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PLANT SPECIES IDENTIFICATION, POTENTIAL USE AND INVASIVENESS

A Training Workshop: Optimisation of Pesticidal-plants- Technology Innovation,
Outreach and Networks (OPTIONS)

By

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Introduction

- Man has always classified things for the accurate recognition of food, fuel, medicines and building materials among others, which essential for his survival on earth.
- The **East African Herbarium** undertakes **taxonomic research of plants and fungi (mushrooms)**
- Taxonomy involves **Identification, Naming and Classification**

Role of taxonomy

- **Identification**- How can plants be recognized?
- **Nomenclature**- What should they be called in order that information about them can be freely exchanged without ambiguity (*E.g. use of ICBN, Melbourne revision, 2012*).
- **Classification** - What are their closest relatives? Are there plants likely to have similar properties or compatible genetic systems? (*e.g. use Flora of Tropical East Africa*)
- **Diversity**- of species: How many species are there in Kenya? (**Vascular species 7004**)
- **Floral Distribution**-Where do they grow?
- **Phenology**- when do they flower or fruit?
- **Ecology** -Where do they grow?
- **Uses** - Have they any useful properties?



Herbarium specimen label data



Plant identification

Identification- naming of an organism by reference to an already existent classification

Local names

- Have evolved over centuries in many languages
- Used within a geographical region
- One plant may therefore be known by several different names
- One name may apply to several different plants

Methods of Plant Identification

1. **Pictures and illustrations.**
2. Identification Keys in botanical books and Floras i.e.
 - **dichotomous keys, then**
 - **Matching in herbarium.**
3. **Asking experts**

Plant Identification tools

- Herbarium
- Reference material (FTEAs, Journals, Monographs, UPWF, KTSL, etc)
- Plant glossary
- Hand lens
- Microscope
- Dissecting kit
- Ruler



Reference literature for
plant species identification

Plant Morphology

- “The way in which plants are constructed”
- Why important to study?
 - For quick and easy identification
 - Writing descriptions

Morphology: Key characters for plant ID

- Habit (herb, shrub, tree, liana/climber)
- Sap
- Leaf (simple, compound, etc.)
- Stipules
- Hairs and glands
- Floral
- Fruit
- Seed

Habit

- Herb
- Climbing:
 - Scrambler
 - Twiner
 - Liana (woody climber)
- Shrub
- Tree



Trunks and stems

□ Branching patterns

- Notable?



□ Bark

- Colour
- Texture
- ? Peeling/flaking
- ? Spines



Sap or exudate

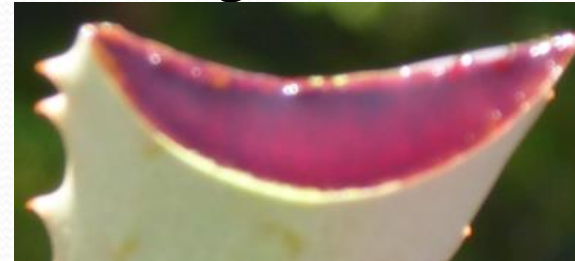
❖ Present/absent from wounds or cuts?

❖ Colour of sap?

➤ Yellow, white, red, etc



➤ changes upon drying or exposure (e.g. from translucent to black or red)



➤ Smell?

Leaf morphology

- Petioles
- Varying lengths (sessile, ? cm long..)
- Swollen nodes
- Winged



Thika palm-(*Filicium decipiens*)

