Invasive Alien Plants in Himalayas: Status, Ecological Impact and Management

Progress Report from 1 April, 2018 – 31 March, 2019

Submitted to
National Mission on Himalayan Studies, (GBPNIHESD),
Kosi-Katarmal, Almora, Uttrakhand, India

Sanction No. NMHS-2017/LG-01/475
Dated: 22/12/2017

Department of Environmental Science and Technology

CENTRAL UNIVERSITY OF PUNJAB
BATHINDA-151001, PUNJAB (INDIA)
(http://cup.edu.in)

Research Partners

1. Panjab University Chandigarh

1. **Prof . Daizy Batish (Professor), Deptt. of Botany, PU, Chandigarh**
2. **Dr Surender Yadav, Botany, MDU, Rohtak**
3. **Dr. Shalinder Kaur, Botany, Panjab University, Chandigarh**

2. Panjab University Chandigarh

1. **Prof . H.P. Singh, Depat. of Environment Studies, PU, Chandigarh**
2. **Dr. Kuldeep Dogra Scientist C, BSI, Dehra Dun (Uttarakhand)**

3. NER Institute of Science and Technology, Arunachal Pradesh

1. **Dr Lalbihari Singha**
2. **Dr. Om Parkesh Tripathi**

4. University of Kashmir, Srinagar, Jammu and Kashmir

1. **Prof. Zafar Reshi, Botany Department, University of Kashmir, Srinagar**
2. **Dr. Manzoor A Shah, Department of Botany, University of Jammu**
3. **Prof. Namrata Sharma, Kargil Campus, University of Kashmir,**
4. **Dr. Aijaz Hassan Ganie, Kargil Campus, University of Kashmir**

5. **Botanical Survey of India, Kolkata**

1. **Dr. S. S. Dash, Scientist D, BSI Kolkata**

6. National Botanical Research Institute, Lucknow

1. **Dr. L B Choudhary , Scientist E-2, National Botanical Research Institute,**
2. **Dr. S K Behra, Scientist E-1, National Botanical Research Institute,**

1. North Eastern Hill University, Shillong

1. **Prof. Umashankar, Botany Department, NEHU, Shillong**

****

Coordination – cum- Advisor

Prof. R.K. Kohli
Vice-chancellor
Central University of Punjab,
Bathinda – 151001, Punjab, India

Advisors

1. Prof R.S. Tripathi, FNA, FNASc
2. Prof R.R. Rao, FNA, FASc
3. Prof. R.K. Kohli, FNA, FASc, FNASc, FNAAS, FBS

Principal Investigator

Prof. V.K. Garg
Department of Environmental Science and Technology
Central University of Punjab,
Bathinda – 151001, Punjab, India

Summary of Coordination – cum- Advisory committee and their roles

Coordination – cum- Advisor Prof. R.K.Kohli, FNA, FASc, FNASc, FNAAS, FBS JC Bose National Fellow Accredited Sr. Ecologist ESA, USA Vice-chancellor Central University of Punjab, Bathinda	• Coordination between the partner Institutions/ investigators. • Periodic Scientific monitoring • Guidance; • Feedback from project partners periodically; • Discussion on the data • Timely submission of UC, ES • Compile Progress Reports of the Project. • Interactions at various forums
Prof R.S. Tripathi FNA, FNASc	• Advisor on ecological perspective • Periodic Scientific monitoring • Guidance; • Feedback from project partners periodically; • Discussion on the data • Timely submission of UC, ES • Compile Progress Reports of the Project. • Interactions at various forums
Prof R.R. Rao, FNA, FASc	• Advisor on taxonomic perspective • Periodic Scientific monitoring • Guidance; • Feedback from project partners periodically; • Discussion on the data • Timely submission of UC, ES • Compile Progress Reports of the Project. • Interactions at various forums
Prof Vinod Kumar Garg Principal Investigator Central University of Punjab, Bathinda 151001	• Over all in charge of the project • Periodic Scientific monitoring • Guidance; • Feedback from project partners periodically; • Discussion on the data • Timely submission of UC, ES • Compile Progress Reports of the Project. • Interactions at various forums

Summary of Project partners and their roles and responsibilities

Units	Investigating Institutions/ Investigators	Project title	Objectives
1	Botany Department Panjab University Chandigarh **Dr Daizy Batish** Professor, **Dr Surender Yadav,** Botany, MDU, Rohtak **Dr. Shalinder Kaur,** Botany Panjab University, Chandigarh	Ecological Studies on the rapidly establishing invasive Alien Plants in the Foot-hills and lower Shiwaliks of Himachal Pradesh	In addition to the common objectives, following will also be worked out: a) Invasion load of alien plants in Foothills and lower Shiwalik, **Himachal Pradesh** and **adjoining areas** b) Identify the habitats heavily, moderately and sparsely invaded by the selected invasive species in the selected study site. c) mechanism of spread of invasive species, traits favouring their spread, propagules involved and their dispersal mechanism. d) Impact of the selected invasive species on the native flora and ecology of the region. e) Possible interactions of the invasive species with the associated species mediated through chemicals. f) Awareness programmes to apprise local people about the consequences of invasive species, if not managed.
2	National Botanical Research Institute, Lucknow **Dr. L B Choudhary** **Scientist E-2** **Dr. S K Behra** **Scientist E-1,**	"Ecological analysis, Distribution and population growth of invasive alien plants in Sikkim and Darjeeling Himalaya in different ecosystems along the altitudinal gradient and their impact on native flora and plant community attributes	In addition to the common objectives, following will also be worked out: a) Invasion load of alien plants in the states of **Sikkim and West Bengal (Darjeeling**) b) Survey, documentation and characterisation of invasive vascular alien plants on the basis of their life-forms, lifespan, nativity, status of invasion in Sikkim and Darjeeling Himalaya. c) Selection of major noxious invasive species in the study area d) Monitoring the distribution patterns and population dynamics of different invasive species (Lantana camara; Eupatorium riparium; E. adenophorum; E. odoratuma and Mikania micrantha) in various ecosystems across the altitudes e) Assessment of ecological impacts of alien plant invasion on native plant community
3	Department of Forestry NER Institute of Science and Technology Nirjuli-791109 Arunachal **Dr Lalbihari Singha** and **Dr. Om Parkesh Tripat**hi	"Ecological analysis of invasive alien species and their niche modelling using geospatial technique in the Indo-Burma biodiversity hotspot of northeast India"	In addition to the common objectives, following will also be worked out: a) Invasion load of alien plants in the states of **Arunachal Pradesh, Nagaland and Manipur** b) Inventory on the diversity and other phytosociological parameters of Invasive Alien Vascular Plant Species in the selective forest ecosystems in these 5 states. c) Distribution pattern, population structure, seed biology and regeneration status for selective

			noxious Invasive Alien Species in the five states. d) Analysis of the rate of spread and Niche modelling for selective noxious Invasive Alien Species in the five states through remote sensing and GIS tools. e) Impact assessment of IAS on soil parameters and native plants in selective forest ecosystems.
4	Botany Department, University of Kashmir, Srinagar, Kashmir **Dr Zafar Reshi** Professor and Chairman, **Dr. Manzoor A Shah** partment of Botany, versity of Jammu, nmu Tawi. **Prof. Namrata Sharma.** partment of Botany, Kargil Campus, versity of Kashmir, nagar. **Dr. Aijaz Hassan Ganie**	Plant invasions in Jammu, Kashmir, Ladakh and adjoining areas of Himachal Pradesh: Taxonomic composition, habitat invasibility and predictive modelling for risk assessment and managment.	In addition to the common objectives, following will also be worked out: a) Invasion load of alien plants in the **Jammu, Kashmir, Ladakh** and **adjoining areas of Himachal Pradesh** b) Documentation of alien vascular plant species across different natural and artificial ecosystems in the three distinct regions of J&K State, and adjoining areas of Himachal Pradesh and identification of ecosystems most vulnerable to alien plant invasions c) Categorization of alien plant species particularly on the basis of their stage of invasion in order to identify current and future invaders. d) Biology of worst invasive species to identify the traits that promote their invasiveness. e) Species distribution modelling for prediction of potential range expansion of alien species in response to present and predicted climate change scenarios. f) Development of effective policies and appropriate strategies for conservation and management of alien plant invasions through community participation.
5	Botany, Department, North Eastern Hill University, Shillong, Meghalaya **Dr Umashankar** **Professor**	"Invasive Alien Plants in **Himalayas**: Status, Ecological Impact and Management in Meghalaya and Assam	In addition to the common objectives, following will also be worked out: a) Invasion load of alien plants in the states of **Meghalaya and Assam** b) Distribution and Phenotypic plasticity of selected species on Shillong plateau c) Biomass allocation patterns in selected species d) Growth and productivity of selected species in varied habitats e) Reproductive strategies of selected species f) Allelopathic strategies of selected species.

6	Environment Science Deptt, Panjab University, Chandigarh **Dr. H.P. Singh** **Prof & Chairman** **. Kuldeep Dogra** Scientist C, BSI, Dehra Dun (Uttarakhand)	„Invasive Alien Plants in the Himalayan Region of Himachal Pradesh and adjoining parts of Uttrakhand: Status and Risk Assessment“	In addition to the common objectives, following will also be worked out: a) Invasion load of alien plants in the states of **Himachal Pradesh** and adjoining areas of **Uttrakhand** b) Identify & locate invasive species in the Kinnaur Himalayas &adjoining parts of Uttrakhand and to determine their potential to spread c) Physiological, ecological and evolutionary traits imparting invasiveness and facilitating the spread in the region. d) Ecological, environmental and socio-economic impact of the selected invasive species of the region on the native flora e) Explore the role of chemical mediated interference as one of the possible mechanism of invasion in the region.
7	**SS Dash** entist D Kolkata	“Ecological investigations to understand causes and consequences of invasion in Tripura, Mizoram and adjoining parts of Assam and Manipur”	In addition to the common objectives, following will also be worked out: a) To evaluate the rate of spread of *Ageratina* and *Mikania* by analyzing their abundance, rate of aboveground growth during different seasons in different ecological habitats, b) To determine the reproductive potential by analyzing their seed production and seedling recruitment and characteristic. c) To study the similarities and differences of spread pattern, invasive load on early recovery successional landscapes and its impact on the natural flora. d) To undertake awareness programmes and to create awareness among all the stalk holders including local people through an interactive local level capacity building programme regarding the consequences of invasive species, if not managed.

NMHS Progress Report

(Period from March, 2018 *to* March,2019)

---

1. Project Information:

Project ID:	**NMHS-2017/LG/01/475**	**Sanction Date:**	**22/12/17**

Project Title:	**Invasive Alien Plants in Himalayas: Status,Ecological Impact and Management**
BTG:	

PI and Affiliation (Institution):	**Prof. Vinod Kumar Garg** **Central University of Punjab, Bathinda**
Name & Address of the Co-PI, if any:	**1) Jammu & Kashmir** • Prof. Zafar A Reshi Departmenyt of Botany, University of Kashmir • Prof. Namrata Sharma Botany Department, University of Jammu • Dr. Manzoor A Shah Botany Department, University of Kashmir • Dr. Aijaz Hassan Ganie Department of Botany, University of Kashmir-Kargil Campus **2) Himachal Pradesh** • Prof. Daizy R. Batish Botany Department, Panjab University, Chandigarh • Dr. ShalinderKaur Botany Department, Panjab University, Chandigarh • Dr. SurenderYadav Botany Department, MDU, Rohtak **3) Uttarakhand** • Prof. Harminder Pal Singh Department of Environment Studies, Panjab University, Chandigarh • Dr. Kuldip Dogra BSI, Dehradun **4) Sikkim & West Bengal** • Dr. L. B. Chaudhary, Senior Principal Scientist Plant Diversity, Systematics and Herbarium Division CSIR- National Botanical Research Institute, Lucknow - 226 001. • Dr. Soumit K. Behera, Senior Scientist Plant Ecology and Climate Change Science Division CSIR- National Botanical Research Institute, Lucknow - 226 001. **5) Mizoram & Tripura** • Dr.S.S.Dash,Scientist-E and Project Partner Botanical Survey of India, 3rd MSO building,sector-1,salt lake city,Kolkata-700064 **6) Manipur,Nagaland & Arunachal Pradesh** • Dr. L.B. Singha • Prof. H.S. Yadav Department of Forestry,North Eastern Regional Institute of Science & Technology (NERIST), Nirjuli, Arunachal Pradesh

Structured Abstract - detailing the current year progress [Word Limit 250 words]:	**1)Jammu & Kashmir** Surveys were carried out in various parts of the study area, including Kashmir, Jammu and Kargil (Ladakh). It needs to be emphasized that the Ladakh is largely unexplored in respect of alien species and also the flora of Ladakh has a considerable biological interest with respect to its diversity, origin, endemism and high adaptability to extreme climatic conditions and biotic pressures. From Kargil region during the present study, 192 plant species were collected and identified. These species belonged to 124 genera and 42 families; of the latter, 35 belong to dicotyledons, 3 to monocotyledons, 2 each of gymnosperms and pteridophytes. Among dicotyledons, Asteraceae included the largest number (36) of species; among monocots Poaceae was the largest family with 28 species. Most of the plant species were herbs and majority of the species had perennial growth habit. Of these 192 plant species, 142 species are native, 12 species are cultivated, 10 species are casual naturalized, 34 species are naturalized in wild and 4 species are invasive. According to the invasion criteria most of the naturalized species (31species) fall in stage II of invasion, 3 species in stage III, 3 species in 'IVa' stage and 1 species in 'IVb'. From the Kashmir region 175 plant species were collected during the present study. These species belonged to 115 genera in 45 families (37 families were of dicotyledons, 6 of monocotyledons, 1 of gymnosperms, and 1 of pteriodophytes). Asteraceae was the largest family with 23 species followed by Fabaceae and Polygonaceae with 11 species each and in monocots Poaceae was the largest family with 21 species. Most of the species collected were annual herbs. Majority of the species are naturalized; among the naturalized taxa, 50 species are alien invasive, 49 naturalized in wild and 5 species are casual aliens. In the Jammu region, 262 species belong to 189 gnera and 73 families were collected and identified during the present study. The speices rich families included: Asteraceae (30 spp.), Fabaceae (21 spp.), Poaceae (17 spp.) and Lamaveae (12 spp.). Species predominantly had herbaceous habit (111 spp.) while shrubs, trees and climbers were represented by 25, 47 and 7 species, respectively. **2)Himachal Pradesh** With the initiation of the project, two Junior Research Fellows (JRFs) and one Field Assistant was recruited. They were briefed about their responsibilities and trained. Thorough literature survey was conducted to get an idea of the invasive load present in the study sites. Two herbarium visits were also conducted- one to Botanical Survey of India, Dehradun and another to the herbarium of Panjabi University, Patiala. Herbarium sheets of various invasive alien species were studied to know about their presence and the date they were first reported. Three field trips were undertaken to Kinnaur, Almora and Mussoorie and different sites were selected to perform vegetation analysis. During the visits, extensive photographs of invasive plants were taken. We have recorded invasive alien species in study sites so far. Soil samples and specimens of plants were collected and dried to prepare herbarium sheets. Analysis of vegetation and physico-chemical analysis of soil samples is in process. **3)Uttarakhand** With the initiation of the project, two Junior Research Fellows (JRFs) and one Field Assistant was recruited. They were briefed about their responsibilities and trained. Thorough literature survey was conducted to get an idea of the invasive load present in the study sites. Two herbarium visits were also conducted- one to Botanical Survey of India, Dehradun and another to the herbarium of Panjabi University, Patiala. Herbarium sheets of various invasive alien species were studied to know about their presence and the date they were first reported. Three field trips were undertaken to Kinnaur, Almora and Mussoorie and different sites were selected to perform vegetation analysis. During the visits, extensive photographs of invasive plants were taken. We have recorded invasive alien

species in study sites so far. Soil samples and specimens of plants were collected and dried to prepare herbarium sheets. Analysis of vegetation and physico-chemical analysis of soil samples is in process.

4)Sikkim & West Bengal

The project was officially started on 1st January 2018. The first installment of the project was received in May 2018. It took nearly two months to recruit the man power after receiving the first installment. In the mean time application was also filed to forest department, Government of Sikkim, Gangtok for granting the permission for field visit. Letters were also sent to the concerned departments regarding to know their willingness to be involved in the project. So far no response has been received on this matter, however, the permission for field visit has been granted by Sikkim forest department. During the reporting period, two field tours were conducted to different regions of South, West and North Sikkim. Phytosociological analyses of invasive alien plant species (IAPS) and its associates were done by random quadrate sampling. One hundred four quadrates of 5 m x 5 m size, covering total area of 3925 m2 were laid between 300 m – 2700 m altitudes, however, the survey was conducted up to 5000 m altitudes in North Sikkim. In the present study, it was noticed that Ageratina adenophora was present in all altitudinal gradients with highest number of individuals while *Chromolaena odorata*, although present in almost all gradients but with lesser number of individuals. *Mikania micrantha* and Lantana camara were reported only in lower altitudes between 300 m–1500 m with lowest density. All these species were majorly found near human interference in open and along roadsides. So far, *Ageratina riparia* has not been noticed in any site. It has been also observed that after 2700 m elevations the target IAPS species were not noticed in the north Sikkim.

5)Mizoram & Tripura

Recruitment of the project personnel and JPFs were performed through a common screening test appointed in due course. All the project personnel were briefed about the objectives of the project. Literature survey was made thoroughly about the study area and all the base line information about invasive species, ecological parameters, study sites were gathered through secondary data. All the research personnel were taken to the field and given training on the basics of invasive plants, laying quadrates, collection of data. Based on elevation data and GIS, the study sites were selected and elevation maps of 1x1 sq.km. Grid maps were prepared. A herbarium tour was conducted to Shillong w.e.f. 23-08-2017 to 02-09-2018 and studied the herbarium sheets of ASSAM herbarium to make a probable list of invasive plants that maybe found in the study sites. Nearly 1480 herbarium sheets were studied to make ascertain the total invasive load, history of the invasion in Mizoram and Tripura. Four field tour to Tripura and Mizoram was conducted w.e.f. 27-10-2018 to 23-11-2018 ; 27-10-2018 to 23-11-2018 ; 05-02-2019 to 05-03-2019 and 12-02-2019 to 05-03-2019 for survey of invasive plants in flowering periods. During this period extensive photographs of the invasive plants were taken. Quantitative analysis of the invasive plants particularly of Mikania micrantha and Ageratina adenophora were done. Different sites were selected in the protected areas of Tripura and Mizoram ,i.e. Phawngpui National park, Murlen National park, Lengteng Wildlife Sanctuary and Pualreng Wildlife sanctuary in Mizoram and Rowa Wildlife sanctuary, Trishna Wildlife Sanctuary, Gomati Wildlife Sanctuary and Sepahijola Wildlife Sanctuary in Tripura.Apart from the protected areas ,the invasion level of other non-protected areas were also observed.For the total invasive load in both the states we have recorded about 85 invasive plant species in Tripura and Mizoram. Plant specimens of the invasive plants were collected and dried and preserved properly for preparing herbarium sheets.

6)Manipur,Nagaland & Arunachal Pradesh

Three districts of Arunachal Pradesh, nine districts of Manipur and three districts of Nagaland were explored for targeted IAPS. Altogether, 59 invasive and

	potentially invasive plant species were observed and documented till date. A total of ten noxious IAPS were identified and recorded viz. *Ageratum conyzoides, Ageratina adenophora, Chromolaena odorata, Lantana camara, Mikania micrantha, Galinsoga quadriradiata, Artemisia nilagirica, Parthenium hysterophorus, Tithonia diversifolia,* and *Mucuna* sp. Plant specimens of these species were collected from each site and herbarium were prepared. Maps for the three states were prepared based on Digital Elevation Model @ 300m asl. GPS locations of all the species recorded were extrapolated on the DEM maps. *Mikania micrantha, Ageratum conyzoides* and *Chromolaena odorata* were recorded in pure patches as well as in mixed population at tropical open forests. They were also recorded in pure patches at higher elevation ranges. *Lantana camara* was absent under tree canopies in both tropical and sub-tropical forests. Densely regenerated population of *Ageratum conyzoides* succeeded most forest floors. *Parthenium hysterophorus* was recorded near the roadsides adjoining to the evergreen forests at tropical range, but with limited population. *Galinsoga quadriradiata* and *Ageratina adenophora* were absent in tropical range but were recorded in sub-tropical and temperate forests. Dense populations of *Tithonia diversifolia* was recorded in few open forests of Arunachal Pradesh whereas, *Mucuna* sp. was recorded from the open forests in Manipur near Indo-Myanmar border. It was ascertained that *Lantana camara* was used as live fencing and Ageratina adenophora as soil binder in different parts of Manipur. Ageratina adenophora was succeeding in subtropical and temperate forests in the three states, while *C. odorata* and *L. camara* were succeeding in forests below 300m asl. Soil samples from the habitats of the IAVPS were collected from respective sites and parameters like pH, moisture, available NPK etc. are under analysis.

Project Partner Name	Affiliations	Role & Responsibilities
Project partner for **Jammu & Kashmir**	Prof. Zafar A Reshi Botany Department, University of Kashmir Prof. Namrata Sharma Botany Department, University of Jammu Dr. Manzoor A Shah Botany Department, University of Kashmir Dr. Aijaz Hassan Ganie Botany Department, University of Kashmir, Kargil Campus	Invasion load of alien plants in the Jammu, Kashmir, Ladakh and adjoining areas of Himachal Pradesh.Documentation of alien vascular plant species across different natural and artificial ecosystems in the three distinct regions of J&K State, and adjoining areas of Himachal Pradesh and identification of ecosystems most vulnerable to alien plant invasions .Categorization of alien plant species particularly on the basis of their stage of invasion in order to identify current and future invaders.Biology of worst invasive species to identify the traits that promotes their invasiveness.Species distribution modeling for prediction of potential range expansion of alien species in response to present and predicted climate change scenarios.Development of effective policies and appropriate strategies for conservation and management of alien plant invasions through community participation.
Project partner for **Himachal Pradesh**	Prof. Daizy R. Batish Botany Department, Panjab University, Chandigarh Dr. ShalinderKaur Botany Department, Panjab University, Chandigarh	To carry out ecological investigation in the state of Himachal Pradesh & to assist in the project work in terms of organizing field trips and preparing the project reports

	Dr. SurenderYadav Botany Department, MDU, Rohtak	
Project partner for **Uttarakhand**	Prof. Harminder Pal Singh Department Environment Studies, Panjab University, Chandigarh Dr. KuldipDogra BSI, Dehradun	To carry out ecological investigation in the district of Kinnaur, Himachal Pradesh and Uttarakhand.
Project partner for **Sikkim & West Bengal (Darjeeeling)**	Dr. L. B. Chaudhary CSIR- National Botanical Research Institute, Lucknow	PI (CSIR-NBRI), Sikkim and Darjeeling Himalayas.
Project partner for **Mizoram & Tripura**	Dr.S.S.Dash, Scientist-E , Botanical Survey of India,3rd MSO building, Sector-1, Salt lake City, Kolkata-700064	To carry out ecological investigation in the state of Tripura and Mizoram.
Project partner for **Manipur, Nagaland & Arunachal Pradesh**	Dr. L.B. Singha Department of Forestry, North Eastern Regional Institute of Science & Technology (NERIST), Nirjuli, Arunachal Pradesh Prof. H.S. Yadav Department of Forestry, North Eastern Regional Institute of Science & Technology (NERIST), Nirjuli, Arunachal Pradesh	Implementation of the project in Arunachal Pradesh, Nagaland and Manipur states of Eastern Himalayas to fulfill the project objects with special reference to *Chromolaena odorata, Ageratina adenophora, Mikania micrantha, Galinsoga ciliata* and other noxious IAP species.The team will look after the survey and identification for Invasive Alien Plant Species, occurring in the proposed three states as well as the analysis of features of the habitats of the IAS,detail sampling, population, phytosociological studies and seed biology for the IAPS.The GPS tagging and geo-referencing of selective IAPS,development of Layer map for IAPS (distribution/density) and analysis of rate of invasion of IAPS using RS/GPS/GIS will be worked out .Impact assessment of IAS on native plants/crops, in terms of regeneration behavior and phytochemical parameters.

2. Project Site Details

Project Site	**INDIAN EASTERN HIMALAYAS**
IHR States Covered	**Jammu & Kashmir**:Jammu, Kashmir, Ladakh and adjoining areas of Himachal Pradesh **HimachalPradesh:**District Solan,Sirmaur,Una,Bilaspur,Hamirpur,Chamba,Kullu, Shimla,Kangra,Mandi. **Himachal Pradesh and Uttarakhand:** District Kinnaur ,Almora, Bageshwar, Chamoli, Champawat, Dehradun, Haridwar, Nainital, PauriGarhwal, Pithoragarh,Rudraprayag,Teri Garhwal,Udham Singh Nagar, Uttarkashi. **Sikkim and West Bengal:** Sikkim & Darjeeling himalayas **Mizoram & Tripura:**-:-Phawngpui NP,Murlen NP,Lengteng WLS,Pualreng WLS, Some Non-protected areas namely Sangau,Vanghmun,Murlen village,Knahlan(**Mizoram**);Sepahijola WLS(Clouded leopard NP),Trishna WLS (Bison NP), Rowa WLS,Gomati WLS, Some Non-protected areas namely Karbook,Gomati ditrict,Jatanbari,Panisagar. (**Tripura**) **Arunachal Pradesh,Nagaland,Manipur**
Long. & Lat.	Attached as **Annexure-V**

Site Maps	Attached as **Annexure-IV (Along with GIS maps)**
Site Photographs	Attached as **Annexure- VI**

3. Project Activities Chart w.r.t. Timeframe [Gantt or PERT]

PROJECT ACTIVITIES	WORK UNDERTAKEN				OUTPUT
	Year				
	Qtr1	Qtr2	Qtr3	Qtr4	
Recruitment of JRF/PDF/Project Staff		+			All the 17 Research staffs were recruited.
Selection of the field stations		+	+		Field stations were selected w.r.t. to all the study sites of the respective states
Reconnaissance of site & local authority		+			Permissions for field surveys and specimen collection for three years was requested to the forest officials of the individual states and taken permission or MoU were signed for three years
Field training of staff		+	+		Field training of research staffs were made with participation of State Forest officials
Identification of study landscapes		+	+		Study sited were physically visited and selected by the respective teams in the selected states.
Field studies			+	+	Multiple herbarium tours & Field tours were undertaken for survey by the individual teams under the supervision of the respective project partners.
Data compilation				+	Compilation of the quadrat data collected from the surveys undertaken with
Project Review Meeting		+		+	First TPDM held at Shillong in August,2018 Second TPDM held at Chandigarh in March,2019.

4. Financial and Resource Information

Note: A separate bank account is expected to be opened for NMHS Project as per the provision of Direct Beneficiary Account (DBA) as laid out by the Govt. of India and also facilitate the audit of accounts. The interest earned out of the NMHS project funds should be reported clearly in the utilization certificate.

Name of the Partner	Total Grant:	Grant Received Date
Prof. Zafar A Reshi	63,17000/-	05 May 2018
Prof. Daizy R. Batish	7,417,000/-	23th May 2017
Prof. Harminder Pal Singh	7,417,000/-	23th May 2018
Dr. L. B. Chaudhary,	51,67000 /-	
Dr. S.S.Dash	51,67000/-	7th May 2018
Dr. L.B. Singha	64,17,000/-	07th May 2018

Project Partner(s)	Affiliations/ Institution	Budget Allocated to	Work Done
Partner 1	University of Kashmir	Prof. Zafar A Reshi	Pl. see the project information
Partner 2	Panjab University, Chandigarh 160014	Prof. Daizy R. Batish	Pl. see the project information
Partner 3	Panjab University, Chandigarh 160014	Prof. Harminder Pal Singh	Pl. see the project information
Partner 4	CSIR- National Botanical Research Institute, Lucknow	Dr. L. B. Chaudhary,	Please see the project information time to time.
Partner 5	Botanical Survey of India,3rd MSO building, Sector-1, Salt lake City, Kolkata-700064	Dr. S.S.Dash ,Scientist-E	Pl. see the project information
Partner 6	North Eastern Regional Institute of Science & Technology (Deemed to be University), Nirjuli, Arunachal Pradesh	Dr. L.B. Singha	Recruitment of staff; procurement of equipment, chemicals and software. Survey of IAPS in few districts of Arunachal Pradesh, Manipur and Nagaland for their diversity, distribution, population structure and soil variables.

Project Staff Information:

Sl.No.	Name	Qualification	Designation	Fellowship/ Wages paid	Remarks
Project Partner: Prof. Zafar A Reshi					
1.	Mr. Shabir Ahmad	Msc botany NET,GATE	JPF	25,000 /-	Joined on 23/07/2018
2.	Mr. Manpreet Singh	Msc botany	JPF	16,000/-	Joined on 20/07/2018
3.	Mr. Sayed Irshad Bukhari	Graduation	Field assistant	10,000 /-	Joined on 21/07/2018
Project Partner : Prof. Daizy R. Batish					
4.	Sonia Rathee	MSc Botany	JRF	25,000 /-	Joined on 27/07/2018
5.	Mustaqeem Ahmad	MSc Botany	JPF	16,000/-	Joined on 27/07/2018
6.	Ram Narayan	12th Standard	Field Assistant	10,000 /-	Joined on 27/08/2018
Project Partner : Prof. Harminder Pal Singh					
7.	Padma Sharma	MSc Environment Studies	JRF	25,000 /-	Joined on 27/07/2018
8.	Astha Sharma	MSc Environment Studies	JRF	25,000/-	Joined on 27/07/2018
9.	Gurpreet	12th Standard	Field Assistant	10,000 /-	Joined on 27/07/2018
Project Partner : Dr. L. B. Chaudhary					
10.	Mr. Anil K. Verma	M.Sc. Botany, GATE	Project-JRF	Rs 25,000/-	Joined on 25/06/2018
11.	Miss Rashmi Nayak	M.Sc. Botany	Project Assistant-II	Rs 16,000/-	Joined on 25/06/2018
Project Partner:Dr.S.S.Dash					
12.	Rabishankar Sengupta	Msc botany	JPF	16,000 /- + 20% HRA	joined on 16/07/2018
13.	Yogesh Prabhakar Khilari	Msc botany	JPF	16,000 /- + 20% HRA	Joined on 29/08/2018
14.	Biswajit Banik	BA english	Field Assistant	10,000 /-	joined on 01/08/2018
Project Partner: Dr. L.B. Singha					
15.	Mr. M. Sanjoy Singh	M.Sc. Pass	Junior Research Fellow	25,000+ 10% HRA	
16.	Mr. Dencil Basumatary	M.Sc. Pass	Junior Project Fellow	16,000/-	..
17.	Mr. Bijit Basumatary	12th standard pass	Field Assistant	10,000/-	....

5. Equipment and Asset Information

1)Prof. Zafar A Reshi

S. No.	Equipment Name (Qty)	Details (Make/ Model)	Cost	Date of Installation	Photographs of Equipment	Lowest Quotation,if not purchased.
1.	Equipment 2	Handheld GPS Mobile Mapper 50	2,94,882	Janury - 2019		
2.	Equipment	Thermo-scientific oven (400 ltr) Model OG5400	440,764	March-2019		

2)Prof. Daizy R. Batish:-

S. No.	Equipment Name (Qty)	Details (Make/ Model)	Cost	Date of Installation	Photographs of Equipment	Lowest Quotation,IF NOT purchased
1.	Equipment 1	GPS (Trimble TDC-100)	In progress			

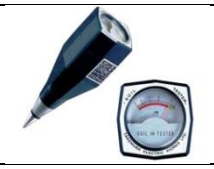
3) Prof. Harminder Pal Singh

S. No.	Equipment Name (Qty)	Details (Make/ Model)	Cost	Date of Installation	Photographs of Equipment	Lowest Quotation,IF NOT purchased
1.	Equipment 1	GPS purchase in process				

4) Dr. L. B. Chaudhary:-

S. NO.	Equipment Name (Qty)	Details (Make/ Model)	Cost	Date of Installation	Photographs of Equipment	Lowest Quotation, IF NOT purchased
1.	Equipment 1 **GPS**	Purchased	1,53,000 /-	April 2019		

5)Dr.S.S.Dash :-

S. No.	Equipment Name (Qty)	Details (Make/ Model)	Cost	Date of Installation	Photographs of Equipment	Lowest Quotation, IF NOT purchased
1.	Equipment 1	GPS (Garmin Montana 680)	53,200/-			
2.	Equipment 2	Imaging device (Two)	64,500/-			
3.	Equipment 3	Takemura Soil pH & Moisture meter	8,909/-			
4.	Equipment 4	Mitutoyo Slide Caliper 150 mm	11,505/-			
5.	Equipment 5	Camera	28000/-			

6) Dr. L.B. Singha:-

S. No.	Equipment Name (Qty)	Details (Make/ Model)	Maker	Cost	Photographs of Equipment	Lowest Quotation, IF NOT purchased
1.	Equipment 1	Fluorescence Spectrometer (1)	BioEra Life Sciences Pvt. Ltd. Model-Quo	6,14,250/-	14 August 2018	Equipment 1
2.	Equipment 2	Cooling Centrifuge (1)	BioEra Life Sciences Pvt. Ltd. Model-Cogent	5,35,500/-	14 August 2018	Equipment 2
3.	Equipment 3	GPS (1)	TRIMBLE TDC 100	1,53,400/-		Equipment 3
4.	Equipment 4	SYSTAT 13.2 (1)	SYSTAT Software Inc. USA	47,250/-		Software
5.	Equipment 5	SIGMAPLOT 14 (1)	SYSTAT Software Inc. USA	37,800/-		Software

6. Expenditure Statement and Utilization Certificate

.

Expenditure Information:

S. No.		Funds Sanctioned	Expenditure up to 31st match	Balance amount	% of Total cost spent
1.	Salaries/Manpower cost	4,320,000	2,293,275	2,026,725	**53.09**
2.	Travel	1,700,000	1,180,457	519,543	**69.44**
3.	Expendables &Consumables(Chemicals and Glasswares)	600,000	367,312	232,688	**61.22**
4.	Contingencies	750,000	566,963	183,037	**75.60**
5.	Activities & Other Project cost	1,800,000	403,942	1,396,058	**22.44**
6.	Institutional Charges	120,000	100,000	20,000	**83.33**
7.	Other expenditures Software's for ecological analysis etc.	1,200,000	0	1,200,000	**0.00**
8.	Equipments	8,800,000	2,031,096	6,768,904	**23.08**
9.	Total	**19,290,000**			
	Interest earned	**423,390**	6,943,045	12,346,955	**35.99**
	Gross total	**19,713,390**			

Expenditure Information:

Period	Annual Report	Expenditure Statement
2018-19	**Annexure-1a**	**Annexure-1b**

7. Project Beneficiary Groups

Beneficiary Groups [Capacity Building]	**Target**	**Achieved**
No. of Beneficiaries with income generation:	Seventeen	Recruitment of Twelve JPF and Five Field Assistant .
No. of stakeholders trained, particularly women:	Eight	02 nos. each from Arunachal Pradesh, Nagaland and Manipur states;02 from Uttarakhand and Himachal Pradesh.
No. of capacity building Workshops/ trainings:	Two	In progress.
No. of Awareness & outreach programmes:	Eight	Six completed,two in progress
No. of Research/ Manpower developed:	Seventeen	Recruitment of Twelve JPF and Five Field Assistant.

8. Project Progress Summary (as applicable to the project)

Description	Total (Numeric)	Description
IHR States Covered	11	Jammu and Kashmir, Himachal Pradesh, Uttrakhand, Sikkim,West Bengal(Darjeeling), Mizoram, Arunachal Pradesh, Manipur, Nagaland, Tripura.
Project Site/ Field Stations Developed:	**Please refer Annexure-IV**	a. **Jammu & Kashmir**:Jammu, Kashmir, Ladakh and adjoining areas of Himachal Pradesh b. **HimachalPradesh:**District Solan,Sirmaur,Una,Bilaspur,Hamirpur,Chamba,Kullu, Shimla,Kangra,Mandi. c. **Himachal Pradesh and Uttarakhand:** District Kinnaur ,Almora, Bageshwar, Chamoli, Champawat, Dehradun, Haridwar, Nainital, PauriGarhwal, Pithoragarh,Rudraprayag,Teri Garhwal,Udham Singh Nagar, Uttarkashi. d. **Sikkim and West Bengal:** Sikkim & Darjeeling himalayas e. **Mizoram:-**:-Phawngpui NP,Murlen NP,Lengteng WLS,Pualreng WLS, Some Non-protected areas namely Sangau,Vanghmun,Murlen village,Knahlan(**Mizoram**); f. (**Tripura**. Sepahijola WLS(Clouded leopard NP),Trishna WLS (Bison NP), Rowa WLS,Gomati WLS, Some Non-protected areas namely Karbook,Gomati ditrict,Jatanbari,Panisagar g. **Arunachal Pradesh,Nagaland,Manipur.**
No. of Patents filed (Description):	NIL	NIL
Article/ Review/ Research Paper/ Publication:	NIL	NIL
New Methods/ Modeling Developed (description in 250 words):	NIL	NIL
No. of Trainings/Awareness programmes (No. of Beneficiaries):	Eight	Forest, NGOs and Students, Some villagers are the target audiences
Workshop:	Two	Will be covered under training programme.
Demonstration Models (Site):	Please refer **Annexure-IV** for maps & Please refer **Annexure-VI** for Images	

Livelihood Options:	**NA**	
Training Manuals:	**Nine**	One Brochure,Three pamphlets and Five posters developed.
Processing Units:	**NA**	NA
Species Collection:	State Jammu & Kashmir Himachal Pradesh Uttarakhand: Sikkim & West Bengal Mizoram & Tripura Manipur,Nagaland & Arunachal Pradesh	Please refer **Annexure-II** No. **65** **65** **65** **70** **85** **59**
Species identified:	State Jammu & Kashmir Himachal Pradesh Uttarakhand: Sikkim & West Bengal Mizoram & Tripura Manipur,Nagaland & Arunachal Pradesh	Please refer **Annexure-II** No. **65** **65** **65** **70** **85** **59**
Database/ Images/ GIS Maps:	State Jammu & Kashmir Himachal Pradesh Uttarakhand: Sikkim & West Bengal Mizoram & Tripura Manipur,Nagaland & Arunachal Pradesh	Please refer **Annexure –IV** for maps Please refer **Annexure-VI** for Images

9. Project Linkages (with nearby Institutions/ State Agencies)

S. No.	Institute/ Organization	Type of Linkages	Brief Description
1.	Department of Forest, Government of **Mizoram**	Official	To provide official permission, to entry in the restricted ,protected areas and logistic supports.
2.	Department of Forest, Government of **Tripura**	Official	To provide official permission ,to entry in the restricted ,protected areas and logistic supports.
3.	Mizoram University	Official	For undertaking capacity building programme.
4.	State Forest Department of Arunachal Pradesh, Nagaland and Manipur	Official	Joint venture for identifying the forest areas affected from the invading exotic plants and strategy planning to mitigate the failure in natural regeneration by native timber species.
5.	Manipur University, Imphal; Central Agricultural University, Imphal; ICAR, Imphal; IBSD, Imphal; Nagaland University, Lumami; ICAR, Medziphema, Nagaland; Rajiv Gandhi University, Itanagar; Central Agricultural University, Pasighat	Official	Knowledge sharing and Capacity building in respective states of the study

10. Additional (publication, recommendations, etc.)

Time Period	Publications (Research Papers, Information Material, Policy drafts, Patents, etc.)
Annual [Year .....]	**[Attach]**

11. Project Concluding Remark

Kindly update the following Progress Parameters for the Reporting Period:

Project Objectives	Project output against each objective	Progress made against monitoring indicators(Specified in sanction letters)	Remarks

Identifying established and new Invasive Alien Vascular Plant Species (IAVPS) in all the 15 Indian Hilly States of Himalaya and estimating the invasion load	New Datasets: Complete inventory, distribution and areas infested by Invasive Alien Species in the Indian Himalayas	✓ Lists of IAVPS from different Himalayan states are documented.	Please refer **annexure-II**
Characterizing the IAVPS on the basis of their life-forms, lifespan, nativity, status of invasion and purpose of invasion/introduction		✓ The collected plant species from different study areas were assigned a growth form category, such as herb, shrub, and tree. Likewise, each alien plant species was assigned a life span category (i.e. annual, biennial or perennial) based on the field observations;their mode of introduction was also recorder from secondary data sources.	Please refer **annexure-II**
Preparing protocols for prediction, early detection and risk assessment of IAVPS	Dynamic model: Rate & mode of spread (including vectors responsible) with GPS & ground truthing	✓ GPS co-ordinates were recorded at each study site for individual quadrats.	
Assessment of Ecological & Environmental Impact of invasion and spread with special reference to phytodiversity and soil especially in relation to climate change; This will include the level of disappearance of native species	Base line studies & Assessment Reports to state agencies of the disappearance of native plant species (If any).	**Will be done in the coming year.**	
Selection of at least 10 most noxious established and 10 Neo-invasives and consolidation of all available information including their biology, itemizing at the same time the knowledge gaps	Value addition and sustainable utilization of bio-resources for livelihood of local communities	✓ A list has been prepared for the 10 most noxious established invasive alien plants; their ecological data have been analysed . Frequency,Abundance, Density,IVI of each plant calculated.	Please refer **annexure-II**

Identification of a cross-sectoral group to assess the situation in the form of case-studies on these species, and also to formulate workable management strategies aiming to prediction, prevention and control.	Policy and legislative mechanisms for management / eradication / mitigation will get framed.	✓ Awareness programme and workshops hav been conducted at respective states to ensure interaction with the local stakeholders preferably forest officials, students, NGOs and nature enthusiasts. ✓ More awareness programmes are going to be held at each study area in the coming year.	Please check **annexure-V** for photographs

Methodology (in brief):

- The methodology involves the survey and collection of IAVPS from Jammu & Kashmir; Himachal Pradesh;Uttarakhand; Sikkim & West Bengal; Mizoram & Tripura; Manipur,Nagaland & Arunachal Pradesh during various seasons from different altitudes. Apart from the collections of specimens, observations were made on the habitat of species, phenology, associate species,life span,temperature,moisture etc. All known localities were surveyed to document IAVPS and know their status of invasion in those areas. Routine herbarium procedures (Jain & Rao, 1976) were followed for preparing voucher herbarium specimens. Identification of species was carried out with the help of Floras, existing regional monographs/ revisions, protologues, renowned journals and other authentic specimens deposited at various herbaria of the country. Phytosociological analysis of IAVPS and its associate species were carried out by quadrat sampling (Mishra, 1968), Mueller-Dombois and Ellenberg (1974) and Magurran (1988) in Jammu & Kashmir;Himachal Pradesh;Uttarakhand; Sikkim & West Bengal; Mizoram & Tripura; Manipur,Nagaland & Arunachal Pradesh regions during the survey conducted in the year 2018 and (January - March) in 2019. Sampling was done by randomly placing quadrats of 5x5 m2 size,and within those 5x5 m2 quadrats of 1x1 m2 were performed to study the phytosociological data. Severe infested areas with IAVPS were marked & tagged for future survey. Tagging was made in selected sites for the study various phytosociological data in the subsequent visit. Mostly the areas highly infested with IAVPS were studied i.e. protected & non-protected areas, roadsides, fallow lands, agricultural fields, landslide areas, wetlands, wastelands etc. which experienced major anthropogenic disturbances. Understory vegetation which were included in the sampling were majorly herbs & shrubs also including few trees. Quadrats were sampled at regular intervals of 2-3 km each. Data on vegetation, including elevation (altimeter), geographical coordinates (GPS) and the presence of disturbances or human interference were recorded.Soil samples of individual IAVPS which are highly infested were also collected for analyzing soil parameter attributes. Seed samples were also collected to study the parameters such as, rate of seed production, seed set mode of seed dispersal and their germination in the wild. In addition, seed viability, germination percent and rate of seedling establishment of the selected IAVPS shall be carried out in the laboratory of respective project partners. Diameter of all herbs/shrubs was taken about 2 cm above ground. Recorded species were preserved and identified by reference to literature in various herbaria in the country. During field surveys, 300 m altitudinal gradient range was covered for each study site. Data on frequency, density and dominance and IVI were calculated for all target species.A list of top 10 most obnoxious & top 5 neo-invasives IAVPS were made based on their IVI values. Rate of spread of selected IAVPS shall be worked out by generating

	temporal multi-layered maps such as, distribution map and population density map etc. using RS data, GPS, ground truthing and GIS techniques.
Major Research Achievements:	❖ Undertaken multiple field tours to Jammu & Kashmir;Himachal Pradesh;Uttarakhand; Sikkim & West Bengal; Mizoram & Tripura; Manipur,Nagaland & Arunachal Pradesh ; visited the targeted study sites ; selected experimental plots to lay quadrats ; ❖ Individual DEM maps according to 300m elevation gradient for the targeted states were prepared with the available data. ❖ Individual list of total invasive load for each state of Jammu & Kashmir;Himachal Pradesh; Uttarakhand; Sikkim & West Bengal; Mizoram & Tripura; Manipur,Nagaland & Arunachal Pradesh are completed based on the data collected till date. ❖ Phytosociological parameters for the selected IAVPS were worked out. ❖ Collected soil samples for the habitats of respective IAPS and forest areas free from IAPS for detail comparative analysis ❖ Herbarium voucher specimens of IAVPS were prepared and submitted to important herbaria of the country. ❖ Seed samples were collected for the top obnoxious and neo-invasives for studying their viability, germination rate and dispersal biology.
Brief Conclusion - the current year progress – during the reporting period (point-wise):	❖ Preparation of A list of Invasive Alien Plant database for the study areas: ❖ State — No. Jammu & Kashmir — **65** Himachal Pradesh — **65** Uttarakhand: — **65** Sikkim & West Bengal — **70** Mizoram & Tripura — **85** Manipur,Nagaland & Arunachal Pradesh — **59** ❖ Soil samples were collected for soil physico-chemical parameter analysis. ❖ Seeds of selected invasive plant were collected for checking viability. ❖ Multiple field tours conducted in different parts of Jammu & Kashmir;Himachal Pradesh;Uttarakhand; Sikkim & West Bengal; Mizoram & Tripura; Manipur,Nagaland & Arunachal Pradesh. ❖ In **JAMMU & KASHMIR**, From Kargil region during the present study, 192 plant species were collected and identified. These species belonged to 124 genera and 42 families; of the latter, 35 belong to dicotyledons, 3 to monocotyledons, 2 each of gymnosperms and pteridophytes. Among dicotyledons, Asteraceae included the largest number (36) of species; among monocots Poaceae was the largest family with 28 species. Most of the plant species were herbs and majority of the species had perennial growth habit. Of these 192 plant species, 142 species are native, 12 species are cultivated, 10 species are casual naturalized, 34 species are naturalized in wild and 4 species are invasive. According to the invasion criteria most of the naturalized species (31species) fall in stage II of invasion, 3 species in stage III, 3 species in 'IVa' stage and 1 species in 'IVb'. From the Kashmir region 175 plant species were collected during the present study. These species belonged to 115 genera in 45 families (37 families were of dicotyledons, 6 of monocotyledons, 1 of gymnosperms, and 1 of pteriodophytes). Asteraceae was the largest family with 23 species followed by Fabaceae and Polygonaceae with 11 species each and in monocots Poaceae was the largest family with 21 species. Most of the species collected were annual herbs. Majority of the species are naturalized; among the naturalized taxa, 50

species are alien invasive, 49 naturalized in wild and 5 species are casual aliens.

In the Jammu region, 262 species belong to 189 gnera and 73 families were collected and identified during the present study. The speices rich families included: Asteraceae (30 spp.), Fabaceae (21 spp.), Poaceae (17 spp.) and Lamaveae (12 spp.). Species predominantly had herbaceous habit (111 spp.) while shrubs, trees and climbers were represented by 25, 47 and 7 species, respectively.

- In **HIMACHAL PRADESH**, Thorough literature survey was conducted to get an estimate of the invasive load present in the study site. Three herbarium visits were also conducted- one to Botanical Survey of India, Dehradun, Herbarium of NBRI, Lucknow and herbarium of Panjabi University, Patiala. Herbarium sheets of various invasive alien species were studied to know about their presence and the date they were first reported. Altitudinal information of the species was also collected. Maps were prepared.Eight field trips were undertaken to Una, Hamirpur, Chamba and Sirmour and different sites were selected to perform vegetation analysis. During the visits, extensive photographs of invasive plants and other vegetation were taken. We have recorded invasive alien species in study sites so far. GPS coordinates were collected. Specimens of plants were collected and dried to prepare herbarium sheets. Soil samples were also collected. Analysis of Quadrat data and physio-chemical analysis of soil samples is in process.
  A list 66 IAVPS is documented for Himachal Pradesh. These plant species belong to 54 genera in 32families;62 species are dicots and 4 species are monocot .The largest familie sinclude: Asteraceae with 16 species followed by Solanaceae with 9 and Convolvulaceae with 5 species.
  An awareness programme has been conducted in District Sirmaur with students and local farmers and Sarpanch.
- In **UTTARAKHAND,**
  Preparation of 65 Invasive Alien Plant database for the study areas (Uttarakhand) towards study of invasive load.Soil samples were collected for soil physico-chemical parameter analysis.Seeds of selected invasive plant were collected for checking viability.Two herbarium tours to check invasion history of the selected plants. Awareness programmes are going to be held with school students and common people in Uttarakhand and Kinnaur district of Himachal Pradesh.
- In **SIKKIM & WEST BENGAL**:In Sikkim at the lower gradient between 600m-900m, it was observed that Ageratina adenophora exhibited highest frequency (100%) while lowest frequency was observed in *Lantana camara* (25%) along with other associates. The density (34.66 ind./100m2), basal cover (6.61 cm2/100m2) and IVI (104.91) values of *Ageratina adenophora* observed highest. while Lowest density was observed in *Lantana camara* (10.6 ind./100m2), but Highest basal cover and highest Importance value index (IVI) was observed in *Lantana camara* (0.222 cm2/m2) and (68.26) respectively, however the lowest basal cover and IVI was exhibited in *Mikania micrantha* (0.006cm2/m2) *Chromolaena odorata* that is 36.*Ageratina adenophorum* showed highest frequency (90.9%), highest density (35.45 ind./100m2), highest IVI (63.33) and basal cover (3.68 cm2/100m2) along with other associate at 900m-1200m altitude, while *Mikania micrantha*, was exhibited minimum values. At the gradient 1200m-1500m *Ageratina adenophora* exhibited highest frequency (90%) with highest density (33.60 ind./100m2) and highest IVI value (76.57), while *Lantana camara* showed highest basal cover (15.70 cm2/m2) along with other associates. In this altitude the lowest values were observed in *Mikania micrantha*. At the higher altitudes between 1500m-1800m, *Ageratina adenophora* represented highest frequency (100%), highest density (40.52 ind./100m2), basal cover (9.86cm2/m2) and highest IVI (87.69) along with other prominent associates, while *Chromolaena odorata* showed minimum values.At 1800m- 2100m, Ageratina adenophora represented highest frequency

(100%), highest density (31.48 ind./100m2), highest basal cover (8.45 cm2/m2) and highest IVI (71.19) value respectively, however other three targeted species were not found during study at this gradient.*Ageratina adenophora* exhibited highest frequency (83.33%) with highest density (21.33 ind./100m2), highest basal cover (10.18cm2/m2) and highest IVI value (92.04) along with other associates, *Lantana camara*, Mikania micrantha and *Chromolaena odorata* were not found during survey at this high altitudinal gradient in between 2100m-2400m.At 2400m-2700m gradient, Ageratina adenophora showed higest values fallowed by *Chromolaena odorata*.

