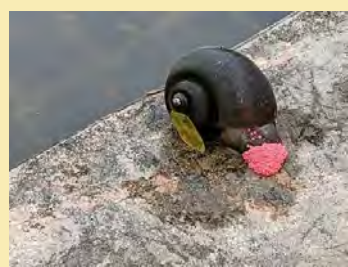


Invasion of Alien Species in Pakistan: Status, Impacts and Management Possibilities

Dr. Asad Shabbir

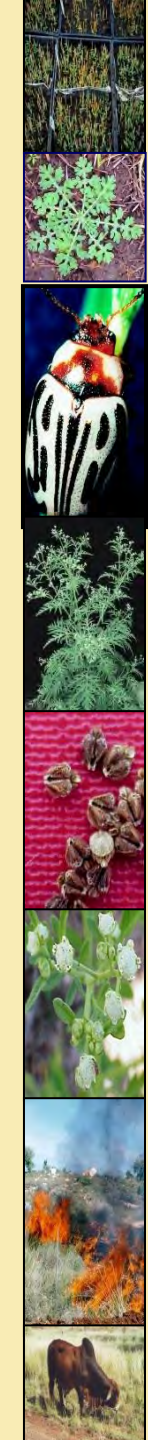
University of Sydney, Australia



ICIMOD, Nepal - 2021

Outline

- **Alien Species of Pakistan**
 - Alien and Invasive Species
 - Origin, Pathways and Spread
- **Impacts of IAS**
 - Terrestrial ecosystems
 - Aquatic ecosystems
- **Management of IAS**
 - Detection and mapping
 - Control strategies
- **IAS policy and management responses**
- **Key messages**



Alien species of Pakistan

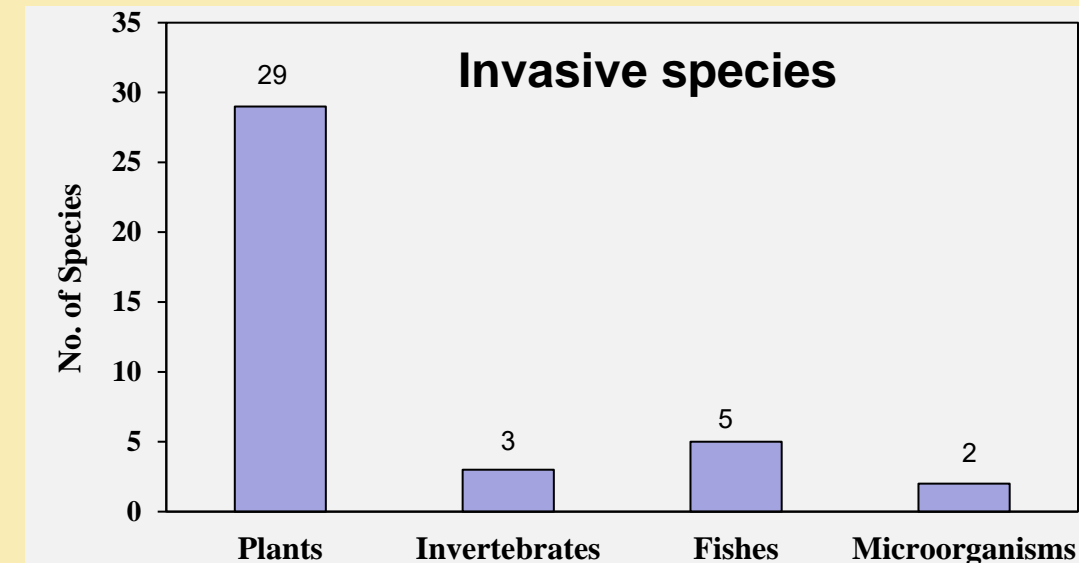
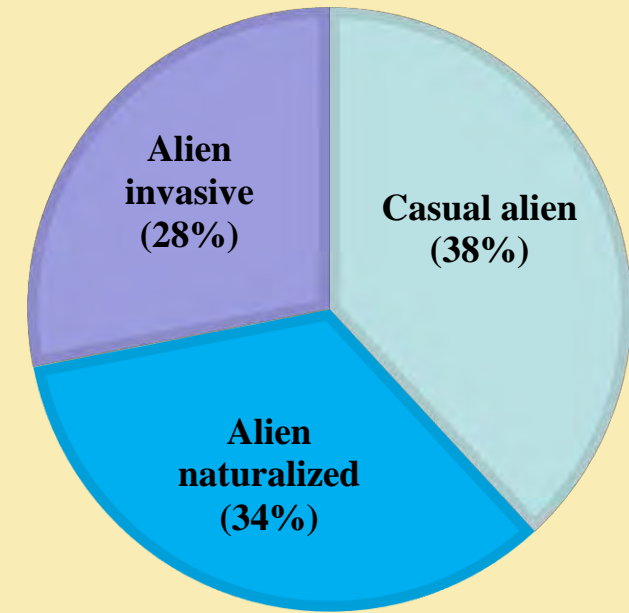
- Enlist alien species in all major taxa
- Categorize alien, naturalized & alien invasive species
- Extensive literature review & online global databases.
- Datasheets for individual species

The screenshot shows the CABI Invasive Species Compendium website. The header includes the CABI logo and navigation links for Home, Other CABI sites, About, and Help. The main content area features a large banner for the 'Invasive Species Compendium' with the tagline 'Detailed coverage of invasive species threatening livelihoods and the environment worldwide'. Below the banner is a search bar with a 'Filter by type' dropdown and a 'Search' button. A 'Featured species' section displays three images with their names: *Spodoptera frugiperda* (Fall armyworm), *Panicum hysteranthropicus* (Parthenium weed), and *Tuta absoluta* (Tomato leafminer). A 'Latest news' section on the right shows a headline: 'Kenya County reaching out to eliminate invasive species - DoorCountyDaily.com'. The footer includes a 'Latest invasive species database' link and a 'Show all' button.

The screenshot shows the GRIS (Global Register of Invasive Alien Species) website. The header features the GRIS logo and navigation links for Home, About GRIS, Sources, Editors, Contributors, How to Use, Contact, and Registration. A search bar is prominently displayed. Below the search bar is a 'COUNTRY' list with a globe icon and a scrollable list of countries including Afghanistan, Albania, Algeria, American Samoa, Andorra, Angola, Anguilla, Antigua and Barbuda, Argentina, Armenia, Aruba, and Australia. To the right, there is a 'KINGDOM' section with icons for ANIMALIA, PLANTAE, and FUNGI. The footer includes a 'Show all' button.

