



TECHNIQUE FOR GRAZING MANAGEMENT

A pilot demonstration in Hoshangabad landscape,
Madhya Pradesh



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SEPTEMBER 2017

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A PILOT DEMONSTRATION IN HOSHANGABAD
LANDSCAPE, MADHYA PRADESH

SEPTEMBER 2017

DISCLAIMER

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ACRONYMS AND ABBREVIATIONS

ACU	Adult Cattle Unit
Forest-PLUS	Partnership for Land Use Science
JFM	Joint Forest Management
JFMC	Joint Forest Management Committee
ISFR	India State of Forest Report
MOEFCC	Ministry of Environment, Forest and Climate Change
MPFD	Madhya Pradesh Forest Department
NTFP	Non-Timber Forest Product
PF	Protected Forest
RF	Reserve Forest
REDD	Reducing Emissions from Deforestation and Forest Degradation
USAID	United States Agency for International Development

UNITS

DM	Dry Matter
ha	hectare
kg	kilogram
km	kilometer
km ²	square kilometer
m	meter
m ²	square meter
MT	metric ton

1.0 INTRODUCTION

The Partnership for Land Use Science (Forest-PLUS) Program is a five-year initiative jointly designed by USAID/India and the Government of India's Ministry of Environment, Forest and Climate Change (MOEFCC). The Program is focused on US-India collaborative scientific and technical research, and exchanges that explore methods and approaches to reduce emissions from deforestation and forest degradation, and enhance sequestration through conservation and sustainable management of forests (REDD+). Forest-PLUS contributes to USAID/India's Development Objective of accelerating India's transition to a low emissions economy by providing technical assistance to develop, demonstrate, and institutionalize forest management practices that reduce greenhouse gas emissions from forested landscapes, increase sequestration of atmospheric carbon in forests, protect forest biodiversity health, and protect and/or enhance forest-based livelihoods, forest ecosystem services, and other social contributions of forests in India. Through these objectives, Forest-PLUS is helping position India to participate in any internationally-agreed REDD+ mechanism.

The Program is achieving these objectives through the development of tools, techniques and methods: (1) for an ecosystem-based approach to forest management and increasing carbon sequestration; (2) for measurement, reporting and verification of carbon stocks; (3) for building institutional structures for effective forest resource governance; and (4) by deploying these tools, techniques, and methods in selected pilot clusters in the four demonstration landscapes, representing forest types widespread in India; and is supported by training programs and communication campaigns targeting a variety of audiences. The Program commenced in August 2012. The four demonstration landscapes are Shivamogga Forest Circle, Karnataka; Hoshangabad Forest Circle, Madhya Pradesh; Rampur Forest Circle, Himachal Pradesh; and the state of Sikkim.

As part of its efforts to promote sustainable forest management by addressing key drivers of forest degradation, Forest-PLUS has developed/adapted and piloted simple yet effective grazing management techniques across its four demonstration landscapes. These techniques take into account productivity, equity, and sustainability aspects. This report documents the learning from the development and piloting of a grazing management technique in its Hoshangabad landscape in Madhya Pradesh.

The rest of this report is divided into four sections. The next section (Section 2.0) provides the broad context within which the grazing management technique was developed and piloted. It is followed by a section on problem analysis (Section 3.0). The details of the technique and preliminary experience with its implementation are discussed in Section 4.0. The report concludes with a summary of key learning points and way forward.

2.0 CONTEXT

India, with only 2.4 percent of the world's geographical area and 1.5 percent of the forest area and pasture lands, supports about 18 percent of the human and 15 percent of the cattle population of the world (Mathukia, et al., 2016). There is considerable biotic pressure on India's forest, which is often beyond its carrying capacity¹. Almost 78 percent of India's forests are subjected to heavy grazing (World Bank, 2005).

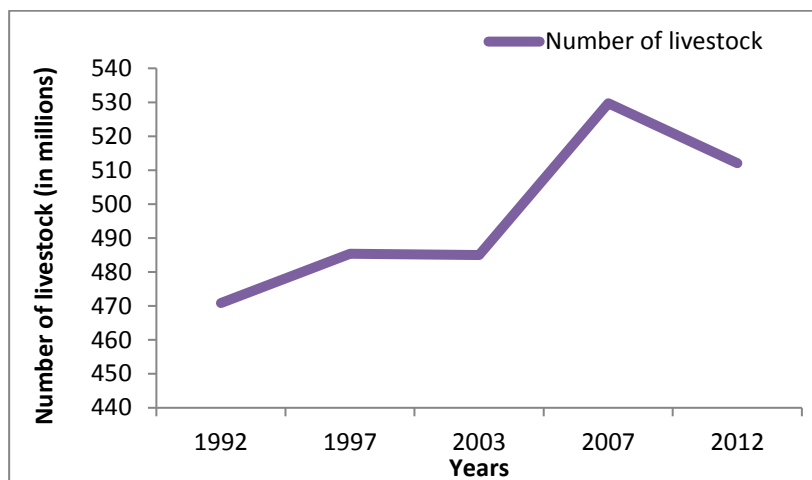


Figure 1: Trend of total livestock population in India during 1992-2012

Source: Livestock Census Reports, 1992, 1997, 2003, 2007, 2012

In Madhya Pradesh, agriculture and animal husbandry are the main sources of livelihood for rural communities. These sectors account for 23.9 percent of the state's Gross Domestic Product. Around 80 percent of the rural people² are involved in livestock activity, either as producers or hired laborers (Planning Commission, 2011). As per the 19th Livestock Census Report 2012, the state had 36,332,627 livestock. However, there is a decreasing trend of permanent pastures and other grazing lands (Government of Madhya Pradesh, n.d.), which shifts the grazing pressure onto forest lands.

