

SOILS OF CANE AND BAMBOO BEARING AREAS IN ARUNACHAL PRADESH

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Abstract

Our land resources are under severe threat due to the alarming rate of degradation and competing demand of various land use based on natural resources. They need to manage in a scientific and rational manner, for which location and site specific information pertaining to nature of soil and other land resources, their constraints, potentials and suitability for various plants and other uses is a prerequisite. Soil survey provides the information needed for efficient management of land resources of an area in a sustainable manner. In this context, the need of identification on cane and bamboo bearing soil of Arunachal Pradesh was studied and surveyed. The study revealed that, almost all soils of Arunachal Pradesh except rocky, Water logging and alpine areas are found conducive for growing of cane and bamboo, however, climatic factors restrict the growth of different species. Hence, the growth and development of different bamboo and cane species are mostly governed by climatic and altitudinal factors and least by soil factors in Arunachal Pradesh.

Keywords: Soil conservation; Cane; Bamboo; Arunachal Pradesh

INTRODUCTION

Arunachal Pradesh, the largest state in North East India and is bounded by Bhutan to the west, China to the North-East, Myanmar (Burma) to the east and plains of Assam to the south. Climate of the state is influenced greatly by the Himalayan Mountains and large variations in altitude across the state. Areas that are at a very high elevation in upper Himalayas close to the Tibet border experience alpine and tundra climates. In the middle Himalayas temperate climate is experienced. Areas at the sub Himalayan generally experience humid sub-tropical climate with hot summers and mild winters.

Arunachal Pradesh is administratively divided into 22 districts, 123 circles and 3863 Villages with lowest population density in India. The decadal growth rate of the state is 27 % (against 21.54 % for the country) and the population of the state continue to grow at a much faster rate than the national rate. Agriculture is the primary source of the economy of the state. Food grains cultivation

includes; rice, maize, millet, wheat, pulses, sugarcane, ginger and oilseeds. About 80 % of population living in rural area is dependent on agriculture and about 62 % of total working populations are engaged in agriculture and allied field. 60 % of the agriculture activities are dependent on shifting cultivation due to undulating topographical condition. Soils are acidic in nature ranging from pH 4-6.5, which is best suited for agro-forestry and horticulture based activities.

Bamboo and cane are two most important group of Non-Timber Forest Produce. Most of the species of bamboo and cane are distributed in lower foot hills of the state which makes people to access easily and rapidly decreasing in its distribution. They need to manage in a scientific and rational manner, for which location and site specific information pertaining to nature of soil and other land resources, their constraints, potentials and suitability for various plants and other uses is a prerequisite. Soil survey provides the information needed for efficient management

of land resources of an area in a sustainable manner.

Table 1: The basic information

Total Area	83,743 Sq.Km
Temperature	0-35 °C
Temperate to alpine	25 %
Tropical	15 %
Sub-tropical	60 %
Rain fall	150-300 cm
Soil types	Mostly Sandy loam Little alluvial
Altitudinal variation	50-6000 m (amsl)

MATERIALS AND METHODS

A base line survey was conducted along the road side from Ziro (Lower Subansiri) to Daporijo (Upper Subansiri) Daporijo to Aalo and Menchukha (West Siang), Aalo to Gengging (Upper Siang), Gengging to Tuting (Upper Siang), Sagalee (Papum Pare), Pasighat (East Siang), Bomdila, Tawang, Hawaii, Tezu, Namsai, Anini, Menchukha, Roing, etc. during January–February’ 2016 to record and data collection on cane and bamboo distribution in Arunachal Pradesh, under the support of state CAMPA-2015-16. The GPS coordinates was used for locating the exact distribution areas. The soil samples were collected from peripheral areas of root zones up to depth of 30-40 cm and packed in polytene bags with tags. The collected soil samples were processed as per procedure and analysed for data. The soil colour was determined with “Munsell Colour Chart” and textural class was done with “Feel Method”. The base point was recorded at various important locations for further investigation as under:

Ziro (Hong village) 27° 33’ 29.3” N, 93° 50’ 32.9” E with 1565 m (amsl); Boa Simla 27° 43’ 53.6” N 93° 59’ 02.1” E with 469 m

