

Annual Report

2016-17



Department of Forestry
Uttar Banga Krishi Viswavidyalaya
Pundibari : Cooch Behar

Academic

Present strength

Sl. No	Name	Designation
1	Dr. A. N. Dey	Associate Professor & Head
2	*Dr. Sumit Chakravarty	Professor
3	Dr. Gopal Shukla	Assistant Professor
4	Dr. Nazir A. Pala	Assistant Professor
5	Miss. Vineeta	Assistant Professor

- Presently as ADR (Actg.) RRS, Hill Zone, Kalimpong

Non-teaching staff

Sl. No	Name	Designation
1	Anupama Das	Technical Assistant Gr-II
2	Ranjit Kr. Anjoy	Lab Attendant Gr-II
3	Ajit Roy	Sr Lab Attendant

Student strength

Under Graduate: B.Sc. (Hort.) Hons: - 20; B. Sc (Agri.) Hons.-80 (UBKV main campus);
B. Tech. 20; B. Sc (Agri.) Hons.-30 (COA-Majhian)
Post Graduate: M. Sc. Students: 03; Ph. D-04

Degree (s) awarded: M. Sc Forestry and Ph. D Forestry

Courses offered at UG level

Semester	Course No.	Title	Credit	Associated teachers
1 st	FOR-101	Introduction to Forestry (COA, Pundibari)	1+1	Miss Vineeta Dr. A. N. Dey Dr. N. A. Pala
1 st	FOR-101	Introduction to Forestry (CoA, Majhian)	1+1	Dr. G. Shukla Dr. A. N. Dey
1 st	HOR-151	Environmental Science (COB. Tech)	3+0	Dr. G. Shukla Dr. G.C. Banik Miss Vineeta
5 th	FOR-301	Introductory Agroforestry (COH)	1+1	Dr. N. A. Pala Miss Vineeta Dr. G. Shukla
4 th	FOR-251	Environmental Science (COH)	2+1	Dr. N. A. Pala Dr. G. Shukla Dr. G.C. Banik Miss Vineeta
6 th	FOR-351	Environmental Science (COA, Pundibari)	1+1	Dr. G. Shukla Dr. N. A. Pala Dr. G.C. Banik Dr. A. N. Dey
6 th	FOR-351	Environmental Science (CoA, Majhian)	1+1	Dr. G. Shukla Dr. N. A. Pala Dr. G.C. Banik

Courses offered at PG level

Semester	Course No.	Title	Credit	Associated teachers
	FOR-501	Silviculture	2+0	Dr. A. N. Dey Ms. Vineeta
	FOR-502	Forest Biometry	1+1	Ms. Vineeta Dr. N.A. Pala
	FOR-503	Forest management	2+0	Dr. A. N. Dey Ms. Vineeta
	FOR-506	Forest Resources management and Economics	1+1	Dr. G. Shukla Dr. N.A. Pala
	FOR-507	Forest protection	1+1	Dr. G. Shukla Dr. N.A. Pala
	FOR-510	Forest and People	2+0	Dr. N.A. Pala Dr. G. Shukla
	FOR-504	Forest products - chemistry and industries	2+1	Dr. N.A. Pala Ms. Vineeta Dr. A. N. Dey
	FOR-509	Tree Improvement	1+1	Dr. N.A. Pala Dr. G. Shukla
	AF - 525	Economics of Agroforestry System	2+1	Dr. A. N. Dey Ms. Vineeta
	AF – 526	Range Land and Pasture Management	2+0	Dr. N.A. Pala Ms. Vineeta
	PT- 521	Seed Collection, storage and Testing	2+1	Dr. A. N. Dey Ms. Vineeta
	EM – 522	Environmental Pollution	3+0	Dr. G. Shukla Dr. N.A. Pala Dr. A. N. Dey
	FGR- 525	Forest Genetic Diversity and Conservation	3+0	Dr. G. Shukla Dr. A. N. Dey
	FBM - 521	Forest Resource Analysis	3+0	Dr. N.A. Pala Dr. G. Shukla Ms. Vineeta

Research

External Funded Research projects

S. No	Title	Funding agency/budget (Rs. In Lakhs)	Project Investigator	Status
1	Tree planting programme in educational institutes of the state of West Bengal	Dept. Of Environment, Govt. of W.B/1.34	PI- Dr. A. N. Dey	Completed
2	Standardization of Agro- technology and mass multiplication for production of quality seedlings of <i>Woodfordia fructosa</i> , <i>Sida cordifolia</i> and <i>Desmodium gangeticum</i>	NMPB, New Delhi, Govt. of India/29.685.00	PI- Miss. Vineeta Co-PI: Dr Gopal Shukla Dr. Nazir A. Pala Dr. S. Chakravarty	Running
3	Assessment of Ecosystem services in Home garden agroforestry systems in Sikkim and sub-Himalayan region of West Bengal (Extramural research)	SERB-DST Govt. of India/ 36.56825.00	PI-Dr. Nazir A. Pala Co-PI: Dr Gopal Shukla Dr. S. Chakravarty	Running
4	Production of quality planting materials of some important medicinal plants through identification multiplication, supply of healthy elite genotype and capacity building programmes for improving rural livelihood in Northern part of West Bengal	NMPB- New Delhi, Govt. of India/40.34.00	PI- Dr Gopal Shukla Co-PI: Dr. Nazir A. Pala Miss. Vineeta Dr. S. Chakravarty	Running

