

# Activities and Achievements of Forest Products and Utilization Department


## OBJECTIVES:


- To impart UG and PG teaching in the field of Forest Products and Utilization as a part of course curriculum
- To carryout experimentation and research activities pertaining to Forest Products and Utilization
- To disseminate information and technologies on wood identification, processing, utilization, value addition and marketing of Timber and Non-Timber Forest Products among various stake holders viz., farmers, foresters, wood merchants, etc.



# Departmental Thrust Areas

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- **Characterization of wood anatomical features for identification of commercial timbers**
  - **Studies on wood science and technological aspects for various end-uses**
  - **Development of Dendro-chronological database for timber species**

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- **Development of propagation protocols for commercial NTFPs & MAPs**
  - **Characterization of genotypes of different tree species for wood properties**
  - **Domestication and conservation of important NTFPs and MAPs**

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- **Sustainable harvesting, processing & value addition of important NTFPs & MAPs**
  - **Honey processing and Development of commercial apiculture models**
  - **Quantification and utilization of biofuel from TBOs**

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- **Improvising scientific tree harvesting methods**
  - **Marketing and Supply chain development for NTFPs & MAPs**
  - **Valuation and certification of forest and forest products**

# Activities undertaken

## Teaching

- Teaching UG & PG students and Guiding post graduate students for their Master's and Doctoral studies pertaining to Forest Products and Utilization
- Offering Experiential Learning Programme (ELP) on Commercial Apiculture for final year B.Sc. (Hons.) Forestry students



## Research

- Research activities in Wood Science and Technology in Timber yielding species; Dendroclimatological studies; Utilization and value addition of Non-timber forest products & Medicinal and Aromatic Plants; Marketing & Trading of wood and non-wood forest products



## Extension

- Transfer of technologies to farmers related to wood identification, tree age determination, wood quality assessment, commercial apiculture, cultivation of medicinal and aromatic plants



# Highlights of the FPU department



LEARNING

Deals with utilization of forest resources-Timber and Non-timber forest produces



COMPETENCE

Offering M.Sc. Forestry and Ph.D. Forestry in the subject of Forest Products and Utilization as per V Dean's recommendation



TRAINING

Offering Experiential learning programme on Commercial Apiculture for B.Sc. (Hons.) Forestry programme



KNOWLEDGE

Established laboratory and other infrastructure facilities for UG & PG teaching and Research in the field of Wood Anatomy lab, Wood Science & Technology lab, Forest Products lab, Honey Processing Unit, NTFP Museum, FPU farm



EXPERIENCE

Running Unit of NAHEP-CAAST project on "Scientific Utilization and Value addition of NTFPs and MAPs"



ADVANCED TRAINING

Organizing training on- Honey processing, Utilization and Value addition of NTFPs & MAPs, Marketing and Supply chain for different stake holders

## Courses offered at B.Sc. (Forestry) level from FPU Dept.

<b>Sr. No.</b>	<b>Course Number</b>	<b>Course Title</b>	<b>Credit hours</b>	<b>Semester</b>
1	FPU 2.1	Wood Anatomy	2 (1+1)	II
2	FPU 4.2	Wood Products & Utilization	3 (2+1)	IV
3	FPU 4.3	Ethnobotany and MAPs	3 (2+1)	IV
4	FPU 4.4	Logging and ergonomics	2 (1+1)	IV
5	FPU 4.5	Non-Timber Forest Products	3 (2+1)	IV
6	FPU 5.6	Wood Science and Technology	3 (2+1)	V
7	FRP 5.3	Experiential Learning (Apiculture)	5 (0+5)	V
8	FPU 6.7	Marketing and Certification of Forest Products	2 (1+1)	VI
9	FPU 6.7	Marketing and Certification of Forest Products	2 (1+1)	VI
10	FRP 6.5	Experiential Learning (Apiculture)	5 (0+5)	VI