Leaf morphology

- Simple – undivided blade



- Compound – fully subdivided blade



Leaf morphology

- leaf arrangement
 - Alternate
 - Opposite
- Venation
- Hairs & glands

alternate

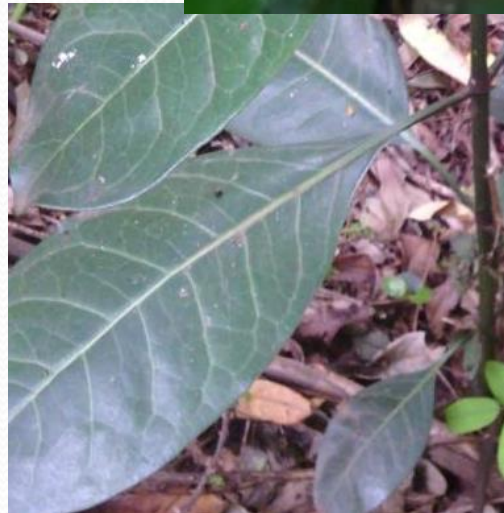


Opposite



Leaf morphology

- **Leaf margin**
 - Dentate
 - Serrate
 - Smooth

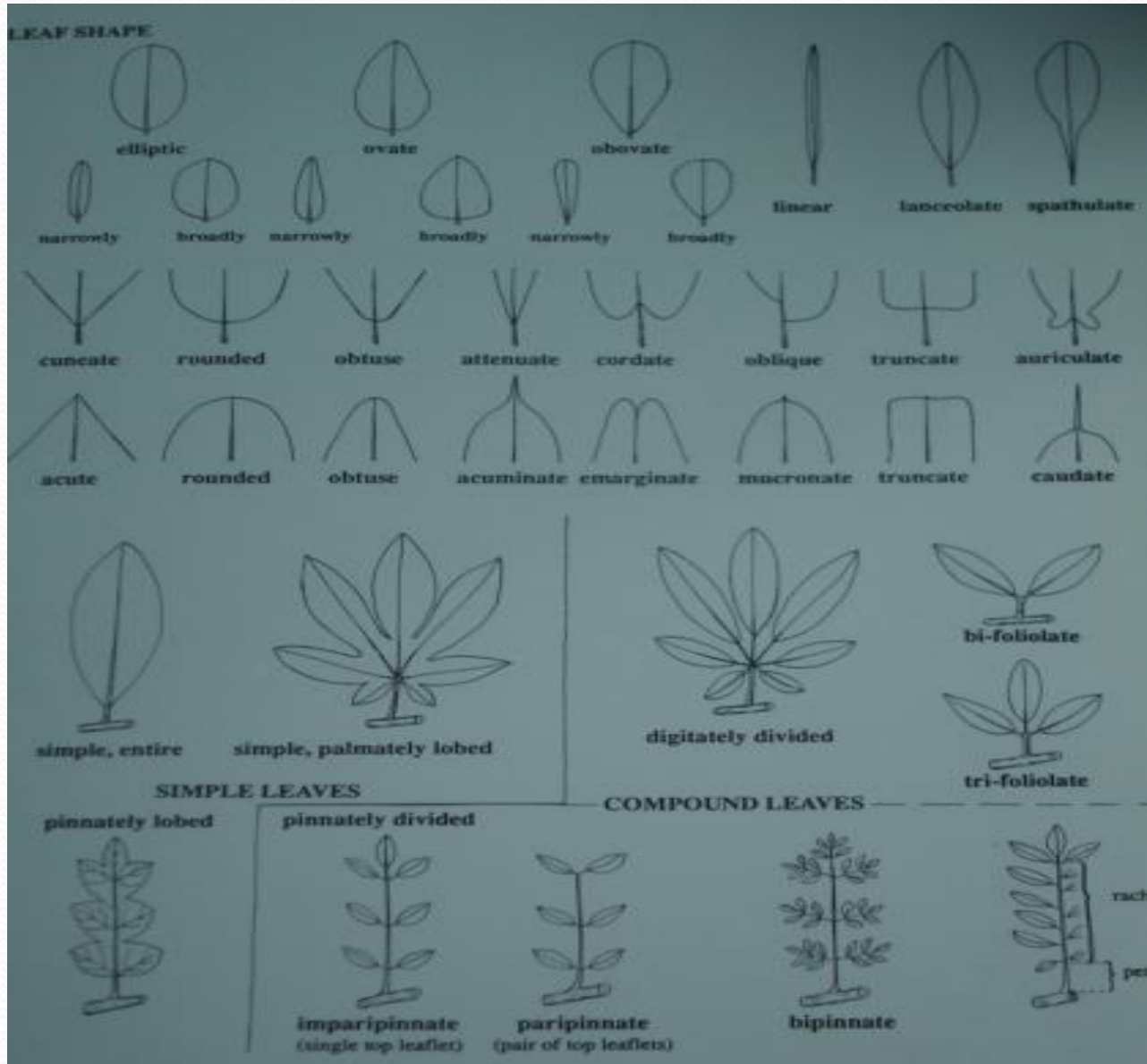


Leaf morphology

- ❖ Shapes - Ovate, Elliptic, Heart-shaped, Linear
- ❖ Apices - acute, acuminate, rounded, etc
- ❖ Bases - cuneate, cordate, etc