Internal Funded Research projects

	Title of the research Project	PI and associated scientists	Status
1	Rejuvenation, gap filling and intercropping in <i>Albizia lebeck</i> agroforestry stand	PI- Dr Gopal Shukla Dr. SubhamoySikder	Running
2	Rejuvenation, gap filling and intercropping in <i>Terminalia arjuna</i> agroforestry stand	Dr. Nazir A. Pala Dr. SubhamoySikder	Running
3	Rejuvenation, gap filling and intercropping in Jarul agroforestry stand	Miss. Vineeta Mr.Shibnath Basfore	Running
4	Moringa based agroforestry system for terai zone of West Bengal	PI- Dr Gopal Shukla Dr. Nazir A. Pala Miss. Vineeta Mr. Shibnath Basfore Dr. Subhamoy Sikder	Running
5	Standardisation of nursery technology on <i>Mimusops elengi</i> and <i>Elaeocarpus floribundus</i>	Dr. A. N. Dey	Running
6	Standardisation of macropropagation of <i>Elaeocarpus floribundus</i> and <i>E. gannitrus</i>	Dr. A. N. Dey	Running

Students of the department

Details of M. Sc student thesis during 2016-17

Sl.	Name of the student	Thesis title	Advisory committee	Status
1	Miss Lakpa Doma Lepcha (H-2015-06-M)	Documentation, utilization pattern and economics of NTFPs of fringe villages in Jaldapara Wild life Sanctuary	Dr G. Shukla Dr. S. Chakravarty Dr. N. A. Pala Dr. P. Pal Prof. A. Sarkar	Awarded
2	Miss Bisleshna Tamang (H-2016-02-M)	Diversity and biomass of woody perennials in Pundibari Campus of Uttar Banga Krishi Viswavidyalaya, Cooch Behar, (W.B)	Dr. N. A. Pala Dr G. Shukla Dr. a. n. Dey Dr. S. Chakravarty Dr. P.S. Patra	On-going
3	Mr. Dinesha. S (H-2016-03-M)	Analysis of litter fall pattern, nutrient return, decomposition and budgeting ecosystem carbon under <i>Swietenia macrophylla</i> King. (Indian mahogany) plantation	Dr. A. N. Dey Miss Vineeta Dr. S. Deb Dr. M. K. Debnath	On-going

Details of Ph. D student thesis during 2016-17

Sl.	Name of the student	Thesis title	Advisory committee	Status
1	Miss. Anjali Kumari	Studies on growth, nitrogen fixing capacity of some nitrogen fixing tree species and use of leaf as green manure	Dr. A. N. Dey Prof. A. Chaudhary Dr. A. Ghosh Prof. S. Chakravarty Prof. D. Mukhopadhaya	Awarded
2	Mr. Prakash Rai	Nutrient status and carbon stock of different stand in a humid tropical forest , Indian Eastern Himalayas	Dr. S. Chakravarty Dr G. Shukla Dr. N. A. Pala Prof. D. Mukhopadhaya	On-going
3	Sharda Dubey	Studies on seed source variation and seedling characteristic of <i>Aquillaria Mallicilnsis</i> (Agar)	Dr. A. N. Dey Prof. S. Chakravarty Prof. A. Saha Dr. S. K. Roy Dr. D. S. Gupta	On-going

4	Tansuri Dey	Carbon Sequestering Status of Different Tree Based Land Use Systems in Terai Zone of West Bengal	Dr. S. Chakravarty Dr G. Shukla Dr. N. A. Pala Prof. D. Mukhopadhaya	On-going
5	Ublert Lepcha	Altitudinal variation on quantitative and qualitative characters of Forest vegetation in Darjeeling Himalaya	Dr. S. Chakravarty Dr G. Shukla Dr. N. A. Pala Dr. S. K. Roy	On-going

Publications

Book

1. Forest Seed Science and Management (2017) eds. **Shuka, G., Pala, N. A and Chakravarty, S.** 268pp New India Publishing Agency, New Delhi, India (ISBN-9789385516757)

Research Paper

1. Dey, K., Ghosh, A., **Dey, A.N.**, Bhowmick (2017). Efficacy of IAA concentration and cutting length on rooting of stem cuttings in *Spondias Pinnata* Linn. *Indian Journal of Horticulture* 74(1):127-131

An experiment was laid out in factorial randomized block design with 12 treatments and 3 replications which included three levels (10, 15 and 20 cm) of cutting length and four levels of IAA treatment (0 control, 500, 1000 and 1500 ppm). Each cutting was treated with different concentrations of IAA for 15 sec. Investigation revealed that 15 cm length of cuttings treated with 1500 ppm IAA gave the best results in terms of earliest bud (13.27 DAP) and leaf (16.32 DAP) initiation, highest success (66.67%), shoot length (34.89 cm), root length (13.49 cm), collar diameter (20.50 mm), root number (9.53), root diameter (6.91 mm), fresh shoot weight (45.47g), fresh leaf weight (14.07 g), dry shoot weight (21.15 g), dry root weight (2.67 g) and total biomass (29.80 g/plant).

2. Biplov Ch. Sarkar, **Amarendra N. Dey**, Ayon Roy and Barun Rai. (2017). Soil Microbial Population in Rasomati Forest of Pundibari Range, Cooch Behar, West Bengal, India. *International Journal of Current Microbiology and Applied Sciences*. 6 (4): 1554-1560.