(amsl); Raga 27° 47’, 49.14” N 94° 04’ 17.2” E with 1124 m (amsl); Tirbin-Tai, 28° 00’ 33.9” N 94° 32’ 32.7” E with 504 m (amsl); Daporijo Town 27° 59’ 13.3” N 94° 13’ 04.7 E with 305 m (amsl); Basar 27° 58’ 48.1” N 94° 41’ 30.5” E with 650 m (amsl); Bam village 28° 01’ 12.4” N 94° 40’ 50.2” E with 673 m (amsl); Aalo (Bagra) 28° 04’ 17.1” N 94° 45’ 10.1” E 418 m (amsl); Aalo (Kamba) 28° 16’ 11.1” N 94° 40’ 39.2 E with 297 m (amsl); Aalo (Kaying) 28° 25’ 14.2” N 94° 40’ 46.5” E with 540 m (amsl); Menchukha 28° 36’ 00.5” N and 94° 07’ 56.3” E with 1922 m (amsl); Dite- Dime 28° 19’ 15.0” N 94° 57’ 30.8” E with 356 m (amsl); Boleng 28° 21’ 22.7” N 94° 03’ 34.7” E with 237 m (amsl); Gengging 28° 32’ 42.5” N 95° 03’ 36.3” E with 845 m (amsl); Riga 28° 26’ 23.3” N 95° 03” E with 640 m (amsl); Migging 28° 50’ 41.2” N 94° 46’ 00.0” E with 1009 m (amsl); Tuting 28° 59’ 40.5” N 94° 54’ 06.5” E with 478 m (amsl); Chessa 27° 01’ 48.1” N, 93° 43’ 44.5” E with 131m (amsl); Pareng (Sagalee) 27° 19’ 48.2” N, 93° 30’ 21.1” E with 1281 m (amsl), Kibitho 28° 07’ 49.9” N, 97° 00’ 52.3” E with 1304 m (amsl); Bomdila 27° 15’ 21.6” N, 92° 02’ 12.0” E with 2533 m (amsl); Tawang 27° 35’ 03.8” N, 91° 52’ 25.1” E with 2791 m (amsl); Zimithang 27° 04’ 59.8” N, 91° 04’ 13.5” E with 2023 m (amsl); Hawaii 27° 53’ 13.3” N, 96° 47’ 58.8” E with 1304 m (amsl); Tezu 27° 56’ 02.5” N, 96° 09’ 19.4” E with 244 m (amsl); Lal Ane 27° 33’ 24.4” N, 93° 19’ 47.4” E with 3704 m (amsl); Damin 28° 06’ 09.3” N, 93° 19’ 51.3” E with 1072 m (amsl); Palin 27° 39’ 57.9” N, 93° 03’ 01.3” E with 1086 m (amsl).

During the survey and investigation, maximum distribution of bamboo and cane was recorded at lower foot hill up to mild temperate belt with evergreen forests. However, bamboo distribution was recorded from Tropical to Alpine region up to 3000 m

(amsl) with different species. The survey also revealed that, naturally occurred bamboo species distribution was attributed by climatic

and altitudinal factors. At tropical level, dominant species was *Dendrocalamus* and *Bambusa pallida*.