The Hoshangabad and Harda districts have an area of 6,707 km² and 3,330 km², respectively. Both districts have a high forest cover – 36.14 percent in Hoshangabad and 30.5 percent in Harda (FSI, 2015). This forest cover is, however, restricted to the hilly tracts in both the districts (see Figure 2).

¹ The number of livestock that can be supported indefinitely by a forest ecosystem without getting degraded.

² The rural population is over three-fourths of the total population.

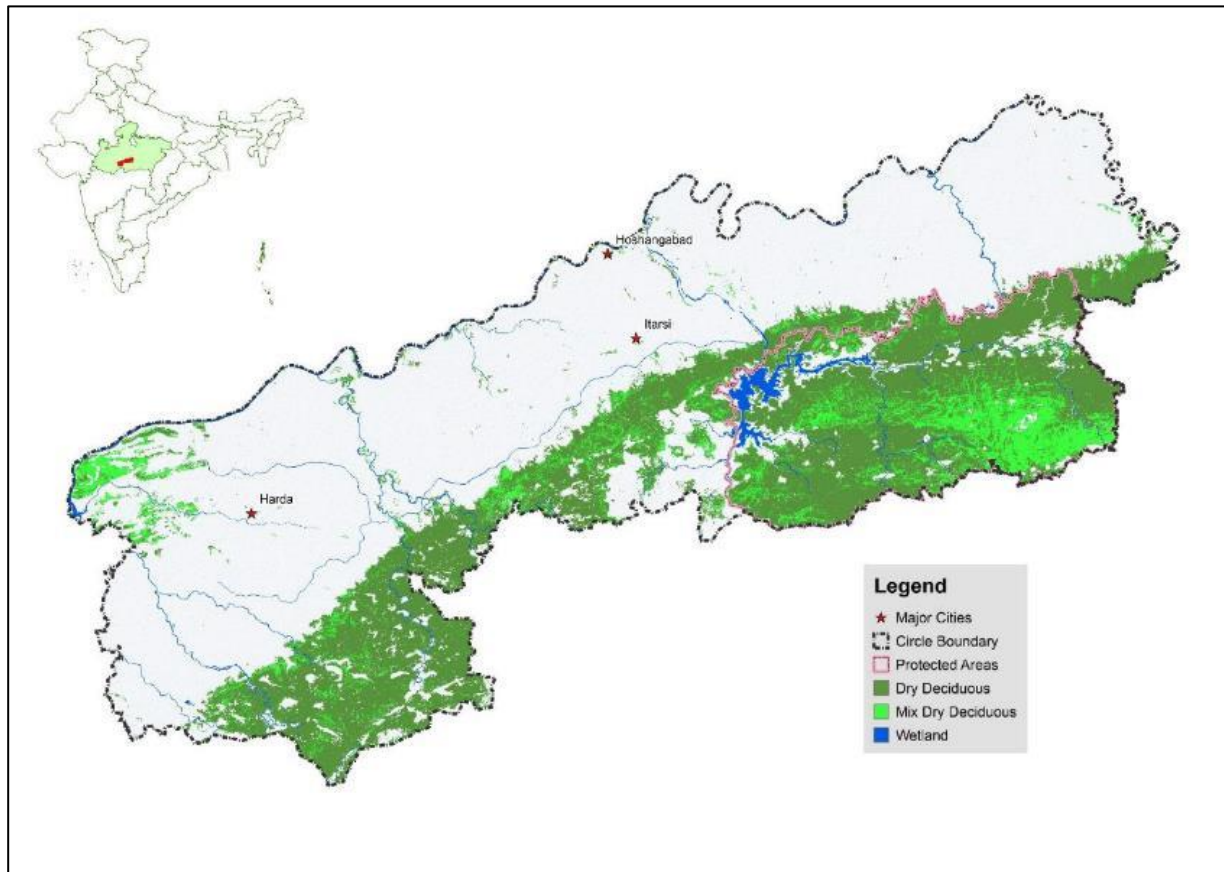


Figure 2: Map of Forest-PLUS landscape in Hoshangabad, Madhya Pradesh

3.0 PROBLEM ANALYSIS

3.1 GRAZING PRESSURE

The issue of grazing in the forests of Hoshangabad and Harda is discussed in this section. The land use pattern for both the districts is presented in Table I. As is evident from the table, there is very little pasture land available in both the districts.

