



Drought tolerant *Ficus thonningii* silvopastures sustain livestock and crops in Northern Ethiopia

1. Background

Northern Ethiopia has historically been affected by recurrent and extended droughts which have caused widespread starvation, deaths, migration and the collapse of centuries old socio-cultural production and adaptation systems. Livestock production in the drylands of northern Ethiopia is plagued by these recurrent droughts which result in the mass chronic malnutrition and death of livestock. The main source of livestock feed i.e., natural pasture, is of extremely low quality and highly dependent on rainfall. A drought-tolerant source of fodder that is not dependent on rainfall is therefore very crucial for sustainable livestock production in northern Ethiopia.

Many initiatives to increase the productive output of farms in drought-prone areas like those of northern Ethiopia have not realized their objectives mainly because their interventions were too costly or technical for local farmers, or because they were not attuned to the socio-ecological needs of local family-based farming communities. Interventions introducing things like high-tech irrigation schemes, chemical fertilizers and pesticides, exotic fodder plants, or high yielding crop varieties and animal breeds have had negative impacts like increased soil salinity, chemical pollution, and the spread of invasive species.

However, some villages in the dry mountainous areas of northern Ethiopia have been able to not only escape the ills of drought, but have also maintained their livestock and reap bountiful harvests in subsequent normal years, while other areas suffered with no oxen to plough their land.

Ficus thonningii (local name *Shibaka*), an evergreen tree species traditionally used only for shade and ornamental purposes, stays green when even the hardiest species such as *Eucalyptus* dies during droughts. Large tree cuttings, which mature within 1.5 to 2 years, provide nutritious green fodder for livestock in large amounts all year round. Planted *F. thonningii* silvopastures also provide other side benefits such as improving soil fertility (through highly decomposable

foliage) even in wastelands and degraded areas. *F. thonningii* also enhances the conservation of soil and water, and protects degraded land from erosion. The merits of the tree include its ability to tolerate drought and lopping, and replenish its leaves after a short time of complete harvest. Furthermore, it is easy to propagate by direct planting of big cuttings, and has no negative effects on crops, making it suitable for farm-side plantations.

In view of its benefits, local farmers in northern Ethiopia have planted the tree species extensively in silvopastoral systems along backyards, farm boundaries, village roads, soil and water conservation structures, and wastelands, despite being coerced by government officials to plant other tree species. This practice has created green, biodiverse islands of climate-resilient farms amidst the drought-stricken landscapes of northern Ethiopia. Local communities have also developed indigenous protocols for the planting, propagation, and use of *F. thonningii*.



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2. The *Ficus thonningii* Silvopasture Project

A project was initiated in 2006 in Sefe'o village of Ahferom district of Tigray Regional State in northern Ethiopia by Mekelle University's College of Dryland Agriculture and Natural Resources and partners, and it is still ongoing. It addresses the issues of increased human population and extreme land degradation which is aggravated by recurrent drought and other climate changes in northern Ethiopia.

This initiative utilizes *Ficus thonningii* silvopastures, a locally available, low cost, environmentally friendly and yet highly transformative approach to simultaneously improve livestock and crop productivity while increasing the capacity of rural communities to adapt to recurrent drought, and enhancing environmental resilience.

The project team obtained financial and technical support to enable it to undertake farmer-to-farmer training programmes and other activities that helped disseminate the practice to more than 20,000 households in northern Ethiopia. The project grew from Sefe'o village in Ahferom district to other

districts, namely, Atsbi Womberta, Degua Tembien and Kola Tembien. Other initiatives have since disseminated it to Wukro Kilite Awlalo, Ganta Afeshum and Tahtay Maichew districts, all of which are in Tigray Regional State.

The project started as a formal study of the role of *F. thonningii* silvopastures in climate change adaptation, livelihood improvement and environmental resilience. After recording local knowledge on the system, the project team undertook scientific studies to understand the impact of the silvopastoral system on water use efficiency for livestock fodder production, livestock productivity, soil fertility and farm productivity.

By combining scientific findings and indigenous knowledge, the researchers developed an integrated protocol and training manuals in local languages for the establishment of the *F. thonningii* silvopasture system in similar areas as the initial site.

Farmer-to-farmer trainings and exchanges were organized where *F. thonningii* silvopastures were traditionally used. The project team also developed scientific publications, presented and popularized results in many international and national conferences and symposia, and undertook different media outreach activities.

