Environmentally friendly management of invasive plant species in Tanzania

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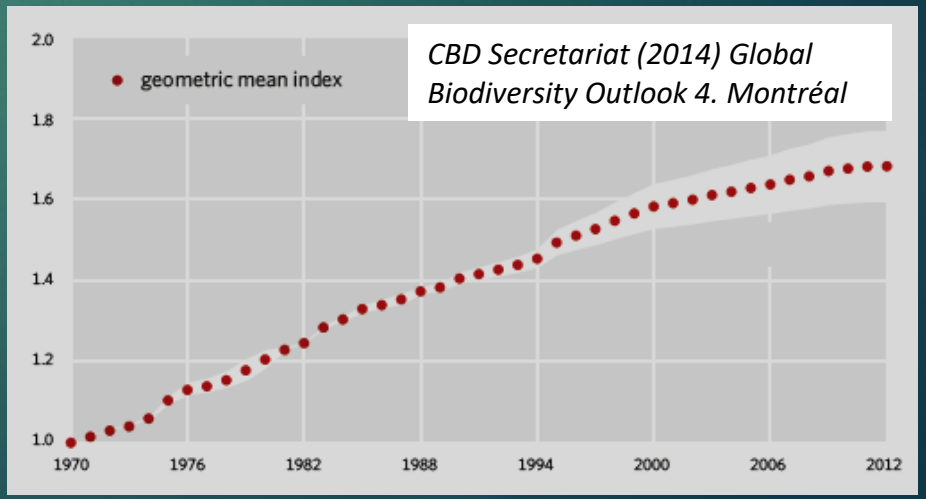
Invasive Species

- Exotic / native species
- One of biggest threats to biodiversity
- > 50% of endangered animals are affected by invasive plants
- Effect higher than pollution, over-harvest, and disease combined
- 120 billion US$ is spent p.a. to control invasives in the US alone
- As successful as never before

(Lucas, 2015; Simberloff, 2000; IUCN Red List, 2010)



Cumulative number of invasive alien species across 21 countries.

Status in Tanzania

- Total number not documented
- In Nogorongoro (UNESCO World Heritage site):
  - 2002: 39 invasive plant species (Henderson, 2002)
  - 2011: 139 invasive plant species (NCA Mangt Plan 2011)

Herbicides

Spraying:
✓Foliar
✓Ground
- effects:
Bio-accumulation

Mechanical control

✓Powered tools
✓Machines
- ➢Slashing
- ➢Mowing
- ➢Cutting

- effects:
Soil disturbance

Manual control

✓With hand
✓Hand led-tools
- ➢Pulling
- ➢Chipping
- ➢Grubbing

- effects:
Labor intensive

Biological control

✓Other organisms
- ➢Animals
- ➢Insects
- ➢Plants

- effects:
Ecological escape

❖Plant extracts
❖Plant-plant competition

Objectives

- Assess effects of invasives on natives and on soils
- Identify the most co-existing native plant species
- Study effects of increasing density of the most co-existing native competitor on the growth and development on invasives
- Study the allelopathic effect of *Desmodium spp* root and leaf crude extracts on invasive germination, growth & development