Table I: Land use pattern of Hoshangabad and Harda Districts

LAND USE PATTERN	AREA ('000 Ha)	
	HOSHANGABAD	HARDA
Cultivable Area	315.0	182.2
Forest Area	256.1	104.8
Land under Non-Agriculture Use	43.7	8.7
Permanent Pasture	26.0	13.7
Culturable Waste land	25.3	5.10
Miscellaneous Tree Crops	0.1	0.4
Barren and Uncultivable Land	2.5	15.7
Current Fallows	5.4	0.1
Other Fallows	8.7	1.5

Source: Department fo Agriculture Cooperation and Farmers Welfare, 2013a and 2013b

However, both districts have high livestock populations and a large proportion of families are classified as 'herder families'. The indigenous cattle population, which often grazes on forest lands, has the highest proportion among livestock in both the districts. Consequently, there is considerable grazing pressure on forest lands.

Table 2: Total livestock population in Hoshangabad and Harda Districts (2012)

LIVESTOCK	HOSHANGABAD	HARDA
Exotic/Crossbred Cattle	20,369	2,469
Indigenous Cattle	340,002	141,709
Buffaloes	112,526	72,850
Sheep	61	1,416

Goats	80,059	45,989
Pigs	272,396	208
Horses/Ponies	254	45
Mules/Donkeys	284	8
Camels	2	-

Source: 19th Livestock Census All India Status Report, 2012

The Hoshangabad Forest Division has 50,109.6 ha of Reserve Forest (RF) and 33,968.8 ha of Protected Forest (PF), while the Harda Forest Division has 74,424.1 ha of RF and 34,622.1 ha of PF. As per their respective Working Plans, there are 644 villages in the Hoshangabad Forest Division with a total of 335,548 Adult Cattle Units (ACU)³, and 567 villages in the Harda Forest Division with 221,011 ACUs⁴. According to the Madhya Pradesh Grazing Rules (1986), the *carrying capacity* is one unit per ha in RFs, and two units per ha in PFs⁵.

Based on the above data, the carrying capacity of the forests of Hoshangabad and Harda Forest Divisions has been calculated, and is presented in Table 3.

Table 3: Carrying capacity of the forests of Hoshangabad and Harda Forest Divisions

DIVISION	NUMBER OF VILLAGES	LIVESTOCK# (ACU)	CARRYING CAPACITY (ACU)			GAP
			PF	RF	TOTAL	
1	2	3	4	5	6=(4+5)	7=(6-3)
Hoshangabad	644	335,548	67,937.6	50,109.6	118,047.2	(217,500.8)
Harda	567	221,011	69,244.1	74,424.1	143,668.2	(77,342.8)

As is evident from the data presented in Table 3, the ACUs present in the districts' villages are much greater than the carrying capacity of forests in both Hoshangabad and Harda Forest Divisions. Although the reality is more complex than the above simple calculation – not all livestock graze in forests, not all forest areas are open for grazing, and the District and Division boundaries do not match exactly⁶, it does show that open grazing on forest lands is an important forest management issue. Since villages are embedded in forest area, since land pressure is high, and since it has been common practice to graze cattle in forest when other fodder is unavailable, cattle are assuredly commonly grazing in forests – and this is evident when visiting the area. Considering that the average daily requirement of dry fodder is 4-6 kg per ACU, unregulated open grazing is a major driver of forest degradation in the landscape.

³ ACU is generally used to compare livestock numbers across various categories on cow equivalent. An "animal unit" (AU) is defined as one mature cow and her suckling calf weighing a cumulative 1,000 pounds (a 920-pound cow with an 80-pound calf) requiring 26 pounds of dry matter (DM) forage per day.

⁴ Villages within Forest Divisions will be those in or near Forest Land managed by the Forest Department

⁵ This is perhaps due to greater focus on timber production in RFs.

⁶ The ACU number is for the District while the forest area is for the Division.

3.2 SEASONALITY

The issue of grazing has a seasonal dimension to it. The dependence on forest lands for grazing is greatest when there are fewer or no alternatives available. In order to better understand the seasonality of fodder availability and use, Forest-PLUS carried out a field survey in 2014. Based on discussions with herders and frontline staff of the Madhya Pradesh Forest Department (MPFD), it was ascertained that green fodder is usually available from the onset of monsoon (July) to winter (January). After harvesting of rabi⁷ crops, livestock are left in open for grazing and mostly uncontrolled grazing takes place during April to June. Livestock are also dependent on dry fodder obtained from wheat, maize, green lentil, black lentil and grams. The seasonal availability of forage is presented in the table below.