The participants are farmers in the Ahferom, Degua Tembien and Atsbi Womberta districts of Tigray. Other

partner organization got involved at different phases of the project by providing financial and technical support. These organizations include the Tigray Bureau of Agriculture and Rural Development, GIZ Sun-SLM (Sustainable Land Management) project in Tigray, SOS-SAHEL Livelihoods Fund, Tropical Biology Association, and Relief Society of Tigray.

3. Outcomes

The researchers measured the impact of *F. thonningii* silvopastures on livelihoods, the environment, and climate change adaptation both in traditional settings and as newly established systems. In the districts where the system was introduced or popularized, all households are now planting the tree in mass as small-scale family silvopastoral systems. In Ahferom district, where such systems were traditionally practised by very few innovative farmers, *F. thonningii* silvopastures have created green islands amidst the degraded dry mountainous landscapes of northern Ethiopia.

Decade-long data on the increasing number of *F. thonningii* cuttings planted relative to other government-introduced fodder tree species is telling evidence of the value of *F. thonningii* to local farming communities (Figure 1).

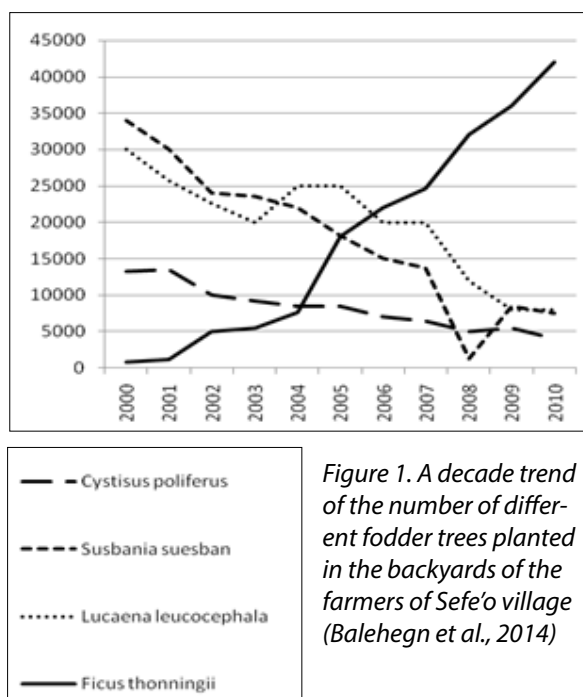


Figure 1. A decade trend of the number of different fodder trees planted in the backyards of the farmers of Sefe'o village (Balehegn et al., 2014)

The most inspiring outcomes of the project are as follows.

- The leaf of *F. thonningii* is highly nutritious with a crude protein content of 18-25% which is more or less the highest that can be achieved from a fodder tree. *F. thonningii* leaf meal can replace costly commercial concentrates by up to 50% while improving the productivity and meat quality of animals. This impact has been confirmed by local farmers who report improved growth rate, health and milk yield of animals as a result of supplementation with *F. thonningii-Ahferom* leaf meal. Cows produce almost twice the amount of milk per day with *F. thonningii-Ahferom* leaf meal compared to grass and straw.
- *F. thonningii* produces about 500-fold of nutritious fodder year-round compared to commonly introduced exotic fodder plants (like *Cystisus proliferus*, *Leucaena leucocephala*, and *Sesbania svesban*). This has enabled small-scale livestock owners to produce enough fodder to feed their animals throughout the year. As a result, old patches of introduced trees are being replaced by *F. thonningii-Ahferom*.
- The planting of *F. thonningii-Ahferom* around and on farmland has improved the physical and chemical fertility indicators of soils, evidenced by improved crop growth and yields under *F. thonningii-Ahferom* canopies compared to outside canopies.
- Being drought-tolerant, *F. thonningii* has reduced the water required for producing a unit of livestock fodder by 85%, increasing livestock water use efficiency.
- All these benefits have resulted in improved livelihoods among rural farming families in areas where this project has been introduced. Many farmers are now able to use extremely degraded, abandoned hill slopes and wastelands for producing nutritious fodder.
- Besides improving livelihoods, *F. thonningii-Ahferom silvopastures* have also improved the overall ecological resilience of hitherto degraded and highly fragile landscapes through contributing to biological soil and water conservation on terraces, hillsides, gullies, etc., and re-attracting once locally extinct wildlife including small mammals, and resident and migratory birds, the most significant being the endangered White-Billed Starling, a bird species which has found refuge in the new flourishing silvopastures and is now found in large numbers there.
- Moreover, preliminary data from an ongoing study indicate a possible significant carbon sequestration potential of the *F. thonningii-Ahferom silvopastures*.

