

COMMERCIAL FORESTRY DEVELOPMENT IN TANZANIA: PROGRESS WITH INVESTMENTS, INNOVATIONS AND INSTITUTIONS SUPPORTING TREE IMPROVEMENT, INPUT SUPPLY AND ADVISORY SERVICES

*Milledge, S., Singo, I. and Sangalali, E.

Forestry Development Trust, P.O. Box 2, Iringa

*Corresponding author email: simon.milledge@forestry-trust.org

ABSTRACT

Commercial forestry is a growing industry in Tanzania, and is central to several major development sectors including construction and rural electrification, and is among the measures which are needed to combat forest loss and address the growing wood supply deficit. The Forestry Development Trust (FDT) is an independent, Tanzanian legal entity which was established in 2013 to help transform the commercial forestry sector by making it more competitive, inclusive and resilient. This paper draws together findings from various lines of FDT's work with partners over the past two years including: (i) an industry outlook for plantation resources and wood markets; (ii) performance measurement of tree improvement genetic trials; (iii) tree grower practices adoption surveys in the Southern Highlands; and (iv) private sector inputs to the revision of the National Forest Policy. Collectively, this work highlights three messages which are relevant to the transformation of the sector. Firstly, the private sector plays a fundamental and growing role in commercial forestry (including tree growers, investors, SMEs and service providers). This requires an enabling policy environment that recognises private roles, addresses key constraints, and stimulates investment and innovation. Secondly, the power of collaboration by public and private actors in technical innovations such as tree improvement research is immense, as it allows for leverage and sharing of technical and financial resources. Ensuring coordinated and sustainably-funded tree breeding is a key challenge to the sector. Thirdly, the sustainability of commercial forestry development and national tree planting initiatives depend on explicit recognition of economic and technical considerations including grower incentives, financial viability, site-species selection, and the quality of inputs and practices.

Keywords: Commercial forestry, innovation, tree improvement

INTRODUCTION

The Forestry Development Trust (FDT) is an independent, Tanzanian legal entity which was established in 2013 with a Memorandum of Understanding signed between the Ministry of Natural Resources and Tourism (MNRT) and Gatsby Charitable Foundation, with the formal support of an Advisory Panel consisting of key public and private forestry actors. FDT works with major public and private forestry actors to help transform the commercial forestry sector to become more competitive producers of high-value wood products, inclusive, and resilient. The Trust works in collaboration with public and private sectors to catalyse innovations and facilitate market actors in areas such as tree improvement, input supply, contractor and advisory services, wood utilisation, markets, and policy.

Economic Contribution of Commercial Forestry

Industrial growth and job creation in Tanzania is heavily reliant on, among others, wood-based products. Several key industries are dependent on a reliable supply of wood-based raw material as an input, including construction (timber, plywood), furniture, rural electrification (poles), retail (wood/paper packaging), and heat intensive industries (e.g. cement, tea and tobacco). Wood-based value chains are also significant job creators (both directly within timber value chains and indirectly in wood-dependent industries), with the potential to increase employment.

Economic opportunities from forestry are inclusive with private growers (small, medium and large) being the greatest source of future wood supply. In addition to large-scale state and private plantations, small and medium-scale private forests are an important supplier segment. In 2016, the forest plantation area in Tanzania was estimated to be 325,000 ha, with 54% (174,000 ha) owned by small/medium scale tree growers, and the balance consisting of Tanzania Forest Services (TFS) plantations (100,000 ha) and large private plantations (UNIQUE, 2017). In the Southern Highlands, some 60,000 private tree growers are a testament to the remarkable growth in the private forestry since the mid-2000s (FDT, 2016) (**Fig. 1**). The small-scale grower segment has high strong potentials of making gains in both productivity and area.

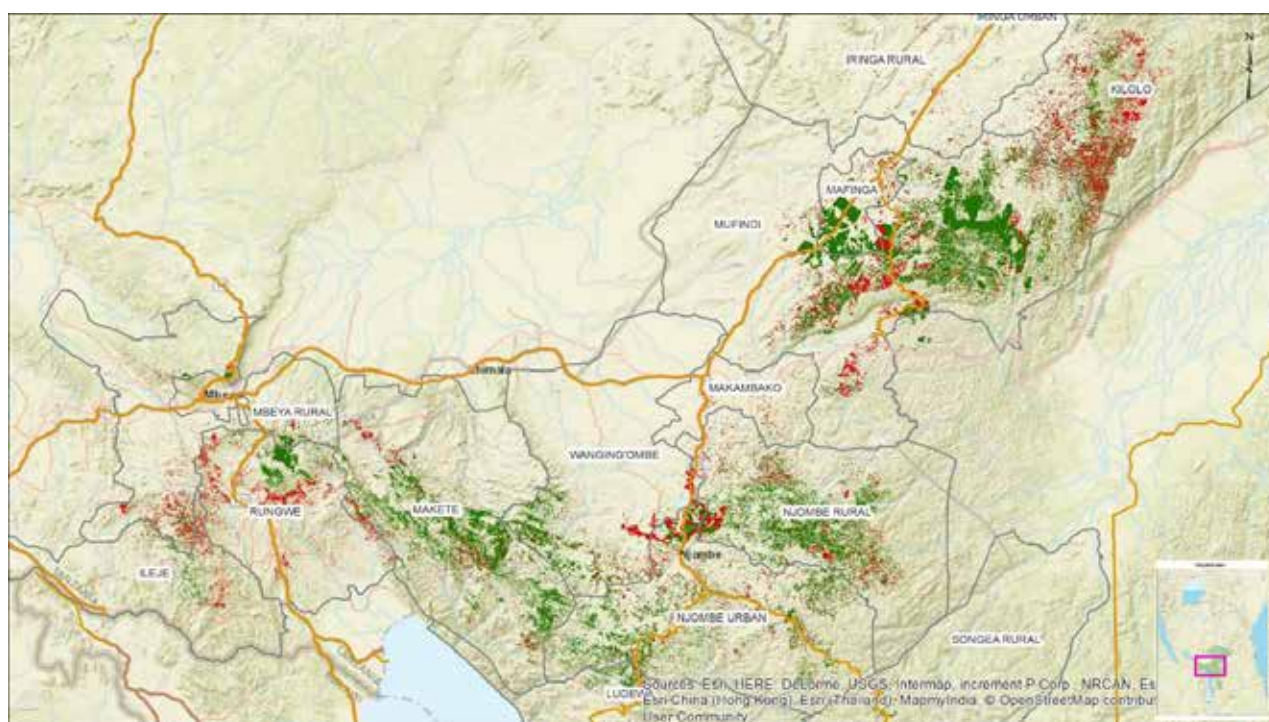


Figure 1: Distribution of pine and eucalyptus woodlots and plantations in the southern highlands

Source: FDT (2013).