Table 4: Fodder availability calendar for Hoshangabad landscape

MONTHS	DRY FODDER (Y=YES, N=NO)			GREEN FODDER (Y=YES, N=NO)	
	WHEAT STRAW	MAIZE, GREEN LENTIL, BLACK LENTIL STRAW	GRAM, PEA STRAW	SEASONAL GRASSES AND WEED	TREE FODDER
January	N	N	N	Y	Y
February	N	N	N	N	N
March	Y	N	Y	N	N
April	Y	Y	Y	N	N
May	Y	Y	Y	N	Y
June	Y	Y	N	N	Y
July	N	N	N	Y	Y
August	N	N	N	Y	Y
September	N	N	N	Y	Y
October	N	N	N	Y	Y
November	N	Y	N	Y	Y
December	N	Y	N	Y	Y

4.0 FIELD DEMONSTRATION

Under the Action-learning Pilot Program (ALPP), Forest-PLUS is intensively working in nine pilot villages; four from Hoshangabad Forest Division, and five from Harda Forest Division (see Table 5). The area accessed by livestock in these nine villages was selected for demonstration of the improved grazing management technique. This section documents the adaptation and demonstration of a locally suitable

⁷ The Indian cropping season is classified into two main seasons - (i) Kharif and (ii) Rabi based on the monsoon. The kharif cropping season is from July-October during the south-west monsoon and the Rabi cropping season is from October-March (winter).

technique to improve grazing management in the landscape, taking into consideration fodder consumption, availability, and sustainability.

The grazing management technique comprises an assessment of the field situation (demand and supply analysis), participatory micro planning, and field implementation through community institutions.

Table 5: Selected villages for demonstration of improved grazing management technique

FOREST DIVISION	FOREST RANGE	CLUSTER	VILLAGE
Hoshangabad	Sukhtawa	Morpani	Morpani
			Mariyarpura
			Mandikhoh
			Gomti
Harda	Temagaon	Kapasi	Kapasi
			Uskalli
			Jinwani
			Jogikhera
			Barodghat

4.1 UNDERSTANDING THE FIELD SITUATION

To understand the field situation – number of livestock, fodder requirement, grazing pattern, availability of fodder, and major fodder species in forests – various field-level surveys were undertaken during 2014-2017. These surveys were supplemented by a study of key documents such as the Working Plans and Livestock Census Reports.

4.1.1 DEMAND ANALYSIS

This exercise revealed that there were a total of 3,671 livestock in the nine pilot villages. The breakdown by the type of livestock is given in Table 6.

Table 6: Livestock in the nine pilot villages (number)

VILLAGE	GOAT/SHEEP			BUFFALO			COW/OXEN/BULL			TOTAL
	ADULT (FEMALE)	ADULT (MALE)	KIDS	ADULT (FEMALE)	ADULT (MALE)	CALF	COW	OXEN	BULL	
Morpani	88	14	31	34	7	17	175	193	103	662
Mandikhoh	63	21	27	53	3	37	235	227	193	859
Mariyarpura	96	23	32	7	0	1	137	89	87	472
Gomti	27	1	17	6	1	3	58	17	60	190

VILLAGE	GOAT/SHEEP			BUFFALO			COW/OXEN/BULL			TOTAL
	ADULT (FEMALE)	ADULT (MALE)	KIDS	ADULT (FEMALE)	ADULT (MALE)	CALF	COW	OXEN	BULL	
Sub-total	274	59	107	100	11	58	605	526	443	2183
Kapasi	38	11	18	29	1	18	108	26	99	348
Uskalli	8	2	3	54	0	30	92	32	75	296
Jinwani	29	8	21	22	0	14	74	55	73	296
Jogikhera	63	6	11	6	0	5	15	25	14	145
Barodghat	70	7	41	25	2	23	96	54	85	403
Sub-total	208	34	94	136	3	90	385	192	346	1488
TOTAL	482	93	201	236	14	148	990	718	789	3671

Using the conversion ratios for the different kinds of livestock as specified in the Working Plans, the absolute numbers of livestock were then converted into ACUs (see Table 7).

Table 7: Livestock in the nine pilot villages (ACUs)

VILLAGE	GOAT / SHEEP	BUFFALOES	COWS / OXEN / BULL	TOTAL LIVESTOCK
Morpani	133	99	419.5	651.5
Mandikhoh	111	149	558.5	818.5
Mariyarpura	151	15	269.5	435.5
Gomti	45	17	105	167
Sub-total	440	280	1352.5	2072.5
Kapasi	67	78	183.5	328.5
Uskalli	13	138	161.5	312.5
Jinwani	58	58	165.5	281.5
Jogikhera	80	17	47	144
Barodghat	118	77	192.5	387.5
Sub-total	336	368	750	1454
TOTAL	776	648	2102.5	3526.5

During the field surveys, household level data was collected on various sources of fodder. This exercise revealed that over two-thirds of the fodder requirement in the nine pilot villages was being met from forest lands (see Table 8).

Table 8: Various sources of fodder in the nine pilot villages (percentage)

VILLAGE	OWN LAND	OTHER PRIVATE LAND	VILLAGE COMMON LAND	FOREST LAND	FROM MARKET
Morpani	29.26	3.3	7.26	59.74	0.43
Mandikhoh	27.37	0.75	3.7	67.21	0.97
Mariyarpura	23.9	0.26	3.9	71.43	0.52
Gomti	26.25	1.94	6.53	65.28	0
Sub-total	26.7	1.56	5.35	65.91	0.48
Kapasi	18.84	3.29	4.45	70.73	2.68
Uskalli	20.65	4.26	4.35	69.26	1.48
Jinwani	22.18	2.09	5.27	70.45	0
Jogikhera	15	0.87	7.61	73.04	3.48
Barodghat	21.38	3.99	6.09	66.23	2.32
Sub-total	19.61	2.9	5.56	69.94	1.99
TOTAL	22.76	2.31	5.46	68.15	1.32

Using the data presented above and assuming the maximum carrying capacity to be two ACUs per hectare (the standard carrying capacity of PF as per MPFD), the requirement of forest area to support the livestock of the nine pilot villages was determined. This assumption permitted the determination of the *minimum* forest area needed for sustainable grazing, if the proportion of fodder obtained from different sources remain constant. This presented in Table 9.