The screenshot shows the Global Invasive Species Database (GISD) website. The header includes the GISD logo and navigation links for Home, About, and Donations. A search bar is located below the header. The main content area features a 'WELCOME TO THE GLOBAL INVASIVE SPECIES DATABASE' section. Below this, there is a 'LATEST ADDITIONS' section with a grid of species names and their common names: *Canis aureus* (Golden Jackal), *Tamias sibiricus* (Siberian Chipmunk), *Trogon aedon* (Common Trogon), *Aceratix adspersus* (Aceratix), *Andropogon caryosus* (Andropogon), *Canis latrans* (Red Fox), *Hemikysus lemnaeus* (Hemikysus), and *Meriones subvirescens* (Meriones). The footer includes logos for the IUCN, IASG, and other organizations, along with a 'Show all' button.

- **139 alien species belonging to different taxa** (107 plants, 16 invertebrates, 12 fishes, 1 bird, 1 mammal and 2 microorganisms).
- 53 (38.1%) were categorized as casual **alien / adventive**, 47 (33.8%) alien **naturalized** and 39 (28%) as **alien invasive species**.
- Of 39 IAS, 29 were plants, 3 invertebrates, 5 fishes and 2 microorganisms.



Shabbir Asad, Jenna Wong L, Pagad Shyama (2018). GLOBAL REGISTER OF INTRODUCED AND INVASIVE SPECIES - PAKISTAN. Version 1.3. Invasive Species Specialist Group ISSG. Checklist dataset <https://doi.org/10.15468/hvltlxg> accessed via GBIF.org

Shehzadi, Madiha (2018) A CHECK LIST AND RISK ASSESSMENT OF ALIEN INVASIVE SPECIES OF PAKISTAN. MSc Thesis, Department of Botany, University of the Punjab, Lahore Pakistan.

Worst invasive species

Taxa	Common name	Scientific name	Origin	Pathway
Plants	mesquite	<i>Prosopis juliflora</i>	South America	Agroforestry
	Parthenium weed	<i>Parthenium hysterophorus</i>	South America	Unknown/trade?
	lantana	<i>Lantana camara</i>	South America	Horticulture
	paper mulberry	<i>Broussonetia papyrifera</i>	SE Asia	Horticulture
	white leadtree	<i>Leucaena leucocephala</i>	Central America	Agroforestry
	red gum	<i>Eucalyptus camaldulensis</i>	Australia	Agroforestry
Vertebrates				
	Nile tilapia	<i>Oreochromis niloticus</i>	Africa	Aquaculture
	Mozambique tilapia	<i>O. mozambicus</i>	Africa	Aquaculture
	blue tilapia	<i>O. aureus</i>	Africa	Aquaculture
	grass carp	<i>Ctenopharyngodon auratus</i>	E. Asia	Aquaculture
	common carp	<i>Cyprinus carpio</i>	Europe	Aquaculture
Invertebrates				
	apple snail	<i>Pomacea maculata</i>	South America	Aquarium trade

