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

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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
• 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.


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

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

Nested Quadrat method (transects of $20 \times 20$ m for trees & woody shrubs while $1 \times 1$ 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

1. Glass house
2. Soil bed preparation
3. Experiment layout
4. Labeling
5. Data recording
6. Transplantations
Seed floatation method

1. Glass house
2. Sieving preparation
3. Soil shifted to sieve
4. Soil washings
5. Drying of sieved material
6. Selected Seeds after sieving
# Invasion status of PAs

<table>
<thead>
<tr>
<th>Protected Area</th>
<th>Invasive species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lehri</td>
<td><em>Lantana camara, Prosopis juliflora, Parthenium hysterophorus</em></td>
</tr>
<tr>
<td>Jindi</td>
<td><em>Leucena leucocephala, L. camara, P. hysterophorus</em></td>
</tr>
<tr>
<td>Jhoke</td>
<td><em>P. hysterophorus, L. camara, P. juliflora</em></td>
</tr>
<tr>
<td>Shahadra</td>
<td><em>P. hysterophorus, Conyza canadensis</em></td>
</tr>
<tr>
<td>Changa Manga</td>
<td><em>L. camara, Acacia fernisiana, P. hysterophorus, Dolichandra unguis-cati</em></td>
</tr>
<tr>
<td>Dandot</td>
<td><em>Prosopis juliflora</em></td>
</tr>
</tbody>
</table>

All forests/PAs are invaded by one or more invasive species!
Species abundance - aboveground

Jindi Reserve Forest, Jhelum

Lehri Reserve Forest, Jhelum

Relative density (%)
Seed bank composition

Jindi Reserve Forest

Leucaena leucocephala
Lantana camara
Grasses & sedges
Other species

Lehri Reserve Forest

Lantana camara
Grasses & sedges
Other species
Aquatic ecosystems

Species relative abundance

Sampling sites (Water bodies)

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

Carasius auratus
Ailia punctata
Colissa fasciata
Chana striatus
Macroganthes pancalus
Oreochromis aureaus
Rita rita
Wallago attu
Gagata cenia

Clupisoma garua
Chanda nama
Colissa lalia
Chana gachua
Notopterus notopterus
Oreochromis mozambique
Mystus cavasius
Ompok bimaculatus
Sisor rhabdophorus

Clupisoma naziri
Parambassis ranga
Chana marulius
Heteropneustes fossilis
Chitala chitala
Oreochromis niloticus
Mystus bleekeri
Ompok pabda
Xenentodon cancila

Eutropichthys vaucha
Mastacembelus armatus
Gudusia chapra
Sperata sarwari
Mystus vittatus
Bagarius bagarius

Nile tilapia
Blue tilapia
Chanda nama
Gudusia chapra
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

- Lantana camara
- Prosopis juliflora
- Parthenium hysterophorus
- Dodonaea viscosa
- Acacia modesta
- Leucaena leucocephala
- Concrete road
- Soil
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.
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Any questions/feedback
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