Table 9: Fodder requirement in the nine pilot villages

VILLAGE	TOTAL LIVESTOCK (IN ACU)	CONTRIBUTION OF FOREST LAND AS A SOURCE OF FODDER (IN %)	NUMBER OF ACUs TO BE SUPPORTED FROM FOREST LAND	FOREST LAND REQUIRED FOR GRAZING (IN HA)
Morpani	651.5	59.74	389.21	194.60
Mandikhoh	818.5	67.21	550.11	275.06
Mariyarpura	435.5	71.43	311.08	155.54
Gomti	167	65.28	109.02	54.51
Sub-total	2072.5	65.91	1365.98	682.99
Kapasi	328.5	70.73	232.35	116.17

VILLAGE	TOTAL LIVESTOCK (IN ACU)	CONTRIBUTION OF FOREST LAND AS A SOURCE OF FODDER (IN %)	NUMBER OF ACUs TO BE SUPPORTED FROM FOREST LAND	FOREST LAND REQUIRED FOR GRAZING (IN HA)
Uskali	312.5	69.26	216.44	108.22
Jinwani	281.5	70.45	198.32	99.16
Jogikhera	144	73.04	105.18	52.59
Barodghat	387.5	66.23	256.64	128.32
Sub-total	1454	69.94	1016.93	508.46
TOTAL	3526.5	68.15	2403.31	1201.65

4.1.2 SUPPLY ANALYSIS

In parallel with the assessment of fodder requirement, an analysis of potential supply from forest areas was also done through an exploratory study in the forest areas adjoining the pilot clusters. Four transect walks of 1 km each were undertaken in the forest area adjoining each pilot cluster. Thus, a total of eight transect walks of 1 km each were undertaken using the coordinates provided by the MPFD.

In each transect line, eight plots of 3 m x 3 m were laid. Four were laid at 200 m from the starting point, and another four at 200 m before the end point (800 m from the starting point). Therefore, a total of 64 plots were laid, covering an area of 576 m². These plots were laid as per the guidelines of the National Working Plan Code, 2014. This exercise led to identification of major fodder species present in the area along with a rough estimate of the quantity of fodder available (see Annexure I).

Another exercise was undertaken to identify locally available fodder species, which could be planted in the landscape to enhance fodder production in pasture lands outside the forest area.

The local herders indicated that the most preferred species by livestock are *Cynodon dactylon*, *Themeda quadrivalvis*, Sukal, and Babri. Additionally, livestock also consume leaves of *Dendrocalamus strictus*, *Gardenia latifolia*, *Terminalia tomentosa*, and *Mitragyna parviflora*. The species preferred by goats are Suj, Elta, *Mitragyna parviflora*, *Acacia pennata*, and *Zizyphus jujube*.

According to the herders, both the quantity and quality of fodder has considerably reduced in the areas surrounding the villages during the past two decades. As a result, livestock has to travel to far-flung areas and hillocks.

There is a need to restore productivity of lands near the villages, especially pasture lands. The high potential fodder species suitable for restoring the productivity of pasture lands and other available land near the villages in Hoshangabad landscape are listed in Table 10.

Table 10: High potential fodder species for the Hoshangabad landscape

TYPE OF FORAGE SPECIES	COMMON / LOCAL NAME	BOTANICAL NAME	AVAILABILITY*	PALATABILITY**
Grasses	Doob	<i>Cynodon dactylon</i>	Very Easy	Very Palatable
	Gunher	<i>Themeda quadrivalvis</i>	Very Easy	Very Palatable
	Bhurwel	<i>Dichanthium annulatum</i>	Easy	Very Palatable
	Ponia	<i>Apluda mutica</i>	Very Easy	Very Palatable
	Deenanath	<i>Pennisetum pedicellatum</i>	Easy	Somewhat Palatable
Shrubs and under-shrubs	Goodskari	<i>Grewia hirsuta</i>	Very Easy	Very Palatable
	Chipti	<i>Desmodium pulchellum</i>	Very Easy	Very Palatable
	Jondhrali	<i>Antidesma ghaesembilla</i>	Easy	Very Palatable
	Pawar	<i>Cassia tora</i>	Easy	Somewhat Palatable
	Makor	<i>Ziziphus oenoplia</i>	Very Easy	Somewhat Palatable
Climbers	Bharnda	<i>Pueraria tuberosa</i>	Easy	Very Palatable
	Raoni	<i>Acacia pennata</i>	Very Easy	Very Palatable
	Peperwel	<i>Combretum decandrum</i>	Easy	Somewhat Palatable
Trees (Small)	Asto	<i>Bauhinia racemosa</i>	Easy	Very Palatable
	Astara	<i>Bauhinia malabarica</i>	Very Easy	Very Palatable
	Kelwar	<i>Bauhinia purpurea</i>	Easy	Very Palatable
	Ghont	<i>Ziziphus xylopyrus</i>	Very Easy	Somewhat Palatable
Trees (Large)	Kusum	<i>Schleichera oleosa</i>	Easy	Very Palatable
	Gular	<i>Ficus glomerata</i>	Neutral	Very Palatable
	Saja	<i>Terminalia tomentosa</i>	Very Easy	Somewhat Palatable
	Anjan	<i>Hardwickia binata</i>	Easy	Somewhat Palatable

