	0.10	1.09	0.18	0.08	0.05	7.4	2.1	0.23	0.05	0.13	0.07
5	0.71	0.39	1.22	0.68	0.08	0.06	8.4	8.0	0.17	0.04	0.20	0.04
6	0.67	0.60	1.16	1.01	0.08	0.07	7.8	8.7	0.24	0.05	0.21	0.09
7	0.67	0.26	1.15	0.44	0.09	0.04	7.2	5.5	0.24	0.06	0.18	0.03
8	0.66	0.36	1.14	0.62	0.09	0.07	7.5	5.2	0.25	0.11	0.12	0.07
9	0.66	0.05	1.15	0.09	0.07	0.06	8.3	0.8	0.23	0.10	0.15	0.05
10	0.66	0.46	1.05	0.80	0.09	0.08	6.4	6.0	0.22	0.07	0.13	0.02
Total	6.60	2.78	11.37	4.80	0.83	0.50	76.2	53.6	2.26	0.59	1.68	0.55
Mean	0.66	0.28	1.14	0.48	0.08	0.08	7.6	5.4	0.23	0.06	0.17	0.05

Table 5

Pawra and Saketanr

Organic Carbon	Organic Matter	Total N%
S = 0.087	S=0.115	S=0.013
= X_1-X_2	=X_1-X_2	=X_1-X_2
(t)=0.215/(0.084x0.447)	=0.35	=0.03
=5.726	(t)=0.35/(0.115x0.447)	(t)=0.03/(0.013x0.447)
C/N Ratio	= 6.81	=5.16
(t)=2.17/(1.06x0.447)		P_2O_5%
=4.58		S=0.011
K_2O%		=X_1-X_2
S=0.017		=0.02
= X_1-X_2		(t)=0.02/(0.011x0.447)
=0.04		=4.16
(t)=0.04/(0.017x0.447)		
=5.26		

Table 6

Khairia and Rukka

Organic Carbon	Organic Matter	Total N%
S=0.38	S=0.69	S=0.01
= X_1-X_2	=X-X	=X_1-X_2
S=0.199	S=0.32	=0.03
(t)=0.38/(0.199x0.447)	(t)=0.69/(0.32x0.447)	(t)=0.03/(0.001x0.447)
=4.27	= 4.82	=6.71
C/N Ratio	K_2O%	P_2O_5%
= X_1-X_2	= X_1-X_2	X_1-X_2
=4.57	= 0.03	=0.09
S=3.84	S=0.011	S=0.014
(t)=4.57/(3.84x0.447)	(t)=0.03/(0.011x0.447	(t)=0.09/(0.01x0.447)
=2.66	=6.10	=14.38

average of soil parameter under Joint Forest Management village Khairia 0.65, 1.12, 0.07, 9.14, 0.11, 0.26) and of not under Forest Management village-Rukka (0.27, 0.43, 0.04, 4.57, 0.08, 0.17) of Hazaribagh District are significant. The difference among the averages of soil parameters of not under Joint Forest Management village Maheshpur (0.15, 0.28, 0.06, 4.1, 0.07, 0.08) and of Joint Forest Management Village

Table 7

Jabra and Silwar

Organic Carbon	Organic Matter	Total N%
(t)=(0.66-0.28)/20.38 =0.38/(0.138x0.447) = 6.16	(t)=(1.14-0.48)/(0.23x0.447) = 0.66/(0.23x0.447) =6.28	(t)=(0.08-0.05)/(0.016x0.447) =0.03/4.47
Significant or 5% level	Significant or 5% level	Significant at 5% level
C/N Ratio	K_2O%	P_2O_5%
(t)=(7.6-5.4)/(2.78x0.447) =2.26	(t)=(0.23-0.06)/0.024x0.447) =15.84	(t)=(0.17-0.05)/0.027x0.447) =9.94
Significant at 5% level	Significant at 5% level	Significant at 5% level

Table 8

Banadag and Mahespur

Organic Carbon	Organic Matter	Total K_2O%
S=0.07	S=0.107	S=0.019
X_1-X_2 = 0.52	X_1-X_2 =0.87	X_1-X_2 = 0.09
(t)=0.52/(0.007x0.447) =16.61	(t)=0.87/(0.107x6.447) =18.18	(t)=0.09/(0.019x0.447) =10.59
Total N	C/N Ratio	P_2O_5%
S=0.016	S=3.795	S=0.019
X_1-X_2=0.03	X_1-X_2 =3.4	X_1-X_2 = 0.04
(t)=0.03/(0.016x0.447) =4.19	(t)=3.4/(3.795x447) =2.00	(t)=0.04/(0.01x0.447) =4.71

Banadag 0.67, 1.15, 0.09, 7.5, 0.16 and 0.21) of District Ranchi are also significant, like wise the differences among the averages of soil parameter under Joint Forest Management village Jabra (0.66, 1.14, 0.08, 1.6, 0.23 and 0.17) and of not under Joint Forest Management village Silwar (0.28, 0.48, 0.05, 5.4, 0.06, 0.05) of Hazaribagh District are also significant at 5% level of significance.

The above results show that there is significant improvement in soil quality of village where the JFM has been in practice compared to those forest where JFM is not practiced. This is explained, possibly due to controlled and prohibited grazing practices in JFM forest leading to amenable conditions for the growth of grasses, bushes and herbs. Also the leaf litter is recycled and not washed away or eaten up by animal. The JFM practices help in also better protection of forests from fires, thus upper layer of humus, leaf litter etc is not burnt. All this has led to better nutrient status of soil in forest managed under JFM or PFM.

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SUMMARY

An experiment conducted in selected village forests of Ranchi and Hazaribagh districts (both where JFM is practiced and where not practiced), indicates that forest where JFM is practiced has better soil characteristics. Though this experiment is not a perfect one and it has to explain some questions but it has definitely given a hint that JFM has certainly positive effect on soil nutrient status of the forest.

मृदा की पोष्याहार स्थिति पर संयुक्त वन प्रबन्धन क्रियाओं से पड़ते प्रभाव

एच०एस० गुप्त

सारांश

रांची और हजारीबाग जिलों के (जहां संयुक्त वन प्रबन्ध किया जा रहा है और नहीं किया जा रहा है) के कुछ चुने हुए ग्राम वनों में किए गए एक संपरीक्षण से संकेत मिलता है कि जहां संयुक्त वन प्रबन्ध किया जा रहा है वहां के वनों की मृदा विशेषताएं ज्यादा अच्छी हैं। हालांकि यह संपरीक्षण सर्वसंपूर्ण नहीं है और कुछ प्रश्नों का स्पष्टीकरण किया जाना बाकी है इससे यह संकेत तो स्पष्ट रूप से मिला है कि संयुक्त वन प्रबन्ध का वनों की पोष्याहार स्थिति पर निश्चय ही सकारात्मक प्रभाव पड़ता है।

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