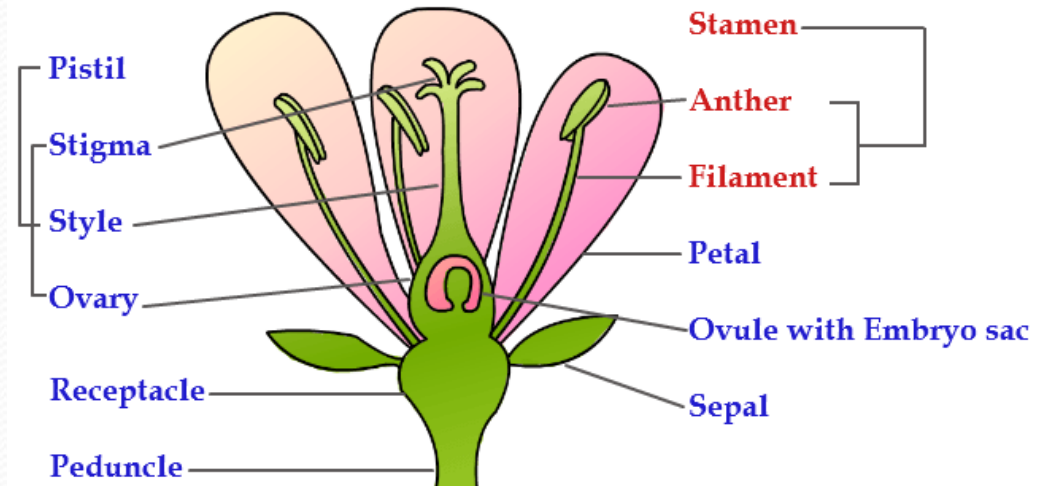


LEAVE PARTS



Inflorescences & Flowers

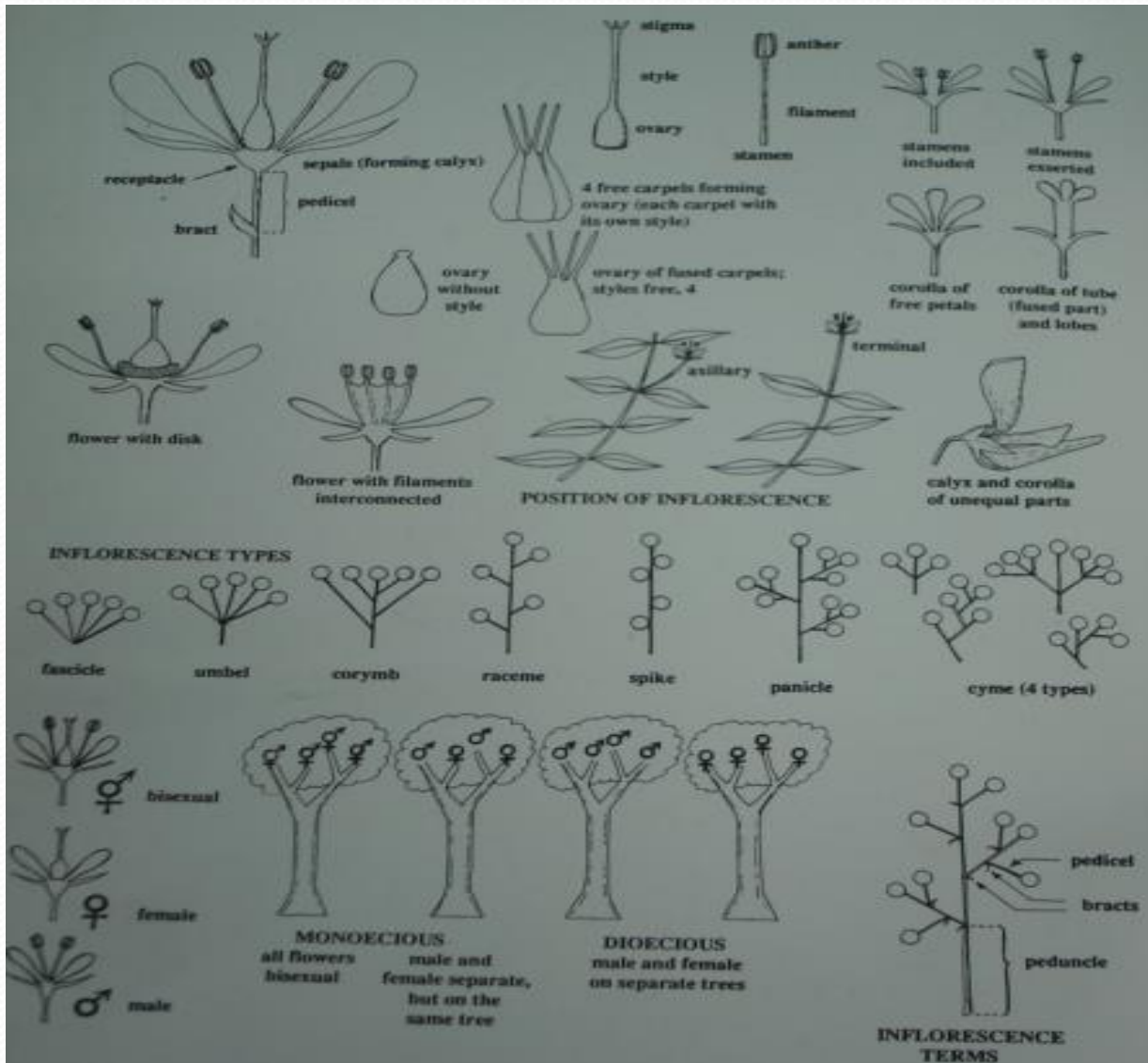
- Arrangement – solitary, racemes, spikes
- Symmetry
- Colour
- Floral parts – number of **stamens, petals, sepals**
- Position of the **ovary** – superior, inferior, semi-inferior