Commercial plantation forestry is a growing sector, driven by economic opportunity and environmental prerogatives. Commercial forestry is one of the suites of mitigation measures which are needed to combat forest loss, climate change, and the growing deficit of wood supply. Wood demand is projected to grow substantially within the main markets, in line with population increase, urbanization, and national development priorities around infrastructure, manufacturing, and retail (**Fig. 2**). According to the latest national wood market study commissioned by FDT, timber demand (not including wood energy) is expected to more than double in round wood equivalent of between 2013 (national consumption of 2.3 million m³) and 2035 (5.2 million m³), driven primarily by the construction sector and paper consumption (UNIQUE, 2017).

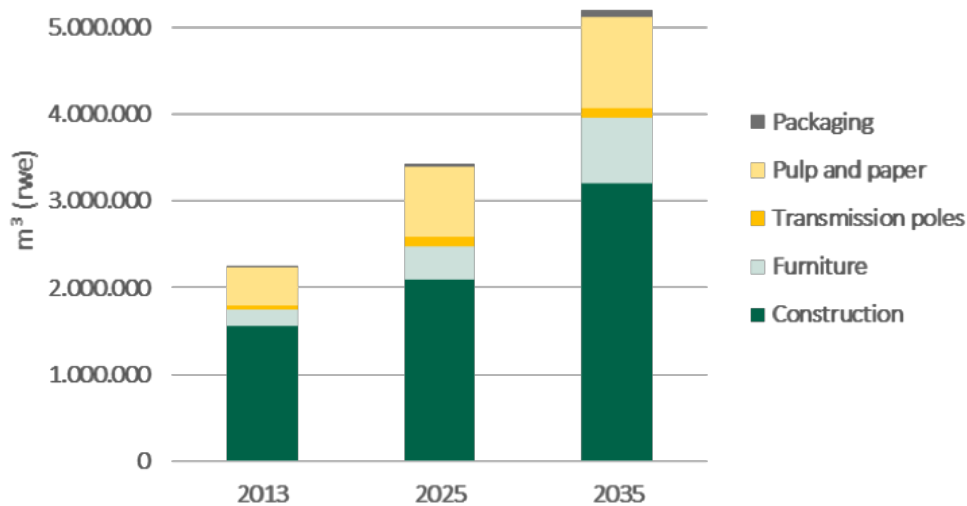


Figure 2: Consumption of wood products in Tanzania by market segments 2035

Source: UNIQUE (2017)

At the same time, a projected raw material supply deficit for most wood value chains can stimulate investments in improved tree growing and management (**Fig. 3**). Based on hectares planted and an estimation for productivity and of rotation age by each supply segment, the supply deficit in the market (not including wood energy¹) will increase between 2025 and 2035 to a supply gap of 3 million m³ round wood equivalent (rwe) (UNIQUE, 2017). The gap mainly consists of large diameter saw logs for sawn timber and veneer production (1.4 million m³) and wood fibre for pulp and particle/fibre board (1 million m³). It is expected that the national wood deficit can be reduced by increasing productivity, increasing rotation (for small tree growers) and increasing processing recovery rates. For example, lengthening small tree grower rotations from currently 12 to 18 years for sawn pine timber will reduce the saw log supply gap by 50% (UNIQUE, 2017).

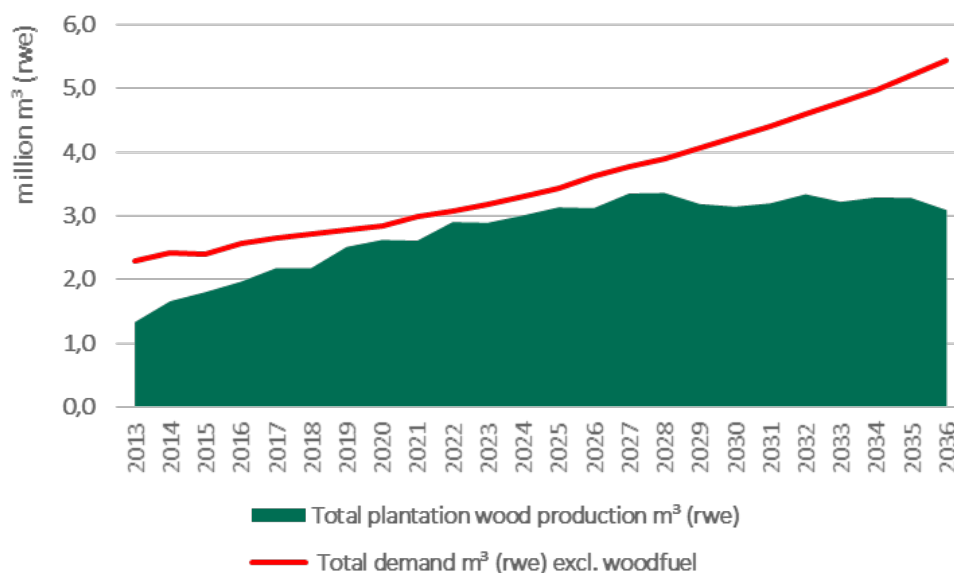


Figure 3: Summary Supply-Demand Scenario (Business As Usual scenario)

Source: UNIQUE (2017).

