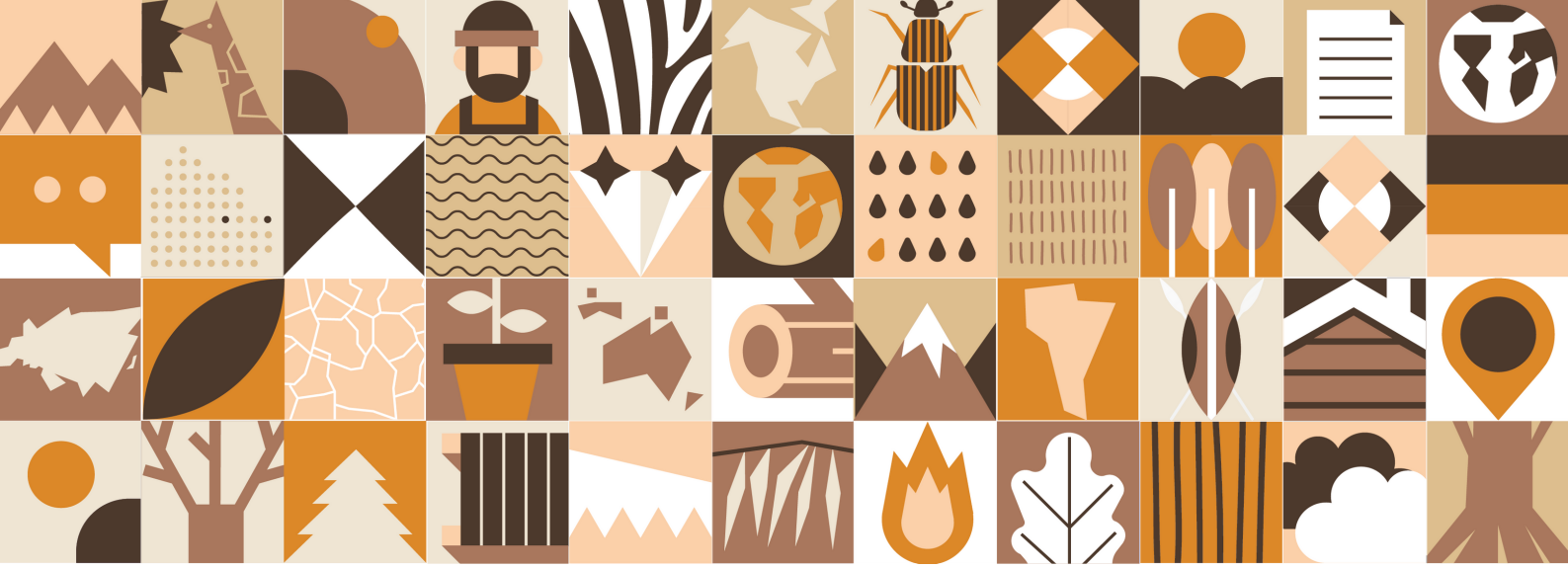

5TH INTERNATIONAL CONGRESS ON PLANTED FORESTS

BOOK OF ABSTRACTS

7-10 NOVEMBER 2023

CIFOR-ICRAF CAMPUS

NAIROBI, KENYA

BOOK OF ABSTRACTS

5th INTERNATIONAL CONGRESS ON PLANTED FORESTS

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Session 1: Plantation in new business models: investing into wood production restoring ecosystem services and enhancing livelihoods.

Abstract n°1

Full name: Nellie Oduor*[1,2] **Email:** noduor@kefri.org

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[2] Kenya Forestry Research Institute (KEFRI), P. O. Box 20412-00200 Nairobi, Kenya

Co-authors: Selim Reza[1]

Abstract title: A community led bamboo charcoal enterprise development initiative in Busia, Kenya

Abstract

Unsustainable wood fuel production has been responsible for increasing deforestation and widening supply-demand deficit of wood fuel in Kenya. This has threatened livelihoods of vulnerable communities while accelerating climate change. Bamboo is a perennial resource, and charcoal produced from it can be used as an alternative to wood charcoal for household clean energy. Bamboo is fast growing, high yielding and can be sustainably harvested annually. Bamboo having a high carbon sequestration potential has relatively high calorific value of 19.8MJ/kg and thus can be used to generate heat. Carbonized bamboo charcoal has high calorific value ranging between 26 and 29 MJ/kg. This paper looks at a study that captures the processing of bamboo charcoal using the Public Private and People Partnership (P4) approach. This is known as the NCPP (Non-profit + Community + Public Partnership) model enterprise situated in Busia, Kenya, with community participation. It exemplifies the business practices adopted by the local community in order to safeguard natural resources and boost people's standard of living. The method has the potential to be implemented widely across African nations.

Keywords

Africa, Charcoal production, Community Enterprise Clusters, Energy, INBAR, Quality Planting Material

Session 1: Plantation in new business models: investing into wood production restoring ecosystem services and enhancing livelihoods.

Abstract n°2

Full name: Anna Ioannou **Email:** anna.ioannou@fao.org

Organisation: FAO

Abstract title: Challenges and enablers for landholder-supporting projects to access the voluntary carbon market and carbon credit payments

Abstract

Carbon markets are growing and practices removing carbon dioxide emission are gaining popularity amongst buyers of carbon credits. Although Asia represents a large portion (70% in 2021) of issued carbon credits globally, it is centred around a few countries in the region (WorldBank,2022). Untapped opportunities exist for capturing carbon through forests and other trees, for example through agroforestry, on marginalized and/or abandoned land. There is momentum for other countries in the Asia-Pacific, with small- and middle scale landholders as core land users (FAO,2020), to access carbon markets and diversify their incomes through carbon sequestration, at the same time strengthening climate change mitigation and adaptation measures in the region.

Drawing from a survey and interviews with projects that support smallholders in Asia-Pacific to access carbon markets, this talk summarizes lessons observed, constraints and opportunities for smallholders to access carbon-credit benefits. One of the identified enabling factors for projects supporting smallholders to enter the carbon market is the availability of one-on-one guidance and having project staff with previous experience of carbon sequestration and certification processes. Carbon crediting mechanisms' guiding documents are also helpful, although with the constraint that every project must develop their own tool for calculation. Other identified challenges are the high verification costs and difficulties to access funds for early project stages. It will also be discussed projects 'possibilities to survive solely on carbon credit sales, and how to avoid carbon projects and markets from becoming yet another channel for development aid.

World Bank, (2022). State and Trends of Carbon Pricing 2022. Available: https://openknowledge.worldbank.org/handle/10986/37455 [Accessed 07-June-2022]

FAO, (2020). Hundreds of millions of family farmers in Asia-Pacific need help to ensure food security in the face of pandemic. Available: https://www.fao.org/asiapacific/news/detail-events/en/c/1300780/ [Accessed 08-June-2022]

Session 1: Plantation in new business models: investing into wood production restoring ecosystem services and enhancing livelihoods.

