Ethiopian Environment and Forest Research Institute,

Tree seeds for dryland restoration

Dryland restoration in Ethiopia: issues, challenges and opportunities

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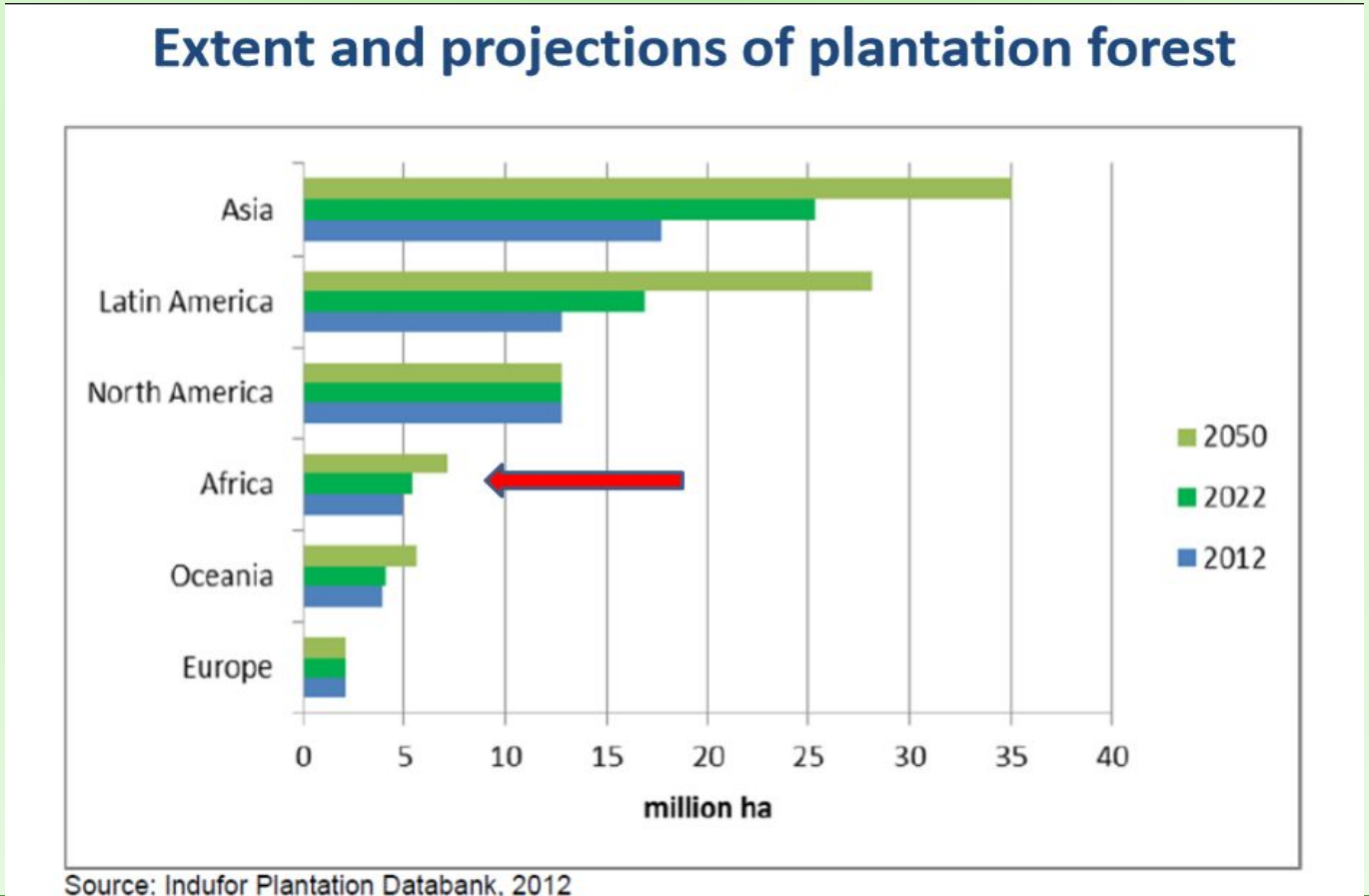
Outline

1. **Introduction:**
2. **Rationale for prioritizing tree species for seed production/restoration**
3. **The tree seed system in Ethiopia**
4. **Tree seeds supply in Ethiopia---for dryland areas and land degradation**
5. **Profile of tree seeds managed by formal seed suppliers in Ethiopia**
6. **Establishing and managing tree seeds sources in Dryland biomes (priority species)**
7. **Gaps that require intervention**
8. **Conclusions and recommendations**

1. Introduction

- The area of land put under plantation forests and for restoration purposes of different countries in Africa and in the world including Ethiopia increases across years.



Source: Indufor Plantation Databank, 2012

Introduction….

In Ethiopia, seeds are the most commonly used reproductive material in A/R and restoration programs

Shortage of tree seeds (both quality, quantity and diversity) **has been a major constraint over the past decades.**

Seed quality:

- Genetic quality, physiological quality, physical quality and seed health
- Suitability of the seed to the site (Species-site matching)

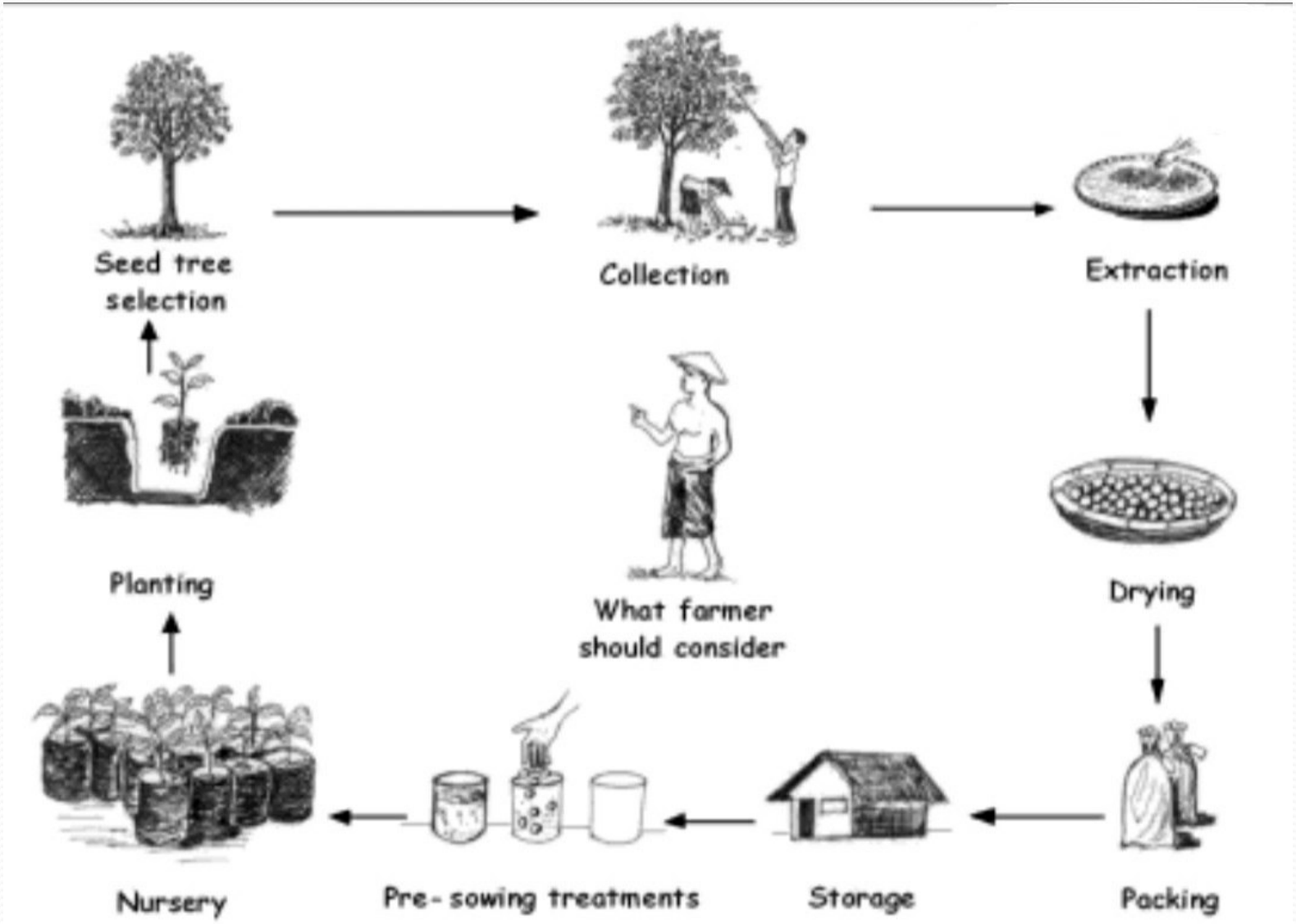
This calls for prioritization of tree species for the intended purposes and the planting site.

