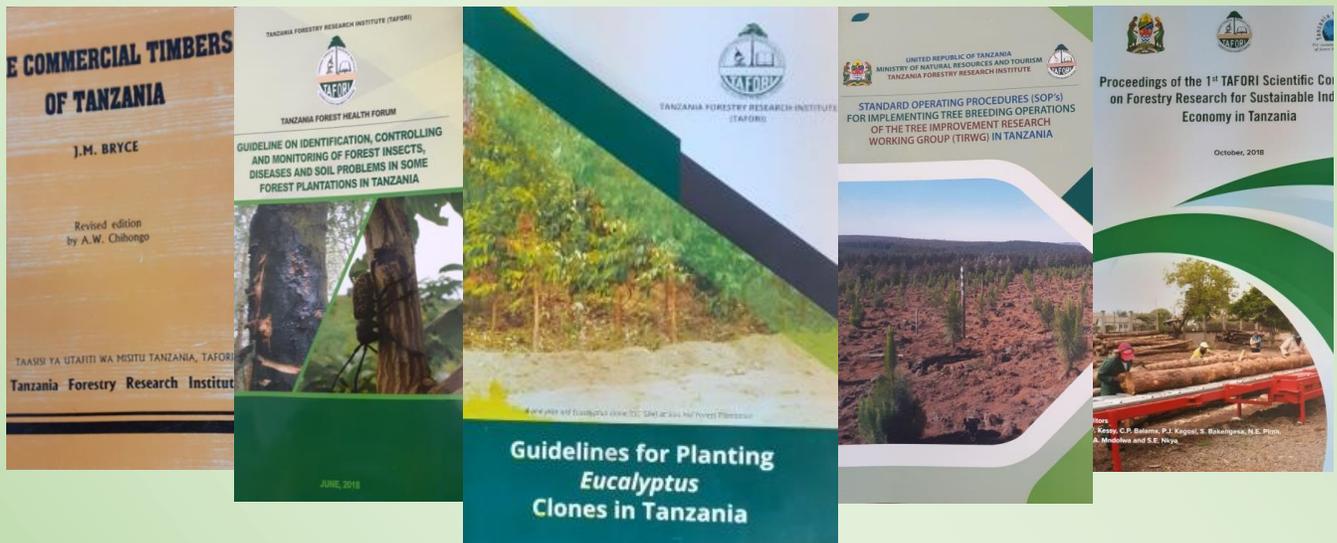




**UNITED REPUBLIC OF TANZANIA
MINISTRY OF NATURAL RESOURCES AND TOURISM
TANZANIA FORESTRY RESEARCH INSTITUTE**



OVERVIEW, RESEARCH PROGRAMMES AND PUBLICATIONS



TANZANIA FORESTRY RESEARCH INSTITUTE

P.O. BOX 1854 | MOROGORO

Tel: 255 23 293 5174 | Fax: 255 23 293 5174

Email: tafori@tafori.or.tz | Website: www.tafori.or.tz

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1.0 OVERVIEW

1.1 Background Information

Tanzania Forestry Research Institute (TAFORI) was established by Act No.5 of 1980 with the mandate to conduct, co-ordinate and regulate forestry research as well as to disseminate scientific information to end users in Tanzania. Its history dates back to 1893 when the Germans established a 2.5 ha tree nursery near Dar es Salaam. The nursery tested over 270 species for tropical plantations, ornamental and other trees. Thereafter, a Biological Agricultural Research Station was established at Amani in 1902 to undertake systematic test of indigenous (Juniper and Podo) and exotic (Cypress, Eucalypts, Teak and Black Wattle) tree species. A number of tree species tested, currently constitute major plantation tree species in Tanzania. During the British Colonial Government in 1928 the Biological Agricultural Research Station in Amani was renamed East African Agricultural Research Station and was subsequently shifted from Amani to Muguga (Kenya) in 1948 to form the East African Agricultural and Forestry Research Organisation (EAAFRO). In the early 1950s the then Tanganyika Government established Silvicultural and Utilisation Research Stations at Lushoto (Tanga) and Moshi (Kilimanjaro), respectively to cater for research problems specific to the country while EAAFRO concentrated on regional research needs. The works of EAAFRO ended following the collapse of the first East African Community (EAC) an umbrella organisation embracing EAAFRO activities in 1977. Forest research work was then handed to Forest Division under the Ministry of Natural Resources, and Tourism before shifting to TAFORI in 1980. Apart of carrying out and coordinating forestry over the time in the country, early in 2019 beekeeping research was transferred to TAFORI from Tanzania Wildlife Research Institute (TAWIRI).