In Darjeeling very few numbers of plots was laid in between 1500m to 2100m altitudinal gradient. there were Ageratina adenophora noticed with highest values followed by other associates there were no other targeted species found during field survey.

- In **MIZORAM & TRIPURA**, Preparation of A list of 85 Invasive Alien Plant database for the study areas(Mizoram and Tripura) towards study of invasive load. Soil samples were collected for soil physico-chemical parameter analysis.Seeds of selected invasive plant were collected for checking viability.One herbarium tour to check invasion history of the selected plants and spread in various regions of the selected states.Four field tours conducted in different parts of Mizoram & Tripura.

  During the study 74 and 78 Invasive or potential invasive alien plant species have been recorded from Mizoram and Tripura respectively till date . These plant species belong to 61 genera in 27 families in Mizoram and 63 genera in 25 families in Tripura respectively. Of these 64 species are dicots and 10 species are monocot in Mizoram whereas 67 species are dicots and 11 species are monocots in Tripura . The largest families include: Asteraceae with 20 species followed by amaranthaceae and convolvulaceae with 6 species each in Tripura and Mizoram.

  The most noxious invasive alien plant species observed in Tripura and Mizoram are *Mikania micrantha* Kunth.(Asteraceae) , *Ageratina adenophora* (Spreng.) King & Robinson. (Asteraceae), *Ageratum conyzoides* (L.)L.(Asteraceae), *Ageratum houstonianum* Mill.(Asteraceae) , *Chromalaena odorata* (L.) R.M.King & H.Rob.(Asteraceae) , *Bidens pilosa* L. (Asteraceae), *Alternanthera sessilis* (L.) R.Br. ex DC. (Amaranthaceae) , *Imperata cylindrica* (L.) Raeusch ,*Lantana camara* L. (Verbenaceae) , *Ipomoea carnea* Jacq (Convolvulaceae) and *Urena lobata* L.(Malvaceae).

  Twenty DEM maps of top 10 most noxious plants in Mizoram and Tripura has been prepared.

  Two awareness programmes are conducted in Mizoram, one conducted in the month of January,2019 another is planned to be conducted in April,2019.

- In **MANIPUR,NAGALAND & ARUNACHAL PRADESH**, Explorations were conducted for complete inventory of Invasive Alien Plant Species in three districts of Arunachal Pradesh, nine districts of Manipur and three districts of Nagaland.Diversity, density and Importance Value Index for respective IAVPS have been worked out for the localities.

  Distribution pattern for the respective IAVPS in the explored localities were extrapolated on DEM maps in tropical open forests, *Mikania micrantha, Ageratum conyzoides and Chromolaena odorata* were recorded in pure patches as well as in mixed population.

  Patches of *Lantana camara* were localized in open forests and not recorded under the dense tree canopies. It was associated with Chromolaena odorata in certain open forests.

  Densely regenerated population of Ageratum conyzoides succeeded forest floors in tropical belt.*Parthenium hysterophorus* was recorded near the roadsides adjoining to the evergreen forests at higher range of tropical belt, but with limited population.

  Distribution of *Parthenium hysterophorus* was restricted only to the tropical forests and *Ageratum conyzoides, Mikania micrantha, Lantana camara* and were observed in both tropical and sub tropical belts.

	Galinsoga ciliata was absent in tropical belt but were observed in trace populations at sub-tropical forests with *Ageratina adenophora*.It was ascertained that Lantana camara was used as live fencing and *Ageratina adenophora* as soil binder in different parts of Manipur.
Progress Achieved (%):	❖ 30%
Remaining work to be done:	❖ Preparing protocols for prediction, early detection and risk assessment of IAVPS ❖ Assessment of Ecological & Environmental Impact of invasion and spread with special reference to phytodiversity and soil especially in relation to climate change; This will include the level of disappearance of native species ❖ Identification of a cross-sectoral group to assess the situation in the form of case-studies on these species, and also to formulate workable management strategies aiming to prediction, prevention and control . ❖ Determining biodiversity threat level from the spread of these two invasive plants. ❖ To study the similarities and differences in spread pattern and invasive load on early recovery successional landscapes, and its impact on natural flora.

.

annexure-2A

A. Plant species recorded from Kargil with different morphological and ecological attribute

Species name	Family	Life Span Category	Growth form	Distributional Range	Plant group	Frequency %*	Density #	Abundance#
Aconogonon tortuosum (D.Don) H.Hara	Polygonaceae	Perennial	Herb	Native	Dicot	1.10	56.66	60
Agrostis filipes Hook.f	Poaceae	Annual	Herb	Native	Monocot	1.03	68.33	62
Agrostis gigantea Roth.	Poaceae	Annual	Herb	Native	Monocot	3.36	85.00	202
Agrostis vinealis Schreb.	Poaceae	Annual	Herb	Native	Monocot	0.05	3.33	3
Althea rosa L.	Rosaceae	Pernnial	Herb	Cultivated	Dicot	1.63	60.00	98
Amaranthus caudatus L.	Amaranthaceae	Perennial	Herb	Naturalized	Dicots	1.46	21.66	88
Amaranthus hybridus L.	Amaranthaceae	Annual	Herb	Naturalized	Dicot	1.83	66.66	110
Amaranthus powellii S.Watson	Amaranthaceae	Annual	Herb	Native	Dicot	1.46	48.33	88
Amaranthus spinosus L.	Amaranthaceae	Perennial	Herb	Naturalized	Dicots	0.85	60.00	51
Anaphalis virgata Thomson	Astreaceae	Perennial	Herb	Native	Dicot	4.88	55.00	293
Anthemis cotula L.	Asteraceae	Annual	Herb	Naturalized	Dicot	2.21	40.00	133
Arctium lappa L.	Asteraceae	Pernnial	Herb	Native	Dicot	0.05	11.66	3
Arnebia euchroma (Royle) I.M.Johnst.	Borogonaceae	Perennial	Herb	Native	Dicot	0.06	3.33	4
Artemisia compacta Fisch.	Asteraceae	Perennial	Herb	Native	Dicot	0.38	31.66	23
Artemisia brevifolia Wall. ex DC.	Asteraceae	Perennial	Herb	Native	Dicot	2.26	36.66	136
Artemisia fragrans Wild.	Asteraceae	Perennail	Herb	Naturalized	Dicots	1.55	50.00	93
Artemisia macrocephala Jacquem. ex Besser	Asteraceae	Perennial	Herb	Native	Dicot	4.33	61.66	260
Artemisia moorcroftiana Wall. ex DC	Asteraceae	Perennial	Herb	Native	Dicot	2.98	58.33	179
Artemisia persica Boiss.	Asteraceae	Perennial	Herb	Naturalized	Dicot	6.78	35.00	407
Artemisia santolinifolia Turcz. ex Besser	Asteraceae	Perennial	Herb	Native	Dicot	1.5	35.00	90
Artemisia scoparia Waldst.	Asteraceae	Perennial	Herb	Native	Dicot	1.88	45.00	113
Artemisia siversiana Ehrh. ex Willd.	Asteraceae	Perennial	Herb	Naturalized	Dicot	3.4	70.00	204
Astragalus rhizanthus Royle ex Benth. in Royle	Fabaceae	Perennial	Herb	Native	Dicot	0.68	18.33	41
Astragalus strictus Grah. Ex Benth.	Fabaceae	Perennial	Herb	Native	Dicot	1.96	51.66	118
Atriplex hortensis L.	Caryophyllaceae	Annual	Herb	Native	Dicot	0.28	13.33	17
Avena sativa L.	Poaceae	Annual	Herb	Cultivated	Monocot	0.25	11.66	15

Bergenia ciliata (Haw.) Sternb.	Saxifragaceae	Perennial	Herb	Native	Dicot	0.31	20.00	19
Brassica rapa L.	Brassicaceae	Biennial	Herb	Cultivated	Dicot	0.80	25.00	48
Bromus oxyodon Schrenk	Poaceae	Annual	Herb	Native	Monocot	0.30	8.33	18
Bromus pectinatus Thunb.	Poaceae	Annual	Herb	Native	Monocot	1.78	35.00	107
Bromus tectorum L.	Poaceae	Annual	Herb	Cultivated	Monocot	2.05	48.33	123
Bukiniczia cabulica (Boiss.) Lincz.	Plumbaginaceae	Biennial	Herb	Native	Dicot	1.65	68.33	99
Capparis spinosa L.	Capparaceae	Perennial	Herb	Naturalized	Dicot	2.53	55.00	152
Capsella bursa pastoris L. Medik.	Brassicaceae	Annual	Herb	Native	Dicot	1.03	45.00	62
Cardamine nudicaulis L.	Brassicaceae	Annual	Herb	Naturalized	Dicot	1.40	31.66	84
Cersium arvense (L.) Scop	Asteraceae	Pernnial	Herb	Naturalized	Dicots	7.31	30.00	439
Chenopodium album L.	Chnopodaceae	Perennail	Herb	Naturalized	Dicots	1.10	56.66	66
Chenopodium ambrosioides L.	Amaranthaceae	Perennial	Herb	Naturalized	Dicot	0.33	11.66	20
Chenopodium botrys L.	Amaranthaceae	Annual	Herb	Naturalized	Dicot	2.55	55.00	153
Chenopodium foliosum (Moench) Ascherson.	Amaranthaceae	Perennial	Herb	Naturalized	Dicot	1.40	36.66	84
Chenopodium pamiricum Iljin	Amaranthaceae	Annual	Herb	Naturalized	Dicot	1.93	58.33	116
Clematis ladakhiana Grey-Wilson.	Ranunculaceae	Perennial	Herb	Native	Dicot	0.08	3.33	33
Clematis tibestica Quézel.	Ranunculaceae	Perennial	Shrub	Naturalized	Dicot	3.45	75.00	159
Codonopsis clematidea (Schrenk) C.B.Clarke	Campanulceae	Perennial	Herb	Native	Dicot	0.76	45.00	46
Colutea nepalensis Sims.	Brassicaceae	Pernnial	Herb	Native	Dicot	1.55	40.00	93
Convolvulus arvensis L.	Convolvolaceae	Pernnial	Herb	Native	Dicot	5.23	60.00	314
Cotoneaster affinis Lindley	Roasaceae	Perennial	Herb	Native	Dicot	3.35	75.00	201
Cousinia thomsonii C.B.Clarke	Asteraceae	Perennial	Herb	Native	Dicot	1.25	18.33	75
Juniperus semiglobosa Regel	Cupressaceae	Perennial	Tree	Native	Gymnosperm	1.51	51.66	91
Desideria linearis (N.Busch) Al-Shehbaz	Brassicceae	Perennail	Herb	Native	Dicots	2.90	20.00	174
Dianthus anatolicus Boiss.	Caryophyllaceae	Perennial	Herb	Naturalized	Dicot	0.83	25.00	50
Dryopteris blanfordii (C. Hope) C. Chr	Dryopteridaceae	Perennial	Herb	Native	Pterdophyte	2.66	45.00	160
Echinops cornigerus DC.	Asteraceae	Perennial	Herb	Native	Dicot	2.15	71.66	129
Elymus repens L.	Poaceae	Annual	Herb	Native	Monocot	1.40	50.00	84
Ephdra regeliona Florin.	Ephdraceae	Perennial	Shrub	Native	Gymnosperm	0.08	3.33	5
Ephedra intermedia Schrenk & C.A.Mey.	Ephdraceae	Perennial	Shrub	Naturalized	Gymnosperm	3.45	75.00	207

Epilobium angustifolium L.	Onagraceae	Perennial	Herb	Natuiralized	Dicot	5.70	80.00	342
Epipactis helleborine (L.) Crantz	Orchidacae	Perennial	Herb	Native	Monocot	2.05	60.00	123
Equilegia fragrans Benth	Ranunculaceae	Perennial	Herb	Native	Dicot	9.93	80.00	234
Equisetum ramosissimum Desf.	Equisteacae	Perennail	Herb	Native	Pteridophyta	9.93	80.00	596
Equisetum ramosissimum Desf.	Equisteceae	Perennial	Herb	Native	Pteridophytra	1.33	36.66	80
Equistem arvense L.	Equisteaceae	Perennial	Herb	Native	Pteridophyta	2.38	48.33	143
Eragrostis minor Host.	Poaceae	Annual	Herb	Native	Monocot	2.38	5.00	143
Erigeron multiradiatus (Lindl. ex DC.) Benth.	Asteraceae	Perennial	Herb	Native	Dicot	1.53	51.66	92
Erigeron uniflorus L.	Asteraceae	Perennial	Herb	Native	Dicot	2.60	43.33	156
.*Erigeron multiradiatus* (Lindl. ex DC.) Benth. & Hook.f.	Asteraceae	Perennial	Herb	Native	Dicot	0.95	38.33	57
Euphorbia hispida Boiss.	Euphorbaiceae	Perennial	Herb	Naturalized	Dicots	0.90	38.33	54
Fagopyrum esculentum Moench	Polygonaceae	Annual	Herb	Cultivated	Dicot	3.35	75.00	197
Fagopyrum tataricum (L.) Gaertn.	Polygonaceae	Annual	Herb	Cultivated	Dicot	1.63	60.00	95
Festicua algae L.	Poaceae	Annual	Herb	Native	Monocot	0.66	31.66	40
Festuca nitidula Stapf	Poaceae	Perennial	Herb	Native	Monocots	0.86	13.33	52
Fragria bucharica Lindley	Roaeaseae	Perennial	Herb	Native	Dicot	1.10	56.66	66
Galinsoga parviflora Cav.	Asteraceae	Perennial	Herb	Native	Dicot	0.46	18.33	28
Gentiana burkillii Harry Sm.	Gentianaceae	Pernnial	Herb	Native	Dicots	5.41	51.66	325
Geranium himalayense Klotzsch ex Hofmeist. &	Geraniaceae	Perennial	Herb	Native	Dicot	4.40	81.66	264
Geranium pratense L.	Geraniaceae	Perennial	Herb	Native	Dicot	2.55	38.33	153
Helianthus annus L.	Asteraceae	Perennial	Herb	Native	Dicot	1.71	55.00	103
Herminium monorchis (L.) R.Br.	Orchidaceae	Perennial	Herb	Naturalized	Monocot	2.08	53.33	125
Hippophae rhamnoides L.	Elaeagnaceae	Perennial	Shrub	Native	Dicot	1.45	43.33	87
Hordeum vulgare L.	Poaceae	Annual	Herb	Native	Monocot	0.73	15.00	44
Impatiens thomsonii Hook.f.	Balsamaceae	Annual	Herb	Native	Dicots	0.95	23.33	57
Indigofera heterantha Brandis.	Fabaceae	Perennial	Shrub	Native	Dicot	7.18	91.66	431
Inula obtusifolia Schrenk	Asteraceae	Pernnial	Herb	Native	Dicot	0.26	18.33	16
Inula rhizocephala Schrenk	Asteraceae	Biennial	Herb	Native	Dicot	1.85	55.00	111
Iris lactea Pall.	Iridaceae	Pernnial	Herb	Native	Monocot	1.91	36.66	115
Iris lactea var. chinensis (Fisch.) Koidz.	Iridaceae	Perennial	Herb	Native	Monocots	0.31	13.33	19
Juglanas regia L.	Juglandaceae	Perennial	Tree	Cultivated	Dicot	4.05	6.66	243
Kochia prostrata (L) Schard.	Chnopodaceae	Perennail	Herb	Naturalized	Dicots	1.76	46.66	106
Kochia stellaris Moq.	Amaranthaceae	Perennial	Herb	Native	Dicot	2.28	36.66	137

Kraschenninnikovia pungens (Popov) Czerep.	Amaranthaceae	Pernnial	Herb	Naturalized	Dicot	1.11	33.33	67
Lactuca dissecta D.Don	Asteraceae	Perennial	Herb	Native	Dicot	1.60	63.33	96
Lactuca orientalis (Boiss.) Boiss.	Asteraceae	Perennial	Herb	Native	Dicot	1.90	48.33	114
Lactuca sativa L.	Asteraceae	Perennial	Herb	Naturalized	Dicot	1.16	50.00	70
Lactuca tatarica L.	Asteraceae	Perennial	Herb	Native	Dicot	0.20	11.66	12
Lepidium latifolium L.	Brassicaceae	Biennial	Herb	Native	Dicot	1.76	43.33	106
Leontopodium nannum Hook.	Asteraceae	Perennial	Herb	Native	Dicot	0.85	60.00	51
Leontopodium ochroleucum Beauv.	Asteraceae	Perennial	Herb	Native	Dicot	0.43	23.33	26
Lepidium capitatum Hook. f. & Thomson	Brassicaceae	Biennial	Herb	Native	Dicot	0.48	28.33	29
Lindelofia stylosa (Kar. & Kir) Brand	Boraginaceae	Perennial	Herb	Native	Dicots	3.58	45.00	215
Lithospermum echioides Benth.	Boraginaceae	Perennial	Herb	Native	Dicot	2.26	36.66	136
Lonicera asperifolia Hook. f. & Thomson	Caprifoliaceae	Perennial	Shrub	Native	Dicot	0.98	45.00	59
Lonicera semenovii L.	Caprifolaceae	Pernnial	Shrub	Native	Dicot	3.80	46.66	228
Lonicera spinosa (Decne.) Walp.	Capperaceae	Pernnial	Shrub	Native	Dicot	0.35	18.33	21
Malus domestica Borkh.	Rosaceae	Perennial	Tree	Cultivated	Dicot	1.76	46.66	106
Malva neglecta Wallr.	Solanaceae	Annual	Herb	Native	Dicot	1.13	20.00	68
Medicago falcata L.	Fabaceae	Perennial	Herb	Naturalized	Dicot	1.20	50.00	72
Medicago lupulina L.	Fabaceae	Perennial	Herb	Native	Dicot	2.03	63.33	122
Medicago lupulina L.	Fabaceae	Perennial	Herb	Native	Dicot	1.48	46.66	89
Medicago polymorpha L.	Fabaceae	Perennial	Herb	Naturalized	Dicots	0.23	10.00	14
Medicago sativa L.	Fabaceae	Perennial	Herb	Native	Dicot	10.81	88.33	649
Medicgo polymorpha L.	Fabaceae	Perennial	Herb	Naturalized	Dicot	2.16	68.33	130
Melica persica Kunt.	Poaceae	Perennial	Herb	Native	Dicot	0.23	10.00	14
Melica persica var. caspica Griseb.	Poaceae	Perennial	Herb	Native	Monocot	2.45	41.66	147
Mentha longifolia Benth. in Wall.	Lamiaceae	Perennail	Herb	Native	Dicots	2.38	48.333	143
Morus alba L.	Moraceae	Perennial	Tree	Naturalized	Dicot	1.41	26.66	85
Myricaria elegans Royle	Tamaricaceae	Perennial	Shrub	Native	Dicot	0.41	11.66	25
Nepeta discolor Royle ex Benth.	Lamiaceae	Perennial	Herb	Native	Dicot	5.26	81.66	316
Nepeta floccosa Benth.	Lamiaceae	Perennial	Herb	Native	Dicot	7.23	68.33	434
Nepeta glutinosa Benth.	Lamiaceae	Perennial	Herb	Native	Dicot	4.95	58.33	297
Oxyria digyna (L.) Hill	Curculionidae	Pernnial	Herb	Naturalized	Dicot	1.35	18.33	81
Oxyris hybrida L.	Chnopodaceae	Annual	Herb	Native	Dicot	1.81	65.00	109
Oxytropis microphylla DC.	Fabaceae	Perennial	Herb	Native	Dicot	1.50	46.66	90

Pedicularis punctate Decne. in Jacquem.	Orobanchaceae	Pernnial	Herb	Native	Dicot	1.66	40.00	100
Pennisetum orientale Rich.	Poaceae	Pernnial	Herb	Native	Monocot	5.61	60.00	337
Perovskia abrotanoides Kar.	Lamiaceae	Perennial	Herb	Naturalized	Dicot	2.43	56.66	146
Persicaria hydropiper L.	Polygonaceae	Annual	Herb	Native	Dicot	1.76	46.66	101
Phragmites australis (Cav.) Trin. ex Steud.	Poaceae	Pernnial	Herb	Native	Monocot	0.70	46.66	42
Physochlaina praealta (Decne.) Miers	Solanaceae	Perennial	Herb	Native	Dicot	1.10	56.66	66
Picris nuristanica Bornm.	Asteraceae	Perennial	Herb	Native	Dicot	1.26	45.00	76
Piptatherum laterale (Regel) Nevski	Poaceae	Annual	Herb	Native	Monocot	0.16	3.33	10
Pisum sativum L.	Fabaceae	Annual	Herb	Native	Dicot	0.60	30.00	36
Plantago depressa Willd.	Plantaginaceae	Perennial	Herb	Native	Dicots	0.71	23.33	43
Plantago major L.	Plantagonaceae	Annual	Herb	Naturalized	Dicot	0.68	13.33	41
Plantago ovata Forssk.	Plantaginaceae	Perennial	Herb	Native	Dicot	1.05	41.66	63
Poa annua L.	Poaceae	Annual	Herb	Naturalized	Monocot	0.70	33.33	42
Poa calliopsis L.	Poaeceae	Annual	Herb	Naturalized	Monocot	0.31	6.66	21
Poa alpina L.	Poaceae	Perennial	Herb	Native	Monocot	1.66	50.00	100
Poa attenuata Trin.	Poaceae	Annual	Herb	Native	Monocot	1.56	40.00	94
Poa calliopsis Litv.Ex Ovcz.	Poaceae	Perennial	Herb	Native	Monocot	0.71	25.00	43
Poa pectinatus L.	Poaceae	Perennial	Herb	Native	Monocot	0.98	41.00	58
Poa pratensis L.	Poaceae	Annual	Herb	Naturalized	Monocot	0.35	10.00	20
Poa tibetica Munro ex Stapf	Poaceae	Annual	Herb	Native	Monocots	0.28	13.33	16
Podophyllum hexandrum Royle	Berberidaceae	Pernnial	Herb	Native	Dicot	1.98	38.33	119
Polygonum abbreviatum Kom.	Polygonaceae	Perennial	Herb	Naturalized	Dicot	1.81	65.00	99
Polygonum alpestres Beth.	Polygonacaeae	Perennial	Herb	Native	Dicot	5.35	80.00	324
Polygonum cognatum Meissn.	Polygonaceae	Annual	Herb	Naturalized	Dicot	5.23	60.00	297
Polygonum orientale L.	Polygonaceae	Perennial	Herb	Native	Dicot	0.31	10.00	21
Polygonum rottboellioides Jaub. & Spach.	Polygonaceae	Perennial	Herb	Native	Dicot	1.88	48.33	103
Polypogon monospeliensis L.	Poaceae	Annual	Herb	Native	Monocots	0.83	25.00	46
Populus nigra L.	Salicaceae	Perennial	Tree	Native	Dicot	3.40	11.66	34
Populus pannonica Kit. ex Besser	Salicaceae	Perennial	Tree	Naturalized	Dicot	0.50	5.00	5
Potentilla anserina L.	Rosaceae	Pernnial	Herb	Naturalized	Dicot	1.81	65.00	99
Prunus armeniaca L.	Rosaceae	Perennial	Tree	Cultivated	Dicot	5.30	13.33	53
Ranunculus longicaulis C.A. Mey. in Ledeb	Ranunculaceae	Perennial	Herb	Native	Dicot	2.38	48.33	145
Raphanus sativus L.	Brassicaceae	Biennial	Herb	Cultivated	Dicot	0.30	23.33	18

Rheum tibeticum Maxim. ex Hook. f.	Polygonaceae	Perennial	Herb	Native	Dicot	2.53	55.00	145
Rheum webbianum Royle	Polygonaceae	Perennial	Herb	Native	Dicot	1.51	51.66	80
Rhodiola tibetica Hook and Thmoson.	Crassulaceae	Perennial	Herb	Native	Dicot	0.31	10.00	19
Ribes orientale Desf.	Grossulariaceae	Perennial	Shrub	Native	Dicot	2.50	3.33	150
Robinia pseudoacacia L	Fabaceae	Perennial	Tree	Naturalized	Dicot	2.98	50.00	179
Rochelia disperma C. Koch.	Boraginaceae	Perennial	Herb	Native	Dicots	0.28	10.00	17
Rosa macrophylla Lindl.	Rosaceae	Perennial	Shrub	Native	Dicot	1.30	6.66	13
Rosa webbiana Wall. ex Royle	Rosaceae	Perennial	Shrub	Native	Dicot	2.60	8.33	26
Rumex angulatus Rech. f.	Polygonaceae	Perennial	Herb	Native	Dicot	1.35	18.33	76
Rumex nepalensis Spreng.	Polygonaceae	Perennial	Herb	Native	Dicot	2.66	45.00	161
Rumex patientia L.	Polygonaceae	Perennial	Herb	Naturalized	Dicot	1.45	43.33	84
Salix caesia Vill.	Salicaceae	Perennial	Shrub	Native	Dicot	5.10	11.66	51
Salix caroliniana Michx.	Salicaceae	Perennial	Shrub	Native	Dicot	6.40	16.66	64
Salix sericocarpa Andersson	Salicaceae	Perennial	Tree	Native	Dicot	0.20	1.66	2
Salsola tragus L.	Amaranthaceae	Perennial	Herb	Naturalized	Dicot	0.56	30.00	34
Sambucus wightiana Wall. ex Wight & Arn.	Adoxaceae	Perennial	Herb	Naturalized	Dicot	11.33	90.00	680
Silene moorcroftiana Wall. ex Benth. in Royle	Caryophyllaceae	Perennial	Herb	Native	Monocot	0.31	6.66	19
Sisymbrium loeselii L.	Brassicaceae	Biernnial	Herb	Naturalized	Dicots	1.30	50.00	78
Descurainia sophia (L.) Webb. ex Prantl in Engl. & Prantl	Brassicaceae	Biennial	Herb	Naturalized	Dicot	1.11	36.66	67
Solanum tuberosum L.	Solanaceae	Pernnial	Herb	Cultivated	Dicot	3.26	48.33	196
Solidago virgaurea L.	Asteraceae	Perennial	Herb	Naturalized	Dicot	0.90	36.66	54
Sorbaria tomentosa (Lindl.) Rehder	Rosaceae	Perennial	Tree	Native	Dicot	1.30	10.00	13
Stachys tibetica Vatke	Lamiaceae	Perennial	Herb	Native	Dicot	5.01	78.33	301
Stellaria deoressa Em.Schmid.	Caryophyllaceae	Annual	Herb	Native	Dicot	2.46	43.33	148
Stellaria irrigua Bunge.	Caryophyllaceae	Annual	Herb	Native	Dicot	5.35	80.00	321
Stipa himalaica Roshev.	Poaeceae	Annual	Herb	Naturalized	Monocot	1.83	61.66	107
Tagetes erecta L.	Asteraceae	Annual	Herb	Naturalized	Dicot	1.58	45.00	95
Tanacetum fruticulosum Ledeb.	Asteraceae	Perennial	Herb	Naturalized	Dicot	6.45	88.33	387
Teraxacum candidatum Kirschner.	Asteraceae	Perennial	Herb	Native	Dicot	1.16	23.33	70
Thymus linearis Benth.	Lamiaceae	Perennial	Herb	Native	Dicot	5.20	50.00	312
Tragopogon gracilis D.Don	Asteraceae	Perennial	Herb	Native	Dicot	0.91	26.66	55
Tragopogon orientalis L.	Asteraceae	Perennial	Herb	Naturalized	Dicot	3.26	48.33	196

Trfolium pratense L.	Fabaceae	Perennial	Herb	Native	Dicot	1.01	31.66	61
Trifolium repens L.	Fabaceae	Perennial	Herb	Native	Dicot	1.76	38.33	106
Tussilago farfara L.	Asteraceae	Perennial	Herb	Naturalized	Dicot	1.63	36.66	98
Urtica dioica L.	Urticacaeae	Perennial	Herb	Native	Dicot	1.93	58.33	116
Urtica hyperborea L.	Urticaceae	Perennial	Herb	Native	Dicot	2.91	51.66	175
Verbascum thapsus DC	Scrophulariaceae	Biannual	Herb	Naturalized	Dicot	1.05	20	63
Zea mays L.	Poaeceae	Annual	Herb	Cultivated	Monocot	2.46	43.33	132

Plants/m^2 (for herbs); Plants/$5m^2$ (for shrubs); Plants/$10m^2$ (for trees) # No. of sampling units in which species occur/total sampling units,For herbs sampling unit is $1m^2$,For shrubs sampling unit is $5m^2$;For herbs sampling unit is $10m^2$

B. Plant species recorded from Kashmir with different morphological and ecological attributes

Name of species	**Family**	**PlantGroup**	**Life Span**	**Distributional Range (Invasion Category)**	**Percentage Frequency***	**Density #**	**Abundance#**
Brassica napus L.	Brassicaceae	Dicot	Annual herb	Naturalized (Casual alien)	6.66	0.06	1
Viburnum cotinifolium D. Don	Caprifoliaceae	Dicot	Shrub	Naturalized (Casual alien)	33.33	0.54	8.2
Lythrum hyssopifolia L.	Lythraceae	Dicot	Annual herb	Naturalized (Casual alien)	8.66	0.13	2
Althaea rosea Cav.	Malvaceae	Dicot	Biennial herb	Naturalized (Casual alien)	6.66	0.26	4
Crataegus songarica K. Koch	Rosaceae	Dicot	Shrub	Naturalized (Casual alien)	6.66	0.20	3
Amaranthus caudatus L.	Amaranthaceae	Dicot	Annual herb	Naturalized (Invasive alien)	13.33	0.10	1.5
Sambucus wightiana Wall. ex Wight & Arn.	Adoxaceae	Dicot	Perennial herb	Naturalized (Invasive alien)	20.00	0.13	2
Daucus carota L.	Apiaceae	Dicot	Biennial herb	Naturalized (Invasive alien)	6.66	0.06	1
Eryngium billardieri Del.	Apiaceae	Dicot	Perennial herb	Naturalized (Invasive alien)	13.33	0.06	1
Cirsium arvense Scop.	Asteraceae	Dicot	Annual herb	Naturalized (Invasive alien)	20.00	0.06	1
Crepis sancta Babc.	Asteraceae	Dicot	Annual herb	Naturalized (Invasive alien)	33.33	4.10	61.6
Galinsoga parviflora Cav.	Asteraceae	Dicot	Annual herb	Naturalized (Invasive alien)	6.66	0.33	5
Siegesbeckia orientalis L.	Asteraceae	Dicot	Annual herb	Naturalized (Invasive alien)	26.66	0.24	3.6
Sonchus oleraceus L.	Asteraceae	Dicot	Annual herb	Naturalized (Invasive alien)	6.66	0.06	1
Xanthium spinosum L.	Asteraceae	Dicot	Annual herb	Naturalized (Invasive alien)	33.33	0.40	6
Anthemis cotula L.	Asteraceae	Dicot	Biennial herb	Naturalized (Invasive alien)	66.66	2.06	39.01
Carduus edelbergii Rech. f.	Asteraceae	Dicot	Biennial herb	Naturalized (Invasive alien)	6.66	0.13	2

Centaurea iberica Trev. ex Spreng	Asteraceae	Dicot	Biennial herb	Naturalized (Invasive alien)	26.66	1.03	15.5
Conyza canadensis Cronquist	Asteraceae	Dicot	Biennial herb	Naturalized (Invasive alien)	63.33	1.88	38.8
Achillea millefolium L.	Asteraceae	Dicot	Perennial herb	Naturalized (Invasive alien)	46.66	0.13	2
Arctium lappa L.	Asteraceae	Dicot	Perennial herb	Naturalized (Invasive alien)	6.66	0.06	1
Taraxacum officinale Weber	Asteraceae	Dicot	Perennial herb	Naturalized (Invasive alien)	53.33	0.30	4.5
Lithospermum arvense L.	Boraginaceae	Dicot	Annual herb	Naturalized (Invasive alien)	26.66	0.23	3.5
Capsella bursa pastoris Medic.	Brassicaceae	Dicot	Annual herb	Naturalized (Invasive alien)	80.00	2.74	41.1
Sisymbrium loesellii L.	Brassicaceae	Dicot	Annual herb	Naturalized (Invasive alien)	26.66	0.50	7.6
Cannabis sativa L.	Cannabiaceae	Dicot	Annual herb	Naturalized (Invasive alien)	6.66	0.20	3
Stellaria media Cyr.	Caryophyllaceae	Dicot	Annual herb	Naturalized (Invasive alien)	20.00	3.40	51
Chenopodium album L.	Chenopodiaceae	Dicot	Annual herb	Naturalized (Invasive alien)	6.66	0.13	2
Chenopodium foliolosum Aschers	Chenopodiaceae	Dicot	Perennial herb	Naturalized (Invasive alien)	13.33	0.20	3
Convolvulus arvensis L.	Convolvulaceae	Dicot	Perennial herb	Naturalized (Invasive alien)	33.33	0.10	1.6
Cyperus difformis L.	Cyperaceae	Monocot	Perennial herb	Naturalized (Invasive alien)	26.66	0.06	1
Cyperus rotundus L.	Cyperaceae	Monocot	Perennial herb	Naturalized (Invasive alien)	46.66	0.96	14.5
Euphorbia helioscopia L.	Euphorbiaceae	Dicot	Annual herb	Naturalized (Invasive alien)	6.66	0.06	1
Medicago polymorpha L.	Fabaceae	Dicot	Annual herb	Naturalized (Invasive alien)	7.00	0.06	1
Trifolium pratense L.	Fabaceae	Dicot	Perennial herb	Naturalized (Invasive alien)	56.66	1.33	20
Trifolium repens L.	Fabaceae	Dicot	Perennial herb	Naturalized (Invasive alien)	86.66	4.34	65.2
Iris ensata Thunb.	Iridaceae	Monocot	Perennial herb	Naturalized (Invasive alien)	6.66	0.13	2
Marrubium vulgare L.	Lamiaceae	Dicot	Perennial herb	Naturalized (Invasive alien)	20.00	0.15	2.3
Mentha longifolia L.	Lamiaceae	Dicot	Perennial herb	Naturalized (invasive alien)	9.66	0.06	1
Oenothera rosea Ait.	Onagraceae	Dicot	Perennial herb	Naturalized (Invasive alien)	13.33	0.20	3
Plantago lanceolata L.	Plantaginaceae	Dicot	Perennial herb	Naturalized (Invasive alien)	6.66	0.93	14
Plantago major L.	Plantaginaceae	Dicot	Perennial herb	Naturalized (Invasive alien)	6.66	0.20	3
Dactylis glomerata L.	Poaceae	Monocot	Annual herb	Naturalized (Invasive alien)	46.66	0.53	8
Poa annua L.	Poaceae	Monocot	Annual herb	Naturalized (Invasive alien)	6.66	0.46	7
Setaria viridis P. Beauv.	Poaceae	Monocot	Annual herb	Naturalized (Invasive alien)	73.33	0.82	12.4
Vulpia myuros Gmel.	Poaceae	Monocot	Annual herb	Naturalized (Invasive alien)	6.66	0.66	10
Sorghum halepense Pers.	Poaceae	Monocot	Perennial herb	Naturalized (Invasive alien)	13.33	0.06	1
Polygonum aviculare L.	Polygonaceae	Dicot	Annual herb	Naturalized (Invasive alien)	6.66	0.06	1
Polygonum hydropiper L.	Polygonaceae	Dicot	Annual herb	Naturalized (Invasive alien)	6.66	0.20	3
Anagalis arvensis L.	Primulaceae	Dicot	Annual herb	Naturalized (Invasive alien)	6.66	0.06	1
Anagalis arvensis L.	Primulaceae	Dicot	Annual herb	Naturalized (Invasive alien)	13.33	0.06	1

Ranunculus muricatus L.	Ranunculaceae	Dicot	Annual herb	Naturalized (Invasive alien)	66.66	0.20	3.1
Ranunculus laetus Wall.ex Hk. f. and T.	Ranunculaceae	Dicot	Perennial herb	Naturalized (Invasive alien)	12.00	0.40	6
Veronica persica Poir.	Scrophulariaceae	Dicot	Annual herb	Naturalized (Invasive alien)	53.33	4.37	65.6
Urtica dioica L.	Urticaceae	Dicot	Perennial herb	Naturalized (Invasive alien)	6.66	0.46	7
Bupleurum marginatum Wall. Ex Dc	Apiaceae	Dicot	Perennial herb	Native	6.66	0.20	3
Hedera nepalensis K. Koch	Araliaceae	Dicot	Climber	Native	6.66	0.20	3
Polygonatum multiflorum All.,	Asparagaceae	Monocot	Perennial herb	Native	13.33	0.46	7
Crepis kashmirica Babc.	Asteraceae	Dicot	Annual herb	Native	6.66	0.06	1
Myriactis nepalensis Less.	Asteraceae	Dicot	Annual herb	Native	6.66	0.13	2
Artemisia indica Wild.	Asteraceae	Dicot	Perennial herb	Native	6.66	0.06	1
Cirsium falconeri Petrak	Asteraceae	Dicot	Perennial herb	Native	13.33	0.13	2
Erigeron multiradiatus (Lindl. ex DC.) Benth. ex C.B. Clarke	Asteraceae	Dicot	Perennial herb	Native	13.33	0.06	1
Impatiens brachycentra Kar. & Kir.	Balsaminaceae	Dicot	Annual herb	Native	6.66	0.06	1
Impatiens glandulifera Royle	Balsaminaceae	Dicot	Annual herb	Native	20.00	0.73	11
Berberis lycium Royle	Berberidaceae	Dicot	Shrub	Native	13.33	0.06	1
Berberis pachyacantha Koehne	Berberidaceae	Dicot	Shrub	Native	6.66	0.06	1
Cynoglossum glochidiatum Wall. ex Benth.	Boraginaceae	Dicot	Biennial herb	Native	6.66	0.06	1
Myosotis sylvatica Ehrh. ex Hoffm.	Boraginaceae	Dicot	Perennial herb	Native	6.66	0.20	3
Drabopsis verna C. Koch	Brassicaceae	Dicot	Annual herb	Native	26.66	0.10	1.6
Sisymbrium officinale Scoop.	Brassicaceae	Dicot	Annual herb	Native	6.66	0.06	1
Asyneuma thomsonii Bornm	Campanulaceae	Dicot	Perennial herb	Native	6.66	0.13	2
Viburnum grandiflorum Wall. ex DC.	Caprifoliaceae	Dicot	Shrub	Native	46.66	0.53	8
Arenaria neelgerrensis Wight & Arn.	Caryophyllaceae	Dicot	Annual herb	Native	6.66	0.06	1
Cerastium cerastioides Britt.	Caryophyllaceae	Dicot	Perennial herb	Native	6.66	0.66	10
Silene vulgaris Garcke	Caryophyllaceae	Dicot	Perennial herb	Native	6.66	0.20	3
Fimbristylis squarrosa Vahl, Enum.	Cyperaceae	Monocot	Annual herb	Native	13.33	8.86	133
Carex fedia Nees	Cyperaceae	Monocot	Perennial herb	Native	6.66	0.40	6
Dioscorea deltoidea Wall. ex Kunth	Dioscoreaceae	Monocot	Perennial herb	Native	6.66	0.13	2
Dryopteris barbigera O.Kze	Dryopteridaceae	Pteridophyte	Perennial herb	Native	6.66	0.06	1
Vicia angustifolia L.	Fabaceae	Dicot	Annual herb	Native	13.33	0.06	1
Desmodium elegans DC.	Fabaceae	Dicot	Shrub	Native	6.66	0.06	1
Indigofera heterantha Wall. ex Brandis	Fabaceae	Dicot	Shrub	Native	20.00	0.22	3.3

Lespedeza elegans Camb	Fabaceae	Dicot	Subshrub	Native	6.66	0.20	3
Geranium nepalense Sweet	Geraniaceae	Dicot	Annual herb	Native	6.66	0.06	1
Geranium pusillum L.	Geraniaceae	Dicot	Annual herb	Native	6.66	0.06	1
Geranium pratense L.	Geraniaceae	Dicot	Perennial herb	Native	6.66	0.20	3
Geranium wallichianum D. Don. ex Sweet	Geraniaceae	Dicot	Perennial herb	Native	20.00	0.13	2
Ajuga parviflora Benth.	Lamiaceae	Dicot	Annual herb	Native	6.66	0.13	2
Salvia moocroftiana Wall. ex Benth.	Lamiaceae	Dicot	Perennial herb	Native	40.00	0.10	1.6
Thymus linearis Benth.	Lamiaceae	Dicot	Perennial herb	Native	20.00	0.73	11
Isodon rugosus Codd	Lamiaceae	Dicot	Shrub	Native	13.33	0.13	2
Tulipa stellata Hk.	Liliaceae	Monocot	Perennial herb	Native	26.66	0.11	1.7
Astragalus grahamianus Royle ex Benth.	Papilionaceae	Dicot	Shrub	Native	13.33	0.40	6
Abies pindrow Royle	Pinaceae	Gymnosperm	Tree	Native	6.66	0.06	1
Cedrus deodara G. Don	Pinaceae	Gymnosperm	Tree	Native	33.33	0.26	4
Picea smithiana Boiss.	Pinaceae	Gymnosperm	Tree	Native	26.66	0.11	1.7
Pinus wallichiana A.B. Jacks.	Pinaceae	Gymnosperm	Tree	Native	93.33	0.26	4
Digitaria cruciata (Nees ex Steud.) A.Camus	Poaceae	Monocot	Annual herb	Native	20.00	0.46	7
Poa bulbosa L.	Poaceae	Monocot	Annual herb	Native	20.00	0.50	7.6
Rostraria cristata (Linn.) Tzvelev	Poaceae	Monocot	Annual herb	Native	20.00	0.84	12.6
Setaria glauca P. Beauv.	Poaceae	Monocot	Annual herb	Native	6.66	0.46	7
Cynodon dactylon Pers.	Poaceae	Monocot	Perennial herb	Native	93.33	3.03	45.5
Oryzopsis munroi Stapf	Poaceae	Monocot	Perennial herb	Native	6.66	0.80	12
Poa sterilis M. Bieb.	Poaceae	Monocot	Perennial herb	Native	33.33	0.33	5
Stipa sibirica Lamk.	Poaceae	Monocot	Perennial herb	Native	6.66	1.13	17
Polygonum convolvulus L.	Polygonaceae	Dicot	Annual herb	Native	13.33	0.13	2
Polygonum kashmirianum	Polygonaceae	Dicot	Annual herb	Native	6.66	0.20	3
Polygonum lapathifolium L.	Polygonaceae	Dicot	Annual herb	Native	10.60	0.33	5
Rumex acetosella L.	Polygonaceae	Dicot	Annual herb	Native	6.66	0.13	2
Polygonum amplexicaule D. Don	Polygonaceae	Dicot	Perennial herb	Native	6.66	0.26	4
Rumex patientia L.	Polygonaceae	Dicot	Perennial herb	Native	33.33	0.20	3
Androsace rotundifolia Hardw.	Primulaceae	Dicot	Annual herb	Native	6.66	0.20	3
Ranunculus hirtellus Royle	Ranunculaceae	Dicot	Annual herb	Native	53.33	0.13	2

Thalictrum cultratum Wallich	Ranunculaceae	Dicot	Perennial herb	Native	73.33	1.06	16
Clematis grata Wall.	Ranunculaceae	Dicot	Perennial herb	Native	13.33	0.26	4
Cotoneaster aitchisonii C.K.Schneid.	Rosaceae	Dicot	Shrub	Native	26.66	0.08	1.2
Cotoneaster nummularioides Pojark.	Rosaceae	Dicot	Shrub	Native	20.00	0.13	2
Rosa macrophylla Lindl.	Rosaceae	Dicot	Shrub	Native	6.66	0.06	1
Rubus paniculatus Sm.	Rosaceae	Dicot	Shrub	Native	6.66	0.20	3
Galium asperuloides Edgew.	Rubiaceae	Dicot	Annual herb	Native	6.66	0.46	7
Veronica agrestis L.	Scrophulariaceae	Dicot	Annual herb	Native	13.33	0.06	1
Veronica minima K. Koch	Scrophulariaceae	Dicot	Annual herb	Native	6.66	0.06	1
Verbascum thapsus L.	Scrophulariaceae	Dicot	Biennial herb	Native	13.33	0.53	8
Verbena officinalis L.	Verbenaceae	Dicot	Perennial herb	Native	13.33	0.13	2
Viola odorata L.	Violaceae	Dicot	Perennial herb	Native	13.33	0.20	3
Myosotis micrantha auct. non Pall. ex Lehm.	Boraginaceae	Dicot	Annual herb	Naturalised alien	6.66	0.26	4
Scandix pecten-veneris L.	Apiaceae	Dicot	Annual herb	Naturalized alien	6.66	0.06	1
Torilis japonica (Houtt.) DC.	Apiaceae	Dicot	Annual herb	Naturalized alien	33.33	1.22	18.4
Carpesium abrotanoides L.	Asteraceae	Dicot	Annual herb	Naturalized alien	20.00	0.15	2.3
Filago arvensis L.	Asteraceae	Dicot	Annual herb	Naturalized alien	46.66	1.38	20.8
Cirsium wallichii DC.	Asteraceae	Dicot	Biennial herb	Naturalized alien	6.66	0.06	1
Artemisia absinthium L.	Asteraceae	Dicot	Perennial herb	Naturalized alien	20.00	0.86	13
Onopordum acanthium L.	Asteraceae	Dicot	Perennial herb	Naturalized alien	20.00	0.26	4
Coronopus didymus Sm.	Brassicaceae	Dicot	Annual herb	Naturalized alien	6.66	0.06	1
Malcolmia africana R. Br.	Brassicaceae	Dicot	Annual herb	Naturalized alien	6.56	0.13	2
Cerastium glomeratum Thuill.	Caryophyllaceae	Dicot	Annual herb	Naturalized alien	6.66	0.26	4
Chenopodium murale L.	Chenopodiaceae	Dicot	Perennial herb	Naturalized alien	20.00	0.80	12
Euphorbia prostrata Aiton	Euphorbiaceae	Dicot	Annual herb	Naturalized alien	6.66	0.06	1
Medicago sativa L.	Fabaceae	Dicot	Biennial herb	Naturalized alien	13.33	0.36	5.5
Lotus corniculatus L.	Fabaceae	Dicot	Perennial herb	Naturalized alien	7.66	0.53	8
Medicago lupulina L.	Fabaceae	Dicot	Perennial herb	Naturalized alien	6.66	0.13	2
Lespedeza cuneata G. Don	Fabaceae	Dicot	Shrub	Naturalized alien	13.33	0.20	3
Erodium cicutarium L'Herit. ex Ait	Geraniaceae	Dicot	Annual herb	Naturalized alien	33.33	0.08	1.2
Erodium cicutarium L'Herit. ex Ait	Geraniaceae	Dicot	Annual herb	Naturalized alien	6.66	1.93	29
Juglans regia L.	Juglandaceae	Dicot	Tree	Naturalized alien	6.66	0.06	1
Prunella vulgaris L.	Lamiaceae	Dicot	Annual herb	Naturalized alien	6.66	0.20	3
Clinopodium umbrosum C. Koch	Lamiaceae	Dicot	Perennial herb	Naturalized alien	6.66	0.46	7

Clinopodium vulgare L.	Lamiaceae	Dicot	Perennial herb	Naturalized alien	6.66	0.13	2
Malva neglecta Wall.	Malvaceae	Dicot	Biennial herb	Naturalized alien	4.66	0.20	3
Jasminum humile L.	Oleaceae	Dicot	Shrub	Naturalized alien	20.00	0.93	14
Oxalis corniculata L.	Fabaceae	Dicot	Perennial herb	Naturalized alien	13.33	0.166	2.5
Bromus japonicus Thumb.	Poaceae	Monocot	Annual herb	Naturalized alien	6.66	0.26	4
Eragrostis poaeoides P. Beauv.	Poaceae	Monocot	Annual herb	Naturalized alien	6.66	2.13	32
Hordeum murinum L.	Poaceae	Monocot	Annual herb	Naturalized alien	33.33	1.10	16.6
Arthraxon prionodes Dandy.	Poaceae	Monocot	Perennial herb	Naturalized alien	20.00	0.40	6
Elymus dahuricus Turcz. ex Griseb.	Poaceae	Monocot	Perennial herb	Naturalized alien	60.00	0.86	13
Poa angustata R.Br.	Poaceae	Monocot	Perennial herb	Naturalized alien	13.33	0.86	13
Poa angustifolia L.	Poaceae	Monocot	Perennial herb	Naturalized alien	33.33	1.40	21
Polypogon fugax Ness ex Steud.	Poaceae	Monocot	Perennial herb	Naturalized alien	46.66	0.93	14
Polygonum minus Huds.	Polygonaceae	Dicot	Annual herb	Naturalized alien	13.33	0.06	1
Rumex dentatus L.	Polygonaceae	Dicot	Perennial herb	Naturalized alien	13.33	0.13	2
Rumex nepalensis Spreng.	Polygonaceae	Dicot	Perennial herb	Naturalized alien	13.33	0.06	1
Ceratocephalus falcatus Pers.	Ranunculaceae	Dicot	Annual herb	Naturalized alien	40.00	0.18	2.7
Ranunculus sceleratus L.	Ranunculaceae	Dicot	Annual herb	Naturalized alien	13.33	0.13	2
Fragaria nubicola Lindel. ex Lacaita	Rosaceae	Dicot	Perennial herb	Naturalized alien	46.66	0.65	9.8
Geum urbanum L.	Rosaceae	Dicot	Perennial herb	Naturalized alien	6.66	0.40	6
Potentilla reptans L.	Rosaceae	Dicot	Perennial herb	Naturalized alien	20.00	0.08	1.3
Rosa brunonii Lindl.	Rosaceae	Dicot	Shrub	Naturalized alien	13.33	0.10	1.5
Galium aparine L.	Rubiaceae	Dicot	Annual herb	Naturalized Alien	6.66	0.20	3
Rubia cordifolia L.	Rubiaceae	Dicot	Climber	Naturalized alien	6.66	0.06	1
Galium palustre L.	Rubiaceae	Dicot	Perennial herb	Naturalized alien	6.66	0.13	2
Populus alba L.	Salicaceae	Dicot	Tree	Naturalized alien	53.33	0.60	9
Veronica beccabunga L.	Scrophulariaceae	Dicot	Perennial herb	Naturalized alien	6.66	0.86	13
Solanum nigrum L.	Solanaceae	Dicot	Annual herb	Naturalized alien	6.66	0.06	1