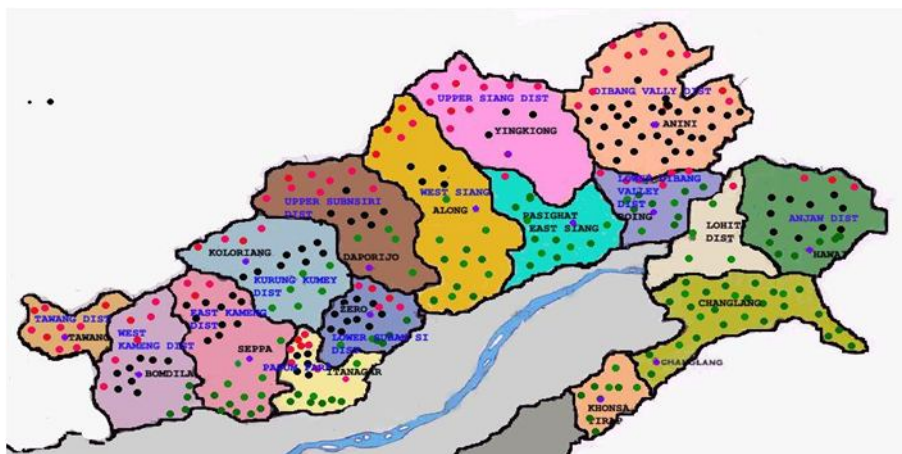


Fig. 1: Surveyed area

The maximum species distribution was recorded at sub-tropical zone and dominant species includes, *Chimonobambusa callosa*, *D. hamiltonii*, *Schizostachyum polymorphum*, *S. capitatum*, *Phyllostachys* spp. etc. The dominant species under temperate to alpine zone was recorded with *Yushania*,

Arundinaria, *Phyllostachys* and *Thamnocalamus*. Bamboos like *Phyllostachys*, *Chimonobambusa*, *Schizostachyum* spp., etc. are distributed at transitional zones in between sub-tropical and Temperate. *Bambusa pallida*, *Dendrocalamus hamiltonii* grows best at peripheral areas of river and streams.

Table 2: Altitudinal zone wise bamboo distribution

Tropical 0-1000 m (amsl)	Sub-Tropical 1000-2000 m (amsl)	Temperate 2000-3500 m (amsl)	Alpine 3500 m and above
<i>Dendrocalamus hamiltonii</i>	<i>Chimonobambusa callosa</i> (Tahu)	<i>Chimonobambusa griffithiana</i> (Budh)	<i>Arundinaria</i>
<i>Bambusa pallida</i>	<i>Chimonobambusa griffithiana</i> (Budh)	<i>Chimonobambusa armata</i> (Hseuh /kara)	<i>Thamnocalamus</i>
<i>Bambusa tulda</i>	<i>Chimonobambusa armata</i> (Hseuh /kara)	<i>Thamnocalamus</i>	--
<i>Schizostachyum pergracile</i>	<i>Chimonobambusa marmoreal</i> (Reji)	<i>Phyllostachys</i>	--
<i>Schizostachyum polymorphum</i>	<i>Phyllostachys species</i>	<i>Neomicrocalamus</i>	--
<i>Schizostachyum dullooa</i>	<i>Bambusa tulda</i>	<i>Chimonobambusa marmoreal</i> (Reji)	--
--	<i>Dendrocalamus hamiltonii</i>	--	--

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Whereas, Cane or Rattan distribution was restricted up to 2500 m (amsl) and maximum at sub-tropical zones. The dominant species at tropical zone was recorded with *Calamus leptospadix*, *C. floribundus*, *C. nambariensis*, *Plectocomia assamica*, etc. At sub-tropical

zone dominant species was *C. khasianus*, *C. jenkinsianus*, *C. leptospadix*, etc. Some species like *P. acanthospathus* and *P. Himalaya* was recorded at temperate zones. No cane species was recorded at alpine zone.

Table 3: Altitudinal Zone wise Cane/Rattan distribution

Tropical 0-1000 m (amsl)	Sub-Tropical 1000-2000 m (amsl)	Temperate 2000-3500 m (amsl)	Alpine 3500 m and above
<i>Calamus leptospadix</i>	<i>Calamus khasianus</i>	<i>Plectocomia acanthospathus</i>	Nil
<i>Calamus floribundus</i>	<i>Calamus jenkinsianus</i>	<i>Plectocomia himalayana</i>	--
<i>Calamus nambariensis</i>	<i>Calamus leptospadix</i>	--	--
<i>Plectocomia assamica</i>	--	--	--

