

Natural silvipastoral resource covers of India

D. R. Palsaniya

ICAR-Indian Grassland and Fodder Research Institute, Jhansi-284003, India

Corresponding author e-mail: drpalsaniya@gmail.com

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Introduction

Silvipastures are one of the important resource bases of a country. They are not only the main source of herbage availability for the livestock rearing and wildlife but also the major instrument for wasteland rehabilitation. Despite of enormous importance, there was a huge gap about the available information on natural forage resources (grasslands/forage trees/silvipastures), their makeup, successions, and coverage constrains and scope for improvement (Dabadghao and Shankarnarayan, 1973). Therefore, an attempt has been made to identify and delineate the natural silvipastoral cover of India which will help in effective planning and execution of watershed development and other forage programmes wherein livestock needs are to be addressed.

Materials and Methods

The information generated through the Diagnosis and Design (D&D) methodology by the 36 AICRPAF centres located in the 15 broad agro climatic zones of the India (Pathak *et al.*, 2000), information from Dabadghao and Shankarnarayan (1973) and other published literature have been utilized to conceptualize following four natural silvipastoral covers in India.

Results and Discussion

***Ulmus-Grewia-Bauhinia-Alnus-Themeda-Arundinella* cover:** This cover comprises over 23.04 million ha area and located in the western and eastern Himalayas and Terai belt. The main fodder trees in this belt are *Ulmus wallichiana* in J&K, *Grewia optiva* in Himachal Himalayas, *Bauhinia purpurea* in Uttarakhand and *B. variegata* and *Alnus nepalensis* in North Eastern Himalayan belt. The other forage trees of significance are *Salix alba*, *Morus alba*, *Populus ciliata* and *Celtis australis* in Western Himalayas while *Litsea polyantha*, *Artocarpus heterophyllus*, *Streblus asper*, *Albizia*, *Gmelina arborea* and *Symingtonia* in Eastern part of Himalayas. *Ficus*, Conifers, *Ailanthus excelsa*, *Prunus armeniaca*, *Cedrella toona*, *Terminalia belerica*, *Bamboo* and *Quercus* sp. are also used as important source of fodder in the Himalayas. As under story component, there are 37 major perennial grasses, 32 annual grasses and 34 dicots in the subtropical belt while the temperate - alpine grasslands found beyond 2100 m altitude in the temperate and cold arid areas has 47 perennial grasses, 5 annual grasses, 68 dicots and few temperate shrubs and devoid of trees. The major grass species are *Arundinella bengalensis*, *Themeda anathera*, *Bothriochloa pertusa*, *B. bladhii*, *Heteropogon contortus*, *Ischaemum barbatum*, *Chrysopogon* and *Cymbopogon*. As we move towards higher altitudes (above 2100 m) in sub-temperate and temperate belt, perennial grass species like *Agropyron*, *Agrotis*, *Dactylis*, *Poa*, etc., dominates. This is one of the most productive silvipastoral cover of India due to favourable climate and vegetation composition. The average dry biomass productivity of natural grasses in this zone is 1.96 t ha⁻¹ year⁻¹ with a carrying capacity of 0.70 ACU ha⁻¹ year⁻¹. The green fodder yield from *Grewia optiva* in Kangra district of Himachal Pradesh was reported to 12-15 kg adult tree⁻¹. In *Bauhinia variegata*, average fodder yield of 15-20 kg tree⁻¹ is reported.