Abstract n°3

Full name: Hubert Inhaizer **Email:** Hubert.Inhaizer@pefc.org

Organisation: PEFC

Abstract title: How PEFC responds the topic of forest plantations in the context of global challenges addressed through national initiatives to meet growing needs in wood products, restore forest ecosystems, and mitigate climate change

Abstract

PEFC is an umbrella organization, which endorses national and regional forest certification systems that have been developed through multi-stakeholder processes and tailored to local priorities and conditions. It is fundamental that forest certification needs to be local; this is why PEFC works with national organizations to promote and implement sustainable forest management (SFM). While these national systems are developed locally, they need to be recognized internationally. To ensure consistency with international requirements, all national forest certification systems undergo rigorous third-party assessment against our unique Sustainability Benchmarks before they can achieve or maintain their endorsement. There are currently 46 endorsed national and regional forest certification systems covering 280 million hectares of certified forests and over 20,000 certified companies in 50 countries around the world. At the core of PEFC's work is forest certification. With around 280 million hectares of PEFC-certified forest, PEFC is the largest forest certification system in the world.

PEFC's main strength comes from the national working groups and their dialogue on how the international SFM benchmark standard (PEFC ST 1003) can be interpreted to the national conditions. This bottom-up approach allows to clearly identify the scope of the certification implementation. PEFC ST 1003 has three sets of requirements. The core set of SMF requirements generally developed for forest management and this is being applied most. To allow better recognition of the sustainability features of the wide scale of forest management systems, there are interpretation possibilities for forest plantations (Annex 1) and trees outside forest (Annex 2). It's important to note, that both Annexes are relying on the core set of requirements, however they provide possibilities for specific aspects of the management of forest plantations and trees outside forest.

The importance of forest plantations and their contribution to the global supply chain are receiving more and more recognition. PEFC is starting to collect certification scope specific information in its database to have better overview of the composition of the covered 280 million hectares of PEFC-certified forest.

Examples of sustainability safeguards for forest plantations from PEFC endorsed systems:

- Australia
- Italy
- Uruguay

The development of international standards is central to PEFC's work. These standards form the basis for nearly all PEFC activities, from endorsing national systems to providing certification solutions. Every standard goes through a detailed and rigorous development process, which is consensus-driven, open and transparent and involves all relevant stakeholders. Multi-stakeholder working groups drive this process. They build consensus on the technical documentation, relying on the involvement of active

and committed individuals from different interest groups. The upcoming application date of the EUDR also triggered preparations at PEFC to make sure that our system delivers on these requirements as well.

Session 1: Plantation in new business models: investing into wood production restoring ecosystem services and enhancing livelihoods.

Abstract n°4

Full name: Nick Embden **Email:** nick.embden@gatsbyafrica.org.uk

Organisation: Gatsby Africa

Abstract title: Lessons from 30 years of investments in African commercial forestry and what this means for future investments to achieve sector transformation

Abstract

Gatsby Africa and Criterion Africa Partners are undertaking a research study examining the past 30years of investments into Africa's commercial forestry sectors. The study will unpack key lessons that have affected performance on a commercial and impact basis, and what this means for future investments, taking into account new opportunities of carbon markets. The objective is to produce a white paper to serve as a guide to new investors looking to enter the African forestry space. The study will use a unique dataset of investment transaction data held by Criterion Africa Partners, coupled with a range of stakeholder interviews, to provide a detailed overview of the challenges and opportunities, covering both industrial scale and smallholder forestry.

The study is currently on-going and will be complete by July 2023. An updated abstract would be able to be submitted at this point. A presentation of this study would be made jointly by Nick Embden at Gatsby Africa, and Jim Heyes at Criterion Africa Partners.

Session 1: Plantation in new business models: investing into wood production restoring ecosystem services and enhancing livelihoods.

Abstract n°5

Full name: Issa Katwesige **Email:** issakatwesige@gmail.com

Organisation: Ministry of Water and Environment

Abstract title: National Incentives Schemes for Commercial Forestry Plantations in Uganda

Abstract

In order to advance plantation forestry in Uganda, the Ugandan government, through the Ministry of Water and Environment, has adopted effective Public-Private Partnership models over the past two decades.

This was aimed at reducing the highest levels of natural forest loss, which reached the peak between 2005 and 2010. The drivers of these losses were mainly associated with conversion of forestry land into agricultural farmlands, governance challenges, high population growth and associated consumption, forces of demand for wood from emerging markets of timber and poles, etc.

The most practical solution that the Ugandan government adopted was to mobilize funds and other incentive schemes to support commercial plantation forestry. The primary goals were to reduce natural forest loss, generate alternatives, generate jobs and incomes, and stimulate the forest-based industries. To accomplish this, a number of policy and administrative reforms have been implemented, including: revision of forestry policy, strengthening of CSO partnerships, land licensing for plantation forestry by the private sector in government forest reserves, Sawlog Production grant schemes, adoption of FSC certification, and models for value addition.

The Ministry of Water and Environment is currently working with a number of development partners such as World Bank (IFPA CD Project) and European Union to reduce the cost of plantation establishment in order to encourage many Ugandans to adopt tree growing. The ministry is also pursuing partnerships with the private sector, including providing seed funding to facilitate establishment of cluster-based processing hubs to strengthen value addition and product diversification, revising vocational training curriculum to address the value addition gap, and promoting the export and import substitution for forest products. It is envisaged that after achieving the aforementioned, plantation forestry will be self-sufficient in the country.

Session 1: Plantation in new business models: investing into wood production restoring ecosystem services and enhancing livelihoods.

Abstract n°6

Full name: Rodney Keenan **Email:** rkeenan@unimelb.edu.au

Organisation: University of Melbourne

Abstract title: The business case for trees on farms

Abstract

Australian livestock farmers are focused on reducing greenhouse gas emissions from farm operations. Treeson farms are a potential pathway to achieving this goal. These trees can also provide benefits for livestock production, such as reduced lambing losses and increased animal productivity from shade and shelter. These benefits, and wider environmental outcomes have been understood for some time, but data from specific experiments and demonstration sites are often difficult to extrapolate to other farm systems or different conditions.

Consequently, many farmers do not grow trees on their property because they do not have good metrics on which to assess the value proposition for growing trees on their farm. This paper describes results from a project supported by Meat and Livestock Australia which used surveys of livestock graziers with established trees and farm systems modelling to quantify the benefits and costs of trees on farms to support improved decision making for integrating trees on farms for carbon neutrality.

The results indicate the financial cost and benefits for farmers investing in trees, including from timber production, and different approaches to estimating the value of carbon sequestration in trees for Australian graziers. The wider implications of these results for family farmers in other countries will be discussed.

Session 1: Plantation in new business models: investing into wood production restoring ecosystem services and enhancing livelihoods.

Abstract n°7

Full name: Jacek Siry **Email:** jsiry@uga.edu

Organisation: University of Georgia

Abstract title: Transforming African forest plantations into mainstream, globally demanded timberland investment opportunities: developing a business model that works.