Inflorescences & Flowers



Flower and Inflorescence types

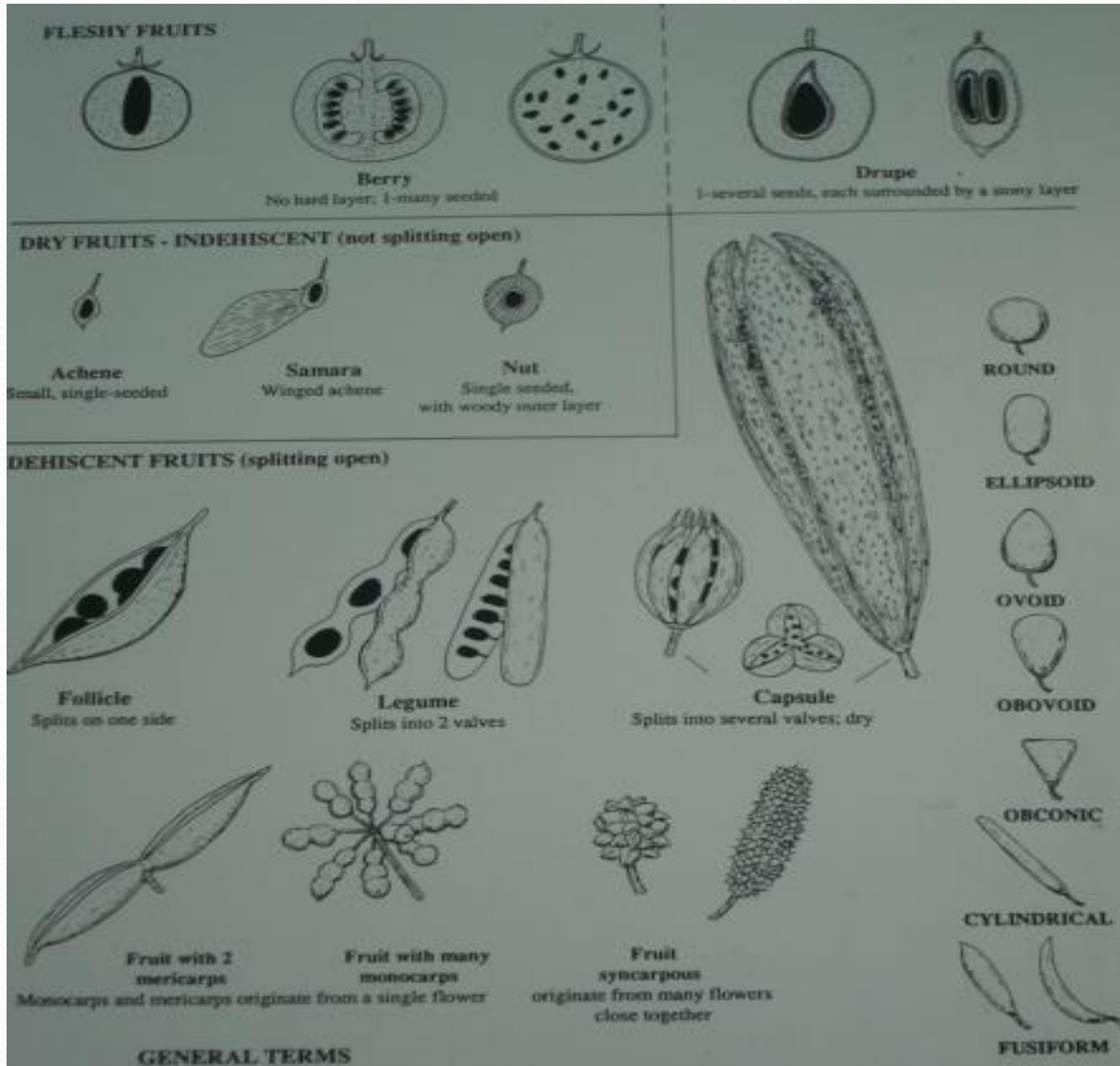


Fruits

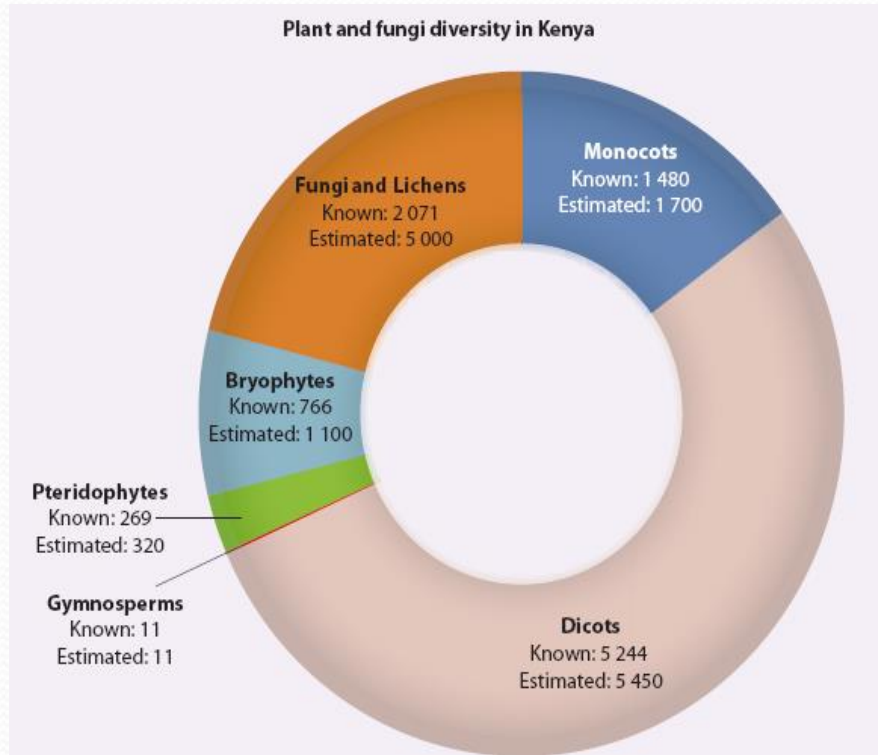
- Simple or aggregated/compound
- Succulent/ fleshy
- Dehiscent or indehiscent (when dry)



Fruit types



Diversity of plants in Kenya



- 12317 vascular plant species in East Africa, 7004 in Kenya (*Mwachala et al., 2014*).
- In addition,
- 766 - bryophytes
- 2071 - fungi