Study species

Tagetes minuta

Gutenbergia cordifolia

Parthenium hysterophorus

Methods

Field survey

Screen house

Laboratory

Field survey

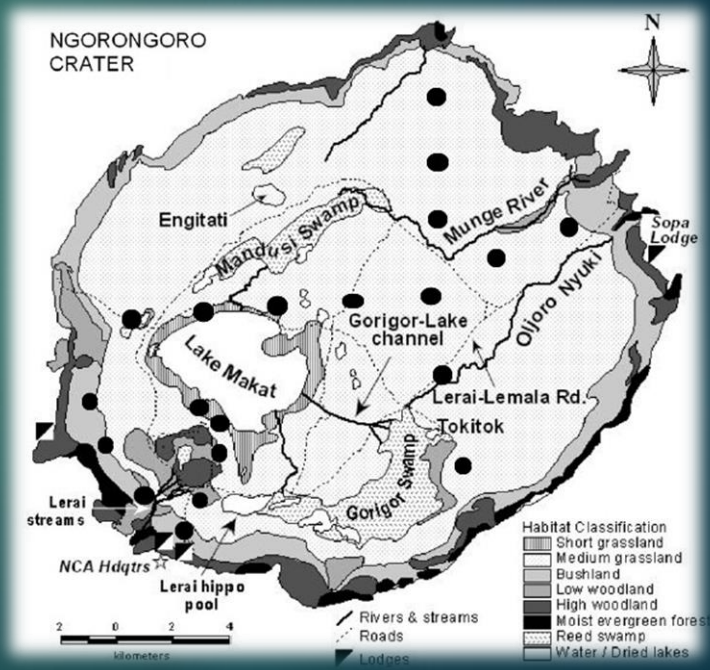
Transects across Ngorongoro

Categories of invasion:

"Uninvaded" = 0 - 24%
"Moderately" = 25 - 49%
"Highly" ≥ 50%

Data collection (1x1 quadrats):

Species abundance
Native plant cover & height
Soil sampling



Source: Estes et al, 2006

Screen house and field plots

Native: *Cynodon dactlyon (co-existing)*

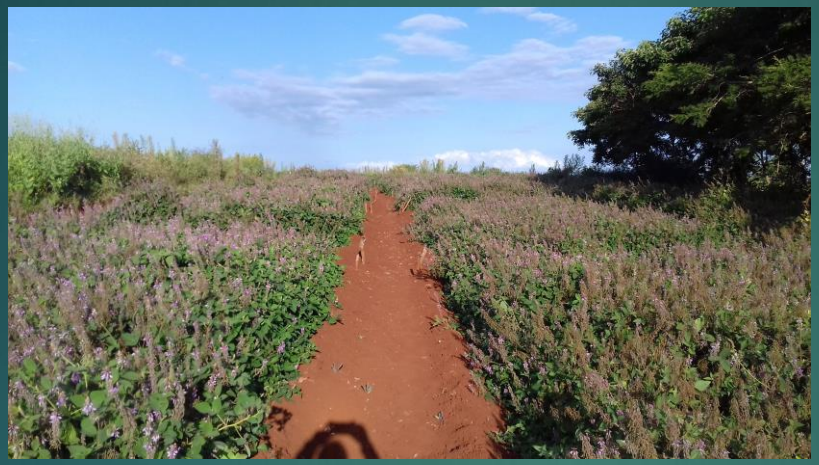
Invasive:

T. minuta, G. cordifolia, P. hysterophorus

W_2:Cd_0, W_2:Cd_4, W_2:Cd_6, W_2:Cd_8, W_2:Cd_{10}

Pots and plots (25 m^2)

Laboratory



Desmodium uncinatum
(Silver leaf Desmodium)