¹ The National Forest Resources Monitoring and Assessment of Tanzania Mainland (NAFORMA) estimated an annual wood deficit of 19.5 million m³ including wood energy supply and demand (MNRT, 2015).

Conditions for Improving Forestry Productivity

Tree planting helps address forest loss, climate change, and wood supply deficit, and receives political support for ambitious planting targets. In 2016, the National Tree Planting Strategy set planting targets of 185,000 ha annually for 17 years to offset more than 400,000 hectares of forest lost annually (MNRT, 2015). Naturally, there is an interest in ensuring the survival and growth of planted trees, whether be it for meeting future wood demands in commercial sectors or for reducing the net forest loss. It is critical that tree planting initiatives make three fundamental considerations for tree survival and growth (**Fig. 4**).

- (i) Technical considerations vastly improve productivity and these include: (1) the selection of the right species for a particular planting site; (2) the use of quality planting material; and (3) the establishment of good land and woodlot/plantation management practices;
- (ii) Sufficient economic incentives are required for actors to invest in these improved inputs and practices on a scale which is needed to reduce the net deforestation and increase wood supply. Commercial private forestry offers a blended combination of incentives for tree growing, including market demand (to pay for trees/wood) and private ownership of trees (to retain benefits); and
- (iii) On the institutional front, effective sector services and an enabling environment are required to support a dynamic, competitive, and resilient commercial forestry subsector. This requires both private and public sector to play key supportive roles, with the government providing necessary incentives and regulation to drive the private sector investment and innovation at scale (e.g. tree growing, processing, retail, and service provision). The market systems approach, which recognises the diversity and interactions among actors, is required to enable sustainable sector change.

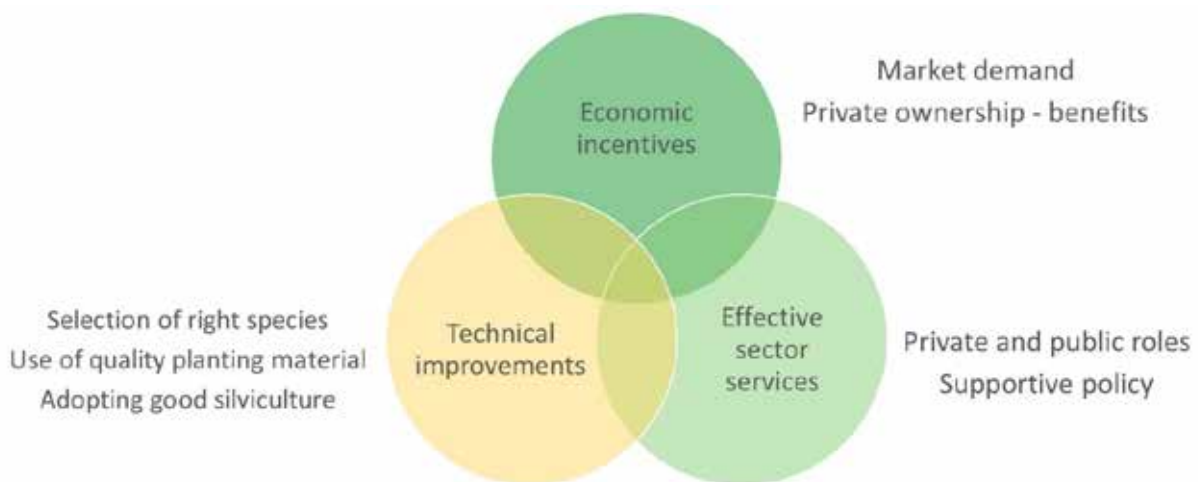


Figure 4: Key considerations to enable planted tree survival and growth

ACHIEVEMENTS IN SECTOR SERVICE DELIVERY IN SUPPORT OF COMPETITIVENESS AND RESILIENCE

Rising levels of wood demand can be met by increasing forest area, by increasing productivity of existing forest area, or both. However, while population pressure and environmental constraints may inhibit large-scale afforestation programs, methods to increase the yield potential of existing forests are often the most feasible means to meet future wood demand. The following sections outline various achievements according to the above-mentioned technical considerations to improve productivity and yield: (1) collaborative public-private tree improvement to ensure selection of the right species for a particular planting site; (2) development of private sector services to supply high quality inputs (planting material);

and (3) tree grower adoption of good land establishment and woodlot/plantation management practices.

Collaborative Public-Private Tree Improvement

Tree improvement plays a major role in commercial forestry development, with the application of high quality and diverse materials being essential to maintain competitiveness and resilience of the sector. Forestry yields and wood quality can be increased in a number of ways by breeding for increased volume, specific gravity, form, and pest & disease resistance. A scoping study carried out in the Southern Highlands revealed that sector competitiveness was hampered by reliance on poor quality and narrow genetic base of planting material (Komakech and Blakeway, 2014). The reliance on a few industrial tree species makes the whole commercial forestry sector vulnerable in the event of pest and disease outbreak. High quality planting material currently originates from other countries with established tree improvement programmes, which are not necessarily adapted to local growing conditions and come at high cost (especially for small-scale private growers).

Following sustained efforts since 2014, Tanzania now hosts an advanced commercial forestry tree improvement programme. Commercial forestry stakeholders (including public sector institutions, private companies, church organisations and individual farmers) have collaborated to develop a multi-partner, long-term tree improvement programme that benefits all scales of tree growers ultimately leading to sustained domestic production of improved planting materials. The aim is to ensure collaborative and commercially-orientated tree improvement that improves the quality, productivity, and options for market end-use of planting material, with coordinated and sustainably funded research, and information dissemination on issues such as species potential, and pest and disease risks. The benefits of collaborative tree improvement come from achieving the economies of scale, with individual actors benefitting from the collective results from all collaborators. To date, research infrastructure with FDT facilitation includes 65 genetic trials (species and clonal hybrids with known properties suited to Tanzanian wood markets), six breeding populations (*Pinus patula* and *Eucalyptus grandis*) and four seedling seed orchards (*P. patula* and *E. grandis*). The genetic trials are aimed at selecting the right genetic material for particular ecological conditions and have been established with the support from ten partners in 19 sites in different parts of the country and representing three distinct climatic zones (warm temperate, sub-tropical and tropical) (**Fig. 5**). Collectively, these genetic trials contain over 100 varieties including pine, eucalyptus, corymbia and casuarina pure species, and eucalyptus and pine clonal hybrids.