# Faculty of FPU involved in Common Courses offered at B.Sc. (Forestry)

<b>Sr. No.</b>	<b>Course Number</b>	<b>Course Title</b>	<b>Credit hours</b>	<b>Semester</b>
<b>1</b>	<b>FRP 4.1</b>	<b>Study Tour of State Forest</b>	<b>1 (0+1*)</b>	<b>IV</b>
<b>Forestry Work Experience (FRP 7.6)</b>				
<b>2</b>	<b>FRP 7.6.1</b>	<b>Attachment with Forest Department- 8 Weeks</b>	<b>10 (0+10)</b>	<b>VII</b>
<b>3</b>	<b>FRP 7.6.2</b>	<b>Industry /NGO Attachment- 3 weeks</b>	<b>4 (0+4)</b>	<b>VII</b>
<b>4</b>	<b>FRP 7.6.3</b>	<b>Socio-economic Surveys &amp; Village Attachment- 2 weeks</b>	<b>3 (0+3)</b>	<b>VII</b>
<b>5</b>	<b>FRP 7.6.5</b>	<b>Report Wring &amp; Presentation-1 week</b>	<b>2 (2+0)</b>	<b>VII</b>
<b>6</b>	<b>FRP 7.7</b>	<b>All India Study Tour (3 weeks)</b>	<b>3 (0+3)</b>	<b>VII</b>



# Courses offered at M.Sc. (Forestry) specialization in FPU

<b>Sr. No.</b>	<b>Course Number</b>	<b>Course Title</b>	<b>Credit hours</b>
1	FOR 504	Forest products - Chemistry and industries	3 (2+1)
2	FPU 521	Wood identification	2 (0+2)
3	FPU 522	Wood chemistry	2 (1+1)
4	FPU 523	General properties of wood	2 (1+1)
5	FPU 524	Wood seasoning and preservation	3 (2+1)
6	FPU 525	Paper & pulp technology	3 (2+1)
7	FPU 526	Wood modification and composite wood	3 (2+1)
8	FPU 527	Basics of plant production and breeding techniques	3 (2+1)
9	FPU 528	Medicinal chemistry and processing of MAPs	3 (2+1)
10	FPU 529	Biotechnological approaches and agrotechniques for MAP species	3 (2+1)
11	FPU 530	Improvement of medicinal and aromatic plants	2 (1+1)
12	FPU 531	Role of medicinal and aromatic plants in health care systems	2 (2+0)
13	FPU 532	Study tour	1 (0+1)
14	FPU 533	Pharmacognosy of MAPs	2 (1+1)

# Courses offered at Ph.D. (Forestry) specialization in FPU

<b>Sr. No.</b>	<b>Course Number</b>	<b>Course Title</b>	<b>Credit hours</b>
1	FOR 603	Advances in Wood and Non-Wood Forest Products	3 (3+0)
2	FPU 621	Advances in wood technology	3 (2+1)
3	FPU 622	Energy and chemicals from wood	3 (2+1)
4	FPU 623	Research methods	3 (1+2)
5	FPU 624	Advances in wood modification	3 (2+1)
6	FPU 625	Application of traditional knowledge	2 (2+0)
7	FPU 626	Quality improvement of Medicinal and Aromatic Plants	3 (2+1)
8	FPU 627	Post harvest and processing of Medicinal and Aromatic Plants	3 (2+1)
9	FPU 628	Biosynthetic analysis of secondary metabolites	3 (3+0)
10	FPU 629	Processing and value addition in MAP	3 (2+1)



# Recommendations to the farmers community and scientific information

Sr. No.	Details of recommendation/scientific information
1	<p>Mayani, J.M., <b>A.A. Mehta</b> and J.G. Pathak (2016). Standardization of the recipe for the preparation of jelly from the Neera of Palmyra palm.</p> <p><b>Farmer's recommendation:</b> Home Makers, processors and entrepreneurs are recommended that jelly from the Neera can be prepared by using pectin 13 g/kg of Neera and can be safely stored for six months. Recipe should be Neera:sugar (1:1.1), 0.5% acidity (50 g citric acid per kg of jelly) and pectin. Boil the mixture till 68oBrix followed by hot filling in to glass bottle.</p>
2	<p>Mayani, J.M., <b>A.A. Mehta</b> and J.G. Pathak (2016). Standardization of the recipe for the preparation of jam from the fruits of Palmyra palm.</p> <p><b>Farmer's recommendation:</b> Home Makers, processors and entrepreneurs are recommended that jam from the tender fruits of palmyra palm can be prepared by using pulp:sugar ratio (1:1.2) and addition of pectin 16g/kg of pulp and it also can be stored for six months at ambient temperature in glass bottle.</p>
3	<p>Mayani, J.M., <b>A.A. Mehta</b> and J.G. Pathak (2016). Standardization of the recipe for the preparation of candy from the fruits of Palmyra palm.</p> <p><b>Farmer's recommendation:</b> Home Makers, processors and entrepreneurs are recommended that, candy from the fruits of Palmyra palm can be prepared by steeping the slices (5cm x 5mm) in sugar syrup having 65% TSS for 8 hours followed by drying of slices for 7 hours at 65°C and packed in PE pouches can be stored successfully up to six month at ambient storage.</p>