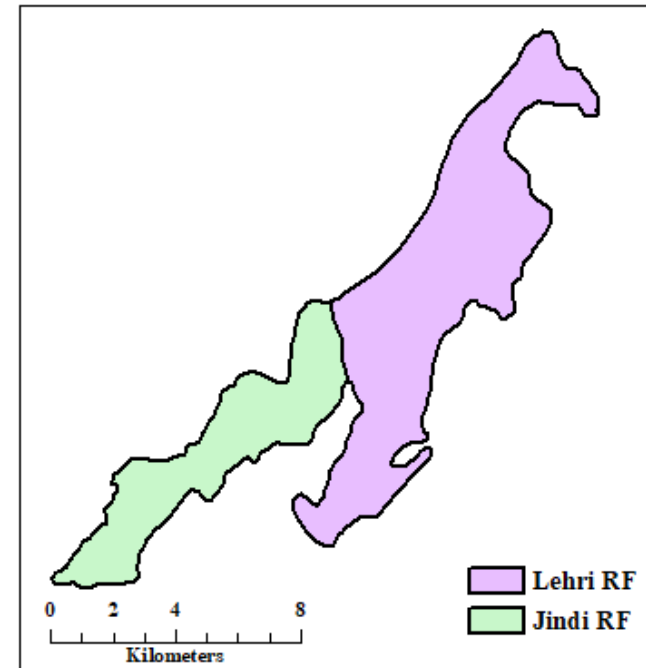
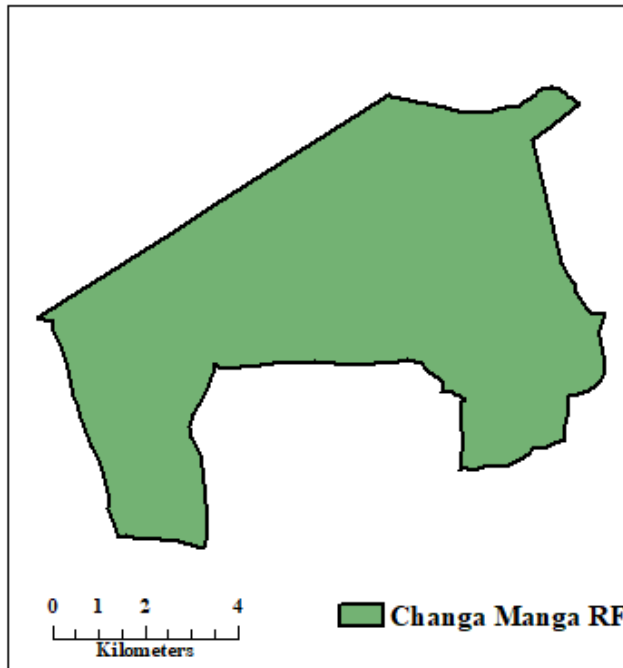
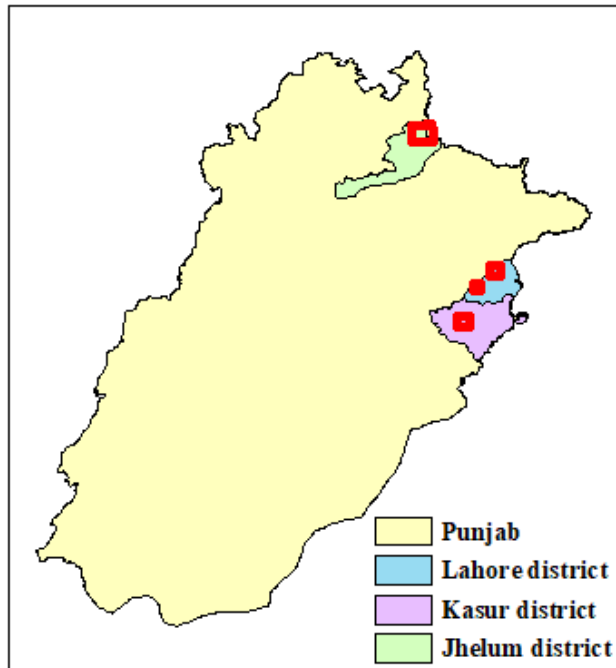
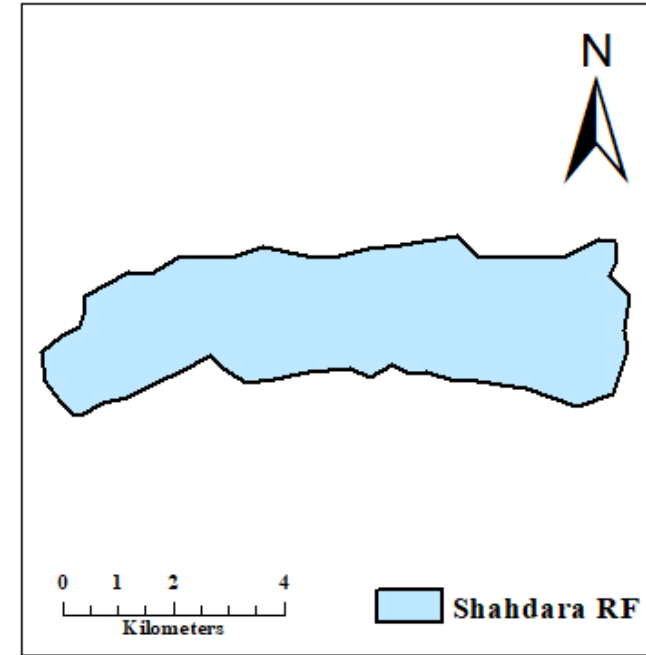
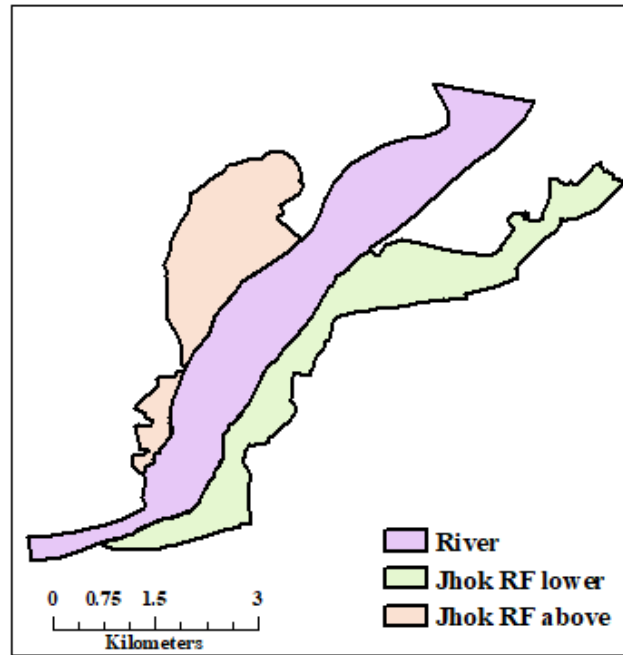
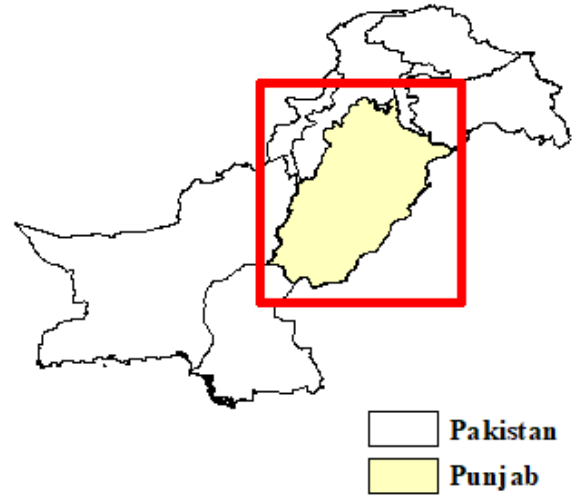
Impacts of invasive species

- Impacts of IAS are diverse in Pakistan.
- Natural and agro-ecosystems, livelihoods, and human health and wellbeing.
- In most cases, impacts are not fully understood
- To fill knowledge gaps, University of the Punjab took some initiatives.

To document plant invasions in Protected Areas (PAs).

To study the impacts of IAS on the native species of PAs.

Study areas



Aboveground vegetation

Nested Quadrat method (transects of 20×20 m for trees & woody shrubs while 1×1 m for herbs).

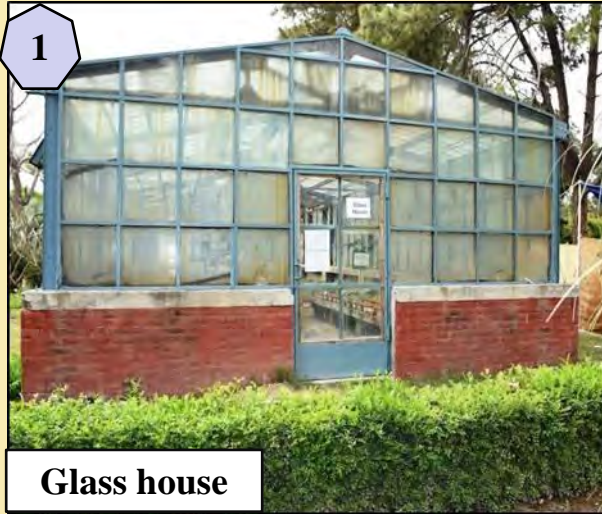


Soil seed bank

Systematic random sampling method. Soil auger used to sample soils at 0-10 cm depths (9 cores per plot).