Given the recent (2017-2018) establishment of trials in drier, warmer, low-lying areas (e.g. Ruvu in Coast Region, Korogwe in Tanga Region), opportunities should emerge in the near future in terms of potential tree species and clonal hybrids for commercial planting.

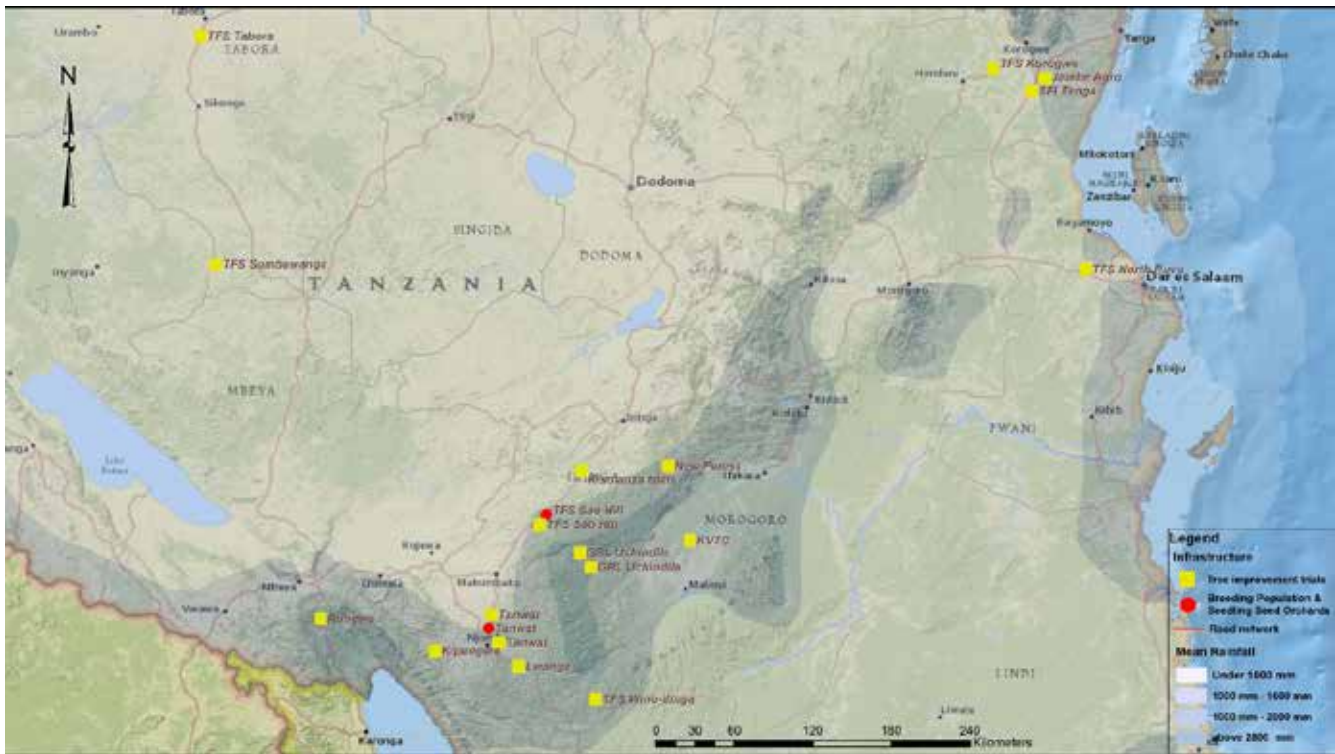


Figure 5: Map showing location of genetic trials established by FDT and partners since 2014

Source: FDT (2018)

The early results of these trials are starting to show new varieties (species and clonal hybrids) with commercial potential. Growth performance of trees in ten trials was measured in August 2017, and whose results are shared with the multi-partner Tree Improvement Research Working Group (TIRWG). As an example of the results, **Figures 6 and 8** show the strong performers after 29 months at a single trial location, Kisolanza (1730 m altitude and 600-1000 mm annual rainfall), including *Eucalyptus nitens*, *E. badjensis*, *E. benthamii*, *E. grandis* and *E. dunnii*, *Pinus tecunumanii*, *P. maximinoi*, and hybrids *E. grandis* x *E. nitens* and *E. grandis* x *E. urophylla* (FDT, 2018). The early growth results demonstrate how imported genetic material is outperforming the local genetic material, while also showing the differences between sources of the same species and underlying the importance of testing through trials.

The results of genetic trials are already becoming useful to commercial forestry operations in revising the selection of planting material. For example, many GxN and GxU eucalyptus hybrids are out-performing GxC hybrids that have traditionally been planted by some commercial operations. However, observation of stem form is helpful in targeting planting material for the production of wooden transmission poles.