1.2 Vision

To be a centre of excellence in research for forestry and beekeeping development in Tanzania.

1.3 Mission

Support forest and beekeeping development through conducting, coordinating, regulating research and dissemination of findings.

1.4 Core Values

TAFORI is embracing the following core values:

- (i) **Team work spirit and partnership:** Providing support to one another, working co-operatively and respecting one another's views;
- (ii) **Integrity and Transparency:** Being honest, transparent and responsible
- (iii) **Accountability:** Accountable within and outside TAFORI;
- (iv) **Results Oriented:** Focused on getting what needs to get done, done;
- (v) **People focus:** Building a positive spirit, giving direction, developing, coaching, building positive spirit and involving; and
- (vi) **Professionalism:** We provide our services based on technical know-how and relevant skills.

1.5 Roles and Functions

The functions of TAFORI as stipulated under Section 4 of Act No. 5 of 1980 (with subsequent revision) establishing this Institute are as follows:

- (i) To promote development, improvement and protection of the forestry and beekeeping industry;
- (ii) To carry out and promote the carrying out of enquiries, experiments and research and to collect or facilitate the collection of information for the purpose of promoting forestry and beekeeping;

- (iii) To carry out, and promote the carrying out of experiments and research relating to the planting, growth, development, conservation and use of local and foreign trees including bee plants and evaluate their suitability for adaptation and alternative use of industries in Tanzania;
- (iv) To carry out research on forest and honeybee health, safety and the ways of controlling and preventing the occurrence of particular diseases or a category of them in Tanzania;
- (v) To co-ordinate and regulate research in forestry and beekeeping carried out within Tanzania;
- (vi) To establish and operate a system of documentation and dissemination of the results of inquiries, experiments and research carried out by or on behalf of the Institute, or other information on forestry and beekeeping acquired by the Institute;
- (vii) To advise the Government, public institutions and other persons or bodies of persons on the practical application of the results of inquiries, experiments and researches carried out by or on behalf of the Institute;
- (viii) To advise the Government, public institutions and other persons or bodies of persons on the application of modern techniques suitable for the development of forests for the purposes of conserving or improving the natural beauty and amenity of the town and the countryside, and the conservation of soil, fauna and flora;
- (ix) In co-operation with the government or any person or body or persons, to promote, or provide facilities for; the instruction and training of local personnel for carrying out research in forestry and beekeeping and for establishment and management of forests, apiaries and bee reserves;
- (x) To prepare, implement, control and supervise programmes relating to the development of forestry and beekeeping;

- (xi) To undertake the collection, preparation, publication and distribution of statistics relating to forestry and beekeeping, and promote and develop instruction and training in forestry and beekeeping;
- (xii) To provide assistance, consultancy and other services for the development of forestry and beekeeping, including:
 - a. The establishment of nurseries and demonstration forest plots, apiaries and queen rearing centre in such areas as the Board may determine;
 - b. The supervision of the cultivation of certain forest trees and the harvesting and processing of their products; and
 - c. The provision of such advice and services as may be needed by forest developers and conservators.
- (xiii) To undertake the management or supervision, upon such terms and conditions as may be agreed upon, or give assistance or advice in relation to the establishment and management, of woods, forests, bee reserve or apiary belonging to any person or body of persons;
- (xiv) To produce, purchase or acquire standing timber and beekeeping equipment or products, and sell or dispose of any timber, equipment or products belonging to the Institute or, subject to such terms as may be mutually agreed, to a private owner, and generally promote the supply, sale, utilization and conversion of timber, equipment or products;
- (xv) To advise, co-operate and assist the Government, public institutions and other persons or bodies of persons in the establishment, carrying on and development of wood, bee products and beekeeping equipment industries;
- (xvi) To control and manage the affairs of Centres vested in the Institute by Section 5 of the Act;
- (xvii) To assume responsibility for the control and management of any Centers which may be established by or vested in the Institute under Section 5 of the Act or any other;