Mushroom



Lichen-Fungi



Bryophytes

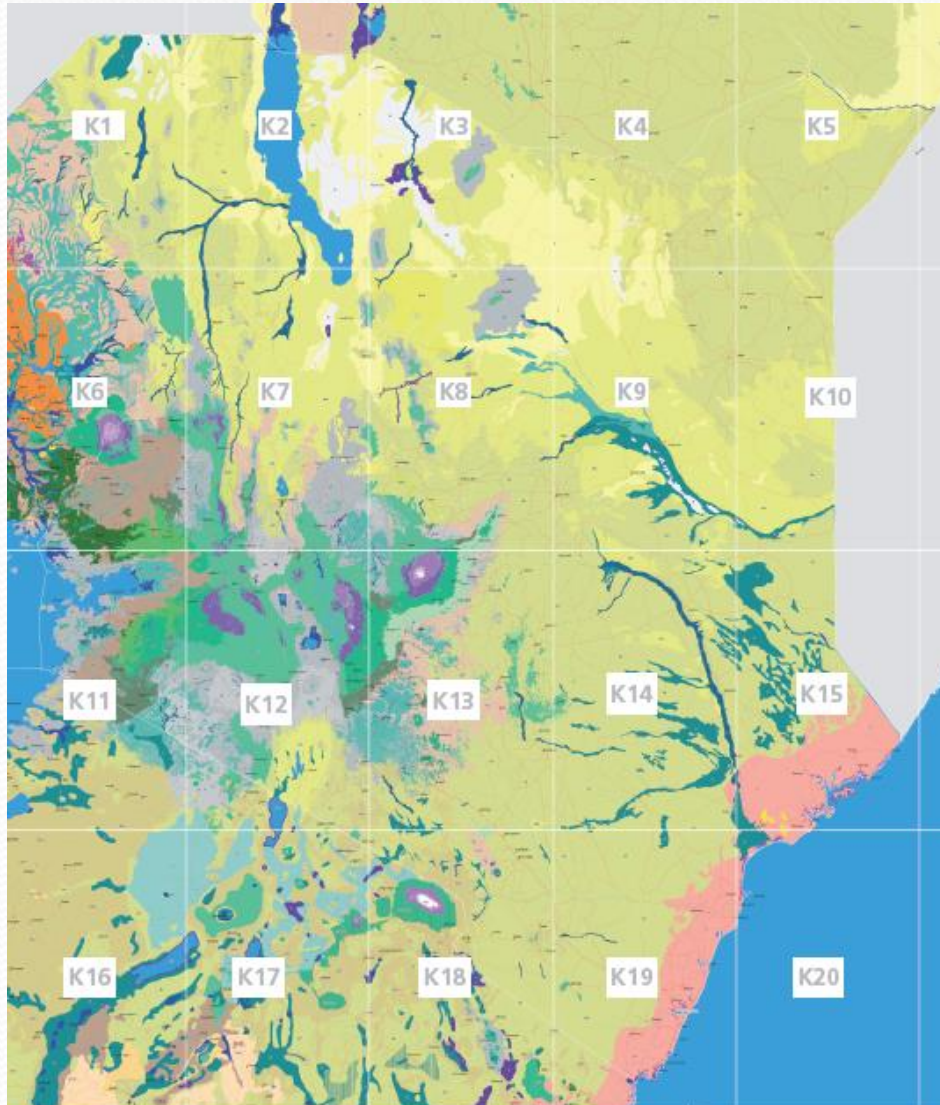


Ferns



Over 1000 seedlings researched and distributed in 2014
Botanic garden, Nairobi

Diversity according to vegetation zones

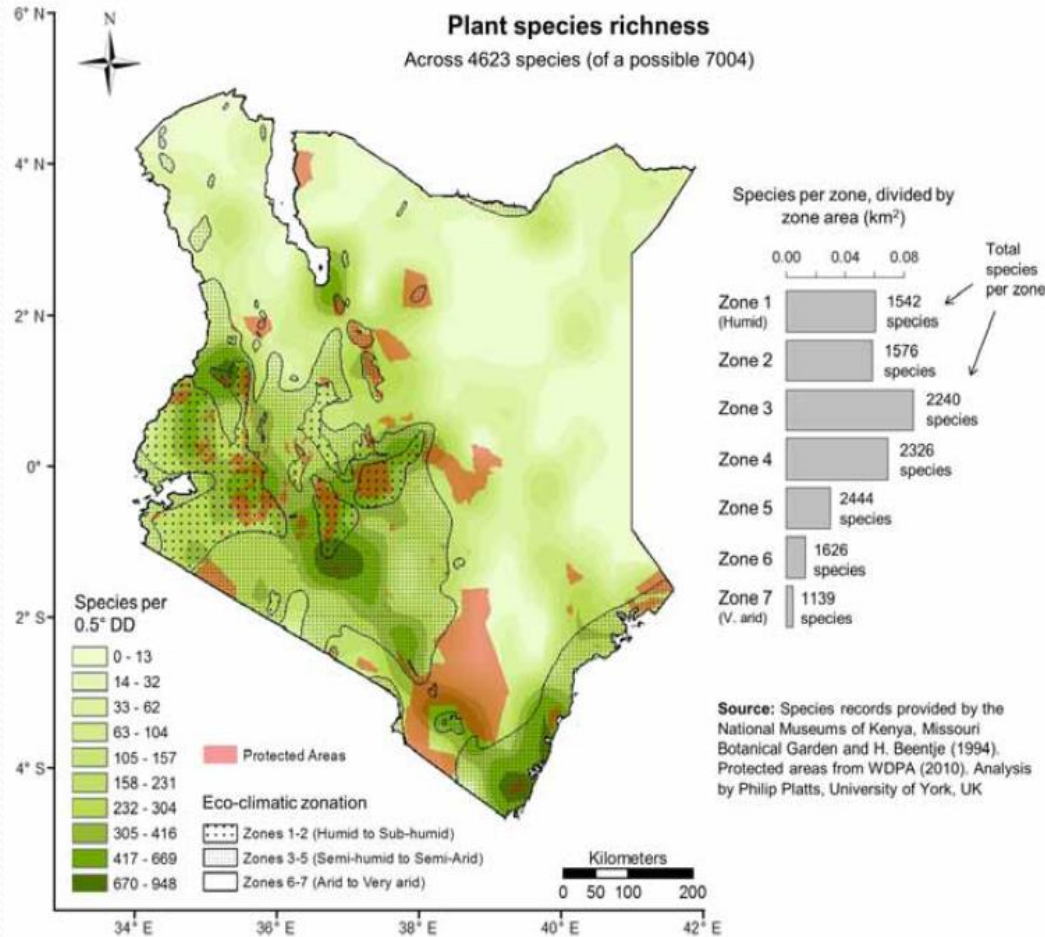


vegetation ecosystems (*Lillesø et al., 2011; White, 1983*)

1. *Somali-Masai (80 % of Kenya from Tsavo to North eastern, between 500 m to c. 2000 m a.s.l.)*
2. *afromontane (Highlands, > 2000 m a.s.l.)*
3. *Swahilian Zanzibar-Inhambane (coastal forests),*
4. *Lake Victoria savanna*
5. *Guinea-Congolian mosaics (Kakamega)*

*Highest diversity of plants found in Somali-masai (especially hilltops) with 4721 species, coastal forests (e.g. **Shimba hills 3000**).*