Seedling emergence method



Labeling

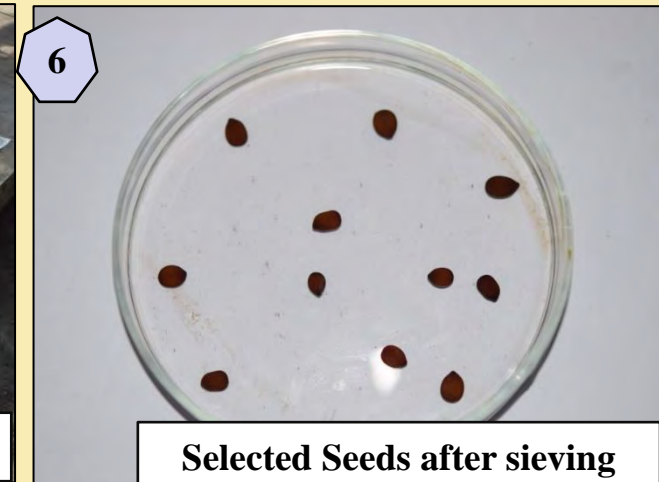
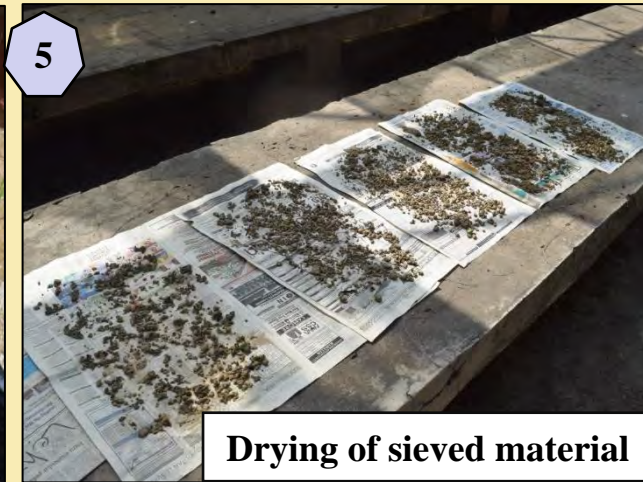


Data recording



Transplantations

Seed floatation method

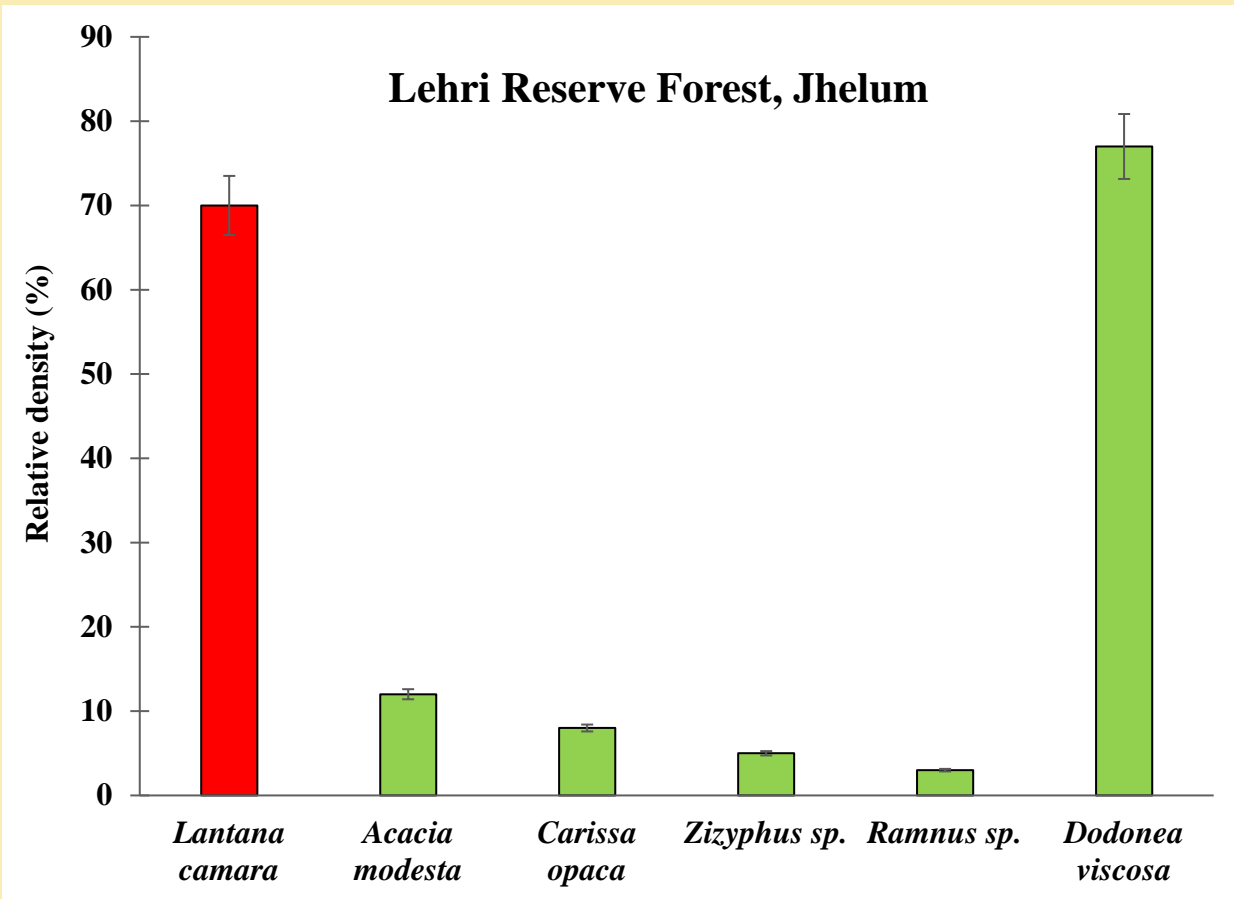
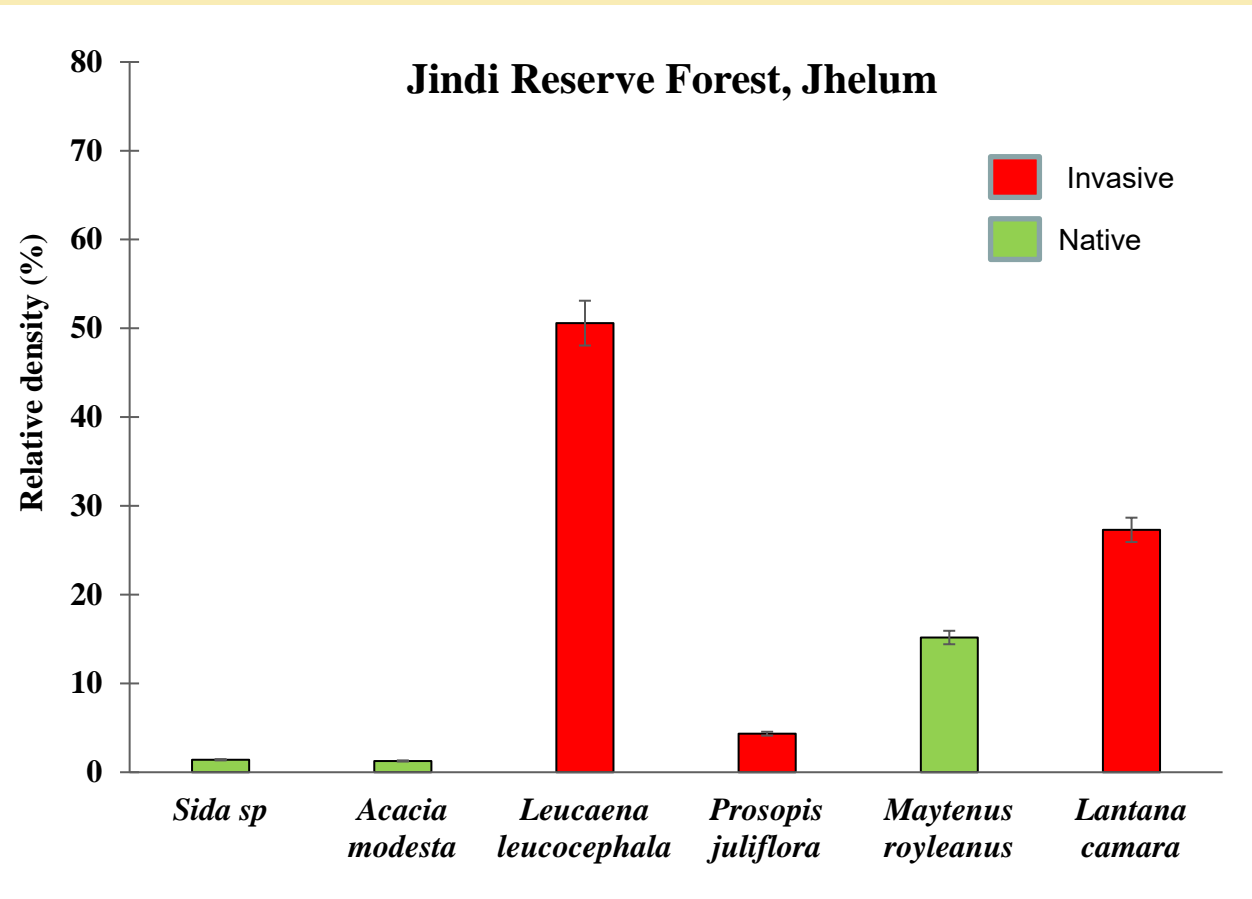