Abstract

Forest plantations play an important role in meeting our needs for wood products and environmental goods and services. They possess several attributes that should make forest plantation projects in Africa an ideal investment for the world's leading timber investors, including Timberland Investment Organizations (TIMOS) and Timber Real Estate Investment Trusts (Timber REITS), as well as other investment organizations. While global timber investors must have examined some of commercial plantation opportunities, to date Africa has attracted limited global investment funds. This presentation examines the reasons behind the limited success of commercial forest projects in attracting funding from leading global investors.

We begin by examining marketing information availability, which would allow projects pass an initial screen before more substantial analytical resources are devoted to the evaluation of commercial plantation projects. We also discuss information needs of investors which have to be met before projects can be analysed and evaluated, ranging from project specifics to the general investment climate. This will allow assessing any information gaps as well as effective global investment marketing strategies.

We then address the opportunities for improving product quality, value added production, new product development, standardization, international grading specifications, and a positive environmental perception of plantations in producing and consuming countries. Global investors, with a proven track record and commitment to sustainability, can bring much needed funds for plantations projects, while generating a range of benefits for producing regions.

Session 1: Plantation in new business models: investing into wood production restoring ecosystem services and enhancing livelihoods.

Abstract n°8

Full name: Joost Hamelink (replaced by Margreet Muizenbelt) **Email:** joost.hamelink@rabobank.com

Organisation: Rabobank (Acorn)

Abstract title: Using the carbon market to help smallholder farmers to switch to agroforestry

Abstract

Acorn is Rabobank's response to climate change, a threat that affects us all, but that disproportionately disadvantages smallholder farmers in developing countries. Acorn is an acronym for Agroforestry Carbon Removal units for the Organic Restoration of Nature. With Acorn, we unlock the international voluntary carbon market for smallholder farmers in Africa, Asia, and South America.

Acorn's mission is to support and compensate millions of smallholder farmers globally in a transition to sustainable agroforestry practices. We turn the CO2that is sequestered through agroforestry into carbon credits to be sold on the voluntary carbon market. We developed an innovative and scalable method for measuring, certifying, and monetizing the biomass growth of planted trees and turning that growth into

Carbon Removal Units (CRUs). The CRUs (or carbon credits) are sold to organizations with strong emission

reduction commitments. To close the loop, 80% of the income of every sold CRU flows back to the original smallholder.

By implementing our program at scale, we can leverage income from the carbon market to help millions of smallholder farmers around the world to adopt agroforestry and plant more trees on their land.

Session 1: Plantation in new business models: investing into wood production restoring ecosystem services and enhancing livelihoods.

Abstract n°9

Full name: Sammy Letema **Email:** tonymwasi@gmail.com

Co-authors: Cheboiwo J.K.,Wekesa L., Langat D., Kiprop J. and Anthony Macharia, Anthony Macharia

Organisation: Kenya Forestry Research Institute

Abstract title: The status, Operational and Institutional Arrangements of Private Forestry in Kenya

Abstract

There are three categories of forests in terms of ownership in Kenya namely private forests that include farm and corporate forests, community forests owned by communities and public forests owned by public agencies. The existing forests are mostly managed for commercial production, conservation and provision of environmental goods and services. The community forests/woodlands are mostly found in the ASALs and forms the largest category in terms of area occupying estimated at 24,510,000 hectares. Private forests are estimated at 10,385,000 hectares mostly located within agricultural landscape and the public forests are estimated at 3,467,000 hectares with forest plantations accounting for 135,000 hectares. Public forests face severe degradation and area losses due to demographic and governance challenges thus making private forests greatest potential to expand forest area and production into the future. However, documentation of trees on farms and private lands is characterized by limited information and data to guide private investment and policy decision making. The review study was aimed at documenting evolution of private forests, their current studies and potential to contribute to the socioeconomic development in the country. The study used various databases, websites and information on forests owned by private entities in the country since 1800s. The study involved literature reviews, and controlled interviews with key actors in the forestry sector to generate complementary information. The study findings shows that tree growing by private entities in Kenya has long history shaped by various land use policies and laws with influence of related factors such to land scarcity, population density and markets. The private sector has developed and positioned itself as critical player in the supply of roundwood to saw mills, pole wood for preservation plants, firewood for food processing industries among others. Farm forestry forms the largest category with varying objectives and management as compared to those owned by large scale investors and corporate entities that are professionally managed with greater efficiency and productivity in both primary and secondary production levels. Farm forests are fast changing from subsistence and amenity into commercial orientation driven largely by diverse markets for forestry products and good economic returns. These developments are transforming and positioning the private sector into a vibrant enterprise to complement the government ambition to attain and maintain 30%tree cover by 2032 while generating incomes and environmental good and services. The sector with favourable policy and regulatory frameworks with emerging institutionalization of social and carbon financing will play important role in forestry growth and development into the future.

Key words: Farm forests, private forests, forest production, social investment

Session 2: Societal perception of plantations and governance

Abstract n°10

Full name: Joram Kagombe **Email:** jokagombe@kefri.org

Organisation: Kenya Forestry Research Institute (KEFRI)

Abstract title: An assessment of the policy and legislative frameworks to upscale commercial forestry in Kenya

Abstract

Kenya has developed a strategy to increase tree cover to 30% by 2032 and forest cover from 8,83% to over10%. The strategy underpins role of commercial forest in delivering 35% of the projected 15 billion trees. This will address wood product deficit of 10 million m3 per year. Commercial forest will focus on land in private and community lands with the highest proportion planted in Arid and Semi-Arid areas. For this to be realized, commercial forestry should be profiled as competitive land use option for it to attract entrepreneurs.

This paper explores policy and legislative framework for commercial forestry in Private and public land. Document is a desk review combined with discussions with key sector players. Forest Management and Coordination Act2016 contains most of the requirements outlined in the FAO Voluntary guidelines on forest concessions. However, there is need to address gaps such as: the harvesting value, improving efficiency in forest revenue collection, evaluation of the concession process and mode of bidding. Commercial forestry should be Promoted a long-term investment venture by ensuring secure land tenure, respect for private ownership, development of reliable economic guidelines and standards, transparent governance, effective measures for tackling corruption, and efficient conflict resolution mechanism.

The Public Private Partnership Act, 2021, capped the duration of 30 years that is short for a forest enterprise. The Act also lack a specific legal framework for establishment of PPPs in commercial forestry. Other hindrances to commercial forestry include limited access to high quality germplasm, inadequate incentive to promote uptake of innovations, unclear benefit sharing mechanisms, low conversion of processed wood, Inadequate market outlets, inadequate capacity of stakeholders and low financing of the forest sector.

The paper recommends a review of existing forestry policies and legal frameworks to align with to address gaps in commercial forestry and Provide incentives to attract private sector investments into commercial forestry.