An experiment was carried out in Rasomati forest of Pundibari range of West Bengal, India in respect to the variation in bacterial and fungal populations. The mean colony forming unit (cfu) of bacteria was 6.02 whereas average fungi colony forming unit (cfu) was 5.31. It was observed that Gram -ve bacteria was found higher as compared to Gram +ve. The genus *Aspergillus* and *Penicillium* was recorded highest percentage as per the counting of colonies. Over all soil were sandy loam to clay loam and slightly acid in all sites with mean pH 6.24 and the percentage of organic carbon was 1.96%.

3. Dey, K., Ghosh, A., **Dey, A.N.**, Bhowmick, N. and Bauri, F.K.2016. Evaluation of Nutritive and Mineral value in Ripe Fruits of Indian Hog Plum (*Spondiaspinnata* Linn.) from Four Different Location of Northern Parts of West Bengal. *Vegetos* 29(4):11-16.

Indian hog plum (*Spondiaspinnata*Linn.) is a drupaceous fruit, popular in the food and nutraceutical industries for its taste and health benefits. This study reports on the physico-chemical constituents at the stages of maturity of Indian hog plum fruits collected from four different sources. This experiment was carried out using CRD with four treatments and five replications. Parameters like fruit weight (35.69 g), specific gravity (1.27), peel/pulp ratio (0.65), seed weight (13.53 g), TSS (8.12obrix), titrable acidity (0.49%), total sugar (6.56%), reducing sugar (4.42%), nonreducing sugar (2.14%), ascorbic acid (22.10 mg/100g pulp), total phenolics (29.19 mg/100g pulp), moisture (78.55%), ash (4.79%), crude fibre (4.09%), food energy value (168.76 kcal/g), calcium (0.84%), iron (1.87%), potassium (1.78%) and sodium (1.51%) etc. were recorded highest in fruits collected from Jalpaiguri source.

4. Dey, K.; Ghosh, A.; **Dey, A.N.**; Bhowmick, N. and Bauri, F.K. 2016. Studies on seed germination and seedling behaviour of Indian hog-plum (*Spondiaspinnata*) in response to different pre-sowing treatments *Seed Sci. & Technol.*, **44**(3): 1-5.

Underutilised crops have an important role to play in future food security due to their consistent use in small land-holder farming and subsistence agriculture. Most of these species have wide adaptability as well as high stress tolerance and the ability to thrive under adverse situations. Therefore, their adoption on a commercial scale, with crop improvement, standardisation of cultural practices and popularisation in adverse farming systems are warranted to achieve stability in farm production. Indian hog-plum or Amra (*Spondiaspinnata*), belongs to the family Anacardiaceae and is a minor fruit in northern parts of West Bengal. A seed germination experiment was carried out with 13 pre-sowing treatments. Seeds treated with 0.01 M KNO₃ for 24 hours provided maximum germination percentage (66%), highest seedling length (387.4 mm), vigour index (25477.1) and biomass (6.5 g plant⁻¹).

5. Shukla, G., Pala, N. A and Chakravarty, S. (2017). Quantification of organic carbon and primary nutrients in litter and soil at foot hill forest stands of eastern Himalaya. *Journal of Forestry Research*. DOI 10.1007/s11676-017-0394-7

The present study was an effort to understand the amount of litter fall and its subsequent decomposition and quantify the release of available nutrients and soil physicochemical characteristics in plantations of four forest tree species (*Lagerstroemia parviflora*, *Tectona grandis*, *Shorea robusta* and *Michelia champaca*) in the Chilapatta Reserve Forest of the Cooch Behar Wildlife Division in the Terai zone of West Bengal, India. The most litter (5.61 Mg ha⁻¹) was produced by T. Grandis plantation and the least (4.72 Mg ha⁻¹) by L. parviflora. The material turnover rate to the soil through decomposition from total litter was fastest during the first quarter of the year and subsequently decreased during the next two quarters. The material turnover rate was only 1 year, which indicates that more than 90% of the total litter produced decomposed within a year. The available primary nutrient content in litter varied across the four plantations over the year. The plantations generally did not significantly influence the soil physical characteristics but did significantly influence the availability of primary nutrients and organic carbon at two depths (1–15 and 16–30 cm) over the year. The availability of soil primary nutrients in the four plantations also increased gradually from the first quarter of the year to the third quarter and then decreased during the

last quarter to the same level as in the first quarter of the year at both depths. The availability for soil organic carbon in the plantations followed a similar trend. The amount of litter produced and the material turnover in the soil in the different plantations differed, influencing the nutrient availability and organic carbon at the plantations. The amount of soil organic carbon was highest for *T. grandis*(2.52 Mg ha⁻¹) and lowest for *L. parviflora*(2.12 Mg ha⁻¹). Litter is the source of soil organic matter, and more the litter that is produced by the plantations, the higher will be the content and amount of soil organic carbon in the plantation.