Invasion status of PAs

Protected Area	Invasive species
Lehri	<i>Lantana camara</i> , <i>Prosopis juliflora</i> , <i>Parthenium hysterophorus</i>
Jindi	<i>Leaucena leucocephala</i> , <i>L. camara</i> , <i>P. hysterophorus</i>
Jhoke	<i>P. hysterophorus</i> , <i>L. camara</i> , <i>P. juliflora</i>
Shahadra	<i>P. hysterophorus</i> , <i>Conyza canadensis</i>
Changa Manga	<i>L. camara</i> , <i>Acacia fernisiana</i> , <i>P. hysterophorus</i> , <i>Dolichandra unguis-cati</i>
Dandot	<i>Prosopis juliflora</i>

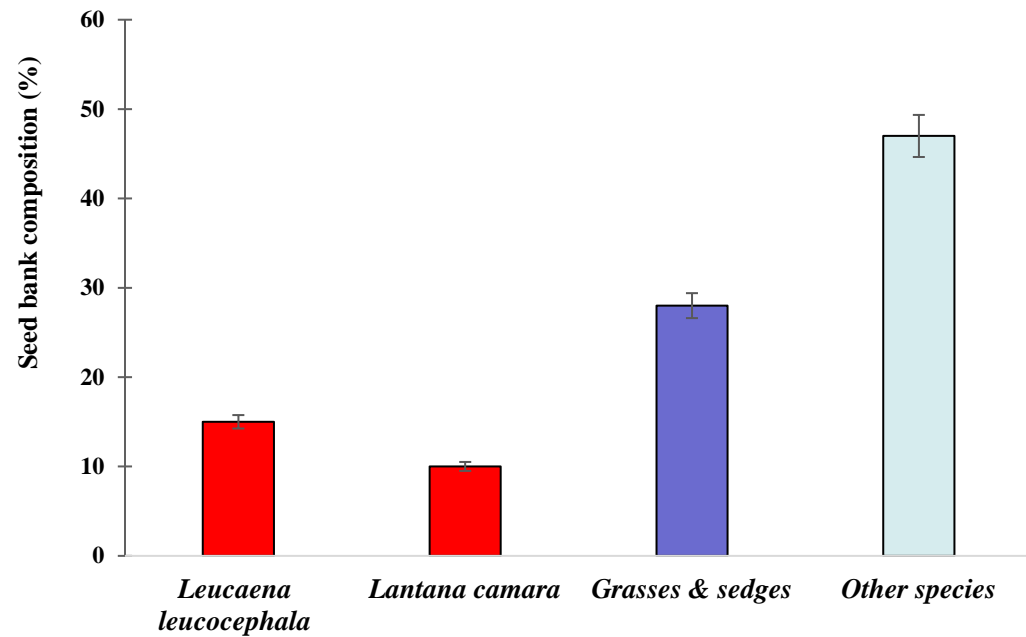
All forests /PAs are invaded by one or more invasive species!