Plant name	Family	Life form	Habit	Plant group	Invasion status	Aboundance	Frequency %	Density
Chenopodium album L.	Amaranthaceae	Annual	Herb	Dicot	Causal	428	86.7	7.1
Beta vulgaris L.	Amaranthaceae	Perennial	Herb	Dicot	Cultivated	287	61.7	4.78
Amaranthus caudatus L.	Amaranthaceae	Annual	Herb	Dicot	Invasive	169	46.7	2.81
Taraxacum officinale (L.) Weber ex F.H.Wigg.	Asteraceae	Perennial	Herb	Dicots	Invasive	200	55.0	3.33
Arctium lappa L.	Asteraceae	Perennial	Herb	Dicot	Invasive	293	58.3	4.8
Bellis perennis L.	Asteraceae	Annual	Herb	Dicot	Invasive	319	65.0	5.316
Carpesium abrotanoides L	Asteraceae	Perennial	Herb	Dicot	Invasive	302	65.0	5.03
Centaurea iberica Trevir. ex Spreng.	Asteraceae	Perennial	Herb	Dicot	Invasive	285	68.3	4.75
Cotula anthemoides L.	Asteraceae	Perennial	Herb	Dicot	invasive	47	26.7	0.78
Lactuca sativa L.	Asteraceae	Perennial	Herb	Dicot	Invasive	98	50.0	1.63
Lithospermum arvense L.	Boraginaceae	Annual	Herb	Dicot	Native	406	45.0	6.76
Myosotis arvensis (L.) Hill	Boraginaceae	Perennial	Herb	Dicot	Native	212	53.3	3.5
Sisymbrium loeselii L.	Brassicaceae	Biennial	Herb	Dicots	Invasive	206	50.0	3.43
Impatiens glandulifera Royle	Bulsimaceae	Annual	Herb	Dicot	Invasive	129	53.3	2.15
Cannabis sativa L.	Cannabaceae	Perennial	Herb	Dicot	Causal	350	68.3	5.83
Cerastium cerastoides (L.) Britton	Caryophyllaceae	Annual	Herb	Dicots	Native	221	42.3	2.65
Stellaria media (L.) Vill.	Caryophyllaceae	Annual	Herb	Dicot	Native	150	50.0	4.78
Silene moorcroftiana Wall. ex Benth.	Caryophyllaceae	Annual	Herb	Dicot	Native	190	54.3	1.8
Convolvulus arvensis L.	Convolvulaceae	Perennial	Herb	Dicots	Invasive	254	63.3	4.35
Convolvulus falcatus L.	Convolvulaceae	Perennial	Herb	Dicot	Causal	296	54.5	7.58
Euphorbia helioscopia L.	Euphorbiaceae	Annual	Herb	Dicots	Invasive	234	65.3	3
Trifolium repens L.	Fabaceae	Perennial	Herb	Dicots	Causal	190	22.3	1.13
Vicia faba L.	Fabaceae	Annual	Herb	Dicots	Cultivated	54	48.4	4.08
Pisum sativum L.	Fabaceae	Annual	Herb	Dicots	Cultivated	98	44.3	6.38
Hypericum perfoliatum L.	Hypericaceae	Perennial	Herb	Dicot	Native	156	51.2	2.4
Iris domestica (L.) Goldblatt & Mabb	Iridaceae	Perennial	Herb	Monocot	Causal	200	48.3	10
Galium aparine L.	Lamiaceae	Annual	Herb	Dicot	Causal	167	43.3	5.76
Mentha arvensis L.	Lamiaceae	Perennial	Herb	Dicot	Causal	143	66.4	5.8
Mentha longifolia L.	Lamiaceae	Perennial	Herb	Dicots	Invasive	189	22.3	5.6
Plantago lanceolata L.	Plantigonaceae	Perennial	Herb	Dicots	Invasive	163	65.4	1.43
Digitaria cruciata (Nees) A.Camus	Poaceae	Annual	Herb	Monocots	Native	23	34.4	1.7
Seteria virdis L	Poaceae	Annual	Herb	Monocots	Native	65	65.3	1.26

Lolium perenne L.	Poaceae	Perennial	Herb	Monocots	Native	98	33.3	3.11
Cynodon dactylon (L.) Pers.	Poaceae	Perennial	Herb	Monocot	Native	113	23.6	4.5
Polygonum abbreviatum Kom.	Polygonaceae	Annual	Herb	Dicot	Invasive	231	12.4	3.6
Polygonum orientale L.	Polygonaceae	Annual	Herb	Dicot	Invasive	54	34.9	3
Polygonum aviculare L.	Polygonaceae	Annual	Herb	Dicot	Invasive	59	45.3	6.9
*Rumex napalensis*L.	Polygonaceae	perennial	Herb	Dicot	Native	56	55.6	11
Rumex acetosa L.	Polygonaceae	Perennial	Herb	Dicot	Native	123	23.8	9.2
Ranunculus abortivus L.	Ranunculaceae	Annual	Herb	Dicot	Invasive	229	19.5	3.4
Ceratocephala falcata (L.) Pers.	Ranunculaceae	Annual	Herb	Dicot	Invasive	98	56.4	8.2
Agrimonia eupatoria L.	Rosaceae	Perennial	Herb	Dicot	Causal	152	44.7	2.7
Potentilla reptans Georgi	Rosaceae	Perennial	Herb	Dicots	Invasive	76	45.6	2.1

Plants/m^2 (for herbs); Plants/$5m^2$ (for shrubs); Plants/$10m^2$ (for trees) , # No. of sampling units in which species occur/total sampling units, For herbs sampling unit is $1m^2$,For shrubs sampling unit is $5m^2$,For herbs sampling unit is $10m^2$

Plant species recorded from various mustard fields in Kashmir valley with different morphological and ecological attributes								
Plant name	**Family**	**Life form**	**Habit**	**Plant group**	**Invasion status**	**Aboundance**	**Frequency %**	**Density**
Chenopodium album L.	Amaranthaceae	Annual	Herb	Dicot	Causal	428	86.7	7.1
Beta vulgaris L.	Amaranthaceae	Perennial	Herb	Dicot	Cultivated	287	61.7	4.78
Amaranthus caudatus L.	Amaranthaceae	Annual	Herb	Dicot	Invasive	169	46.7	2.81
Taraxacum officinale (L.) Weber ex F.H.Wigg.	Asteraceae	Perennial	Herb	Dicots	Invasive	200	55.0	3.33
Arctium lappa L.	Asteraceae	Perennial	Herb	Dicot	Invasive	293	58.3	4.8
Bellis perennis L.	Asteraceae	Annual	Herb	Dicot	Invasive	319	65.0	5.316
Carpesium abrotanoides L	Asteraceae	Perennial	Herb	Dicot	Invasive	302	65.0	5.03
Centaurea iberica Trevir. ex Spreng.	Asteraceae	Perennial	Herb	Dicot	Invasive	285	68.3	4.75
Cotula anthemoides L.	Asteraceae	Perennial	Herb	Dicot	invasive	47	26.7	0.78
Lactuca sativa L.	Asteraceae	Perennial	Herb	Dicot	Invasive	98	50.0	1.63
Lithospermum arvense L.	Boraginaceae	Annual	Herb	Dicot	Native	406	45.0	6.76
Myosotis arvensis (L.) Hill	Boraginaceae	Perennial	Herb	Dicot	Native	212	53.3	3.5
Sisymbrium loeselii L.	Brassicaceae	Biennial	Herb	Dicots	Invasive	206	50.0	3.43
Impatiens glandulifera Royle	Bulsimaceae	Annual	Herb	Dicot	Invasive	129	53.3	2.15
Cannabis sativa L.	Cannabaceae	Perennial	Herb	Dicot	Causal	350	68.3	5.83
Cerastium cerastoides (L.) Britton	Caryophyllaceae	Annual	Herb	Dicots	Native	221	42.3	2.65
Stellaria media (L.) Vill.	Caryophyllaceae	Annual	Herb	Dicot	Native	150	50.0	4.78
Silene moorcroftiana Wall. ex Benth.	Caryophyllaceae	Annual	Herb	Dicot	Native	190	54.3	1.8

Convolvulus arvensis L.	Convolvulaceae	Perennial	Herb	Dicots	Invasive	254	63.3	4.35
Convolvulus falcatus L.	Convolvulaceae	Perennial	Herb	Dicot	Causal	296	54.5	7.58
Euphorbia helioscopia L.	Euphorbiaceae	Annual	Herb	Dicots	Invasive	234	65.3	3
Trifolium repens L.	Fabaceae	Perennial	Herb	Dicots	Causal	190	22.3	1.13
Vicia faba L.	Fabaceae	Annual	Herb	Dicots	Cultivated	54	48.4	4.08
Pisum sativum L.	Fabaceae	Annual	Herb	Dicots	Cultivated	98	44.3	6.38
Hypericum perfoliatum L.	Hypericaceae	Perennial	Herb	Dicot	Native	156	51.2	2.4
*Iris domestica (*L.) Goldblatt & Mabb	Iridaceae	Perennial	Herb	Monocot	Causal	200	48.3	10
Galium aparine L.	Lamiaceae	Annual	Herb	Dicot	Causal	167	43.3	5.76
Mentha arvensis L.	Lamiaceae	Perennial	Herb	Dicot	Causal	143	66.4	5.8
Mentha longifolia L.	Lamiaceae	Perennial	Herb	Dicots	Invasive	189	22.3	5.6
Plantago lanceolata L.	Plantigonaceae	Perennial	Herb	Dicots	Invasive	163	65.4	1.43
Digitaria cruciata (Nees) A.Camus	Poaceae	Annual	Herb	Monocots	Native	23	34.4	1.7
Seteria virdis L	Poaceae	Annual	Herb	Monocots	Native	65	65.3	1.26
Lolium perenne L.	Poaceae	Perennial	Herb	Monocots	Native	98	33.3	3.11
Cynodon dactylon (L.) Pers.	Poaceae	Perennial	Herb	Monocot	Native	113	23.6	4.5
Polygonum abbreviatum Kom.	Polygonaceae	Annual	Herb	Dicot	Invasive	231	12.4	3.6
Polygonum orientale L.	Polygonaceae	Annual	Herb	Dicot	Invasive	54	34.9	3
Polygonum aviculare L.	Polygonaceae	Annual	Herb	Dicot	Invasive	59	45.3	6.9
*Rumex napalensis*L.	Polygonaceae	perennial	Herb	Dicot	Native	56	55.6	11
Rumex acetosa L.	Polygonaceae	Perennial	Herb	Dicot	Native	123	23.8	9.2
Ranunculus abortivus L.	Ranunculaceae	Annual	Herb	Dicot	Invasive	229	19.5	3.4
Ceratocephala falcata (L.) Pers.	Ranunculaceae	Annual	Herb	Dicot	Invasive	98	56.4	8.2
Agrimonia eupatoria L.	Rosaceae	Perennial	Herb	Dicot	Causal	152	44.7	2.7
Potentilla reptans Georgi	Rosaceae	Perennial	Herb	Dicots	Invasive	76	45.6	2.1

Botanical name	***Family***	***Life form***	***Growth form***
Abrus precatorius L.	Malvaceae	Perennial	Climber
Abutilon bidentatum Hochst. ex A.Rich	Malvaceae	Perannial	Shrub
Abutilon hirsutum (Vell.) K.Schum.	Malvaceae	Perennial	Shrub
Abutilon indicum (L.) Sweet	Malvaceae	Perennial	Shrub
Abutilon ramosum A.St.-Hil.	Malvaceae	Perennial	Shrub
Acacia auriculiformis A.Cunn. ex Benth.	Mimosaceae	Perennial	Tree

Acacia catechu (L.f.) Willd.	Mimosaceae	Perennial	Tree
Acacia farnesiana (L.) Willd	Mimosaceae	Perennial	Tree
Acacia modesta Wall.	Mimosaceae	Perennial	Tree
Acacia nilotica (L.) Delile	Mimosaceae	Perennial	Tree
Achyranthes aspera L.	Amaranthaceae	Perennial	Herb
Achyranthes tomentosa L.	Amaranthaceae	Perennial	Herb
Aegle marmelos (L.) Corrêa	Rutaceae	Perennial	Tree
Ageratum conyzoides Sieber ex Sieber ex Steudel	Asteraceae	Annual	Herb
Albizzia lebbeck (L.) Benth	Mimosaceae	Perennial	Tree
Allium rubellum C.Presl	Amarylidaceae	Perennial	Herb
Alstonia scholaris (L.) R. Br.	Apocynaceae	Perennial	Tree
Amaranthus spinosus L.	Amaranthaceae	Annual	Herb
Amaranthus viridis L.	Amaranthaceae	Annual	Herb
Anagalis arvensis L.	Primulaceae	Annual	Herb
Anthemis cotula L.	Asteraceae	Annual	Herb
Arabidopsis thaliana (L.) Heynh.	Brassicaceae	Annual	Herb
Argemone mexicana L.	Papaveraceae	Annual	Herb
Artemisia scoparia Waldst. & Kitam.	Asteraceae	Perennial	Herb
Arundo donax L.	Poaceae	Perennial	Herb
Asparagus spp.	Liliaceae	Annual	Herb
Azadirachta indica A.Juss.	Meliaceae	Perennial	Tree
Bombax ceiba L.	Bombaceae	Perennial	Tree
Barleria cristata L.	Acanthaceae	Perennial	Shrub
Bauhinia variegata L.	Caesalpinaceae	Perennial	Tree
Bidens bipinnata L.	Asteraceae	Perennial	Herb
Blumea lacera (Burm.f.) DC.	Asteraceae	Annual	Herb
Boerhavia diffusa	Nyctaginaceae	Annual	Herb
Borreria stricta L.	Rubiaceae	Annual	Herb
Bougainvillea spectabilis	Bignoniaceae	Perennial	Shrub
Butea monosperma Wild.	Paplionaceae	Perennial	Tree
Calendula arvensis M.Bieb.	Asteraceae	Annual	Herb
Caloropis procera (Aiton) W.T.Aiton	Asclepidaceae	Annual	Shrub
Cannabis sativa L.	Cannabaceae	Annual	Herb
Capparis sepiaria L.	Capparidaceae	Perennial	Shrub
Carissa tomentosa A.Rich.	Apocynaceae	Annual	Herb
Carthamus oxycantha M.Bieb.	Asteraceae	Annual	Herb
Cassia fistula L.	Caesalpinaceae	Perennial	Tree
Cassia glauca Lam.	Caesalpinaceae	Perennial	Tree
Cassia occidentalis L.	Caesalpinaceae	Annual	Herb
Cassia tora L.B.Sm. & B.G.Schub.	Caesalpinaceae	Annual	Herb
Centella asiatica (L.) Urb.	Apiaceae	Annual	Herb

Chrysanthemum accuminatum	Apiaceae	Annual	Herb
Clematis gouriana Roxb.	Ranunculaceae	Annual	Herb
Clematis graveolens Roxb.	Ranunculaceae	Annual	Herb
Cleome gynandra L.	Capparidaceae	Annual	Herb
Cleome viscosa L.	Capparidaceae	Annual	Herb
Coccinia grandis Voigt.	Cucurbitaceae	Annual	Climber
Colebrookea oppositofolia Sm.	Lamiaceae	Perennial	Shrub
Commelina benghalensis L.	Commelinaceae	Annual	Herb
Convolvulus glomeratus Choisy	Convolulaceae	Biannual/Perennial	Herb
Cordia dichotoma G. Forst.	Boraginaceae	Annual	Tree
Crotolaria juncea L.	Fabaceae	Perennial	Shrub
Crotolaria prostrate Wild.	Fabaceae	Perennial	Herb
Cucumis melo L.	Cucurbitaceae	Annual	Herb
Cuscuta reflexa Roxb.	Cuscutaceae	Perennial	Herb
Cyanoglossum lanceolatum Forssk.	Boraginaceae	Biannual	Herb
Cyathocline purpurea (Buch.-Ham. ex D.Don) Kuntze	Asteraceae	Annual	Herb
Cymbopogon Stracheyi (Hook.f.) Raizada & S.K.Jain	Poaceae	Perennial	Herb
Cynodon dactylon Pers.	Poaceae	Perennial	Herb
Cyperus niveus Retz.	Cypetaceae	Perennial	Herb
Cyperus rotundifolia L.	Cyperaceae	Perennial	Herb
Dalbergia sissoo Roxb.	Fabaceae	Perennial	Tree
Datura innoxia Mill.	Solanaceae	Annual	Herb
Datura metal L.	Solanaceae	Annual	Herb
Deeringia amaranthoides Merr.	Amaranthaceae	Annual	Shrub
Dendrocalamus strictus Bl.	Poaceae	Perennial	Herb
Dendrophthoe falcata Ettings.	Loranthaceae	Annual	Epiphyte
Desmodium gangeticum DC.	Fabaceae	Perennial	Herb
Desmodium triflorum DC.	Fabaceae	Perennial	Herb
Desmodium heterocarpon DC.	Fabaceae	Perennial	Herb
Dicliptera bupleuroides Nees	Acanthaceae	Perennial	Herb
Digera muricata (L.) Mart.	Amaranthaceae	Annual	Herb
Dioscorea bulbifera L.	Dioscoeaceae	Perennial	Herb
Diospyros lotus L.	Ebenaceae	Perennial	Tree
Dodonoea viscosa (L.) Jacq.	Sapindaceae	Perennial	Shrub
Dichanthium annulatum (Forssk.) Stapf	Poaceae	Annual	Herb
Eclipta prostrata L.	Asteraceae	Annual	Herb
Ehretia laevis Roxb.	Ehretieceae	Perennial	Tree
Epilobium sp.	Onagraceae	Annual	Herb
Eremostachys superba Royle.	Lamiaceae	Annual	Herb
Eucalyptus lanceolatus	Myrtaceae	Perennial	Tree
Euphorbia helioscopia	Euphorbiaceae	Annual	Herb

Euphorbia hirta L.	Euphorbiaceae	Annual	Herb
Euphorbia indica	Euphorbiaceae	Annual	Herb
Euphorbia prostrate	Euphorbiaceae	Annual	Herb
Evolvulus alsinoides	Convolvulaceae	Annual	Herb
Ficus auriculata Lour.	Moraceae	Perennial	Tree
Ficus benbhalensis L.	Moraceae	Perennial	Tree
Ficus hispida L.	Moraceae	Perennial	Tree
Ficus palmata Forssk.	Moraceae	Perennial	Tree
Ficus racemosa L.	Moraceae	Perennial	Tree
Ficus religiosa L.	Moraceae	Perennial	Tree
Foeniculum vulgare	Apiaceae	Annual	Herb
Fumaria indica	Fumariaceae	Annual	Herb
Galium aparine L.	Rubiaceae	Annual	Herb
Galium rotundifolium L.	Rubiaceae	Annual	Herb
Gloriosa superba	Asteraceae	Annual	Herb
Gnaphalium leuteoalbum L.	Asteraceae	Annual	Herb
Gomphrena celosioides	Amaranthaceae	Annual	Herb
Grewia optiva J.R.Drum.	Tiliaceae	Perennial	Tree
Grewia tenax Fiori.	Tiliaceae	Perennial	Tree
Heteropogon controtus	Poaceae	Annual	Herb
Indigofera cordifolia	Fabaceae	Perennial	Herb
Indigofera tinctora	Fabaceae	Perennial	Herb
Inula cappa	Asteraceae	Annual	Herb
Ipomoea carnae	Convolvulaceae	Annual	Climber
Ipomoea carica	Convolvulaceae	Annual	Climber
Ipomoea muricata Jacq.	Convolvulaceae	Annual	Climber
Ipomoea purpurea	Convolvulaceae	Annual	Climber
Jasminium auriculatum Wall.	Oleaceae	Annual	Shrub
Justicia adhotoda	Acanthaceae	Perennial	Shrub
Kigella pinnata	Bignoniaceae	Perennial	Tree
Kydia calycina Roxb.	Malvaceae	Perennial	Tree
Lannea coromandelica Merr.	Anacaediaceae	Perennial	Tree
Lantana camara var. aculeata Mold.	Verbanaceae	Perennial	Shrub
Leucaena leucocephala	Mimosaceae	Perennial	Tree
Linderbergia indica Vatke.	Scrophulariaceae	Annual	Herb
Luffa acutangula Roxb.	Cucurbitaceae	Annual	Climber
Mazus japonicas	Scrophulariaceae	Annual	Herb
Mallotus philippensis Muell-Arg.	Euphorbiaceae	Perennial	Tree
Malva parviflora	Malvaceae	Annual	Herb
Malvastrum coromandelianum	Malvaceae	Annual	Herb

5Mangifera indica	Anacardiaceae	Perennial	Tree
Medicago lupulina	Fabaceae	Annual	Herb
Melia azedarach L.	Meliaceae	Perennial	Tree
Melilotus alba	Fabaceae	Annual	Herb
Mentha spicata	Lamiaceae	Annual	Herb
Micromeria biflora Bth.	Lamiaceae	Annual	Herb
Momordica charantia	Cucurbitaceae	Annual	Climber
Mimosa rubicaulis	Mimosaceae	Perennial	Shrub
Moringa oleifera Lamk.	Moringaceae	Perennial	Tree
Morus alba	Moraceae	Perennial	Tree
Murraya koenigii Spreng.	Rutaceae	Perennial	Tree
Nepeta gracilifera	Lamiaceae	Annual	Herb
Nepeta laevigata	Lamiaceae	Annual	Herb
Nerium indicum	Apocynaceae	Perennial	Shrub
Ocimum americanum L.	Lamiaceae	Annual	Herb
Olea cuspidate	Oleaceae	Perennial	Tree
Opuntia vulgaris Mill.	Cactaceae	Perennial	Shrub
Oroxylum indicum	Bignoniaceae	Perennial	Tree
Oxalis corniculata	Oxalidaceae	Annual	Herb
Parthenium hysterophorus L.	Asteraceae	Annual	Herb
Pergularia extensa	Asclepiadaceae	Annual	Herb
Phoenix sylvestris	Arecaceae	Perennial	Tree
Poa annua L.	Poaceae	Annual	Herb
Phyllanthus emblica L.	Euphorbiaceae	Perennial	Tree
Pinus roxburghii Sarg.	Pinaceae	Perennial	Tree
Plantago lanceolate	Plantaginaceae	Annual	Herb
Pyrus pashia Buch, & Ham.	Rosaceae	Perennial	Tree
Randia tetrasperma Roxb.	Rubiaceae	Perennial	Shrub
Ranunculus arvensis	Ranunculaceae	Annual	Herb
Rauwolfia serpentine	Apocynaceae	Annual	Herb
Reinwardtia indica	Linaceae	Perennial	Shrub
Ricinis communis L.	Euphorbiaceae	Perennial	Shrub
Rosa multiflora	Rosaceae	Perennial	Shrub
Rubus ellipticus	Rosaceae	Perennial	Shrub
Rumex hestatus	Polygonaceae	Annual	Herb
Saccharum spontaneum	Poaceae	Perennial	Herb
Sagittaria sagittifolia	Poaceae	Annual	Herb
Salvia lanata	Lamiaceae	Annual	Herb
Setaria glauca	Poaceae	Annual	Herb
Sida alba	Malvaceae	Annual	Herb
Salanum surratense	Solanaceae	Annual	Herb

Solanum nigrum	Solanaceae	Annual	Herb
Sonchus arvensis	Asteraceae	Annual	Herb
Sonchus oleraceus	Asteraceae	Annual	Herb
Sonchus asper	Asteraceae	Annual	Herb
Stellaria media	Caryophyllaceae	Annual	Herb
Syzygium cumini	Myrtaceae	Perennial	Tree
Taraxacum officinale	Asteraceae	Perennial	Herb
Terminalia chebula	Combretaceae	Perennial	Tree
Tinospora cordifolia	Menispermaceae	Perennial	Climber
Tridax procumbens	Asteraceae	Annual	Herb
Tridesma indicum	Boraginaceae	Annual	Herb
Verbascum Thapsus	Scrophulariaceae	Annual	Herb
Vicia faba	Fabaceae	Annual	Shrub
Vitex negundo	Lamiaceae	Perennial	Shrub
Xanthium strumarium	Asteraceae	Annual	Herb

The forest areas of Jammu region were also surveyed. From Mahamaya area which include dry mixed deciduous forest and Scrub forest area, 262 plant species were recorded. The recorded species are depicted in Table below:

Botanical name	**Family**	**Life form**	**Growth form**
Abrus precatorius L.	Malvaceae	Perennial	Climber
Abutilon bidentatum Hochst.ex A.Rich	Malvaceae	Perannial	Shrub
Abutilon hirsutum (vell.) K.Schum	Malvaceae	Perennial	Shrub
Abutilon indicum (L.) Sweet	Malvaceae	Perennial	Shrub
Abutilon ramosum (Cav.) Guill. & Perr.	Malvaceae	Perennial	Shrub
Acacia auriculiformis Benth.	Mimosaceae	Perennial	Tree
Acacia catechu (L.f.) Willd.	Mimosaceae	Perennial	Tree
Acacia farnesiana (L.) Willd.	Mimosaceae	Perennial	Tree
Acacia modesta Wall	Mimosaceae	Perennial	Tree
Acacia nilotica (L.) Delile	Mimosaceae	Perennial	Tree
Achyranthes aspera L.	Amaranthaceae	Perennial	Herb
Cyathula tomentosa (Roth)	Amaranthaceae	Perennial	Herb
Aegle marmelos (L.) Correa	Rutaceae	Perennial	Tree
Ageratum conyzoides (L.) L.	Asteraceae	Annual	Herb
Albizzia berteriana (DC.) Fawc.	Mimosaceae	Perennial	Tree
Allium rubellum M.Bieb.	Amarylidaceae	Perennial	Herb
Alstonia scholaris (L.) R. Br.	Apocynaceae	Perennial	Tree
Amaranthus spinosus L.	Amaranthaceae	Annual	Herb
Amaranthus viridis L.	Amaranthaceae	Annual	Herb

*Lysimachia arvensis (*L.) U.Manns & Anderb.	Primulaceae	Annual	Herb
Anthemis cotula L.	Asteraceae	Annual	Herb
Arabidopsis thaliana (L.) Heynh.	Brassicaceae	Annual	Herb
Argemone mexicana L.	Papaveraceae	Annual	Herb
Artemisia scoparia Waldst. &Kitam	Asteraceae	Perennial	Herb
Phragmites australis (Cav.) Trin. ex Steud.	Poaceae	Perennial	Herb
Asparagus flagellaris (Kunth) Baker	Liliaceae	Annual	Herb
Azadirachta indica A.Juss	Meliaceae	Perennial	Tree
Bombax ceiba L.	Bombaceae	Perennial	Tree
Barleria cristata L.	Acanthaceae	Perennial	Shrub
Bauhinia variegate L.	Caesalpinaceae	Perennial	Tree
Bidens bipinnata L.	Asteraceae	Perennial	Herb
Blumea lacera (Burm.f) DC.	Asteraceae	Annual	Herb
Boerhavia diffusa L.	Nyctaginaceae	Annual	Herb
Spermacoce verticillata L.	Rubiaceae	Annual	Herb
Bougainvillea spectabilis Willd.	Bignoniaceae	Perennial	Shrub
Butea monosperma (Lam.) Taub.	Paplionaceae	Perennial	Tree
Calendula arvensis M.Bieb.	Asteraceae	Annual	Herb
	Apocynaceae	Annual	Shrub
Cannabis sativa L.	Cannabaceae	Annual	Herb
Capparis umbonata Lindl.	Capparaceae	Perennial	Shrub
Carissa spinarum L.	Apocynaceae	Annual	Herb
Carthamus carduncellus L.	Asteraceae	Annual	Herb
Cassia fistula L.	Caesalpinaceae	Perennial	Tree
Senna sulfurea (Collad.) H.S.Irwin &Barneby	Caesalpinaceae	Perennial	Tree
Senna occidentalis (L.) Link	Caesalpinaceae	Annual	Herb
Senna obtusifolia (L.) H.S.Irwin & Barneby	Caesalpinaceae	Annual	Herb
Centella asiatica (L.) Urb.	Apiaceae	Annual	Herb
Chrysanthemum abolinii (Kovalevsk.) H. Ohashi & Yonek.	Apiaceae	Annual	Herb
Clematis gouriana Roxb.ex DC.	Ranunculaceae	Annual	Herb
Clematis graveolens Lindl.	Ranunculaceae	Annual	Herb
		Annual	Herb
		Annual	Herb
Coccinia grandis (L.) Voigt.	Cucurbitaceae	Annual	Climber
Colebrookea oppositofolia Sm.	Lamiaceae	Perennial	Shrub
Commelina Africana L.	Commelinaceae	Annual	Herb
Convolvulus glomeratus Choisy	Convolulaceae	Biannual/Perennial	Herb

Cordia dichotoma G.Forst.	Boraginaceae	Annual	Tree
Crotalaria juncea L.	Fabaceae	Perennial	Shrub
*Crotolaria stipularia var. prostrate (*Chodat & Hassl.) Hassl.	Fabaceae	Perennial	Herb
Cucumis melo L.	Cucurbitaceae	Annual	Herb
Cuscuta reflexa Roxb.	Convolvulaceae	Perennial	Herb
Cyanoglossum lanceolatum Forssk.	Boraginaceae	Biannual	Herb
Cyathocline purpurea (Buch-Ham. ex D.Don) Kuntze	Asteraceae	Annual	Herb
Cymbopogon pospischilii (K.Schum.) C.E.Hubb.	Poaceae	Perennial	Herb
Cynodon dactylon (L.) Pers.	Poaceae	Perennial	Herb
Cyperus niveus Retz.	Cyperaceae	Perennial	Herb
Pycreus aethiops (Welw.ex Ridl.) C.B.Clarke	Cyperaceae	Perennial	Herb
Dalbergia sissoo DC.	Fabaceae	Perennial	Tree
Datura innoxia Mill.	Solanaceae	Annual	Herb
Datura metal L.	Solanaceae	Annual	Herb
Deeringia amaranthoides (Lam.) Merr.	Amaranthaceae	Annual	Shrub
*Dendrocalamus strictus (*Roxb.) Nees	Poaceae	Perennial	Herb
Dendrophthoe falcata (L.f.) Ettingsh.	Loranthaceae	Annual	Epiphyte
Desmodium gangeticum (L.) DC.	Fabaceae	Perennial	Herb
Desmodium triflorum (L.) DC.	Fabaceae	Perennial	Herb
Desmodium heterocarpon (L.) DC.	Fabaceae	Perennial	Herb
Dicliptera bupleuroides Nees	Acanthaceae	Annual	Herb
Digera muricata (L.) Mart.	Amaranthaceae	Annual	Herb
Dioscorea bulbifera L.	Dioscoeaceae	Perennial	Herb
Diospyros abyssinica (Hiern) F.White	Ebenaceae	Perennial	Tree
Dodonaea viscosa (L.) Jacq.	Sapindaceae	Perennial	Shrub
Dichanthium annulatum (Forssk.) Stapf	Poaceae	Annual	Herb
Eclipta prostrata (L.) L.	Asteraceae	Annual	Herb
Ehretia laevis Roxb.	Ehretieceae	Perennial	Tree
Epilobium spp.	Onagraceae	Annual	Herb
Phloloides superba (Royle ex Benth.) Kamelin & Makhm.	Lamiaceae	Annual	Herb
Eucalyptus abdita Brooker & Hopper	Myrtaceae	Perennial	Tree
Euphorbia helioscopia L.	Euphorbiaceae	Annual	Herb
Euphorbia hirta L.	Euphorbiaceae	Annual	Herb
Euphorbia indica Lam.	Euphorbiaceae	Annual	Herb
Euphorbia Chamaesyce L.	Euphorbiaceae	Annual	Herb
Evolvulus alsinoides (L.) L.	Convolvulaceae	Annual	Herb
Ficus auriculata Lour.	Moraceae	Perennial	Tree

Ficus benghalensis L.	Moraceae	Perennial	Tree
Ficus hispida L.f.	Moraceae	Perennial	Tree
Ficus palmata Forssk.	Moraceae	Perennial	Tree
Ficus racemosa L.	Moraceae	Perennial	Tree
Ficus religiosa L.	Moraceae	Perennial	Tree
Foeniculum vulgare Mill.	Apiaceae	Annual	Herb
Fumaria indica (Hausskn.)	Fumariaceae	Annual	Herb
Galium aparine L.	Rubiaceae	Annual	Herb
Galium rotundifolium L.	Rubiaceae	Annual	Herb
Gloriosa superba L	Colchicaceae	Annual	Herb
Gomphrena celosioides Mart.	Amaranthaceae	Annual	Herb
Grewia optiva J.R.Drum. J.R. Drumm.ex Burret	Malvaceae	Perennial	Tree
Grewia tenax (Forssk.) Fiori.	Tiliaceae	Perennial	Tree
Heteropogon controtus (L.) P.Beauv.ex Roem. & Schult.	Poaceae	Annual	Herb
Indigofera cordifolia Roth	Fabaceae	Perennial	Herb
Indigofera suffruticosa Mill.	Fabaceae	Perennial	Herb
Inula cappa (Buch.- Ham. ex D.Don)	Asteraceae	Annual	Herb
Ipomoea carnae Jacq.	Convolvulaceae	Annual	Climber
Ipomoea cairica (L.) Sweet	Convolvulaceae	Annual	Climber
Ipomoea muricata (L.) *Jacq.*	Convolvulaceae		
Ipomoea purpurea (L.) Roth	Convolvulaceae		
Jasminum auriculatum Vahl	Oleaceae		
Justicia adhotoda L.	Acanthaceae	Perennial	Shrub
Kigelia Africana (Lam.) Benth.	Bignoniaceae	Perennial	Tree
Kydia calycina Roxb.	Malvaceae	Perennial	Tree
Lannea coromandelica (Houtt.) Merr.	Anacardiaceae	Perennial	Tree
Lantana camara L.	Verbanaceae	Perennial	Shrub
Leucaena leucocephala (Lam.) de Wit	Mimosaceae	Perennial	Tree
Lindenbergia indica Vatke.	Scrophulariaceae	Annual	Herb
Luffa acutangula (L.) Roxb.	Cucurbitaceae	Annual	Climber
Mazus pumilus (Burm.f)	Scrophulariaceae	Annual	Herb
*Mallotus philippensis (*Lam.) Mull.Arg.	Euphorbiaceae	Perennial	Tree
Malva parviflora L.	Malvaceae	Annual	Herb
*Malvastrum coromandelianum (*L.) Garcke	Malvaceae	Annual	Herb
Mangifera indica L.	Anacardiaceae	Perennial	Tree
Medicago lupulina L.	Fabaceae	Annual	Herb
Melia azedarach L.	Meliaceae	erennial	Tree

Melilotus officinalis subsp. alba (Medik) H. Ohashi & Tateishi	Fabaceae	Annual	Herb
Mentha spicata L.	Lamiaceae	Annual	Herb
Micromeria biflora (Buch-Ham.ex D.Don) Benth.	Lamiaceae	Annual	Herb
Momordica charantia L.	Cucurbitaceae	Annual	Climber
Mimosa rubicaulis Lam.	Mimosaceae	Perennial	Shrub
Moringa oleifera Lam.	Moringaceae	Perennial	Tree
Morus alba L.	Moraceae	Perennial	Tree
Murraya koenigii (L.) Spreng.	Rutaceae	Perennial	Tree
Nepeta gracilifera Benth.	Lamiaceae	Annual	Herb
Nepeta laevigata (D.Don) Hand.-Mazz.	Lamiaceae	Annual	Herb
Nerium oleander L.	Apocynaceae	Perennial	Shrub
Ocimum americanum L.	Lamiaceae	Annual	Herb
Olea europaea L.	Oleaceae	Perennial	Tree
Opuntia ficus-indica (L.) Mill	Cactaceae	Perennial	Shrub
Oroxylum indicum (L.) Kurz	Bignoniaceae	Perennial	Tree
Oxalis corniculata L.	Oxalidaceae	Annual	Herb
Parthenium hysterophorus L.	Asteraceae	Annual	Herb
Pergularia daemia (Forssk.) Chiov.	Apocynaceae	Annual	Herb
Phoenix sylvestris (L.) Roxb.	Arecaceae	Perennial	Tree
Poa annua L.	Poaceae	Annual	Herb
Phyllanthus emblica L.	Phyllanthaceae	Perennial	Tree
Pinus roxburghii Sarg.	Pinaceae	Perennial	Tree
Plantago lanceolat L.	Plantaginaceae	Annual	Herb
Pyrus pashia Buch, & Ham.ex D.Don	Rosaceae	Perennial	Tree
Himalrandia tetrasperma (Wall.ex Roxb.) T.Yamaz.	Rubiaceae	Perennial	Shrub
Ranunculus arvensis L.	Ranunculaceae	Annual	Herb
Rauwolfia serpentine (L.) Benth.ex Kurz	Apocynaceae	Annual	Herb
Reinwardtia indica Dumort.	Linaceae	Perennial	Shrub
Ricinus communis L.	Euphorbiaceae	Perennial	Shrub
Rosa multiflora Buch.-Ham.ex Hook.f	Rosaceae	Perennial	Shrub
Rubus ellipticus Sm.	Rosaceae	Perennial	Shrub
Rumex hastatus D.Don	Polygonaceae	Annual	Herb
Saccharum spontaneum L.	Poaceae	Perennial	Herb
Sagittaria trifolia L.	Poaceae	Annual	Herb
Salvia aethiopsis L.	Lamiaceae	Annual	Herb
Pennisetum glaucum (L.) R.Br.	Poaceae	Annual	Herb
Sida spinosa L.	Malvaceae	Annual	Herb

Salanum surratense Burm.f	Solanaceae	Annual	Herb
Solanum americanum Mill.	Solanaceae	Annual	Herb
Sonchus arvensis L.	Asteraceae	Annual	Herb
Sonchus oleraceus (L.) L.	Asteraceae	Annual	Herb
Sonchus asper (L.) Hill	Asteraceae	Annual	Herb
Stellaria media (L.) Vill.	Caryophyllaceae	Annual	Herb
Syzygium cumini (L.) Skeels	Myrtaceae	Perennial	Tree
Taraxacum campylodes G.E.Haglund	Asteraceae	Perennial	Herb
Terminalia chebula Retz.	Combretaceae	Perennial	Tree
Tinospora sinensis (Lour.) Merr.	Menispermaceae	Perennial	Climber
Toona ciliata M.Roem	Meliaceae	Perennial	Tree
Tridax procumbens (L.) L.	Asteraceae	Annual	Herb
Tridesma indicum	Boraginaceae	Annual	Herb
Verbascum Thapsus L.	Scrophulariaceae	Annual	Herb
Vicia faba L.	Fabaceae	Annual	Shrub
Vitex negundo L.	Lamiaceae	Perennial	Shrub
Xanthium strumarium L.	Asteraceae	Annual	Herb

annexure-2B

LIST OF INVASIVE PLANTS OF HIMACHAL PRADESH

S.No.	Name	Family	Nativity	Taxonomic Group	Taxonomic Sub-Group	Life Form	Habit	Habitat	Mode Of Intro
1.	*Acanthospermum hispidum*DC.	Asteraceae	Brazil	AN	D	H	A	W	Ui
2.	*Ageratina adenophora* (Spreng.) R.M.King&H.Rob.	Asteraceae	Mexico	AN	D	H	P	FE, W	Ui
3.	*Ageratum conyzoides*(L.) L.	Asteraceae	Trop. America	AN	D	H	A	W	O
4.	*Alternanthera paronychioides* St. Hill.	Amaranthaceae	Trop. America	AN	D	H	P	RB	Ui
5.	*Anagallis arvensis* L.	Primulaceae	Europe	AN	D	H	A	CF	Ui
6.	*Argemone mexicana* L.	Papaveraceae	S. America	AN	D	H	A	W	Ui
7.	*Bidens pilosa* L.	Asteraceae	Trop. America	AN	D	H	A	CF	Ui
8.	*Blumea lacera* (Burm. F.) DC.	Asteraceae	Trop. America	AN	D	H	A	W	Ui
9.	*Blumea obliqua* (L.) Druce	Asteraceae	Trop. America	AN	D	H	A	W	Ui
10.	*Calotropis gigantea* (L.) R. Br.	Asclepiadaceae	Trop. Africa	AN	D	S	P	W	Ui
11.	*Calotropis procera* (Ait.) R. Br.	Asclepiadaceae	Trop. Africa	AN	D	S	P	W	Ui
12.	*Calyptocarpus vialis Less.*	Asteraceae	Mexico	AN	D	H	A	W,AR	Ui
13.	*Cannabis sativa* L.	Cannabaceae	Central Asia	AN	D	H	P	AR, W	Ui
14.	*Cassia tora* L.	Caesalpiniaceae	S. America	AN	D	H	A	W	Ui
15.	*Catharanthus pusillus* (Murr.) G. Don	Apocynaceae	Trop. America	AN	D	H	A	CF	O
16.	*Chenopodium album* L.	Chenopodiaceae	Europe	AN	D	H	A	CF	Fd
17.	*Chenopodium murale* L.	Chenopodiaceae	Trop. America	AN	D	H	A	CF, W	Ui
18.	*Convolvulus arvensis* L.	Convolvulaceae	Europe	AN	D	H	A	F, W	Ui
19.	*Cuscuta reflexa*Roxb.	Cusutaceae	Mediterranean	AN	D	H	A	P	Ui
20.	*Cyperus difformis* L.	Cyperaceae	Trop. America	AN	M	H	A	CF	Ui
21.	*Cyperus iria* L.	Cyperaceae	Trop. America	AN	M	H	A	CF	Ui

22.	*Datura innoxia* Mill.	Solanaceae	Trop. America	AN	D	S	P	W	Ui
23.	*Datura metel* L.	Solanaceae	Trop. America	AN	D	S	P	W	Ui
24.	*Datura stramonium* L.	Solanaceae	Trop. America	AN	D	S	P	AR, W	Ui
25.	*Echinochloa crus-galli* (L.) P. Beauv.	Poaceae	S. America	AN	M	H	A	RB	Ui
26.	*Echinops echinatus*Roxb.	Asteraceae	Afghanistan	AN	D	H	A	W	Ui
27.	*Eclipta prostrata* (L.) Mant.	Asteraceae	Trop. America	AN	D	H	A	AR	Ui
28.	*Emilia sonchifolia* (L.) DC.	Asteraceae	Trop. America	AN	D	H	A	RB	Ui
29.	*Euphorbia hirta* L.	Euphorbiaceae	Trop. America	AN	D	H	A	CF	Ui
30.	*Evolvulus nummularius* (L.) L.	Convolvulaceae	Trop. America	AN	D	H	P	W	Ui
31.	*Gnaphalium polycaulon* Pers.	Asteraceae	Trop. America	AN	D	H	A	W	Ui
32.	*Gomphrena celosioides*Martius	Amaranthaceae	S. America	AN	D	H	A	CF	Ui
33.	*Hyptis suaveolens* (L.) Poit.	Lamiaceae	Trop. America	AN	D	H	A	AR	Ui
34.	*Impatiens balsamina* L.	Balsaminaceae	Trop. America	AN	D	H	A	RB	O
35.	*Indigofera astragalina* DC.	Fabaceae	Trop. America	AN	D	H	A	F	Ui
36.	*Indigofera linifolia* (L.f.) Retz.	Fabaceae	S. America	AN	D	H	A	AR	Ui
37.	*Ipomoea carnea*Jacq. subsp. Fistulosa (Mart. ex Choisy) Austin	Convolvulaceae	Trop. America	AN	D	S	P	W	Ui
38.	*Ipomoea purpurea* (L.) Roth	Convolvulaceae	S. America	AN	D	H	A	CF, W	Ui
39.	*Lantana camara* L.	Verbenaceae	Trop. America	AN	D	H	P	F	O
40.	*Leucaena leucocephala*(Lam.) de Wit	Mimosaceae	Trop. America	AN	D	T	P	CF, WP,	Af
41.	*Ludwigia adscendens* (L.) Hara	Onagraceae	Trop. America	AN	D	H	A	A	Ui
42.	*Malvastrum coromandelianum* (L.) Garcke	Malvaceae	Trop. America	AN	D	H	A	W	Ui
43.	*Martynia annua* L.	Pedaliaceae	Trop. America	AN	D	H	P	W	Ui
44.	*Merremia aegyptia* (L.) Urb.	Convolvulaceae	Trop. America	AN	D	C	P	W	Ui
45.	*Mirabilis jalapa* L.	Nyctaginaceae	Peru	AN	D	H	A	W	O
46.	*Nicotiana plumbaginifolia*Viv.	Solanaceae	Trop. America	AN	D	H	A	W	Ui
47.	*Ocimum americanum* L.	Lamiaceae	Trop. America	AN	D	H	A	W	Ui
48.	*Opuntia elatior* Miller	Cactaceae	S. America	AN	D	S	P	AR, W	Ui
49.	*Oxalis corniculata* L.	Oxalidaceae	Europe	AN	D	H	P	CF	Ui
50.	*Parthenium hysterophorus* L.	Asteraceae	N. America	AN	D	H	A	W	Ui
51.	*Pennisetum purpureum*Schum.	Poaceae	Trop. America	AN	M	H	A	F	Fo
52.	*Peperomia pellucida* (L.) Kunth	Piperaceae	S. America	AN	D	H	A	AR	Ui
53.	*Physalis minima* L.	Solanaceae	Trop. America	AN	D	H	A	W	Ui
54.	*Physalis peruviana* L.	Solanaceae	Peru	AN	D	H	A	W, CF	Ui

55.	*Pilea microphylla* (L.) Liebm.	Urticaceae	S. America	AN	D	H	A	RB	Ui
56.	*Portulaca oleracea* L.	Portulacaceae	S. America	AN	D	H	A	W	Fd
57.	*Prosopis juliflora* (Sw.) DC.	Mimosaceae	Mexico	AN	D	S	P	W	Af
58.	*Rubus ellipticus* Smith	Rosaceae	Trop. America	AN	D	S	P	W	Ui
59.	*Solanum nigrum* L.	Solanaceae	Trop. America	AN	D	H	A	CF	Ui
60.	*Solanum pseudo-capsicum* L.	Solanaceae	Trop. America	AN	D	H	P	FE	Ui
61.	*Solanum viarum*Dunal	Solanaceae	Trop. America	AN	D	H	P	F	Ui
62.	*Sonchus asper*(L.) Hill	Asteraceae	Mediterranean	AN	D	H	A	AR	Ui
63.	*Sonchus oleraceus* L.	Asteraceae	Mediterranean	AN	D	H	A	RB	Ui
64.	*Tribulus terrestris* L.	Zygophyllaceae	Trop. America	AN	D	H	P	W	Ui
65.	*Tridax procumbens* L.	Asteraceae	Central America	AN	D	H	P	CF	Ui
66.	*Xanthium strumarium* L. P. P.	Asteraceae	Trop. America	AN	D	H	A	AR, WP	Ui

Life form: H—Herb; C—Climber; US—Undershrub; S—Shrub; SE—Sedges; T—Tree; G—Grass.
Habit: A—Annual; P—Perennial.Habitat: W—Wastelands; CF—Cultivated fields; F—Forests; AR—Along roadside; A—Aquatic; P—Parasites; CF—Crop fields; RB—River beds.Mode of introduction: Af—Agroforestry; Fd—Food; Fo—Fodder; O—Ornamental; Ui—Unintentional.