* **5 Point Scale of Availability:** (1) Very Easy, (2) Easy, (3) Neutral, (4) Difficult, (5) Very Difficult

** **5 Point Scale of Palatability:** (1) Very Palatable, (2) Somewhat Palatable, (3) Neutral, (4) Somewhat Unpalatable, (5) Not Palatable

4.2 SILVOPASTORAL MICRO PLAN

The analyses of the fodder demand and supply in the pilot villages were shared with MPFD and local communities and a silvopastoral micro plan to reduce unsustainable grazing in the forest areas was developed.

A silvopastoral system, where forestry and grazing are combined in a mutually beneficial manner, was identified as a suitable grazing management technique for the landscape⁸. Locally available, easy-growing fodder species can be planted along with the indigenous tree species to develop this model.

The micro plan has interventions to enhance supply as well as manage demand. It envisages active involvement of Joint Forest Management Committees (JFMCs) present in the pilot clusters.

The following are the key elements of the micro plan:

- **Rotational Grazing**

Each JFMC will be allotted a plot of land based on the fodder requirement of that particular village (see Table 9). The forest area allotted to the JFMC will be sub-divided into sub-plots for undertaking rotational grazing. The number of livestock allowed will be regulated as per the carrying capacity of the sub-plot.

- **Resource Augmentation**

In areas where grazing is restricted for some time, assisted natural regeneration as well as planting of fodder species will be taken up. MPFD has agreed to support the JFMCs for undertaking fodder resource augmentation measures.

Some of the potential fodder species are listed in Table 11.

Table 11: Yield of selected fodder grass species

COMMON / LOCAL NAME	BOTANICAL NAME	SEEDLING / SEED REQUIRED	YIELD (IN TONS DM ⁹ /HA/YEAR)	REFERENCE*
Doob	<i>Cynodon dactylon</i>	About 5-10kg/ha	8-12 tons; under best conditions up to 20 tons	(Heuzé, et al., 2015)
Gunher	<i>Themeda quadrivalvis</i>	About 5-8kg/ha	3-8 tons	(Keir & Vogler, 2006)
Bhurwel	<i>Dichanthium annulatum</i>	About 4-6kg/ha	6-10 tons	(Kumar, et al., 2008)
Ponia	<i>Apluda mutica</i>	About 4-6kg/ha	5-8 tons	(Clayton, et al., n.d.)
Desho grass / Deenanath	<i>Pennisetum pedicellatum</i>	About 4-7kg/ha	8-13 tons, under best conditions up to 27.4 tons	(Heuzé & Hassoun, 2015)

⁸ Many successful case studies from India and abroad on suitable silvopasture practices exist, providing important lessons learned and recommendations.

⁹ DM implies Dry Matter

- **Pasture land development**

It was decided to enhance the productivity of pasture lands by planting suitable fodder species. Further, the community members agreed to plant traditional millet crops on private fallow lands. These interventions are likely to reduce grazing pressure on forest lands.

- **Capacity building of communities**

All the above interventions require capacity building of local communities along with hand-holding support. Forest-PLUS provided training on various grazing and fodder management issues during its field deployment phase. Linkages were developed with agriculture department (including *Krishi Vigyan Kendras*) for long-term capacity building support.

4.3 IMPLEMENTATION

The implementation of the grazing management technique was initiated from the Morpani cluster in the Hoshangabad Division. Two plots of 25 ha each (in compartment numbers PF-76 and RF-60) were identified by MPFD for undertaking various grazing management and productivity enhancement measures.