- (xviii) To do all such acts and things as, in the opinion of the Board may be necessary to uphold and support the credit of the Institute, to obtain and justify public confidence, and to avert or minimize loss to the Institute; and
- (xix) To do anything or enter into any transaction which, in the opinion of the Board, is calculated to facilitate the proper exercise of the functions of the Institute under this Act.

1.6 Strategic Objectives

- A. To strengthen Intervention and Prevention of HIV/AIDS and Non Communicable Diseases Programmes at work place;
- B. To enhance Internalization of the National Anti-Corruption Strategy;
- C. To improve Forestry and beekeeping research;
- D. To improve Forestry and beekeeping research coordination;
- E. To enhance Dissemination of forestry and beekeeping research findings; and
- F. To strengthen Institutional capacity to deliver services.

1.7 Organisation Structure

The TAFORI organisation structure consists of:

- The Board of Directors.
- The Director General under which there are Four Units namely; Internal Audit Unit, Procurement Management Unit, Information Technology (ICT) Unit and Legal Services Unit.
- Under the Director General there are also four Directorates namely: Forest Production Research; Forest Utilisation Research, Beekeeping Research and the Finance and Administration.
- There are seven Research Centres allocated in different agro-ecological zones in the country.

2.0 RESEARCH PROGRAMMES

2.1 National Forestry Research Programmes

The National Forestry Research Programmes have been drawn from the National Forestry Research Master Plan III (NAFORM III) which covers the period 2021 to 2031.

It has six Research programmes:

- (i) Management of Natural Forests and Biodiversity Conservation;
- (ii) Urban and Farm Forestry;
- (iii) Forest Plantations and Tree Improvement;
- (iv) Forest Resources Assessment;
- (v) Socio-economics, Policy and Forestry Extension; and
- (vi) Sustainable Harvesting and Utilization of Forest Products.

The following are research focus areas:

2.1.1 Management of Natural Forests and Biodiversity Conservation

- (i) Surveys and monitoring of biodiversity and ecological processes in various natural forest types,
- (ii) Identification, collection, listing and characterization of endemic, rare and threatened species which need conservation;
- (iii) Identification and analysis of impacts/effects of potential invasive/aliens' species, lianas, pathogens, pests, diseases and vermin in various natural forest types;
- (iv) Establishment and evaluation of suitable *ex-situ/in-situ* conservation methods;
- (v) Monitoring forest regeneration and factors influencing it;
- (vi) Studies on Evaluation of different propagation techniques;
- (vii) Phenological and ecological studies of indigenous tree species in various ecosystems;

- (viii) Monitoring the effects of fire, pathogens, pests, grazing, logging, shifting cultivation, and wildlife on seedling recruitment, species diversity, and soil properties;
- (ix) Monitoring hydrological processes and anthropogenic impacts on the hydrological cycle, including water use by different tree species and their respective implications to climate change;
- (x) Identification and improvement of growth characteristics of fast-growing indigenous tree species for enrichment and restoration of degraded forests;
- (xi) Studies on carbon sequestration potential (above and below ground) of different tree species and stands, soil carbon monitoring, and implications to the tapping of carbon trade;
- (xii) Studies on the effect of deforestation and forest degradation on the release of Green House Gases (GHGs) to the atmosphere;
- (xiii) Modelling and mapping of production and flow of ecosystem/environmental goods and services under climate change;
- (xiv) Evaluation of species distribution responses as a result of climate change; and
- (xv) Strategic Environmental Impact Assessment (SEIA) for investments on forest lands.