2. Tree species prioritization rationale

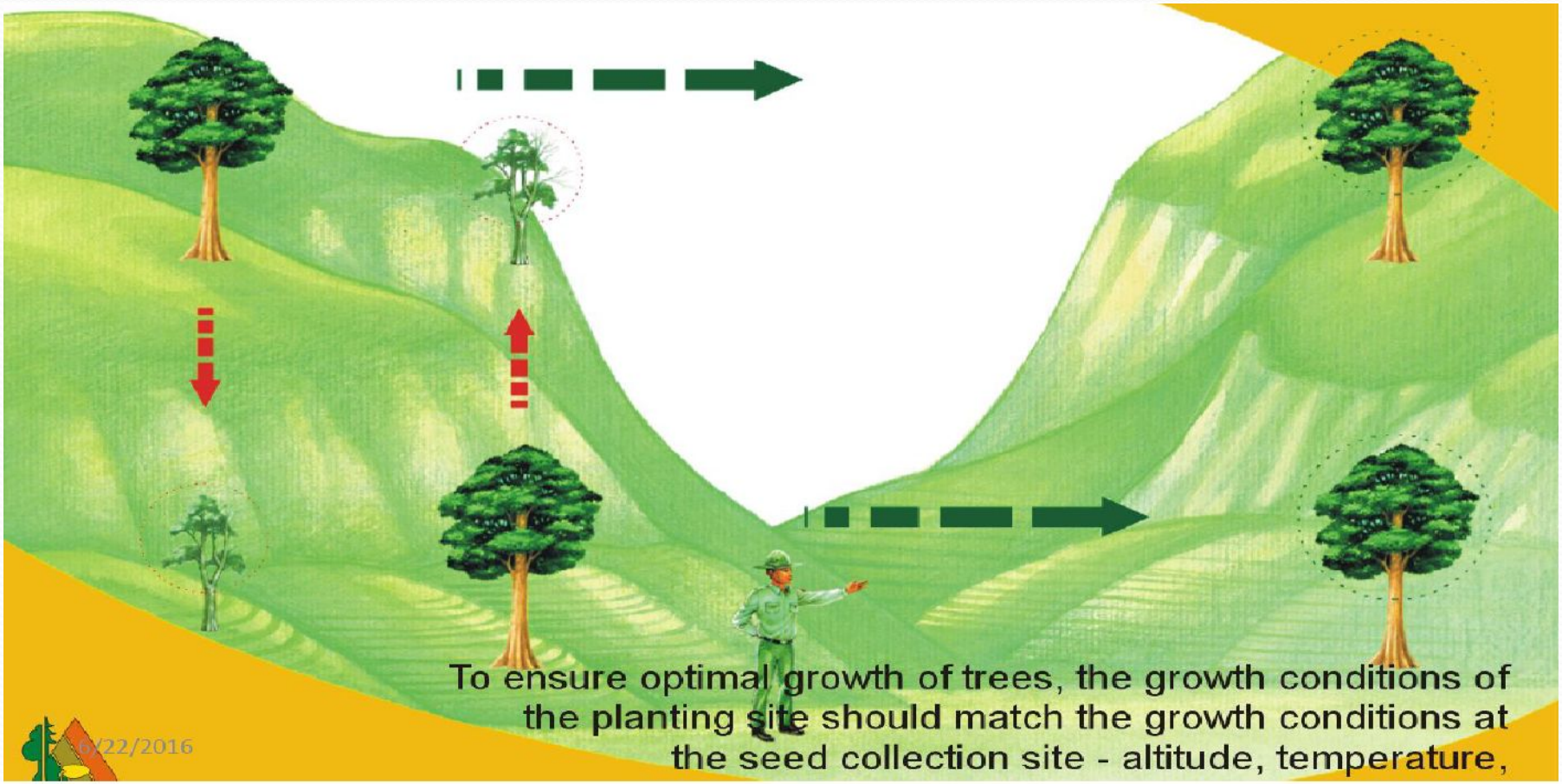
Rationale

- Conservation status of species varies from critically endangered to low risk
- What is the best species for targeted end products and uses- set of best species for land rehabilitation and protection, industrial uses, fuelwood, fodder, fruit
- Large tree diversity (over 1000 native trees in Ethiopia) and ecological diversity – set of best matching species for planting site
  - In Ethiopia, dry forests are largerv egetation resources, as compared to high forests (WBISPP, 2004).
  - ACW, DDS, CTW, WGG, DAF encompass many characteristic species (including endemic ones) that can be developed,conserved and utilized as seed sources
- Limited resources available for species conservation and management
- Demand/ responding to changing market

Continuum of activities seed quality is affected

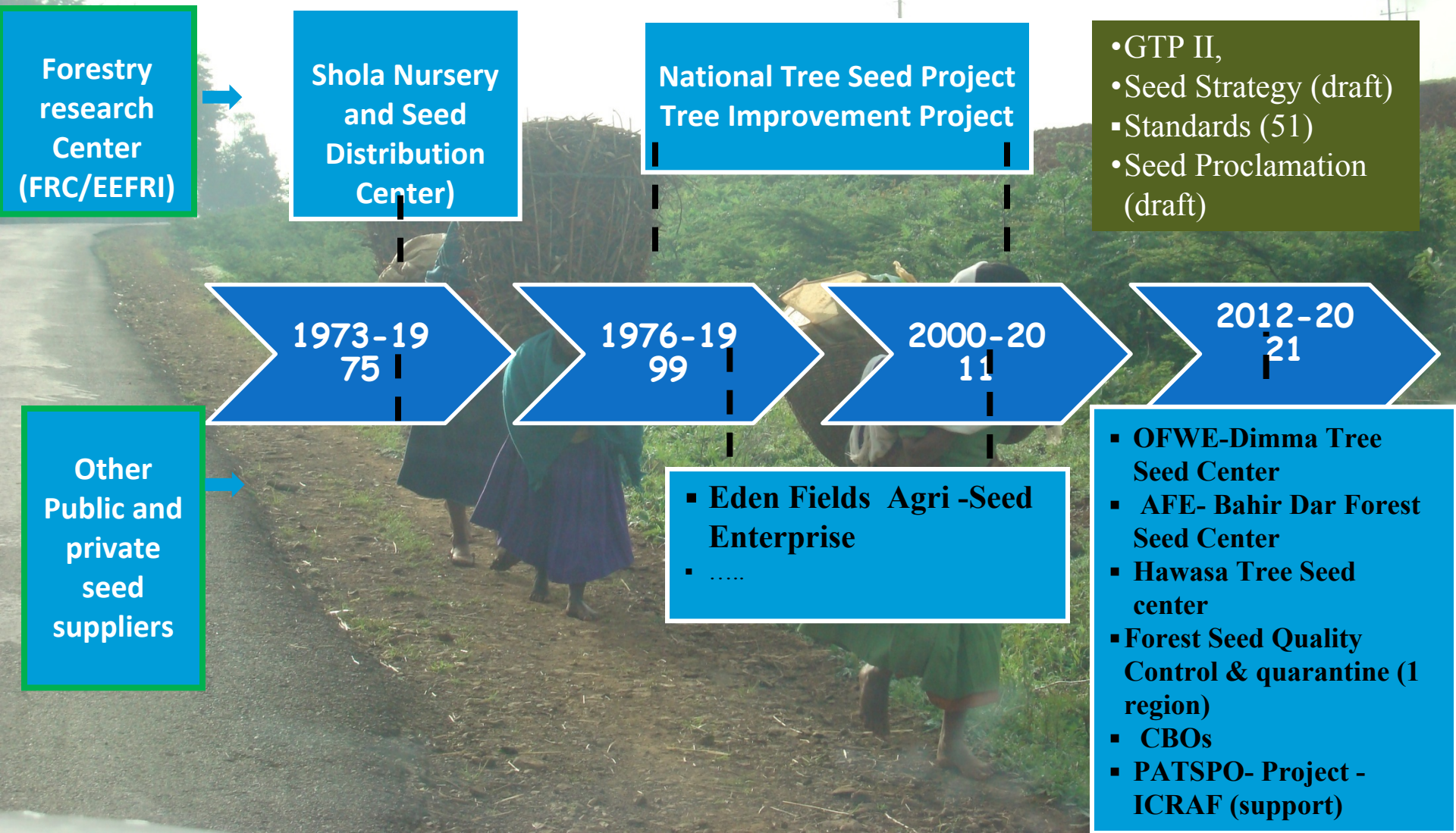


Matching the ecological conditions of seed source site with the ecological conditions of the planting site (the issue of seed zones)