6. Dey, T., Pala, N. A., Shukla, G., Pal, P. K., Das, G and Chakravarty, G. (2017). Climate change perceptions and response strategies of forest fringe communities in Indian Eastern Himalaya. *Environment Development and Sustainability* DOI 10.1007/s10668-017-9920-1

The study documented perception of forest fringe community of Chilapata reserve forest in West Bengal, India, from September 2013 to May 2015 through questionnaire-based personal in-depth interviews involving 400 respondents and group discussions. Adaptation strategies used by the community in response to impact of climate change were also documented. Majority of the respondents were farmers with marginal land holding. Almost all the respondents perceived the phenomena of climate change. The overall perception of the community toward change in temperature-related events and precipitation is high with average perception score of 0.74, while it is medium for change in regularity of climate events with score of 0.51. In spite of such perceptions, the community had low average livelihood impact perception score of 0.23. Considering the adaptation strategies based on knowledge–adoption index, the adaptation in response to climate change is at medium level with average mean score of 0.63. A total of 17 coping options were identified. Pre-monsoon dry seeding, agroforestry, crop rotation, short duration crop varieties and use of organic products were popular. The study recommend a need for scientists, government and non-government agents and other stakeholders to support efforts by farmers to adapt to effects of climate change through technological, policy and financial interventions with an aim of improving livelihoods and food security.

7. Dey, T., Pala, N. A., Shukla, G., Pal, P. K., and Chakravarty, S. (2017). Perception on Impact of Climate Change on Forest Ecosystem in Protected Area of West Bengal, India. *Journal of Forest and Environmental Science*, 33 (1): 1-7, <https://doi.org/10.7747/JFES.2017.33.1.1>

In the present exploration we identified perception of forest dependent communities in relation to impact of climate change on forest ecosystem in and around Chilapatta reserve forest in northern part of West Bengal, India. Purposive sampling method was used for selection of area and random sampling method was used for selection of respondent. The data collection in this study was through questionnaire based personal in-depth interviews. Almost all the respondents (94%) were farmers and rest had occupation other than farming. Almost all the respondents perceived negative impact of climate change on forest though the level of perception varies from very low to medium (0.23-0.52) based on average perception score after assigning score to individual statements. The level of perception on impact of climate change on forest ecology and forest flora of the community is low and very low as the average perception score is 0.39 and 0.23, respectively while, it is medium (0.52) for forest fauna. Alternately their perception on decreased stream/river flow and quick drying of seasonal streams or water bodies is based on their livelihood experience as they depend on these for their domestic and irrigation water use and fish catch for family diet.

8. Subba, M., Pala, N.A., Shukla, G and Chakravarty, S. (2017). Are size, distance and location responsible for species richness in home garden agroforestry systems? *Indian Forester*, 143 (3):223-227

The present study is a baseline survey of home gardens to explore the variation in species richness based on size, distance and location. The study site is terai zone in northern part of West Bengal covering three districts i. e. Jalpaiguri, part of Cooch Behar and Siliguri sub-division of Darjeeling district. A total of 100 home gardens were selected for the study. Among the sampled garden, 62 % were small (less than 0.5 ha), 26 % medium (0.5-1.0 ha) and only 12 % large (more than one ha). Similarly, 33%, 48% and 19 % of the total sampled gardens were located near, far and farthest from the main road of district or sub-division towns. A total of 55, 42 and 45 species were recorded from near, far and farthest category of home gardens, whereas 60, 38 and 44 number of species was recorded from small, medium and large home gardens, respectively.

9. Bhardwaj, D.R., Bandy, M., Pala, N.A and Rajput, R. S. (2016). Variation of biomass and carbon pool with NDVI and altitude in sub-tropical forests of northwestern Himalaya. *Environment Monitoring and Assessment*, 188:635; DOI 10.1007/s10661-016-5626-3

In the present study, forests at three altitudes, viz., A1 (600–900 m), A2 (900–1200 m) and A3 (1200-1500 m) above mean sea level having normalised differential vegetation index (NDVI) values of N1 (0.0–0.1), N2 (0.1–0.2), N3 (0.2–0.3), N4 (0.3–0.4) and N5 (0.4–0.5) were selected for studying their relationship with the biomass and carbon pool in the state of Himachal Pradesh, India. The study reported maximum stem density of (928 trees ha⁻¹) at the A2 altitude and minimum in the A3 and A1 with 600 trees ha⁻¹ each. The stem densities in relation to NDVIs were observed in the order N5 > N3 > N4 > N1 > N2 and did not show any definite trend with increasing altitude. Highest stem volume (295.7 m³ ha⁻¹) was observed in N1 NDVI and minimum (194.1 m³ ha⁻¹) in N3 index. The trend observed for stem biomass at different altitudes was A3 > A1 > A2 and for NDVIs, it was N5 > N1 > N4 > N2 > N3. Maximum aboveground biomass (265.83 t ha⁻¹) was recorded in the 0.0–0.1 NDVI and minimum (169.05 t ha⁻¹) in 0.2–0.3 NDVI index. Significantly, maximum total soil carbon density (90.82 t C ha⁻¹) was observed in 0.4–0.5 NDVI followed by 0.3–0.4 NDVI (77.12 t C ha⁻¹). The relationship between soil carbon and other studied parameters was derived through different functions simultaneously. Cubic function showed highest r² in most cases, followed by power, inverse and exponential function. The relationship with NDVI showed highest r² (0.62) through cubic functions. In relationship between ecosystem carbon with other parameters of different altitudinal gradient and NDVI, only one positively significant relation was formed with total density (0.579) through cubic function. The present study thus reveals that soil carbon density was directly related to altitude and NDVIs, but the vegetation carbon density did not