Places of highest plant species concentration and endemism



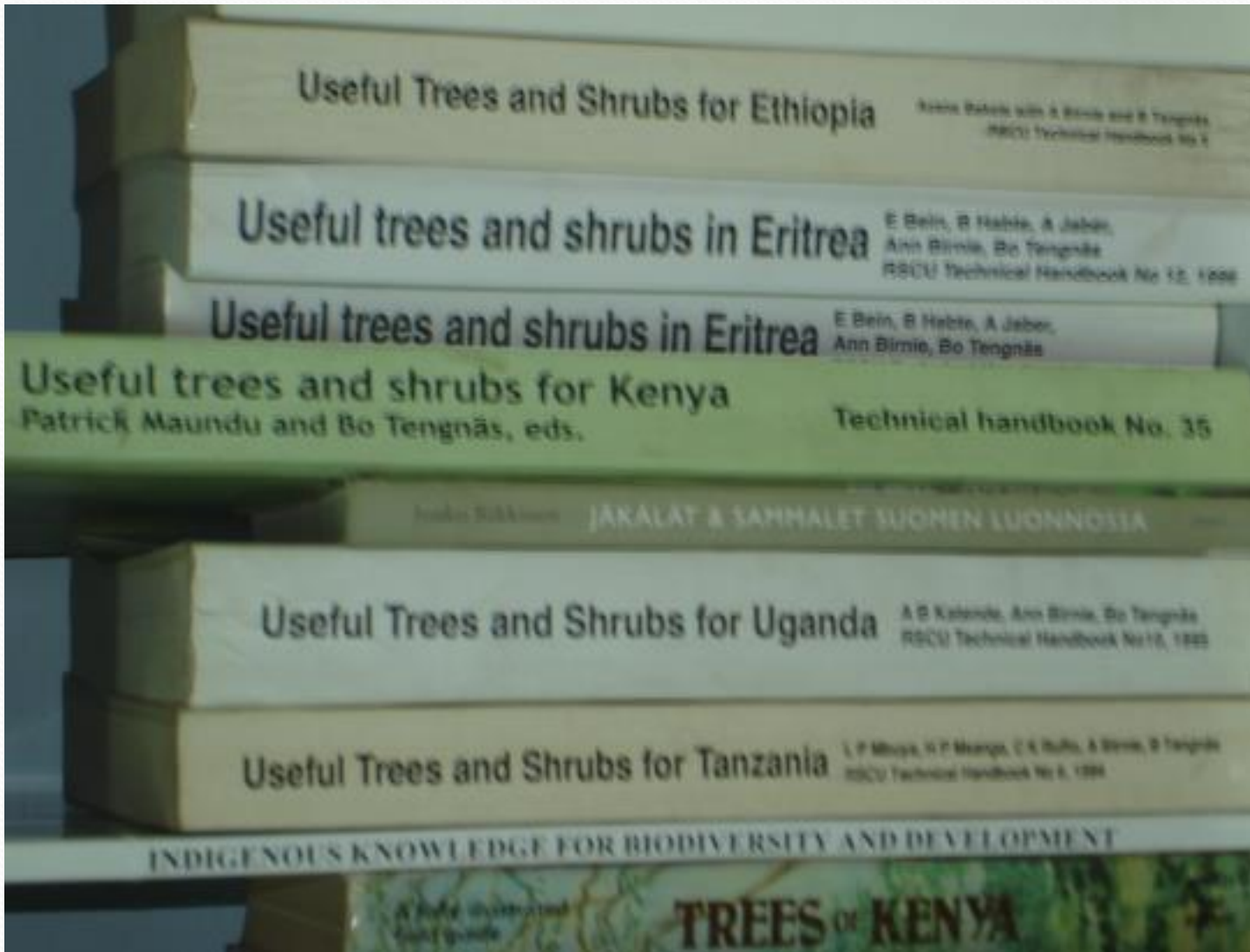
- Highest in eco-climatic zones 1-3
- 577 (8%) are endemic (plants found only in Kenya or East Africa)
- High endemism in Central Highlands and the Coastal forest.
- The highest proportion of endemic plants are found in the arid environments

Plant uses

Over **800 plant species** in Kenya with potential uses. For example;

1. **Food** (800 species. fruits form about 50%, leaf vegetables 25%, tuber and root species 12.5% see Maundu, et al., 1999).
2. **Fodder and forage** (livestock and pollinators such as bees)
3. **Medicines** (80% of the world's people rely on traditional medicine)
4. **Pesticides** (e.g. *Securidaca longipedunculata*, *Zanha africana*, *Tithonia diversifolia*, *Tagetes minuta*, *Lippia javanica*)
5. **Fibre and dyes** (e.g. *Euclea divinorum* for dying kiondo).
6. **Fuel and firewood**
7. **Building e.g. Kiang'ombe Hill (Mbeere), annual average household forest value esti. KSh. 16,175.6 (US\$256.80), i.e. 55.4% of household income (Ngugi et al., 2011).**
8. **Manufacturing** (e.g glue, soap, cosmetics, lubricants)
9. **Ornamentals** (Succulent plants such as aloes and euphorbia)
10. **Protection of soil erosion**
11. **Ecosystem services..insect pollination**

Resource references



Some medicinal and pesticidal plants

Examples

1. *Croton dichogamus* (Muthinia)
2. *Securidaca longipedunculata* (Muuka)
3. *Zanha africana* (Kilolekyia)
4. *Strychnos henningsii* (Muteta)
5. *Lippia kituensis* (Muthieti)
6. *Aloe sp.* (Kiluma)
7. *Plectranthus pseudomaruboides* (Kiyo)
8. *Tithonia diversifolia* (mwivatha)



Lippia kituensis



Beautiful landscapes and important plants to human livelihoods



African potato

Invasive Alien Species and Management

Invasive Species?