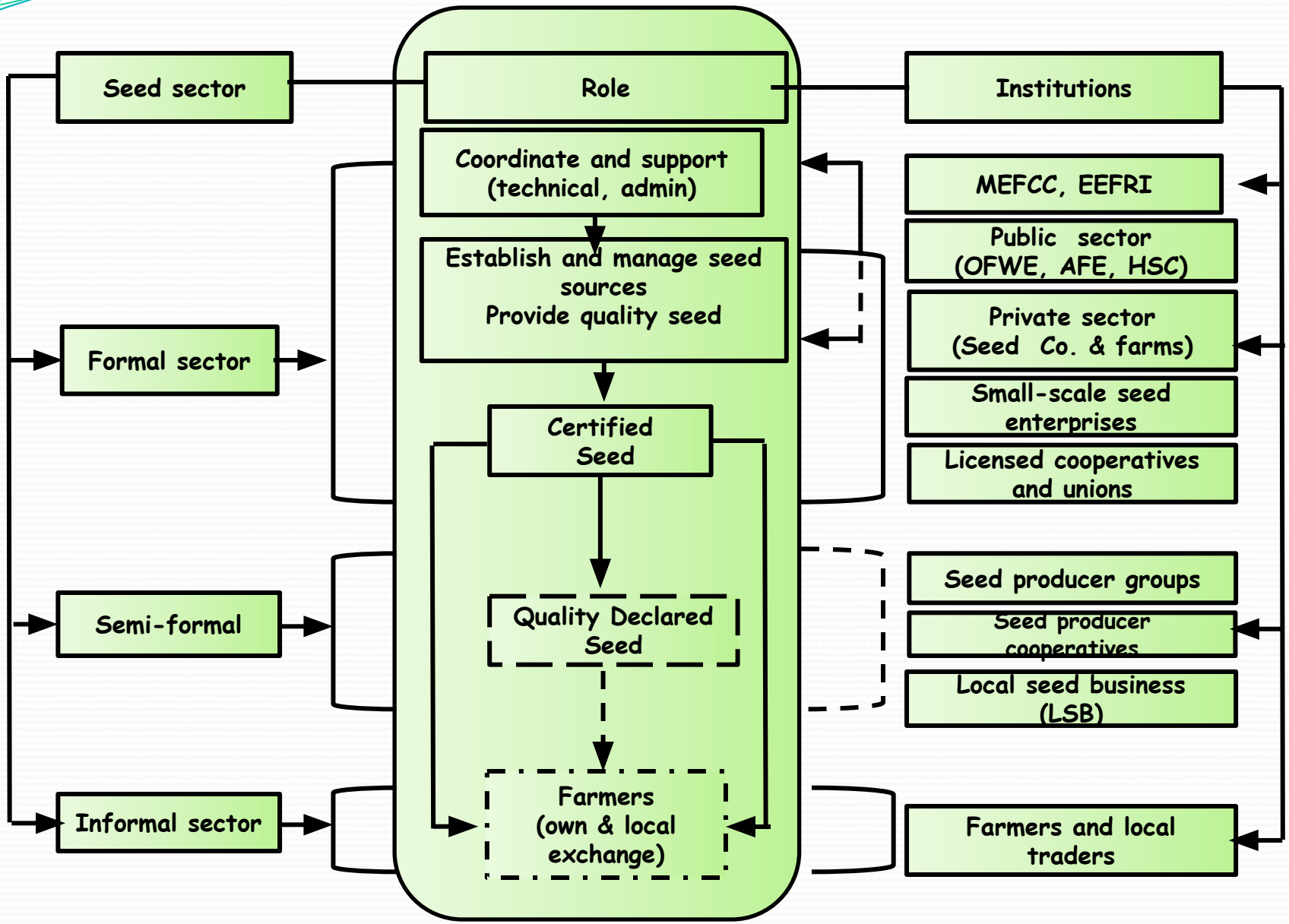


3. The tree seed system in Ethiopia:

Historical trend-from a single and simple supplier to many and complex system



Institutional responsibilities in seed production



4. Tree seeds supply in Ethiopia

Tree seeds under distribution by the formal seed suppliers in Ethiopia (2020/2021)…. 77.5 ton…Indgenous and Exotic species

S.N.	Species/origin	Number os species	Amount in store (kg)					
			EEFRI	Bahirdar	Dimma	Hawasa	Eden fields (Dec. bal)	Total
	Indigenous species	21	3,894	4,560	2,876	3,944	8,200	23,474
	Introduced Species	21	2,427	8,496	11,966	682	6,930	30,500
	Grand Total	42	**6,321**	**13,056**	**14,842**	**4,626**	**15,130**	**53,974**

- **Informal suppliers: supply more that 80% of the seed**

5. Profile of Tree seeds that have been supply in Ethiopia---the case of EEFRI

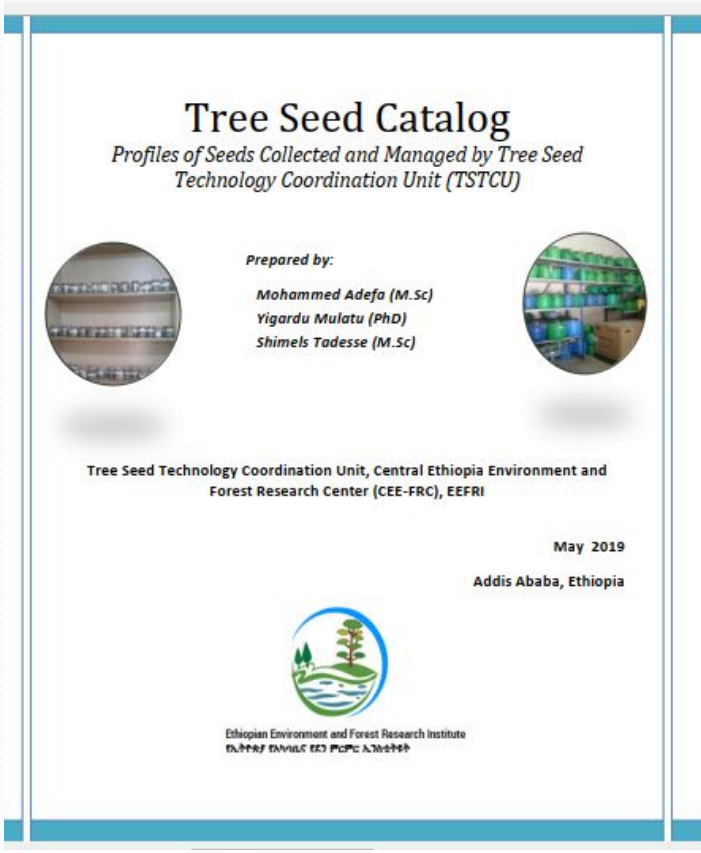
Profiles of 53 Seeds Collected and Managed by Tree Seed:

About 30 of the species can be used in dryland areas

But how many of them can be used for degraded land restoration purposes?

It depends on the level of degradation of the site?

Some sites also feasible for seeds in the seed bank.