2.1.2 Urban and Farm Forestry

- (i) Studies on species and provenances of various trees/shrubs for AF, urban and woodlots in various ecological zones, farming systems and end uses;
- (ii) Socio-economic and biological evaluation of various AF technologies for various end uses in sets of ecological zones and farming systems;
- (iii) Selection, propagation, domestication, management and processing of high-value indigenous fruit, medicinal and ornamental trees;
- (iv) Assessment and development of management techniques/guidelines for urban forests, woodlots and ToF;

- (v) Carbon sequestration potential of AF systems, urban forests and woodlots;
- (vi) Vulnerability and adaptation of AF systems, urban forests and woodlots to climate variability and change;
- (vii) Tree and AF products value chains and marketing of products and services,
- (viii) Studies on tree species suitable for AF, value chain of AF products, marketing of products and services for industrial development; and
- (ix) Studies on the effects of exotic ornamental invasive species.

2.1.3 Forest Plantations and Tree Improvement

- (i) Screening of genetically improved materials for use in plantations and development of seed orchards; including suitable tree species for gum and resin production;
- (ii) Studies on application of biotechnology on tree improvement;
- (iii) Evaluation of impact of silvicultural practices and environment on the productivity of succeeding rotations;
- (iv) Research on new plantation tree species with emphasis on indigenous species;
- (v) Monitoring and evaluation of forest health with respect to insect pests, pathogens, invasive species, fire and climate change;
- (vi) Carbon sequestration potential of different tree species in plantations;
- (vii) Improvement and development of management practices/guidelines for different new tree species in plantations;
- (viii) Establishment and evaluation of mixed tree species in plantations; and
- (ix) Assessment of effects of forest plantations on water resources, biodiversity and soil health.

2.1.4 Forest Resources Assessment

- (i) Development of standards and classifications, definitions and structure of trees and forest resources data and information;

- (ii) Monitoring of permanent sample plots (PSPs) established under NAFORMA in various representative vegetation types including establishing new ones where necessary;
- (iii) Estimation at regular intervals of forest cover, stocking, timber and NTFPs, yield, in different vegetation types for management and carbon accounting;
- (iv) Development of affordable technology for collecting, processing and validating tree and forest resources/services database;
- (v) Development of appropriate forest resource assessment methods for local communities;
- (vi) Development of growth and yield models for different species and vegetation types;
- (vii) Quantification of deforestation and forest degradation;
- (viii) Studies on regeneration recovery dynamics for sustainable management of natural forests;
- (ix) Assessment and evaluation of the impact of land use and land cover change on watershed hydrology for improved catchment management; and
- (x) Evaluation of the impact of climate change on hydrology of forested watersheds.

2.1.5 Socio-economics, Policy and Extension

Policy Research:

- (i) Assessment of current revenue collection methods and development of marketing options for forest products;
- (ii) Studies on the effect of various extra-sectoral policies such as agriculture, mining, energy, livestock, land, financial, trade and investment; and international conventions and agreements on the management of forest resources;
- (iii) Studies on global and national Reduced Emissions from Deforestation and Forest Degradation (REDD+) and climate change policies;

- (iv) Assessment of the effect of different policy options on taxes, subsidies, tariffs and regulations; and international transfers to governments to protect forests;
- (v) Assessment of variables that affect supply and consumption of forest products from different production systems;
- (vi) Studies on opportunity costs and trade-offs on land use options;
- (vii) Studies on different forest concession options for sustainable forest management; and
- (viii) Studies on the adoptions, and impacts of existing forest policy on the management of forest resources.