10. Gokhale, Y and Pala, N. A. (2016). Developing conservation management strategies for biodiversity rich sacred natural sites of Uttarakhand, India. *Asian Biotechnology and Development Review*, 18 (3): 85-94

Importance of Sacred Natural Sites (SNS) in India with Uttarakhand being no exception. The existing SNS are degrading and losing the ground not only due to physical threats but also due to lack of documentation and studies to understand ecological importance. For documentation purpose a semistructured questionnaire was prepared which covered aspects such as village management of these SNS. Of the surveyed 132 SNS from nine districts of Uttarakhand, a total of 294 plant species belonging to 108 families

were enlisted. The management options followed by the local communities are documented. Out of various conservation management options followed, three options are mainly dominant, viz. social fencing, boundary demarcation and customary rights. The faith of the local people in the deity is the most obvious conservation management option followed by the local communities. There are three major suggestions that dominate out of the total eight suggestions made for conservation management of the SNS in Uttarakhand. The most important suggestion (26 per cent) is awareness and education for not only the younger generation but also for the practitioners and the government departments such as the State Forest Department. The research on protection and management of plan for practitioners and policymakers.

11. **Chakravarty, S., Bhutia, K. D., Suresh, C. P., Shukla, G and Pala, N. A.** (2016). A review on diversity, conservation and nutrition of wild edible fruits. *Journal of Applied and Natural Science*, 8 (4): 2346-2353

The United Nations adopted the Millennium Declaration of September 2009 to improve the global living conditions through reducing poverty and hunger. However, considerable numbers of people are still living in utter penury and are deprived of a dignified living. In such tough circumstances nature's free gift in the form of wild edible foods are benefiting the vulnerable and dependent communities. Wild edible plants (WEPs) are the species those are neither cultivated nor domesticated however are available in their wild natural habitat and used as sources of these plants have played a significant role in the development and civilization of human history throughout the ages and globe. These wild edible plants have played a significant role in supplying food and nutritional requirements of poor communities in many rural parts of the world. These wild edibles can be popularized only when they are compared for their nutritional and health benefits with major or widely used cultivated plants. The social, cultural, religious, and belief system of the rural communities are incomplete without these wild edible plants. Domestication of these wild edible plants can increase their use and their conservation as well. The present review paper has described the wild edible plants in context of their diversity, traditional knowledge, conservation practices and nutritional composition from the available secondary literature. Authors feel there is still scope to incorporate more contextual variables for explaining more variations embedded with local people's perception on values and usage of these wild edible fruits.

12. **Hussain, A., Negi, A.K., Singh, R.K., Aziem, S., Iqbal, K and Pala, N. A.** (2016). Comparative study of fuelwood consumption by semi-nomadic pastoral community and adjacent villagers around Corbett Tiger Reserve, India. *Indian Forester*, 142(6) : 574-581

The present study was carried out to understand the fuelwood resource use pattern by semi-nomadic pastoralist community (Van Gujjar) and adjacent villagers in and around Corbett Tiger Reserve, Uttarakhand, India. A total of nineteen settlements of Van Gujjars and fourteen adjacent villages were surveyed. Overall average fuelwood consumption of Van Gujjars community was found higher than adjacent villagers. But the average per capita fuelwood consumption of adjacent villagers was found higher than Van Gujjars. The fuelwood consumption by both communities was 1584.1 t dm and the observed total deforested wood was found 833.73 m³, which leads to the emission of various greenhouse gasses. Inaccessibility of the area, lack of communication, high prices and a limited supply of alternative source of energy are largely responsible for the total dependence on nearby forests for fuelwood, fodder and other life supporting demands.

13. **Subba, M., Pala, N.A., Shukla, G and Chakravarty, S.** (2016). Inventory of flora in home gardens of sub-humid tropical landscapes, West Bengal, India. *International Journal of Forest Usufructs Management*.17 (1): 47-54

The present inventory was carried out in Home gardens of Terai region, West Bengal, India to explore the plant diversity in them. The study was the part of the documentation and inventorization about the existing home gardens in the region. The study site is terai zone (foot hills plains area of Himalayas) in northern part of West Bengal which lies between 26° 30' and 26° 56' N latitude and 88° 7' and 89° 53' E longitude and spreading in the districts of Jalpaiguri, part of Cooch Behar and Siliguri sub-division of Darjeeling district. A total of 142 species belonging to 59 families and 123 genera were recorded from 100 surveyed home gardens. The documented flora consisted of 72 tree species (33 families and 61 genera), 55 herb species (31 families and 47 genera), 10 shrub species (9 families and 10 genera); three palms (*Cocosnucifera*, *Areca catechu* and *Phoenix dactylifera*) represented by one family (Arecaceae) and three genera and two bamboo species (*Dendrocalamusstrictus* and *Bambusatulda*) represented by one family (Poaceae) and two genera. Nevertheless, this study presented list of home garden plant species in the terai region makes a neartotal inventory.