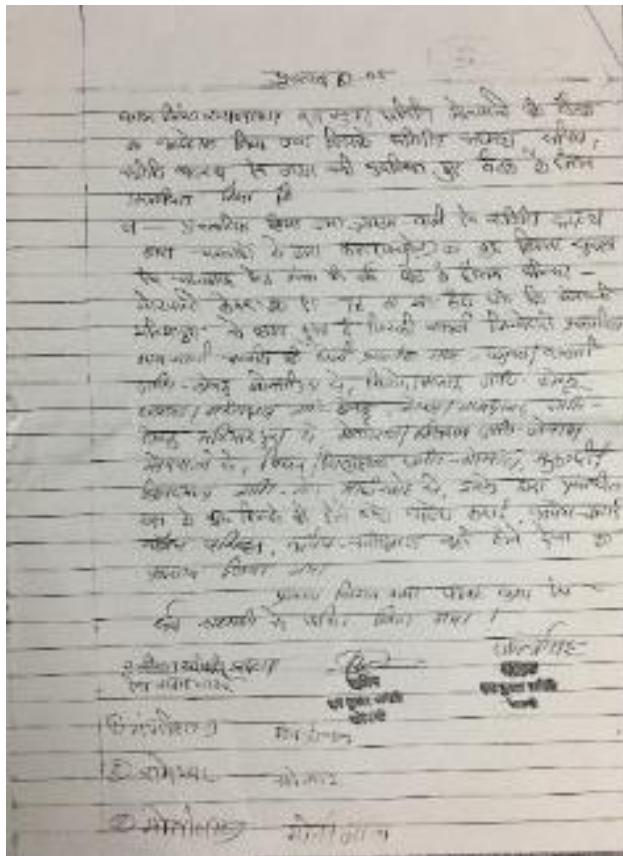
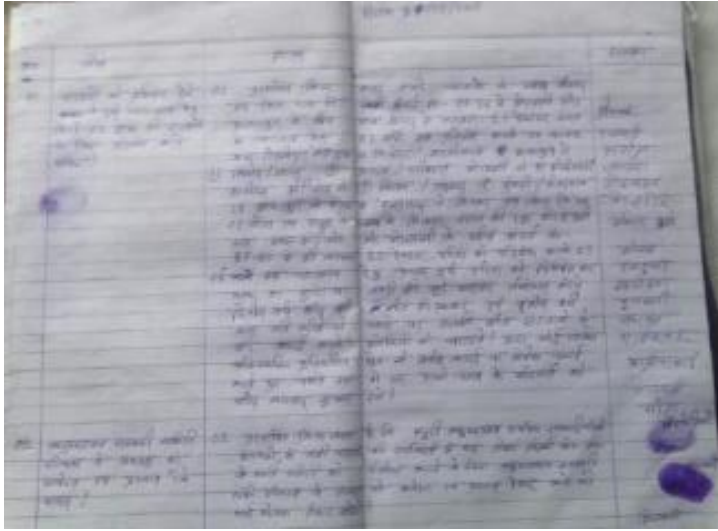


Plate 1: Proposal discussed in the Morpani meeting regarding adoption of grazing management technique

A committee of seven members representing the different villages was also formed during the meeting. This committee will be primarily responsible for ensuring protection of the grazing plot, through regular monitoring.

A similar intervention is also planned in the Kapasi cluster. Apart from demarcation of the two plots in 2017, two plots each of 25 ha will be demarcated and developed similarly each year over the next three

years as well. The additional grazing plots can be used rotationally over the years to fulfill the fodder requirement of the livestock of the pilot villages.



MAHESH THAKUR

Plate 2: A snapshot of the JFMC Meeting Register with minutes of the meeting held on 24 July, 2017

5.0 WAY FORWARD

The field demonstration of the improved grazing management technique developed/adapted for the Hoshangabad landscape comprises a silvopasture technique with allotment of forest land to JFMCs to be developed as grazing plots for rotational grazing and resource augmentation, along with development of pasture/fallow lands for fodder production outside the forest areas.

Such improved grazing management techniques can play an important role in enhancing forest health, and restoring its flora and fauna. Before an intervention is initiated, it is imperative to understand demand as well as supply, along with current and potential species. The demand-supply gap analysis can help in designing appropriate interventions and serve as a baseline for monitoring the impact of the interventions undertaken. The improved grazing management technique also needs to involve appropriate village institutions through a consultative approach. The proposed grazing management technique is based on scientific approach and is easily replicable and scalable. This has a high potential for addressing a major driver of forest degradation in India and beyond.