Socio-economic:

- (i) Studies on socio-economic impact of anthropogenic activities on forest resources and the surrounding communities;
- (ii) Climate change impacts on forests and livelihoods, adaptation and mitigation measures;
- (iii) Studies on effectiveness of Participatory Forest Management (PFM) and cost benefit analysis in forest management and estimation of opportunity costs for different land uses;
- (iv) Investigation of factors contributing to failure to meet woodfuel, pole and construction timber demand;
- (v) Investigation of modes of land and tree tenure, and the effect of alternative property right regimes on sustainable forest management;
- (vi) Contribution of the forest sector to food security, GDP, local economy and employment;
- (vii) Studies on the magnitude of environmental benefits including eco-tourism potentials;
- (viii) Studies on tangible and intangible values of various forest ecosystems including mangroves;

- (ix) Modalities of payment for environmental services (PES) including carbon trade opportunities at local and national levels;
- (x) Studies on financing mechanisms for sustainable forest management;
- (xi) Studies on effects of crosscutting issues on forest management including gender, HIV and /AIDS, non-communicable diseases, unemployment, governance and environment;
- (xii) Assessment of impacts of invasive species on rural livelihoods; and
- (xiii) Assessment and promotion of value addition of forest products.

Forestry Extension:

- (i) Studies on effectiveness of extension services and dissemination on forest management;
- (ii) Studies on the impact of technologies and forestry programmes/projects to local communities' livelihoods; and
- (iii) Surveys of existing indigenous forestry knowledge under different land use systems.

2.1.6 Sustainable Harvesting and Utilization of Forest Resources

Sustainable harvesting of forest resources:

- (i) Studies on optimum logging productivity under various terrain conditions at minimum costs;
- (ii) Assessment and improvement of forest staff working conditions and welfare;
- (iii) Development of road design guidelines which minimize road construction, hauling and maintenance costs;
- (iv) Studies on logging and log/timber hauling technologies, costs and their impacts on roads;
- (v) Studies on impacts of harvesting trees and Non Wood Forest Products (NWFPs) on environment;

- (vi) Development of harvesting guidelines/protocols for woodlots, plantations and natural forests;
- (vii) Studies on integrated logging system for efficient utilisation of forest resources, and
- (viii) Studies on sustainable harvesting of NTFPs.

Sustainable utilization of forest resources:

- (i) Studies on anatomical, physical and strength properties, and natural durability of wood as basis for timber grading and classification for different uses;
- (ii) Studies on the use of different biomass materials and processing technologies in wood based industries;
- (iii) Studies on value addition and marketing of timber and NTFPs;
- (iv) Studies on investments and business enterprises in wood based and non-wood products including artisanal woodworks and crafts;
- (v) Development of efficient technologies for producing quality biomass energy from different tree species and other sources;
- (vi) Development of technologies for converting biomass material into gaseous and liquid fuel;
- (vii) Studies on forest certification schemes for international trade;
- (viii) Evaluation of environmental friendly wood treatment technologies, including use of indigenous knowledge for efficacy tests of various plants;
- (ix) Assessment of indigenous knowledge with respect to use and management of timber and NTFPs; and
- (x) Studies on recovery rates of different technologies for converting wood into different forms for sustainable forest management.

2.2 National Beekeeping Research Programmes

The National Beekeeping Research Programmes have been drawn from the National Beekeeping Research Master Plan I (NABERM I) which covers the period 2020 to 2030.

It has six Research programmes:

- (i) Conservation of Conservation of Honey bees and their Habitats;
- (ii) Conservation of Stingless Bees and their Habitats;
- (iii) Harvesting, Processing and Packaging of Bee Products;
- (iv) Beekeeping-Based Industries and Services;
- (v) Bee Products Markets and Marketing Systems; and
- (vi) Socio-Economic, Policy and Extension.

The following are research focus areas:

2.2.1 Conservation of Conservation of Honey bees and Their Habitats

Bee hives and accessories:

- (i) Establish bee hive standards (type, size, entrance size and position);
- (ii) Design bee hives and accessories suitable for production of bee products other than honey and beeswax;
- (iii) Identify locally available tree species and other materials suitable to bees for making hives; and
- (iv) Carry out studies on traditional beehives aiming at conserving bees and their habitats.