14. Rajput, B. S., Bhardwaj, D. R and **Pala, N. A.** (2016). Factors influencing biomass and carbon storage potential of different land use systems along an elevational gradient in temperate northwestern Himalaya. *Agroforestry System* DOI 10.1007/s10457-016-9948-5

We observed the influence of five different altitudes and prevailing agro ecosystems on biomass and carbon sequestration potential in Kullu district of Himachal Pradesh, India. The study area had five prevailing land uses viz., agriculture, agro-horticulture, horticulture, silvi-pasture, and forest at four elevations representing about 1 °C temperature change. The results showed that maximum total biomass of 404.35 Mg C ha⁻¹ was accumulated by forest land use and followed a decreasing trend in the order as forest[silvi-pasture[agro-horticulture[horticulture[agriculture. Similar trends were also seen with respect to biomass carbon (C) density and C-sequestration potential of different land uses. Biomass and carbon density potential enhanced with the increase in the altitudinal ranges from 1100–1400 to 2000–2300 m a.s.l. But, the rate of C-sequestration potential enhanced from 1100 to 2000 m and declined at 2000–2300 m a.s.l. Maximum carbon density (393.29 Mg C ha⁻¹) of both plant as well as soil was displayed by the forest-based land use systems situated at an altitudinal gradient of 2000–2300 m a.s.l. The rate of C-sequestration was maximum (2.17 Mg ha⁻¹) in the agro-horticulture at 2000–2300 m a.s.l. This study brings out the potential of different land use systems influenced by varying factors on their C-sequestration potential in western Himalayan elevation gradient, thereby providing useful information for effective management in a climate change mitigation and carbon budget.

15. **Chakravarty, S., Rai, P., Puri, A., Shukla, G and Pala, N. A.** (2016). The plant that survived atomic explosion, can it survive human threat? *Indian Forester*, 142 (3) : 264-276, 2016

Ginkgo biloba L., the maidenhair tree and a living fossil that survived the first atomic explosion in Japan reminds us with hope of survival. It is the single surviving species of the Order Ginkgoales that has restricted wild distribution in China. The *Ginkgo biloba* has multitude medicinal, spiritual and horticultural importance worldwide. It is amongst few plant species that have been traditionally or scientifically used and evaluated for their possible medicinal applications. Its usage has been documented in traditional Chinese

medicine since 5000 years. Now, it is one of the most widely prescribed herbals or pharmaceuticals in the western world. In spite of its rarity, long reproductive cycle and low rate of natural regeneration, the tree has been exploited indiscriminately due to its high medicinal value, forcing it to face a high risk of extinction. Unfortunately, despite of having huge medicinal properties and ornamental value, the species still has not received much conservation attention. Considering the international importance and conservation value of *Gingko biloba* multi-strategic efforts are required involving all stakeholders. In addition to its *in situ* and *ex situ* measures, environmental legislation and government planning is also essential to ensure adequate conservation of this living fossil plant.

16. Pala, NA., Negi, AK., Gokhale, Y., Shah, Sand Kumar M (2016) Community Structure and Plant Diversity of Community Based Religious Conserved Forests of Garhwal Himalaya, India, *Journal of Earth Science and Climate Change* 2016, 7:2; <http://dx.doi.org/10.4172/2157-7617.1000334>

The present study was carried out in four community based religious conserved forests areas i.e., Ansuiya Devi, Ulkagari, Maroor and Jameshwar in Garhwal Himalaya. The aim of the study was to access the ecological and diversity status. The selected sites have status either of reserve forest, communal forest/Van Panchyat or a combination of these apart from having several temples of religious significance. Study was conducted following the stratified random sampling technique by placing random quadrats of 10 m × 10 m size at forest floor. A total of 240 species of plants were recorded from the four study sites, which varied from 93 in Jameshwar to 119 in Ansuiya Devi. The density of these forests ranged from lowest of 782 trees/ha in Jameshwar to 1352 trees/ha in Maroor. The total basal cover (TBC) for trees showed a range of 31.67 m²/ha in Ulkagari to 84.34 m²/ha in Ansuiya Devi. Distribution pattern of whole herb and shrub layers were found contagious whereas only three tree species were found randomly distributed. Shannon diversity index (H') for tree species was recorded highest in Ansuiya Devi (2.93) whereas; lowest value (2.10) was recorded in Maroor. Species richness (Margalef index) for trees ranged from 3.29 to 4.35. The study is a pioneer in the aspect and can be helpful in making protocols and policy implications to protect these sites by involving local communities in biodiversity conservation outside the protected area network.

17. Reang, I., Goswami, S., Pala, N. A., Kumar, M and Bussmann, R. W. (2016). Ethnoveterinary Applications of Medicinal Plants by Traditional Herbal Healers in Reang Tribes of South District Tripura, India. *Medicinal and Aromatic Plants*, 5:2. doi.org/10.4172/2167-0412.1000234

The present study was carried out in two small towns namely Santir Bazar and Julaibari situated within the subdivision of South District Tripura to document the traditionally used ethnomedicinal plants for curing domestic animal ailments prevailing in the locality. Four developmental blocks Bakafa and Jolaibari in the Santir Bazar subdivision and Amarpur and Karbook in the Jatanbari subdivision were selected for the survey. Data were collected through a structured questionnaire and observations were made during the field visit. The Forest Department facilitated the consultation of nine traditional healers along with other village elders. In the present investigation we have reported a total of 37 species of plants belonging to 32 families of 37 genera used by local communities to treat various animal ailments. These include 14 herb species, 9 trees, 7 climbers, 5 shrubs, 1 grass, and 1 epiphyte. The reported plants were used to treat majorly seven ailments viz., cuts and wounds, bone injury, skin infection, eye infection, dysentery, indigestion and constipation. The survey is preliminary in the area and needs further support to cover other areas occupied by tribal communities.