Annexure-2C

Invasive Alien Plant Species of Uttarakhand Himalaya

S.No.	Species	Family	Taxonomic group	Taxonomic subgroup	Life form	Nativity	Mode of introduction	Habit	Habitat
1.	*Acacia farnesiana* (L.) Willd.	Mimosaceae	A	Dicot	T	Australia	Ui	Perennial	F
2.	*Acmella radicans* (Jacq.) R.K.Jansen	Compositae	A	Dicot	H	America	Ui	Annual	AR, Wp
3.	*Ageratum conyzoides*L.	Asteraceae	A	Dicot	H	Trop. America	O	Annual	W
4.	*Ageratum houstonianum* Mill.	Asteraceae	A	Dicot	H	Trop. America	Ui	Annual	W
5.	*Amaranthus spinosus*L	Amaranthaceae	A	Dicot	H	Trop. America	Ui	Annual	CF
6.	*Amaranthus spinosus* L.	Amaranthaceae	A	Dicot	H	Trop. America	Ui	Annual	CF
7.	*Anagallis arvensis* L.	Primulaceae	A	Dicot	H	Europe	Ui	Annual	CF
8.	*Argemone mexicana* L	Papaveraceae	A	Dicot	H	S. America	Ui	Annual	W
9.	*Argemone mexicana*L.	Papavaraceae	A	Dicot	H	S. America	Ui	Annual	W
10.	*Bidens pilosa*L.	Asteraceae	A	Dicot	H	Trop. America	Ui	Annual	CF
11.	*Blainvillea acmella (L.)* Philipson	Asteraceae	A	Dicot	H	Trop. America	Ui	Annual	W
12.	*Cannabis sativa* L.	Cannabinaceae	A	Dicot	H	Central Asia	Ui	Perennial	W, AR
13.	*Chenopodium album* L.	Chenopodiaceae	A	Dicot	H	Europe	Fd	Annual	CF
14.	*Chenopodium album* L.	Chenopodiaceae	A	Dicot	H	Europe	Fd	Annual	CF
15.	*Cleome viscosa* L.	Cleomaceae	A	Dicot	H	Trop. America	Ui	Annual	W
16.	*Commelina benghalensis*L.	Commelinaceae	A	Dicot	H	Trop. Asia	Ui	Perennial	W
17.	*Cuscuta reflexa*Roxb	Cuscutaceae	A	Dicot	H	Mediterranian	Ui	Annual	P
18.	*Cyperus rotundus*	Cyperaceae	A	Dicot	H	Mediterranian	Ui	Perennial	W, CF
19.	*Datura metel*L	Solanaceae	A	Dicot	S	Trop. America	Ui	Perennial	AR,W
20.	*Echinochloa colona*(L.)Link	Poaceae	A	Monocot	G	S. America	Ui	Annual	RB
21.	*Eupatorium glandulosum*H.B.K.	Asteraceae	A	Dicot	H	Europe	Ui	Perennial	Wp
22.	*Euphorbia hirta*L.	Euphorbiaceae	A	Dicot	H	Trop. America	Ui	Annual	CF
23.	*Gnaphalium coarctatum*Willd.	Asteraceae	A	Dicot	H	Trop. America	Ui	Annual	W
24.	*Gnaphalium pensylvanicum* Willd.	Asteraceae	A	Dicot	H	Trop. America	Ui	Annual	RB
25.	*Gnaphalium polycaulon* Pers.	Asteraceae	A	Dicot	H	Trop. America	Ui	Annual	W
26.	*Impatiens balsamina* L	Balsaminaceae	A	Dicot	H	Trop. America	Af	Annual	CF
27.	*Imperata cylindrica* (L.) Raeusch.	Poaceae	A	Monocot	G	Trop. America	Ui	Perennial	F
28.	*Indigofera astragalina* DC.	Fabaceae	A	Dicot	H	Trop. America	Ui	Annual	F
29.	*Indigofera linifolia* (L.f.) Retz.	Fabaceae	A	Dicot	H	S. America	Ui	Annual	AR
30.	*Lantana camara*L.	Verbenaceae	A	Dicot	S	Trop. America	O	Perennial	F

31.	*Malvastrum coromandelianum* (L.) Garcke	Malvaceae	A	Dicot	S	Trop. America	Af	Perennial	F
32.	*Mirabilis jalapa* L.	Nyctaginaceae	A	Dicot	H	Peru	O	Annual	W
33.	*Nicotiana plumbaginifolia*Viviani	Solanaceae	A	Dicot	H	Trop. America	Ui	Annual	W
34.	*Ocimum americanum* L.	Lamiaceae	A	Dicot	H	Trop. America	Af	Perennial	CF
35.	*Oxalis corniculata*L.	Oxalidaceae	A	Dicot	H	Europe	Ui	Perennial	CF
36.	*Oxalis latifolia*	Oxalidaceae	A	Dicot	H	America	Ui	Perennial	CF
37.	*Parthenium hysterophorus*L.	Asteraceae	A	Dicot	H	N. America	Ui	Annual	W
38.	*Pennisetum purpureum* Schum.	Poaceae	A	Monocot	G	Trop. America	Fo	Annual	F
39.	*Physalis angulata* L.	Solanaceae	A	Dicot	H	Trop. America	Ui	Annual	W
40.	*Physalis peruviana*L.	Solanaceae	A	Dicot	H	Peru	Ui	Annual	CF, W
41.	*Prosopis juliflora* (Sw.) DC.	Mimosaceae	A	Dicot	S	Mexico	Af	Perennial	W
42.	*Ranunculus sceleratus*L.	Ranunculaceae	A	Dicot	H	Asia	Ui	Annual	W
43.	*Ricinus communis*L	Euphorbiaceae	A	Dicot	S	Central Asia	Ui	Perennial	W
44.	*Rorippa dubia*(Pers.) Hara	Brassicaceae	A	Dicot	H	Trop. America	Ui	Annual	CF
45.	*Rubus ellipticus*Smith.	Rosaceae	A	Dicot	S	Trop. America	Ui	Perennial	W
46.	*Rubus niveus*Thunb.	Rosaceae	A	Dicot	S	Asia	Ui	Perennial	F
47.	*Rumex hastatus*D.Don	Polygonaceae	A	Dicot	H	Asia	Ui	Perennial	W
48.	*Saccharum spontaneum*L.	Poaceae	A	Monocot	G	Trop. West Asia	Ui	Perennial	RB
49.	*Senna alata* (L.) Roxb	Fabaceae	A	Dicot	S	Trop. America	O	Annual	W
50.	*Sida acuta*Burm. f	Malvaceae	A	Dicot	H	Trop. America	Ui	Perennial	W
51.	*Solanum mauritianum*	Solanaceae	A	Dicot	S	S. America	O	Perennial	W
52.	*Solanum nigrum*L.	Solanaceae	A	Dicot	H	Trop. America	Ui	Anual	CF
53.	*Solanum torvum* Sw.	Solanaceae	A	Dicot	S	West Indies	Ui	Perennial	F
54.	*Solanum viarum*Dunal	Solanaceae	A	Dicot	H	Trop. America	Ui	Perennial	F
55.	*Sonchus olearecus*L.	Asteraceae	A	Dicot	H	Mediterranian	Ui	Annual	RB
56.	*Stellaria media* (L.)Villars	Caryophyllaceae	A	Dicot	H	Europe	Ui	Annual	W
57.	*Synedrella nodiflora*(L.) Gaertn.	Asteraceae	A	Dicot	H	West Indies	Ui	Annual	W,AR
58.	*Tridax procumbens* L.	Asteraceae	A	Dicot	H	C. America	Ui	Perennial	W
59.	*Tridax procumbensL.*	Asteraceae	A	Dicot	H	Central America	Ui	Perennial	CF
60.	*Trifolium repens*L.	Fabaceae	A	Dicot	H	Europe	Ui	Perennial	W
61.	*Triumfetta rhomboidea* Jacq.	Tiliaceae	A	Dicot	S	Trop. America	Ui	Perennial	F
62.	*Xanthium strumarium*L	Asteraceae	A	Dicot	H	Trop. America	Ui	Annual	AR, WP

Life form- H: Herb, S: Shrub, G: Grass, T: Tree, **Mode of Introduction-**Ui: Unintentional, O: Ornamental, Af: Agroforestry, Fd: Food, Fo: Fodder,**Habitat-** CF: Cultivated fields, W: Wastelands, F: Forests, Wp: Waste places, P: Parasite, AR: Along Roadside, RB: River banks

Annexure-2D

List of IAPS found in Sikkim and West Bengal (Darjeeling)

Sl No.	Accepted names	Families	Taxonomic group	Taxonomic sub- group	Himalayan state from which being reported	Nativity	Habit	Growth form	Mode of introduction	Habitats invaded (General)
1	*Acacia mearnsii* De Wild.	Mimosaceae	A	D	Sikkim	South east Australia	Perennial	Tree	_	Agricultural land
2	*Adenostemma lavenia* (L.) Kuntze	Asteraceae	A	D		S. America	Annual	Herb	Unintentional	Roadsides
3	*Ageratum conyzoides* L.	Asteraceae	A	D	Sikkim, Darjeeling	C. America	Annual	Herb	Ornamental	waste land and roadsides
4	*Ageratum houstonianum* Mill.	Asteraceae	A	D	Sikkim, Darjeeling	C. America	Annual	Herb	Ornamental	waste land and roadsides
5	*Ageratina adenophora* (Spreng.) R.M.King&H.Rob.	Asteraceae	A	D	Sikkim	Mexico	Perennial	shrub	Ornamental	Roadsides
6	*Alternanthera philoxeroides* (Mart.) Griseb	Amaranthaceae	A	D	Sikkim	South America	Perennial	Herb	Unintentional	riverbanks and wetlands
7	*Alternanthera sessilis* (L.) R.Br. ex DC.	Amaranthaceae	A	D	Sikkim, Darjeeling	Trop. America	Annual	Herb	Unintentional	riverbanks and wetlands
8	*Alternanthera pungens* Kunth	Amaranthaceae	A	D	Sikkim	South America	Annual	Herb	_	waste land, roadsides
9	*Anaphalis contorta* Hook.f.	Asteraceae	A	D	Sikkim, Darjeeling	C. Asia	Perennial	Herb	Unintentional	open slopes and screes
10	*Anaphalis margaritacea* (L.) Benth. & Hook.f.	Asteraceae	A	D	Sikkim, Darjeeling	N. America	Perennial	Herb	Unintentional	open slopes and screes
11	*Argemone mexicana* L.	Papaveraceae	A	D	Darjeeling	S. America	Annual	Herb	Unintentional	Agricultural Lands
12	*Arundo donax* L.	Poaceae	A	M	Darjeeling	S. America	Perennial	Grass	Unintentional	Roadsides
13	*Axonopus compressus* (Sw.) P.Beauv.	Poaceae	A	M	Darjeeling	S. America	Perennial	Grass	Fodder	Roadsides

14	*Bidens pilosa* L.	Asteraceae	A	D	Sikkim, Darjeeling	Tropical & Subtropical America	Annual	Herb	unintentional	Roadsides
15	*Blumea lacera* (Burm.f.) DC.	Asteraceae	A	D	Sikkim	Europe	Annual	Herb	Unintentional	Agricultural Lands
16	*Brugmansia suaveolens* (Humb. & Bonpl. ex Willd.) *Sweet*	Solanaceae	A	D	Darjeeling	SE Brazil	Perennial	Shrub	Unintentional	Disturbed areas
17	*Calceolaria tripartita* Ruiz & Pav.	Scrophulariaceae	A	D	Darjeeling	C. America	Annual	Herb	Ornamental	Roadsides
18	*Calotropis procera* (Aiton) W.T.Aiton	Asclepiadaceae	A	D	Sikkim	Trop. Africa	Perennial	Shrub	Unintentional	Agricultural Lands
19	*Cannabis sativa* L.	Cannabaceae	A	D	Darjeeling	C. Asia	Annual	Herb	Narcotic	Roadsides
20	*Cenchrus clandestinus* (Hochst. ex Chiov.) Morrone	Poaceae	A	M	Darjeeling	Trop. America	Perennial	Grass	Fodder	Agricultural Lands
21	*Cenchrus purpureus* (Schumach.) Morrone	Poaceae	A	M	Sikkim	Trop. America	Annual	Grass	As a forage crop	Agricultural Lands, disturbed areas
22	*Cestrum aurantiacum* Lindl.	Solanaceae	A	D	Darjeeling	C. America	Perennial	Shrub	Ornamental	Roadsides, Disturbed areas
23.	*Cestrum elegans* (Brongn. ex Neumann) Schltdl.	Solanaceae	A	D	Sikkim	Mexico	Perennial	Shrub	Ornamental	Roadsides, Disturbed areas
24	*Chromolaena odorata* (L.) R.M.King & H.Rob.	Asteraceae	A	D	Sikkim, Darjeeling	N. America	Perennial	Herb	Unintentional	Roadsides
25	*Cissus discolor* Blume	Vitaceae	A	D	Darjeeling	Java	Perennial	Climber	Unintentional	Moist roadsides
26	*Cleome rutidosperma* DC.	Capparaceae	A	D	Sikkim, Darjeeling	Trop. Africa	Annual	Herb	Unintentional	Agricultural lands
27.	*Cleome viscosa* L.	Capparaceae	A	D	Sikkim	Trop. America	Annual	Herb	Unintentional	Roadsides, agricultural lands
28	*Clerodendrum chinense* (Osbeck) Mabb.	Verbenaceae	A	D	Darjeeling	Japan	Perennial	Shrub	Unintentional	Roaddades, disturbed areas
29	*Crassocephalum crepidioides* (Benth.) S. Moore	Asteraceae	A	D	Darjeeling	Trop. America	Annual	Herb	Unintentional	Agricultural lands
30	*Cynodon dactylon* (L.) Pers.	Poaceae	A	M	Darjeeling	Africa	Perennial	Grass	Unintentional	Agricultural lands
31	*Cyperus difformis* L.	Cyperaceae	A	M	Sikkim	Trop. America	Annual	Sedg	Unintentional	Roadsides,

								es		Agricultural lands
32.	*Cytisus scoparius* (L.) Link	Papilionaceae	A	D	Sikkim	Europe	Annual	Herb	Horticulture reasons	Roadsides
33	*Drymaria villosa* Schltdl. & Cham.	Caryophyllaceae	A	D	Darjeeling	Trop. America	Annual	Herb	Weed	Damp shaded sites
34	*Dysphania ambrosioides* (L.) Mosyakin & Clemants	Chenopodiaceae	A	D	Darjeeling	C. America	Annual	Herb	Accidentally	Agricultural lands
35	*Echinochloa colonum* (L.) Link	Poaceae	A	M	Sikkim	S. America	Annual	Gras s	Unintentional	Open disturbed, roadsides
36	*Echinochloa crus-galli* (L.) P.Beauv.	Poaceae	A	M	Sikkim	S. America	Annual	Gras s	As a fodder (unclear)	Agricultural lands
37	*Elephantopus scaber* L.	Asteraceae	A	D	Darjeeling	C. Asia	Perennial	Herb	Unintentional	Agricultural lands, roadsides
38	*Emilia sonchifolia* (L.) DC. ex DC.	Asteraceae	A	D	Darjeeling	Africa	Perennial	Herb	Unintentional	Open disturbed
39	*Erigeron karvinskianus* DC.	Asteraceae	A	D	Sikkim, Darjeeling	C. America	Perennial	Herb	Weed	Agricultural lands
40	*Fagopyrum cymosum* (Trevir.) Meisn.	Polygonaceae	A	D	Darjeeling	SW. China	Annual	Herb	Unintentional	Agricultural Lands
41	*Fragaria nubicola* (Lindl. ex Hook.f.) Lacaita	Rosaceae	A	D	Darjeeling	Temp. Europe	Perennial	Herb	Unintentional	Open grasslands
42	*Galinsoga parviflora* Cav.	Asteraceae	A	D	Sikkim,Darjelling	Trop. America	Annual	Herb	Unintentional	Open disturbed
43	*Galinsoga quadriradiata* Ruiz & Pav.	Asteraceae	A	D	Sikkim	Mexico	Annual	Herb	Unintentional	Agricultural lands
44	*Gamochaeta pensylvanica* (Willd.) Cabrera	Asteraceae	A	D	Darjeeling	N. America	Annual	Herb	_	Roadsides, disturbed areas
45	*Hyptis suaveolens* (L.) Poit	Lamiaceae	A	D	Darjeeling	S. America	Annual	Herb	unintentional	Agricultural lands
46	*Indigofera trita* L.f.	Fabaceae	A	D	Sikkim	Trop. Africa	Perennial	Shru b	Unintentional	Agricultural lands, roadsides
47	*Ipomoea purpurea* (L.) Roth	Convolvulaceae	A	D	Sikkim	S. America	Annual	Herb	Ornamental	Agricultural lands
48	*Lantana camara* L.	Verbenaceae	A	D	Sikkim,Darjelling	Trop. America	Perennial	Shru b	Ornamental	Agricultural lands

49	*Macroptilium atropurpureum* (DC.) Urb.	Fabaceae	A	D	Sikkim	Trop. America	Perennial	Herb	Deliberately	Agricultural lands
50	*Martynia annua* L.	Pedaliaceae	A	D	Sikkim	Trop. America	Perennial	Herb	Ornamental	Roadsides
51	*Miconia crenata* (Vahl) Michelang.	Melastomataceae	A	D	Sikkim	Trop. America	Annual	Herb	Accidentally	Agricultural lands, roadsides
52	*Mikania micrantha* Kunth.	Asteraceae	A	D	Sikkim,Darjelling	S. America	Perennial	Climber	Brought for camouflaging army during world war II	Open disturbed, Agricultural lands
53	*Mimosa pudica* L.	Fabaceae	A	D	Darjeeling	C. America	Annual	Herb	Unintentional	Open disturbed
54	*Nicandra physalodes* (L.) Gaertn.	Solanaceae	A	D	Darjeeling	Peru	Annual	Herb	Not clear	Roadsides
55	*Oxalis corniculata* L.	Oxalidaceae	A	D	Darjeeling	Europe	Perennial	Herb	Unintentional	Agricultural lands, Disturbed areas
56.	*Oxalis debilis Kunth*	Oxalidaceae	A	D	Darjeeling	S. America	Perennial	Herb	_	Orchards
57	*Oxalis latifolia* Kunth	Oxalidaceae	A	D	Darjeeling	Trop. America	Perennial	Herb	_	Agricultural lands
58	*Parthenium hysterophorus* L.	Asteraceae	A	D	Sikkim,Darjeeling	Tropical & Subtropical America	Annual	Herb	Unintentional	Open disturbed,
59	*Peperomia pellucida* (L.) Kunth	Piperaceae	A	D	Darjeeling	Trop. America	Annual	Herb	Unintentional	Agricultural lands
60	*Persicaria chinensis* (L.) H.Gross	Polygonaceae	A	D	Darjeeling	China	Annual	Herb	Accidentally	Agricultural lands
61	*Physalis peruviana* L.	Solanaceae	A	D	Darjeeling	Trop. America	Perennial	Herb	Unintentional	Disturbed areas
62	*Plantago erosa* Wallich.	Plantaginaceae	A	D	Darjeeling	Mediterranean	Annual	Herb	Unintentional	Roadsides
63	*Pontederia crassipes* Mart.	Pontederiaceae	A	M	Darjeeling	Trop. America	Perennial	Herb	Ornamental	Agricultural lands
64	*Rubus ellipticus* Sm.	Rosaceae	A	D	Darjeeling	Trop. America	Perennial	Shrub	Ornamental	Agricultural lands, roadsides
65	*Senna alata* (L.) Roxb.	Caesalpiniaceae	A	D	Darjeeling	S. America	Perennial	Shrub	Ornamental	Roadsides, Disturbed areas
66	*Senna tora* (L.) Roxb.	Caesalpiniaceae	A	D	Darjeeling	S. America	Annual	Herb	Unintentional	Roadsides
67	*Sida acuta* Burm.f.	Malvaceae	A	D	Darjeeling	Trop. America	Annual	Herb	Unintentional	Open

										disturbed
68	*Solanum seaforthianum* Andrews	Solanaceae	A	D	Sikkim	Brazil	Perennial	Climber	_	Roadsides, Disturbed areas
69	*Solanum torvum* Sw.	Solanaceae	A	D	Darjeeling	West Indies	Perennial	Shrub	Unintentional	Forests, roadsides,
70	*Solanum viarum* Dunal	Solanaceae	A	D	Darjeeling	Trop. America	Annual	Herb	Unintentional	Agricultural lands
71	*Sonchus asper* (L.) Hill	Asteraceae	A	D	Sikkim,Darjelling	Mediterranean	Annual	Herb	Unintentional	Open disturbed
72	*Sonchus oleraceus* (L.) L.	Asteraceae	A	D	Sikkim	Mediterranean	Annual	Herb	Unintentional	Agricultural lands, roadsides
73	*Stellaria media* (L.) Vill.	Caryophyllaceae	A	D	Darjeeling	Mediterranean	Annual	Herb	Unintentional	Roadsides
74	*Stephania japonica* (Thunb.) Miers	Menispermaceae	A	D	Darjeeling	Japan	Perennial	Climber	Unintentional	Forests
75	*Synedrella nodiflora* (L.) Gaertn.	Asteraceae	A	D	Darjeeling	West Indies	Annual	Herb	Unintentional	Agricultural lands, roadsides
76	*Tiarella polyphylla* D.Don	Saxifragaceae	A	D	Darjeeling	China	Perennial	Herb	Unintentional	Forests
77	*Tithonia diversifolia* (Hemsl.) A.Gray	Asteraceae	A	D	Sikkim,Darjelling	Trop. America	Perennial	Herb	Ornamental	Agricultural lands
78	*Torenia thouarsii* (Cham. & Schltdl.) Kuntze	Scrophulariaceae	A	D	Darjeeling	Trop. Africa	Annual	Herb	_	Roadsides
79	*Tridax procumbens* (L.) L.	Asteraceae	A	D	Sikkim,Darjelling	C. America	Perennial	Herb	Unintentional	Agricultural lands, roadsides
80	*Trifolium repens* L.	Fabaceae	A	D	Darjeeling	Europe	Perennial	Herb	Fodder	Roadsides
81	*Triumfetta rhomboidea* Ja cq.	Tiliaceae	A	D	Sikkim,Darjelling	Trop. America	Annual	Herb	Unintentional	Agricultural lands
82	*Tropaeolum majus* L.	Tropaeolaceae	A	D	Darjeeling	S. America	Perennial	Herb	Ornamental	Disturbed areas
83	*Urena lobata* L.	Malvaceae	A	D	Sikkim, Darjeeling	Trop. America	Perennial	Herb	Unintentional	Agricultural lands
84	*Youngia japonica* (L.)DC.	Asteraceae	A	D	Darjeeling	S. America	Annual	Herb	Unintentional	Agricultural lands
85	*Zephyranthes carinata* Herb.	Liliaceae	A	M	Darjeeling	Mexico	Perennial	Herb	Ornamental	Roadsides

Annexure-2E

List of Invasive plants observed during the Field tour to Mizoram and Tripura

Accepted names	FAMILIES	Taxonomic group	Taxonomic Sub-group	Himalayan State from which being reported	NATIVITY	HABIT	Growth form	Mode of introduction	Habitats invaded
1. *Aeschynomene americana* L.	Papilionaceae	AN	D	MZ	Tr.America	P	H	Ui	Ag.L.
2. *Ageratina adenophora* (Spreng.) R.M.King&H.Rob.	Asteraceae	AN	D	TR,MZ	Mexico	P	H	O	Op.F.
3. .*Ageratina riparia* (Regel) R.M.King & H.Rob.	Asteraceae	AN	D	MZ	Mexico	P	H	Ui	Op.F.
4. *Ageratum houstonianum Mill.*	Asteraceae	AN	D	TR,MZ	Tr.America	A	H	O	Ag.L.
5. *Ageratum conyzoides* (L.) L.	Asteraceae	AN	D	TR,MZ	Tr.America	A	H	O	Ag.L.
6. *Alternanthera paronychioides* St. Hill.	Amaranthaceae	AN	D	TR,MZ	Tr.America	A	H	Ui	Ag.L.
7. *Alternanthera philoxeroides* (Mart.) Griseb.	Amaranthaceae	AN	D	TR,MZ	Tr.America	A	H	Ui	Rd.
8. *Alternanthera sessilis* (L.) DC.	Amaranthaceae	AN	D	TR,MZ	Tr.America	P	H	Ui	Rd.
9. *Alternanthera ficoidea* (L.) Sm.	Amaranthaceae	AN	D	TR,MZ	Tr.America	A	H	Ui	Rd.
10. *Amaranthus spinosus* L.	Amaranthaceae	AN	D	TR,MZ	Tr.America	A	H	Ui	Rd.
11. *Argemone mexicana* L.	Papaveraceae	AN	D	TR	S. America	A	H	Ui	Ag.L.
12. *Bidens pilosa* L.	Asteraceae	AN	D	TR,MZ	Tr.America	A	H	Ui	
13. *Blainvillea acmella* (L.)Philipson	Asteraceae	AN	D	TR,MZ	Tr.America	A	H	Ui	Ag.L.
14. *Blumea lacera* (Burm.f.) DC.	Asteraceae	AN	D	TR,MZ	Tr.America	A	H	Ui	Ag.L.
15. *Calotropis procera* (Ait.) R. Br.	Asclepiadaceae	AN	D	MZ	Tr.Africa	P	SH	Ui	Ag.L.
16. *Cardamine hirsuta* L.	Brassicecae	AN	D	TR,MZ	Tr.America	P	H	Ui	Ag.L.
17. *Senna alata* (L.) Roxb.	Caesalpiniaceae	AN	D	TR	S. America	P	SH	O	Rd.
18. *Senna occidentalis* (L.) Link.	Caesalpiniaceae	AN	D	TR	S. America	P	H	Ui	Rd.
19. *Senna tora* (L.) Roxb.	Caesalpiniaceae	AN	D	TR	S. America	A	H	Ui	Rd.
20. *Celosia argentea* L.	Poaceae	AN	M	TR,MZ	Tr.Africa	A	H	Fd	Rd.
21. *Ceratophyllum demersum* L.	Ceratophyllaceae	AN	M	TR,MZ	Trop.America	A	H	Ui	Rd.
22. *Chenopodium album* L.	Chenopodiaceae	AN	D	TR,MZ	Europe	A	H	Fd	Rd.
23. *Chloris barbata* Sw.	Poaceae	AN	M	TR,MZ	Trop.America	P	GR	Ui	Rd.
24. *Chromolaena odorata* (L.) R.M.King&H.Rob.	Asteraceae	AN	D	TR,MZ	Central,S.America	P	H	Ui	Rd.
25. *Cleome viscosa* L.	Capparaceae	AN	D	TR	Trop.America	A	H	Ui	Rd.
26. *Cleome rutidosperma* DC.	Capparaceae	AN	D	TR	Trop.America	A	H	Ui	Rd.
27. *Erigeron canadensis L.*	Asteraceae	AN	D	TR,MZ	S. America	A	H	Ui	Rd.
28. *Corchorus aestuans* L.	Tiliaceae	AN	D	TR	S. America	A	H	Ui	Ag.L.
29. *Crassocephalum crepidioides* (Benth.) S. Moore	Asteraceae	AN	D	TR,MZ	Tr.America	A	H	Ui	Ag.L.

30. *Crotalaria pallida* Ait.	Papilionaceae	AN	D	TR,MZ	Tr.America	A	H	Ui	Ag.L.
31. Croton bonplandianus Baill.	Euphorbiaceae	AN	D	TR,MZ	S. America	P	H	Ui	Ag.L.
32. *Cuscuta chinensis* Lam.	Convolvulaceae	AN	D	TR,MZ	Mediterranean	P	CL	Ui	Ag.L.
33. Cuscuta reflexa Roxb.	Convolvulaceae	AN	D	TR,MZ	Mediterranean	A	CL	Ui	Rd.
34. *Cyanthillium cinereum* (L.) H.Rob.	Asteraceae	AN	D	TR,MZ	Tr.Africa	A	H	Ui	Rd.
35. *Cyperus difformis* L.	Cyperaceae	AN	M	TR,MZ	Tr.America	A	SE	Ui	Rd.
36. *Cyperus iria* L.	Cyperaceae	AN	M	TR,MZ	Tr.America	A	SE	Ui	Op.D.
37. *Datura metel* L.	Solanaceae	AN	D	TR	Tr.America	P	SH	Ui	Op.D.
38. *Datura stramonium* L.	Solanaceae	AN	D	TR,MZ	Tr.America	P	SH	Ui	Op.D.
39. *Echinochloa colona* (L.) Link	Poaceae	AN	M	TR,MZ	S. America	A	GR	Ui	Op.D.
40. *Eclipta prostrata* (L.) L.	Asteraceae	AN	D	TR,MZ	Tr.America	A	H	Ui	Op.D.
41. *Eichhornia crassipes* (Mart.) Solms	Pontederiaceae	AN	M	TR,MZ	Tr.America	P	H	O	Aq.B.
42. *Emilia sonchifolia* (L.) DC. ex DC.	Asteraceae	AN	D	TR,MZ	Tr.America	A	H	Ui	Op.D.
43. *Euphorbia hirta* L.	Euphorbiaceae	AN	D	TR,MZ	Tr.America	A	H	Ui	Op.D.
44. *Evolvulus nummularius* (L.) L.	Convolvulaceae	AN	D	TR,MZ	Tr.America	P	H	Ui	Op.D.
45. *Galinsoga parviflora* Cav.	Asteraceae	AN	D	TR,MZ	Tr.America	A	H	Ui	Op.D.
46. *Gompherena serrata* L.	Amaranthaceae	AN	D	TR	Tr.America	A	H	Ui	Op.D.
47. *Hyptis suaveolens* (L.) Poit.	Lamiaceae	AN	D	TR,MZ	Tr.America	A	H	Ui	Op.D.
48. *Imperata cylindrica* (L.) Raeusch.	Poaceae	AN	M	TR,MZ	Tr.America	P	GR	Ui	Ag.L.
49. *Indigofera trita* L.f.	Papilionaceae	AN	D	MZ	Tr.Africa	P	SH	Ui	Ag.L.
50. *Ipomoea carnea* Jacq.	Convolvulaceae	AN	D	TR,MZ	Tr.America	P	SH	Ui	Ag.L.
51. *Ipomoea hederifolia* L.	Convolvulaceae	AN	D	TR,MZ	Tr.America	A	CL	Ui	Ag.L.
52. *Ipomoea quamoclit* L.	Convolvulaceae	AN	D	TR,MZ	Tr.America	P	CL	O	Ag.L.
53. *Lantana camara* L.	Verbenaceae	AN	D	TR,MZ	Tr.America	P	H	O	Ag.L.
54. *Leonotis nepetifolia* (L.) R.Br.	Lamiaceae	AN	D	TR,MZ	Tr.Africa	A	H	Ui	Ag.L.
55. *Ludwigia perennis* L.	Onagraceae	AN	D	TR,MZ	Tr.Africa	A	H	Ui	Ag.L.
56. *Ludwigia adscendens* (L.) Hara.	Onagraceae	AN	D	TR,MZ	Tr.Africa	A	H	Ui	Ag.L.
57. *Malvastrum coromandelianum* (L.) Garcke	Malvaceae	AN	D	TR	Tr.America	A	H	Ui	Op.D.
58. *Mecardonia procumbens* (Mill.)Small	Scrophulariaceae	AN	D	TR,MZ	Trop.North America	A	H	Ui	Op.D.
59. *Mikania micrantha* Kunth.	Asteraceae	AN	D	TR,MZ	Central,S.America	P	CL	Ui	Op.D.
60. *Mimosa pudica* L.	Mimosacae	AN	D	TR,MZ	Brazil	P	H	Ui	Op.D.
61. *Oxalis corniculata* L.	Oxalidaceae	AN	D	TR,MZ	Europe	P	H	Ui	Op.D.
62. *Parthenium hysterophorus* L.	Asteraceae	AN	D	TR,MZ	N.America	A	H	Ui	Op.D.
63. *Hypoestes phyllostachya* Baker	Acanthaceae	AN	D	TR,MZ	S.Africa	A	H	Ui	Ag.L.
64. *Peperomia pellucida* (L.) Kunth	Piperaceae	AN	D	TR,MZ	S.America	A	H	Ui	Ag.L.
65. *Physalis minima* l.	Solanaceae	AN	D	MZ	Tr.America	A	H	Ui	Ag.L.
66. *Pilea microphylla* (L.)Liebm.	Urticaceae	AN	D	TR,MZ	S.America	A	H	Ui	Ag.L.
67. *Pistia stratiotes* L.	Araceae	AN	M	TR,MZ	Trop.America	P	H	Ui	
68. *Ricinus communis* L.	Euphorbiaceae	AN	D	TR	Mediterranean,E.Africa	P	SH	Fd	Op.D.
69. *Rorippa dubia*(Pers.)Hara.	Brassicaaceae	AN	D	TR,MZ	Trop.America	A	H	Ui	Op.D.

70. *Ruellia tuberosa* L.	Acanthaceae	AN	D	TR,MZ	Trop.America	A	H	Ui	Op.D.
71. *Saccharum spontaneum* L.	Poaceae	AN	M	TR,MZ	Tr.West Asia	P	GR	Ui	Op.D.
72. *Scoparia dulcis* L.	Scrophulariaceae	AN	D	TR,MZ	Tr.America	A	H	Ui	Op.D.
73. *Sida acuta* Burm.f.	Malvaceae	AN	D	TR,MZ	Tr.America	A	H	Ui	Op.D.
74. *Solanum torvum* Sw.	Solanaceae	AN	D	TR,MZ	West Indies	P	SH	Ui	Op.D.
75. *Sonchus oleraceus* (L.) L.	Asteraceae	AN	D	TR,MZ	Mediterranean	A	H	Ui	Op.D.
76. *Sonchus asper* (L.) Hill	Asteraceae	AN	D	TR,MZ	Mediterranean	A	H	Ui	Op.D.
77. *Spermacoce hispida* L.	Rubiaceae	AN	D	TR,MZ	Tr.America	A	H	Ui	Op.D.
78. *Stachytarpheta jamaicensis* (L.) Vahl	Verbenaceae	AN	D	TR,MZ	Tr.America	A	H	Ui	Ag.L.
79. *Synedrella nodiflora* (L.) Gaertn.	Asteraceae	AN	D	TR,MZ	West Indies	A	H	Ui	Ag.L.
80. *Tridax procumbens* (L.) L.	Asteraceae	AN	D	TR,MZ	Central America	A	H	Ui	Ag.L.
81. *Triumfetta rhomboidea* Jacq.	Malvaceae	AN	D	TR,MZ	Tr.America	A	H	Ui	Ag.L.
82. *Typha angustifolia* L.	Typhaceae	AN	M	MZ	Tr.America	P	GR	Ui	Ag.L.
83. *Urena lobata* L.	Malvaceae	AN	D	TR,MZ	Tr.Africa	P	SH	Ui	Ag.L.
84. *Xanthium strumarium* L.	Asteraceae	AN	D	TR,MZ	Tr.America	A	H	Ui	Ag.L.
85. *Youngia japonica*(L.)DC.	Asteraceae	AN	D	MZ	S.America	A	H	Ui	Ag.L.

Himalayan State from which being reported: TR=Tripura, MZ=Mizoram; Taxonomic group: AN=Angiosperms; Taxonomic Sub-group : D=Dicots, M=Monocots ; Habit : P= Perennial , A=Annual ; Growth form: H=Herb, SH=Shrub, GR=Grass, SE=Sedge, CL=Climber ; Mode of introduction: Ui=Unintentional, O=Ornamental,Fd=Food ;Habitats invaded: Ag.L.=Agricultural Lands, Op.D. =Open disturbed , Rd=Roadside , Op.F.=Open Forest .

List of Established and New Invasive Alien Vascular Plant Species (including potentially invasive) recorded in Arunachal Pradesh (AP), Manipur (MN) and Nagaland (NL).

Name of the IAVPS	**Family**	**Taxonomic group**	**Taxonomic sub group**	**Origin**	**Established/ New**	**State of occurrence**	**Habit**	**Growth Form**
Acanthospermum hispidum DC	Asteraceae	AN	D	Brazil	New	AP	Annual	Herb
Achyranthes aspera L.	Amaranthaceae	AN	D	South East Asia and/or Africa	New	AP, MN	Perennial	Herb
Ageratina adenophora (Spreng.) King & H. Rob.	Asteraceae	AN	D	Mexico, Central America	Established	AP,MN,NL	Perennial	Herb
Ageratum conyzoides L.	Asteraceae	AN	D	Tropical America	Established	AP,MN,NL	Annual	Herb
Ageratum haustonianum Mill.	Asteraceae	AN	D	Tropical America	Established	AP,MN,NL	Annual	Herb
Alternanthera philoxeroides (Mart.) Griseb.	Amaranthaceae	AN	D	South America	New	MN, NL	Annual	Herb
Alternanthera sessilis (L.) DC.	Amaranthaceae	AN	D	Tropical America	New	AP	Perennial	Herb
Anaphalis margaritaceae L.	Asteraceae	AN	D		New	AP	Perennial	Herb
Artemisia nilagirica (C.B. Clarke) Pamp.	Asteraceae	AN	D	India	New	AP,MN,NL	Annual	Shrub
Arundo donax L.	Poaceae	AN	M	Eastern and Southern China	New	MN	Perennial	Grass
Axonopus compressus (Sw.) P.Beauv.	Poaceae	AN	M	South America	Established	AP, MN	Perennial	Grass
Bidens pilosa L.	Asteraceae	AN	D	Trop. America	Established	AP,MN,NL	Annual	Herb
Bombax ceiba L.	Malvaceae	AN	D	Africa, Australia, Asia	New	AP,NL,MN		Tree
Broussonetia papyrifera (L.) L'Hér. ex Vent.	Moraceae	AN	D	Asia	New	NL		Tree
Carex baccans Nees	Cyperaceae	AN	M	Tropical & Subtropical Asia	New	AP, NL	Perennial	Sedge
Chromolaena odorata (L.) R.M. King & H. Rob.	Asteraceae	AN	D	North America, South America	Established	AP,MN,NL	Perennial	Shrub
Commelina benghalensis L.	Commelinaceae	AN	M	Tropical Asia and Africa	Established	AP	Perennial	Herb

*Crotalaria pallida*Aiton	Fabaceae	AN	D	Tropical America	New	AP, MN	Annual	Shrub
Cuphea carthagenensis (Jacq.) J.F. Macbr.	Lythraceae	AN	D	North and South America	New	AP,MN	Annual	Herb
Cuscuta reflexa Roxb.	Convolvulaceae	AN	D		New	AP	Annual	Climber
Cynodon dactylon (L.) Pers.	Poaceae	AN	M	Africa	Established	AP,MN,NL	Perennial	Grass
Eleusine indica (L.) Gaertn.	Poaceae	AN	M	Tropical & Subtropical Old World	Native	AP,MN,NL	Annual	Grass
Euphorbia hirta L.	Euphorbiaceae	AN	D	Tropical America	New	AP, MN	Annual	Herb
Fagopyrum esculentum Moench	Polygonaceae	AN	D	China	New	NL	Annual	Herb
Galinsoga parviflora Cav.	Asteraceae	AN	D	South America	New	AP, MN	Annual	Herb
Galinsoga quadriradiata Ruiz & Pav.	Asteraceae	AN	D	South America	New	AP, NL	Annual	Herb
Girardinia diversifolia (Link) Friis	Urticaceae	AN	D	Tropical & Subtropical Old World	New	AP, NL		Shrub
Gnaphalium affine D. Don	Asteraceae	AN	D	Tropical America	Established	AP,NL	Annual	Herb
Hyptis suaveolens (L.) Poit.	Lamiaceae	AN	D	Tropical America	New	AP, MN	Annual	Herb
Imperata cylindrica (L.) Raeusch.	Poaceae	AN	M	Tropical America	Established	AP,MN,NL	Perennial	Grass
Ipomoea carnea Jacq.	Convolvulaceae	AN	D	Tropical America	New	MN	Perennial	Shrub
Lantana camara L.	Verbenaceae	AN	D	Tropical America	Established	AP,MN,NL	Perennial	Shrub
Laportea interrupta (L.) Chew	Urticaceae	AN	D	East Asia, Australia	New	AP, NL	Annual	Herb
Melastoma malabathricum L.	Melastomaceae	AN	D	Tropical & Subtropical Asia to N. & E. Australia.	New	AP, MN	Perennial	Shrub
Mikania micrantha Kunth	Asteraceae	AN	D	Sub-tropical America	Established	AP,MN,NL	Perennial	Climber
Mimosa invisa Colla	Fabaceae	AN	D	South America	Established	MN	Perennial	Shrub
Mimosa pudica L.	Fabaceae	AN	D	Central America South America	Established	AP,MN,NL	Perennial	Herb
Muccuna sp.	Fabaceae	AN	D		New	MN	Perennial	Climber
Osbeckia nepalensis Hook. f.	Melastomaceae	AN	D	East Asia	New	AP,MN,NL	Perennial	Shrub
Parthenium hysterophorus L.	Asteraceae	AN	D	Tropical America	New	AP,MN,NL	Annual	Herb
Peperomia pellucida (L.) Kunt	Piperaceae	AN	D	South America	New	AP	Annual	Herb
Phragmites karka (Retz.) Trin. ex Steud.	Poaceae	AN	M	North America	New	AP,MN,NL	Perennial	Grass

Pilea scripta (Buch.-Ham. ex D. Don) Wedd.	Urticaceae	AN	D	Tropical Asia	New	AP,MN,NL	Perennial	Herb
Pueraria sp.	Fabaceae	AN	D	Tropical America	New	AP, MN	Perennial	Climber
Rubus ellipticus Sm.	Rosaceae	AN	D	South East Asia	New	AP,MN,NL	Perennial	Shrub
Rubus sp.	Rosaceae	AN	D		New	NL	Perennial	Shrub
Rumex nepalensis	Polygonaceae	AN	D		New	AP		Herb
Saccharum spontaneum L.	Poaceae	AN	M	Asia	Established	AP	Perennial	Grass
Scoparia dulcis L.	Plantaginaceae	AN	D	Tropical America	New	AP	Annual	Herb
Solanum viarum Dunal	Solanaceae	AN	D	Brazil	New	AP,MN,NL	Perennial	Herb
*Spermacoce alata*Aubl.	Rubiaceae	AN	D	South America	New	AP,MN	Perennial	Herb
Stachytarpheta indica (L.) Vahl	Verbenaceae	AN	D	Tropical America	New	AP, MN	Annual	Herb
Synedrella nodiflora (L.) Gaertn.	Asteraceae	AN	D	West Indies	New	AP	Annual	Herb
Thysanolaena latifolia (Roxb. ex Hornem.) Honda	Poaceae	AN	M	Tropical & Subtropical Asia	Native	AP,MN,NL	Perennial	Grass
Tithonia diversifolia (Hemsl.) A. Gray	Asteraceae	AN	D	Mexico	New	AP,MN,NL	Perennial	Shrub
Triumfetta pilosa Roth	Malvaceae	AN	D	Tropical Africa	New	MN,NL	Perennial	Shrub
Triumfetta rhomboidea Jacq	Tiliaceaea	AN	D	Tropical America	New	AP,MN,NL	Perennial	Shrub
Urena lobata L.	Malvaceae	AN	D	Tropical America	Established	AP,MN,NL	Perennial	Shrub
Urtica dioica L.	Urticaceae	AN	D	Africa, Europe	New	AP,NL	Perennial	Herb

D=Dicotyledons,M=Monocotyledons,AN=Angiosperms

APPENDIX-3

annexure-3A

DATA ANALYSIS FOR JAMMU & KASHMIR

A. **Kargil (Ladakh)**

Table1: Number of genera and species belonging to different families recorded from Kargil

Family name	No. of genera	No. of species	Family name	No. of genera	No. of species
Dicots			**Monocots**		
Asteraceae	20	36	Poaceae	15	28
Brassicaceae	9	10	Orchidacae	2	2
Rosaceae	8	9	Iridaceae	1	2
Fabaceae	7	14	**Gymnosperms**		
Polygonacaeae	6	14	Cupressaceae	1	1
Amaranthaceae	5	11	Ephedraceae	1	2
Lamiaceae	5	7	**Pteridophytes**		
Boraginaceae	4	4	Equistaceae	1	3
Caryophyllaceae	4	5	Dryopteridaceae	1	1
Ranunculaceae	4	4	**Total**	**124**	**192**
Chenopodiaceae	3	4			
Solanaceae	3	3			
Salicaceae	2	5			
Adoxaceae	1	1			
Balsaminaceae	1	1			
Berberidaceae	1	1			
Campanulaceae	1	1			
Capparaceae	1	1			
Caprifoliaceae	1	2			
Convolvulaceae	1	1			
Crassulaceae	1	1			
Capparaceae	1	1			
Elaeagnaceae	1	1			
Euphorbiaceae	1	1			
Grossulariaceae	1	1			
Juglandaceae	1	1			
Moraceae	1	1			
Onagraceae	1	1			
Orobanchaceae	1	1			
Plantaginaceae	1	3			
Plumbaginaceae	1	1			
Saxifragaceae	1	1			
Scrophulariaceae	1	1			
Tamaricaceae	1	1			
Urticacaeae	1	2			

Table 2: Conspectus of floristic diversity recorded till date

Group	*Number of*		
	Families	***Genera***	***Species***
Dicotyledons	*35*	*102*	*153*
Monocotyledons	*3*	*18*	*32*
Gymnosperms	*2*	*2*	*3*
Pteridophytes	*2*	*2*	*4*
Total	***42***	***124***	***192***

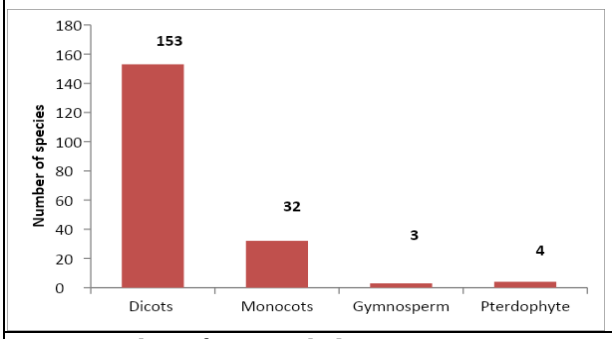


Fig.1: Number of species belonging to various taxonomic groups

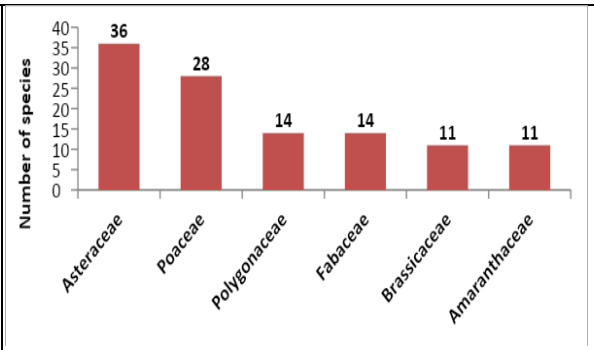


Fig.2: Five largest families with more than ten species

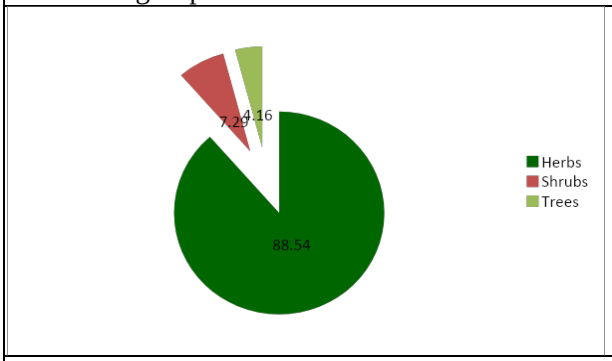


Fig.3: Percentage of various growth forms of the recorded plant species

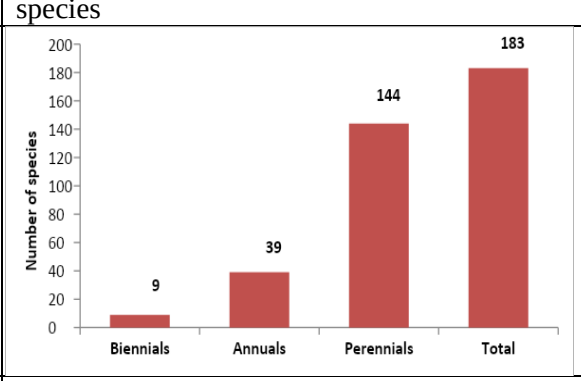


Fig.4: Number of plant species belonging to different Life span categories

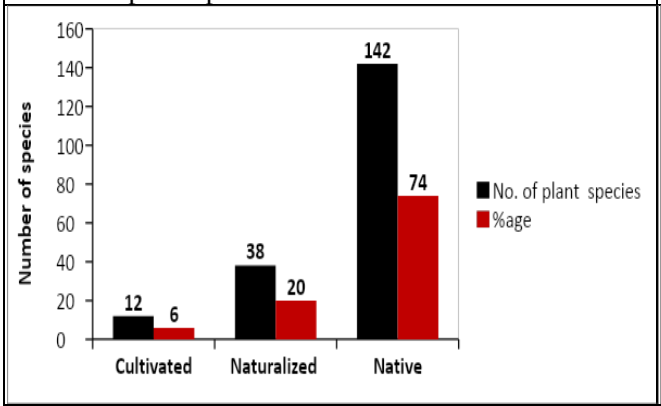


Fig.5: Proportion of cultivated, naturalized and native species

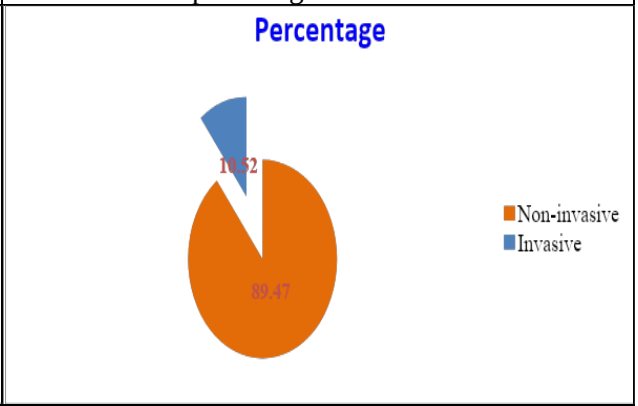


Fig. 6: Percentage of invasive and non- invasive species among the naturalized flora

Table 3: Different invasion stages assigned to Invasive and probable alien Invasive species

Species	**Frequency%**	**Density**	**Abundance**	**Stage of Invasion**
Robinia pseudoacacia L.	18.92	3.2	192	III
Poa annua L.	20.00	10.81	649	III

Populus pannonica Kit. ex Besse	18.97	10.01	620	III
Chenopodium botyrs L.	29.61	16.45	987	IV b
Artemisia fragrans Wild.	63.33	5.7	342	IV a
Cersium arvense (L.) Scop	51.23	8.28	497	IV a
Lactuca sativa L.	63.33	20.53	1232	IV a

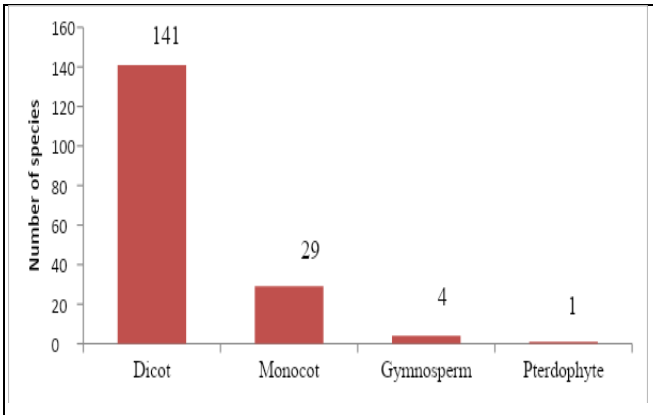
b. Kashmir

Table 1: Number of genera and species belonging to different families (Kashmir)