# Recommendations to the farmers community and scientific information

Sr. No.	Details of recommendation/scientific information
4	<p><b>Sinha, S.K., A.A. Mehta, L.K. Behera and P.K. Shrivastava (2016).</b> Investigation on tree ring analysis (Dendrochronology) to monitor radial growth responses of teak to climate in South Gujarat.</p> <p><b>Farmer's recommendation</b> To enhance the radial growth in teak (<i>Tectona grandis</i> L.), the farmers of South Gujarat Heavy Rainfall Agro-climatic Zone-1 (AES-I &amp; III) growing teak in their plantations may give light irrigation during March and normal irrigation during peak growth period from June to July, especially, when there is a moisture stress due to deficient rainfall.</p>
5	<p><b>Mehta, A.A., S.K. Sinha, L.K. Behera and B.S. Desai (2017).</b> Potential and prospects of Minor Forest Products in the Dangs of South Gujarat.</p> <p><b>Farmer's recommendation:</b> The tribal of the Dang of south Gujarat heavy rainfall zone-I are recommended to do collection and marketing of Minor Forest Produces like Mahuda flower, Karamda, Puvad seed, Kadayo gum, Safed musli, Honey and Bamboo in community groups for getting remunerative price.</p>
6	<p><b>Gunaga, R.P., M.J. Dobriyal, H.T. Hegde, A.A. Mehta, S.K. Sinha and B.S. Desai (2017).</b> Sustainable Bark Harvesting Techniques in Arjun sadad (<i>Terminalia arjuna</i>).</p> <p><b>Farmer's recommendation:</b> The farmers of South Gujarat heavy rainfall zone-1 harvesting <i>Terminalia arjuna</i> (Arjun Sadad) bark commercially for medicinal purpose are recommended to make incision of 10 cm (h) x 5 cm (w) size in trees having more than 100 cm GBH (Girth at breast height) for higher and sustainable bark yield.</p>



# Recommendations to the farmers community and scientific information

Sr. No.	Details of recommendation/scientific information
7	<p><b>Mehta, A.A., L.K. Behera, S.K.Sinha, J.J. Pastagia and R.P. Gunaga</b> (2018). Nesting habitat and nest architecture of stingless bees (<i>Tetragonula laeviceps</i>) in South Gujarat condition.</p> <p><b>Farmer's recommendation:</b> While making the hive for the stingless bees (<i>Tetragonula laeviceps</i>), beekeepers are advised to keep entrance opening of hive in the range of 75 to 150 mm<sup>2</sup> with minimum hive volume of 1330 cm<sup>3</sup>.</p>
8	<p><b>Mehta, A.A., L.K. Behera, S.K.Sinha, J.J. Pastagia and R.P. Gunaga</b> (2018). Influence of weather parameters on foraging activity of stingless bees (<i>Tetragonula laeviceps</i>) near the nests.</p> <p><b>Farmer's recommendation:</b> Farmers of South Gujarat Heavy Rainfall Agro-climatic Zone-I (AES-III) are advised to avoid application of pesticides during 13:00 to 15:00 hrs because of higher foraging activity (moving in and out of the nest) of stingless bees (<i>Tetragonula laeviceps</i>).</p>
9	<p><b>Sinha, S.K., R.P. Gunaga, L.K. Behera, P.K. Shrivastava and A.A. Mehta</b> (2019). Influence of climate on the wood production and anatomical variations in teak trees.</p> <p><b>Scientific Information:</b> Teak growing in dry and moist deciduous forests varied in terms of wood production and its quality, which are influenced by radial growth, basic density and anatomical properties viz., fibre length, cell wall thickness, vessel diameter and vessel density. Further, fibre length is positively influenced by rainfall, whereas cell wall thickness positively and vessel density negatively influenced by both rainfall and temperature. However, vessel diameter negatively influenced by temperature and positively influenced by rainfall.</p>