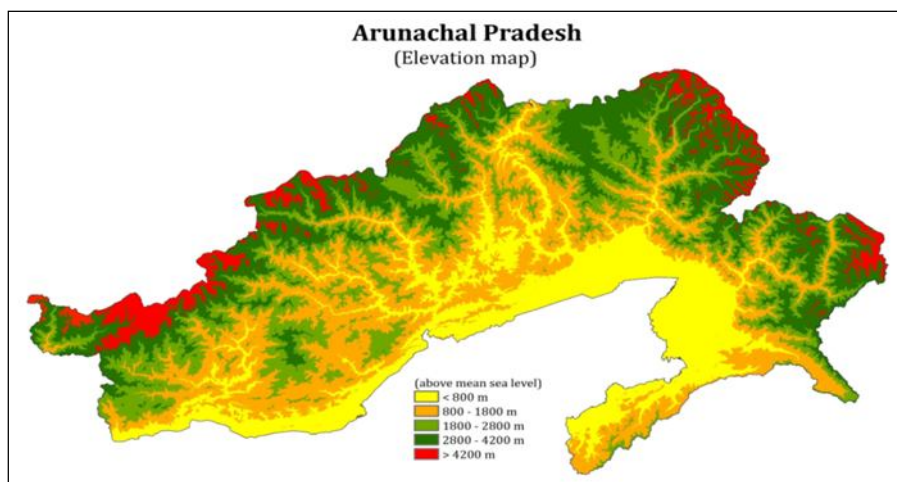


Fig. 2: Altitudinal or elevation zones

A co-relation study was also made during the survey to co-relate the agro-climatic zones of commercially important plants and other crops

during survey. The recorded data's are reflected in table 4.

Table 4: Agro climatic zones of Arunachal Pradesh and the commercially important plants/crops.

Agroclimatic zone	Area	Plant / Crops
Temperate zone	Tawang, Dirang, Bomdila, Shergaon, Thembang, Mukto, Anini, Mippi, Hunli, Taksing, Nacho, Siyum, Ziro, Lali Ane, Togru Putu (Papum Pare), Monigong, Menchukha, Pidi, Gelling, Singa, Kibitho, Chaglam, Dong and North Eastern part of Lohit, Kra Dadi, and Northern part of East Siang, Upper Siang, etc.	<p>Forestry: <i>Illicium griffithii</i>, <i>Cinnamomum</i>, <i>Taxus baccata</i>, Bamboo, Rhododendron, etc.</p> <p>Fruits: Apple, pear peach, plum, cherries, pistachio, almond, apricot, walnut, chestnut and kiwi, etc.</p> <p>Vegetables: Cabbage, cauliflower, knoll-khol, broccoli, radish, turnip, beetroot, potato, carrot garlic, onion, spinach, cucumber, tomato, brinjal, okra, French bean, asparagus, bean, capsicum, allium, peas, etc.</p>
Subtropical zone	Yazali, Daporijo, Sagalee, Khonsa, Aalo, Basar, Damin, Tali, Tippi, Hawaii, Tuting, Panging, Daporijo, etc.	<p>Forestry: <i>Rubia cordifolia</i>, <i>Zanthoxylum armatum</i>, Bamboo, Cane, timber species.</p> <p>Fruits: Mango, guava, citrus, litchi, low chilling peaches, pears, plums, almond, aonla, etc.</p> <p>Vegetables: Brinjal, tomato, okra, beans, peas, all cucurbits, carrot, radish, turnip, cole crops, leafy vegetables, onion, garlic, chillies and capsicum etc.</p> <p>Condiments & Aromatic: Ginger, cardamom, allium, etc.</p> <p>Tuber crops: Potato, sweet potato, <i>Colocasia</i>, yams, <i>Dioscorea</i>, etc.</p> <p>Ornamentals: Rose, gladiolus, orchids, carnation, chrysanthemum, marigold, petunia, large number of other ornamental and foliage plants.</p>
Tropical zone	Itanagar, Doimukh, wakka, Wakro, Seppa, Likabali, Banderdewa, Balijan, Pasighat, Tezu, Namsai, Changlang, Khonsa, Singhthow, etc.	<p>Forestry: Hollong, Kadam, Khokan, Hollock, Titasopa, Bonsum, Bogipoma, Agar, Mekai, Borpat, Amari, Jutli, Bamboo, Cane, etc.</p> <p>Fruits: Mango, citrus, banana, pineapple, papaya, grape, sapota</p> <p>Vegetables: Brinjal, tomato, okra, beans, gourds, amaranthus etc.</p> <p>Tuber crops: Cassava, sweet potato, amorphophallus, dioscorea, yams, coleus, colocasia etc.</p> <p>Plantation crops: Coconut, arecanut, cashew, oilpalm, rubber, coco</p> <p>Spices: Turmeric, ginger large cardamom, Cinamomum, pepper, etc.</p> <p>Ornamentals: Rose, chrysanthemum, jasmine, marigold, zenna, balsum, orchids, etc.</p>

Precipitation and soil moisture regime

The soil temperature is another important property which controls within limits, plant growth and soil evapotranspiration, effective rainfall and type of vegetation and organic matter decomposition. The rainfall in Arunachal Pradesh ranges from 150-300 cm, with high humidity during summer and dry during winter months. Most part of the state is having UDIC and USTIC moisture regime.