70.8 cm3

CRD = 3 Rep
N = (3x6) = 18
N(total R+L) = 36

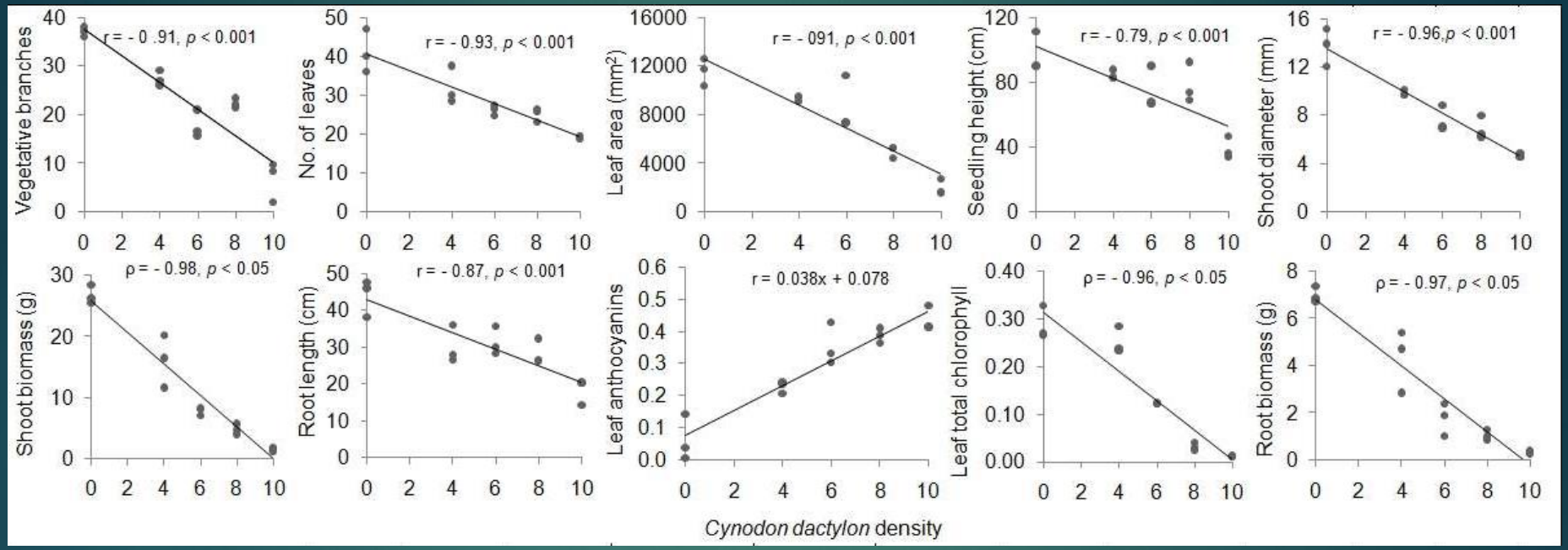
763.8 cm^3

CRD = 3 Rep
N = (3x6) = 18
N(total R+L) = 36

Plant extract
(roots and shoots)