Honeybee colony management:

- (i) Carry out colony manipulation to increase their number, acquire desired traits and achieve optimal yield;
- (ii) Conduct studies on baiting materials, height of hive from the ground, hive entrance direction in different ecological zones to increase hive occupancy rate;

- (iii) Undertake studies on migration, swarming and absconding behavior of bees in different areas;
- (iv) Develop beekeeping calendar specific to vegetation zones in the wake of climate change;
- (v) Study beekeeping adaptation practices in the face of climate and land use changes;
- (vi) Establish methods for controlling pests, predators, diseases and disorders;
- (vii) Study effects of shifting bee colonies between ecological zones on bees and beekeeping;
- (viii) Develop colony management techniques for harvesting different bee products (other than honey and beeswax);
- (ix) Examine commonly used fuels for bee smokers, their effect on bees and bee products; and
- (x) Carry out cost-benefit analysis of different beekeeping models.

Data base on beekeeping resources:

- (i) Map beekeeping potential areas;
- (ii) Study the carrying capacity of bee colonies in a specified vegetation area;
- (iii) Identify different types of honeybees in different ecological zones;
- (iv) Study indigenous knowledge in beekeeping industry (hive making, siting, inspection, harvesting, processing, storage and use of bee products);
- (v) Carry out surveillance of occurrence of invasive species and their effect on beekeeping industry; and
- (vi) Carry out inventory on beekeepers, apiaries, bee colonies and productivity of hives.

Beekeeping in different forms of land uses:

- (i) Identify important factors in arranging Joint Management of protected areas and other forms of Public Private Partnership (PPP) with reference to beekeeping;
- (ii) Undertake studies on equitable mechanisms for joint beekeeping activities in agricultural, protected areas, open areas and private owned lands (different ecological zones);
- (iii) Carry out studies on socio-economic and ecological contribution of beekeeping in protected areas;
- (iv) Examine the use of pesticides and their effects in beekeeping industry;
- (v) Determine and promote plant species suitable in api-agroforestry systems; and
- (vi) Carry out studies on pollination requirements of various plant species by bees in farmland and forest areas.

2.2.2 Conservation of Stingless Bees and their Habitats

- (i) Develop standards for stingless bee products;
- (ii) Identify species of stingless bees and their distribution;
- (iii) Carry out studies on biology and behaviour of stingless bees;
- (iv) Develop and promote use of suitable hives and their siting methods;
- (v) Develop suitable colony management regimes in different areas;
- (vi) Identify important fodder/forage resources for stingless bees;
- (vii) Study the impact of transferring colonies from natural nests to another nest; and
- (viii) Carry out studies on occurrence of pests, predators and diseases including control methods.

2.2.3 Harvesting, Processing and Packaging of Bee Products

- (i) Assess factors of importance that influence consumer preferences;
- (ii) Assess efficiency and effectiveness of existing collection and processing facilities;

- (iii) Develop suitable and affordable harvesting, processing and storage technology that ensure quality bee products;
- (iv) Carry out post-market surveillance for bee products; and
- (v) Carry out studies on appropriate packaging materials, packaging design and handling of bee products;

2.2.4 Beekeeping-Based Industries and Services

- (i) Assess the existing beekeeping based industries;
- (ii) Carry out study on suitable beekeeping equipment in different ecological zones;
- (iii) Develop various secondary bee products;
- (iv) Analyze nutritional and medicinal values including api – therapy services;
- (v) Identify and promote unique api-tourist attractions; and
- (vi) Identify traditional values and myths in beekeeping for tourist attraction.

2.2.5 Bee Products Markets and Marketing Systems

- (i) Examine existing players and their roles in the bee products value chain;
- (ii) Assess market forces/factors that determine prices of bee products along the value chain;
- (iii) Assess bee products and determine their properties;
- (iv) Map bee products based on their geographical, botanical origin and physicochemical properties;
- (v) Conduct studies on market potential of bee products;
- (vi) Identify important factors in determining location of collection and processing centers for bee products; and
- (vii) Develop financing mechanism for different beekeeping models along the value chain.