Session 2: Societal perception of plantations and governance

Abstract n°11

Full name: Sarah Juster **Email:** shj22@vt.edu

Co-authors: John Munsell

Organisation: Virginia Tech

Abstract title: Comparing Tree-Based Interventions in a Uganda Refugee Settlement

Abstract

Refugee resettlement represents a global environmental quandary. Deforestation is a particular concern in areas where refugees depend heavily upon trees for fuelwood and shelter-building purposes. Tree-based interventions (TBIs)—including woodlots, agroforestry, and tree conservation efforts– are increasingly promoted in displacement settings to reduce environmental harm while improving human health and well-being among refugees and hosts. Although the social and environmental benefits of TBIsin displacement settings are evident, less understood are their unique qualities.

This research studies and synthesizes the differences and similarities of TBIs implemented by four non-governmental organizations(NGOs) in the Imvepi refugee settlement of northwest Uganda. The selection of four NGOs as case studies is driven by their diversity of services offered, ranging from the distribution of tree seedlings to households, to community woodlot establishment, to the planting of food forests at local institutions. Imvepi—hosting nearly 65,000 predominantly South Sudanese refugees—provides the chance to deeply explore the scale, resources, and guiding philosophies of each case organization. Semi-structured interviews will be conducted with local and administrative staff from NGOs in May, June, and July 2023. Data will also include TBI site visits and the review of organizational documents and reports. Synthesized TBI characteristics will inform the development of a qualitative scenario decision support tool—a dichotomous flowchart to guide the selection of appropriate TBIs based on context and capacity across a range of social and environmental displacement settings.

TBIs are a crucial feature of organizations focused on the well-being of displaced people and surrounding landscapes, yet TBIs differ depending on the resources and mission of a given organization. This study analyses differences and similarities across programs and synthesizes the spectrum of activities and services into a single framework applicable across diverse displacement contexts.

Session 2: Societal perception of plantations and governance

Abstract n°12

Full name: Lucie Félicité TEMGOUA **Email:** temgoualucie@yahoo.fr

Organisation: University of Dschang

Abstract title: Creating local forest plantations: Can farmers make a difference in western Cameroon?

Abstract

In Cameroon reforestation has become essential in region of the country where the natural forest cover was no longer sufficient to meet the needs of the population. Despite the significant financial and technical efforts deployed for their establishment, the areas covered by state plantations have continuously regressed. Meanwhile, as state plantations were devastated by fire and encroachment, farmers adopted exotic and local species to introduce them into cropping systems, or to plant them as pure stands.

The study of the practices of farmers in western Cameroon shows that there is a wide range of behaviour concerning the silviculture. Farmers show ingenuity to adapt traditional systems or integrate external technologies and adapt them to their current needs and their ability, while looking at different uses, sometimes over several generations.

Thus, for private Eucalyptus plantations, they integrated the system used by state departments and projects, innovating in the following areas: plant production and direct seeding, spacing, association with crops, coppice selection, and diversity of products.

Regarding the traditional live fences, we found that species that have no current use are eliminated in Favor of new species. These are selected, on the base of family needs and local market opportunities. For example, near the art center of Foumban, Polysciasfulva is planted because wood can be sold to the sculptors of masks. Canarium schweinfurthii, a multipurpose species (fruit and timber), with an average growth, is largely retained and planted.

It is surprising to see farmers planting hedges with local species producing timber after more than 50 years, as Podocarpus mannii or Entandrophragmacandollei while the state itself does not. It should, however, be noticed that individual farmer initiatives are not often supported by the administration and that their diffusion is often blocked by badly adapted (or interpreted) protectionist laws. For example, a farmer can freely exploit the exotic species (eucalyptus, pines) he planted but not local species (E. Candollei orC. schweinfurthii) for which he has to obtain a cutting license. When the state plantations burn in a general indifference, despite the best efforts of their managers, it is recommended to explore the possibilities of credits and support for private and peasant reforestation which presents better results.

Session 2: Societal perception of plantations and governance

Abstract n°13

Full name: Gary Dunning **Email:** gary.dunning@yale.edu

Organisation: The Forest School at the Yale School of the Environment

Abstract title: Key Learnings from a Yale University/FAO Webinar Series on Smallholder Planted Forests and Trees for Climate, Restored Landscapes, and Livelihoods

Abstract

During the Spring of 2023, the Forest School at the Yale School of the Environment coordinated a webinar series on smallholder forestry practices, risks, and policies. The series was co-created and co-hosted by the Food and Agriculture Organization (FAO) Forestry Division. The Webinars included a diverse array of speakers that explored vital issues related to harnessing the potential of smallholder planted forests and trees to contribute to the provision of environmental services, including addressing climate change, and livelihoods. A significant portion of planted forests and trees outside forests are owned and/or managed by smallholders, and while smallholder forestry, has a long history in Western Europe and North America, it has rapidly expanded in recent years to other parts of the globe. But smallholders face technical, commercial, policy, and institutional challenges that hamper their performance, negatively impact their returns on investment, and ultimately affect their long-term viability.

With speakers from Africa, Europe, Latin America, Asia, and North America, the series showcased effective practices and models, like silvopastoral agroforestry, poplar roundwood plantations, and community restoration projects, and identified important barriers to success, including land tenure policy, financial constraints, and evolving/uncertain global markets. While specific smallholder forestry practices are tied to local biogeography, land-use history, and cultural values, these farmers and forest owners play a key role in providing sustainable products, conserving biodiversity, and adapting to climate change for local and global communities. This presentation/event will highlight the important findings from the series and open a conversation to showcase stories of smallholders from around the world and share avenues to support and promote expanding best practice in smallholder forestry going forward.

For this presentation, we propose two options:

Option 1 (longer):

Event including:

- A keynote speaker to present key findings

- Moderated Panel Discussion with series speakers or other stakeholders

- Concluding remarks and brief Q&A

Option 2 (shorter):

- Speaker to present key findings

Session 2: Societal perception of plantations and governance

Abstract n°14

Full name: Batachoka Mastaki Daniel **Email:** mastakidaniel5@gmail.com

Organisation : Centre de Recherche en Gestion de la Biodiversité et Changement climatique (CRBC)

Abstract title: Perceptions locales et utilisation des espèces des forêts plantées dans le territoire de Walungu en République Démocratique du Congo

Abstract

Les forêts plantées du territoire de Walungu sont une source des revenus pour les communautés locales et les concessionnaires. Ces écosystèmes fournissent de nombreux autres services tels que le loisir, l'atténuation du changement climatique, l'amélioration de la qualité de l'eau, le contrôle de l'érosion et l'atténuation des inondations. Cependant, les propriétaires des forêts plantées sont plus préoccupés par le gain économique que par ces services ci-haut évoqués. Les investigations ont été réalisées auprès de trente propriétaires des forêts plantées dans deux groupements (Karhongo et Nduba) du territoire de Walungu. Les forêts plantées sont constituées de plusieurs espèces, généralement des espèces exogènes, introduites dans la région depuis l'époque coloniale. Ces espèces sont principalement l'eucalyptus sp, le Grevillea robusta, le Cupressussemperviren, le Podocarpus macrophyllus, le Maesopsis eminii et le Prunus sp. L'Eucalyptus sp est entête dans toutes les forêts plantées occupant plus de80% de leurs surfaces. Le choix des espèces plantées est lié notamment à la topographie du terrain/la qualité du sol, à sa croissance (espèce à croissance rapide), à sa valeur économique (qualité des planches, du bois, du charbon de bois), sa résistance au feu et sa pérennité (capacité de repousse).