Species abundance - aboveground

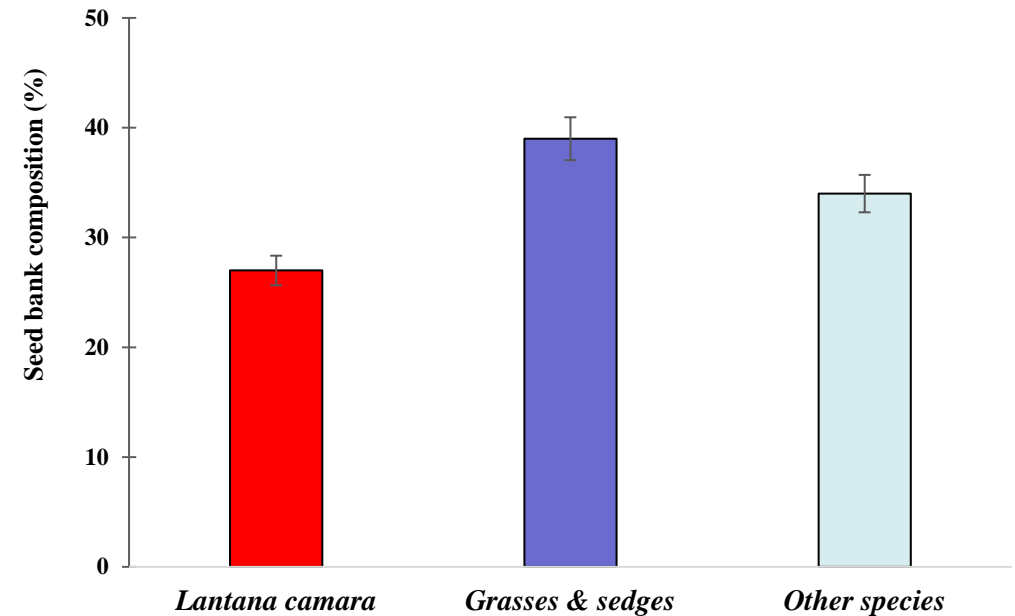


Seed bank composition

Jindi Reserve Forest

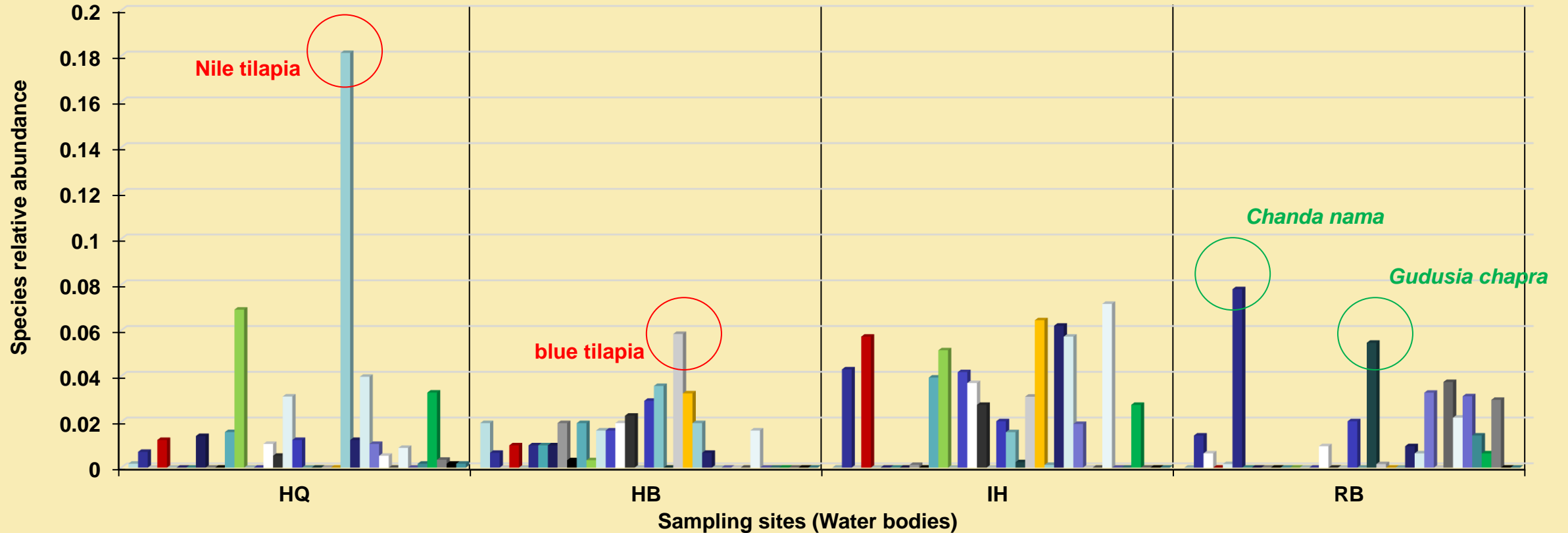


Lehri Reserve Forest



Aquatic ecosystems

Imran, M (2021) Effect of Alien Fishes on Economically Important Native Freshwater Fish Fauna of Punjab, Pakistan. PhD Thesis, Institute of Zoology, University of the Punjab, Lahore Pakistan.