IAS are *non-indigenous species* that have been deliberately or accidentally introduced to new biogeographical system (Givens, 1994), and which then spread beyond cultivation and human care to impact biodiversity

Invasive plant species

1. IAS-Aquatic



2. IAS: Grasslands/Woodlands/forests



***Opuntia* spp.**



Tarchonanthus (Leleswa)



Parthenium hysterophorus
(Parthenium Weed)

IAS: Farmlands



Tithonia diversifolia
(Mexican Sunflower)



Catharanthus roseus
(Madagascar Periwinkle)



Calliandra calothyrsus
(Calliandra)

IAS Impacts

IAS can have negative impacts at the species, population and community levels, and the most damaging significantly alter ecosystem functions and processes

Community and Population Level Impacts

1. Resource competition and reduced recruitment (altered **succession**)
2. **Competition for pollinators**, seed dispersers and other mutualists
3. Population reductions and eliminations
4. Alterations in community composition and vegetation structure
5. **Hybridization** with native species

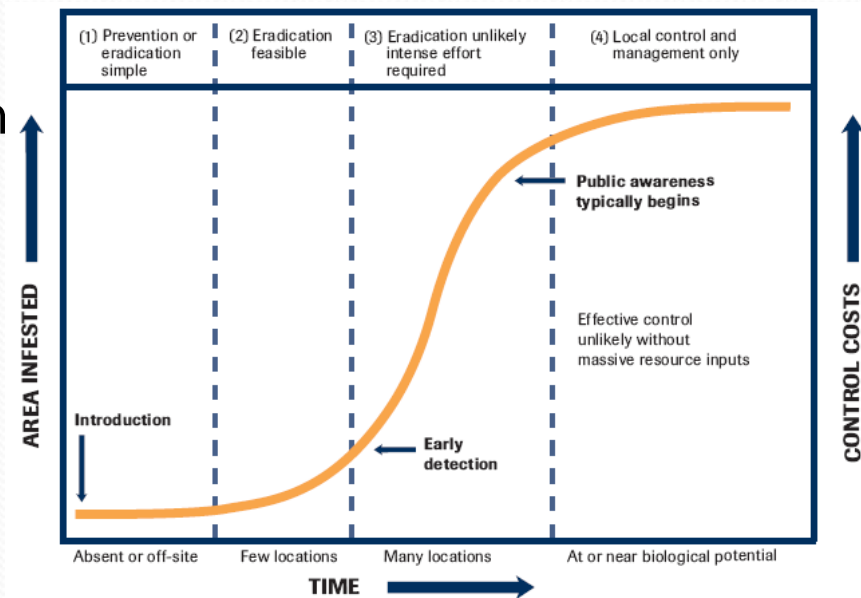
Ecosystem Level Impacts

1. Alterations in disturbance regimes (e.g. fire, hydrology, etc.)
2. Geomorphologic processes (erosion, sedimentation)
3. Soil chemistry (nutrients, nutrient cycles, pH)

Management strategy of IAS

Effectively strategy to manage IAS required at national and international-scale policies (e.g. Awareness of threats)

1. Assessment of current and potential threats and pathways
2. Prevention practices and policies
3. Early detection and rapid response
4. Management, control and restoration
5. Secured and maintained funding



Management efforts of IAS in Kenya


NMK's EA herbarium through BioNET-EAFRINET, the East African partnership for Taxonomy, developed an

IAS fact sheet of the Priority 100 IAS in the region

(<http://keys.lucidcentral.org/keys/v3/eafrinet/weeds/key/weeds/Media/Html>)

Fact sheet details

1. Synonyms
2. Common names
3. Family
4. Origin
5. Naturalised distribution (global)
6. Introduced, naturalised or invasive in East Africa
7. Habitat
8. Description
9. Reproduction and dispersal
10. Economic and other uses
11. Environmental and other impacts
12. Management
13. Legislation
14. References
15. Editors
16. Acknowledgments
17. Contact



BioNET-EAFRINET KEYS AND FACT SHEETS

← Back to Start screen

Invasive Plants

Invasive alien species may threaten native species as direct predators or competitors, as vectors of disease, or by modifying the habitat or altering native species dynamics. Entire ecosystems may be placed at risk through knock-on effects and given the critical role biodiversity places in the maintenance of essential ecosystem functions. This interactive key and accompanying fact sheets provides a resource that can help those who wish to identify species of concern and to undertake management efforts to minimise their impact.

LUCID KEY

The species key is designed using Lucid 3.5 software & requires a recent version of Java. See the About The CD section for more information

FACT SHEETS

Fact sheet list for all species included in the key. Fact sheets contain diagnostic features, images, information about impact, management and more

GLOSSARY

Terms used in the key and fact sheets

LINKS & RESOURCES

Additional links and resources on invasive plants

AUTHORS & ACKNOWLEDGEMENTS

Authors and acknowledgements to all the assistance received throughout the project

ABOUT THE CD

A Lucid key and fact sheets to 100 of the most important invasive alien plant species in the East African Region.



- Fact Sheet index
- Glossary
- To Invasive Plants Home

- Back to top
- Synonyms
- Common names
- Family
- Origin
- Naturalised distribution (global)
- Introduced, naturalised or invasive in East Africa
- Habitat
- Description
- Reproduction and dispersal
- Similar species
- Economic and other uses
- Environmental and other impacts
- Management
- Legislation
- References
- Editors
- Acknowledgments
- Contact

Azolla filiculoides (Red Water Fern)

Scientific name

Azolla filiculoides Lam.

Synonyms

A. arbuscula Desv.; *A. filiculoides* var. *rubra* (R. Br.) Strasb.; *A. magellanica* Willd.; *A. squamosa* Molina

Common names

Red water fern, water fern

Family

Azollaceae

Origin

Azolla filiculoides is native to most of South America.

Naturalised distribution (global)

Locations within which *Azolla filiculoides* is **naturalised** include western Europe, eastern, central and southern Africa, tropical Asia, North America, Australia and New Zealand.

Introduced, naturalised or invasive in East Africa

Azolla filiculoides is invasive in parts of Kenya, Uganda (A.B.R. Witt pers. obs.) and in Tanzania (Henderson 2002).