La conversion des terres agricoles en forêts plantées est également d'actualité dans ce territoire. Les champs agricoles, de fois dégradés, sont transformés en espaces forestiers. Le processus de remplacements fait soit brusquement ou soit progressivement. Cette pratique réduit sensiblement les terres cultivables et, par conséquent, affecte la production agricole dans les deux groupements. Il serait important de revaloriser les forêts plantées dans le territoire de Walungu en mettant l'accent sur tous les services qu'offrent ces forêts, notamment l'atténuation du changement climatique étant ignorés par les communautés locales et de réglementer les surfaces que doivent occuper les forêts plantées pour éviter la diminution des terres agricoles.

Session 2: Societal perception of plantations and governance

Abstract n°15

Full name: Subhash Chander **Email:** syadavhfs02@gmail.com

Organisation: Environment, Forest and Wildlife Department, Government of Haryana

Abstract title: Policies for promotion of Tree Plantations in Haryana, India

Abstract

Haryana is the premier state in north India famous for agroforestry mainly based on eucalyptus and popular based systems. Promotion of wood-based industries and farmers friendly policies has helped in promotion of Tree Plantations on farmers files and on common lands. This has led to socio-economic upliftment of tree growers and restoration of waste lands in the State of Haryana. The best practices and policies that has helped in promotion of Tree Plantations will be presented in the conference.

Session 2: Societal perception of plantations and governance

Abstract n°16

Full name: Joram Kagombe **Email:** jokagombe@kefri.org

Organisation: Kenya Forestry Research Institute (KEFRI)

Abstract title: Potential of Small-Scale Tree growers in On-Farm Plantation Development: Case of Nyandarua Tree Growers Association in Kenya

Abstract

Kenya aspires to grow its tree cover to 30% by 2032with 35% being contributed by commercial forestry. Private forest under small scale holders provide opportunity for forest growth and attainment of 30%tree cover. However, the growers need to come together to access joint technical advisory services, value addition and marketing. The Farm Forestry Program with support of FAO have provided support to tree growers association to upscale commercial forestry with one being Tree Growers Association of Nyandarua (TGAN). This is a legally registered entity under the Societies Act with a membership of approximately 3,000 tree growers in Nyandarua County. It is a member of Farm Forest Smallholders Producer Association of Kenya (FFSPAK). To be able to trade members of TGAN formed a Cooperative society. All the activities that TGAN is engaged in are demand-driven. The demands are identified through a process of problem identification, project planning and project implementation facilitated by the Association in a participatory process. With support from FAO/FFF programme, TGAN implemented the tree census project in 2020 to support farmers undertake an on-farm tree inventory and develop a strategic business plan for sustainable production and marketing of timber products including wood fuel. The results from the census indicated that the net worth of the association is about 53million USD$ hence there is great potential in farm forestry. Eucalyptus constituted48%, Cypress 44%, Pine 3% and other 6%. . By 2023,TGAN had 785 ha under trees and this is projected to increase to 1,578ha in 2,028 and 3.175 ha in 2033.Annual products offered projections by 2023 was5022 tons of carbon, 6840 M3 of saw logs, 6840M3 of firewood and 196,012 pieces of transmission poles. This shows that forestry under small scale tree growers have huge potential to increase forest cover and livelihood of participating farmers. Results recommend continuous capacity building in value addition and marketing, monitoring of stocks held by farmers and tapping into financial models that can support tree growing.

Session 2: Societal perception of plantations and governance

Abstract n°17

Full name: Poojanraj Khurun (replaced by Cecily Cyparsade) **Email:** pkhurun@gmail.com

Organisation: Forestry Service

Abstract title: Promoting inclusive forestry through policy and legislative revisions in the Republic of Mauritius

Abstract

Small Island Developing States like the Republic of Mauritius face multiple challenges of land degradation, shifting climate patterns, decreased agricultural productivity and food and nutritional security as well as food safety. Despite being small the resources to manage forest areas efficiently and resisting forestland conversion to other land uses represents significant challenges. The Forestry service of the Republic of Mauritius is nurturing the inclusion of the private sector and locals to lessen the investment burden for the proper management burden on forest areas. The Forestry Service is providing the enabling environment to facilitate forest lands especially marginal lands and difficult terrains to private entities to undertake forest compatible activities. This approach is seen as a shift away from monocultured forests which are simply economically not viable. The shift focusses on multi-species trees that makes up the forest aiming to achieve sustainable economic growth and green jobs, secure forest land tenure and lessen the cost of reversing land degradation and promote water recharge in underground aquifers. The forest compatible activities being envisaged and encouraged are the production of wood biomass from invasive species, increase wildlife, promote food/nutritional security/safety, innovative industries of nutraceuticals and the diversification of leisure spots away from traditional seaside. This approach would ensure the involvement of a larger chunk of the population into forestry activities and create the necessary momentum to contribute to the GDP in a sustainable manner that in turn enhances the interests of the Government to further invest in the sector.

Session 2: Societal perception of plantations and governance

Abstract n°18

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Organisation: Scion

Abstract title: Public perception of plantation forests for energy – a case from New Zealand

Abstract

Forest plantations play an important role in supporting the transition to a more sustainable and low-carbon economy. These plantations can provide a sustainable source of biomass which can be converted into biofuels such as liquid biofuels or wood pellets. In New Zealand, liquid biofuel is one of the options to decarbonize the transport sector by 2050 by converting wood to drop-in liquid fuels. While the technology is underway, public perception of the potential for growing plantation forests for energy was explored in order to determine public acceptance and political support. A survey was conducted with a total of 1,003 respondents across all the regions in New Zealand in 2022. Key findings show that there is an overall positive attitude towards the use of wood-based liquid biofuel for transport. However, more than50% of the respondents were not aware of the potential increase of large-scale plantations for energy. Despite this low awareness, the majority of the respondents were positive about the potential expansion of small woodlots and forest plantations as feedstocks for bioenergy. Motivations of the respondents were also expressed during the survey. The results provide insights for developing wood-based liquid biofuel policies in New Zealand.