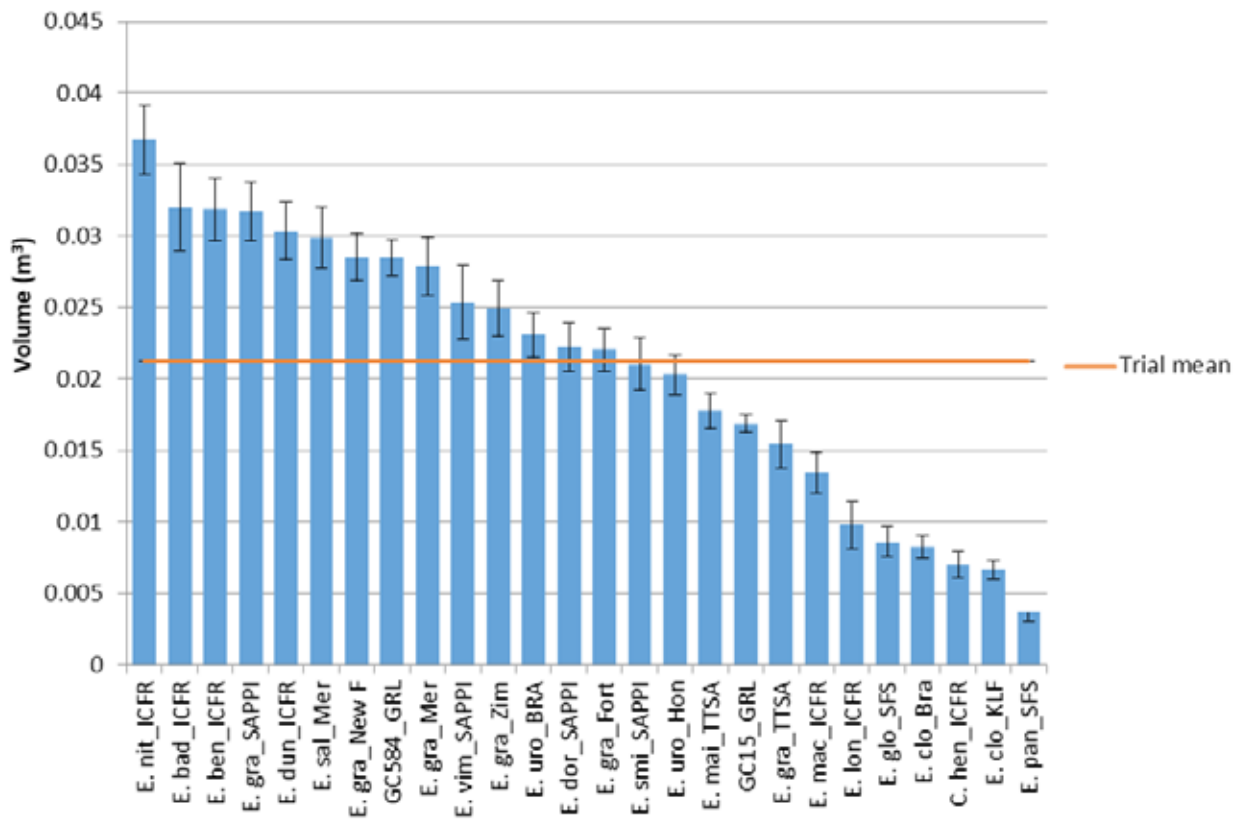


Figure 6: Mean volume of Eucalyptus pure species after 29 months, Kisolanza (established 2014/15)

Source: FDT (2018)

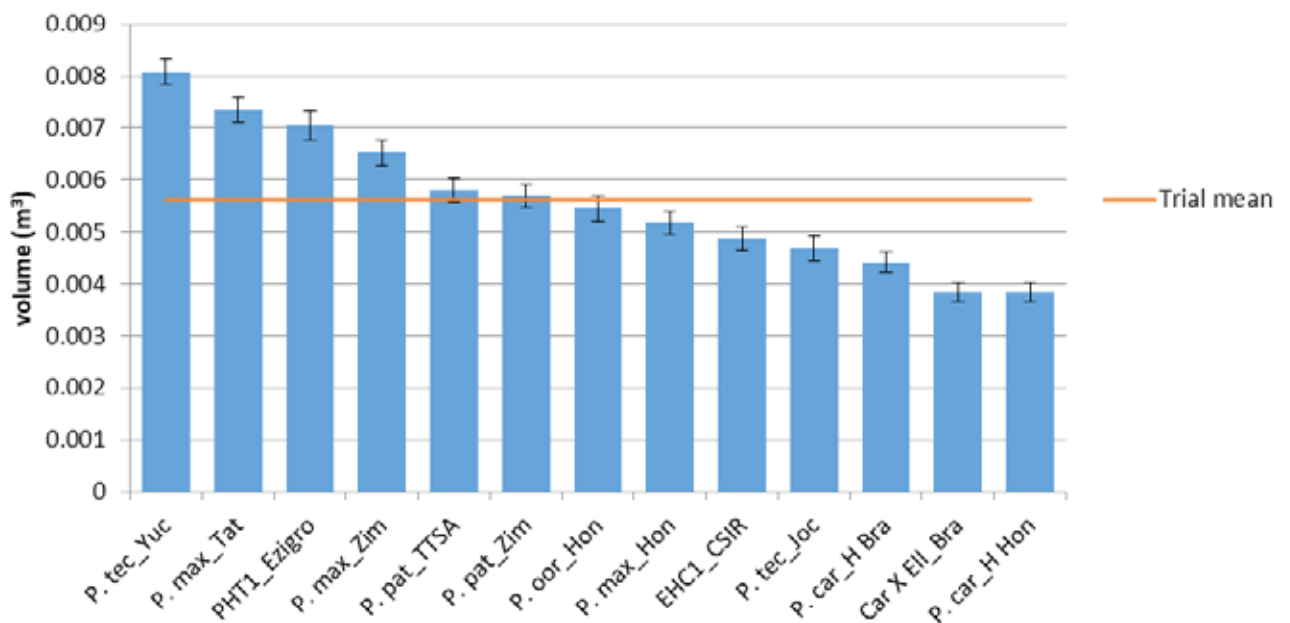


Figure 7: Mean volume of Pine pure species after 29 months, Kisolanza (established 2014/15)

Source: FDT (2018)