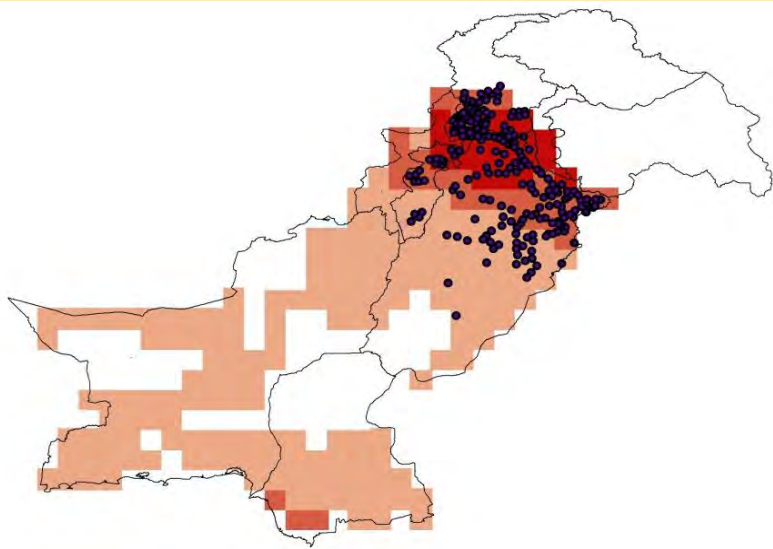


- | | | | |
|-------------------------|--------------------------|---------------------------|-------------------------|
| ■ Carasius auratus | ■ Clupisoma garua | ■ Clupisoma naziri | ■ Eutropichthys vaucha |
| ■ Ailia punctata | ■ Chanda nama | ■ Parambasis baculis | ■ Parambasis ranga |
| ■ Colissa fasciata | ■ Colissa lalia | ■ Chana marulius | ■ Chana punctatus |
| ■ Chana striatus | ■ Chana gachua | ■ Heteropneustes fossilis | ■ Mastacembelus armatus |
| ■ Macroganthus pancalus | ■ Notopterus notopterus | ■ Chitala chitala | ■ Gudusia chapra |
| ■ Oreochromis aureus | ■ Oreochromis mozambicus | ■ Oreochromis niloticus | ■ Sperata sarwari |
| ■ Rita rita | ■ Mystus cavasius | ■ Mystus bleekeri | ■ Mystus vittatus |
| ■ Wallago attu | ■ Ompok bimaculatus | ■ Ompok pabda | ■ Bagarius bagarius |
| ■ Gagata cenia | ■ Sisor rabdophorus | ■ Xenentodon cancila | |

HQ = Head Qadirabad
IH = Islam Headworks
HB = Head Baloki
RB = Rasool Barrage

Management of IAS

- Detection and Mapping
- Physical and manual control
- Chemical control
- Biological control
- Weed utilization

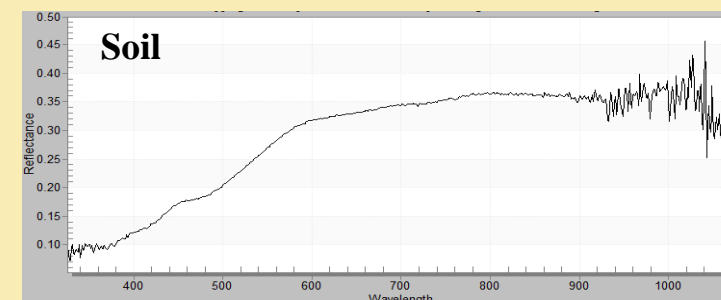
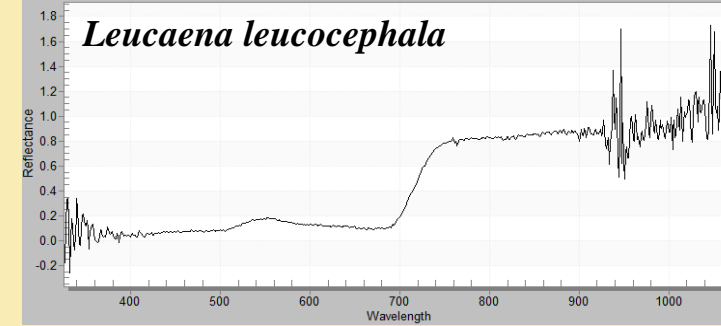
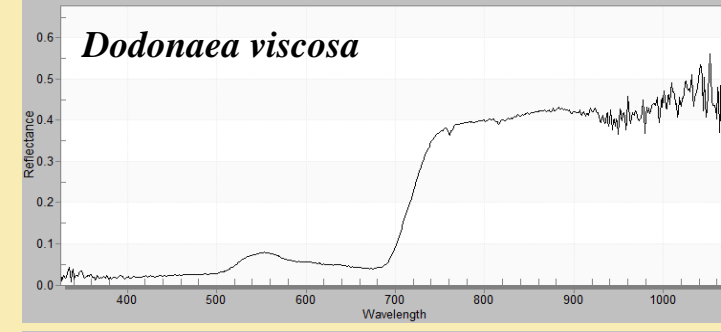
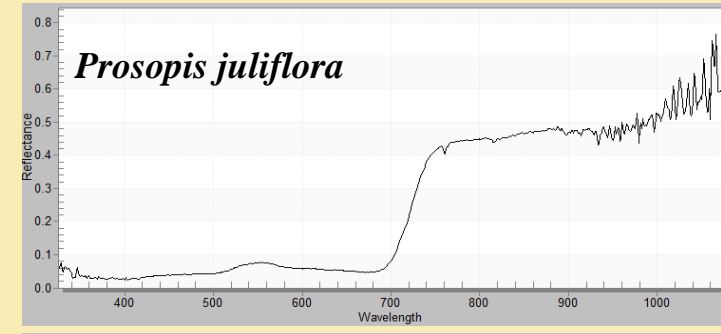
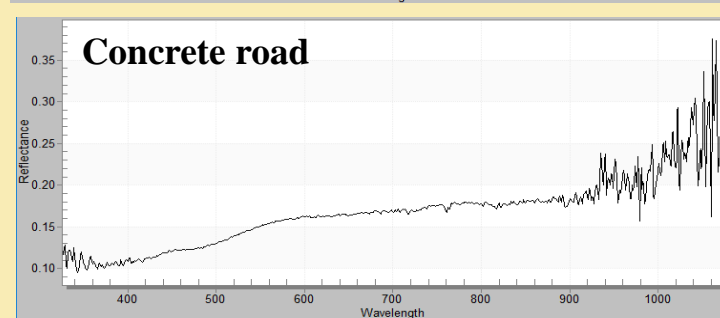
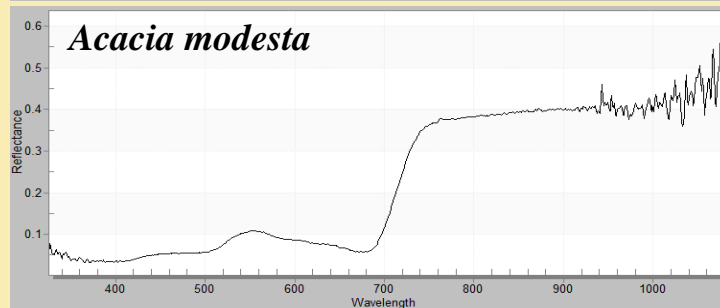
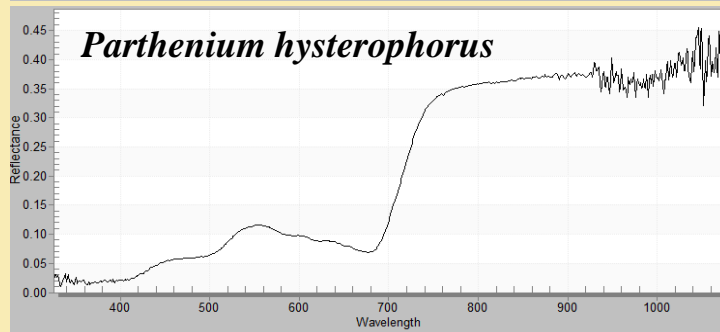
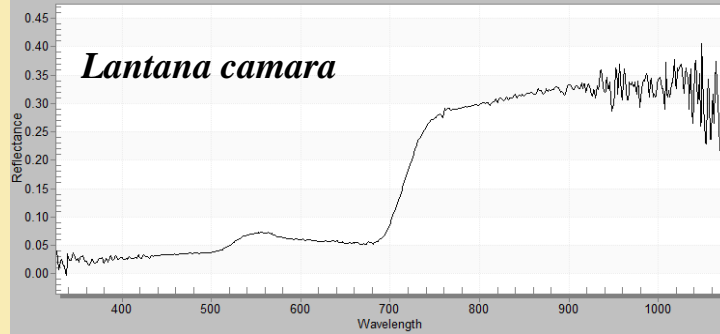