SESSION 3: Planted forests and trees, a critical option for and ecosystem restoration

Session 3a: Best practices and innovations for the sustainable management of planted forests

Abstract n°19

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Abstract title: ARF@pt – a tool to support landowners' and policy decisions

Abstract

Forests cover 35% of Portugal mainland, value similar to the land covered by pastures and shrublands (32%). Therefore, there is a large opportunity for planted forests, either for production of for other purposes. Most land in Portugal is privately owned and landowners are the main responsible for the reforestation/afforestation projects, taking decisions on the basis of the income they expect, including the policy incentives/restrictions available. The ARF@pt tool is a web tool under development designed to support landowners' decision in species selection for afforestation/reforestation projects. The tool is based on the NFI grid of 500 x 500 m and allows to identify the species that can be grown in each pixel. For each combination of pixel-species an average site index and the respective 90, 75, 25 and 10% percentiles are made available. Once the site index is set by the users, different situations of harsh environment and at least two management options can be combined. At present, the tool covers the most important tree species in the country (Maritime pine, eucalyptus and cork oak). For each combination pixel-species-environment-management, the tool simulates the growth and estimates net present value (NPV) using cost and prices provided through a participatory process involving a large committee of stakeholders involved in the project.

ARF@pt can also be used by policy makers in order to incentivise the plantation of slow growing species, with a less favourable NPV but that can contribute more to the so-called public ecosystem services, difficult to value. The idea behind the usability of the tool for policy-making purposes is that public ecosystem services can be valued by the difference in the expected income between two alternative species and/or management.

Session 3a: Best practices and innovations for the sustainable management of planted forests

Abstract n°20

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Organisation: Kwame Nkrumah University of Science and Technology, Kumasi

Abstract title: Assessing Cocoa farmers' perception on the phenological changes and resilience of five selected shade trees: a strategy for mixed plantation and an ecosystem restoration in the Adansi North District and Offinso Municipality of Ghana

Abstract

In Ghana, cocoa farmers are encouraged to grow shade trees in their farms with the aim of crating moist condition, reducing temperature and water stress in their farms and thereby increasing their cocoa production. Climate change is an obvious phenomenon which affect phenological patterns of trees because of their high sensitivity to the change in environmental conditions. Despite the vast scientific research on the effect of the changes on the trees, little is known about cocoa farmers' perception on how the changes in the shade tree's phenology affect cocoa production. Management practices could be greatly improved if these knowledges are acquired and incorporated in the management policy for cocoa farming in Ghana. This could also be used as a strategic option for and ecosystem restoration. The study aimed to access Cocoa farmers' perception on how changes in phenological patterns and resilience of five selected shade trees affect their production and how to overcome these effects in the Offinso municipality and Adani North District of Ghana. Majority of farmers(80%) were of the view that planting cocoa shade trees in their cocoa farms increased cocoa productivity as compared to those with just a few or without shade trees. With limited availability of lands, planting genetically selected trees in cocoa farms is one of the keys for mixed plantation development which will help cocoa farmers boost their productivity as well as helping in ecosystem restoration at very low cost to the government in maintaining them by applying silvicultural practices in response to climate change. Several management practices were given by the cocoa farmers regarding sylvicultural methods used to curb the climate change effects in their cocoa farms

Session 3a: Best practices and innovations for the sustainable management of planted forests

Abstract n°21

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Organisation: University of Alberta

Abstract title: Assessment of soil nutrients and understory vegetation composition in pure vs mixed spruce – aspen forests

Abstract

Mixed forests are often considered a source of resilience in terms of future climate change and related uncertainties. Several studies indicate that mixed forests have the potential to increase soil nutrient availability and biodiversity, compared to monocultures. In this study, we aimed to assess soil nutrient availability and species composition of understory vegetation in white spruce (Picea glauca(Moench) Voss), aspen (Populus tremuloides Michx.),vs mixed stands of aspen and spruce. We used an experiment established 20 years ago with planted white spruce and naturally regenerated aspen to doso. This study involved spot removal of aspen within a2m radius of 400 white spruce per hectare at the time of planting and subsequent thinning of the remaining aspen at age 10. An earlier assessment of the stands before thinning showed that mixed forest didn't increase the soil nitrogen. However, after thinning, mixed-wood stands thinned to the lowest aspen densities appearing to have the highest understory cover. Field inventory will be completed this summer2023 to investigate how soil nutrient availability and vegetation coverage vary with stand characteristics created by treatments and subsequent thinning operations. The preliminary findings will be presented at the conference.

Session 3a: Best practices and innovations for the sustainable management of planted forests

Abstract n°22

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Abstract title: Breeding of *Melia volkensii*: Establishment of Clonal Seed Orchards and Subsequent Progeny Trials in Kenya

Abstract

Melia volkensii is a fast-growing drought tolerant and termite resistant tree that grows naturally in arid and semi-arid areas of Eastern Africa. The species produces high quality timber (similar to mahogany) which can be harvested in 10-12 years. The species has been tested and can be grown on commercial scale in the drylands. Melia has been undergoing a high level of dysgenic selection due to overharvesting of good trees. A breeding strategy for the species was initiated in 2010 that involved initial selection of Candidate Plus trees (CPTs) followed by grafting and establishment of clonal seed orchards, and subsequent progeny trials across 8 sites. The objective of breeding Melia is to supply genetically superior timber producing materials that are adapted to target planting areas. One hundred CPTs were selected between 2010 and 2012 in a range from northern to the Kenyan coast. Scions were collected, grafted and used for establishment of two x 11-Ha, 3000-tree clonal seed orchards in Tiva and Kibwezi in 2012. After three years, seed was collected from the orchards, seedlings raised and used for establishment of 8 progeny trials in a range of sites spanning north east Kenya in Marimanti to south west Kenya in Taita-taveta in 2015. The objectives of the progeny tests were: To compare test the genetic worth of the CPTs, to rank the parent trees based on performance of their progenies, to estimate heritability of traits assessed and the General Combining Ability (GCA) of the female parent trees. Tree height, diameter at breast height (DBH) and at 50cm above ground level (D50), tree form and fecundity were assessed bi-annually. Height growth at 5 years ranged from 3.4 m to 11.2 m for Marimanti, 3.9 m to 11.4 m for Tiva, 3.8 m to 9.7 m for Kibwezi and 3.7 m to 9.8 m for Kasigau. Diameter growth was up to 20.8 cm for Marimanti, 21.6 cm for Tiva, 18.1 cm for Kibwezi and 17.7 cm for Kasigau. Analyses of variance showed highly significant differences among the progeny for all the traits assessed. Ranking of the progenies showed that the best parents were Nos 43, 26, 53 and 49. Family heritability was moderate, 0.52 and 0.41 for height and DBH respectively at 5 years, suggesting a potential for transmitting desirable characteristics to operational commercial forest plantations. Site x family interactions were not significant. Thirty seven of 76 of 100 female parent trees showed a positive GCA for both height and DBH. The results indicate a substantial variation among the selected trees of Melia volkensii and potential further genetic improvement is possible. Establishment of 2nd generation seed orchards has been done and future directions in improvement of the species will aim at establishing 2nd generation progeny tests and release of more improved seed for commercial forestry in the drylands

Keywords: Melia volkensii, tree improvement

Session 3a: Best practices and innovations for the sustainable management of planted forests

Abstract n°23

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Abstract title: Effects of different tree spacing on growth performance of Melia volkensii stand planted in two sites in drylands of Kenya