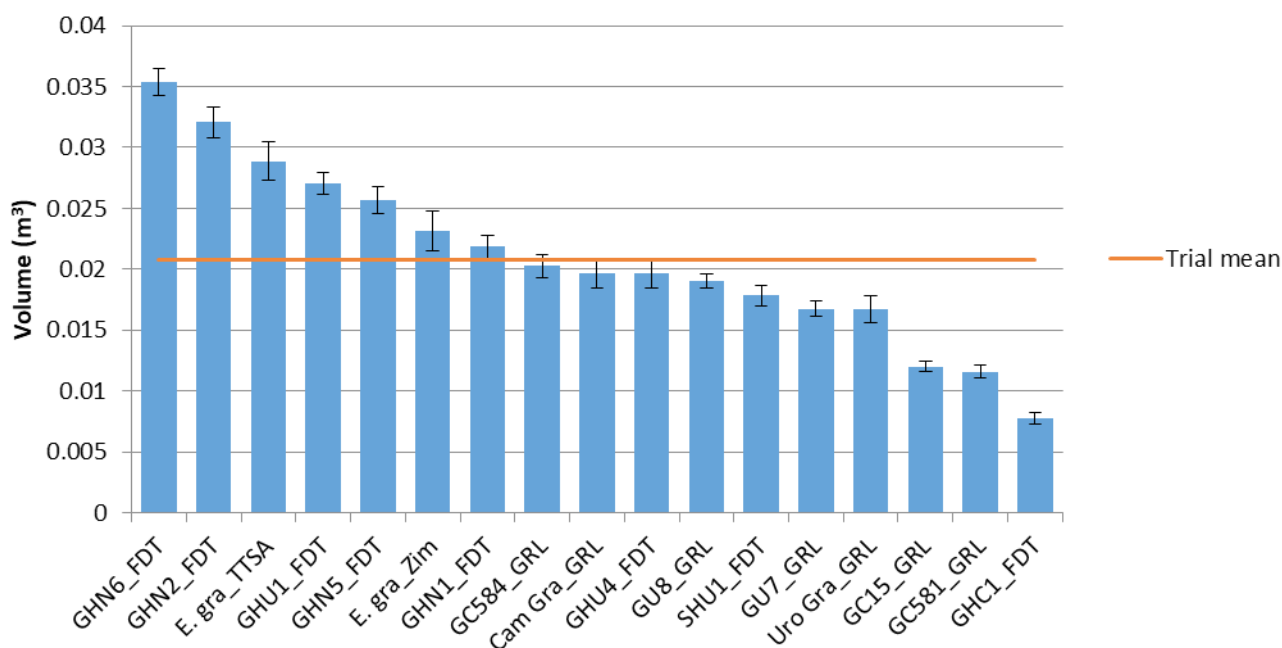


Figure 8: Mean volume of Eucalyptus clonal hybrids after 29 months, Kisolanza (established 2014/15)

Source: FDT (2018)

Growing stakeholder engagement in collaborative tree improvement is a testament to the realization of the potentially long-term benefits to commercial forestry. Central to the development of collaborative and commercially-orientated tree improvement research and development is effective coordination, sustainable resourcing, and sharing of results/benefits. To foster coordination and collaboration, a Tree Improvement Research Working Group (TIRWG) has been operational since 2015, and which was most recently chaired by the Forestry and Beekeeping Division (FBD). The TIRWG comprises interested public and private stakeholders including FBD, TAFORI, TFS, TTSA, major private forestry companies (GRL, TANWAT, NFC, KVTC, SFI) service providers (Jambe Agro) and support programmes (FDT, PFP). The number of active players continues to increase, with cost sharing also constantly rising.

Adherence to a clear strategy and the highest quality standards have been a key to ensuring relevance and quality of the collaborative tree improvement efforts to date. Key TIRWG outputs have included a Tree Improvement Strategy for the Southern Highlands (TIRWG, 2016) and Standard Operation Procedures (FBD, *in press*). The sustainability of collaborative tree improvement activities requires partnership arrangements with agreed financing modalities. Recent review by the TIRWG suggested that a social enterprise would best meet key criteria for success, and work is on-going to develop a business model.

Development of Tree Grower Services – Inputs and Advisory

In order to ensure the supply of quality wood products, plantations and woodlots should be established using genetically improved seed or vegetative propagules so as to produce fast growing trees of good form (FBD, 2017; PFP, 2016). However, the overall competitiveness of Tanzania commercial forestry is hampered by limited production and access to quality genetic material (UNIQUE, 2017).

Until recently, relatively few seed orchards were in place, including four owned by TTSA (producing seeds of *Pinus patula*, *Tectona grandis*, *Eucalyptus tereticornis* and *Grevillea robusta*) and a TAFORI-owned seed orchard of *Cupressus lusitanica*, and improved eucalyptus clones. Collectively, these seed sources cannot meet the current demand (FBD, 2017). Small/medium-scale private tree growers have traditionally lacked access to improved planting material (FBD, 2017; UNIQUE, 2017). In order to make available quality

inputs to all scales of tree growers, FDT initially sourced imported improved seeds through TTSA to be used in commercial nurseries. As the demand picked up, the strategy shifted to facilitating the importation of seeds by other market players for longer-term sustainability. FDT works with commercially-driven public and private entities to source, package and distribute seeds in the short-term. One private actor, Jambe Agro, is increasingly demonstrating the ability of making available high-quality seed, including innovative ‘One Acre Packs’ suitable for small-scale growers.

At the same time, FDT has facilitated the establishment of high quality seed orchards to ensure local supply of genetic improved planting material over a longer term. This s included four seedling seed orchards (*E. grandis* and *P. patula*) with TFS (Sao Hill Forest Plantation) and TANWAT, each of which has the explicit intention of distributing 40% of seeds to small-holders. In collaboration with TTSA, the efforts are on-going to develop materials for grafted seed orchards. The Trust also provided technical advice to PFP and TTSA for the establishment of seed orchards for other species with Tree Grower Associations.

Apart from seed suppliers, FDT has been working with around 100 independent commercial nurseries in the Southern Highlands to adopt best practices and increase grower access to quality planting material.