Detection and mapping

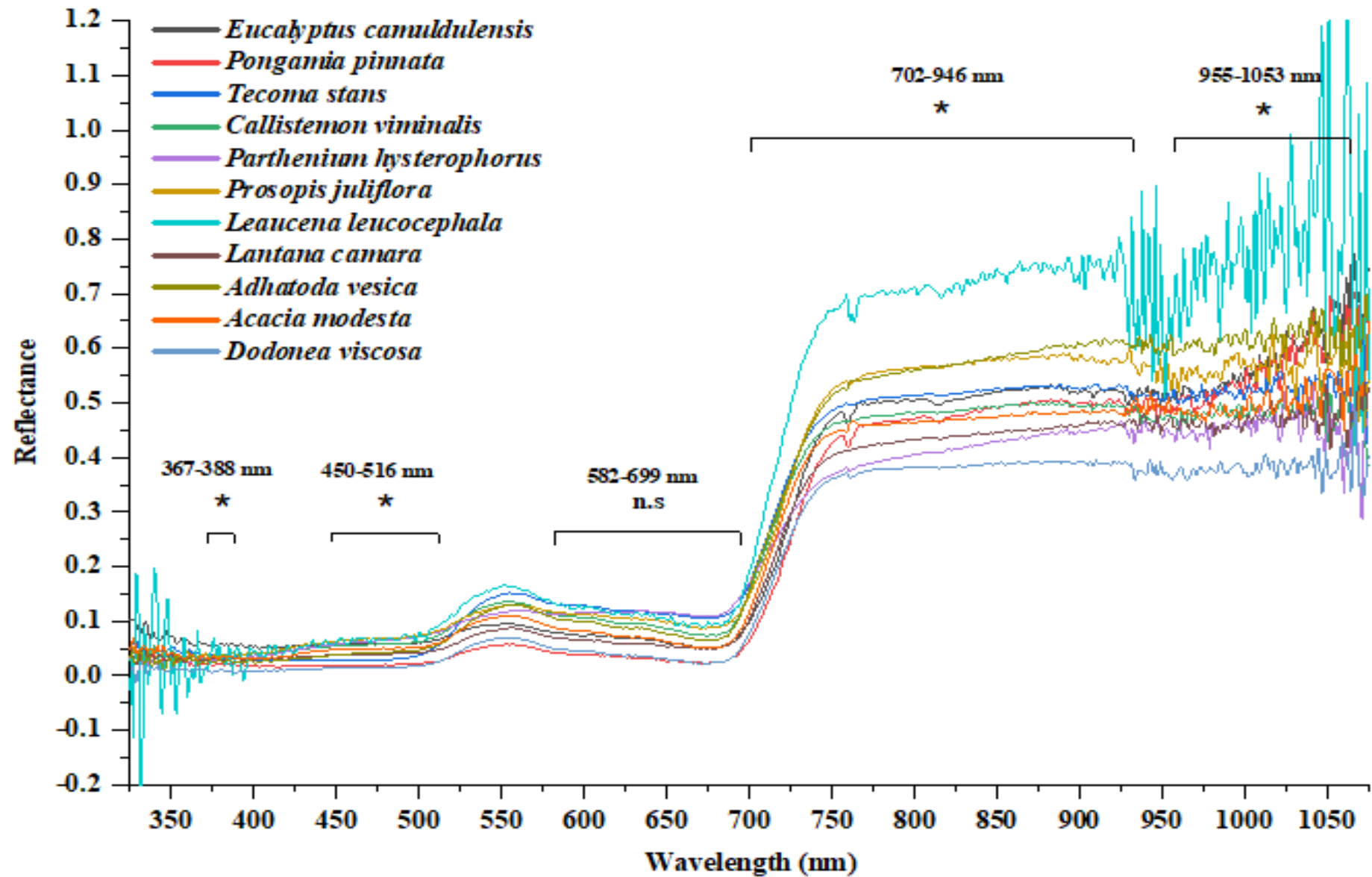
- **To determine the potential of remote sensing to detect discriminate and map invasive species**
- **Hyperspectral Remote Sensing**

Field surveys to collect spectral data using spectroradiometer





Individual Spectral signatures using hyperspectral RS instrument



Graphical representation of ANOVA results showing discriminating wavebands ($p < 0.05$) among plant species in different regions of electromagnetic spectrum

IAS policy and management responses

- **No national policy/Action program on IAS**
- **Spread pathways are not identified and prioritized**
- **Impacts are diverse but not fully understood**
- **Lack of coordination among stakeholders**
- **Awareness about IAS is generally low**
- **Some progress on weed biological control**
- **Strong and effective legislation**

Key messages

- **A preliminary list of alien invasive species of Pakistan is completed.**
- **IAS have adversely affected the native species and ecosystems.**
- **It is possible to detect, discriminate and map IAS through RS.**
- **A risk assessment is required to prioritize potential IAS.**
- **To achieve national and global targets, a coordinated effort is needed.**

Acknowledgements

Ms. Iram Mujahid Iqbal

Ms. Madiha Shehzadi

Dr. Abdul Majid Khan

Dr. Muhammad Imran



THANKS

Any questions/feedback

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