Abstract

Melia volkensii has been planted extensively by farmers and private forest companies in Kenya for drylands reforestation programmes and has become one of the most valuable timbers. It is a [2]fast-growing drought tolerant species with a rotation age of 10 to 25 years and it produces timber which is durable and termite resistant and which is pale reddish-brown in colour resembling the Khaya species (Mahogany). Melia is planted often at a spacing of 4 x 4 m a spacing adopted from the major exotic industrial species such as *Pinus patula* and *Cupressus lusitanica*. However, there is lack of silvicultural practice especially on spacing and pruning management of on growth performance Melia species. Two experiments were established in Mutomo and Kibwezi sites in farmers' fields at a spacing of 3 x 3 m, 4 x 4 m, 5 x 5 m and 6 x 6 m were assessed. The variables studied were diameter at breast height (DBH), total height and height to the first live branch, survival, number of branches, basal area and volume production at age 10 years. Breast height diameter increased significantly with increasing spacing. The highest DBH for the sites was in 6x6m spacing with Kibwezi's DBH being 14.85±0.77cm while Mutomo DBH had 17.16±0.66 cm. Height increase significantly with decreasing spacing. The highest height was in the spacing of 4x4m PR for the sites with Kibwezi having height of 7.36±0.16m while Mutomo was 7.90±0.17m. A two-way ANOVA revealed that there was not a statistically significant interaction between the effects of site and spacing for DBH ($F(4, 185) = 1.516$, $p = 0.199$) and height ($F(4, 185) = 0.376$, $p = 0.826$). Basal area ($F(4, 183) = 10.95$, $p = <.001$) and tree volume ($F(4, 183) = 11.52$, $<.001$) decreased significantly with increasing spacing. In conclusion, spacing significantly affected DBH, tree height, bole height, basal area and the volume of Melia at aged 10 years. This means the wider the spacing, the larger the diameter for timber production, but the lower the volume per hectare, the lower bole height, and the lower carbon sequestration.

Key words: *Melia volkensii*, Drylands, stand volume and tree basal area

Session 3a: Best practices and innovations for the sustainable management of planted forests

Abstract n°24

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Abstract title: Enhancing Planting Success of Native Trees in Dry Tropical Areas: implications for Restoration

Abstract

Recent studies suggest that restoring multiple forest functions requires multiple species. However, tropical dry forest restoration often relies on monospecific plantations of exotic species due to a lack of detailed ecological studies on the diversity of native trees and their impact on ecosystem functioning. To address this gap, a common garden experiment (IDENT-Ethiopia) was conducted using nine native dry tropical tree species. The objective was to examine the impact of tree species diversity and shading on the survival, vitality, and productivity of young forests in dryland areas. The experiment followed a block design, consisting of 270 plots. These plots encompassed a gradient in native tree species richness, including one-, two-, and four-species mixtures and three levels of functional diversity gradient: low, medium, and high. To investigate the effects of shading, a shading treatment was implemented (shaded versus non-shaded), and all treatments were replicated in triple. The overall survival rate of seedlings was 84% after two growing seasons. Our findings revealed that shaded conditions significantly increase the likelihood of planting success by enhancing seedling survival, vitality, and chlorophyll content (SPAD value) of seedlings. In addition, species richness and shading were positively associated with seedling growth. Specifically, stem volume growth increased by 10.1% in sheltered environments and 15.4% in four species mixture. Interestingly, 57% of all mixtures showed a positive diversity effect, indicating higher productivity compared to monoculture. This overyielding was primarily attributed to the competitive dominance effect. Overall, the evidence presented in this study demonstrates that careful selection of native tree species, appropriate shade levels, and species diversity can significantly improve the survival and growth performance of seedlings. These findings are particularly valuable for the successful restoration of degraded dryland areas.

Keywords: Drylands, IDENT-Ethiopia, Restoration, Shading, Species Diversity

Session 3a: Best practices and innovations for the sustainable management of planted forests

Abstract n°25

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Organisation: Kenya Forestry Research Institute

Abstract title: Influence of cone physical characteristics and extraction exposure duration on seed yield of Pinus Patula

Abstract

This study examines the correlation between extraction exposure periods and cone physical characteristics on Pinus patula seed yield. Systematic random sampling was employed for tree identification in an even-aged clonal seed orchard, and the laboratory phase was laid down as a factorial experiment with two factors: cone physical characteristics and extraction exposure period at three levels. Seed counts were taken for cones categorized as; heavy, light, narrow, and wide at three extraction exposure periods 6 hours, 12 hours, and 24hours in a constant oven temperature of 65°C. The experiment had 12(L1,H1,N1,W1,L2,H2,N2,W2,L3,H3,N3,W3)treatments with 60 cones per treatment. The time spent counting and returning cones during the inter-stage observation ranged from 10 to 15 minutes. Data collected were tabulated and means analysed using ANOVA with results generated as per the objectives. The number of seeds released within the hours of exposure was captured as the seed extraction rate. The first six hours yielded the optimum number of seeds per cone with the mean highest number of seeds from wide cones. The lowest mean number of seeds released observed was 28, from light cones, while the highest mean number of seeds was observed to be 56 from wide cones. Cone sorting based on size before extraction is recommended for optimized seed yield. The stages of seed extraction employed here can be used in mechanized seed extraction cabinets equipped with timers at controlled temperatures.

Session 3a: Best practices and innovations for the sustainable management of planted forests

Abstract n°26

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Abstract title: Solution for climate-smart forestry of Norway spruce combining tree breeding and silviculture

Abstract

Forests are major natural resource in Northern Europe, thereby defining the crucial role of forestry sector inthe bioeconomy. In this context, production of sawn wood of Norway spruce - dominant coniferous tree species – is crucial. Tree breeding is estimated to achieve up to 30% of gain in growth, yet evidence of realised genetic gains at harvest age is still lacking.

We studied 50-years-old sparse (400 trees ha-1)clonal Norway spruce plantation in Latvia to describe the clonal effect on diameter (DBH) growth patterns and its relation to wood density. The realised genetic gain in DBH varied from -6.3 to +24.0% over the trial mean, when the trees had reached the final harvest dimensions. Significant clone-specific growth patterns were observed: genotypic coefficient of variation ranged between 11 and 17 % for asymptote, growth rate and shape of the applied Chapman-Richard function. At individual tree level, no relation between and wood density was observed. Genotypic correlations between DBH and mean, earlywood and latewood density were negative, yet weak (rG = -0.06.. -0.24), implying potential for selection of productive genotypes without reduced wood strength. The sparse plantation demonstrated almost twice as large mean DBH and similar yield comparing to conventionally managed (initially ca. 3300 trees ha-1)stand without compromising wood density. Theshortened rotation period due to fast growth (i.e., Achieving the target diameter) can also mitigate various risks, such as drought or wind damage. Improved light conditions in sparse plantation ensure favourable conditions for various ground vegetation species. Therefore, the highly productive clonal plantation indicated complex benefits of combining breeding and silviculture, thus being one of climate-smart forestry approaches for our region.