Click on images to enlarge



Azolla and *Pistia* in livestock dam, Mbarara (Photo: Geoffrey Howard, IUCN)

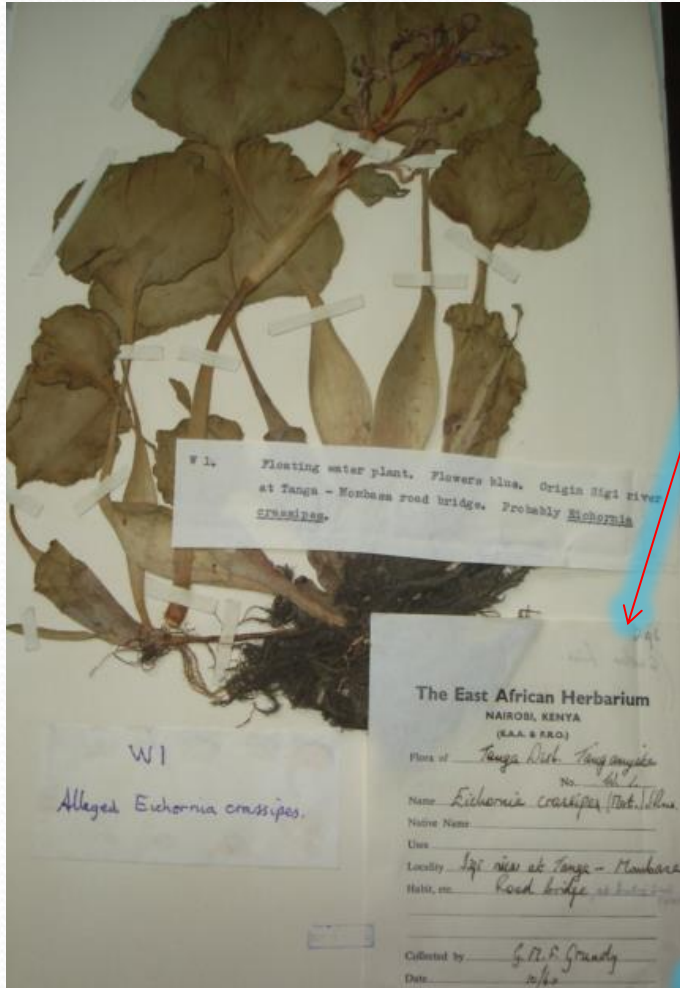


Azolla covering watering pond, near Rushere, Mbarara, Uganda (Photo: Geoffrey Howard, IUCN)



Azolla in ricefield (Photo: Geoffrey Howard, IUCN)

Species data from EA herbarium



Eichornia crassipes

The East African Herbarium
NAIROBI, KENYA
(E.A.A. & F.R.O.)

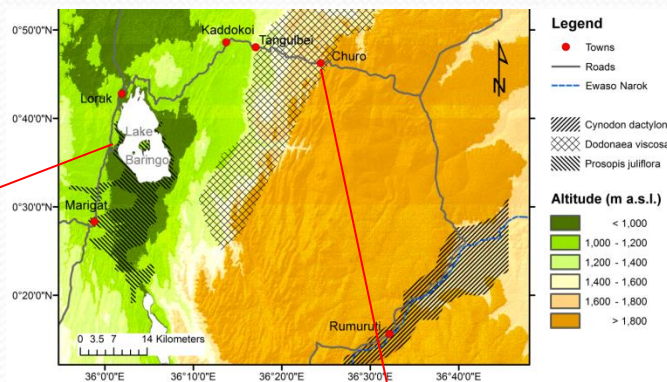
Flora of Tanga Dist. Tanganyika
No. W. 1.

Name *Eichornia crassipes* (Poir.) Solms.
Native Name _____
Uses _____

Locality Sigi river at Tanga - Mombasa
Habit, etc. Road bridge at Mombasa level

Collected by G. N. F. Grundy
Date 10/60

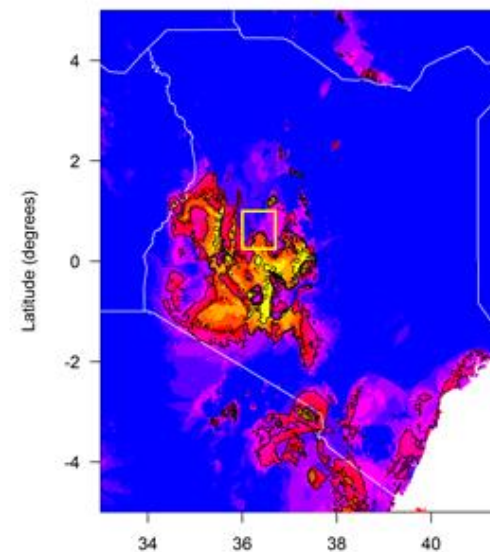
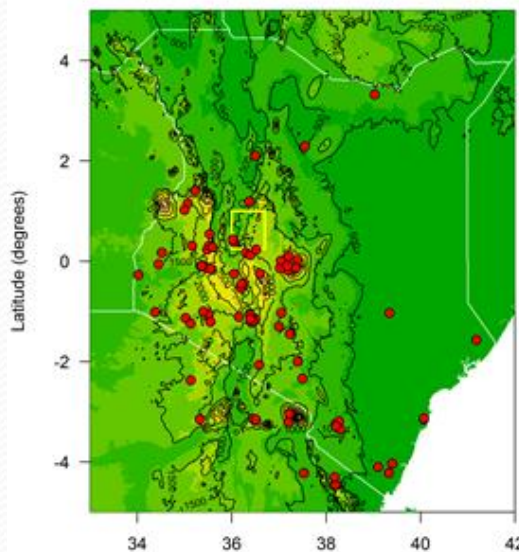
Ecological dynamics of invasive plant species: *Prosopis* & *Dodonaea*



Spreading *Dodonaea*. An early warning system (Paper in prep.)

Distribution of observations

Potential distribution



How can you get assessment data and information on IAS?

1. Field surveys,
2. Literature and internet database searches,
3. Collection records,
4. Remotely-sensed data, and
5. Experts and local professionals (academics, partners, etc.).

ASANTENI