Profiles of 53 Seeds Collected and Managed by Tree Seed

ሳይንሳዊ መጠሪያ (Scientific name)	አካባቢያዊ መጠሪያ (Local name)	ተስማሚ ስነምህዳር (Agroecology)	አማካይ የዘር ቁጥር በኪ.ግ. (No. of seeds/kg)	የዘር ባህሪ (Seed behavior)	የዘር ቅድመ መዝራት ህክምና (Pre-sowing treatment)	የአዘራር ዘዴ (Sawing method)	የዝርያው ዋና ዋና ጥቅሞች (Uses of the species)
Acacia nilotica	ጥቁር ግራር፣ ጨባ፣ ቦቁቂ	ከ600-1700 ሜ.ባ.ጠ.በ በሁሉም በቆላ፣ እርጥብ ቆላማና በረሃ አካባቢዎች	7317	ኦርቶዶክስ	ጫፉን መቁረጥ	በቀጥታ በፖት ላይ ወይም በመደብ ላይ ተዘርቶ ወደ ፖት ማዛወር	ለከሰል፣ ለማገዶ፣ ለቁሳቁሰስ መስሪያ፣ ለጉብ ማነብ፣ ለአፈር ጥበቃ፣ ለእንስሳት መኖ፣ ለጥላ፣ ለጥርስ መፋቂያ፣ ለደን ጥምር እርሻ
Acacia polyacantha	ግማርዳ	ከ500-1600 ሜ.ባ.ጠ.በ በደረቅና እርጥብ ቆላማ አካባቢዎች	13722	ኦርቶዶክስ	አያስፈልገውም	በቀጥታ በፖት ላይ ወይም በመደብ ላይ ተዘርቶ ወደ ፖት ማዛወር	ለማገዶ፣ ለከሰል፣ ለሙጫ፣ ለእርሻ ቁሳቁስ መስሪያነት፣ ለአካባቢ ውበት፣ ለእጥር፣ ለአፈር ጥበቃ፣ ለንፋስ መከላከያ፣ ለመድሃኒትነት (ቅጠሉና ስሩ)፣ ለእንስሳት መኖ
Acacia saligna	አቃጫ	በደረቅና እርጥብ ቆላማ እንዲሁም ወይና ደጋ አካባቢዎች	65734	ኦርቶዶክስ	በፈላ ዉሃ ዘሩን ለ24 ሰአት መዘፍዘፍ	በቀጥታ በፖት ላይ ወይም በመደብ ላይ ተዘርቶ ወደ ፖት ማዛወር	ለማገዶ፣ ለአካባቢ ውበት፣ ለከሰል፣ ለአፈር ጥበቃ
Acacia senegal	ቆንጥር፣ ስባንሳ ግራር፣ ሲባንሳ ዲማ	ከ500-1700 ሜ.ባ.ጠ.በ ሁሉም በረሃማ በሆኑና ወይና ደጋማ አካባቢዎች	10615	ኦርቶዶክስ	ጫፉን መቁረጥ	በቀጥታ በፖት ላይ ወይም በመደብ ላይ ተዘርቶ ወደ ፖት ማዛወር	ለማገዶ፣ ለከሰል፣ ለሙጫ፣ ለቤት ውስጥና ለእርሻ ቁሳቁስ መሥሪያ፣ ለእንስሳት መኖ፣ ለአፈር ጥበቃ፣ ለአሳ መረብ መሥሪያ(ስሮቹ)
Acacia seyal	ቢጫ ግራር	ከ 500-2100 ሜ.ባ.ጠ.በ ሁሉም በረሃማ በሆኑና ወይና ደጋማ አካባቢዎች	17722	ኦርቶዶክስ	ጫፉን መቁረጥ	በቀጥታ በፖት ላይ ወይም በመደብ ላይ ተዘርቶ ወደ ፖት ማዛወር	ለማገዶ፣ ለከሰል፣ ለሙጫ
Acacia tortilis	ደወኒ ግራር፣ ጠዴቻ	ከ300-1900 ሜ.ባ.ጠ.በ በበረሃማ፣ ደረቅና እርጥብ ቆላማ አካባቢዎች	14675	ኦርቶዶክስ	ጫፉን መቁረጥ	በቀጥታ በፖት ላይ ወይም በመደብ ላይ ተዘርቶ ወደ ፖት ማዛወር	ለማገዶ፣ ለከሰል፣ ለጥላ፣ ለእጥር፣ ለአፈር ጥበቃ፣ ለጉብ ማነብ፣ ለእንስሳት መኖ፣
Azadirachta indica	ኒም፣ ገለሎ	ከ400-1500 ሜ.ባ.ጠ.በ ሲሆን በደረቅና እርጥብ ቆላማ እንዲሁም እርጥብ ወይና ደጋማ አካባቢዎች	9631	ሪካልሲትራንት	አያስፈልገውም	በቀጥታ በፖት ላይ ወይም በመደብ ላይ ተዘርቶ ወደ ፖት ማዛወር	ለማገዶ፣ ለጣውላ፣ ለከሰል፣ ለጉብ ማነብ፣ ለአካባቢ ውበት፣ ለአፈር ጥበቃ፣ ለእንስሳት መኖ፣ ለመድሃኒትነት፣ ለጥላ፣ ለደን ጥምር እርሻ

Profiles of 53 Seeds Collected and Managed by Tree Seed…

ሳይንሳዊ መጠሪያ	አካባቢያዊ መጠሪያ	ተስማሚ ስነምህዳር	አማካይ የዘር ቁጥር በኪ.ግ.	የዘር ባህሪ	የዘር ቅድመ መዝራት ህክምና	የአዘራር ዘዴ	የዝርያው ዋና ዋና ጥቅሞች
Cajanus cajan	የርግብ አተር	ከ1000-2400 ሚ.ባ.ጠ.በ በደረቅና እርጥብ ቆላማ፣ ወይና ደጋማ እ ደጋማ አካባቢዎች	7898	ኦርቶዶክስ	አያስፈልገውም	በፖት ላይ ወይም በመድብ ላይ መዝራት	ለማገዶ፣ ለአፈር ጥበቃ፣ ለንፋስ መከላከያ፣ ለጥላ፣ ለቅርጫት መሥሪያ፣ ለእንስሳት መኖ፣ ለንብ ማነብ
Cordia Africana	ዋንዛ፣ ወይሳ	ከ900-2500 ሚ.ባ.ጠ.በ በደጋና በወይና ደጋ ቦታዎች	6141	ኦርቶዶክስ	በቀዝቃዛ ዉሃ ዘሩን ለ12 ሰዓት መዘፍዘፍ	በቀጥታ በፖት ላይ መዝራት	ለማገዶ፣ ለውበት፣ ለአፈር ጥበቃ፣ ለጥላ፣ ለንብ ማነብ፣ ለጥምር ደን እርሻ፣ ለጣውላ
Cupressus lustanica	የፊረንጅ ጥድ	ከ1500-3200 ሚ.ባ.ጠ.በ በደጋና በወይና ደጋ አካባቢዎች	156739	ኦርቶዶክስ	በረጠበ አሸዋ ላይ ፍሪጅ ውስጥ ለ 21 ቀናት ማስቀመጥ	በመደብ ላይ ተዘርቶ ወደ ፖት ማዛወር	ለአፈር ጥበቃ፣ ለጥላ፣ ለንፋስ መከላከያ፣ ለውበት፣ ለጣውላ፣ ለህንጻ ግንባታ
Cupressus pyremidals	ሾጣጣ ጥድ	ከ1500-3200 ሚ.ባ.ጠ.በ በእርጥበና በጣም እርጥብ ወይና ደጋ እና ደጋማ አካባቢዎች	146977	ኦርቶዶክስ	በረጠበ አሸዋ ላይ ፍሪጅ ውስጥ ለ 21 ቀናት ማስቀመጥ	በመደብ ላይ ተዘርቶ ወደ ፖት ማዛወር	ለውበት፣ ለጣውላ፣ ለመድሃኒትነት
Delonix regia	የድሬዳዋ ዛፍ	ከ200-1600 ሚ.ባ.ጠ.በ ሲሆን በደረቅና እርጥብ ቆላማ እንዲሁም እርጥብ ወይና ደጋማ አካባቢዎች	2961	ኦርቶዶክስ	ጫፉን መቁረጥ	በቀጥታ በፖት ላይ መዝራት	ለጥላ፣ ለውበት
Dovyalis caffra	ኮሽም	ከ0-1800 ሚ.ባ.ጠ.በ በደረቅና እርጥብ ቆላማ አካባቢዎች	29446	ሪካልሲትራንት	አያስፈልገውም	በቀጥታ በፖት ላይ መዝራት	ለአጥርነት፣ ለምግብነት
Dodonaea angustifolia	ክትክታ	ከ1000-2400 ሚ.ባ.ጠ.በ በደረቅና እርጥብ ቆላማ፣ ወይና ደጋማ እና ደጋማ አካባቢዎች	117259	ኦርቶዶክስ	አያስፈልገውም	በመደብ ላይ ተዘርቶ ወደ ፖት ማዛወር	ለጣውላ፣ ለንብ ማነብ፣ ለማገዶ፣ ለመድሃኒትነት
Eucalyptus camaldulnesis	ቀይ ባህር ዛፍ	ከ1200-2800 ሚ.ባ.ጠ.በ በደረቅና እርጥብ ቆላማ፣ ወይና ደጋማ እና ደጋማ አካባቢዎች	1887507	ኦርቶዶክስ	አያስፈልገውም	በመደብ ላይ ተዘርቶ ወደ ፖት ማዛወር	ለማገዶ፣ ለምሰሶ፣ ለጣውላ