REFERENCES

- Clayton, W. D., Vorontsova, M. S., Harman, K. T. & Williamson, H., n.d. *GrassBase - The Online World Grass Flora*. [Online]
Available at: <http://www.kew.org/data/grasses-db/index.htm>
[Accessed 1 May 2017].
- Department of Agriculture Cooperation and Farmers Welfare, 2013a. *Agriculture Contingency Plan for Harda District, Madhya Pradesh*, New Delhi: Ministry of Agriculture and Farmers Welfare, Government of India.
- Department of Agriculture Cooperation and Farmers Welfare, 2013b. *Agriculture Contingency Plan for Hoshangabad District, Madhya Pradesh*, New Delhi: Ministry of Agriculture and Farmer's Welfare, Government of India.
- Forest Department, Harda Forest Division, 2010-11 to 2019-20. *Working Plan: Harda Forest Division*, Harda: Madhya Pradesh Forest Department.
- Forest Department, Hoshangabad Forest Division, 2013-14 to 2022-23. *Working Plan: Hoshangabad Forest Division*, Hoshangabad: Madhya Pradesh Forest Department.
- FSI, 2015. *India State of Forest Report*, Dehradun: Forest Survey India, Ministry of Environment Forest and Climate Change.
- Government of Madhya Pradesh, n.d. *Government of Madhya Pradesh: State Service Delivery Gateway*. [Online]
Available at: <http://www.mp.gov.in/en/mp-krishi/arg-st/landuse-ir-pop/l-class-mp>
[Accessed 17 May 2017].
- Heuzé, V. & Hassoun, P., 2015. *Evaluation of desho grass (Pennisetum pedicellatum) hay as a basal diet for growing local sheep in Ethiopia*. [Online]
Available at: www.feedipedia.org/node/396
[Accessed 2017].
- Heuzé, V., Tran, G., Delagarde, R. & Lebas, F., 2015. *Bermuda grass (Cynodon dactylon). Cereal and grass fodder*. [Online]
Available at: <http://www.feedipedia.org/node/471>
[Accessed 23 May 2017].
- Keir, A. & Vogler, W. D., 2006. A review of current knowledge of the weedy species Themeda quadrivalvis (grader grass). *Tropical Grasslands*, 40(1), pp. 193-201.
- Kumar, D. et al., 2008. Seed yield response of marvel grass (*Dichanthium annulatum*) to cutting management and nitrogen fertilisation in central India. *Agronomy Research*, 6(2), p. 499–509.
- Mathukia, R. K., Sagarka, B. K. & Panara, D. M., 2016. Fodder Production through Agroforestry: A Boon for Profitable Dairy Farming. *Innovare Journal of Agricultural Sciences*, 4(2), pp. 13-19.
- MoA, 1992. *15th Livestock Census All India Report*, New Delhi: Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture, Government of India.
- MoA, 1997. *16th Livestock Census All India Report*, New Delhi: Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture, Government of India.

- MoA, 2003. *17th Livestock Census All India Report*, New Delhi: Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture, Government of India.
- MoA, 2007. *18th Livestock Census All India Report*, New Delhi: Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture, Government of India.
- MoA, 2012. *19th Livestock Census All India Report*, New Delhi: Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture, Government of India.
- Planning Commission, 2011. *Madhya Pradesh Development Report*, New Delhi: Academic Foundation.
- World Bank, 2005. *India: Unlocking Opportunities for Forest Dependent People in India, Volume I, Main Report*, Washington DC: The World Bank.

ANNEXURE

ANNEXURE-I

Availability of fodder species in the forest area adjoining the two pilot clusters in Hoshangabad landscape

#	NAME		UTILITY(IES)
	NAME OF THE SPECIES	LOCAL NAME	
1.	<i>Eragrostis interrupta</i>	Bhurbhusi	Used as fodder
2.	-	Dongli	Used as fodder
3.	-	Kunda	Used as fodder
4.	<i>Acacia leucocephala</i>	Riuja	Used as fodder & NTFP
5.	<i>Flacourtia indica</i>	Kakhai	Used as NTFP
6.	<i>Tectona grandis</i>	Teak	Used as timber
7.	<i>Butea monosperma</i>	Palash	Used as fodder & fuel wood
8.	<i>Saccharum spontaneum</i>	Kans	Used as fodder
9.	-	Chidgan	Used as fodder
10.	<i>Themeda quadrivalvis</i>	Gunher	Used as fodder
11.	<i>Eulaliopsis binata</i>	Sabai grass	Used as fodder
12.	-	Rjan	Used as fodder
13.	<i>Dendrophthoe falcata</i>	Vanda	Used as fodder
14.	-	Bherchora	Used as fodder
15.	-	Bhorh	Used as fodder
16.	-	Sukhal	Used as fodder
17.	-	Jangli tuar	Used as fodder
18.	-	Ghiriya	Used as fodder for goat
19.	-	Gatheli	Used as fodder
20.	<i>Eragrostis tenella</i>	Bhurbhuri	Used as fodder
21.	-	Lipti	Used as fodder & timber
22.	<i>Apluda mutica</i>	Ponia	Used as fodder
23.	<i>Terminalia tomentosa</i>	Saaj	Used as fodder

#	NAME		UTILITY(IES)
	NAME OF THE SPECIES	LOCAL NAME	
24.	-	Charau ghas	Used as fodder
25.	-	Popti	Used as fodder
26.	-	Phang	Used as fodder
27.	-	Chamrel	Used as fodder
28.	-	Dhanbela	Used as fodder for goat
29.	<i>Grewia tiliifolia</i>	Dhaman	Used as fodder
30.	-	Chichola	Used as fodder
31.	-	Jangli gathru	Used as fodder
32.	-	Sital	Used as fodder
33.	-	Dongla	Used as fodder
34.	-	Badi lipty	Used as fodder
35.	-	Kharbuchat	Used as fodder
36.	<i>Dendrocalamus strictus</i>	Bamboo	Used as fodder
37.	-	Kiruwala	Used as fodder
38.	<i>Indigofera cordata</i>	-	Used as fodder
39.	<i>Cynodon dactylon</i>	Doob	Used as fodder
40.	-	Golpatti	Used as fodder
41.	-	Jungli tilli	Used as fodder
42.	<i>Dichanthium annulatum</i>	Loari	Used as fodder



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