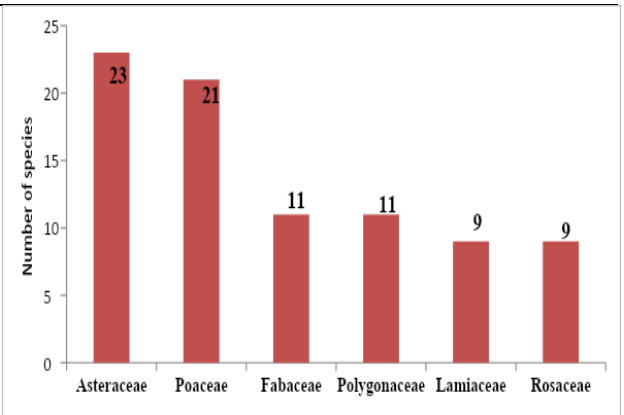
Family name	No. of genera	No. of species	Family name	No. of genera	No. of species
Dicots			**Monocots**		
Adoxaceae	1	1	Asparagaceae	1	1
Apiaceae	5	5	Cyperaceae	3	4
Araliaceae	1	1	Dioscoreaceae	1	1
Asteraceae	9	23	Poaceae	17	21
Balsaminaceae	1	2	Iridaceae	1	1
Berberidaceae	2	3	Liliaceae	1	1
Brassicaceae	5	6	**Gymnosperms**		
Campanulaceae	1	1	Pinaceae	4	4
Cannabiaceae	1	1			
Caprifoliaceae	1	2	**Pteridophytes**		
Caryophyllaceae	4	5	Dryopteridaceae	1	1
Chenopodiaceae	1	3	**Total**	**175**	**115**
Convolvulaceae	1	1			
Euphorbiaceae	1	2			
Fabaceae	7	11			
Geraniaceae	3	5			
Juglandaceae	1	1			
Lamiaceae	8	9			
Lythraceae	1	1			
Malvaceae	2	2			
Oleaceae	1	1			
Onagraceae	1	1			
Oxalidaceae	1	1			
Papilionaceae	1	1			
Plantaginaceae	1	2			
Polygonaceae	2	11			
Primulaceae	2	3			
Ranunculaceae	4	7			
Rosaceae	7	9			
Rubiaceae	2	4			
Salicaceae	1	1			
Scrophulariaceae	2	5			
Solanaceae	1	1			
Urticaceae	1	1			
Verbenaceae	1	1			
Violaceae	1	1			

Table 2: Conspectus of floristic diversity recorded till date

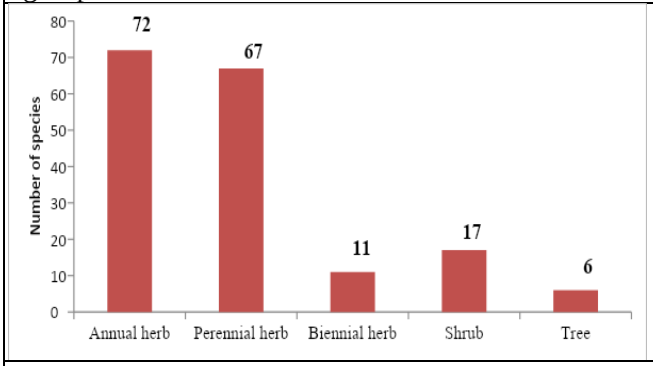
Group	Number of		
	Families	**Genera**	**Species**
Dicotyledons	37	86	141
Monocotyledons	6	24	24
Gymnosperms	1	4	4
Pteridophytes	1	1	1
Total	**45**	**115**	**175**



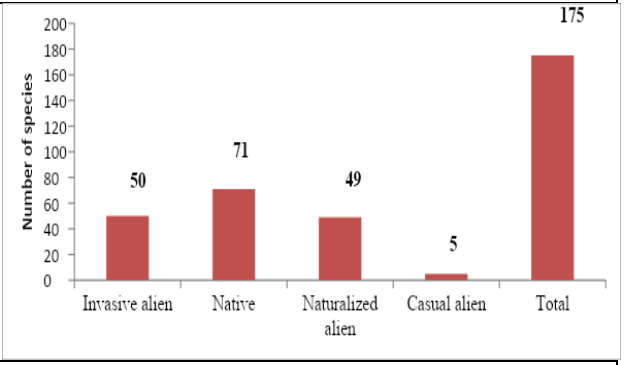
Number of species belonging to various taxonomic groups



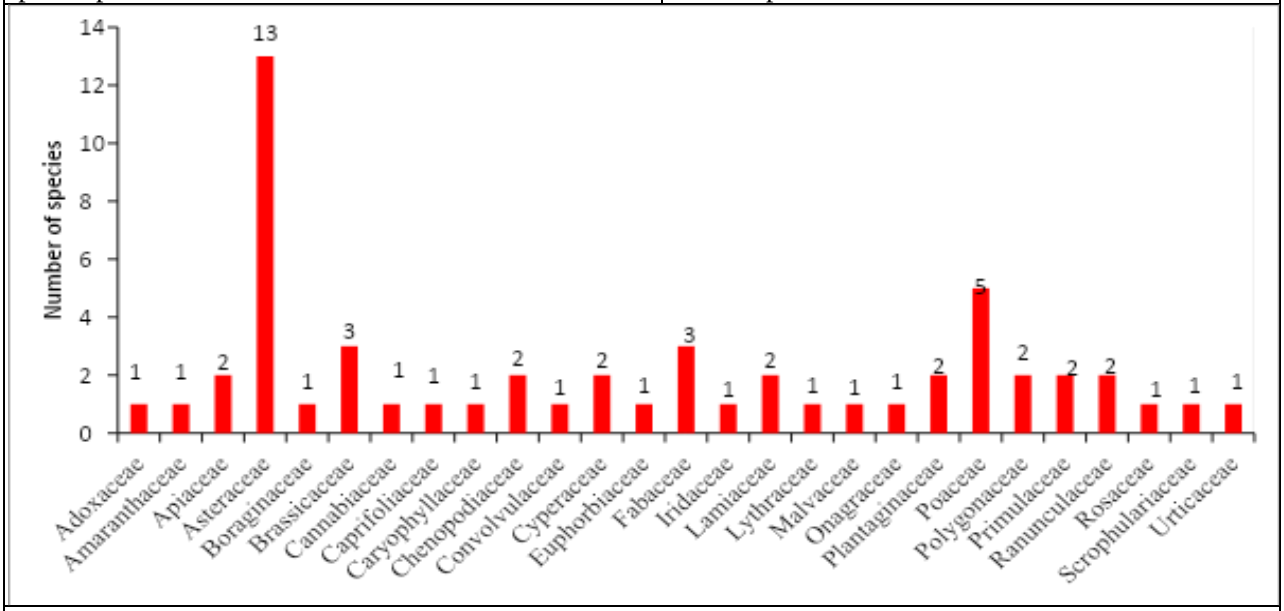
Six largest families with more than ten species



Percentage of various growth forms of the recorded plant species



Proportion of invasive, naturalized, casual and native species

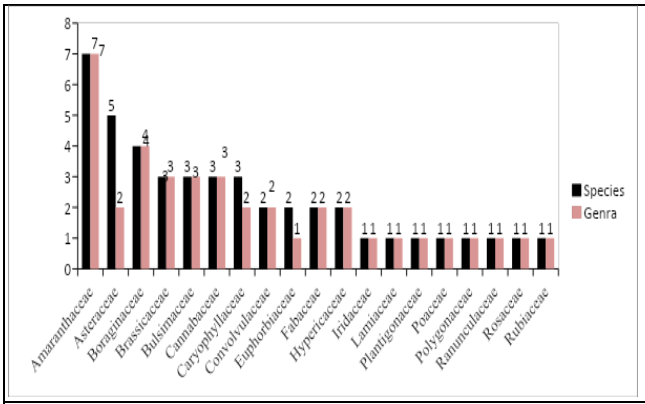


Number of invasive species belonging to various families

Table 3: Different invasion stages assigned to Invasive alien Invasive species

Species	**Frequency%**	**Density**	**Abundance**	**Stage of Invasion**
Conyza canadensis Cronquist	63.33	1.88	38.8	IV b
Ranunculus muricatus L.	66.66	0.20	3.1	IV b
Trifolium repens L.	86.66	4.34	65.2	V
Veronica persica Poir.	53.33	4.37	65.6	V
Setaria viridis P. Beauv	73.33	0.82	12.4	IV b
Capsella bursa pastoris Medic.	80.00	2.74	41.1	IV b
Anthemis cotula L.	66.66	2.06	39.01	IV b

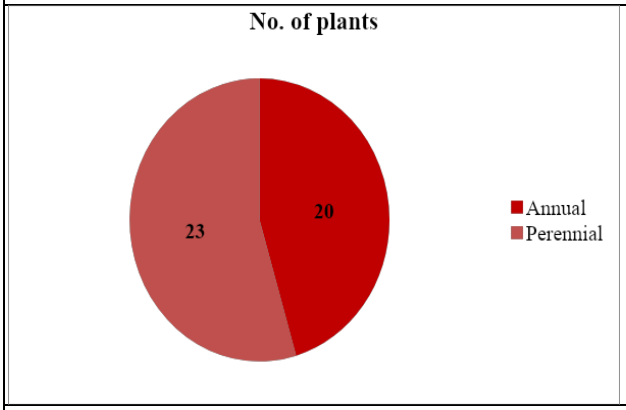
Mustard fields:



Number of species and genera recorded from mustard fields of Kashmir

Plant group	**No. of plants**
Dicots	38
Monocots	5
Total	**43**

Number of plant species belonging to different plant groups



Number of plant species belonging to various life span categories recorded in Mustard Fields of Kashmir

Invasion status	**No. of plants**
Causal	10
Cultivated	3
Invasive	18
Native	12
Total	**43**

Number of casual, cultivated, Invasive and native species recorded from mustard fields

B. Jammu

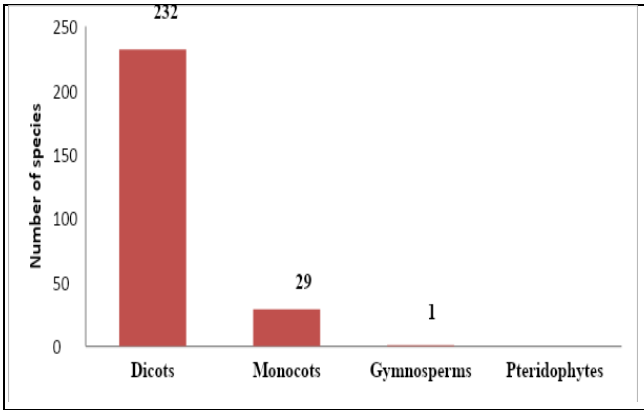
Number of genera and species belonging to different families in Jammu

Family	**Number of Genera**	**Number of Species**	**Family**	**Number of Genera**	**Number of Species**
Asteraceae	16	30	Arecaceae	01	01
Fabaceae	11	21	Violaceae	01	01
Poaceae	14	17	Linaceae	02	01
Lamiaceae	08	12	Geraniacaeae	01	02
Convulvulaceae	05	08	Oxalidacaeae	01	03
Acanthaceae	03	08	Meliaceae	03	03
Solanaceae	05	08	Vitacaeae	01	02
Verbenaceae	04	08	Sapindaceae	01	01
Mimosaceae	05	05	Myrtaceae	01	01
Euphorbiaceae	08	12	Lythraceae	01	01
Rubiaceae	04	08	Onagraceae	01	01

Amaranthaceae	06	06	Primulaceae	01	01
Scrophulariaceae	04	06	Combretaceae	01	01
Caesalpinaceae	03	07	Ehretiaceae	01	01
Moraceae	02	05	Dioscorreaceae	01	01
Rosaceae	05	09	Commelinaceae	01	03
Asclepidaceae	02	01	Portulaceae	01	02
Brassicaceae	01	03	Papaveraceae	01	01
Ranunculaceae	02	06	Polygalaceae	01	01
Tiliaceae	01	04	Fumariaceae	01	01
Rutaceae	03	03	Bombacaceae	01	01
Apiaceae	04	02	Punicaceae	01	01
Cyperaceae	01	02	Moringaceae	01	01
Caryophyllaceae	02	01	Plumbaginaceae	01	01
Rhamnaceae	03	02	Ebenaceae	01	01
Bignoniaceae	02	05	Oleaceae	02	02
Boraginaceae	05	02	Cactaceae	01	02
Capparidaceae	02	04	Polygonaceae	02	03
Anacardiaceae	01	03	Pinaceae	01	01
Liliaceae	03	06	Pedaliaceae	01	01
Malvaceae	05	05	Papilionaceae	01	02
Apocyanaceae	05	07	Cuscutaceae	01	01
Cucurbitaceae	05	07	Plantaginaceae	01	01
Flacourtiaceae	01	04	Nyctaginaceae	01	02
Begoniaceae	01	O1	Menispermaceae	01	01
Loranthaceae	01	01	Total	**189**	**262**
Cannabaceae	01	01			
Nymphaeaceae	01	01			

Conspectus of floristic diversity recorded till date in Kashmir

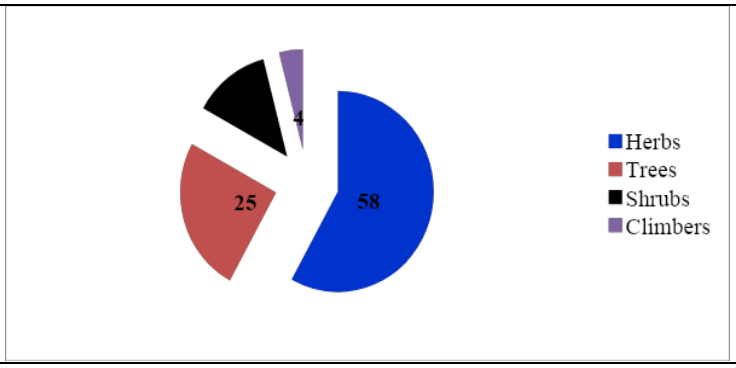
S.NO.	Groups	Families	Number of Genera	Number of Species
1	Dicotyledons	67	168	232
2	Monocotyledons	5	20	29
3	Gymnosperms	1	1	1
Total		**73**	**189**	**262**



Number of species belonging to various taxonomic groups in Jammu & Kashmir

S.No.	Family	Genera	Species
1	Asteraceae	16	30
2	Fabaceae	11	21
3	Poaceae	14	17
4	Lamiaceae	08	12

Largest families with more than ten plant species Jammu & Kashmir



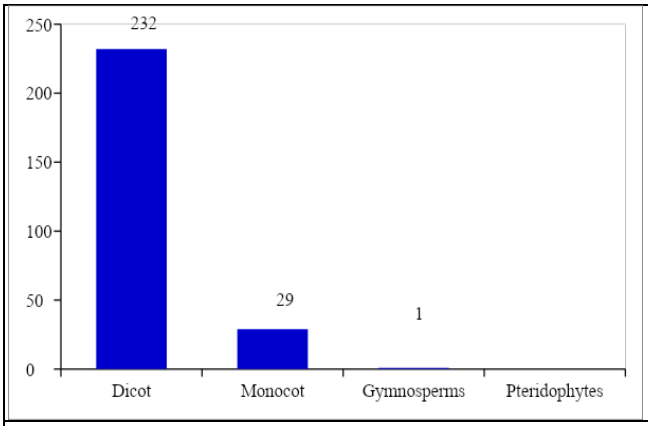
Percentage of various growth forms of the recorded plant species

Table 4: Alien invasive herbs and shrubs recorded from Jammu region

Growth Form	Plant species	Total plant species
Herbs	*Cannabis sativa, Poa annua, Oxalis corniculata, Tridax procumbens, Boerhavia difussa, Parthenium hysterophorus, Anagalis arvensis, Evolvulus alsinoides, Amaranthus viridis Barleria cristata, Cyperus niveus, Ipomoea carnea, Borreria strica, Convolvulus arvensis, Majus japonica, Amaranyhus viridis, Saccharum benglense* and *Ageratum conyzoides*	**18**
Shrubs	*Ricinis communis, Lantana camara, Dodonoeae viscosa, Perqularia extensa, Carissa apaca, Calotropis procera, Vitex negundo, Randia spinosa* and *Abutilon ramosus*	**9**

Conspectus of the species collected from Jammu forest (Mahamaya)

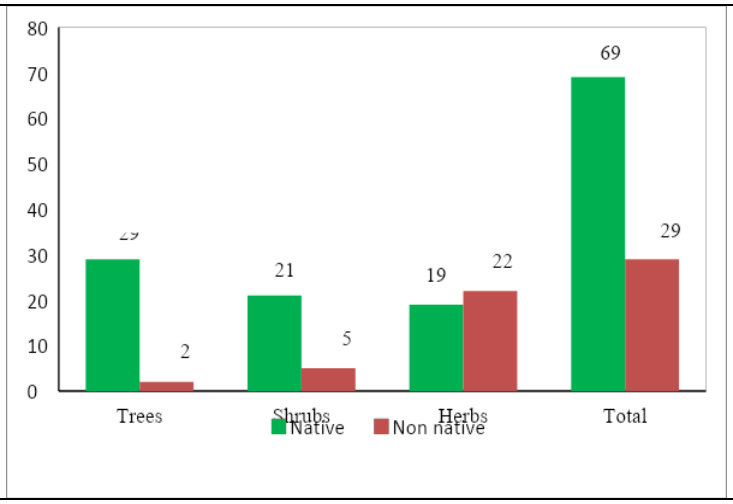
S.NO.	Groups	Families	Number of Genera	Number of Species
1	**Dicotyledons**	67	168	232
2	**Monocotyledons**	5	20	29
3	**Gymnosperms**	1	1	1
4	**Pteridophytes**	-	-	-
Total		**73**	**189**	**262**



Number of species belonging to various taxonomic groups (Mahamaya forest)

S.No.	Family	Genera	Species
1	Asteraceae	16	30
2	Fabaceae	11	21
3	Poaceae	14	17
4	Lamiaceae	08	12
5	Rosaceae	05	06

Five Largest families with more than ten plant species



Number of species belonging to different gowth forms in Mahamaya

The invasive species recorded from Mahamaya forests are as under:

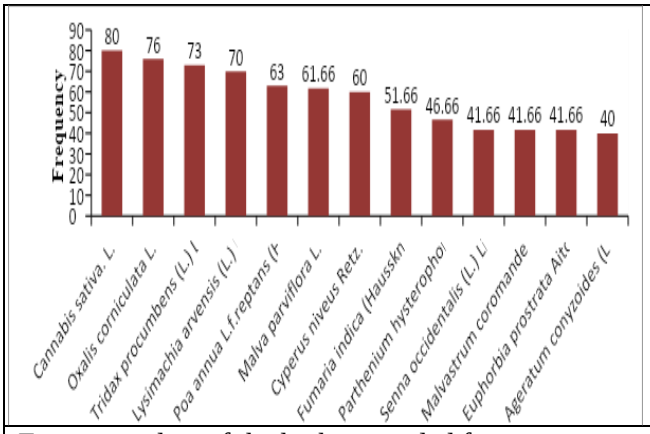
A. Herbs

Cannabis sativa L. , *Poa annua* L. , *Oxalis corniculata* L. , *Tridax procumbens* (L.) L. , *Sida spinosa* L. , *Boerhavia difussa* L. , *Parthenium hysterophorus* L. , *Anagallis arvensis* L. , *Malvastrum coromandelium* (L.) Garcke , *Evolvulus alsinoides* (L.) L. , *Amaranthus viridis* L. , and *Fumaria indica* (Hausskn.) Pugsley

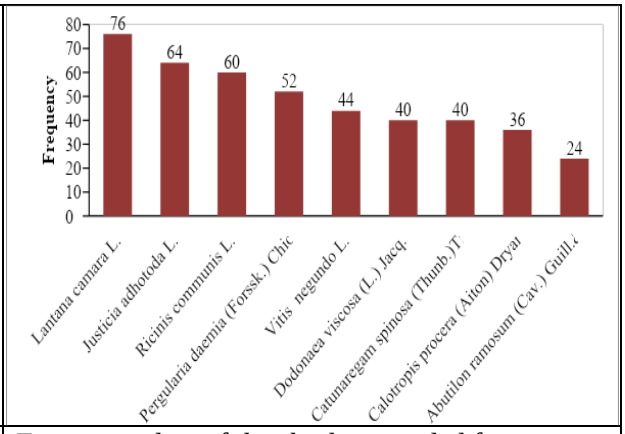
B. Shrubs

Ricinus communis L., *Lantana camara* L., *Dodonaea viscosa* (L.) Jacq., *Pergularia daemia* (Forssk.) Chiov. , *Calotropis procera* (Aiton) Dryand. , *Vitex negundo* L.

.

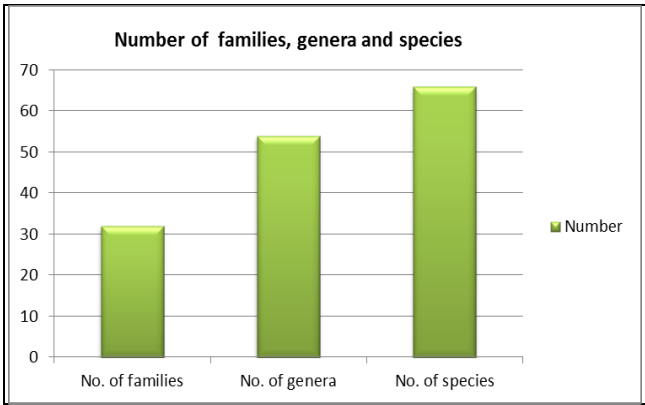


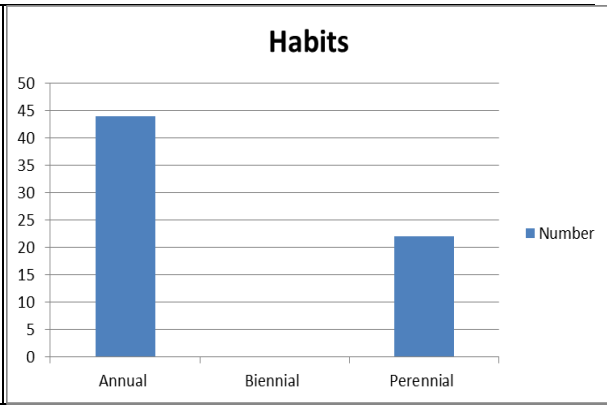
Frequency data of the herbs recorded from Mahamaya

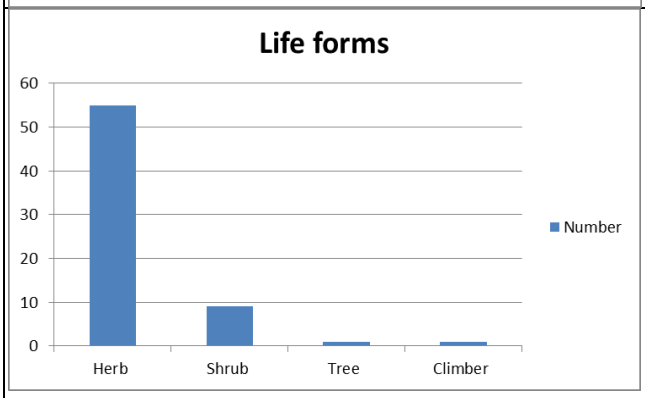


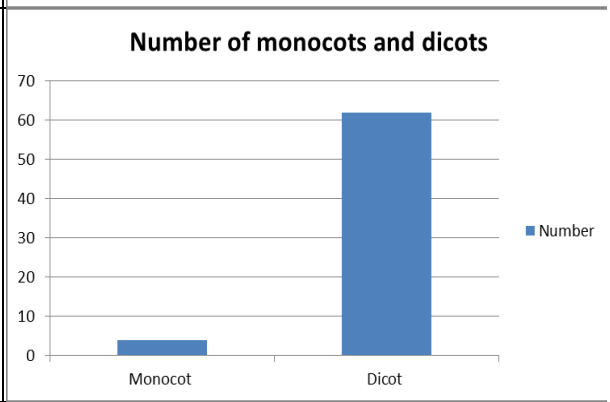
Frequency data of the shrubs recorded from Mahamaya

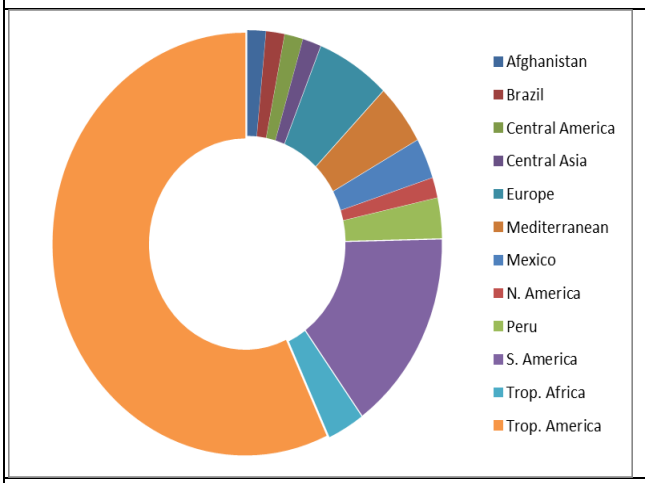
DATA ANALYSIS FOR HIMACHAL PRADESH



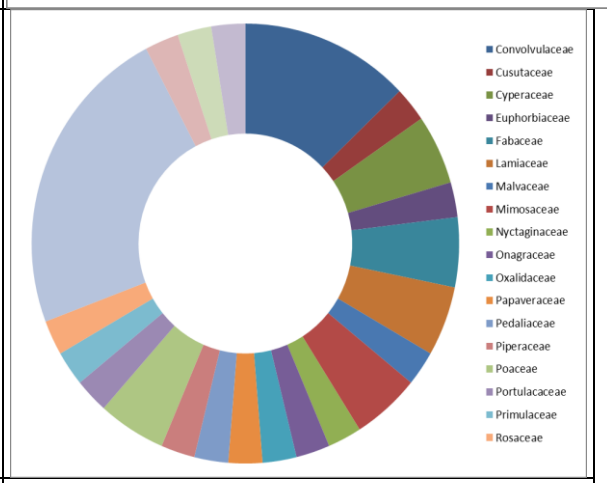








DISTRIBUTION OF NATIVITY OF PLANTS IN HIMACHAL PRADESH



DISTRIBUTION OF PLANTS BETWEEN DIFFERENT FAMILIES IN HIMACHAL PRADESH

Frequency, abundance, densit and IVI of some noxious invasive species encountered during field surveys in Himachal Pradesh

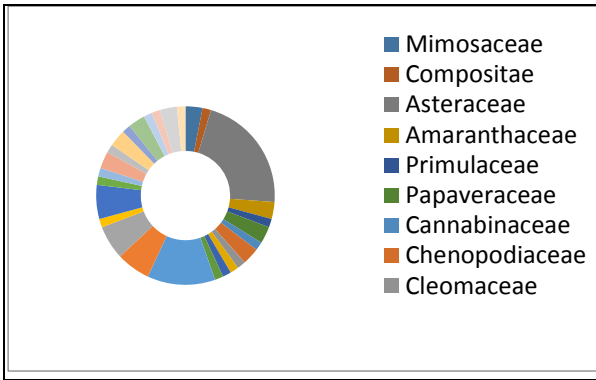
Name	Density	Frequency (%)	Abundance	IVI
Ageratinaadenophora	2.4	44	5.45	5.18
Ageratum conyzoides	4.84	43.95	11.02	7.31
Bidenspilosa	5.14	30.70	16.73	7.21
Calyptocarpusvialis	0.17	1.67	10	1.36
Hyptis suaveolens	1.83	25.40	7.20	3.72
Lantana camara	1.20	36.60	3.27	3.67
Parthenium hysterophorus	19.84	49.83	39.81	20.12

annexure-3C

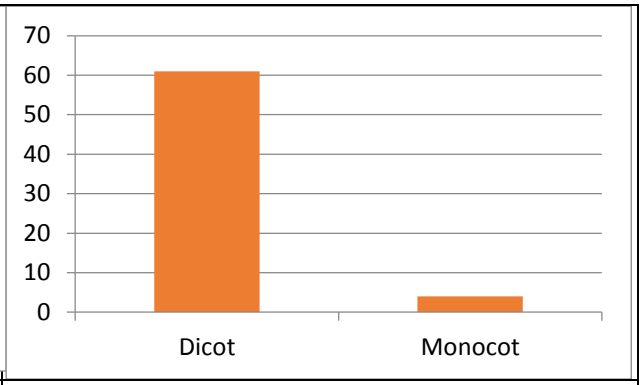
DATA ANALYSIS FOR UTTARAKHAND

List of some invasive alien species; abundance, frequency & density and IVI in Uttarakhand:

S.No	Species	Density	Frequency	Abundance	IVI
1	*Ageratina adenophora*	1.115	15	7.433	3.3377
2	*Ageratum conizoides*	0.085	3	2.833	0.7339
3	*Bidens pilosa*	0.86	10.5	8.19	2.8182
4	*Lantana camara*	0.29	12	2.416	1.6624
5	*Parthenium hysterophorus*	0.3	1	30	4.4607
6	*Taraxacum officinale*	0.035	3	1.17	0.4626

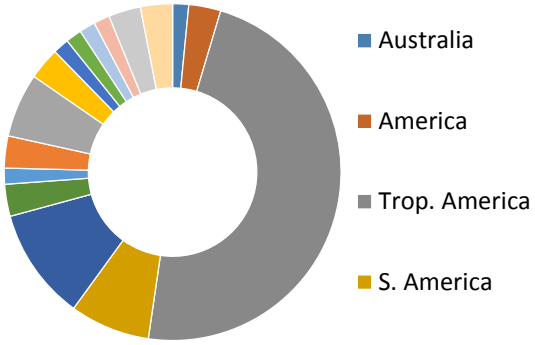


Family wise distribution of species in Uttarakhand

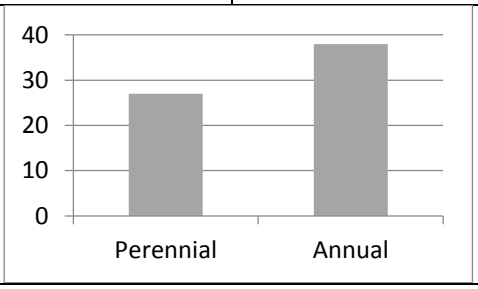


Taxonomic subgroup of species in Uttarakhand

Life form wise distribution of species

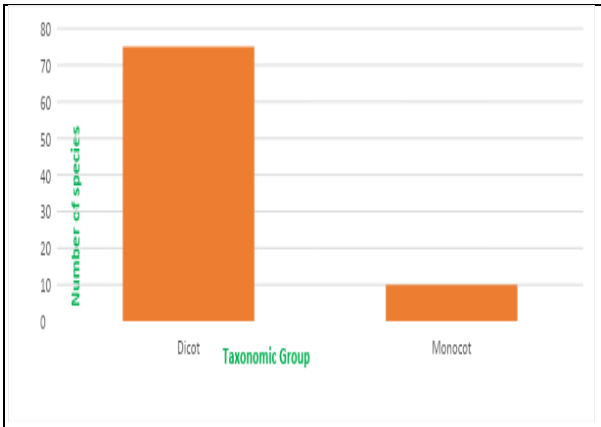


Nativity wise distribution of species

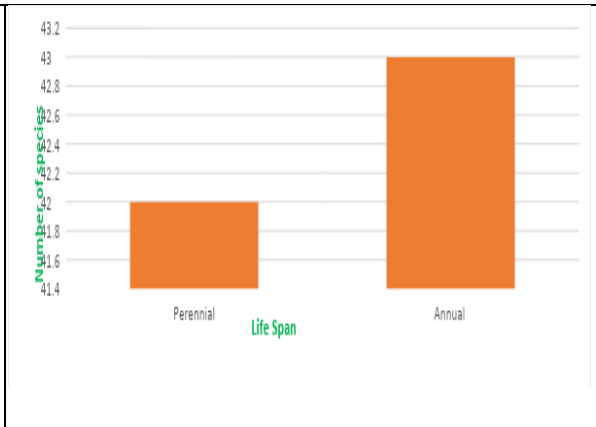


Habit wise distribution of species in Uttarakhand

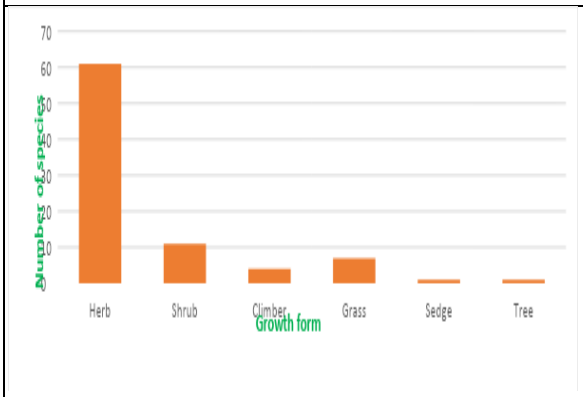
DATA ANALYSIS FOR SIKKIM & DARJEELING:



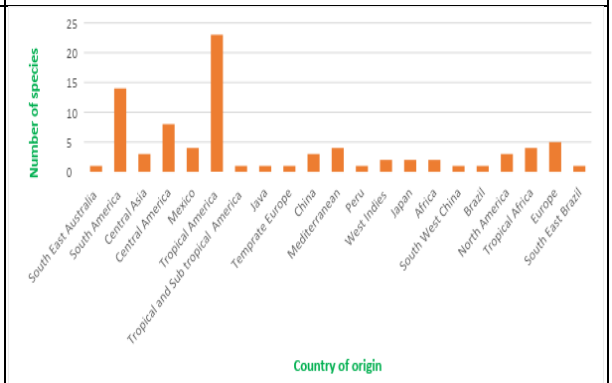
Distribution of species among angiosperms



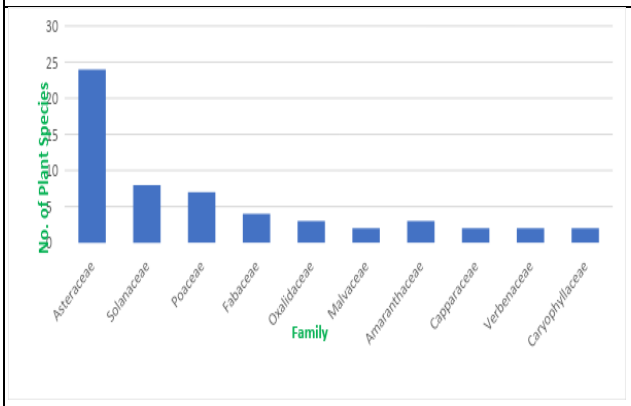
Plant species on the basis of life span.



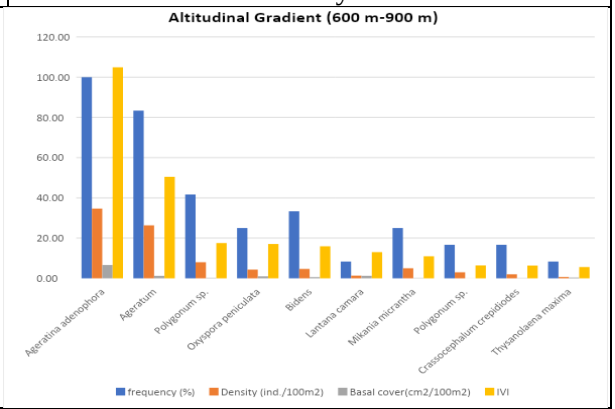
Plant species on the basis of growth form



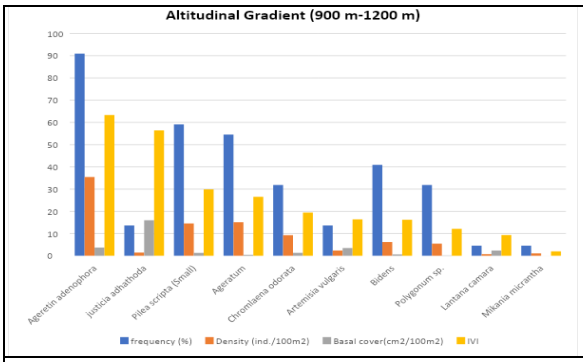
Grouping of plant species on the basis of nativity.



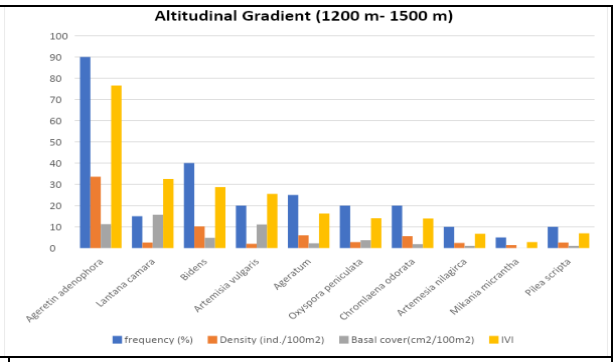
Distribution of species among top ten families



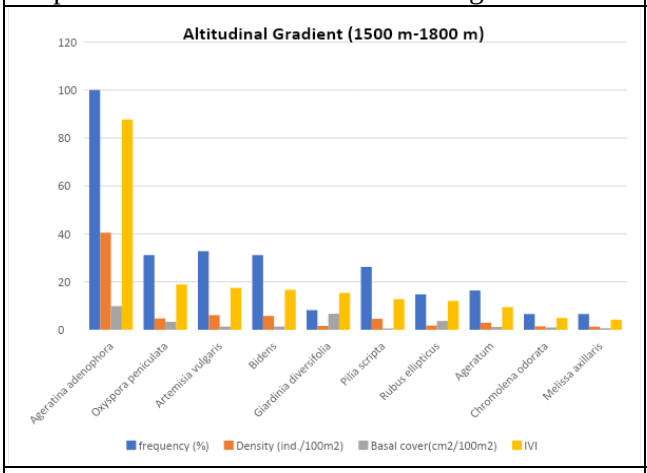
Phytosociological attributes of different plant species at 600 m-900 m altitudinal gradient.



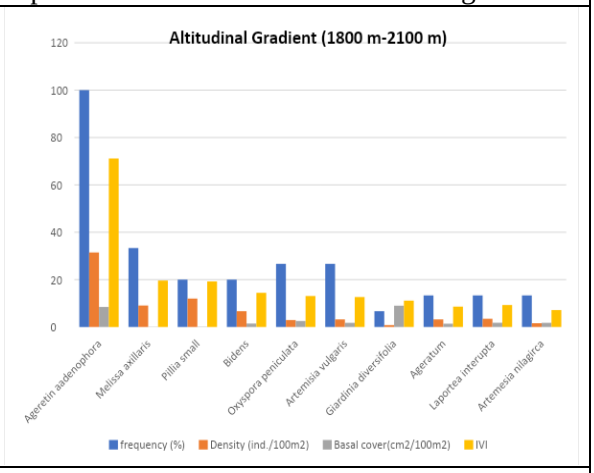
Phytosociological attributes of different plant species at 900 m-1200 m altitudinal gradient.



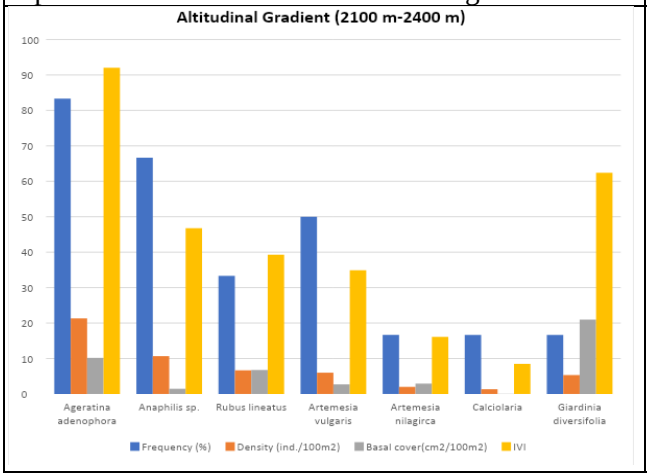
Phytosociological attributes of different plant species at 1200 m-1500 m altitudinal gradient



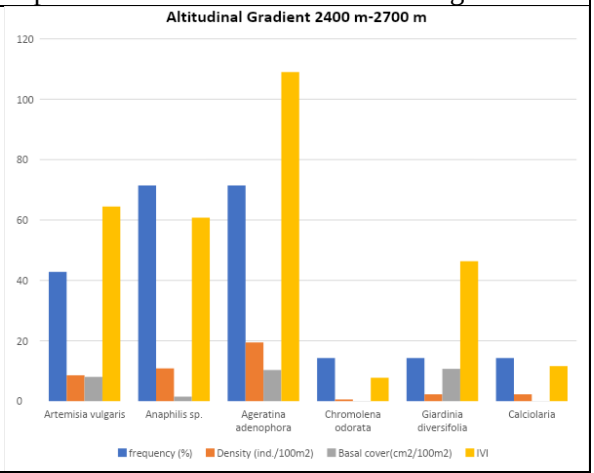
Phytosociological attributes of different plant species at 1500 m-1800 m altitudinal gradient.



Phytosociological attributes of different plant species at 1800m-2100m altitudinal gradient.



Phytosociological attributes of different plant species at 2100 m-2400m altitudinal gradient.



Phytosociological attributes of different plant species at 2400 m-2700 m altitudinal gradient.

Distribution of species among angiosperms, Plant species on the basis of life span, Plant species on the basis of growth form

Plant Group		Life Span		Growth form	
Dicots	75	Annual	43	Herb	61
Monocots	10	Perennial	42	Shrub	11
				Climber	4
				Grass	7
				Sedge	1
				Tree	1

.

Grouping of plant species on the basis of nativity.	
Nativity	Number
South East Australia	1
South America	14
Central Asia	3
Central America	8
Mexico	4
Tropical America	23
Tropical and Sub tropical America	1
Java	1
Temprate Europe	1
China	3
Mediterranean	4
Peru	1
West Indies	2
Japan	2
Africa	2
South West China	1
Brazil	1
North America	3
Tropical Africa	4
Europe	5
South East Brazil	1

Distribution of species among top ten families.	
Family	Number
Asteraceae	24
Solanaceae	8
Poaceae	7
Fabaceae	4
Oxalidaceae	3
Malvaceae	2
Amaranthaceae	3
Capparaceae	2
Verbenaceae	2
Caryophyllaceae	2

Phytosociological attributes of different plant species at 600 m-900 m altitudinal gradient

Name of the species	Frequency	Density	Basal cover	IVI
Ageratina adenophora	100.00	34.67	6.62	104.92
Ageratum conyzoides	83.33	26.33	1.24	50.49
Polygonum sp.	41.67	8.00	0.22	17.53
Oxyspora peniculata	25.00	4.33	0.99	17.07
Bidens	33.33	4.67	0.60	15.92
Lantana camara	8.33	1.33	1.25	13.02
Mikania micrantha	25.00	5.00	0.17	10.96
Polygonum sp.	16.67	3.00	0.04	6.41
Crassocephalum crepidiodes	16.67	2.00	0.13	6.34
Thysanolaena maxima	8.33	0.67	0.40	5.60

Phytosociological attributes of different plant species at 900 m-1200 m altitudinal gradient

Name of Species	frequency (%)	Density (ind./100m^2)	Basal cover(cm^2/100m^2)	IVI
Ageretin adenophora	90.90	35.45	3.68	63.33
justicia adhathoda	13.63	1.45	15.97	56.43
Pilea scripta (Small)	59.09	14.54	1.30	29.88
Ageratum	54.54	15.09	0.42	26.52
Chromlaena odorata	31.81	9.27	1.32	19.43
Artemisia vulgaris	13.63	2.36	3.47	16.38
Bidens	40.90	6.18	0.61	16.20
Polygonum sp.	31.81	5.45	0.15	12.12
Lantana camara	4.54	0.72	2.35	9.32
Mikania micrantha	4.54	1.09	0.01	1.99

Phytosociological attributes of different plant species at 1200 m-1500 m altitudinal gradient

Name of Species	frequency (%)	Density (ind./100m^2)	Basal cover(cm^2/100m^2)	IVI
Ageretina adenophora	90	33.6	11.25	76.57
Lantana camara	15	2.6	15.70	32.53
Bidens	40	10.2	4.82	28.712
Artemisia vulgaris	20	2	11.11	25.51
Ageratum	25	6	2.24	16.26
Oxyspora peniculata	20	2.8	3.69	14.04
Chromlaena odorata	20	5.6	1.83	13.93
Artemesia nilagirca	10	2.4	1.03	6.73
Mikania micrantha	5	1.4	0.05	2.80
Pilea scripta	10	2.6	1.03	6.94

Phytosociological attributes of different plant species at 1500 m-1800 m altitudinal gradient

Name of Species	frequency (%)	Density (ind./100m^2)	Basal cover(cm^2/100m^2)	IVI
Ageratina adenophora	100	40.52	9.86	87.69
Oxyspora peniculata	31.15	4.72	3.34	18.89
Artemisia vulgaris	32.79	6.1	1.36	17.46
Bidens	31.15	5.77	1.34	16.65
Giardinia diversifolia	8.2	1.64	6.69	15.36
Pilia scripta	26.23	4.59	0.56	12.74
Rubus ellipticus	14.75	1.77	3.69	12.02
Ageratum	16.39	2.95	1.17	9.46
Chromolena odorata	6.56	1.44	0.97	4.93
Melissa axillaris	6.56	1.31	0.63	4.21

Phytosociological attributes of different plant species at 1800 m-2100 m altitudinal gradient

Name of Species	frequency (%)	Density (ind./100m^2)	Basal cover(cm^2/100m^2)	IVI
Ageretin aadenophora	100	31.467	8.453	71.192
Melissa axillaris	33.33	9.06	0.11	19.60
Pillia small	20	12	0.13	19.23
Bidens	20	6.66	1.44	14.42
Oxyspora peniculata	26.66	2.93	2.53	13.08
Artemisia vulgaris	26.66	3.2	1.74	12.64
Giardinia diversifolia	6.66	0.8	8.99	11.13
Ageratum	13.33	3.2	1.37	8.60
Laportea interupta	13.33	3.46	1.78	9.27
Artemesia nilagirca	13.33	1.6	1.75	7.14

Phytosociological attributes of different plant species at 2100 m-2400 m altitudinal gradient

Name of species	Frequency (%)	Density (ind./100m^2)	Basal cover(cm2/100m2)	IVI
Ageratina adenophora	83.33	21.33	10.18	92.04
Anaphilis sp.	66.66	10.66	1.45	46.76
Rubus lineatus	33.33	6.66	6.76	39.28
Artemesia vulgaris	50	6	2.70	34.90
Artemesia nilagirca	16.66	2	2.91	16.10
Calciolaria	16.66	1.33	0.04	8.49
Giardinia diversifolia	16.66	5.33	20.95	62.42

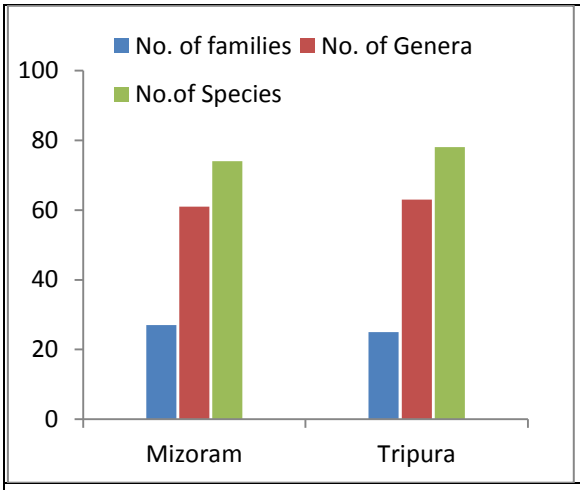
Phytosociological attributes of different plant species at 2400 m-2700 m altitudinal gradient

Name os Species	frequency (%)	Density (ind./100m^2)	Basal cover(cm2/100m2)	IVI
Artemisia vulgaris	42.857	8.571	8.039	64.43
Anaphilis sp.	71.429	10.857	1.498	60.808
Ageratina adenophora	71.429	19.429	10.32	109.04
Chromolena odorata	14.286	0.571	0.065	7.76
Giardinia diversifolia	14.286	2.286	10.709	46.349
Calciolaria	14.286	2.286	0.052	11.614

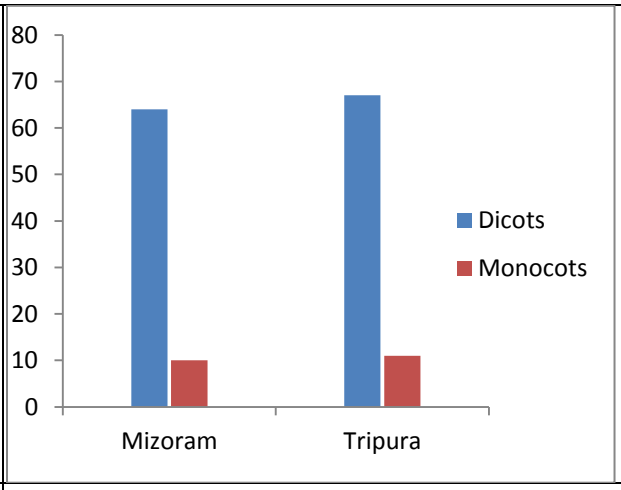
DATA ANALYSIS FOR MIZORAM & TRIPURA

Number of taxa reported from the two Himalayan States			Characterization of plant species on the basis of plant group		
Taxa	Plant Group	Mizoram	Plant Group	Mizoram	Tripura
No.of Families	Dicots	64	Dicots	64	67
No. of Genera	Monocots	10	Monocots	10	11
No. of Species	74	78			

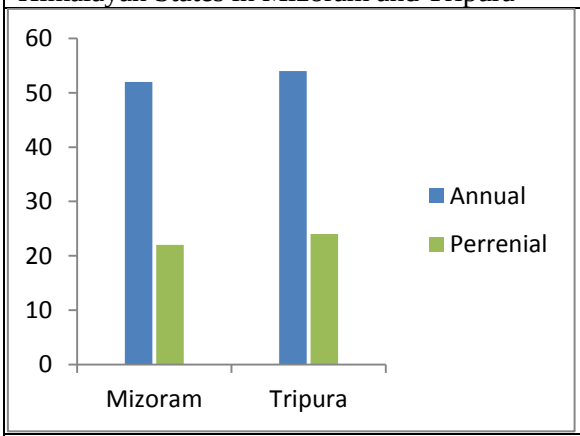
Characterization of plant species on the basis of life span		
Life Span	Mizoram	Tripura
Annual	52	22
Perrennial	54	24



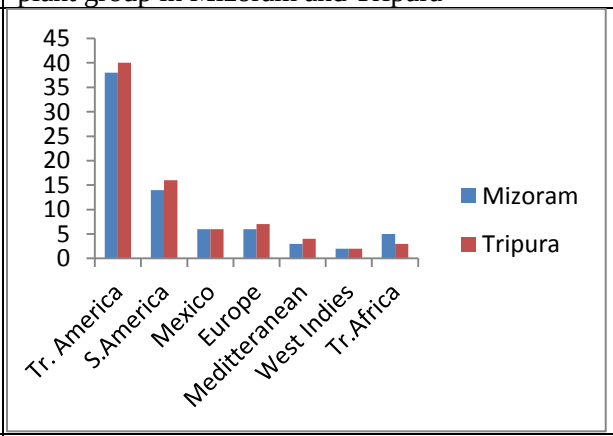
Number of taxa reported from the two Himalayan States in Mizoram and Tripura



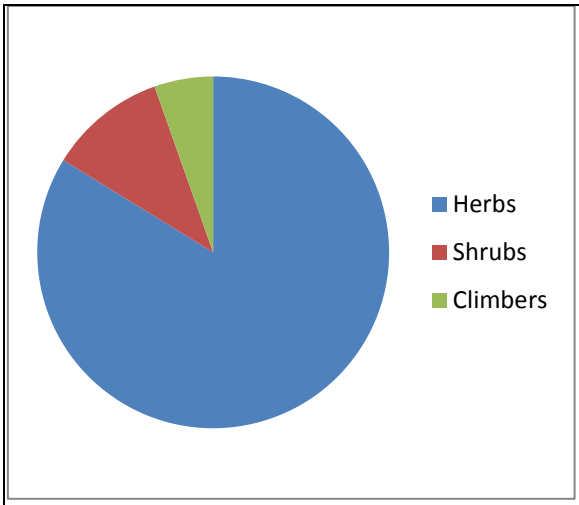
Characterization of plant species on the basis of plant group in Mizoram and Tripura



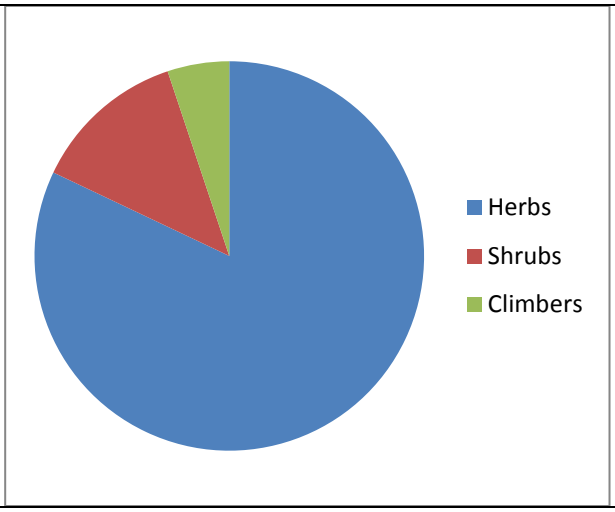
Characterization of plant species on the basis of life span in Mizoram and Tripura



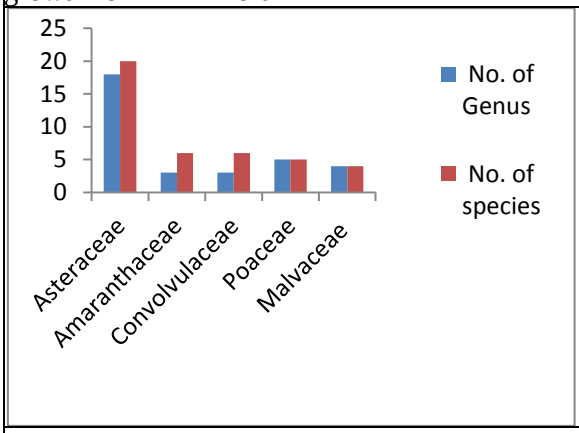
Characterization of plant species on the basis of native places in Mizoram and Tripura



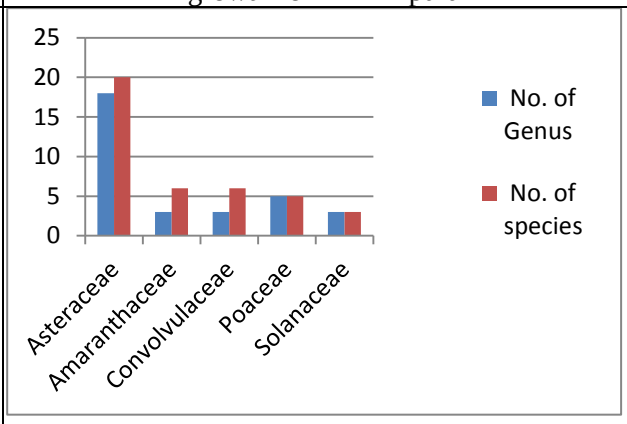
Characterization of plant species on the basis of growth form in Mizoram



Characterization of plant species on the basis of growth form in Tripura



Top five dominant family in Mizoram state



Top five dominant family in Tripura state

Characterization of plant species on the basis of native places:

Native Place	Mizoram	Tripura
Tr. America	38	40
S.America	14	16
Mexico	6	6
Europe	6	7
Meditteranean	3	4
West Indies	2	2
Tr.Africa	5	3

Characterization of plant species on the basis of growth form

Growth Form	Mizoram	Tripura
Herbs	62	64
Shrubs	8	10
Climbers	4	4

Top five dominant family in Mizoram state.