With increasing temperature soil reflectance property changes and soil becomes more reddish and less grayish. At alpine zones, there is very less biotic activity where temperature is below freezing point between 0° C and 5° C, root growth of most of the bamboo and cane growth are not feasible. In most of the tropical to sub-tropical areas, the temperature ranges from 5° C to 35° C which is important in determining the degree of biological and chemical activities.

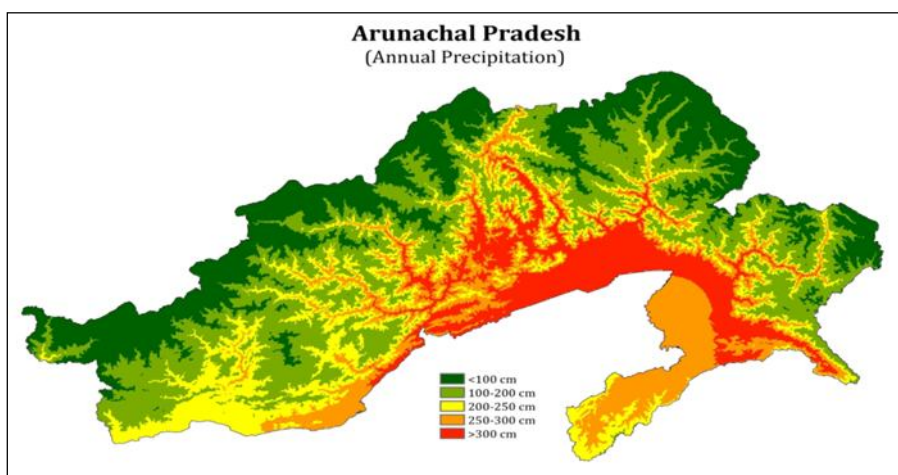


Fig. 3: Annual precipitation

Table 5: Soil sample analysis report of bamboo and cane growing areas in Arunachal Pradesh

NAME OF PLACE	PH	CONDUCTIVITY %	TOTAL O.C Av %	TOTAL Phos. %	Na %	K %	TOTAL NITROGEN %	CLAY %	SILT %	SAND %	WATER HOLDING CAPACITY	SOIL COLOUR
Hawai (Anjaw)	6.53	31.5	2.16	0.18	0.05	0.05	0.20	9	65	26	57.78	Weak red
Itanagar (Papum Pare)	5.82	71.9	0.17	0.02	0.05	0.03	0.07	5	65	30	35.02	Pole red
Mechuka (W/Siang)	5.39	97.9	1.92	0.04	0.06	0.07	0.15	6	70	24	37.35	Weak red
Ziro (L/Subansiri)	4.85	130.3	3.32	0.27	0.04	0.08	0.50	4	56	40	66.58	Weak red