# Recommendations to the farmers community and scientific information

Sr. No.	Details of recommendation/scientific information
10	<p><b>Sinha, S.K., R.P. Gunaga, L.K. Behera and H.T. Hegde</b> (2019). Documentation of basic density and calorific value of different tree species of South Gujarat.</p> <p><b>Farmer's Recommendation:</b> Farmers, foresters, plantationers from south Gujarat growing tree crops are recommended to utilize pruned branches rather than stem of Sharu (<i>Casuarina equisetifolia</i> L.), Bengali babul (<i>Acacia auriculiformis</i> A. Cunn. ex Benth.), Rosewood (<i>Dalbergia latifolia</i> Roxb.), Deshi Neem (<i>Azadirachta indica</i> A. Juss.), Biyo (<i>Pterocarpus marsupium</i> Roxb.) and Haldu (<i>Haldina cordifolia</i> Roxb. Ridsdal) for fuelwood purpose as well as value added products like charcoal and briquettes, as branch wood recorded higher calorific values than stem wood.</p>
11	<p>Behera, L.K., <b>S.K. Sinha, A.A. Mehta, R.P. Gunaga</b> and M.J. Dobriyal (2018). Study of Carbon Sequestration Potential of Important Tree Species</p> <p><b>Farmer's Recommendation:</b> Farmers are recommended to grow tree species such as Casuarina, Eucalyptus and Bijasal for obtaining higher biomass and carbon sequestration under South Gujarat.</p>
12	<p>Jha, S.K., V.M. Prajapati and <b>Amol Vasishth</b> (2020). Vegetative propagation of Dambel (<i>Tylophora indica</i>).</p> <p><b>Farmer's Recommendation:</b> It is recommended to the farmers and nurseryman that the vegetative propagation of Dambel can be achieved by dipping 10 cm cutting in 1 g/l IBA solution for 10 minutes and growing in coco-peat or red soil media under net house conditions.</p>



# Completed Research Projects

Sr. No.	Title of Project	Funding Agency	Scientists from FPU involved	Role
1.	Forest Resource Survey of Vyara Forest Division	Gujarat Forest Department	Dr. SK Sinha	Co-PI
2.	Forest Resource Survey of Valsad (North & South) Forest Divisions	Gujarat Forest Department	Dr. HT Hegde	Co-PI
3	Investigations on Non-Timber Forest Products (NTFP) of Gujarat	ICFRE, Dehradun	Dr. A.A. Mehta	PI
4	Commercial Apiculture- Experiential Learning Programme (On time grant)	ICAR, New Delhi	Dr. A.A. Mehta	PI
5	Socioeconomic status and ethanobotany of forest dwellers in the Dang	Gujarat Forest Department	Dr. HT Hegde	Co-PI

## Currently running Research Projects

Sr. No.	Title of Project	Funding Agency	Year of Start	Scientists from FPU involved	Role
1	Development of Bamboo Resource Center	Plan Project, GOG	2013	Dr. SK Sinha	Co-PI
2	Determination of Carbon Sequestration Potential of Forest Tree Species of South Gujarat	Plan Project, GOG	2014	Dr. RP Gunaga Dr. SK Sinha	PI Associated Scientist
3	Popularizing <i>Melia composita</i> based Agroforestry System in Gujarat through production of quality planting material	Plan Project, GOG	2016	Dr. HT Hegde	Co-PI
4	Regeneration Technique for Lesser known and Threatened Tree Species of South Gujarat	Plan Project, GOG	2018	Dr. RP Gunaga	Co-PI
5	Development of Industrial Agroforestry Models for South Gujarat region	Plan Project, GOG	2018	Dr. RP Gunaga	Co-PI

# Currently running Research Projects

Sr. No.	Title of Project	Funding Agency	Year of Start	Scientists from FPU involved	Role
6	Establishment of secondary agriculture unit for skill development in students and farmers at NAU: Unit-2: Scientific Utilization of NTFPs and Medicinal and Aromatic Plants	NAHEP-CAAST (ICAR-World Bank Funded)	2018	Dr. RP Gunaga Dr. SK Sinha Dr. HT Hegde Dr. AA Mehta	Co-PI Co-PI Assoc. Scientist Assoc. Scientist
7	Development of descriptors and DUS testing guidelines for <i>Eucalyptus urophylla</i>	PPVFRA, New Delhi	2019	Dr. RP Gunaga	Co-PI
8	Survey, Selection, Phyto-Chemical Evaluation, Cytogenetical Characterization and Multi-location testing of Harar ( <i>Terminalia chebula</i> Rets.) in India	NMBP, New Delhi (Multi-institutional project)	2021	Dr. HT Hegde	Co-PI