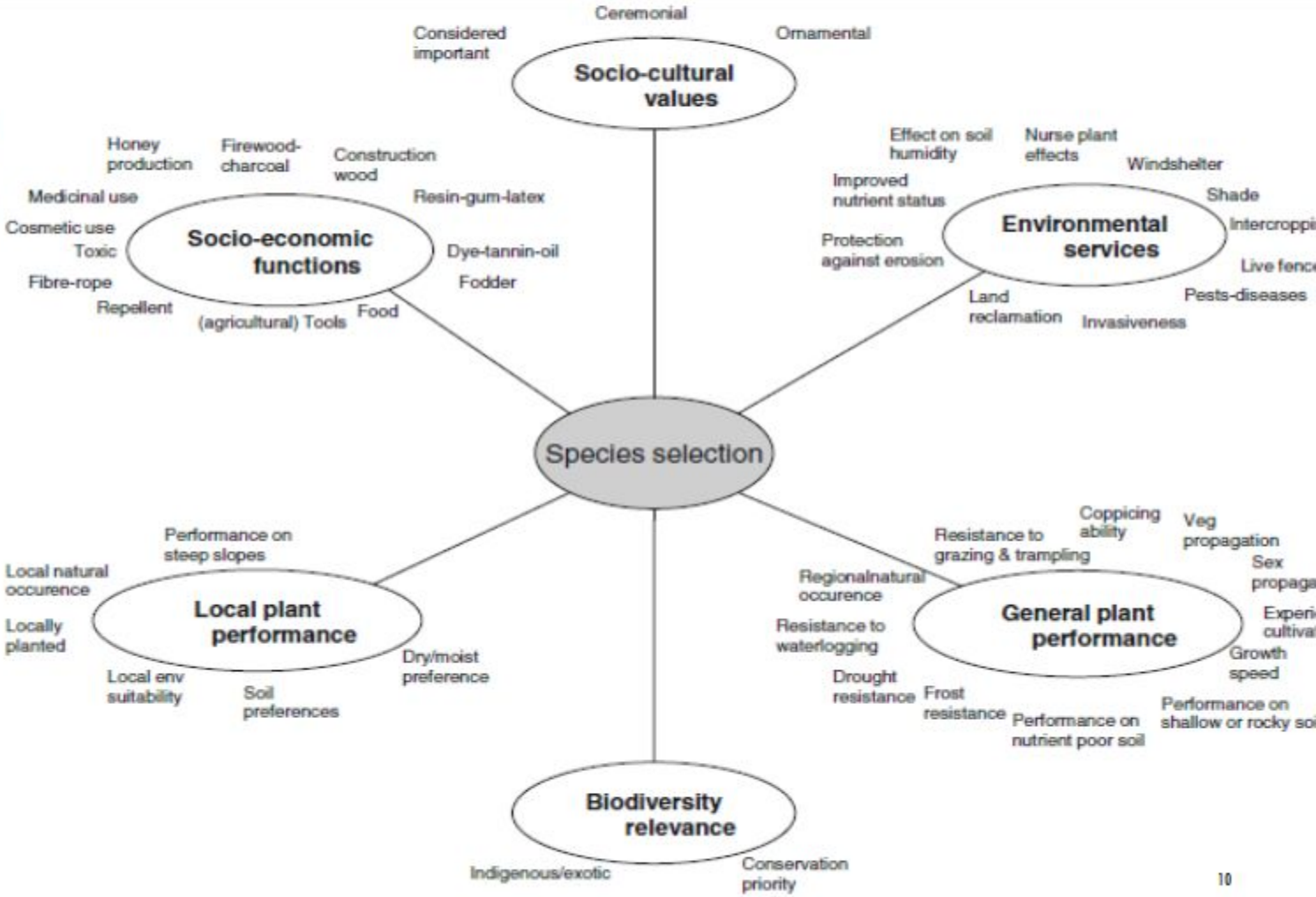
Profiles of 53 Seeds Collected and Managed by Tree Seed....

ሳይንሳዊ መጠሪያ	አካባቢያዊ መጠሪያ	ተስማሚ ስነምህዳር	አማካይ የዘር ቁጥር በኪ.ግ.	የዘር ባህሪ	የዘር ቅድመ መዝራት ህክምና	የአዘራር ዘዴ	የዝርያው ዋና ዋና ጥቅሞች
Grevillea robusta	ግራቪሊያ	ከ1500-2700 ሜ.ባ.ጠ.በ በአርጥብና በጣም አርጥብ ወይና ደጋ እና ደጋማ አካባቢዎች	78751	ኢንተርሚዴት	በቀዝቃዛ ውሃ ውስጥ ለ48 ሰዓት በማቆየት አውጥቶ መዝራት	በመደብ ላይ ተዘርቶ ወደ ፖት ማዛወር	ለማገዶ፣ ለጣውላ፣ ለውበት
Jatropha curcas	አይደርቄ	ከ200-1600 ሜ.ባ.ጠ.በ ሲሆን በደረቅና አርጥብ ቆላማ እንዲሁም አርጥብ ወይና ደጋማ አካባቢዎች	2400	ኢንተርሚዴት	በቀዝቃዛ ውሃ ለ2 ሰዓት መዘፍዘፍ	በቀጥታ በፖት ላይ ወይም በመደብ ላይ ተዘርቶ ወደ ፖት ማዛወር	ለመድሃኒትነት፣ ለምግብነት፣ ለአፈር ለምነት፣ ለማገዶ
Leucaena leucocephla	ሉሲኒያ	ከ0-1600 ሜ.ባ.ጠ.በ በቆላማና በወይና ደጋ አካባቢዎች	21437	ኦርቶዶክስ	በፈላ ዉሃ ዘሩን ለ2 ደቂቃ መዘፍዘፍ	በመደብ ላይ ተዘርቶ ወደ ፖት ማዛወር	ለጥምር እርሻ ደን፣ ለእንስሳት መኖ፣ ለአፈር ጥበቃ
Melia azedarach	ሚሊያ	ከ0-2400 ሜ.ባ.ጠ.በ በቆላማና በወይና ደጋ አካባቢዎች	4695	ሪካልሲትራንት	ለ 3 ቀን በቀዝቃዛ ዉሃ ዉስጥ ማቆየት	በመደብ ላይ ተዘርቶ ወደ ፖት ማዛወር	ለውበት
Moringa stenopetala	ሺፈራው	ከ500-1700 ሜትር ከባ.ጠ.በ ሁሉም በረሃማ በሆኑና ወይና ደጋማ አካባቢዎች	1980	ኦርቶዶክስ	የዘሩን ሽፋን ማስወገድ	በቀጥታ ፖት ላይ መዝራት	ለምግብነት፣ ለጥምር እርሻ ደን
Olea africana	ወይራ	ከ1400-3300 ሜ.ባ.ጠ.በ በአርጥብና በጣም አርጥብ ወይና ደጋ እና ደጋማ አካባቢዎች	10020	ኢንተርሚዴት	የዘሩን ሽፋን ማስወገድ	በመደብ ላይ ተዘርቶ ወደ ፖት ማዛወር	ለማገዶ፣ ለጣውላ፣ ለከሰል
Parkinsonia aculeata	የኢየሩስ አሌም እሾህ	ከ300-1700 ሜ.ባ.ጠ.በ ሁሉም በረሃማ በሆኑና ወይና ደጋማ አካባቢዎች	11282	ኦርቶዶክስ	ጫፉን መቁረጥ	በመደብ ላይ ተዘርቶ ወደ ፖት ማዛወር	ለጥላ፣ ለውበት፣ ለንብ ማነብ
Schinus molle	ቁንዶ በርበሬ	ከ0-2400 ሜ.ባ.ጠ.በ በቆላማና በወይና ደጋ አካባቢዎች	28335	ኦርቶዶክስ	አያስፈልገውም	በቀጥታ ፖት ላይ መዝራት	ለውበት፣ ለማገዶ
Sesbania aculeata	ሰስባኒያ	ከ300-2000 ሜ.ባ.ጠ.በ ሲሆን በደረቅና አርጥብ ቆላማ እንዲሁም አርጥብ ወይና ደጋማ አካባቢዎች	72643	ኦርቶዶክስ	አያስፈልገውም	በመደብ ላይ ተዘርቶ ወደ ፖት ማዛወር	ለመኖ፣ ለመድሃኒትነት፣ ለአፈር ለምነት፣ ለምግብነት
Spathodea nilotica	የጫካ ነበልባል	በደረቅና አርጥብ ቆላማ እንዲሁም ወይና ደጋ አካባቢዎች	205939	ሪካልሲትራንት	አያስፈልገውም	በቀጥታ በፖት ላይ ወይም በመደብ ላይ ተዘርቶ ወደ ፖት ማዛወር	ለውበት፣ ለማገዶ፣ ለጥላ
Tamarindus indica	ሁመር፣ ሮቃ	ከ0-1500 ሜ.ባ.ጠ.በ በቆላማና በወይና ደጋ አካባቢዎች	2174	ኦርቶዶክስ	አያስፈልገውም	በቀጥታ በፖት ላይ ወይም በመደብ ላይ ተዘርቶ ወደ ፖት ማዛወር	ለማገዶ፣ ለከሰል፣ ለጣውላ፣ ለምግብነት፣ ለመኖ፣ ለመድሃኒትነት
Ziziphus macrocarpa	ቁርቁራ	ከ400-1600 ሜ.ባ.ጠ.በ ሁሉም በረሃማ በሆኑና ወይና ደጋማ አካባቢዎች	2542	ኦርቶዶክስ	አያስፈልገውም	በቀጥታ በፖት ላይ ወይም በመደብ ላይ ተዘርቶ ወደ ፖት ማዛወር	ለምግብነት፣ ለመድሃኒትነት፣ ለጥምር እረሻ ደን

Tree species selection for land rehabilitation

TREE SPECIES SELECTION FOR LAND REHABILITATION IN ETHIOPIA, - REUBENS ET AL. 2011

MCDA for species ranking and selection: Hierarchical model



Selection of tree species for degraded land rehabilitation (Species screening trials)

Degraded hills: Waghemra zone: Out of 32 tree/shrub species *Dodonia angustifolia* and *Olea africana* found promising

In North Wollo **mid altitude** degraded hills: *Acacia decurrence, Acacia saligna, Eucalyptus sp., Olea africana*

In North Wollo **high altitude** degraded hills (frost affected): *Acacia decurrence, Eucalyptus viminalis, Eucalyptus globulus,*

Selection of tree species for degraded land rehabilitation (Species screening trials)

successful in growing in the degraded land; and therefore, recommended for restoration projects.