Sr.No	Family name	No. of Genus	No. of species
1.	Asteraceae	18	20
2.	Amaranthaceae	3	6
3.	Convolvulaceae	3	6
4.	Poaceae	5	5
5.	Malvaceae	4	4

Top five dominant family in Tripura state.

Sr.No	Family name	No. of Genus	No. of species
1.	Asteraceae	18	20
2.	Amaranthaceae	3	6
3.	Convolvulaceae	3	6
4.	Poaceae	5	5
5.	Solanaceae	3	3

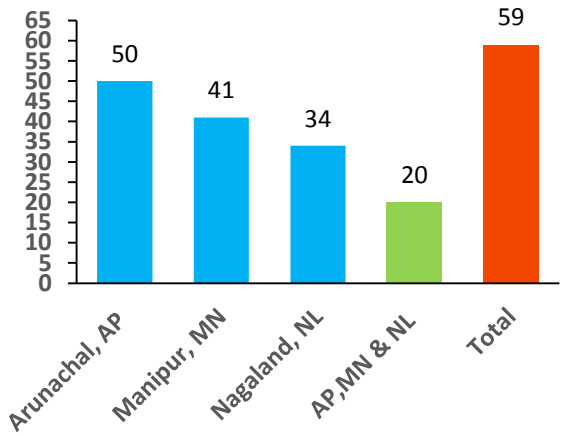
Some Invasive alien plant species recorded from Mizoram with their Invasion status

Name of the Species	Frequency	Density	Abundance	RF	RD	Rdo	IVI
Ageratina adenophora (Spreng.) King & Robinson.	**90**	**35**	**38.88**	**15**	**17.62**	**25.14**	**57.76**
Ageratina riparia (Regel) R.M.King & H.Rob.	**80**	**29**	**36.25**	**13.33**	**16.42**	**21.75**	**51.51**
Mikania micrantha Kunth.	**80**	**22.5**	**28.12**	**13.33**	**12.74**	**17.42**	**43.50**
Imperata cylindrica (L.) Raeusch	**50**	**12.5**	**25**	**8.33**	**11.32**	**4.40**	**24.06**
Ageratum houstonianum Mill.	**60**	**9.4**	**15.66**	**10**	**7.09**	**6.58**	**23.67**
Ageratum conyzoides (L.)L.	50	11	22	8.33	9.96	8.49	26.79
Chromalaena odorata (L.) R.M.King & H.Rob.	60	3.5	5.83	10	2.64	4.90	17.55
Bidens pilosa L.	50	21.5	43	8.33	19.48	3.05	30.87
Alternanthera sessilis (L.) R.Br. ex DC.	50	1.3	2.6	8.33	1.17	1.64	11.15
Lantana camara L.	30	1	3.33	5	1.51	6.58	13.09

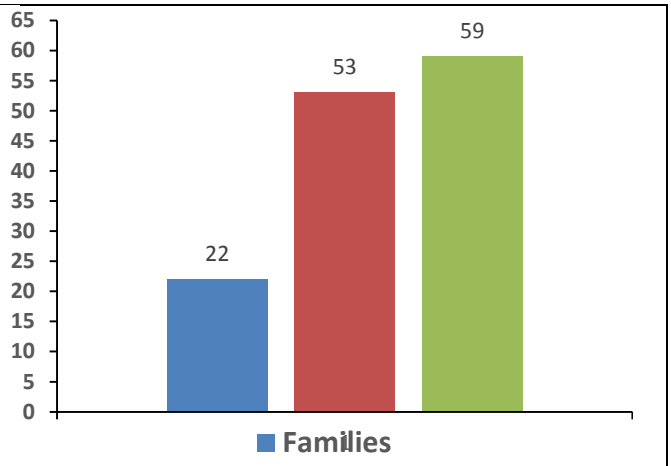
Some Invasive alien plant species recorded from Tripura with their Invasion status

Name of the Species	Frequency	Density	Abundance	RF	RD	Rdo	IVI
Mikania micrantha Kunth	**80**	**24**	**30**	**14.81**	**18.33**	**20.94**	**54.09**
Chromolaena odorata (L.) R.M.King&H.Rob.	**70**	**18**	**25.71**	**12.96**	**19.83**	**16.94**	**49.74**
Lantana camara L.	**50**	**15**	**30**	**9.25**	**22.39**	**17.95**	**49.61**
Ageratum conyzoides (L.) L.	**50**	**13.5**	**27**	**9.25**	**17.91**	**9.90**	**37.08**
Ipomea carnea Jacq.	**40**	**8**	**20**	**7.40**	**9.51**	**15.01**	**31.93**
Imperata cylindrica (L.) Raeusch.	60	5.5	9.16	11.11	3.73	1.77	16.61
Urena lobata L.	60	3.8	6.33	11.11	3.26	5.29	19.66
Ageratum houstonianum Mill.	50	1.5	3	9.25	1.67	3.29	14.23
Bidens pilosa L.	50	1.3	2.6	9.25	1.45	1.77	12.48
Saccharum spontaneum L.	30	1	3.33	5.55	1.86	7.09	14.51

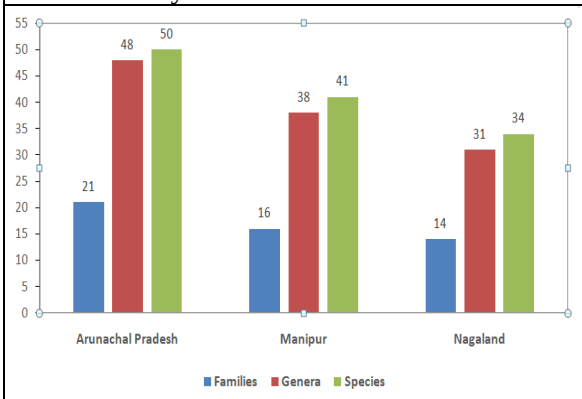
DATA ANALYSIS FOR MANIPUR,NAGALAND & ARUNACHAL PRADESH



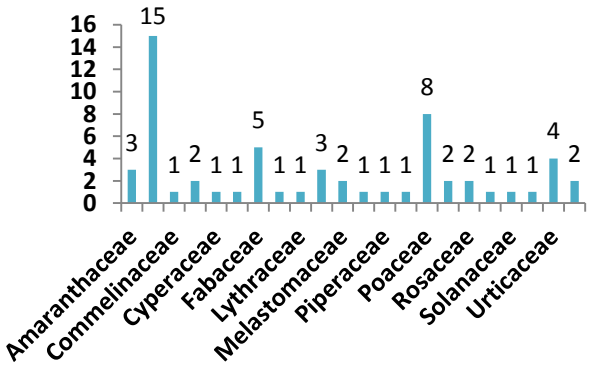
Number of recorded invasive species from the three Himalayan States



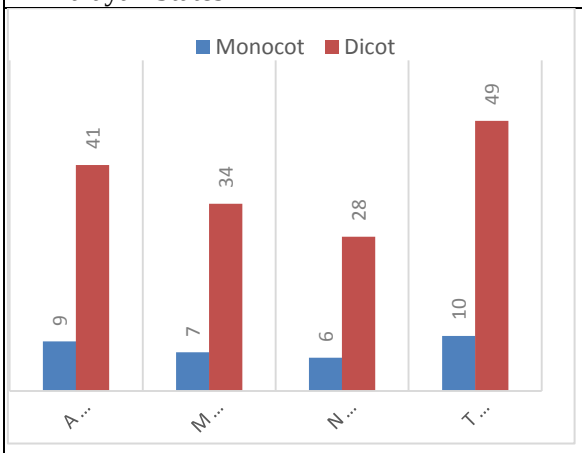
Number of taxa reported from the three states



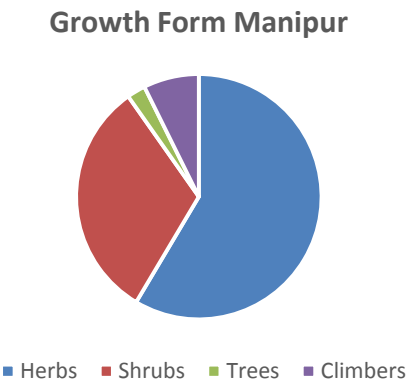
Number of taxa reported from each of the three Himalayan States



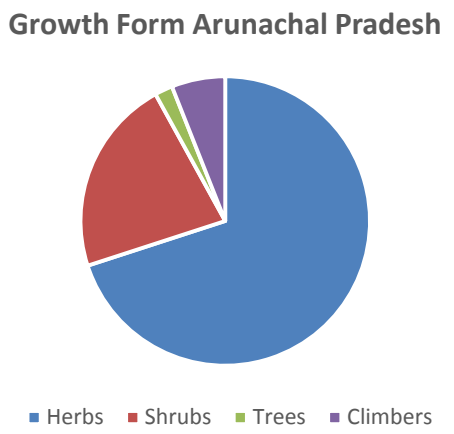
Observed families for the fifty nine different plants

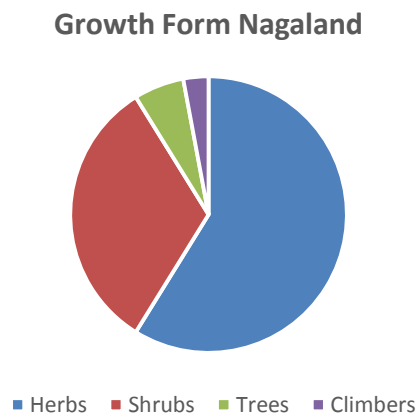


Characterisation of plant species on the basis of plant group



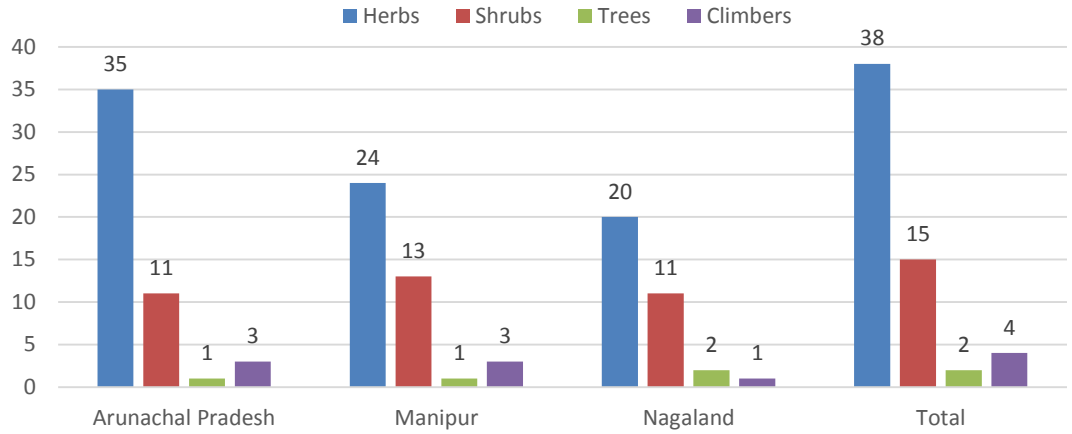
Characterization of plant species on the basis of growth form





Characterization of plant species on the basis of growth form

Characterization of plant species on the basis of growth form



Characterisation of plant species on the basis of life forms

Number of taxa reported from each of the three Himalayan States			
No. of Taxa	Arunachal Pradesh	Manipur	Nagaland
Families	21	16	14
Genera	48	38	31
Species	50	41	34

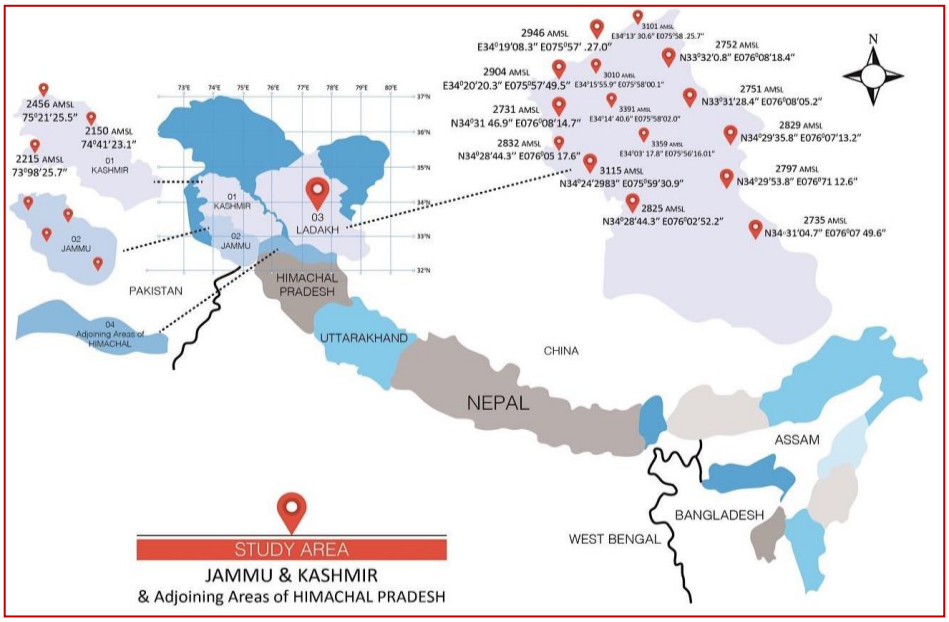
Characterisation of plant species on the basis of growth form			
Growth form	Arunachal Pradesh	Manipur	Nagaland
Herbs	35	24	20
Shrubs	11	13	11
Trees	1	1	2
Climbers	3	3	1
Characterisation of plant species on the basis of plant group			
Group	AP	Manipur	Nagaland
Monocot	9	7	6
Dicot	41	34	28

Invasive status of ten different invasive species according to their respective IVI Values in Arunachal Pradesh, Manipur and Nagaland .

Species	Family	Average IVI		
		Arunachal Pradesh	Manipur	Nagaland
Chromolaena odorata	Asteraceae	24.61	55.53	24.44
Ageratum conyzoides	Asteraceae	60.88	18.69	21.49
Lantana camara	Verbenaceae	8.63	33.22	7.09
Mikania micrantha	Asteraceae	9.79	11.81	4.13
Ageratina adenophora	Asteraceae	17.11	48.61	87.16
Galinsoga quadriradiata	Asteraceae	5.61	-	-
Tithonia diversifolia	Asteraceae	2.56	14.99	-
Artemisia nilagirica	Asteraceae	9.81	12.38	6.15
Parthenium hysterophorus	Asteraceae	4.05	0.23	2.28
Mucuna sp.	Fabaceae	-	0.23	-

annexure-4A

SITE DETAILS FOR JAMMU & KASHMIR

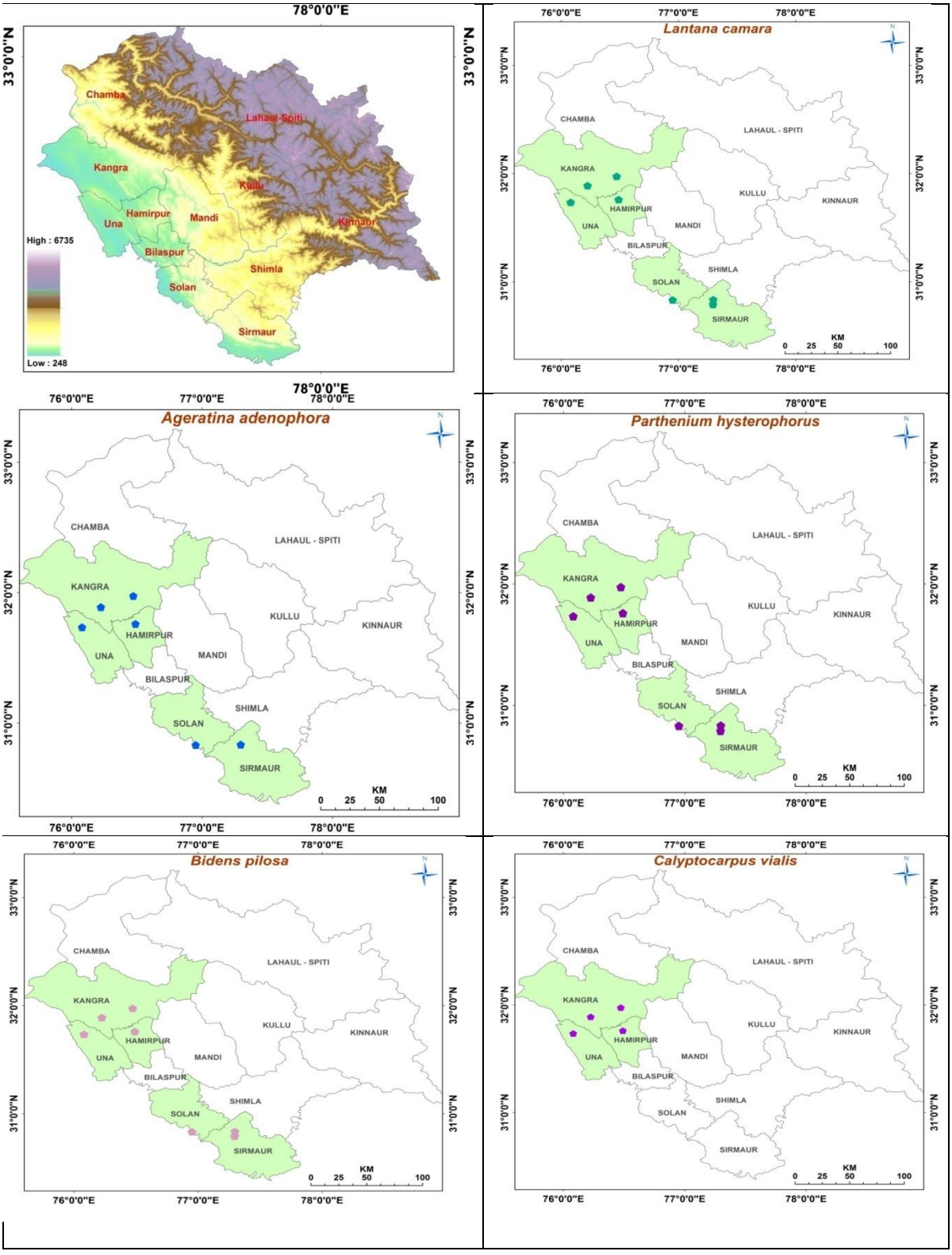


Collection sites recorded, their geo-coordinates and habitat types

Site Name	Altitude(Ft)	Lat.	Long.	Habitat type
Titichumik	2752	N33°32′0.8″	E076°08′18.4″	Sandy and Rocky
Minji Kargil				
	2751	N33°31′28.4″	E076°08′05.2″	Moist and shady area
Trespone Kargil				
	2781	N34°30′21.7″	E076°07′36.4″	Rocky open area
Kargil campus				
	2829	N34°29′35.8″	E076°07′13.2″	Rocky area
Faroona Kargil				
	2797	N34°29′53.8″	E076°71 12.6″	Rocky area
Lankarchay				
	2735	N34°31′04.7″	E076°07 49.6″	Moist and shady Area
Sankoo Kargil				
	2832	N34°28′44.3″	E076°05 17.6″	Moist and shady Area
Karpokhar Kargil				
	2825	N34°28′44.3″	E076°02 52.2″	Rocky open type
Pampore Saffron fieds	1584	N 33° 98' 50.96"	74° 93' 52.57" E	Open karewas
Chandhara Pampore	1588	N 33°98'01.4"	E074°95'43.18"	Open karewas
Parkhachik	3359	E34°03′ 17.8″	E075°561′6.1″	Rocky Moist area
Hunderman	2904	E34°20′20.3″	E075°57 .49.5″	Rocky Area

Gahan Viloo	2203	E33°60'90.78"	E075◦41.64.6″	Waste land
Pampore Along road side open area	1587	N 33°98'34.69"	E0 74°93'53.61"	Open karewas along road side
Kokernag	1808	N33°60'51.8"	E075°26'90.1"	Mustard field
Kulgam	2100	N32°59'49.6"	E074°16'10.1"	Orchid
National highway wanpoh	1600	N33°64'55.2"	E075°01'50.9"	waste land
National highway bijbihara	1559	N33°74'43.8"	E075°12'60.61"	Road side waste land
Thagiwar	1530	E33°70'78.5"	E075°19'36.8"	Barren field
Awantipora	1556	E33°88'63.84"	E075°02'8.3"	Waste land
Kupwara	1688	E 34°52'37.8"	N074°3'22.78"	Orchid
Bandipora	1930	34°60'30.6	N074°29'19.6	Rce field and Orchid

SITE DETAILS FOR HIMACHAL PRADESH



Study sites- Lower and Middle Shiwaliks of Himachal Pradesh covering 10 Districts:	**Solan, Sirmaur, Una, Bilaspur, Hamirpur, Chamba, Kullu, Shimla , Kangra , Mandi**

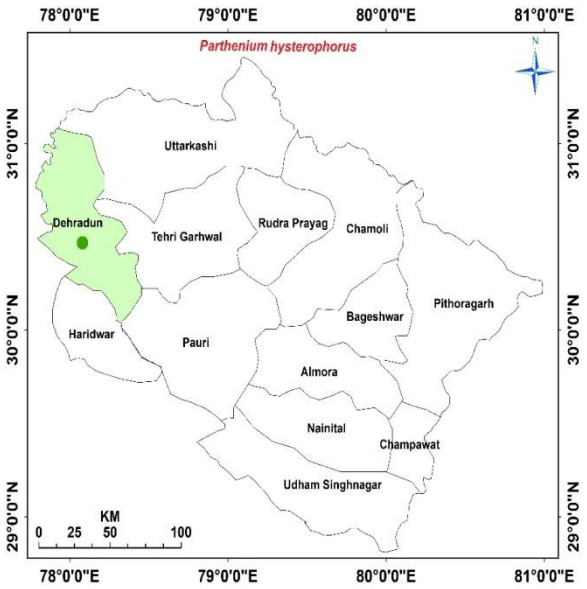
STUDY SITES WITH CO-ORDINATES

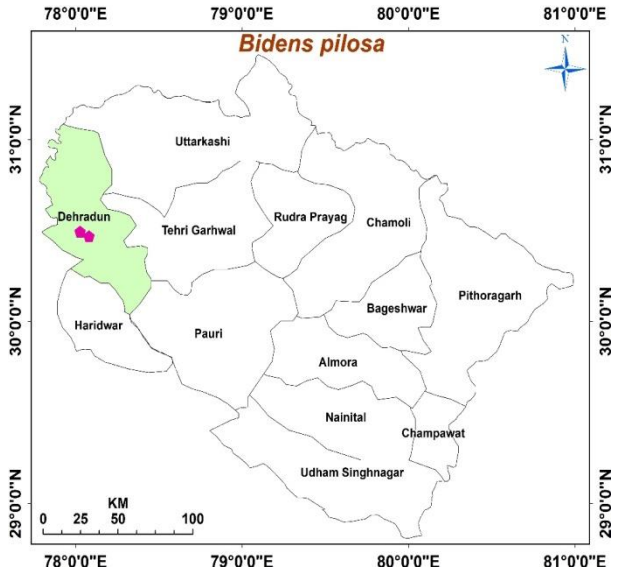
Site no.	S.no.	Name	Latitude	Longitude	Altitude
SITE 1	1.1	*Ageratum conyzoides*(L.) L. *Bidenspilosa* L. *Calyptocarpusvialis Less.* *Lantana camara* L. *Parthenium hysterophorus* L.	31°58'29.10"	076°28'20.76"	675m
	1.2	*Ageratum conyzoides* (L.) L. *Bidenspilosa* L. *Calyptocarpusvialis Less.* *Lantana camara* L. *Parthenium hysterophorus* L. *Ageratinaadenophora* (Spreng.) R.M.King&H.Rob.	31°45'37.08"	076°29'21.48"	835m
SITE 2	2.1	*Ageratum conyzoides* (L.) L. *Bidenspilosa* L. *Calyptocarpusvialis Less.* *Lantana camara* L. *Parthenium hysterophorus* L. *Ageratinaadenophora* (Spreng.) R.M.King&H.Rob.	31°53'20.10"	076°13'28.92"	600m
	2.2	*Ageratum conyzoides* (L.) L. *Bidenspilosa* L. *Calyptocarpusvialis Less.* *Lantana camara* L. *Parthenium hysterophorus* L. *Ageratinaadenophora* (Spreng.) R.M.King&H.Rob.	31°44'05.88"	076°04'49.56"	700m
SITE 3	3.1	*Ageratum conyzoides* (L.) L.	30°49'54.72"	076°57'02.28"	

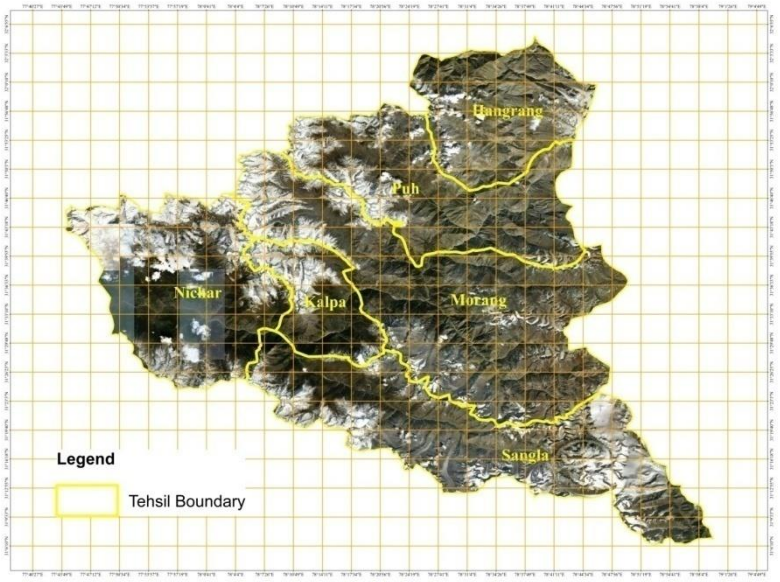
		Bidenspilosa L.			725m
		Parthenium hysterophorus L.			
		Lantana camara L.			
		Hyptis suaveolens (L.) Poit.			
	3.2	*Bidenspilosa* L.	30°47'25.62"	077°17'38.38"	872m
		Parthenium hysterophorus L.			
		Lantana camara L.			
	3.3	*Ageratum conyzoides* (L.) L.	30°53'29.62"	076°13'39.70"	1075m
		Parthenium hysterophorus L.			
		Lantana camara L.			
		Bidenspilosa L.			
		Ageratinaadenophora (Spreng.) R.M.King&H.Rob.			
	3.4	*Ageratum conyzoides* (L.) L.	30°50'06.00"	077°17'46.40"	1488m
		Parthenium hysterophorus L.			
		Lantana camara L.			
		Bidenspilosa L.			
		Ageratinaadenophora (Spreng.) R.M.King&H.Rob.			
SITE 4	4.1	None of the above species found	32°26'12.70"	076°32'57.14"	2293m
	4.2	None of the above species found	32°35'15.39"	076°05'24.02"	1018m

SITE DETAILS FOR UTTARAKHAND AND KINNAUR DISTRICT OF HIMACHAL PRADESH

Site name	Coordinates	Altitude (m)	Species name
Dehradun (Mussoorie)			
Site 1	30°27’33.721”, 078°4’42.978”	1857m	*Ageratina adenophora, Ageratum conyzoides*
Site 2	31°44’5.881”, 076°5’50.161”	1721m	*Taraxicum officinale, Artemesia*sp., *Ageratina adenophora*
Site 3	30°28’ 6.780”, 078°4’50.221”	1316m	*Bidens pilosa, Lantana camara, Ageratum conyzoides, Parthenium hyterophorus, taraxicum officinale*
Almora (Binsar)			
Site 1	30°29’36.060”, 078°1’37.679”	1726m	*Ageratina adenophora, Taraxacum officinale, Bidens pilosa, Rumex nepalensis*
Site 2	29°38’21.059”, 079°36’42.779”	1249m	*Rubusellipticus, Artemisia* sp.
Site 3	29°40’10.859”, 079°29’24.000”	1729m	*Ageratina adenophora,*
Site 4	29°23’31.801”, 079°30’43.200”	1649m	*Rubus ellipticus, Lantana camara, Artemisia* sp.
Kinnaur			
Site 1	31°32’10.799”, 078°15’31.201”	2477m	*Artemisia* sp., *Robinia pseudoacacia*
Site 2	31°21’5.400” 078°26’16.199”	3520m	*Robinia pseudoacacia*



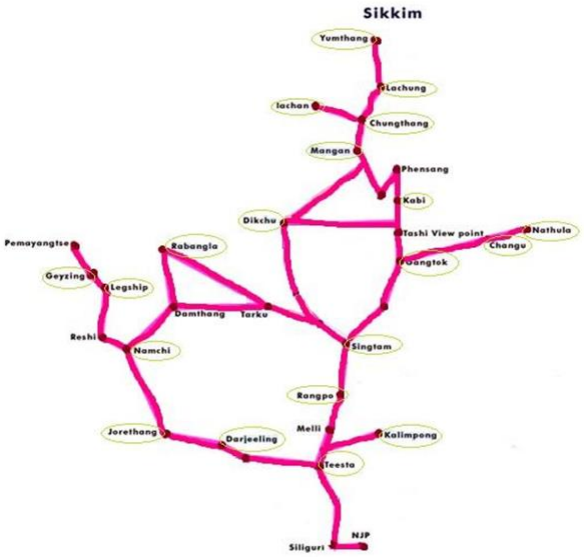




Grid map of Kinnaur district, Himachal Pradesh

SITE DETAILS FOR SIKKIM & DARJEELING (WEST BENGAL)

Map of study areas.



Map showing area visited in Sikkim

SITE DETAILS FOR MIZORAM & TRIPURA

MIZORAM:-

Phawngpui National Park is situated near the state's south-eastern border overlooking the bend of the Chhimtuipui River and the hill ranges of Myanmar. Sangau village, which is about 229 kms from Aizawl, is the closest settlement to Phawngpui. With a height of 2157 meters at the peak, the ridge stretches nearly 10 kms in north-south direction. Abounding with diverse flora and fauna, Phawngpui has been declared a National Park covering an area of about 50 sq.km. Exploring the park requires trekking to reach Far Pak. Our team of three people visited the national park on 30/10/2018 and performed quadrate study for various plants species for 3 days including trekking and field work. We took data for 4 sites at Mizoram and performed quadrates of 1 m X 1 m .Plant species like Bidens pilosa L.(Asteraceae), Crassocephalum crepidioides (Benth.) Moore (Asteraceae) Emilia sonchifolia (L.) DC.(Asteraceae) , Galinsoga parviflora Cav. .(Asteraceae), Sida acuta Burm.f. (Malvaceae), Triumfetta rhomboidea Jacq.(Tiliaceae), Urena lobata L.(Malvaceae), Ageratina adenophora (Spreng.) King & Robinson. (Asteraceae) , Ageratum houstonianum Mill. (Asteraceae) etc. Mikania micrantha Kunth. (Asteraceae) was abundant till 1700 m elevation but afterwards spread of Ageratina adenophora (Spreng.) King & Robinson (Asteraceae) was abundant whereas Mikania micrantha Kunth (Asteraceae) was scarce.

Murlen National Park is a national park located in the Champhai district Mizoram in India. The size of the park area is 200 sq.km. (77 sq mi). The park is situated about 245 km east of Aizawl, and is close to the Chin Hills. It lies north of Lengteng Wildlife Sanctuary in the same district. It covers an area of approximately 100 km2. The tropical, semi-evergreeen and sub montane Forests of Murlen are home to a rich variety of flora and fauna. Plant species like Ageratum houstonianum Mill. (Asteraceae), Triumfetta rhomboidea Jacq. (Tiliaceae), Emilia sonchifolia (L.) DC. (Asteraceae), Sida acuta Burm.f.(Malvaceae), Galinosoga parviflora Cav.(Asteraceae), Urena lobata L.(Malvaceae), Ageratina adenophora (Spreng.) King & Robinson. (Asteraceae) etc. Mikania micrantha Kunth. (Asteraceae) etc are observed.

Lengteng Wildlife Sanctuary is a protected area in Champhai district in eastern Mizoram, northeast India. It is an alpine forest and contains the second highest peak in Mizoram. Lengteng Wildlife Sanctuary is located a few kilometres from Indo-Burma border and north of Murlen National Park. It lies adjacent to the village Lamzawl, and the nearest town is Ngopa. Selam village is within the sanctuary. It is at an altitude of 400-2,141 m alt. It covers an area of 60 km2.. Common invasive alien herbs are Ageratina adenophora (Spreng.) King & Robinson. (Asteraceae) etc. Mikania micrantha Kunth. (Asteraceae), Maesa indica (Roxb.) A. DC. (Primulaceae) etc.

TRIPURA:-

Sepahijola wildlife sanctuary is truly the biodiversity heaven of Tripura with an area of 18.53 km2. With the increase in population, there was considerable pressure threatening to diminish the forest cover and the related biodiversity of the Sepahijola area. To conserve and propagate the biodiversity of the area, the Sepahijola bio-complex came into existence in 1972. The sanctuary has numerous plant species, many kinds of bamboo and a variety of grasses and medicinal plants also grow in the sanctuary. One important cultivated area of Sepahijala are coffee and rubber plantations. Clouded Leopard National Park was established in the year of 2007. Total area of the park is 5.08 km2.Invasive herbs like Tridax procumbens L. (Asteraceae), Triumfetta rhomboidea Jacq.(Tiliaceae), Turnera ulmifolia L. (Turneraceae), Urena lobata L. (Malvaceae) , Stachytarpheta jamaicensis (L.) Vahl (Verbenaceae), Synedrella nodiflora (L.) Gaertn(Asteraceae) , Sonchus asper Hill(Asteraceae), Mikania micrantha Kunth.(Asteraceae), Spermacoce hispida L.(Rubiaceae), Sida acuta Burm.f.(Malvaceae), Lantana camara L. (Verbenaceae), Ipomoea carnea Jacq (Convolvulaceae), Chromolaena odorata (L.) King & Robinson (Asteraceae), Hyptis suaveolens (L.) Poit.(Lamiaceae) etc are observed.

Trishna Wildlife Sanctuary is another protected area 111 km far from Agartala dedicated to the vital mission of conservation of nature, wildlife and .It's area is 194.704 km2. with healthy forest coverage and plant-plethora.Trishna wildlife sanctuary also possess some important aquatic bodies which are full of Nymphaea nouchali N. L. Burman(Nymphaeaceae), Utricularia aurea Loureiro (Lentibulariaceae), Nymphoides indica (Linnaeus) Kuntze (Menyanthaceae), Ceratophyllum

Distributionersum L.(Ceratophyllaceae) , Pistia stratiotes Linnaeus (Araceae) etc.

The Rowa Wildlife Sanctuary is over an area of 0.86 km2 of erstwhile protected forests (unclassified open Government Forest) in mouja Rowa of tehsil panisagar under Dhamanagar subdivision in north Tripura.The sanctuary is home to a bewildering variety of plant species including several species of medicinal value and their protection in the wilderness is extremely important from the conservation point of view. Invasive plants like Mikania micrantha Kunth.(Asteraceae), Spermacoce hispida L.(Rubiaceae), Sida acuta Burm.f.(Malvaceae), Lantana camara L. (Verbenaceae), Ipomoea carnea Jacq (Convolvulaceae), Chromolaena odorata (L.) King & Robinson(Asteraceae), Hyptis suaveolens (L.) Poit. (Lamiaceae) etc are observed.

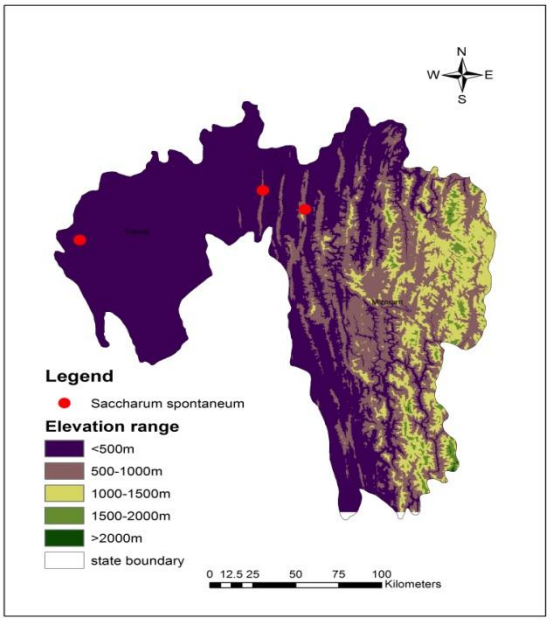
Gomati Wildlife Sanctuary is the largest sanctuary of Tripura. The sanctuary is located in the south-East corner of the state in between the Gomati District & Dhailai District. Its area is 289.54 Kms. Adjoining the sanctuary, there is a vast water reservoir covering approximately 300 km2. Aquatic plants like Nymphoides indica (Linnaeus) Kuntze (Menyanthaceae), Ceratophyllum Distributionersum L.(Ceratophyllaceae) , Pistia stratiotes Linnaeus (Araceae) , Eichhornia crassipes (Martius) Solms (Pontederiaceae) etc are observed in here. Invasive weeds like Ageratum conyzoides L. (Asteraceae), Blumea lacera (Burm. f.) DC. (Asteraceae), Cleome rutidosperma DC.(Cleomaceae), Chromolaena odorata (L.) King & Robinson ((Asteraceae), Evolvulus nummularius (L.) L.(Convolvulaceae), Hyptis suaveolens (L.) Poit. (Lamiaceae) , Mimosa pudica L.(Mimosaceae) etc are observed.