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Daporijo (U/Subansiri)	5.09	115.2	0.55	0.12	0.05	0.06	0.11	20	36	44	58.69	Strong brown
Tawang	4.99	118.8	1.52	0.14	0.05	0.11	0.14	9	52	39	63.57	Pole red
Anini (Dibang Valley)	5.65	80.2	0.56	0.15	0.05	0.03	0.11	6	72	22	26.83	Weak red
Deomali (Tirap)	4.44	15.8	0.61	0.11	0.04	0.08	0.14	25	29	46	53.86	Pole red
Roing (L/Dibang Valley)	5.88	66.4	0.79	0.14	0.04	0.02	0.11	4	60	36	37.71	Weak red
Namsai (Lohit)	6.05	59.7	0.93	0.31	0.04	0.08	0.09	8	31	61	50.66	Reddish grey
Khonsa (Tirap)	5.00	123.5	1.45	0.25	0.01	0.12	0.27	20	42	38	51.51	Pole red
Seppa (E/Kameng)	5.56	87.5	0.26	0.13	0.05	0.07	0.07	14	60	26	39.66	Yellow
Old Changlang	5.17	110.9	0.30	0.11	0.03	0.12	0.15	20	28	52	57.37	Red
Namong (Changlang)	4.95	123.6	0.81	0.12	0.02	0.14	0.23	20	46	34	51.60	Reddish yellow
Dirang (W/Kameng)	6.02	40.4	2.47	0.19	0.05	0.11	0.27	14	62	24	46.08	Dark reddish
Tezu (Lohit)	5.28	104.2	2.62	0.24	0.04	0.11	0.27	6	54	40	59.56	Weak red
VVK Chessa (Papum Pare)	5.03	58.5	0.91	0.33	0.03	0.07	0.25	4	34	60	39.71	Brown
Rengging (E/Siang)	5.37	94.7	0.94	0.27	0.04	0.16	0.19	20	28	52	46.88	Light brown
Basar (W/Siang)	5.25	107.8	0.64	0.09	0.01	0.06	0.16	22	30	48	57.23	Red brown
Pasighat (E/Siang)	4.63	142.0	1.23	0.16	0.03	0.05	0.18	8	30	62	51.48	Brown
Lal Ane	4.02	176.3	2.51	0.137	0.02	0.073	0.7	10	50	40	10.02	5/2 YR
Phassang	5.37	96.9	2.947	0.131	0.012	0.065	0.33	17	29	44	12.06	Brown to red
Bomdilla	5.53	87.7	1.119	0.127	0.022	0.103	0.21	14	28	58	11.31	Brown
Namong	5.64	86.77	0.85	0.084	0.034	0.125	0.13	25	35	40	8.12	Pole red
Pangsu Pass	4.79	131.8	1.574	0.076	0.024	0.083	0.11	18	24	58	10.24	Pole red
Sangram	5.13	109.7	2.083	0.105	0.005	0.234	0.067	26	40	34	11.47	Brown
yarchang	5.54	81.37	1.078	0.093	0.005	0.215	0.147	18	46	36	9.21	Brown
Leel	5.03	115.5	1.214	0.102	0.050	0.217	0.3	20	48	32	9.02	Light brown
Ruhik	5.25	98.8	1.296	0.109	0.001	0.164	0.273	18	4	42	9.16	Weak red
Yachi tap	6.72	12.3	2.35	0.14		0.44	0.2	20	35	45	58.60	Strong brown
Ruhi (Tali)	5.67	60.75	1.93	0.46		0.42	0.3	9	51	40	63.00	Pole red
Boa simla	4.97	104.4	3.31	0.36		0.10	0.2	8	60	32	27.83	Weak red
Pareng	4.31	134.9	2.16	0.12		0.23	0.1	25	29	46	52.86	Pole red
Damin	5.09	97.65	1.70	0.14		0.21	0.1	10	54	36	37.71	Weak red
Aye	6.65	122.75	2.62	0.23		0.11	0.2	9	31	60	50.60	Reddish grey
Koloriang	4.68	120.9	2.53	0.15		0.21	0.1	15	40	45	50.22	7/4-10 yr.