18. Thakur, K.S., Munesh, K and **Pala, N. A.** (2016) Utilization of Valuable Higher Altitude Plants as a Source of Income Generation and Traditional Medicine in Bharmour Forest Division, Himachal Pradesh, India. *Medicinal and Aromatic Plants* 5: 226. doi:10.4172/2167-0412.1000226

The present study was conducted in Holi and Bharmour areas of Bharmour Forest Division of Himachal district in Himachal Pradesh state of India. Seven (07) valuable and conservation demanding traditionally used medicinal plant species were covered under the study. The information includes traditional knowledge of the plants used by the local people of the area. The species reported are highly exploited for various purposes as different parts like root, leaves and even whole plant is harvested for reasons. The informants from the study area blame the excessive extraction for reducing population of these species. Therefore, suggested *ex situ* and *in situ* conservation measures can be helpful for conservation of the species for sustainable utilization.

Book Chapters

1. **Shuka, G., Pala, N. A., Vineeta and Chakravarty, S.** (2017). Forest seed science- Necessity for present day forestry. In Forest seed science and management, eds. Shukla, G., Pala, N. A and Chakravarty, S. New India Publishing Agency, New Delhi, India. Pp1-13 (ISBN-9789385516757)
2. Pal, S., Biswas, S., **Shuka, G., Pala, N. A and Chakravarty, S.** (2017). Insect pests of forest seed and their management in natural and storage environment. In Forest seed science and management, eds. Shukla, G., Pala, N. A and Chakravarty, S. New India Publishing Agency, New Delhi, India. Pp85-103 (ISBN-9789385516757)
3. **Shukla, G., Pala, N. A., Gantait, S and Chakravarty, S.** (2017). Quantitative description of upper story vegetation at a foot hill forest in Indian Eastern Himalaya. In: Plant Biodiversity, Monitoring, Assessment and Conservation, eds. Ansari, A. A., Gill, S. S., Abbas, Z. K and Naeem, M. CAB International Nosworthy Way Wallingford Oxfordshire (UK). Pp- 309-316. ISBN-13: 9781780646947
4. **Shukla G, Pala NA, Kumar, K and Chakravarty S.** (2016). Forest Genetic resources, threats and their conservation in Jharkhand. In: *Biodiversity and Sustainability: opportunities and challenges*, eds. Biswas, R.D and Sarkar, A. Raiganj Surendranath Mahavidyalaya, Raiganj, Uttar Dinajpur, West Bengal, India. Pp 77-88. (ISBN: 978-93-5254-104-1)

School/Workshop/Training/Course/

S. No	Name of the participant	Details	Organiser
1	Nazir A. Pala	Livelihood and climate change mitigation and adaptation through agroforestry	ICAR-CAZRI, Jodhpur from 3 rd to 23 rd August, 2016
2	A. N. Dey	Assessing Resource Management, Climate Risk and environmental sustainability using simulation models	ICAR-IISS, Bhopal from 8 th -28 th November, 2016
3	Miss Vineeta	Bioactive compounds from medicinal plant-a wealth of novelties and opportunities	DMAPR, Gujrat, 01 st -21 st December, 2016
National/international Seminar/symposium/conference			
1	Miss Vineeta	Bamboo shoot-traditional uses and value addition. In national conference on Enhancing	COBACAS and RRS, UBKV,

		nutritional security through climate smart farming practices	Kalimpong from 16-17March, 2017
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External Examiner/Question setter

Sl. No.	University/Organisation	Purpose	Teacher
1	Sam Higginbottom Institute of Agriculture, technology and Sciences, Allahabad	End term answer sheet evaluation	Dr. Nazir A. Pala
2	College of Forestry, OUAT, Odisha	End term answer sheet evaluation	Dr. A. N. Dey
3	College of Agriculture, BCKV (W.B)	End term answer sheet evaluation	Dr. A. N. Dey

Invited lectures/ Recourse person

Sl. No.	University/Organisation	Purpose	Teacher
1	UBKV, Pundibari	Development of spices, medicinal and aromatic plants and its industries in North Bengal” under MIDH Scheme on 27-28 August, 2016.	Dr. Nazir A. Pala

Membership of Professional Society/Journal/Organisation

Sl. No.	Society	Address	Name status
1	Coochbehar Association for cultivation of agricultural sciences	UBKV, Pundibari	Dr. Gopal Shukla
2	Coochbehar Association for cultivation of agricultural sciences	UBKV, Pundibari	Dr. Nazir A. Pala
3	International Union for Conservation of Nature and Natural Resources UCN-(WCPA) World Commission for Protected Areas	IUCN Headquarters Rue Mauverney 28 1196 Gland Switzerland	Dr. Nazir A. Pala
4	International Society for Environmental Information Sciences,	4246 Albert Street, Suite 413 Regina, Saskatchewan S4S 3R9, Canada	Dr. Nazir A. Pala
5	Coochbehar Association for cultivation of agricultural sciences	UBKV, Pundibari	Dr. A. N. Dey
6	Coochbehar Association for cultivation of agricultural sciences	UBKV, Pundibari	Miss. Vineeta
7	Indian Society of Agroforestry	ICAR-CARI, Jhansi	Dr. A. N. Dey
8	International society for minor fruits, medicinal and aromatic plants	BAU, Mymensingh, Bangladesh	Dr. A. N. Dey