- Early growth and survival of different woody plant species established through direct sowing in a degraded land, Southern Ethiopia—Rift valley (Shiferaw Alem*, Hana Habrova 2019)

Table 1. Species used for the field study, their respective characteristics and altitudinal ranges.

No.	Species	Family	Tree/ shrub	Uses of the species	Altitudinal Range (m. a.s.l)
1	*Vachellia abyssinica*	Fabaceae	Tree	Firewood, charcoal, poles, posts, tool handles, food (edible gum), medicine, fodder, bee forage, shade, nitrogen fixation, soil conservation, fence	1500-2800
2	*Vachellia nilotica*	Fabaceae	Tree	Food, fodder, apiculture, fuel, timber, fibre, gum or resin, tannin or dyestuff, medicine, reclamation of degraded land, soil improver, intercropping	600-1700
3	*Vachellia seyal*	Fabaceae	Tree	Food, Fodder, apiculture, fuel, fibre, timber, gum or resins, tannin or dyestuff, medicine, shade or shelter	1200-2100
4	*Vachellia tortilis*	Fabaceae	Tree	Food, Fodder, fuel, timber, tannin or dyestuff, erosion control, medicine, shade or shelter, nitrogen fixing	600-1900
5	*Dodonaea angustifolia*	Sapindaceae	Shrub/ tree	Fodder, Apiculture, Fuel, Timber, Medicine, soil conservation	1100-1800
6	*Moringa stenopetala*	Moringaceae	Tree	Food, Fodder, Fuel, Ornamental, Intercropping, pollution control	500-1600
7	*Maerua angolensis*	Capparaceae	Tree	Firewood, fodder (leaves), furniture, bee forage, milk curdler (leaves), flavouring of milk (smoked wood)	600-1800
8	*Senna didymobotrya*	Fabaceae	Shrub	Medicine, ornamental, Shade or shelter, soil improver	1400 - 2400

Tree species selection for land rehabilitation

Result from a multi criteria species selection employing Multi Criteria Tree species Selection (MCTS) and Criterium DecisionPlus software (CDP)
- Reubens et al. 2011

MCTS		CDP	
Species	Relative score	Species	Relative score
Scenario 1: Species selection for planting on private land			
20 highest scores			
Dodonaea angustifolia	1.000	*Cordia africana*	1.000
Eucalyptus camaldulensis	0.985	*Eucalyptus camaldulensis*	0.993
Cordia africana	0.982	*Dodonaea angustifolia*	0.990
Eucalyptus globulus	0.969	*Eucalyptus globulus*	0.974
Olea europaea	0.965	*Acacia abyssinica*	0.968
Acacia abyssinica	0.951	*Acacia saligna*	0.948
Acacia seyal	0.936	*Olea europaea*	0.944
Sesbania sesban	0.920	*Acacia seyal*	0.941
Acacia saligna	0.917	*Leucaena leucocephala*	0.940
Juniperus procera	0.899	*Sesbania sesban*	0.936
Euphorbia candelabrum	0.897	*Euphorbia candelabrum*	0.929
Faidherbia albida	0.894	*Faidherbia albida*	0.922
Acacia etbaica	0.893	*Acacia etbaica*	0.919
Leucaena leucocephala	0.891	*Juniperus procera*	0.918
Ficus sur	0.882	*Ficus sur*	0.908
Euphorbia abyssinica	0.878	*Croton macrostachys*	0.898
Podocarpus falcatus	0.878	*Ficus sycomorus*	0.898
Ficus sycomorus	0.876	*Podocarpus falcatus*	0.897
Croton macrostachys	0.874	*Schinus molle*	0.891
Schinus molle	0.871	*Euphorbia abyssinica*	0.885

Priority fodder and fruit tree species in pastoral and agropastoral areas

Species	Vernacular names		Uses	Importance value		Fruits marketed (yes/no)
	Afar	Somali		Afar	Somali	
Acacia nilotica	Keselto		fodder	10.0		no
Acacia tortilis	A'eb	Qudhac	fodder	7.7	6.9	no
Balanites aegyptiaca	Uda		fodder + fruit	6.4		no
Berchemia discolor		Dheen	fodder + fruit		11.8	yes
Cordia sinensis	Medera	Madheedh	fodder + fruit	10.1	13.5	yes
Dobera glabra	Garsa		fodder + fruit	6.9		yes
Grewia ferruginea	Hedayito		fodder + fruit	8.1		no
Grewia pencillata		Hohob	fodder		9.4	no
Grewia villosa		Gomosh	fodder		11.7	no
Salvadora persica	Adayito		fodder + fruit	8.4		no
Tamarindus indica		Hamar	fodder + fruit		6.9	yes
Tamarix aphyla	Segento		fodder	7.4		no
Ximenia americana		Hudeh	fodder + fruit		7.2	yes
Ziziphus spina-christi	Kusra	Gob	fodder + fruit	10.5	12.4	yes

The Ethiopia report to: THE STATE OF THE WORLD's FOREST GENETIC RESOURCES priority species

Top 25 species identified as priority species by the Ethiopian report of the SoW Forest Genetic Resources

-(FAO, 2014)

Priority species		
Scientific name	Native/Exotic	Reasons for priority
Acacia drepanolobium	N	Invasive
Acacia senegal	N	Economic, gum and resin production
Adansonia digitata	N	Economic, high value fruit tree in the lowlands
Arundinaria alpina	N	Economic value, multipurpose
Boswellia paprifera	N	Economic, gum and resin production
Catha edulis	N	Economic and social, stimulant and medicinal, agroforestry
Coffea arabica	N	Economical and social, stimulant and medicinal
Commiphora myrrha	N	Economic, gum and resin production
Cordeauxia edulis	N	Economic, high value fruit tree in the lowlands
Cordia africana	N	Economic, timber and agroforestry species; threatened
Cupressus lusitanica	E	Economic, timber
Eucalyptus camaldulensis	E	Economic, construction and fuelwood
Eucalyptus globulus	E	Economic, construction and fuelwood
Acacia albida	N	agroforestry tree species
Grevillea robusta	E	Economic, multipurpose
Hagenia abyssinica	N	Economic, timber, medicinal and agroforestry species; threatened
Juniperus procera	N	Economic, timber; threatened
Moringa stenopetala	N	Economic, multipurpose
Oxytenanthera abyssinica	N	Economic, multipurpose
Podocarpus falcatus	N	Economic, timber; threatened
Pouteria adolfi-friederici	N	Economic, timber
Prosopis juliflora	E	Invasive
Prunus africana	N	Economic, timber and medicinal;threatened
Rhamnus prinoides	N	Economic, beverage
Tamarindus indica	N	Economic, high value fruit tree in the lowlands
Vitellaria paradoxa	N	Economic, high value fruit tree in the lowlands
Ziziphus mauritiana	N	Economic, high value fruit tree in the lowlands

Establishing and managing tree seeds sources in dryland areas

Current State

From which seed source is seed collected by different seed suppliers?