Air dried for 14 days, ground → 0%, 25% , 50%, 62.5%, 75% 100%

Results: competition

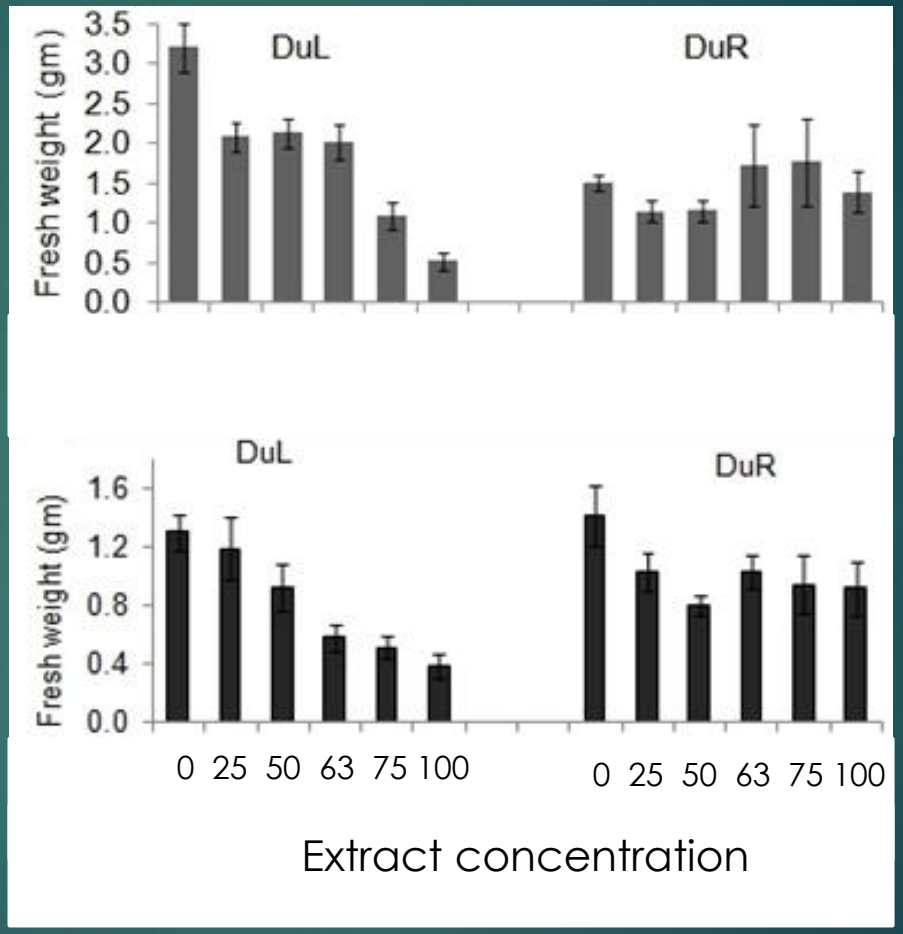


Pearson's product-moment and Spearman's rank-order correlation: *Tagetes minuta*

Results: spraying extracts

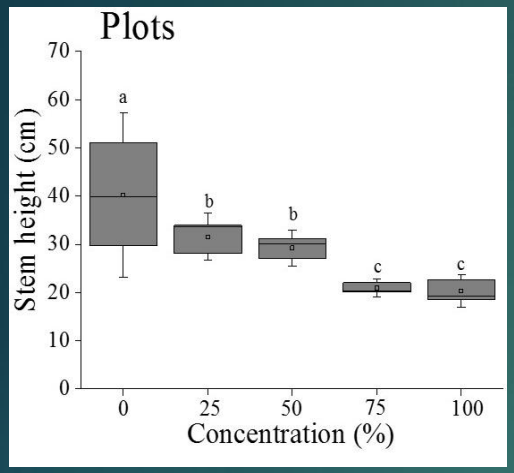
G. cordifolia

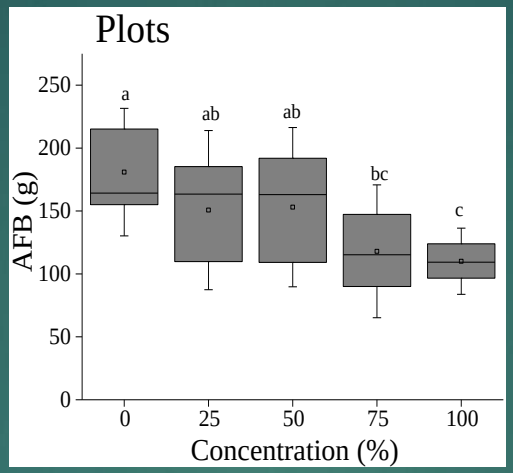
T. minuta

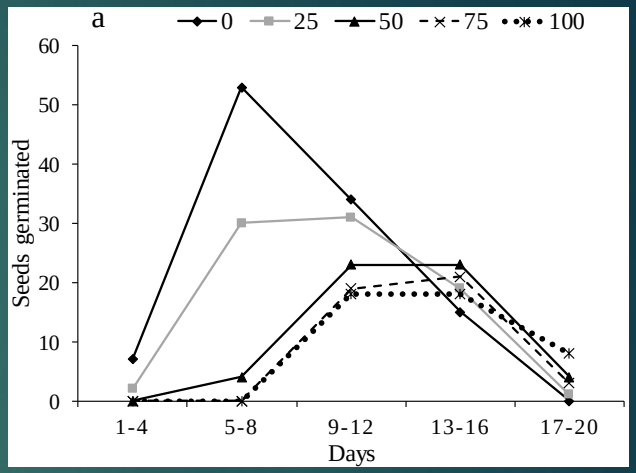


Mean percentage (±SE) seedling fresh weight

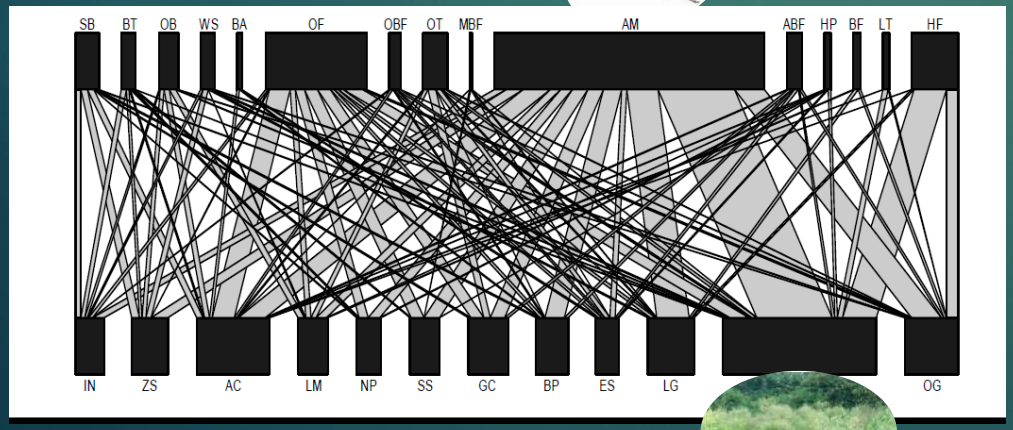
P. hysterophorus results







Pollinators

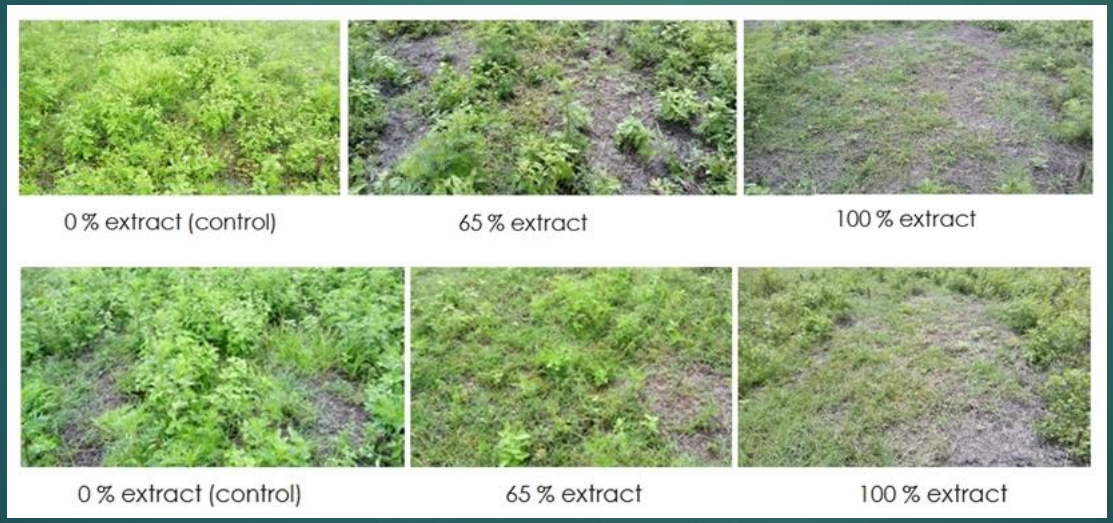


Biological control: *Zygogramma bicolorata*

Scaling up now

Fenced plot

Unfenced plot



Unfenced

Fenced

Invasive species ground cover change at different *Desmodium* leaf extract concentrations

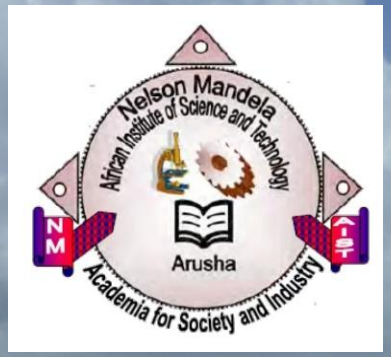
Way forward / conclusions

- Scaling up: testing competition and allelopathy in Ngorongoro
- Understand impact of spraying on other organisms & soils

- Modeling possible future spread of the invasives into new areas
- Isolation of *D. uncinatum* active compounds
- Pro-active measures to prevent introduction of invasives to protected rangelands should be adopted


UHURU
NA
UMOJA


MAMLAKA YA HIFADHI YA
NGORONGORO
CONSERVATION AREA AUTHORITY
TANZANIA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Thank You!