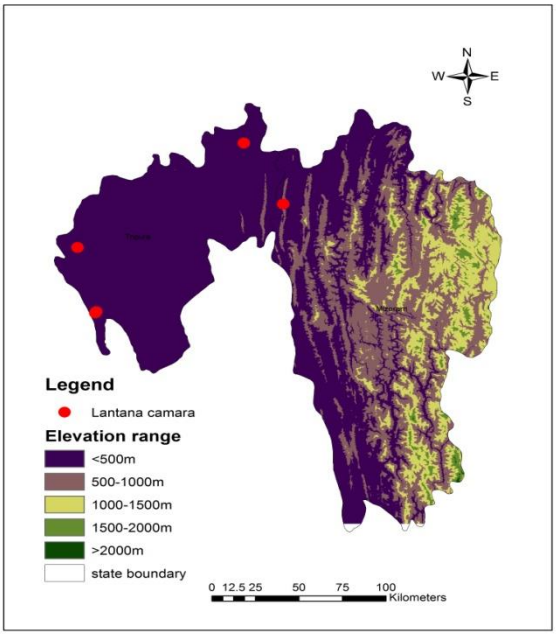
	Long(E)	Lat(N)		Long(E)	Lat(N)
Gomati WLS	91.76521	23.41451	Vanghmun	92.18752	24.25465
	91.78127	23.41658		92.1999	24.21969
	91.79188	23.41268		92.20539	24.18159
	91.79883	23.41533		92.20928	24.13675
	91.81096	23.42307		92.20259	24.09436
	91.81251	23.42363		92.19907	24.04721
	91.82577	23.42533		92.24383	24.03768
	91.82686	23.42442		92.24383	24.03768
	91.82684	23.42443		92.27735	24.05838
	91.82682	23.42444		92.27975	24.01056
			Phawnhpui NP	93.04851	22.72714
Trishna WLS	91.40071	23.28034		93.04838	22.72676
	91.40219	23.27843		93.04851	22.72419
	91.40246	23.27649		93.04853	22.71979
	91.40237	23.27805		93.04818	22.7155
	91.40264	23.28077		93.04819	22.71374
	91.40235	23.28233		93.04834	22.71303
	91.40039	23.28269		93.04937	22.71193
	91.40198	23.28039		93.04889	22.71093
	91.39812	23.28108		93.04738	22.7097
	91.39808	23.28111			
Rowa WLS	92.14668	24.23548	Ngopa(Lengteng WLS)	92.7169	23.73702
	92.1534	24.28022		92.79829	23.72225
	92.1652	24.29057		92.80148	23.72141
	92.16798	24.29161		92.81374	23.74184
	92.16812	24.29183		92.81735	23.74234
	92.16815	24.29187		92.83917	23.73493
	92.16856	24.2931		92.86437	23.72214
	92.16608	24.29378		92.87176	23.7127
	92.16502	24.29463		92.87765	23.71321
	92.16438	24.29388		92.88404	23.69012

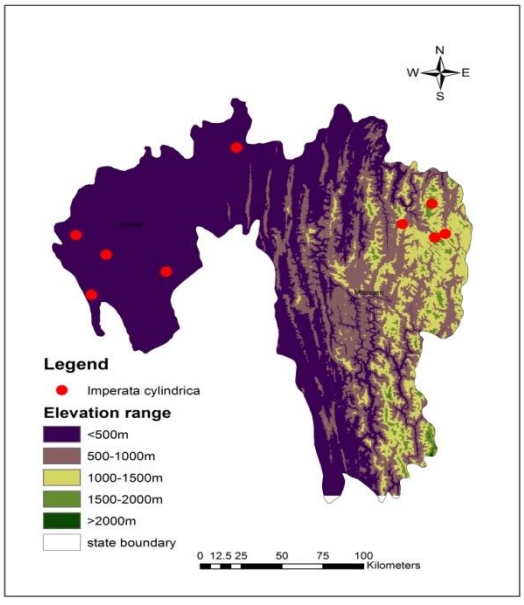
Murlen NP	93.37625	23.70612
	93.38297	23.70409
	93.37782	23.6965
	93.34792	23.66955
	93.34774	23.66955
	93.34639	23.65168
	93.34456	23.64219
	93.34471	23.64003

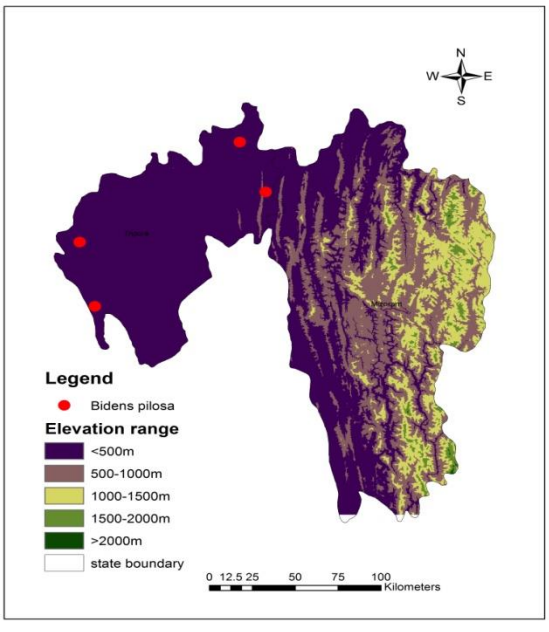
Elevation Maps of Mizoram & Tripura with IAVPS co-ordinates

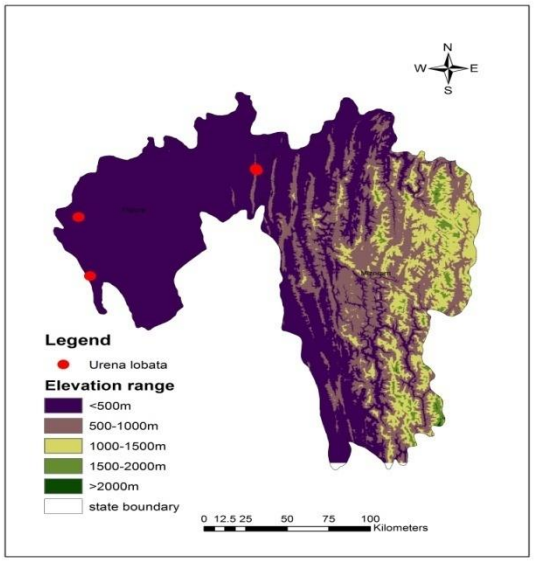
TRIPURA MAPS

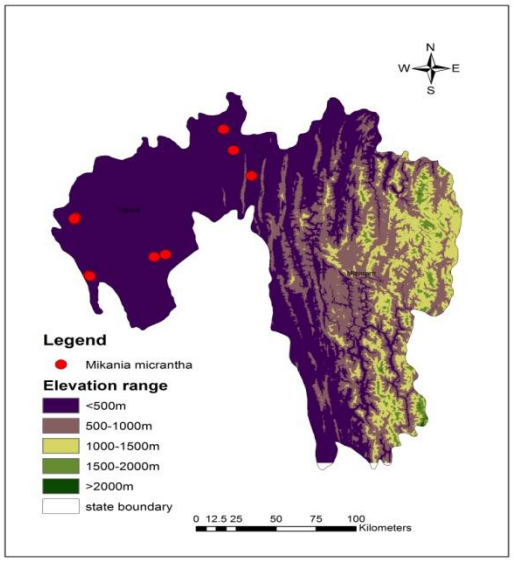


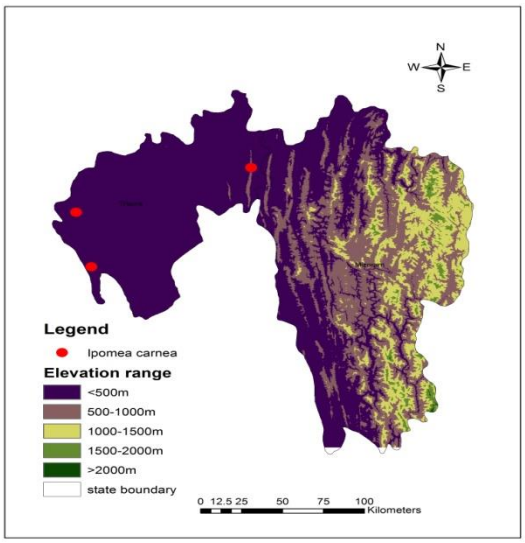


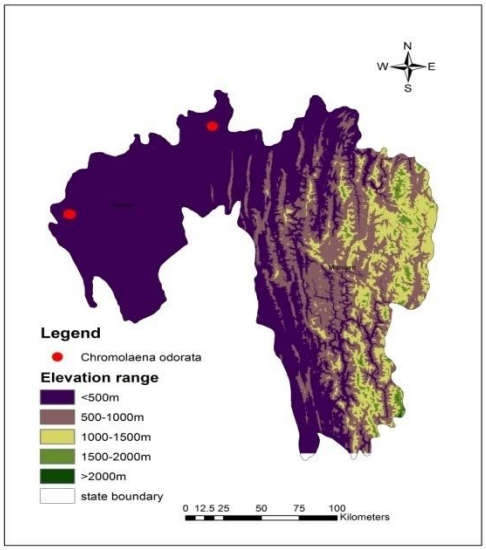


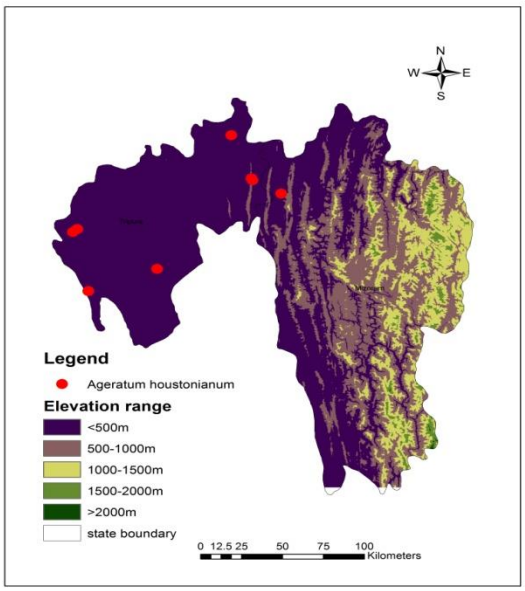


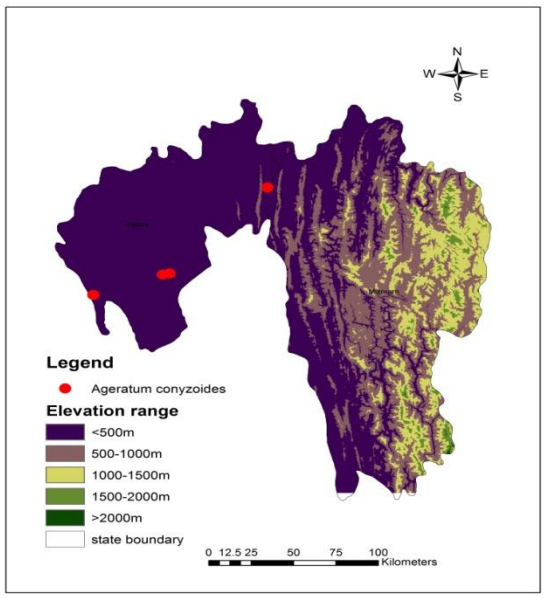

N
W
E
S
Legend
Urena lobata
Elevation range
<500m
500-1000m
1000-1500m
1500-2000m
>2000m
state boundary
0 12.5 25 50 75 100
Kilometers


N
W
E
S
Legend
Mikania micrantha
Elevation range
<500m
500-1000m
1000-1500m
1500-2000m
>2000m
state boundary
0 12.5 25 50 75 100
Kilometers

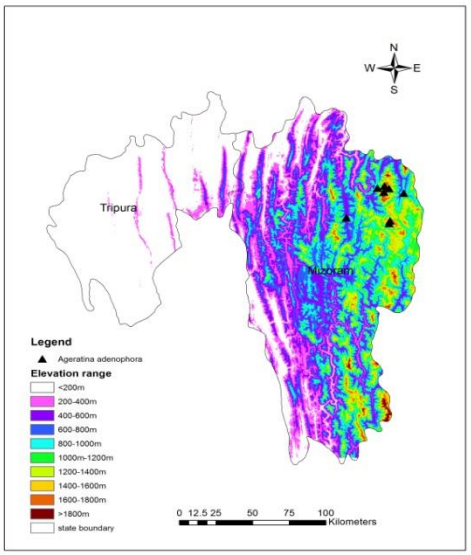

N
W
E
S
Legend
Ipomea carnea
Elevation range
<500m
500-1000m
1000-1500m
1500-2000m
>2000m
state boundary
0 12.5 25 50 75 100
Kilometers

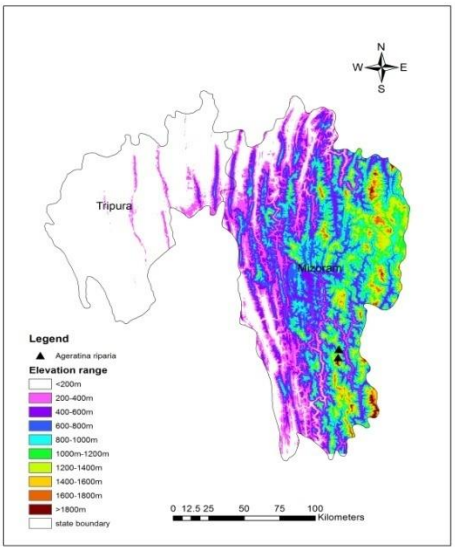

N
W
E
S
Legend
Chromolaena odorata
Elevation range
<500m
500-1000m
1000-1500m
1500-2000m
>2000m
state boundary
0 12.5 25 50 75 100
Kilometers

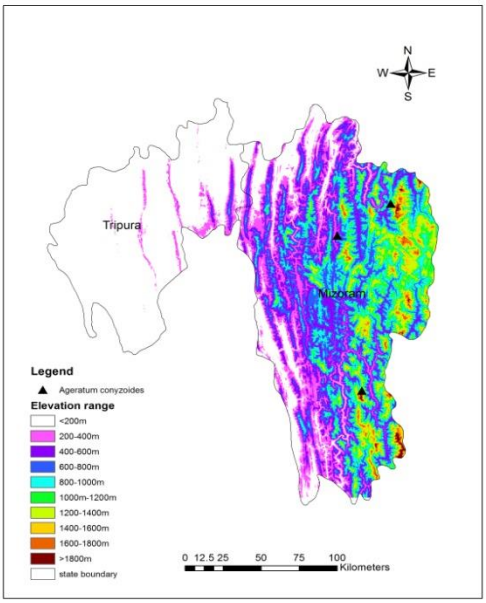

N
W
E
S
Legend
Ageratum houstonianum
Elevation range
<500m
500-1000m
1000-1500m
1500-2000m
>2000m
state boundary
0 12.5 25 50 75 100
Kilometers

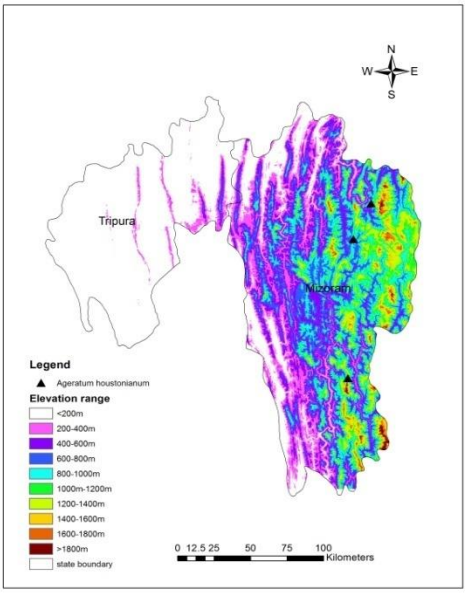

N
W
E
S
Legend
Ageratum conyzoides
Elevation range
<500m
500-1000m
1000-1500m
1500-2000m
>2000m
state boundary
0 12.5 25 50 75 100
Kilometers

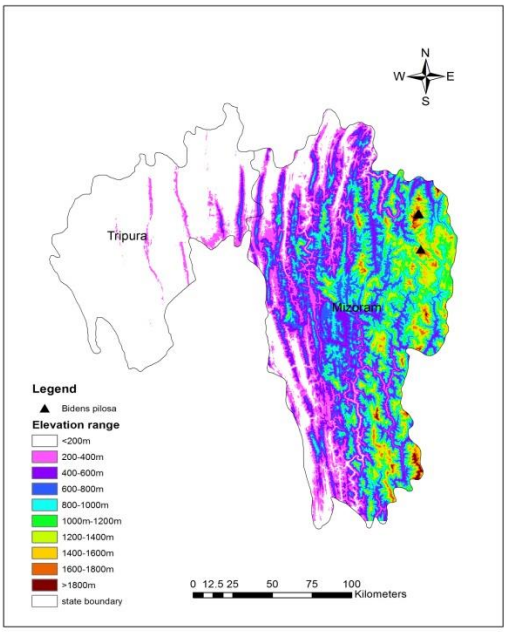
MIZORAM MAPS

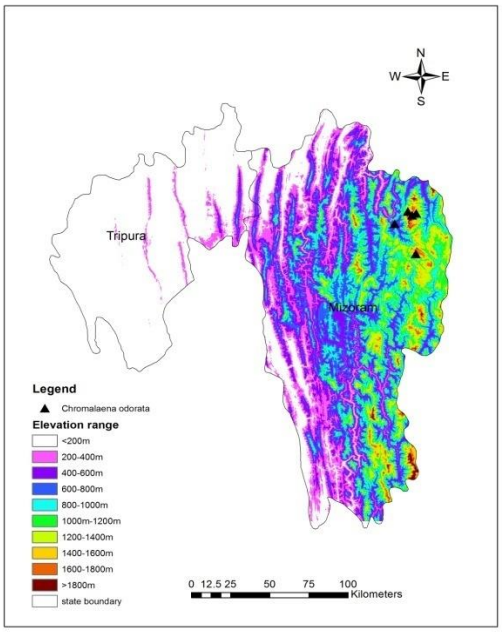


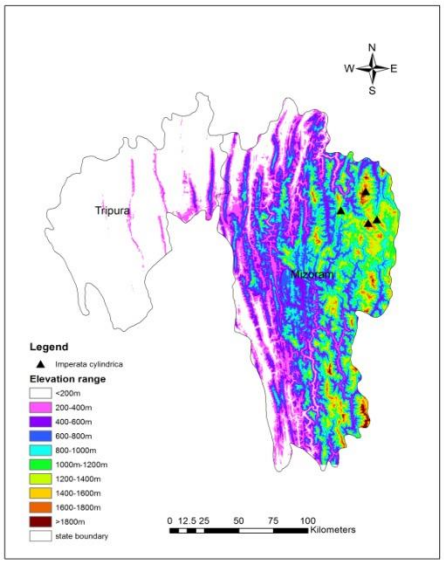


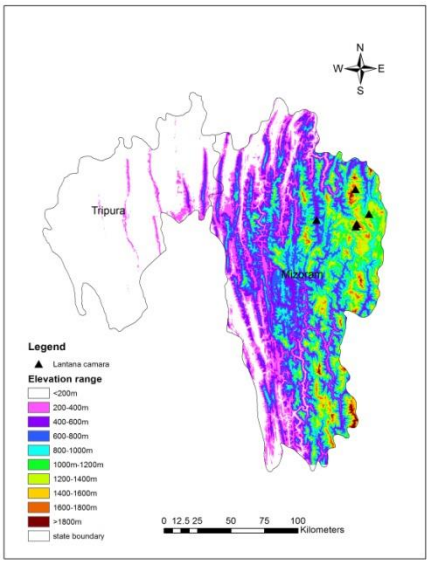


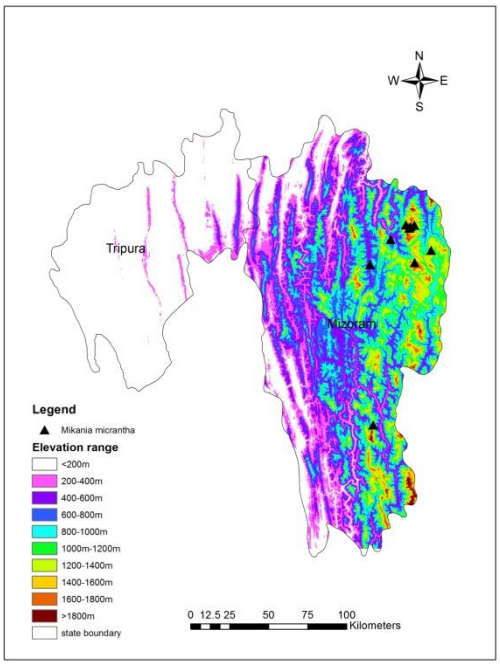







N
W
E
S
Tripura
Mizoram
Legend
Imperata cylindrica
Elevation range
<200m
200-400m
400-600m
600-800m
800-1000m
1000m-1200m
1200-1400m
1400-1600m
1600-1800m
>1800m
state boundary
0 12.5 25 50 75 100
Kilometers


N
W
E
S
Tripura
Mizoram
Legend
Lantana camara
Elevation range
<200m
200-400m
400-600m
600-800m
800-1000m
1000m-1200m
1200-1400m
1400-1600m
1600-1800m
>1800m
state boundary
0 12.5 25 50 75 100
Kilometers


N
W
E
S
Tripura
Mizoram
Legend
Mikania micrantha
Elevation range
<200m
200-400m
400-600m
600-800m
800-1000m
1000m-1200m
1200-1400m
1400-1600m
1600-1800m
>1800m
state boundary
0 12.5 25 50 75 100
Kilometers

SITE DETAILS FOR MANIPUR,NAGALAND & ARUNACHAL PRADESH

1. Arunachal Pradesh:

Geographically, Arunachal Pradesh is the largest state in the region covering an area of 83,743 sq km. Physiographically, the state is characterized by 96% rugged hilly terrain and only 4% valleys with elevation ranging from 50-7000m asl. The state is home to northernmost tropical rainforests of the world along with other forest types viz. tropical semi-evergreen forests, tropical moist deciduous forests, Himalayan sub-tropical broad leaved forests, sub-tropical pine forest, temperate broad leaved forests, temperate conifer forests, sub-alpine woody shrub, Alpine meadow (Mountain tundra) and secondary bamboo brake. The diverse forest types of the state harbors more than 7000 species of angiosperms which is almost one half of the total flowering plants occurring in India, over 500 species of orchids, more than 60 species of Rhododendron and over 60 species of bamboo. Different localities under three districts were visited based on different elevation zones ranging from < 300m at Kimin, Pamto and Hoj upto areas having altitude of more than 2600m at Bomdila. Other sites include sites like, Ziro, Yazali, Bhalukpong, Shergaon, Rupa, Yachuli, etc. Low populations of invasive plants were observed in localities like Rupa, Shergaon, Ziro, etc in high elevation where species like *A. conyzoides, C. odorata, M.. micrantha and L. camara* were found to be dominantly established in the lower zones.

Table 6A. Sampling points with GPS Coordinates of IAVPS in Arunachal Pradesh

District	Species	Latitude	Longitude
PAPUM PARE	*Lantana camara*	27°15'22.70"N	93°47'45.50"E
	Ageratum conyzoides	27°12'55.10"N	93°47'50.70"E
	Lantana camara	27°20'04.77"N	93°58'57.50"E
	Chromolaena odorata	27°20'03.05"N	93°58'58.32"E
	Ageratum conyzoides	27°20'06.01"N	93°58'57.27"E
LOWER SUBANSIRI	*Chromolaena odorata*	27°23'50.20"N	93°45'26.24"E
	Chromolaena odorata	27°30'30.20"N	93°46'48.05"E
	Mikania micrantha	27°30'24.80"N	93°46'28.46"E
	Chromolaena odorata	27°28'50.19"N	93°45'45.81"E
	Chromolaena odorata	27°28'50.50"N	93°45'45.11"E
WEST KAMENG			
	Parthenium hysterophorus	27°20'21.50"N	92°16'21.50"E
	Ageratina adenophora	27°22'01.30"N	92°14'15.00"E
	Ageratum conyzoides	27°22'17.80"N	92°14'12.10"E
	Lantana camara	27°12'23.88"N	92°33'30.00"E
	Ageratum conyzoides	27°10'49.00"N	92°35'54.70"E
	Ageratina adenophora	27°10'48.90"N	92°33'41.50"E
	Galinsoga quadriradiata	27°06'51.20"N	92°32'27.40"E
	Mikania micrantha	27°06'07.50"N	92°34'58.10"E

2. Manipur:

Manipur lies in the Indo-Myanmar with 352 km long border. The altitude of the state varies from 790m asl to 2020m asl. with a total geographical area of 22,327 sq km out of which only 2238 sq km is valley surrounded by hilly terrain comprising of 20,089 sq km. Natural vegetation occupies an area of about 14,365 sq km, nearly 64% of the total geographical area of the state, and consists of short and tall grasses, reeds and bamboos, and trees. Broadly, there are four types of forests: Tropical Semi-evergreen, Dry Temperate Forest, Sub-Tropical Pine, and Tropical Moist Deciduous. There are also pure forests of *Tectona grandis*, *Pinus roxburghii*, *Quercus*, *Michelia*, bamboo, and cane. The state lies in the Indo-Bhutan World Biodiversity hotspot, is very rich in endemic and RET plants and animals. Field survey for the study of IAVPS was carried out in nine districts in areas having different elevation zones ranging from 300-600m (Kwatha) upto 1800 m in Ukhrul. Localities visited include Keibul Lamjao, Lamdeng, Nongmaiching, Gwarok, Khudengthabi, Litan, Keithelmanbi, Kangchup, Saikot, etc. *A. adenophora* population was found to be lesser in elevation more than 1500 m than the same observed in the site under 600-900m site and also observed to be growing in elevations below 600m. *P. hysterophorus* was observed only in roadsides and grounds nearby human habitats. Several areas being invaded by *M. micrantha, C. odorata and L. camara* were encountered during the visits at different localities like Gwarok, Pechi, Kangchup, etc.

Sampling points with GPS Coordinates of IAPS in Manipur

District	Species	Latitude	Longitude
IMPHAL EAST	*Lantana & Chromolaena*	24°48'25.50"N	94°00'20.10"E
	Chromolaena odorata	24°48'26.30"N	94°00'21.50"E
	Chromolaena odorata	24°48'23.50"N	94°00'12.20"E
	Lantana camara	24°48'23.80"N	94°00'12.70"E
	Lantana & Chromolaena	24°48'01.50"N	94°00'32.80"E
	Ageratina adenophora	24°39'57.50"N	94°04'16.70"E
	Mikania & Ageratum	24°42'49.90"N	94°00'47.70"E
	Chromolaena odorata	24°42'18.40"N	94°01'09.50"E
IMPHAL WEST	*Lantana & Chromolaena*	24°48'25.50"N	94°00'20.10"E
	Chromolaena odorata	24°48'26.30"N	94°00'21.50"E
	Chromolaena odorata	24°48'23.50"N	94°00'12.20"E
	Lantana camara	24°48'23.80"N	94°00'12.70"E
	Lantana & Chromolaena	24°48'01.50"N	94°00'32.80"E
	Ageratina adenophora	24°39'57.50"N	94°04'16.70"E
	Mikania & Ageratum	24°42'49.90"N	94°00'47.70"E
	Chromolaena odorata	24°42'18.40"N	94°01'09.50"E
BISHNUPUR	*Chromolaena odorata*	24°28'20.30"N	93°48'76.52"E
	Chromolaena & Mikania	24°28'11.22"N	93°48'58.82"E
	Ageratum conyzoides	24°28'24.34"N	93°48'55.80"E
	Lantana & Chromolaena	24°28'31.90"N	93°48'47.45"E
THOUBAL	*Lantana & Chromolaena*	24°39'57.40"N	94°04'16.60"E
	Chromolaena odorata	24°39'39.60"N	94°04'12.70"E
SENAPATI	*Mikania micrantha*	24°47'43.80"N	93°56'31.30"E
	Chromolaena odorata	24°47'43.80"N	93°56'31.30"E
CHURACHANDPUR	*Lantana camara*	24°19'09.50"N	93°46'29.60"E
	Lantana & Chromolaena	24°52'51.10"N	93°48'15.90"E
	Mikania micrantha	24°19'12.70"N	93°44'46.00"E
	Lantana & Chromolaena	24°17'08.70"N	93°40'03.80"E
	Lantana camara	24°19'02.60"N	93°46'32.10"E
TAMENGLONG	*Tithonia diversifolia*	24°48'09.80"N	93°43'56.80"E
	Ageratina adenophora	24°49'02.20"N	93°45'01.70"E
	Ageratina & Tithonia	24°47'25.60"N	93°46'36.20"E
CHANDEL	*Chromolaena & Ageratina*	24°18'16.70"N	94°14'40.90"E
	Chromolaena	24°19'05.30"N	94°16'26.40"E
	Mucuna	24°19'47.80"N	94°16'32.00"E
	Chromolaena	24°19'20.10"N	94°14'01.00"E
	Chromolaena	24°19'49.50"N	94°14'07.00"E
	Ageratina	24°21'46.50"N	94°11'13.10"E
	Ageratina	24°22'40.80"N	94°09'27.70"E
	Lantana	24°26'34.20"N	94°01'25.80"E
UKHRUL	*Ageratina, Chromolaena & Mikania*	24°56'25.07"N	94°09'11.70"E
	Tithonia, Chromolaena & Lantana	24°57'08.02"N	94°11'03.70"E
	Ageratum, Ageratina & Mikania	24°57'26.00"N	94°13'04.20"E
	Tithonia	24°58'52.90"N	94°13'41.20"E

	Ageratina	24°59ˈ41.01"N	94°15ˈ02.70"E
	Ageratina	25°23ˈ25.20"N	94°20ˈ01.80"E
	Ageratina &Chromolaena	25°05ˈ11.80"N	94°21ˈ42.80"E

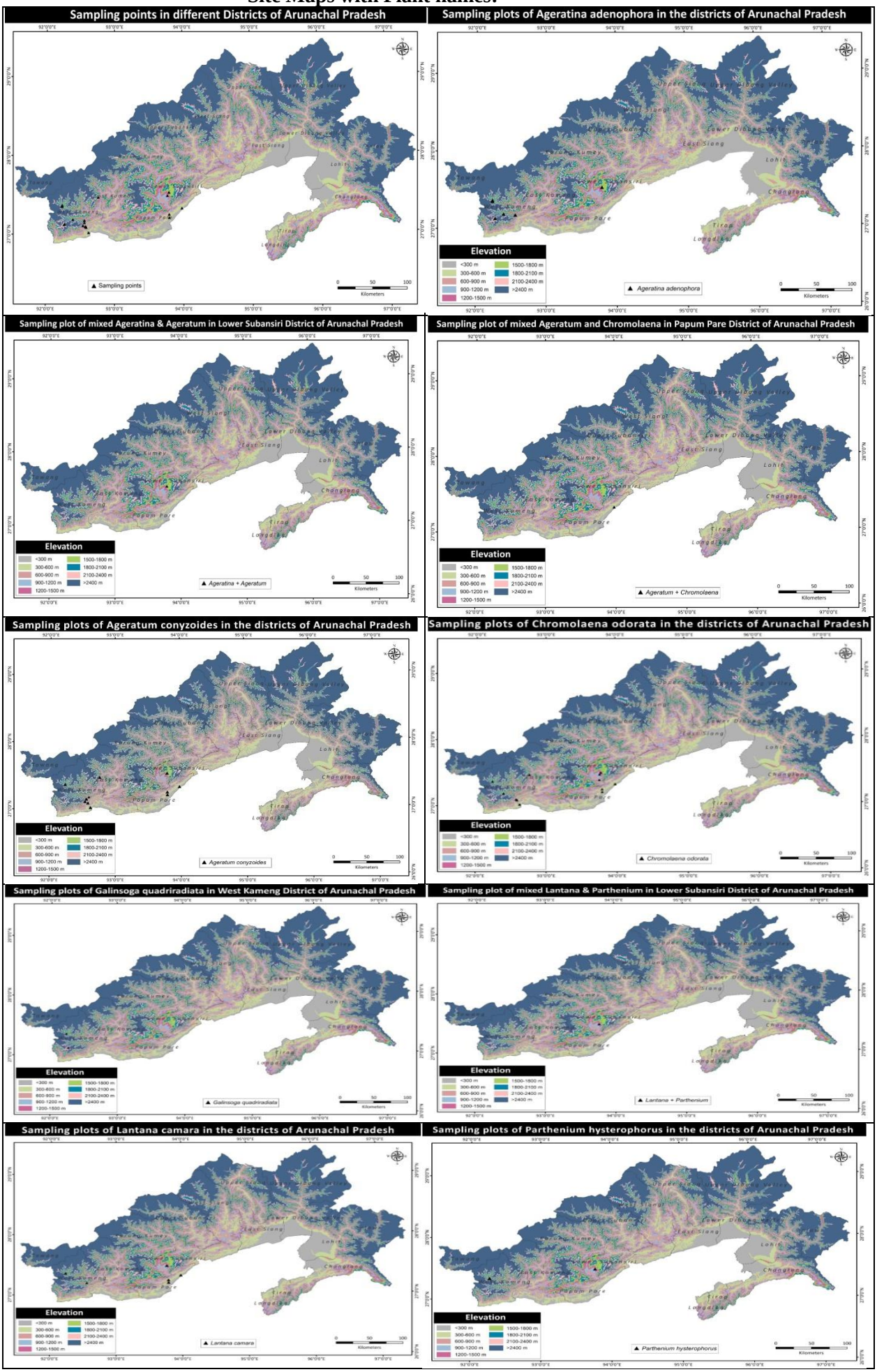
3. Nagaland:

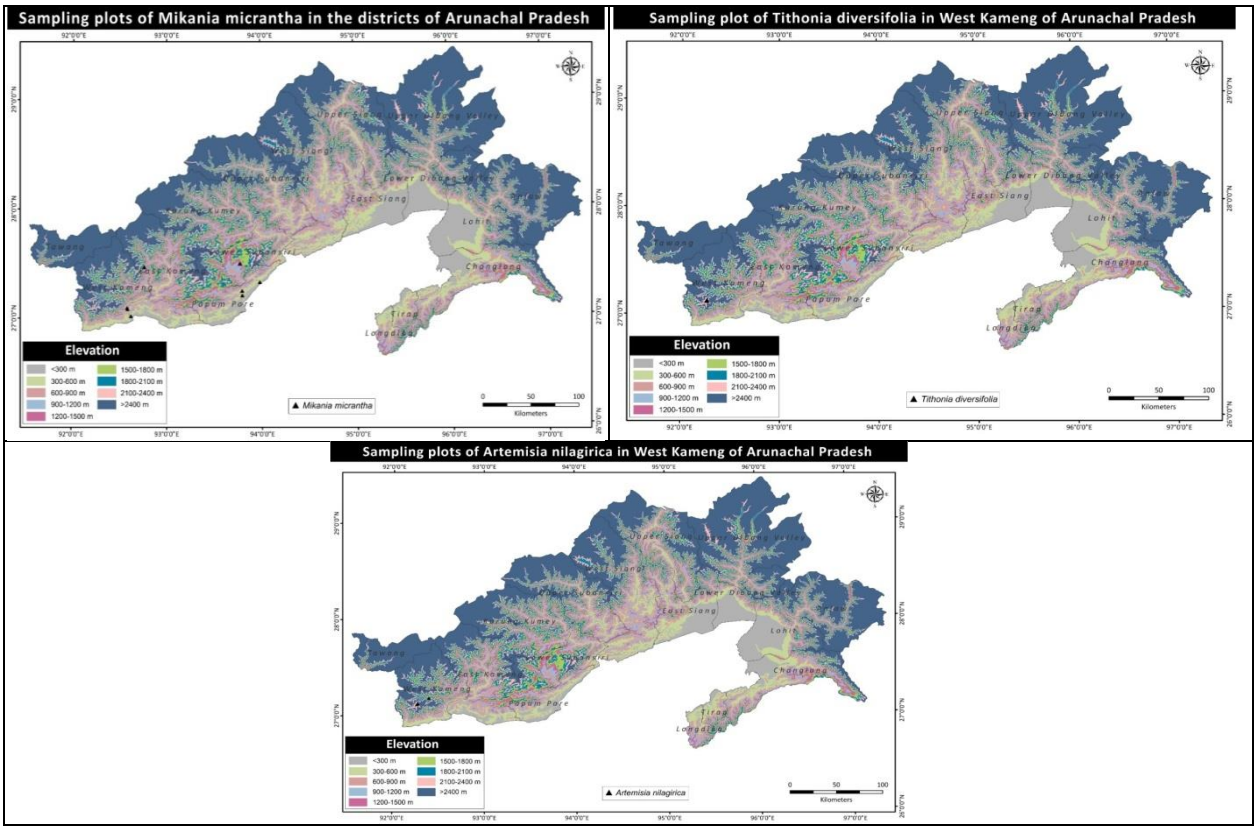
Nagaland is largely a mountainous state with hilly terrain. The Naga hills rise from the Brahmaputra valley in Assam to about 610 m asl and rise further to the southeast, as high as 1,800 m asl. Mount Saramati at an elevation of 3,826 m asl is the tallest peak in the state, this is where the Naga Hills merge with the Patkai range in Burma. Rivers such as the Doyang and Diphu to the north, the Barak River in the southwest and the Chindwin river of Burma in the southeast, dissect the entire state. The major types of forests found in the state are Tropical Wet Evergreen Forests, Tropical Semi- Evergreen Forests, Sub-Tropical Broad Leaved Wet Hill Forests, Sub-Tropical Pine Forests, Montane Wet Temperate Forests &Temperate Forests. Till date, three districts namely Wokha, Kohima and Dimapur districts were surveyed for the status of the IAVPS. In Dimapur, with elevation less than 300m, *A. adenophora* was found to be absent while other species *C. odorata, M. micrantha*and *L. camara* were having luxuriant growth. *P. hysterophorus* was also observed on the roadside only. While, *A. adenophora* was observed to be well established in different areas of the other two districts having elevation ranging from900- 1800m amsl.

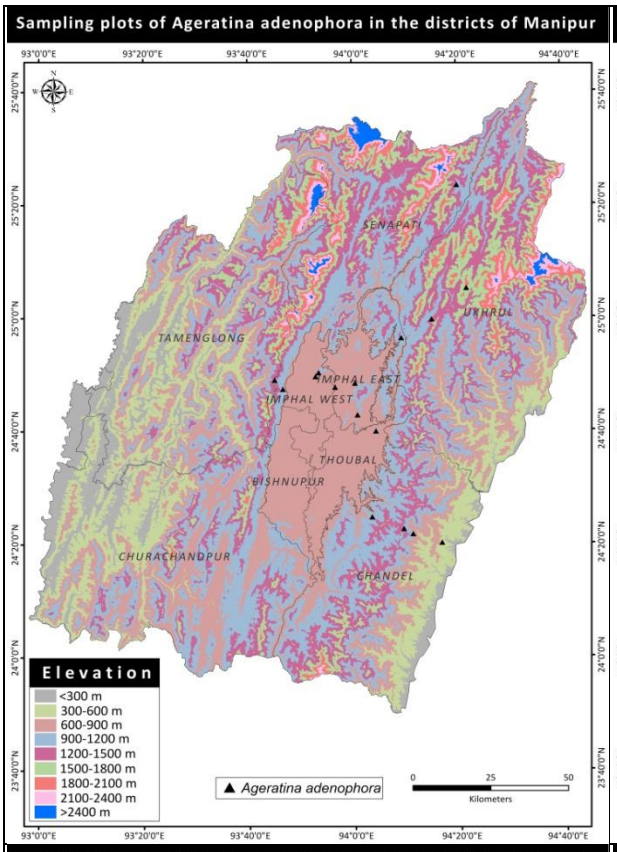
15 Sampling points with GPS Coordinates of IAPS in Nagaland

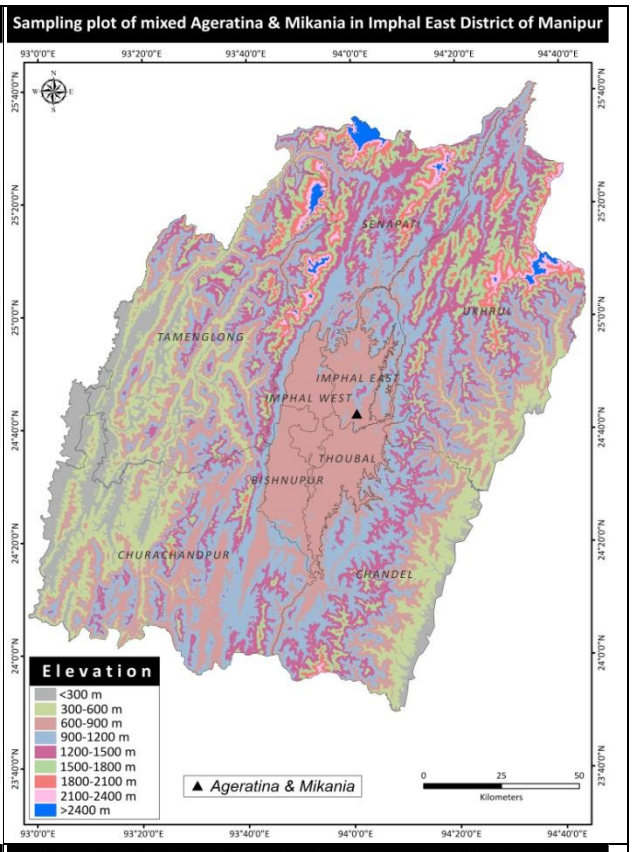
District	Species	Latitude	Longitude
WOKHA	*Ageratum*	26°06'21.2" N	94°15'54.4" E
	Ageratina	26°06'19.8 "N	94°15'57.2" E
	Ageratina &Artemisia	26°06'17.1" N	94°15'59.5" E
	Ageratina	26°06'09.9" N	94°16'13.3" E
	Ageratina &Artemisia	26°06'14.9" N	94°16'03.1" E
	Ageratum & Ageratina	26°06'16.5" N	94°15'58.6" E
	Ageratina	26°11'04.6" N	94°16'01.4" E
	Ageratina &Chromolaena	26°11'07.9" N	94°15'56.6" E
	Ageratina	26°11'14.7" N	94°16'05.3" E
	Ageratina, Ageratum &Mikania	26°09'04.0" N	94°14'36.3" E
	Ageratina	26°14'58.5" N	94°14'58.5" E
KOHIMA	*Ageratina*	25°38'18.9" N	94°00'56.6" E
	Ageratina & Artemisia	25°38'11.6" N	94°00'49.1" E
	Ageratina	25°38'27.8" N	94°01'08.1" E
	Ageratina	25°38'57.9" N	94°01'40.9" E
	Ageratina	25°39'40.0" N	94°01'42.6" E
	Ageratina	25°40'00.0" N	94°02'15.0" E
	Ageratina & Artemisia	25°39'42.2" N	94°03'14.0" E
	Ageratina	25°39'44.8" N	94°03'15.6" E
	Ageratina	25°39'44.6" N	94°03'14.5" E
	Ageratina	25°40'24.4" N	94°03'57.9" E
	Ageratina	25°38'18.9" N	94°00'56.6" E
DIMAPUR	*Parthenium & Lantana*	25°49'27.9" N	93°40'48.0" E
	Chromo, Mikania & Lantana	25°46'29.6" N	93°37'11.5" E
	Chromolaena & Lantana	25°47'27.5" N	93°37'50.1" E
	Chromolaena & Lantana	25°47'25.7" N	93°37'54.7" E
	Chromo, Mikania& Lantana	25°48'13.0" N	93°38'04.3" E
	Lantana, Chromo & Mikania	25°40'00.0" N	93°39'01.7" E

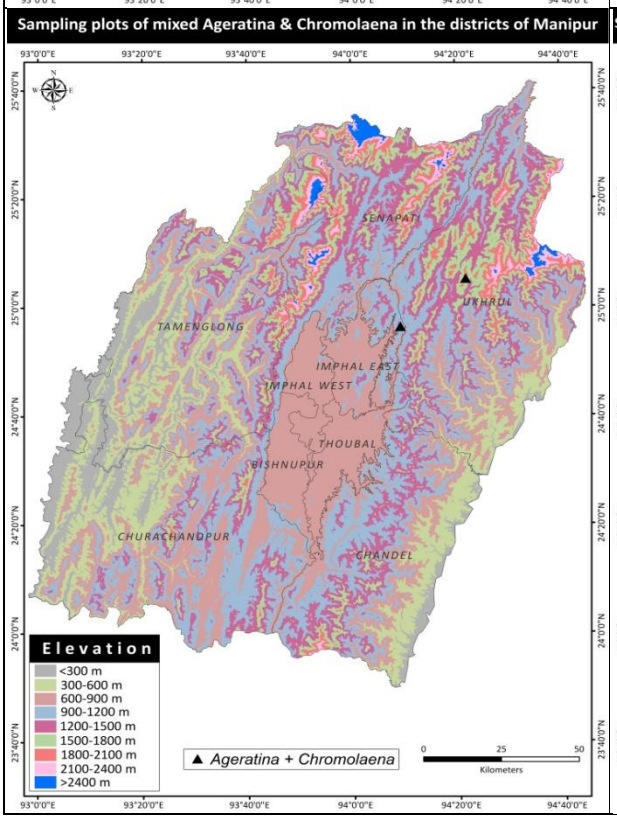
Site Maps with Plant names:

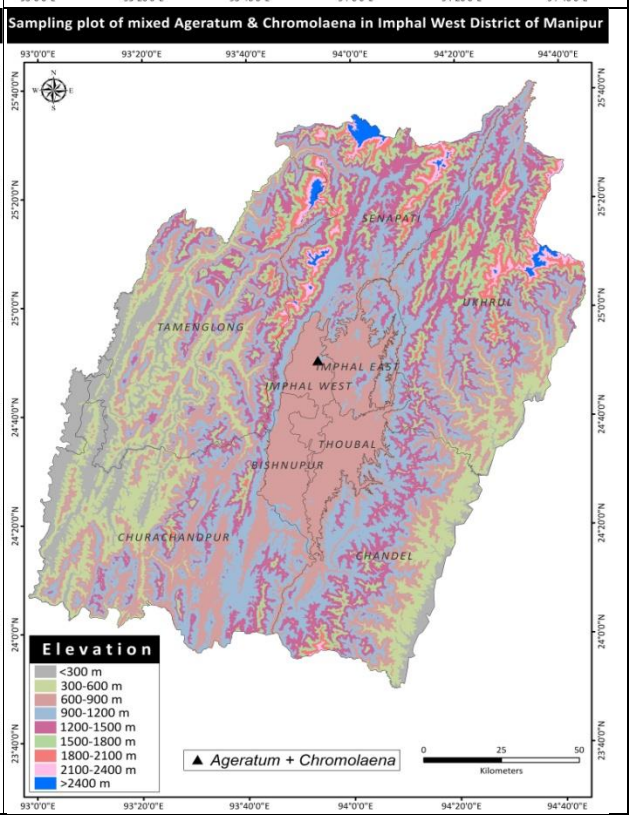


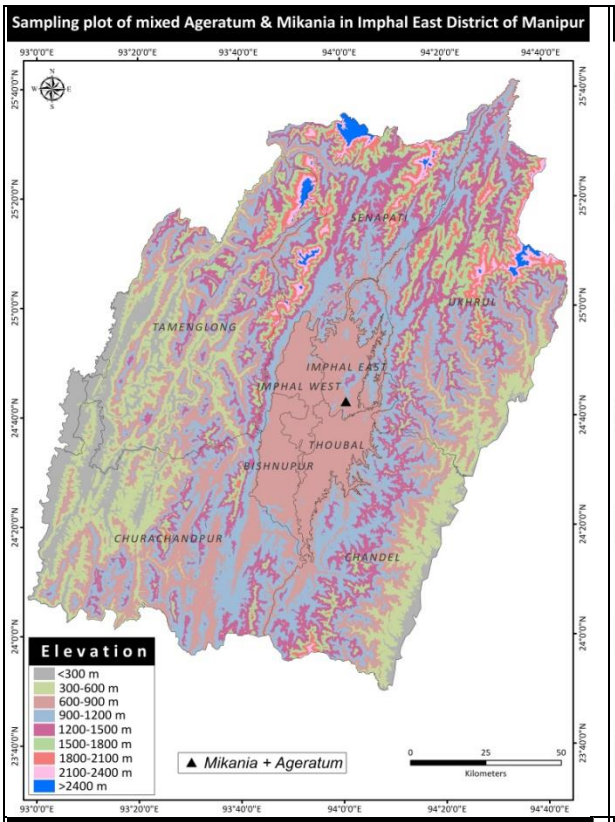

Sampling plots of Mikania micrantha in the districts of Arunachal Pradesh
Elevation
<300 m
300-600 m
600-900 m
900-1200 m
1200-1500 m
1500-1800 m
1800-2100 m
2100-2400 m
>2400 m
Mikania micrantha
Kilometers
Sampling plot of Tithonia diversifolia in West Kameng of Arunachal Pradesh
Tithonia diversifolia
Sampling plots of Artemisia nilagirica in West Kameng of Arunachal Pradesh
Artemisia nilagirica

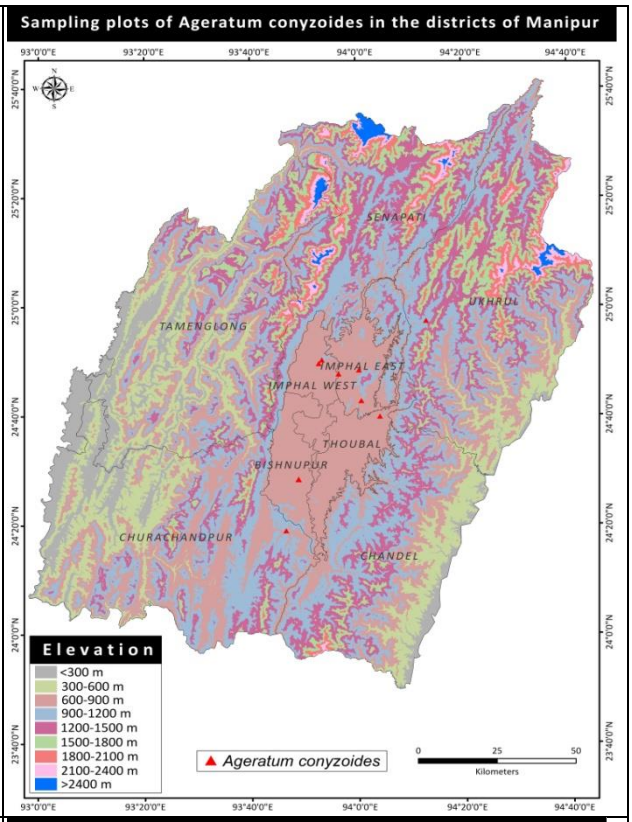

Sampling plots of Ageratina adenophora in the districts of Manipur
SENAPATI
UKHRUL
TAMENGLONG
IMPHAL EAST
IMPHAL WEST
THOUBAL
BISHNUPUR
CHURACHANDPUR
CHANDEL
Elevation
<300 m
300-600 m
600-900 m
900-1200 m
1200-1500 m
1500-1800 m
1800-2100 m
2100-2400 m
>2400 m
▲ Ageratina adenophora
0 25 50
Kilometers

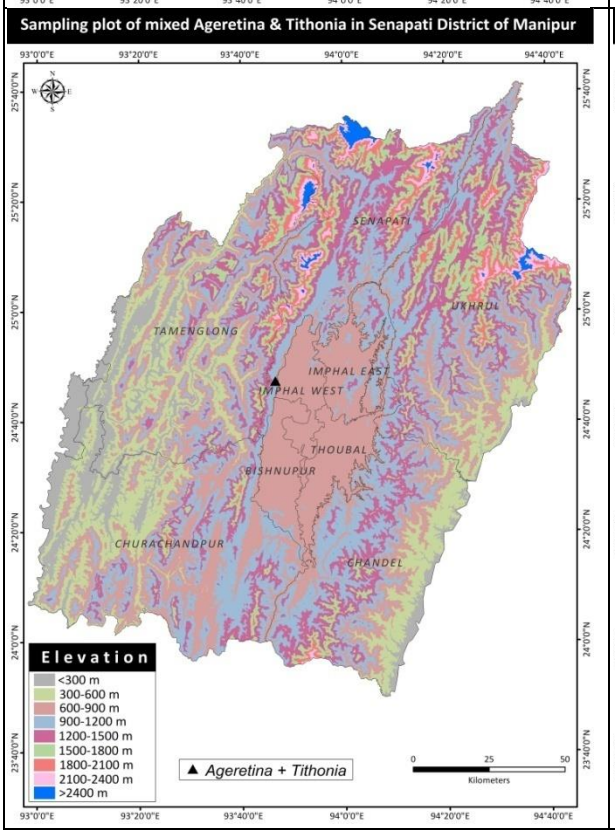

Sampling plot of mixed Ageratina & Mikania in Imphal East District of Manipur
SENAPATI
UKHRUL
TAMENGLONG
IMPHAL EAST
IMPHAL WEST
THOUBAL
BISHNUPUR
CHURACHANDPUR
CHANDEL
Elevation
<300 m
300-600 m
600-900 m
900-1200 m
1200-1500 m
1500-1800 m
1800-2100 m
2100-2400 m
>2400 m
▲ Ageratina & Mikania
0 25 50
Kilometers

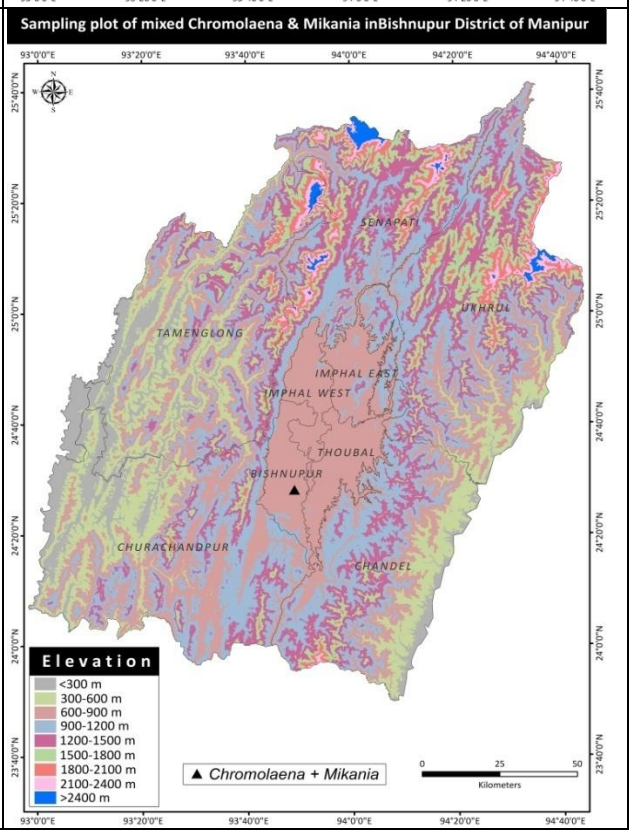

Sampling plots of mixed Ageratina & Chromolaena in the districts of Manipur
SENAPATI
UKHRUL
TAMENGLONG
IMPHAL EAST
IMPHAL WEST
THOUBAL
BISHNUPUR
CHURACHANDPUR
CHANDEL
Elevation
<300 m
300-600 m
600-900 m
900-1200 m
1200-1500 m
1500-1800 m
1800-2100 m
2100-2400 m
>2400 m
▲ Ageratina + Chromolaena
0 25 50
Kilometers

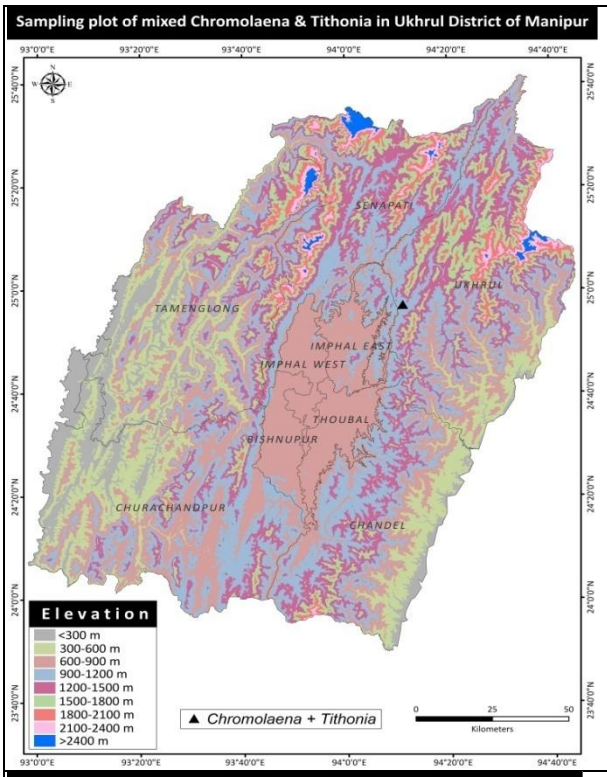

Sampling plot of mixed Ageratum & Chromolaena in Imphal West District of Manipur
SENAPATI
UKHRUL
TAMENGLONG
IMPHAL EAST
IMPHAL WEST
THOUBAL
BISHNUPUR
CHURACHANDPUR
CHANDEL
Elevation
<300 m
300-600 m
600-900 m
900-1200 m
1200-1500 m
1500-1800 m
1800-2100 m
2100-2400 m
>2400 m
▲ Ageratum + Chromolaena
0 25 50
Kilometers

