Prosopis introduction and impacts: A Synthesis of Socio-Economic and Ecological Consequences of Land Rehabilitation with *Prosopis* Species in Kenya

Muturi G.M., Choge, S.K. and Kariuki J.G.

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Presentation Outline

- 1. General introduction of the subject
- 2. Genesis of *Prosopis* introduction in drylands of Kenya
- 3. Prosopis Invasion and Challenges in Kenya
- 4. Socio-economic impacts
- 5. Ecological impacts
- 6. Emerging opportunities of *Prosopis* resource
- 7. Conclusion/ take home message

- 44 species Africa, America, Asia and Australia
- •
- 90% native to North and South America
- American species widely introduced
- Mostly for land rehabilitation
- Prosopis juliflora among those introduced

Prosopis Genus



Burkart, A. 1976. Monograph of the genus Prosopis (Leguminosae-subfam- Mimosoideae). Journal of the Arnold Arboretum 57: 219-249, 450-525.
Pasiecznik, N.M., Felker P., Harris, P.J.C., Harsh, L.N., Cruz, G., Tewarri, J.C., Cadoret, K., Maldonado, L.J. 2001. The Prosopis juliflora-Prosopis pallida complex: A monograph. HDRA.
http://www.issg.org/database/welcome/

Post introduction trends

- Introductions were ecologically and economically justified
- Environmental impacts assessments??
- Escaped the introduction niches
- Thro' natural seed dispersal pathways; livestock, wildlife and water



Mixed post introduction impacts perceptions

In Sudan and India the benefits and costs of *P. juliflora* differs amongst stakeholders (Laxen 2007, Walter 2011); pastoralists benefit most from fodder whereas farmers incur losses from clearing farmlands

Extravagant water use as does not close stomata; lowers water table

Detailed cost benefits analysis required



?? Are we comprehensive enough in the analysis or there are some negative or positive impacts that we have not yet understood

Shackleton et. al. 2014. Prosopis: a global assessment of the biogeography, benefits, impacts and management of one of the *world's worst* woody invasive plant taxa

Ecological impacts of prosopis Invasion in Riverine forests of Kenya



Gabriel Mukuria Muturi

Rehabilitation of Degraded Areas Surrounding Kakuma Refugee Camp

Editors: G. M. Muturi, J. G. Kariuki, J. M. Machua, B. Kamondo, P. Tuwei, J. Wanjiku and D. Ochieng

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Why were Prosopis species introduced to Kenya?





Mitigation measures were urgently required

Species screening trial of 80s Prosopis spp adaptable



2. Exotic species grew fast and were tolerant to drought and salinity

Species introductions

Prosopis alba, Prosopis chilensis, Prosopis cineraria, Prosopis juliflora, Prosopis pallida, Prosopis pubescens, Prosopis nigra and Prosopis tamarugo





Prosopis chilensis, pallida & juliflora, Prosopis juliflora / P. chilensis

Challenges required urgent government intervention



Annual benefits, losses and net gain/loss (US\$) for villages in Marigat, Baringo

Village	Average benefit	Average loss	Net
Nairag-Enkare	163.1	250.0	-86.9
Masai	262.0	274.3	-12.2
Chemonke	140.3	1322.9	-1182.6
Keper	182.9	247.5	-64.6
Tingtinyon	101.9	25.8	76.0
Kapronguno	165.8	39.9	125.9
Loboi	5.8	25.8	-20.1
Total	1021.8	2186.3	-1164.5

Overall, negative socio economic impacts revealed; hence invasive

Invasion trends and impacts



Variable	Acacia C	Mixed C	Prosopis C
Stem Density #/ ha	333b	756b	1,225a
Seedling density #/ ha	9,464ab	19,722a	71,093a
Herb cover %	35.5a	29.3a	5.3b
Herb diversity (H')	1.75a	1.4ab	1.18b
Prosopi seedlings #/ a	4,500	14,444	58,594
Acacia seedlings	6,167	0	0
Ficus seedlings #/ ha	833	4,167	1,719

Negative ecological impacts >> Invasive

Ecosystem dynamics



Litter nutrients (N, P,K and phenol concentration) & Phenol leaching trend





Dotted lines are for Prosopis and complete lines for A. tortilis seed germination trends

Allelopathy >> Invasive

Opportunities: use of pods









Opportunities: thinning





Commercial products





Stumps management



Indigenous species regenerate in reclaimed areas or other plants can be planted





Modified drum

Charcoaling





Lid covering the firing area



Faster about 6 to 12 hours
Recovery is between 26%-30%
Portable kiln

Chimney

Opportunities charcoal, gassification





2 Billion KShs, 80,000 tons/yr, 2 Shs/ Kg Prosopis

Choge S.K., Ngujiri F.D., Kuria M.N., Busaka E.A., Muthondeki J.K..2002. The status and impact of Prosopis spp. in Kenya. Nairobi: KEFRI.

Prediction of *Prosopis* species invasion in Kenya using geographical information system techniques

Gabriel M. Muturi^{1,2*}, Godefridus M. J. Mohren² and Jacob N. Kimani³

Genetic diversity of Kenyan *Prosopis* populations based on random amplified polymorphic DNA markers

Gabriel M. Muturi^{1,2*}, Joseph M. Machua¹, Godefridus M. J. Mohren², Lourens Poorter², John M. Gicheru¹ and Lorna W. Maina¹

¹Kenya Forestry Research Institute (KEFRI) P. O. Box 20412 00200 Nairobi, Kenya.
²Forest Ecology and Forest Management Group, Wageningen University, P. O. Box 47, 6700 AA Wageningen, The Netherlands.

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Allometric equations for estimating biomass in naturally established *Prosopis* stands in Kenya

Gabriel M. Muturi^{1,2*}, Jason G. Kariuki¹, Lourens Poorter² and Godefridus M. J. Mohren²

Ecological impact of Prosopis species invasion in Turkwel riverine forest, Kenya

G.M. Muturi^{a,b,*}, L. Poorter^b, G.M.J. Mohren^b, B.N. Kigomo^a

Unleached Prosopis litter inhibits germination but leached stimulates seedling growth of dry woodland species

Gabriel M. Muturi ^{a, *}, Lourens Poorter ^b, Pauline Bala ^a, Godefridus M.J. Mohren ^b

Conclusion/ Take home message

Introduction without management options, hence became a challenge

Researchers provide the requisite knowledge

Transforms Prosopis challenges to opportunities

Government's Capacity to regulate exploitation

Conflicts management over Prosopis utilization

Management thro' utilization; noxious weeds act?

Invasion challenges and mitigation are dynamic

Thank you for your attention