***Prosopis-Acacia-Zizyphus-Ailanthus-Dichanthium-Cenchrus-Lasiurus* cover:** This silvipastoral cover comprises parts of Punjab, Haryana, Uttar Pradesh, Rajasthan and Gujarat and covers nearly 43.6 million ha area. The dominant forage trees in this belt are *Prosopis cineraria*, *Zizyphus nummularia*, *Acacia nilotica* and *Ailanthus excelsa*. *Prosopis cineraria*, *Z. nummularia* and *A. excelsa* dominates in Rajasthan and Gujarat and their density decreases as we move from South Western part towards north-eastern region with simultaneous increase in the density of *A. nilotica*. The other fodder trees are *Azadirachta indica*, *Morus alba*, *A. leucophloa*, *A. lebbeck*, *A. catchu*, *Bauhinia variegata*, *L. leucocephala* and *A. tortilis*. The mean tree density (tree ha⁻¹) is 6 in Gujarat, 20-30 in Rajasthan, 15 in Haryana and 33 in Punjab. There are 11 perennial grass species, 43 annual grass species and 45 dicots out of which 19 are legumes. The most important grasses in this belt are *Dichanthium annulatum*, *Cenchrus ciliaris*, *C. setigerus* and *Lasiurus indicus*. The others are *Eleusine flagellifera*, *Cynodon dactylon*, *Sporobolus marginatus*, *S. pallidus*, *Panicum turgidum*, *Heteropogon contortus* and *Dactyloctenium indicum*. The average dry biomass productivity of natural grasses in this belt is estimated at 1.44 t ha⁻¹ year⁻¹ with a carrying capacity of 0.53 ACU ha⁻¹ year⁻¹. In Rajasthan, a full grown *P. cineraria* produced 59 kg tree⁻¹ green

leaf on complete lopping leaving the central leading shoot, 28 kg tree⁻¹ when lower 2/3 crown is lopped and 20 kg tree⁻¹ when lower 1/3 crown is lopped. Leaf fodder yield of *Z. nummularia* ranges from 105 kg ha⁻¹ (at 11% density) to 150 kg ha⁻¹ (at 18% density) on the basis of annual lopping. Average 3.10 t ha⁻¹ dry leaf fodder from *A. excelsa* (100 trees ha⁻¹) at 8th year of establishment was obtained in Rajasthan. The average leaf fodder yield in young trees of *A. excelsa*, *P. cineraria*, *A. indica* and *D. cinerea* was 21.13, 25.70, 12.65 and 0.67 kg tree⁻¹, respectively in Rajasthan.

Anogeissus-Albizia-Hardwickia-Sehima-Dichanthium cover: This silvipastoral cover spread over 17.40 million ha area covering whole of peninsular India between longitudes 68 and 87° E and latitudes 8 and 24° N and represents tropical vegetation. The major forage trees in this silvipastoral zone are *Anogeissus pendula*, *A. latifolia*, *Albizia procera*, *A. lebbek*, *A. amara* and *Hardwickia binata*. The other fodder trees are *Leucaena leucocephala*, *A. nilotica*, *A. leucophloea*, *Azadirachta indica*, *Z. mauritiana*, *Madhuca latifolia*, *Terminalia arjuna*, *S. sesban*, *Ficus* sp., *Pithecellobium dulce*, *Pterocarpus marsupium*, *A. planifrons*, *Thespesia populnea*, *Tamarandus indica*, *Grewia tilaefolia*, *Gmelina arboretum* and *Bridelia retusa*. The tree density under rainfed conditions ranges between 5-115 in Maharashtra, 7-12 in Karnataka and 5-150 in Andhra Pradesh. This cover has 24 species of perennial grasses, 89 species of annual grasses and 129 species of dicots including 56 legumes. The most important grasses in this region are *Sehima nervosum* and *Dichanthium annulatum*. The other important grasses are *Arundinella*, *Aristida*, *Chrysopogon*, *Bothriochloa*, *Cymbopogon*, *Heteropogon* and *Themeda*. The average dry biomass productivity and carrying capacity in this zone are 3.12 t ha⁻¹ year⁻¹ and 1.08 ACU ha⁻¹ year⁻¹. Top feed production of six fodder trees of this zone showed the maximum dry leaf fodder of 11.38 kg tree⁻¹ with *A. procera* followed by *A. amara* (11.20 kg tree⁻¹), *A. lebbek* (4.21 kg tree⁻¹), *H. binata* (3.67 kg tree⁻¹) and *D. cinerea* (2.76 kg tree⁻¹) and the minimum yield of 0.51 kg tree⁻¹ was noted with *A. tortilis* at 10 years. Harvesting of 12 tree species at 10 years of age grown in red gravelly soils showed the maximum dry leaf fodder of 3.81 t ha⁻¹ or 0.38 t ha⁻¹ year⁻¹ with *A. procera* followed by *L. leucocephala*.