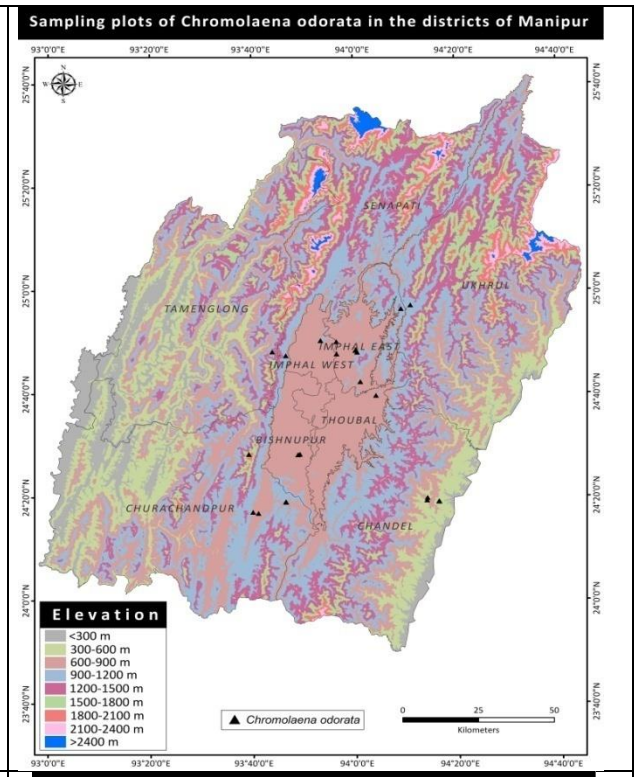

Sampling plot of mixed Ageratum & Mikania in Imphal East District of Manipur
SENAPATI
UKHRUL
TAMENGLONG
IMPHAL EAST
IMPHAL WEST
THOUBAL
BISHNUPUR
CHURACHANDPUR
CHANDEL
Elevation
<300 m
300-600 m
600-900 m
900-1200 m
1200-1500 m
1500-1800 m
1800-2100 m
2100-2400 m
>2400 m
▲ Mikania + Ageratum
Kilometers

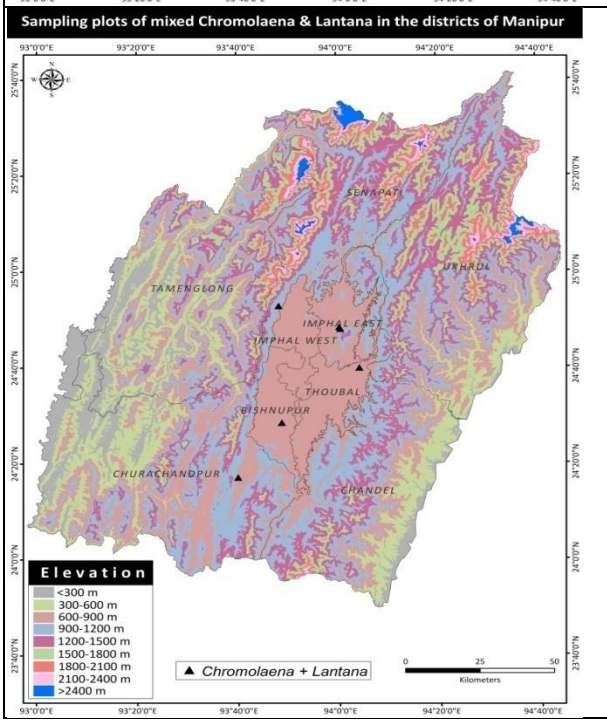

Sampling plots of Ageratum conyzoides in the districts of Manipur
SENAPATI
UKHRUL
TAMENGLONG
IMPHAL EAST
IMPHAL WEST
THOUBAL
BISHNUPUR
CHURACHANDPUR
CHANDEL
Elevation
<300 m
300-600 m
600-900 m
900-1200 m
1200-1500 m
1500-1800 m
1800-2100 m
2100-2400 m
>2400 m
▲ Ageratum conyzoides
Kilometers

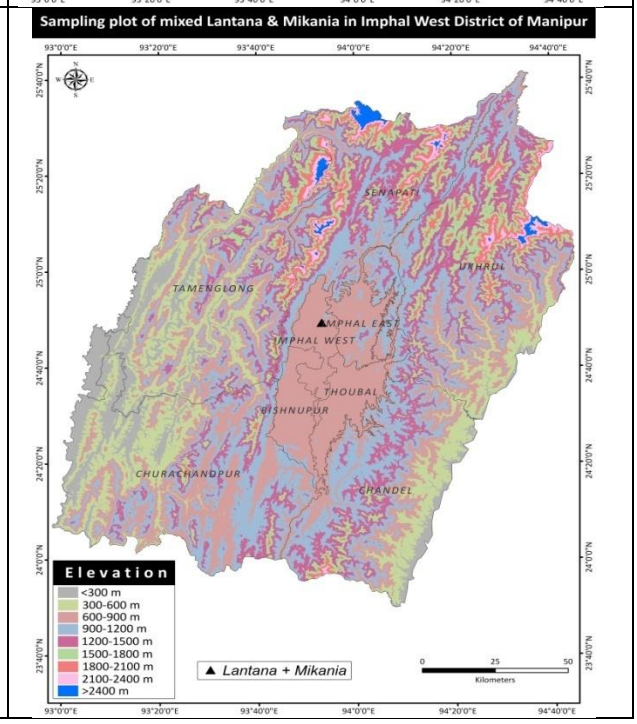

Sampling plot of mixed Ageretina & Tithonia in Senapati District of Manipur
SENAPATI
UKHRUL
TAMENGLONG
IMPHAL EAST
IMPHAL WEST
THOUBAL
BISHNUPUR
CHURACHANDPUR
CHANDEL
Elevation
<300 m
300-600 m
600-900 m
900-1200 m
1200-1500 m
1500-1800 m
1800-2100 m
2100-2400 m
>2400 m
▲ Ageretina + Tithonia
Kilometers

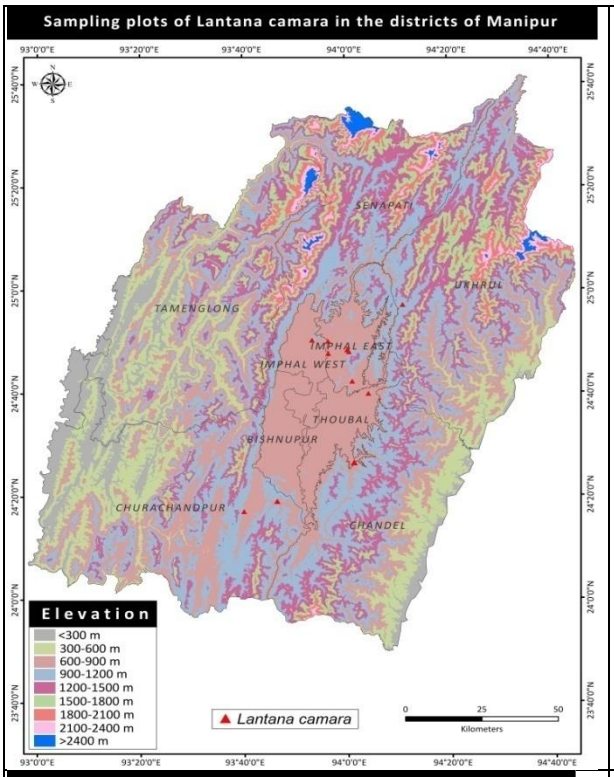

Sampling plot of mixed Chromolaena & Mikania inBishnupur District of Manipur
SENAPATI
UKHRUL
TAMENGLONG
IMPHAL EAST
IMPHAL WEST
THOUBAL
BISHNUPUR
CHURACHANDPUR
CHANDEL
Elevation
<300 m
300-600 m
600-900 m
900-1200 m
1200-1500 m
1500-1800 m
1800-2100 m
2100-2400 m
>2400 m
▲ Chromolaena + Mikania
Kilometers

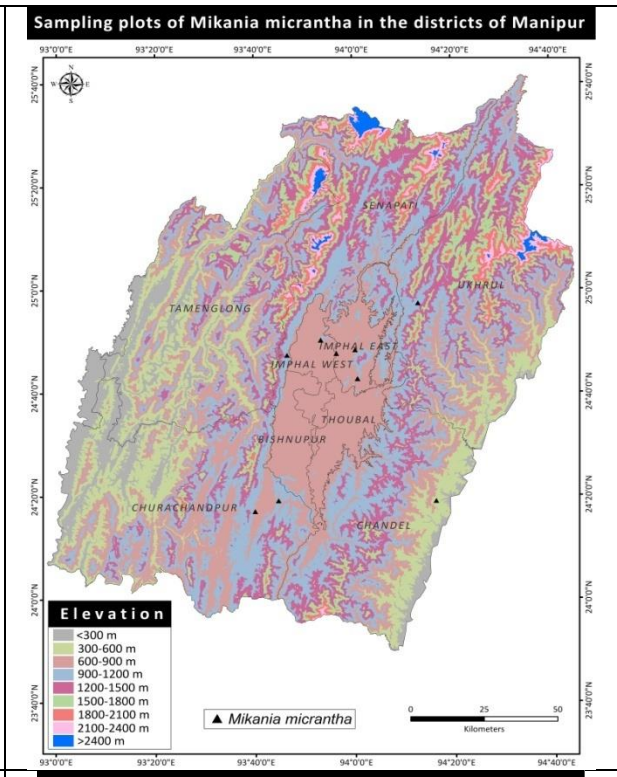

Sampling plot of mixed Chromolaena & Tithonia in Ukhrul District of Manipur
SENAPATI
UKHRUL
TAMENGLONG
IMPHAL EAST
IMPHAL WEST
THOUBAL
BISHNUPUR
CHURACHANDPUR
CHANDEL
Elevation
<300 m
300-600 m
600-900 m
900-1200 m
1200-1500 m
1500-1800 m
1800-2100 m
2100-2400 m
>2400 m
▲ Chromolaena + Tithonia
Kilometers

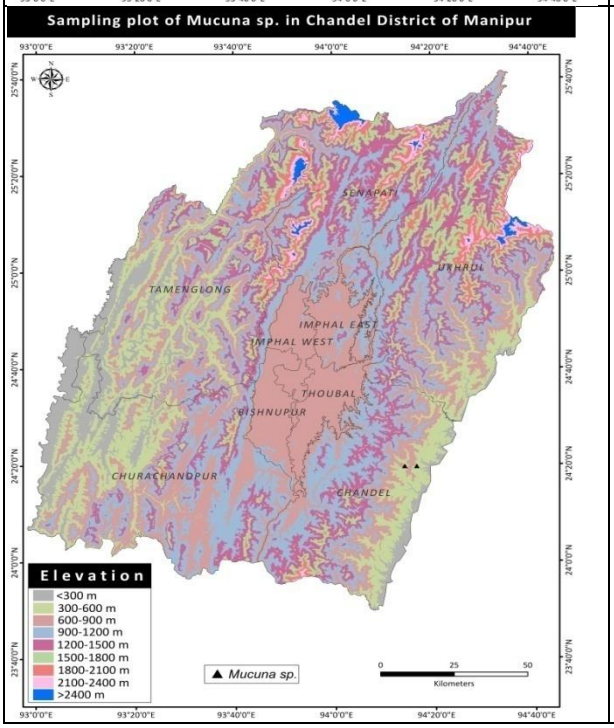

Sampling plots of Chromolaena odorata in the districts of Manipur
SENAPATI
UKHRUL
TAMENGLONG
IMPHAL EAST
IMPHAL WEST
THOUBAL
BISHNUPUR
CHURACHANDPUR
CHANDEL
Elevation
<300 m
300-600 m
600-900 m
900-1200 m
1200-1500 m
1500-1800 m
1800-2100 m
2100-2400 m
>2400 m
▲ Chromolaena odorata
Kilometers

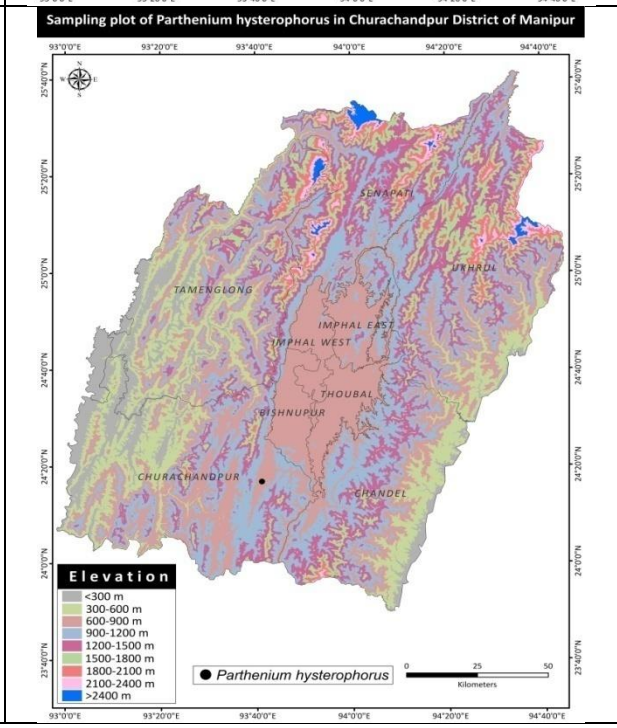

Sampling plots of mixed Chromolaena & Lantana in the districts of Manipur
SENAPATI
UKHRUL
TAMENGLONG
IMPHAL EAST
IMPHAL WEST
THOUBAL
BISHNUPUR
CHURACHANDPUR
CHANDEL
Elevation
<300 m
300-600 m
600-900 m
900-1200 m
1200-1500 m
1500-1800 m
1800-2100 m
2100-2400 m
>2400 m
▲ Chromolaena + Lantana
Kilometers

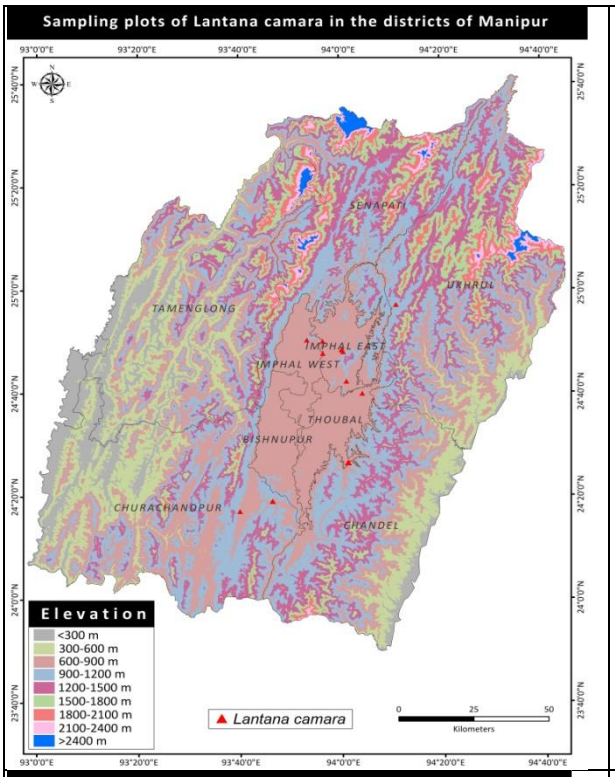

Sampling plot of mixed Lantana & Mikania in Imphal West District of Manipur
SENAPATI
UKHRUL
TAMENGLONG
IMPHAL EAST
IMPHAL WEST
THOUBAL
BISHNUPUR
CHURACHANDPUR
CHANDEL
Elevation
<300 m
300-600 m
600-900 m
900-1200 m
1200-1500 m
1500-1800 m
1800-2100 m
2100-2400 m
>2400 m
▲ Lantana + Mikania
Kilometers

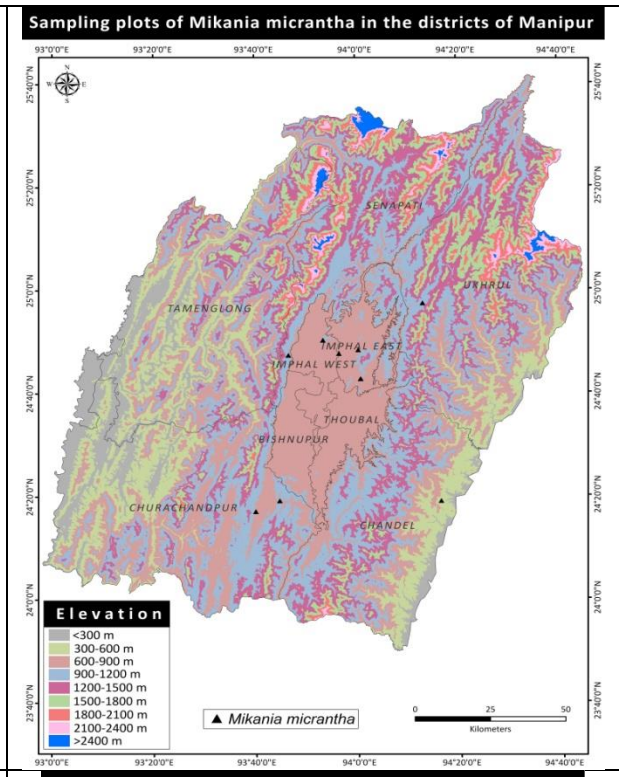

Sampling plots of Lantana camara in the districts of Manipur
SENAPATI
UKHRUL
TAMENGLONG
IMPHAL EAST
IMPHAL WEST
THOUBAL
BISHNUPUR
CHURACHANDPUR
CHANDEL
Elevation
<300 m
300-600 m
600-900 m
900-1200 m
1200-1500 m
1500-1800 m
1800-2100 m
2100-2400 m
>2400 m
Lantana camara
Kilometers

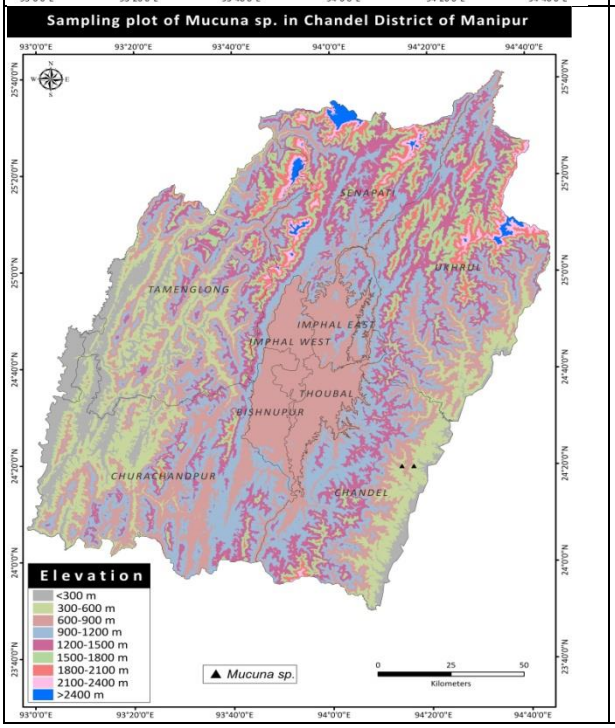

Sampling plots of Mikania micrantha in the districts of Manipur
SENAPATI
UKHRUL
TAMENGLONG
IMPHAL EAST
IMPHAL WEST
THOUBAL
BISHNUPUR
CHURACHANDPUR
CHANDEL
Elevation
<300 m
300-600 m
600-900 m
900-1200 m
1200-1500 m
1500-1800 m
1800-2100 m
2100-2400 m
>2400 m
Mikania micrantha
Kilometers

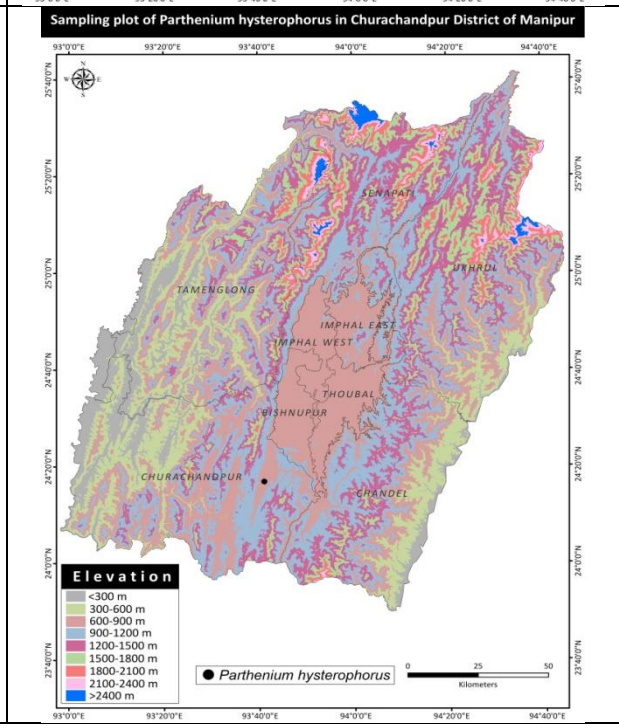

Sampling plot of Mucuna sp. in Chandel District of Manipur
SENAPATI
UKHRUL
TAMENGLONG
IMPHAL EAST
IMPHAL WEST
THOUBAL
BISHNUPUR
CHURACHANDPUR
CHANDEL
Elevation
<300 m
300-600 m
600-900 m
900-1200 m
1200-1500 m
1500-1800 m
1800-2100 m
2100-2400 m
>2400 m
Mucuna sp.
Kilometers

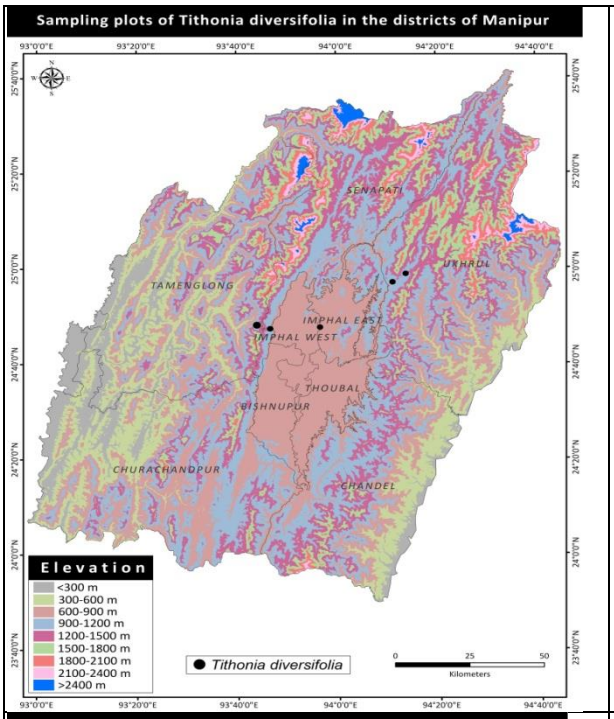

Sampling plot of Parthenium hysterophorus in Churachandpur District of Manipur
SENAPATI
UKHRUL
TAMENGLONG
IMPHAL EAST
IMPHAL WEST
THOUBAL
BISHNUPUR
CHURACHANDPUR
CHANDEL
Elevation
<300 m
300-600 m
600-900 m
900-1200 m
1200-1500 m
1500-1800 m
1800-2100 m
2100-2400 m
>2400 m
Parthenium hysterophorus
Kilometers

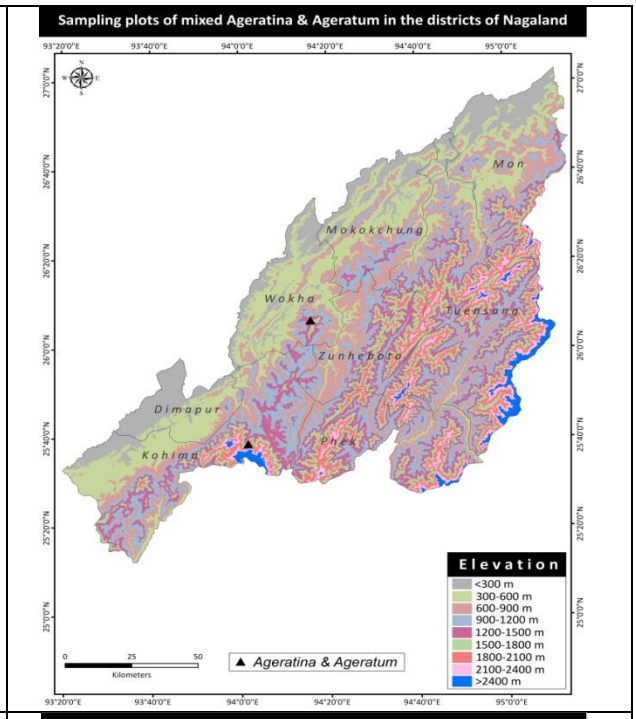

Sampling plots of Lantana camara in the districts of Manipur
SENAPATI
UKHRUL
TAMENGLONG
IMPHAL EAST
IMPHAL WEST
THOUBAL
BISHNUPUR
CHURACHANDPUR
CHANDEL
Elevation
<300 m
300-600 m
600-900 m
900-1200 m
1200-1500 m
1500-1800 m
1800-2100 m
2100-2400 m
>2400 m
Lantana camara
Kilometers

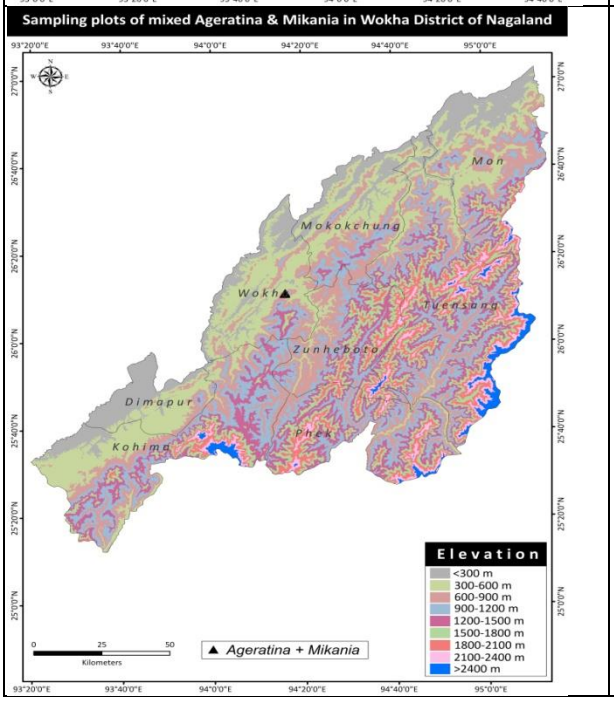

Sampling plots of Mikania micrantha in the districts of Manipur
SENAPATI
UKHRUL
TAMENGLONG
IMPHAL EAST
IMPHAL WEST
THOUBAL
BISHNUPUR
CHURACHANDPUR
CHANDEL
Elevation
<300 m
300-600 m
600-900 m
900-1200 m
1200-1500 m
1500-1800 m
1800-2100 m
2100-2400 m
>2400 m
Mikania micrantha
Kilometers

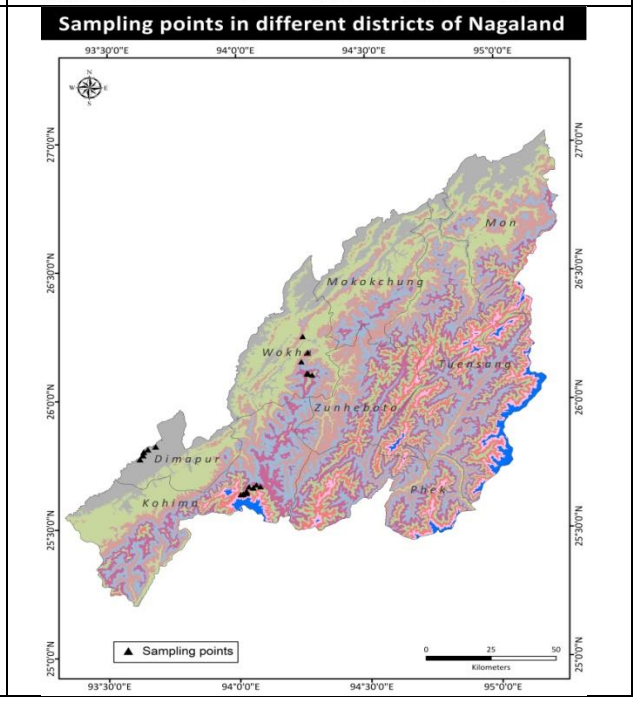

Sampling plot of Mucuna sp. in Chandel District of Manipur
SENAPATI
UKHRUL
TAMENGLONG
IMPHAL EAST
IMPHAL WEST
THOUBAL
BISHNUPUR
CHURACHANDPUR
CHANDEL
Elevation
<300 m
300-600 m
600-900 m
900-1200 m
1200-1500 m
1500-1800 m
1800-2100 m
2100-2400 m
>2400 m
Mucuna sp.
Kilometers

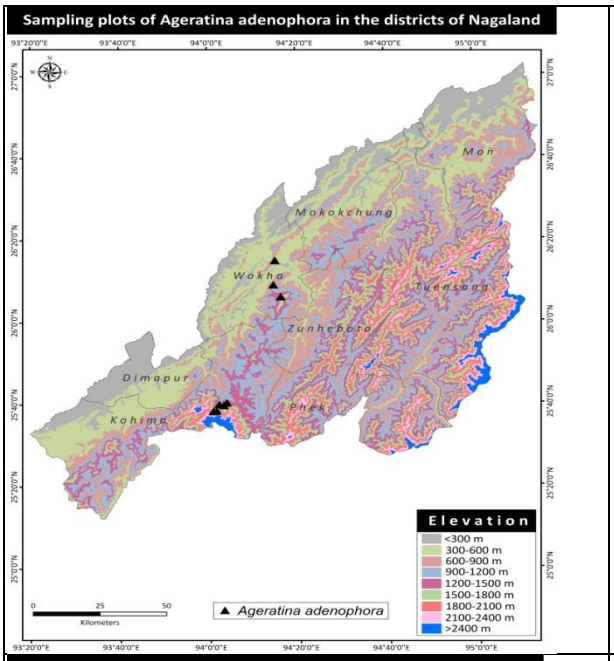

Sampling plot of Parthenium hysterophorus in Churachandpur District of Manipur
SENAPATI
UKHRUL
TAMENGLONG
IMPHAL EAST
IMPHAL WEST
THOUBAL
BISHNUPUR
CHURACHANDPUR
CHANDEL
Elevation
<300 m
300-600 m
600-900 m
900-1200 m
1200-1500 m
1500-1800 m
1800-2100 m
2100-2400 m
>2400 m
Parthenium hysterophorus
Kilometers

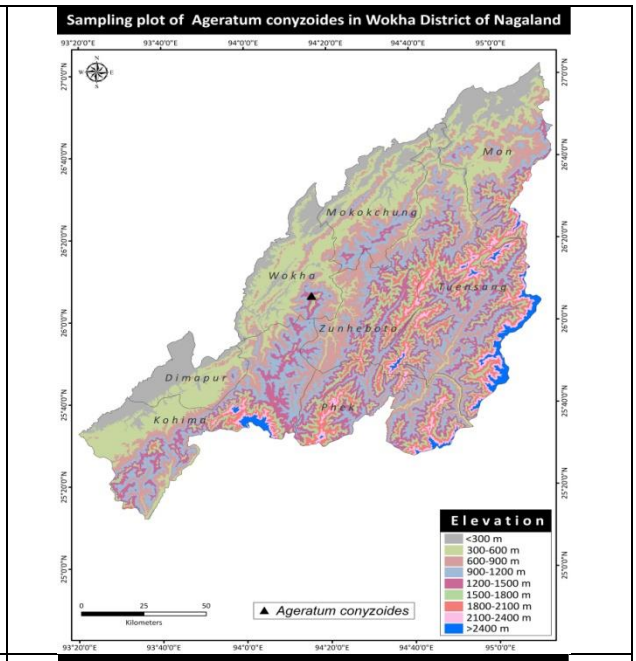

Sampling plots of Tithonia diversifolia in the districts of Manipur
SENAPATI
TAMENGLONG
UKHRUL
IMPHAL EAST
IMPHAL WEST
THOUBAL
BISHNUPUR
CHURACHANDPUR
CHANDEL
Elevation
<300 m
300-600 m
600-900 m
900-1200 m
1200-1500 m
1500-1800 m
1800-2100 m
2100-2400 m
>2400 m
Tithonia diversifolia
Kilometers

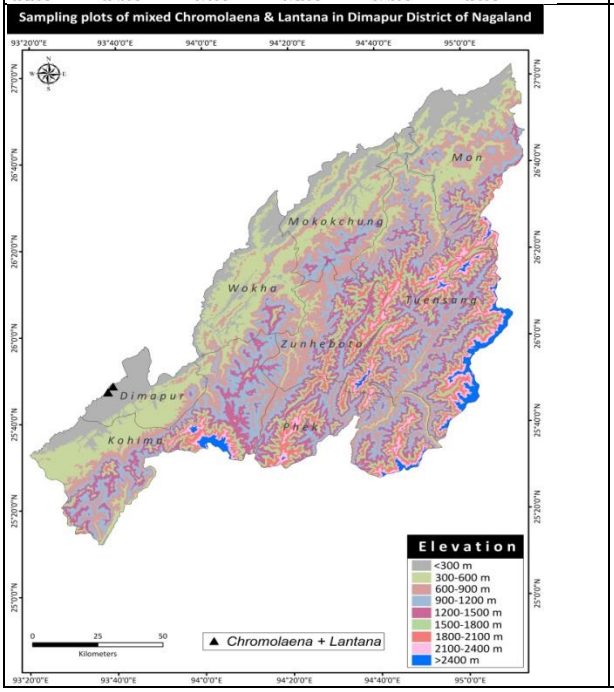

Sampling plots of mixed Ageratina & Ageratum in the districts of Nagaland
Mon
Mokokchung
Wokha
Tuensang
Zunheboto
Dimapur
Phek
Kohima
Elevation
<300 m
300-600 m
600-900 m
900-1200 m
1200-1500 m
1500-1800 m
1800-2100 m
2100-2400 m
>2400 m
Ageratina & Ageratum
Kilometers

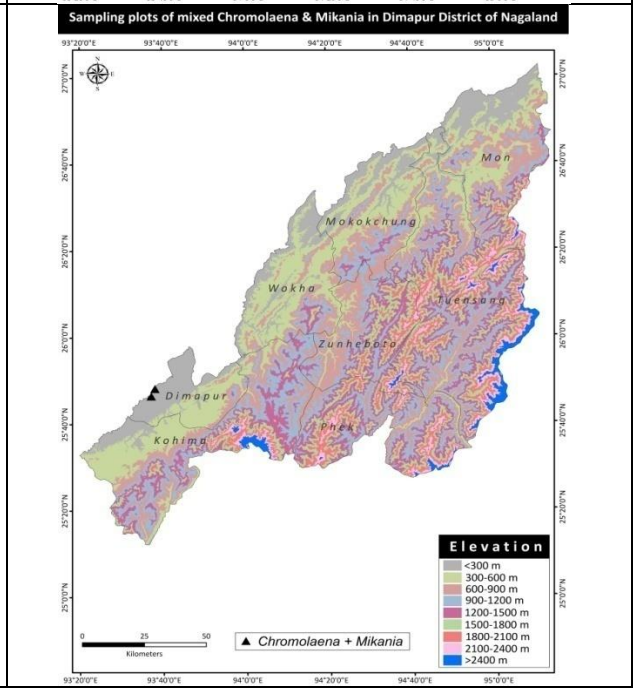

Sampling plots of mixed Ageratina & Mikania in Wokha District of Nagaland
Mon
Mokokchung
Wokha
Tuensang
Zunheboto
Dimapur
Phek
Kohima
Elevation
<300 m
300-600 m
600-900 m
900-1200 m
1200-1500 m
1500-1800 m
1800-2100 m
2100-2400 m
>2400 m
Ageratina + Mikania
Kilometers

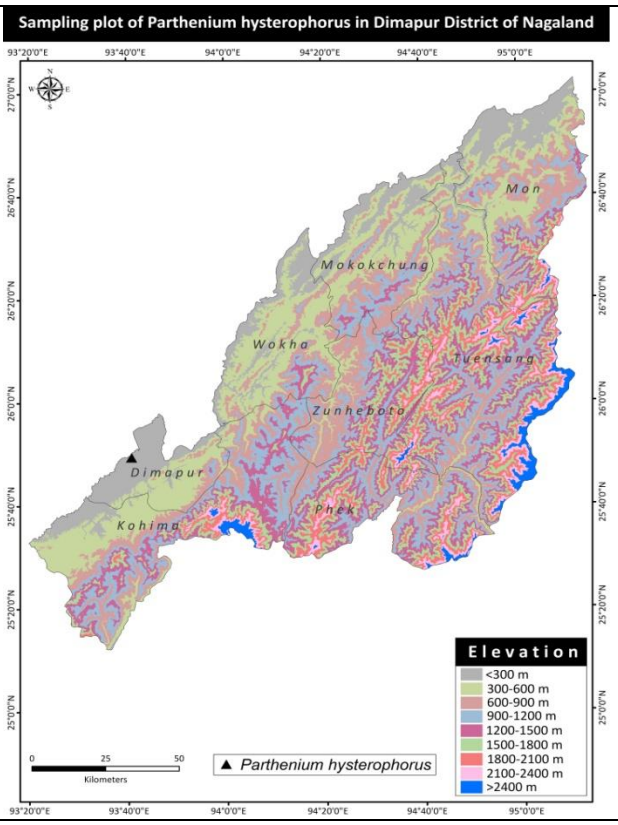

Sampling points in different districts of Nagaland
Mon
Mokokchung
Wokha
Tuensang
Zunheboto
Dimapur
Phek
Kohima
Sampling points
Kilometers


Sampling plots of Ageratina adenophora in the districts of Nagaland
Mon
Mokokchung
Wokha
Tuensang
Zunheboto
Dimapur
Kohima
Phek
Elevation
<300 m
300-600 m
600-900 m
900-1200 m
1200-1500 m
1500-1800 m
1800-2100 m
2100-2400 m
>2400 m
0 25 50
Kilometers
▲ Ageratina adenophora


Sampling plot of Ageratum conyzoides in Wokha District of Nagaland
Mon
Mokokchung
Wokha
Tuensang
Zunheboto
Dimapur
Kohima
Phek
Elevation
<300 m
300-600 m
600-900 m
900-1200 m
1200-1500 m
1500-1800 m
1800-2100 m
2100-2400 m
>2400 m
0 25 50
Kilometers
▲ Ageratum conyzoides


Sampling plots of mixed Chromolaena & Lantana in Dimapur District of Nagaland
Mon
Mokokchung
Wokha
Tuensang
Zunheboto
Dimapur
Kohima
Phek
Elevation
<300 m
300-600 m
600-900 m
900-1200 m
1200-1500 m
1500-1800 m
1800-2100 m
2100-2400 m
>2400 m
0 25 50
Kilometers
▲ Chromolaena + Lantana


Sampling plots of mixed Chromolaena & Mikania in Dimapur District of Nagaland
Mon
Mokokchung
Wokha
Tuensang
Zunheboto
Dimapur
Kohima
Phek
Elevation
<300 m
300-600 m
600-900 m
900-1200 m
1200-1500 m
1500-1800 m
1800-2100 m
2100-2400 m
>2400 m
0 25 50
Kilometers
▲ Chromolaena + Mikania


Sampling plot of Parthenium hysterophorus in Dimapur District of Nagaland
93°20'0"E
93°40'0"E
94°0'0"E
94°20'0"E
94°40'0"E
95°0'0"E
27°0'0"N
26°40'0"N
26°20'0"N
26°0'0"N
25°40'0"N
25°20'0"N
25°0'0"N
Mon
Mokokchung
Wokha
Tuensang
Zunheboto
Dimapur
Kohima
Phek
Elevation
<300 m
300-600 m
600-900 m
900-1200 m
1200-1500 m
1500-1800 m
1800-2100 m
2100-2400 m
>2400 m
0
25
50
Kilometers
Parthenium hysterophorus

SOME PICTURES OF SITES AND IAVPS FROM JAMMU & KASHMIR

Chenopodium botrys

Lactuca sativa

Cirsium arvense

Conium maculatum

Anthemis cotula

Bidens pilosa

Medicago falcuta

Sambucus wightiana

SOME PICTURES OF SITES AND IAVPS FROM HIMACHAL PRADESH

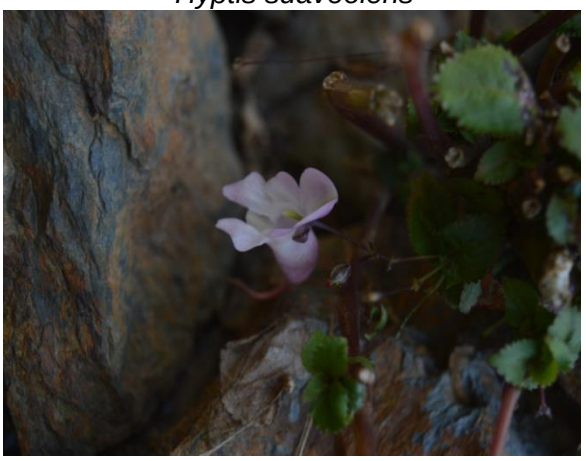
Field covered with Parthenium hysterophorus

Field covered with Parthenium hysterophorus

Martynia annua

Hyptis suaveolens

Calotropis procera



Impatiens sp.

Parthenium hysterophorus

Datura sp.

Ageratina adenophora

Zanthium strumarium

Ageratina adenophora

Students working in the field

Bidens pilosa

Ageratum conyzoides

Rubus ellipticus

Quadrat (1 × 1) m

Oxalis corniculata

Field covered with *Ageratina adenophora*

Lantana camara

Field covered with Lantana camara

Parthenium hysterophorus in flowering stage

Awareness program regarding invasive species for students

SOME PICTURES OF SITES AND IAVPS FROM UTTARAKHAND

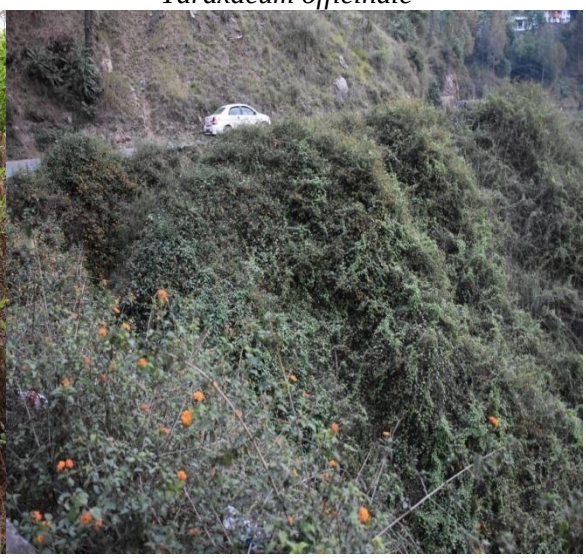
Pinus roxburghii

Aster sp.

Picture of the site

Taraxacum officinale

Ageratina adenophora



Lantana camara

Cirsium sp.

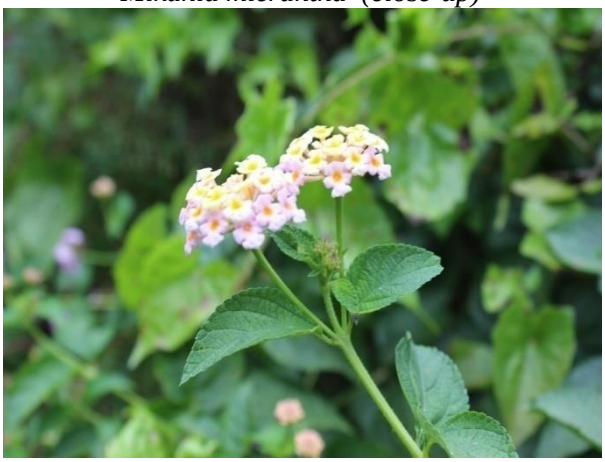
Cirsium sp.

Ageratina adenophora

SOME PICTURES OF SITES AND IAVPS FROM SIKKIM & DARJEELING

Mikania micrantha (close-up)

Mikania micrantha



Lantana camara (close-up)

Lantana camara

Chromolaena odorata

Chromolaena odorata (close-up)

Ageratina adenophora

Ageratina adenophora (close up)

Bidens pilosa

Persicaria capitata

Ageratum houstonianum

Ageratum conyzoides

Oxyspora peniculata

Girardinia diversifolia

Artemisia nilagirica

Elsholtzia ciliata

Anaphalis margaritacea

Hypoestes phyllostachya

Acemella paniculata

Rubus ellipticus

View of field work

View of field work

View of field work

View of field work

View of field work for population dynamics study

View of field work for population dynamics study

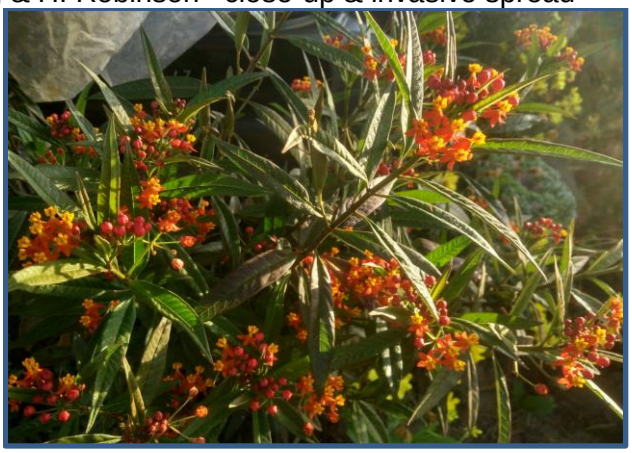
annexure-5e

SOME PICTURES OF SITES AND IAVPS FROM MIZORAM & TRIPURA

Ageratina riparia (Regel) R.M.King & H.Rob. Close-up & Invasive spread


Ageratum conyzoides L. close-up & invasive spread


Ageratina adenophora (Sprengel) R. M. King & H. Robinson close-up & invasive spread

Asclepias curassavica L. close-up & invasive spread


Bidens pilosa L. close-up & invasive spread


Eichhornia crassipes (Mart.) Solms close-up & invasive spread


Chromolaena odorata (L.) R.M.King & H.Rob. close-up & Invasive spread


Lantana camara L. close-up & invasive spread


Mikania micrantha Kunth close-up & invasive spread

Tithonia diversifolia (Hemsl.) A.Gray close-up &invasive spread

Field team at Phanghpui National Park,Mizoram

Field team preparing for Work at Phawnghpui NP

Selection of Study sites in the field

Measuring & selection of study site

1st Awareness programme to a group of students of a local school at Sangau at Phawnghpui NP,Mizoram

In-field demonstration during the 2nd awareness programme

Certificate distribution in 2nd Awareness programme

Group photo with the 2nd awareness programme participants in Mizoram

annexure-5f

SOME PICTURES OF SITES AND IAVPS FROM ARUNACHAL PRADESH,MANIPUR & NAGALAND

Vegetative phase of Ageratum houstonianum Mill.

Invasion by *Ageratum conyzoides* L. to the canopy gaps of tropical forests in Arunachal Pradesh

Invasion by Ageratina adenophora (Spreng.) King & H. Rob. to open canopies in Nagaland

Vegetative phase of Ageratina adenophora (Spreng.) King & H. Rob. in Manipur

Tithonia diversifolia (Hemsl.) A. Gray invasion in Manipur

Tithonia diversifolia (Hemsl.) A. Grayinvasion on road side in Arunachal Pradesh.

Mucuna sp. in full bloom at Manipur

Mucuna sp.coexisting with other IAVPS

Colorful inflorescence of *Lantana camara* L. in Manipur

Lantana camara L.invasion to forests in Manipur

Invasion by *Artemisia nilagirica* (C.B. Clarke) Pamp to open canopies of Forests in Manipur

Invasion by *Parthenium hysterophorus* L. in Dimapur, Nagaland

Dense population of *Galinsoga quadriradiata* Ruiz & Pav. at open canopies in Arunachal Pradesh

Invasion by *Galinsoga quadriradiata* Ruiz & Pav. in buffer zones at Arunachal Pradesh

Chromolaena odorata (L.) R.M. King & H. Rob.

Chromolaena odorata (L.) R.M. King & H. Rob.

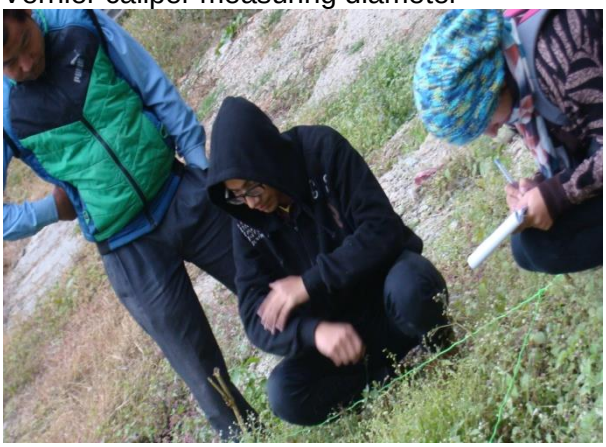
Project team_in Manipur Tour

1 x 1 m quadrate for herbs

Project Team_Arunachal Tour

Vernier caliper measuring diameter

Project Team_Arunachal Tour



Project Team Arunachal Tour

Jhum Field at Ryiphim, Wokha District, Nagaland

Jhum Field at Ryiphim, Wokha District, Nagaland

Invasion by *Cuscuta reflexa* Roxb. Recorded in Manipur

Ageratum houstonianum, *Chromolaena odorata* and *Mikania micrantha* growing together

Ageratum conyzoides plot

1m x 1 m quadrate demarcation for herbs regeneration rate