# Important Research Articles

- Sinha, S.K.,** L.K. Behera, **A.A. Mehta,** P.K. Shrivastava (2019). Dendroclimatological approach in plantation management of teak (*Tectona grandis*). *Indian Journal of Agricultural Sciences*, **89**(12): 55-59.
- Sinha, S.K.,** M.S. Deepak, R. Vijendra Rao, H.P. Borgaonkar (2011). Dendroclimatic analysis of teak (*Tectona grandis* L. f.) annual rings from two locations of peninsular India. *Current Science*, **100**(1): 84-88.
- Sinha, S.K.,** Pravin A. Chaudhari, Narender Singh Thakur, Suman K. Jha, Dhiraj P. Patel, Ravindra K. Dhaka (2019). *Melia dubia* Cav. wood properties vary with age and influence the pulp and paper quality. *International Wood Products Journal*, **10**(4): 139-148. <https://doi.org/10.1080/20426445.2019.1688947>
- Sinha, S.K.,** R. Vijendra Rao, M.S. Deepak (2017). Influence of climate on the total vessel lumen area in annual rings of teak (*Tectona grandis* L.f.) from Western Ghats of Central Karnataka, India. *Tropical Ecology*, **58**(1): 167-175.
- Sinha, S.K.,** R. Vijendra Rao, T.S. Rathore and H.P. Borgaonkar (2017). Growth ring structure and specific gravity variation in juvenile and mature wood of natural-grown Teak (*Tectona grandis* L.f.). In: Pandey K., Ramakantha V., Chauhan S., Arun Kumar A. (eds) Wood is Good. Springer, Singapore. [https://doi.org/10.1007/978-981-10-3115-1\\_11](https://doi.org/10.1007/978-981-10-3115-1_11)
- Mehta, A.A.,** L.K. Behera, M.B. Tandel, D.B. Jadeja and B.G. Vashi (2015). Efficacy of different oils used for the extraction of annatto colour from the seeds of *Bixa orellana* L. *Journal of Applied and Natural Science*, **7**(2), 828-831.
- Mehta, A.A.,** L.K. Behera, S.K. Jha, C.A. Dholariya and D.B. Jadeja (2019). Genetic divergence study for growth characters among the accessions of Safed Musli. *IJCS*, **7**(1): 2349-2351.
- Mehta, A.A.,** Tandel M.B., Patel D.P., Behera L.K., Prajapati D.H. and Jadeja D.B. (2017). Yield performance of *Chlorophytum borivilium* Sant. & Fernand accessions in *Moringa* based Agroforestry system. *International Journal of Agriculture Sciences*, **9**(10): 3976-3979.
- Hedge, H.T., Gunaga, R.P.** and Thakur, N.S. (2018). Population structure and regeneration of mahua (*Madhuca longifolia* var. *latifolia* (Roxb.) A. Chev.) in disturbed and undisturbed sites. *Indian Journal of Ecology*, **45**(4): 724-727.
- Hegde, H. T., Gunaga, R. P.,** Thakur, N. S., Bhusara, J. B. and Soundarva, R. L. (2019). Utilization of mahua resources: Traditional knowledge as a tool for sustainable management. *Current Science*, **117**(10): 1727- 1730.
- Hegde, H.T.,** Kalkoor, M.A., Jha S.K. and Thakur, N.S. (2014). Evaluation of Variation in Physical Properties of Wood among Some Tropical Tree Species of South India. *Indian Forester*, **140** (1):70-75.
- Thakur, N.S., Kumar, D. Chauhan, R.S. **Hegde, H.T.** and **Gunaga, R.P.** (2019). Allelopathic effects of *Melia azedarach* L. on germination, growth and yield of black gram and chickpea. *Allelopathy Journal*, **46**(1): 133-144.
- Kumar Mukesh, Thakur N S and **Hegde H T.** (2015). Growth, herb yield and financial flows from *Ocimum* spp. intercropped under teak (*Tectona grandis* L. f.)-*Ocimum* spp. based silvi-medicinal system in Gujarat, India. *International Journal of Innovative Horticulture*, **4**(2):113-118.
- Behera, L.K., **A.A. Mehta** and **S.K. Sinha** (2014). Suitable bee flora availability for commercial apiculture during dearth period in the heavy rainfall zone of South Gujarat. *Research Journal of Chemical and Environmental Sciences*, **2**(6): 65-68.
- Behera, L.K., **A.A. Mehta,** C.A. Dholariya, **S.K. Sinha, R.P. Gunaga,** S.M. Patel (2017). Bee foraging activity on MPTs by honeybee species during minor honey flow period in South Gujarat condition. *Int. J. of Usuf. Mngt.*, **18**(2), 47-53.