Acacia- Madhuca-Gmelina-Phragmites - Saccharum - Imperata cover: This type covers an area of 28.0 million ha in middle and lower Gangetic plains and Brahmaputra valley and located in the moist subtropical zone. The major forage trees in this silvipastoral zone are *A. nilotica*, *Madhuca latifolia* and *Gmelina arborea*. The other fodder trees are *Azadirachta indica*, *Z. mauritiana*, *Terminalia arjuna*, *Mangifera indica*, *S. sesban*, *Bauhinia purpurea*, *Pithecellobium dulce*, and *Ficus* sp. The tree density under rainfed conditions ranges between 25-30 in West Bengal, 10-30 in eastern Uttar Pradesh and 100 in Assam. There are 10 perennial grasses, 26 annual grasses and 56 herbaceous species including 16 legumes in this zone. The main grasses of this area are *Phragmites australis*, *Saccharum spontaneum*, *S. arundinaceum*, *S. bengalense* and *Imperata cylindrica*. Others grasses are *Arundinella*, *Cymbopogon*, *Leersia*, *Bothriochloa*, *Paspalum*, *Panicum*, *Alyosia*, *Desmodium*, *Melilotus* and *Desmostachya*. The average dry biomass productivity and carrying capacity in this zone are 2.51 t ha⁻¹ year⁻¹ and 0.83 ACU ha⁻¹ year⁻¹. The leaf fodder yield of *A. nilotica* and *Terminalia arjuna* was recorded at 0.39 and 0.18 kg tree⁻¹, respectively at the age of 5 years with a population density of 300 trees ha⁻¹ while *Leucaena leucocephala* and *Sesbania sesban* produced 1.5 and 0.3 kg tree⁻¹ leaf fodder at 3.5 year age at 5000 density.

Table 1: Major characteristics of silvipastoral covers of India

Silvi-pastoral cover	Area (m ha)	Agro-climatic zone	Soil conservation region	States	Climate	Rainfall range (cm)	Mean annual temperature (°C)	Growing period (days)	Dry biomass (t/ha/year)	Carrying capacity (ACU/ha/year)
<i>Ulmus-Grewia-Bauhinia-Alnus-Themeda-Arundinella</i>	23.27	1,2	I,II,III,XV,XVI	Jammu and Kashmir, Himachal Pradesh, Uttarakhand and seven sisters of NEHR	Cold arid, semi arid, sub humid and per humid	10-250	<20-27.5	0-300	0.33-3.95	0.1-1.4
<i>Prosopis-Acacia-Zizyphus-Ailanthus-Dichanthium-Cenchrus-Lasiurus</i>	43.6	5,6,8,13,14	IV,V,VI,VII	Rajasthan, Gujarat, Punjab, Haryana and Uttar Pradesh	Arid, semi-arid dry to moist	10-75	22-27.5	0-210	0.45-4.50	0.16-1.1

<i>Anogeissus- Albizia- Hardwickia- Sehima- Dichanthium</i>	17.4	7,8,9,10, 11,12,13 ,15	VII,VIII,IX,X, XI,XII,XIII,	Whole of peninsular India and island region	Arid, semi arid, sub humid, humid and per humid	50-300	20-28	60-300	1.09- 4.86	0.4-1.7
<i>Acacia- Madhuca- Gmelina- Phragmites - Saccharum - Imperata</i>	28.0	2,3,4	IV,XIV,XV	Uttar Pradesh, Bihar, West Bengal and Assam	Sub humid dry to sub humid moist	100- 150	20-27.5	150- 300	1.81- 4.57	0.5-1.5

References

Dabadghao, P. M. and K. A. Shankarnarayan 1973. *The Grass Cover of India*. Indian Council of Agriculture Research, New Delhi.

Pathak, P. S., H. M. Pateria and K. R. Solanki. 2000. *Agroforestry Systems in India: A Diagnosis and Design Approach*. Indian Council of Agriculture Research, New Delhi.