4. Success Factors

The following are the success factors of the *F. thonningii silvopasture* system.

- Indigenous innovation - The fact that the technology was developed from an indigenous innovation, the benefits of which were well-known to farmers, made it easier to convince them to expand on it in a scientifically assisted or improved way.
- Comprehensiveness - Unlike common agro-forestry practices where trees are planted to provide one or two ecosystem services, *F. thonningii*, being a drought-resistant, easy-to-propagate, fast-growing tree with very nutritious fodder, and diverse multipurpose benefits, uniquely contributes to the alleviation of poverty, climate vulnerability and environmental degradation simultaneously.
- Low-cost and low-input - *F. thonningii* is an indigenous tree in Ethiopia (and 33 other African countries). Therefore, planting material is locally available and affordable by small-scale farming families. Being adaptable to diverse ranges of soil fertility, the propagation does not require additional agronomic inputs such as fertilizers, pesticides, etc. Most importantly, the tree is drought-tolerant and can grow to maturity on water stored naturally in the stems, thus, it does not need watering or irrigation.
- No technical skills or knowledge required - The protocols and procedures developed for plant selection, preparation of cuttings, planting, nursing, fodder treatment, feeding, etc. are based on indigenous practices originally devised by farmers, and modified from experimental findings. They require no prior technical knowledge or skills and can be easily understood and performed by lay people.
- Synergy between livelihood improvement, climate change adaptation, mitigation, and environmental rehabilitation - *F. thonningii silvopastures* do not just result in improved productivity of livestock and farmlands, but also builds the adaptive capacity of the communities to droughts, as the plant is drought-tolerant. The tree's fodder productivity is not affected by climate variabilities, thus providing a steady resource.



Incubated cuttings

5. Opportunities and Challenges

Many opportunities exist for further dissemination and scaling-up of *F. thonningii* silvopastures. The *F. thonningii* plant, or at least its different varieties, are adapted to a diverse range of agro-ecological systems in the lowlands, middle lands and highlands of Ethiopia, which makes it an ideal species for distribution. It is also indigenous to 33 other African countries, and some countries in Asia like China and India where this silvopastoral system can be applied. Its qualities of drought tolerance, high biomass productivity, tolerance to loping, ease of propagation, low cost, etc. also make it a very suitable system for propagation. The first step would be for the Ministry of Agriculture and Rural Development of Ethiopia to recognize *F. thonningii* as a key fodder tree species and officially allow its wide distribution.

There are, however, challenges to the widespread dissemination of the system. These are:

- The lack of awareness and understanding about the benefits of *F. thonningii* silvopastures;
- The lack of recognition of *F. thonningii* as a mainstream fodder tree by the Ministry of Agriculture and Natural Resources in Ethiopia;
- The current means of propagation, by cuttings, although technically easy, makes mass propagation rather cumbersome, and the transportation of cuttings

from place to place could be costly. Scientists should undertake research to find easier ways to propagate this species in mass.



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"This is a common rhyme that shepherds and women sing during their leisure time. It can roughly be translated as "It is by 'Shibaka' or *Ficus thonningii* that we survived the drought, therefore, 'durka' or hay cannot take the credit". This song signifies the role of the *F. thonningii* silvopastures on drought adaptation. It shows how much the community values the tree."

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"This is what one of the local farmers said. It can be translated as "*Shibaka (F. thonningii)* is a holy tree; it has many advantages, but no disadvantages".

6. Conclusions

The *Ficus thonningii* silvopastoral system has resulted in livelihood improvement, enhanced climate change adaptation, and improved environmental resilience in areas where it has been implemented through low-cost, farmer-to-farmer training and other dissemination pathways. Therefore, it should be broadly disseminated and adopted in areas with similar climate challenges and chronic land degradation.

Successful climate change adaptation practices and technologies need not come from outside a system. If scientists keenly observe traditional practices, they could find innovative solutions that suit local communities and their circumstances better than externally sourced ones.



Looping



Livestock feeding



Dried and stored foliage

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