- Own forest/Permission from forest owners or Kebele/ community forest, protected forest/ plantation/ church forests

(effort made to utilize base on plant seed proclamation-?????), other criteria

Certificate of competence (Amhara)

- No legal binding legal tools to concerning seed quality, transfer, etc.
- Amhara 54 licenced forest seed supplier
- SNNP 60 (Seed center)

Types of Seed Sources in Ethiopia (ESA, 2018):

(1) Identified Seed Stands
(2) Selected seed stands):-
(3) Seed production area):-
(4) Provenance seed stand):-
(5) Seed orchard:-
6) Trees on farm

Possible seed sources of Ethiopia for native tree species in in dryforests Ethiopia

i) Combretum–Terminalia (broad-leaved) deciduous woodland; lowland dry forest

Location and distribution: Between 500 and 1800 m a.s.l., confined to western, northwestern and parts of southwestern lowlands. (>14 species)
Characteristic species: *Boswellia papyrifera, Terminalia laxiflora, Acacia polycantha, Grewia spp., Stereospermum kunthianum, Sterculia setigera, Oxytenanthera abyssinica, Balanites aegyptiaca, Annona senegalensis, Acacia senegal, Acacia seyal, Combretum adenogonium, Combretum collinum, Combretum molle*

ii) Dry evergreen montane forest

Characteristic species (>13 species): *Juniperus procera, Afrocarpus falcatus, Prunus africana, Ekebergia capensis, Oleaspp., Apodytes dimidiata, Allophylus abyssinica, Euphorbia ampliphylla, Olinia rochetiana Myrsine melanophloeos, Dovyalis abyssinica, Myrsine africana, Calpurnia aurea*

iii) Acacia Commiphora Wood Land: Characteristic species (>13 species):

Acacia tortilis, *A. millifera*, *Balanites aegyptiaca Acalypha spp.*, *Aerva sp*, *Combretum spp.*, *Terminalia spp.*, *Capparis spp.*, *Codeauxia edulis*, and several species of *Boswellia* and *Commiphora*.

iV) Desert and semi-desert scrubland (DSS):

comprises mainly drought tolerant species.

The Characteristic species are: *Acacia spp., Boscia sp., Cadaba sp., Commiphora sp., Maerua sp., Ziziphus sp., Aloe sp., Commelina sp., Dactyloctenium sp., Euphorbia spp.*, etc.

On rocky outcrops where succulents predominate may be found *Euphorbia spp., Aloe spp.*, *Caralluma spp., Sansevieria spp., Cissus spp.*, *Commiphora spp., Dracaena ombet, Withania somnifera, Aenium spp.*,etc.

In the Ogaden region of the ecosystem only, which is floristically the most rich in endemism in Ethiopia, are found six of the seven endangered endemic plant species of the ecosystem

(V) **Wooded grassland of the western Gambela region (WGG):**

is characterized by a tall grass stratum, herbaceous flora, grass species and different acacia species,

Tamarindus indica / ኩመር

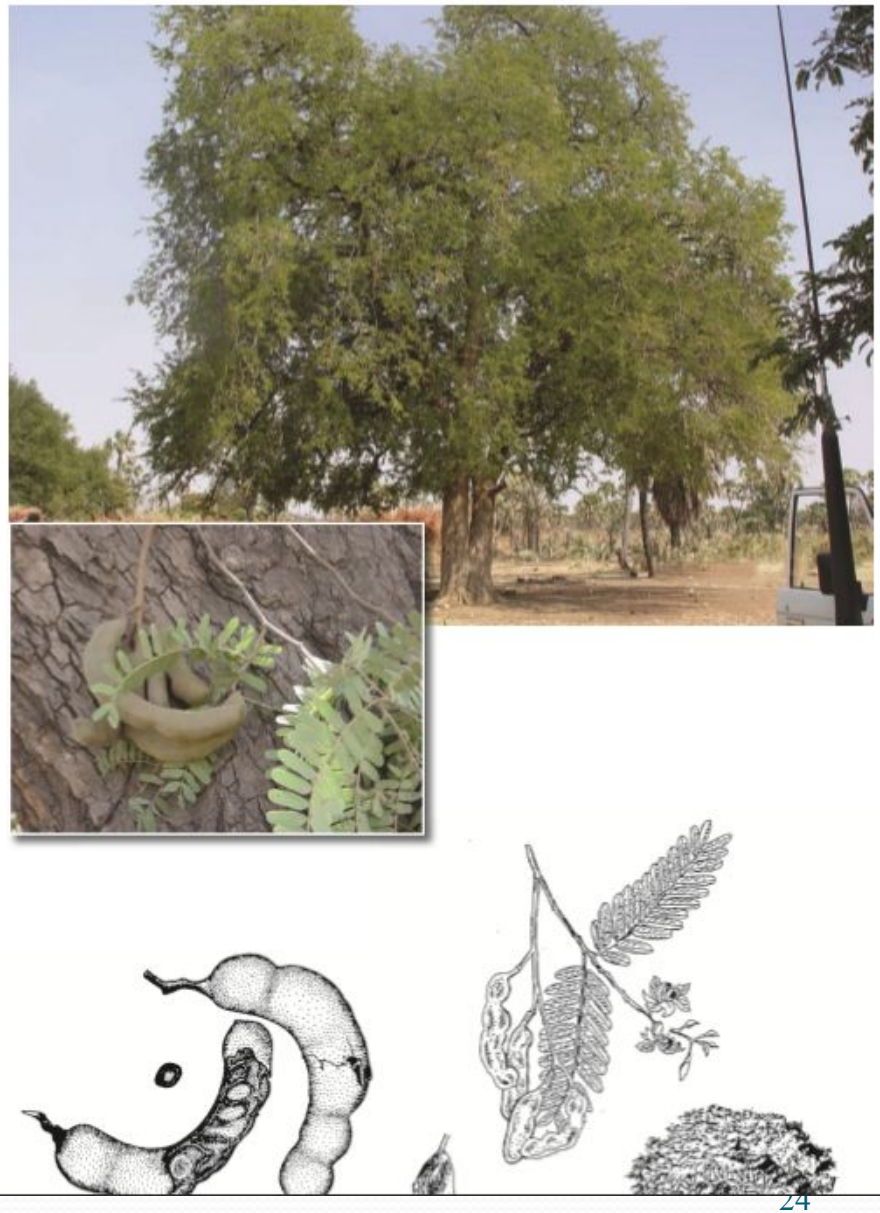
Seed:

350—1,400 seed per kg.

Germination rate: around 90%.

Treatment: Soak seed in cold water for 12 hours or nick the seed.

Storage: Seed can be stored for more than two years if kept in a dry, cool and insect-free place.



TERMINALIA LAXIFLORA

- **WEMBELLA/ BAGURI**

- *Flowers in June to September and fruits in October to November.*
- *Storage: Can be stored if well dried and in insect-free containers.*

DIOSPYROS ABYSSINICA (HIEM) F. WITE/ *GIANT DIOSPYROS*

Serkin /

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- 2,500–3,000 seed per kg.
- Treatment: Not necessary.
- Storage: Seeds store for several years. Add ash to reduce insect damage.

BALANITES AEGYPTIACA/ በደኖ

Treatment: Soak seed for 24 hours in cold water, then change water and soak for another 24 hours.
Alternatively collect seeds that have passed though goats.
Germination: 50–70%.
Storage: After removal from the fruit the seed can be stored for up to one year. Store dry and insect-free. As the seed is very susceptible to insect attack, it is best to avoid storage.

ADANSONIA DIGITATA / ባኦባብ

Seed collection is done in September to October.
Seed germination is sporadic in up to three months, but good and well‑treated seeds can germinate in 30—50 days.
1,500–2,500 seed per kg.
Treatment: Nick or pour boiling water over seed, remove at once and cool to room temperature.

Naturally the seed may take several years to germinate and be induced by fire. Passing through the digestive tract of large mammals such as elephants also breaks seed dormancy. Storage: Seed can be stored for a long time if kept cool and dry.