Private Grower Adoption of Good Management Practices

Growers can maximise quality and productivity of their plantations and woodlots through a combined use of improved planting materials and adoption of good land and silvicultural practices. Studies have shown that rigorous site preparation such as complete cultivation results in improved survival and early growth of planted seedlings as compared to strip or cultivation (FBD, 2017; FDT, 2017). **Figure 9** shows the impact of different weeding practices on productivity of *E. grandis* from a flagship plantation demonstration site, illustrating the importance of reducing weed competition in enabling higher survival and timely canopy closure. Similarly, other establishments and silvicultural practices have a positive effect on performance (e.g. spacing, pitting, pruning and thinning).

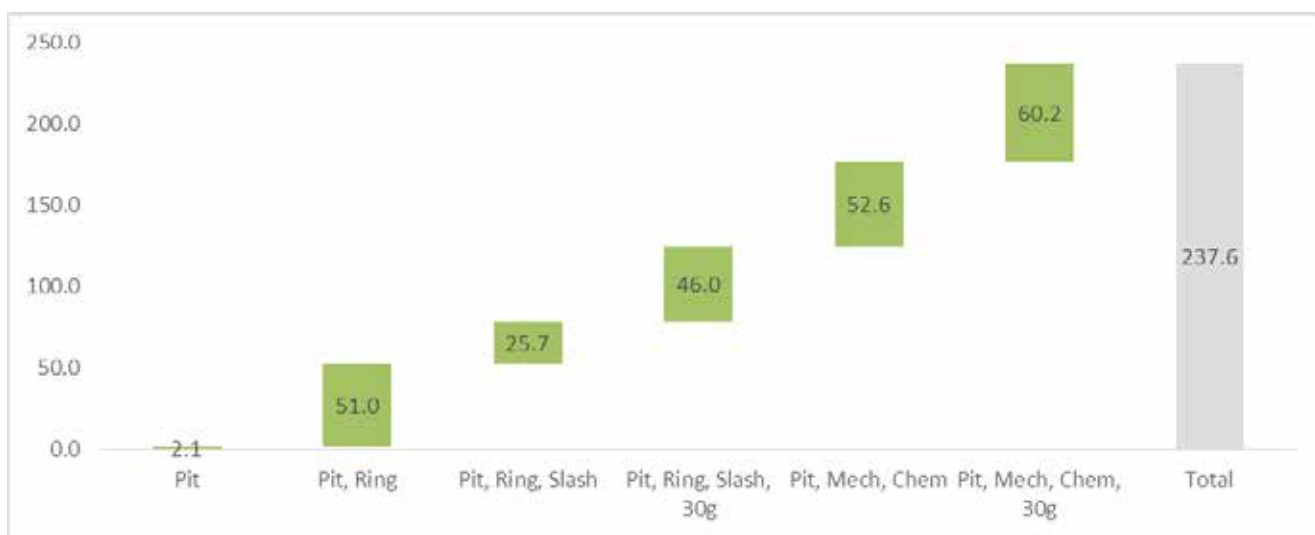


Figure 9: Incremental volume impact (m³ per ha) of weeding practices on *E. grandis* after 43 months

Source: FDT (2018)

The establishment of effective plantation and management by growers of all scales must be supported through a range of advisory service models including inclusive out-grower arrangements, commercial providers, grower associations and government extension. The quality of silviculture employed by most small and medium tree grower woodlots is affected by low access to extension and advisory services.

Building on the *Forest Plantation and Woodlot Technical Guidelines* (FBD, 2017), FDT efforts to accelerate the adoption of good silvicultural practices have included building the business cases to deliver improved information, outreach and training, developing materials in multiple media, providing targeted training and developing industry-led standards. The focus is currently directed to: (1) government extension, a respected source of advice for tree growers with the potential of enhancing the quality of farmer-extension interactions; (2) commercial providers such as contractors, nurseries and input suppliers who provide information and advisory as part of bundled services.

A key finding is that increased adoption of improved planting material has occurred in the absence of subsidy. Commercial forestry in the Southern Highlands is dynamic, with market forces enabling growth in tree growing, enterprises and industries over the past decade. The diversity of value chains is steadily increasing (e.g. emergence of small diameter veneer peeling), which is indicative of a maturing sector with many actors ready to respond to new innovations and opportunities. FDT's approach has therefore been to facilitate sector improvements without providing direct financial subsidy. Collectively, these efforts have seen the adoption of improved planting material growing over the three years since 2014 (Fig. 10).

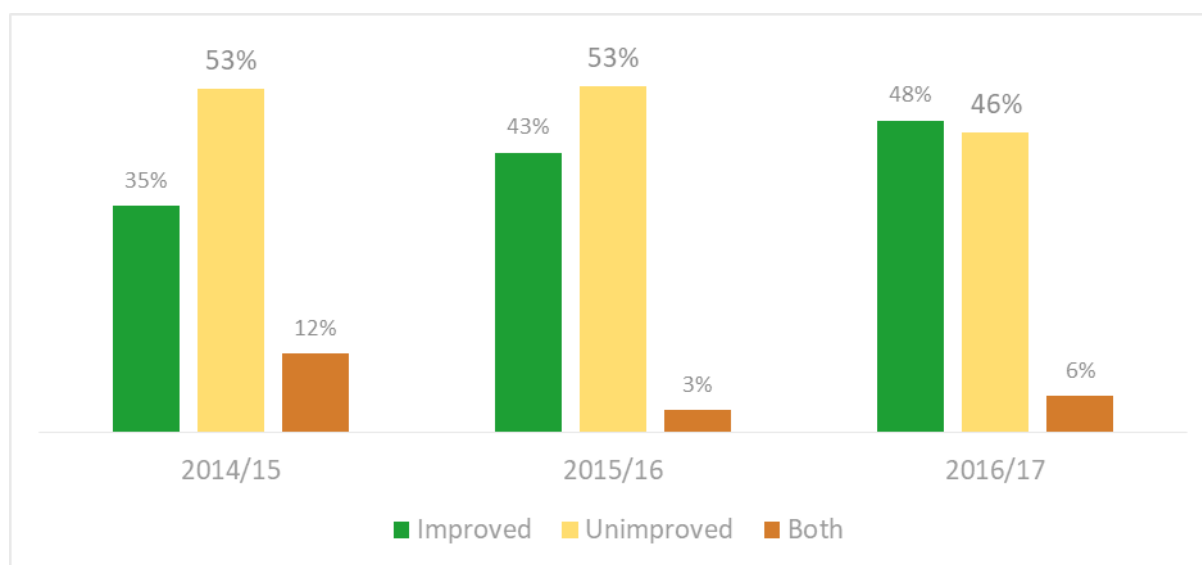


Figure 10: Improved planting material adoption trends among tree growers in the Southern Highlands