2.2.6 Socio-Economic, Policy and Extension

- (i) Identify existing gaps in policy, legislations and law enforcement in beekeeping;
- (ii) Undertake studies on the effect of various relevant policies, and international conventions and agreements on the management of bee resources;
- (iii) Assess the effects of different policy options on taxes, tariffs and subsidies;
- (iv) Assess impact of regulatory framework to beekeeping industry;
- (v) Undertake studies on gender and youths involvement in beekeeping;
- (vi) Conduct a study on effectiveness of different extension services and dissemination of research findings on beekeeping management;
- (vii) Study the impact of various technologies and beekeeping programmes/projects to local communities' livelihoods; and
- (viii) Examine enabling environment for investment in beekeeping.

3.0 TAFORI LATEST PUBLICATIONS OF REGIONAL AND GLOBAL RELEVANCE FOR FORESTRY AND BEEKEEPING RESEARCH

1. **Uisso, A.J.**, Chirwa, P.W., Ackerman, P.A. and Mbwambo, L. (2021). Non-carbon benefits as incentives for participation in REDD+ and the role of Village Participatory Land Use Plans in supporting this: Insights from Kilosa District, Tanzania, *Journal of Environmental Planning and Management*, 64(6): 1111 – 1132. <https://doi.org/10.1080/09640568.2020.1802239>.
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9. **Msalilwa, U.**, Munishi, L. Makule, E. and Ndakidemi, P.A. (2020). Physicochemical Properties, Fatty Acid Composition, and the Effect of Heating on the Reduction of Cyclopropenoid Fatty Acids on Baobab (*Adansonia digitata* L.) Crude Seed Oil. *Journal of Lipids*, 2020(2), Article ID 6691298, 13 pages. URL: <https://doi.org/10.1155/2020/6691298>
10. **Msalilwa, U.**, Ndakidemi, P.A., Makule, E. and Munishi, L. (2020). Demography of Baobab (*Adansonia digitata* L.) population in different land uses in the semiarid areas of Tanzania. *Global Ecology and Conservation*, 24. DOI: 10.1016/j.gecco.2020.e01372.
11. Sungusia, E., Lund, J.F., Hansen, C.P., **Amanzi, N.**, Ngaga, Y.N., Mbeyale, G., Treue, T. and Meilby, H. (2020). Rethinking Participatory Forest Management in Tanzania (No. 2020/02). IFRO working paper
12. **Njoghomi, E. E.**, Valkonen, S., Karlson, K., Saarinen, M., Mugasha, W.A., Pentti, N., **Balama, C.** and Malimbwi, R. (2020). Regeneration Dynamics and Structural changes in Miombo Woodland stands at the Kitulangalo Forest Reserve in Tanzania. *Journal of Sustainable Forestry*. <https://doi.org/10.1080/10549811.2020.1789478>
13. **Sawe, T.C.**, Nielse, A., Ørjan, T., Samora, M. and Eldegard, K. (2020). Inadequate pollination services, constraints watermelon yield in Tanzania. *Basic and Applied Ecology*, 44: 35-45. <https://doi.org/10.1016/j.baae.2020.02.004>
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16. **Maguzu, J., Uisso, A.J.**, Nshubemuki, L., Mlowe, E., **Pima, N.E., Mushumbusi, R.P.** and Nyanda, H.N. (2020). Social physical-chemical properties as indicators of site suitability for commercial forest plantation establishment in Tanzania. *International Journal of Forest, Soil and Erosion (IJFSE)*, 10(3): 34-43
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Tanzania Forestry Research Institute
P. O. Box 1854 | Morogoro | Tanzania
Tel: +255 23 2935174 | Fax: +255 23 2935174
Email: tafori@tafori.or.tz | Website: www.tafori.or.tz