Additional Responsibilities

Dr. A. N. Dey

- Member departmental committee
- Public Information Officer, UBKV, Pundibari
- Member Faculty Council
- Member, BTCFT, Govt. Of West Bengal
- Member as ecologist, Dept. of Forest Govt. Of W.B
- Representative of Commissioner Jalpaiguri Division in the District Level Environmental Impact Assessment Authority and District Level Expert Appraisal Committee of Alipurduar District
- Representative of Commissioner Jalpaiguri Division in the District Level Environmental Impact Assessment Authority and District Level Expert Appraisal Committee of CoochBehar District
- Associated teacher in student READY programme
- Associated teacher in student village exposure team
- Associated teacher in student industrial training visit
- Convenor of Refreshment Committee for 5th Convocation of UBKV on 6th February, 2017

Dr. Gopal Shukla

- Member departmental committee
- In charge departmental Library
- Member Anti-ragging squad and committee
- Member UG admission committee
- Member PG admission committee
- Associated with RHWE and RAWE
- Associated with Student ELP
- Member Departmental accreditation committee
- Advisory member, NSS
- Team manager for All India AgriUnifest at RAJUVAS, Bikaner Rajasthan from 22nd-25th February, 2017
- Member Reception and Registration Committee for 5th Convocation of UBKV on 6th February, 2017
- Member, Organising Committee for one day workshop on “Food Security and Climate Change in India” on 5th December, 2016
- Tour guide for 3rd year Agri/Horti. Students for North India Educational tour from 17th October-3rd November, 2016.
- Member publicity Committee for Jackfruit Exhibition AT Pundibari Campus, UBKV on 14th July, 2016.
- Member publication committee for ‘National Consultative Meet on Large Cardamom’ at RRS, Hill Zone, Kalimpong on 18th September, 2015
- Member, Publication and Communication Committee in State Level Seminar “ Spices under MIDH at RRS, OAZ, ManikchakMalda, from 16-17th December, 2016.
- Joint organising secretary “National conference on Enhancing nutritional security through climate smart farming practices’ Organised by COBACAS and RRS, UBKV, Kalimpong from 16-17March, 2017

Member editorial board/reviewer of journals

- Indian forester
- Human Ecology
- Agroforestry system
- Journal of agricultural and technology
- African journal of agricultural science
- Journal of tree science
- Canadian journal of agriculture
- Asian journal of biology

Dr. Nazir A. Pala

- Member departmental committee
- In charge departmental Laboratory
- Member Anti-ragging committee and squad
- Member UG admission committee
- Member PG admission committee
- Member End term examination conducting committee
- Member Departmental accreditation committee
- Referee for project evaluation in 'The Rufford project Foundation, formerly the Rufford Maurice Laing Foundation, Rufford Abbey Country Park, Nottinghamshire, Ollerton NG22 9DF, United Kingdom
- Associated with RHWE 2016-17
- Team manager for All India AgriUnifest at RAJUVAS, Bikaner Rajasthan from 22nd-25th February, 2017
- Member Campus Beautification Committee for 5th Convocation of UBKV on 6th February, 2017
- Member, Organising Committee for one day workshop on "Food Security and Climate Change in India" on 5th December, 2016
- Member of the Committee for Central Quality Analysis Laboratory for Faculty of Horticulture, UBKV.
- Representative of Commissioner Jalpaiguri Division in the District Level Environmental Impact Assessment Authority and District Level Expert Appraisal Committee of Alipurduar District.
- Tour guide for 3rd year Agri/Horti. Students for North India Educational tour from 17th October-3rd November, 2016.
- Member publicity Committee for Jackfruit Exhibition AT Pundibari Campus, UBKV on 14th July, 2016.
- Member publication committee for 'National Consultative Meet on Large Cardamom' at RRS, Hill Zone, Kalimpong on 18th September, 2015
- Member, Publication and Communication Committee in State Level Seminar " Spices under MIDH at RRS, OAZ, ManikchakMalda, from 16-17th December, 2016.
- Member, Library Advisory Committee, UBKV, Pundibari

- Member publication committee “National conference on Enhancing nutritional security through climate smart farming practices’ Organised by COBACAS and RRS, UBKV, Kalimpong from 16-17March, 2017

Member editorial board/reviewer of journals

- Journal of Applied Forestry, Columbia International Publishing USA
- Journal of Forestry Research (Springer)
- Journal of sustainable forestry (Taylor and Francis)
- International journal of conservation sciences
- Indian Forester
- Biomass and Bio energy (Elsevier)
- Actaecologia since (Elsevier)
- Land degradation and development (Wiley)
- Indian Journal of Agroforestry
- Climate Change and Environmental Sustainability
- Journal of Agriculture and technology, COBACAS

Miss Vineeta

- Member Anti ragging squad
- Member departmental committee
- Associated teacher in coordinating team of RHWE
- Member Beautification committee of 5th convocation, UBKV, Pundibari
Member of different protected structures located at the backside of the faculty building
- Associated teacher in student READY programme
- Associated teacher in student village exposure team
- Associated teacher in student industrial training visit
- Member UG, admission committee
- Member Reception committee “National conference on Enhancing nutritional security through climate smart farming practices’ Organised by COBACAS and RRS, UBKV, Kalimpong from 16-17March, 2017