Source: FDT (2017)

CHALLENGES AND POLICY PRIORITIES FOR THE DEVELOPMENT OF COMMERCIAL FORESTRY SECTOR

Clear opportunities for growth in the commercial forestry sector are presented by favourable growing conditions, a growing national wood supply deficit, and the increasing dynamism shown by private and public actors. However, it needs to be realised that these opportunities are limited many constraints and challenges:

- (i) Mostly domestic market are characterised by low value addition and limited reward of quality;
- (ii) Limited competitiveness driving imports and substitution for some wood products;
- (iii) Low access to quality planting material and service models for growers;
- (iv) Dispersed nature of relatively low-quality wood supply, with limited aggregation;
- (v) Limited investment in efficient harvesting and processing technology;
- (vi) Limited coordination and preparedness around fire, pests and disease, and climate change;

- (vii) Limited partnerships and financing for forestry investments (including tree improvement);
- (viii) the gap between the needs of industry and commercial forestry skills and training; and
- (ix) High costs due to weak road and electricity infrastructure.

During 2017, a wide spectrum of private commercial forestry actors from the Southern Highlands² provided their perspectives on policy issues which are needed in driving the private sector investment and innovation at scale in support of commercial forestry sector growth (Anon., 2017):

- (i) *Policy recognition*: Explicit recognition of the contribution of commercial forestry sector to national development and need to promote private sector's growing role and potential.
- (ii) *Forest plantation development*: Land availability, acquisition and tax; fire, pests and disease; tree improvement and planting material; information, extension and outreach.
- (iii) *Forest industry development*: Raw material supply; industrial output and efficiency; trade and markets for wood products; improving business environment.
- (iv) *Industry-wide enabling conditions*: Private sector coordination and dialogue; financial mechanisms and incentives; rural infrastructure; forestry research, training and education.

CONCLUSIONS

Commercial forestry is a growing industry in Tanzania with high dependence on wood from major development sectors, including construction (timber, plywood), rural electrification (poles), retail (packaging), tea and tobacco (wood energy). Commercial forestry is also a major contributor to industrial development, employment and incomes, and one of the suites of mitigation measures of combating forest loss. Opportunities for the growth of the sector are presented by favourable growing conditions, the growing national wood supply deficit, and an increase of dynamism which is shown by private and public actors. The economic opportunities are inclusive with private growers being the greatest source of future wood supply.

REFERENCES

- Anon. 2017. *Synthesis of Private Commercial Forestry Stakeholder Recommendations on the Draft National Forest Policy*. Submitted by private sector commercial forestry stakeholders based in the Southern Highlands as an input to the policy review process, 28 August 2017. http://forestry-trust.org/wp-content/uploads/2018/01/2017_UNIQUE-Tanzania-Wood-Market-Study-FINAL.pdf
- FBD. (in press). *Standard Operation Procedures for Implementation of Tree Breeding Activities in Southern Highlands of Tanzania*. Forestry and Beekeeping Division, Ministry of Natural Resources and Tourism.
- FBD. 2017. *Forest Plantation and Woodlot Technical Guidelines*. Forestry and Beekeeping Division. Dar es Salaam, Tanzania. <http://forestry-trust.org/wp-content/uploads/2015/10/Forest-Plantation-and-Woodlot-Technical-Guidelines-final-print-2017.pdf>
- FDT. 2017. *Tree growers' adoption survey report*. Forestry Development Trust. Iringa, Tanzania.
- FDT. 2016. *Baseline tree grower survey report, July 2015*. Forestry Development Trust. Iringa, Tanzania. <http://forestry-trust.org/wp-content/uploads/2015/10/FDT-Baseline-Tree-Grower-Survey-Report-Final.pdf>
- FDT. 2018. *Growth assessment and survival results for species and clonal hybrid trials in Southern Highlands: August 2017 measurements*. Forestry Development Trust. Iringa, Tanzania

² Including SMEs, associations such as UWAMBA, SAFIA, NOFIA and SHIVIMITA, wooden pole enterprises, tree grower associations, medium scale tree growers, processors, service providers, timber traders and transporters.

- Komakech, C. and Blakeway, F. (2014). *Tree Improvement Scoping study for Southern Highlands of Tanzania*. 15pp.
- MNRT. 2015. *National Forest Resources Monitoring and Assessment of Tanzania Mainland (NAFORMA): Main Results*. Ministry of Natural Resources and Tourism, Dar es Salaam, Tanzania. <http://www.fao.org/forestry/43612-09cf2f02c20b55c1c00569e679197dcde.pdf>
- PFP. 2016. *Value Chain Analysis of Plantation Wood from the Southern Highlands*. Private Forestry Programme. Iringa, Tanzania. <http://www.privateforestry.or.tz/en/resources/view/value-chain-analysis-of-wood-plantation-from-the-southern-highlands>
- TIRWG. 2016. *Tree Improvement Strategy for Southern Highlands*. Tree Improvement Research Working Group, Tanzania. <http://forestry-trust.org/wp-content/uploads/2015/10/Forest-Plantation-and-Woodlot-Technical-Guidelines-final-print-2017.pdf>
- UNIQUE. 2017. *Tanzanian Wood Product Market study*. UNIQUE Forestry and land use GmbH. Freiburg, Germany. http://forestry-trust.org/wp-content/uploads/2018/01/2017_UNIQUE-Tanzania-Wood-Market-Study-FINAL.pdf