Photo: Patrick Maundu


Photo: Maryam Imbumi


Photo: Patrick Maundu

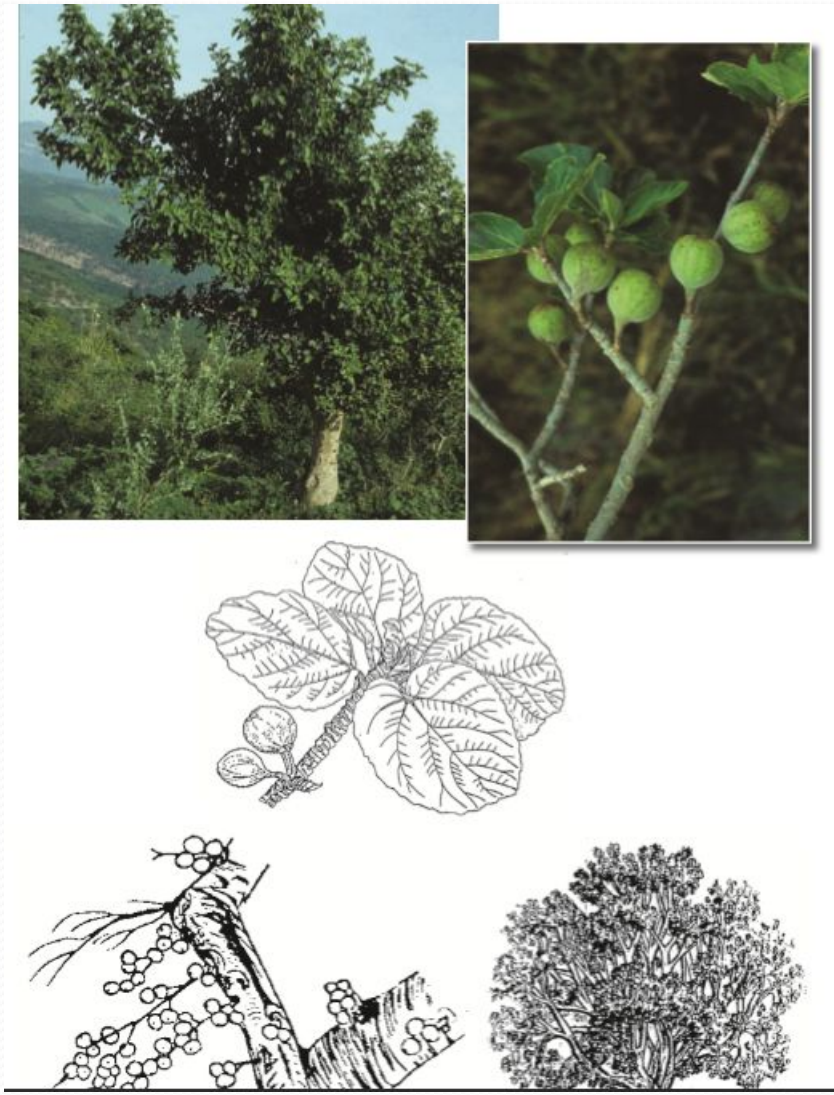

Photo: Maryam Imbumi

Ficus sycomorus

Am: Bamba, Shola Br: Oda Eng: Sycamore fig, Faroh's tree

A large semi-deciduous spreading tree to 25 m, sometimes with stem buttresses and the base commonly spreading over the ground.

Seed Not used. ?
Treatment: ?
Storage: ?



Terminalia brownii Fresen.

Flowering branch

Distribution and habitat

Terminalia brownii is naturally distributed in E. Af-rica, e.g. Kenya, Uganda, Tanzania, Eritrea, Ethio-pia and Somalia, extending southwards to Malawi

The species grows in moist savannahs of the semi arid regions, where it is part bushland or woodland. In dry areas it grows near rivers or wadies. Altitude range from 600-1,800 masl and rainfall range 500 – 1,300 mm. It can grow on a wide range of soil types but is mainly found on sandy loam soils and does not thrive on heavy clay soil with poor drainage

Fruits of *T. brownii*

Uses

The wood is strong, durable and termite resistant. It is used for all types of construction purposes and house-hold implements.Leaves are fodder for livestock. The sap is rich in tan-nin. Extracts from the tree are used in traditional medi-cine for humans and livestock. The tree is often planted as an ornamental amenity tree in towns and parks.

Fruit and Seed description

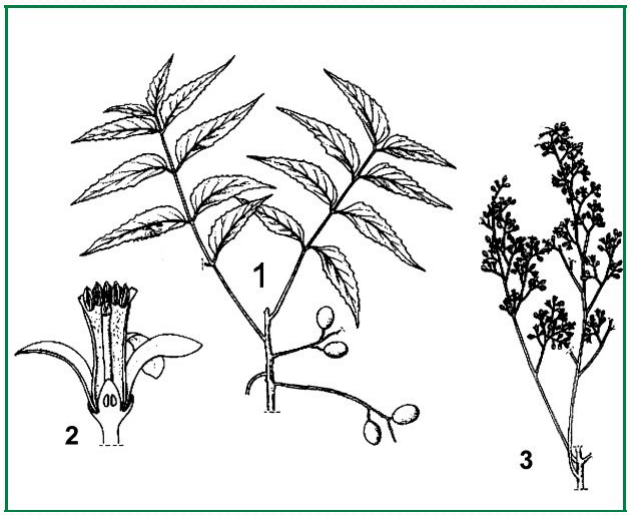
Fruit: The fruit is a woody samara. It is broadly elliptic–ovate, 2½-3½ cm long, flat, with an 1-1½ cm broad wing surrounding the central fruit part. The fruit is purple red at maturity, turning choco-late brown with age.

Seed: The seed handling unit is the samara. It is very hard and the morphological

Azadirachta indica A. Juss

Vernacular/common names: neem, neem-tree, Indian lilac, white cedar (Eng.); margosa tree (Port.); nim (Urdu); indischer zedrac (Ger.); azad-darakht-i-hindi (Persian); tamaka, bowtamaka, tama, (Burmese); sadao india, sadao thai (Thai

Uses
Fodder, oil, soap, shade, soil conservation, ornamen-tal, insecticide.



1, Fruiting branch; 2, section through flower; 3, part of inflorescence.
From: Plant Resources of South-East Asia No.5:2.

Flowering and fruiting habit
Flowers hermaphroditic or male. Pollination by in-sects. The tree starts flowering and fruiting at about 5 years of age

- **Harvest**
- **Processing and handling**
- **Storage and viability**
- **Dormancy and pretreatment**
- **Sowing and germination**

Fruit and seed description

Fruit: The fruits are 8-18 by 6-16 cm, and each weigh 1-1.5 kg. They are smooth, and have persistent outer petals surrounding the base. They are often ovoid to slightly triangular; however, the shape depends on the number of seeds developed. A persistent, protective calyx covers approximately a quarter of the fruit. The fruits turn a dull orange-brown colour when ripe. The fibrous fruit pulp is yellow to white and slightly oily. Each fruit contains up to 3 ovoid compressed pyrenes.
Seed: The seed handling unit is the pyrene, which is hard coated and about 10 cm in diameter. Each pyrene weighs about 100 g. The morphological seeds are bilobed, pointed and basally attached, with an apical embryo, and a homogeneous, centrally hollow endosperm.

Flowering and fruiting habit

Reproduction is highly delayed and the reproductive period of the plant, before death, is short, about 20 years. Flowering usually occurs in the second part of the rainy season. *Borassus aethiopum* is dioecious; Females typically bear 50-100 fruits in a fruiting season. The seeds are naturally dispersed by mammals, such as chimpanzees.

Processing and handling

In West Africa, fruits are usually harvested from November till May. The pericarp is removed by hand-slashing to release the pyrenes.

Storage and viability

Seeds have a short viability and should be sown as soon as they are removed from the fruit pulp.

FOREST & LANDSCAPE

SEED LEAFLET

No. 120 September 2007

MILLENNIUM SEED BANK PROJECT Kew

Borassus aethiopum Mart.

Taxonomy and nomenclature

Family: Arecaceae

Synonyms: *Borassus flabellifer* L. var. *aethiopum* (Mart.) Warburg.

Vernacular/common names: African fan palm, ron palm, elephant palm. Local names: mtappa, mchapa (Swahili), sebe (Bambara), koanga (Mooré), murifate (Ilwana), mugumo (Duruma), mardafa (Somali), delieb (Arabic).

Related species of interest: *Borassus akeassii* sp. nov., whose petioles are green and less spiny, and whose fruits are greenish when ripe.

Distribution and habitat

Borassus aethiopum is indigenous to tropical Africa; being found in semi-arid and sub-humid zones from Senegal to eastern and southern parts of the continent. It is cultivated in India, Southeast Asia, Malaysia and also in Hawaii and Florida. It grows in great abundance on riverine flats and coastal plains, and also occurs in open secondary forest, dense forest borders and in savannah in drier areas where it is restricted to grassland with high ground water table, or along as being used for a mouthwash. The leaves are said to be an aphrodisiac and the sap is reported to have many uses. The seedlings are used in cooking. The fruits are eaten as a food supplement; both the fruit pulp and seeds are edible. The fruit is made into soft drinks, while the sap is fermented into palm wine used e.g. during traditional ceremonies. However, excessive tapping kills the plant.

Borassus aethiopum crown with hanging mature orange fruits. Photo: M Sacande.

Gaps that require intervention…

Thus the following challenges/ Gaps are apparent.

Challenges in the seed supply

- Degradation of natural forests that has been used as seed source (selective harvesting of good quality mother trees)
- Natural forests that can be used as seed source have become inaccessible
- Seeds of some species mainly indigenous spp. is critically limited in supply .
- Trees that need promotion are not identified hence collection is not accordingly
- Establishment of improved seed sources are limited.

Gaps that require intervention…

Policy and standard related challenges

- The quality control and support system of the seed sector is not strong (despite the structure)
  - Seed quality control system is not established yet at regional level (except in one region)
  - Low awareness on seed quality, focus on seed prices, by seed buyers.
  - Seeds that are low in their quality (mainly physiological) are abundant in the market mainly by informal seed suppliers
- Seed source certification systems, schemes (seed source owner vs. seed collector), seed supply models (centralized vs. decentralized) are not developed

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