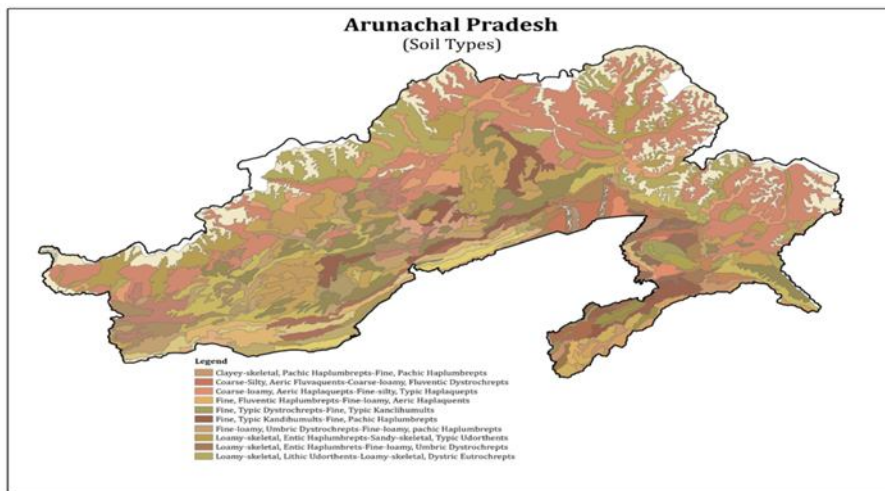


Fig. 4: Soil type and moisture regimes

Soil Characteristics

The types of soil recorded are brown, red, grey and yellow. There is a wider variation in the mechanical soil composition. Textural classes vary from sandy loam to clay loam. The cane bearing soils has lesser amounts of clay particles and rich in organic matter content. The clay percentage varies from 4 to 30 which show very high variations from place to place. The organic carbon content was high and varied from 0.26 to 2.7 % and base saturation varied from 23-80%. Most of the bamboo bearing areas is degraded and sloppy or jhum fallow land. The nutrient status of different cane & bamboo bearing soil is reflected in nitrogen, phosphorous and potassium availability. The soil pH and clay content decreases as the elevation increases with an increase in sand, organic matter and cation exchange capacity of soil.

CONCLUSION/ SUMMARY

Cane/Rattan: Most of the cane bearing areas is under tropical to sub-tropical wet evergreen moist humid soil under primary forests canopy cover. Cane mostly prefers virgin with decomposed leaf litters, twigs and decayed

plants. The soil are slightly acidic and pH ranges from 5.5- 6, mostly with brown colour. Nitrogen and phosphorous content was little higher in cane bearing areas.

Bamboo: Bamboo distribution shows no discrimination on soil fertility status. Bamboo grows in all types of soil including degraded and waste land in Arunachal Pradesh. However, altitudinal variation differs and affects the growth of different bamboo species. Bamboos like *Dendrocalamus hamiltonii*, *Bambusa pallida*, *Bambusa tulda* prefers wet and moist soil preferably near stream and river side in tropical to sub-tropical areas. Whereas, *Chimonobambusa callosa*, *Thamnocalamus*, *Neomicrocalamus*, *Yushania*, *Arundinaria*, *Phyllostachys*, etc. Species prefers hilly and mountain soils similar to cane bearing areas.

Hence, from the study it is revealed that, almost all soils of Arunachal Pradesh except rocky and water logging areas are conducive for growing of cane and bamboo, however, climatic factors may restrict the growth of different species. The growth and development of different bamboo and cane species are mostly governed by climatic and altitudinal

factors and least by soil factors in Arunachal Pradesh.

REFERENCES

Anonymous, 2009. Field Guide for Soil Survey. NBSS & LUP, Nagpur.

Haridasan, K., et al., 2002. Field Manual for Propagation and Plantation of Canes in Arunachal Pradesh. Information Bulletin

No.15, State Forest Research Institute, Itanagar.

Renuka, C., 2000. Field Identification Key for Rattans of Kerela, KFRI report 188.

Sehgal, J., Mandal, D.K., 1995. Soil-Climatic Environment in India, NBSS Publication No. 58.

Taj, R.K., et al., 2009, Bamboos of Arunachal Pradesh, Vol I-II. Technical Report, State Forest Research Institute, Itanagar.

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Representative soil profile of Daporijo



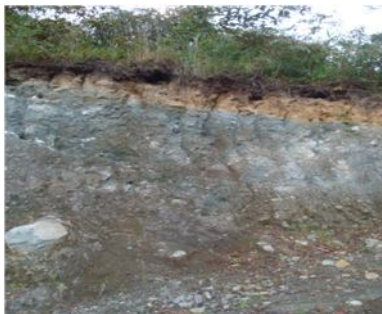
Representative soil profile of Changlang



Representative soil profile of Bomdila



Representative soil profile of Seppa



Representative soil profile of Hawaii



Representative soil profile of Wakro (Tezu)



Representative soil profile of Mippi (Anini)



Representative soil profile of Mechuka



Representative soil profile of Basar



Representative soil profile of Pangsu Pass



Representative soil profile of Joram



Representative soil profile of Ziro



Representative soil profile of Dumporijo



Representative soil profile of Yingkiang



Representative soil profile of Kibitho



Representative soil profile of Pasighat