Session 3a: Best practices and innovations for the sustainable management of planted forests

Abstract n°27

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Abstract title: The importance of tree species diversity for the resistance of planted forests to insect damage

Abstract

The world's forests are experiencing a sharp increase in insect damage, in response to climate change for native pests and increased global trade for exotic pests.

It is now well established that curative control solutions for these pests, based on the use of insecticides, should be avoided because of their low efficacy and their economic and environmental cost. To reduce the impact of these emerging risks, it is preferable to adopt a preventive and generic method capable of affecting the multiple species of insect pests that can affect forest health.

There is growing empirical and experimental evidence that multi-species forests are, on average, more resistant to insect pest attacks than tree monocultures. In this presentation, we will examine how forest insects respond to increased forest diversity. We will propose ecological mechanisms to explain the greater resistance of mixed forests to these herbivorous insects. We will discuss how these results can be used to propose changes in the design of new plantation forests to maintain their long-term productivity.

Session 3a: Best practices and innovations for the sustainable management of planted forests

Abstract n°28

Full name: Roman Plichta **Email:** roman.plichta@mendelu.cz

Organisation: Mendel University in Brno

Abstract title: The influence of tree composition and diversity on the microclimate of planted forests

Abstract

Due to climate change, European forests face rising temperatures and increasing severity and frequency of droughts. However, forests may buffer a significant part of the negative climate-change effects. These buffering effects likely depend on a structure, composition, and diversity, which, in planted forests, can be easily adjusted to support these climate-change mitigation functions of planted forests. Here, we present the results of the project in which we measured soil moisture, temperature, and air temperature in planted forests with varying species composition and diversity in several locations across Europe. Our data show that the most pronounced differences in the measured microclimate variables were between pure coniferous and pure broadleaved forest stands. Broadleaved stands had greater summer maximum and winter minimum air and soil temperatures but conserved better soil moisture, especially in late summer and autumn. Mixed forests had microclimate conditions similar to pure conifer forests, which indicates that conifers are the primary driver of microclimate in the mixed stands. We also found that increasing tree density and cover reduced temperature extremes but decreased soil moisture. The results suggest that foresters may influence forest microclimate by varying tree composition and structure. However, the species that mediate temperature extremes may differ from those that best conserve soil moisture.

Session 3a: Best practices and innovations for the sustainable management of planted forests

Abstract n°29

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Organisation: Ecology and Nature Conservation Institute, Chinese Academy of Forestry

Abstract title: The nonlinear relationship between tree species richness and topsoil organic carbon stock in a subtropical mixed-species planted forest

Abstract

Despite recent evidence from inventories and experimental forests indicating that high species richness among trees increases productivity and further improves soil organic carbon (SOC) storage, the mechanisms controlling the richness–SOCrelationship are variable and complex. Hence, the optimal tree species richness required to increase SOCstocks needs to be further explored. Based on field observations from a subtropical mixed-species planted forest, which was established 40 years ago through a mosaic pattern of afforestation and natural regeneration, we examined the effects of tree species richness on the SOC stock, and the chemical composition of SOC in the 10 cm layer. We found that a quadratic relationship between tree species richness and SOC stocks. Tree species richness affected theSOC stocks primarily by increasing the leaf litter amount, and decreasing the leaf litter and fine root quality. In addition, tree species richness changed the chemical composition of SOC by affecting the chemical composition of the plant carbon, and soil bacterial diversity, thereby affecting the SOC stock. The trade-off between leaf litter and fine root Csources contributed to the quadratic relationship between tree species richness and SOC stocks. These results show that the mixing of a moderate number of tree species can achieve a higher SOC level than having fewer or more tree species in a planted subtropical forest. Establishing synergetic relationships in richness–leaf litter and richness–fine root biomass by selecting targeted tree species would be an efficient approach for maintaining a positive richness–SOC relationship.

Session 3a: Best practices and innovations for the sustainable management of planted forests

Abstract n°30

Full name: Radim Matula **Email:** radimmatula@gmail.com

Organisation: Czech University of Life Sciences Prague

Abstract title: Varying effects of composition and diversity on growth and resilience of common European tree species in forest plantations

Abstract

Growing mixed-species forests instead of monocultures is considered a crucial approach to increasing the productivity and stability of planted forests under climate change. However, there is limited information on how common European tree species grow and react to drought in mixed-species forests compared to monocultures. To address this gap, we utilized automatic dendrometers to continuously measure stem diameter changes in over 1000 trees from eight tree species across forest plantations with varying levels of diversity (ranging from 1 to 5) and species composition in the Czech Republic, Germany, Belgium, and Finland. Our measurements, which also included the growing season of 2022 - a year marked by extreme heat and drought in several locations -provided data on hourly growth and water deficit. We then modelled this data as a function of tree diversity and composition of the studied forest stands. Our results revealed a wide range of responses to species mixing across the studied species and sites. Oaks, European beech, and Scots pine, for instance, showed strongly negative responses, growing mostly better in monoculture. In contrast, birch and spruce displayed positive effects, growing better and exhibiting better resistance to drought in mixed-species forests. However, we found that these effects were primarily driven by species-to-species interactions, underscoring the importance of selecting the right species combinations to achieve the benefits of growing mixed-species plantations.

Session 3b: Planted forests in productive, resilient and restored landscapes

Abstract n°31

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Organisation: Makerere University, Kampala, Uganda

Abstract title: An assessment and monitoring of restoration planting in remnant natural forests in the Lake Victoria crescent, Uganda

Abstract

Tropical rainforests within the Lake Victoria crescent(LVC), Uganda, have been severely degraded. In response, the National Forestry Authority and other stakeholders undertook restoration tree planting in several forests. However, evidence indicates that no systematic evaluation and regular monitoring of the restoration progress has been conducted. Regular monitoring and evaluation appraises the restoration progress and assist in taking corrective actions. This study is being undertaken in Gangu, Nawandingi, Kobablock and Luwafu forests in the LVC. Specifically, it aims to determine; the current diversity and structure of trees and other plant forms, amount of carbon sequestered by the forests, the restoration projects 'contribution to livelihoods and factors affecting the restoration progress.

Data collection involves in-forest surveys and stakeholder interviews. Preliminary findings on trees ≥5.0 cm diameter at breast height (dbh) indicate that a total of 75 species were recorded in all the forests of which 10.2 % (n =8) were planted during the restoration while others naturally regenerated. The planted species were Albizzia coriaria, Cedrellaordorata, Croton Africana, Khaya anthotheca,Markhamia lutea, Terminaria superba, Maesopsiseminii and Prunus Africana. All enumerated trees had a mean stem density of 504/hectare and the planted ones constituted 49.0%. A relatively higher tree species composition (n= 49) but lower tree abundance/ha (n = 439) was recorded in forests restored over 30 years ago while the forests restored about 20 years ago had lower species composition (n500/ha). Although NFA reported that the planted trees had a high survival rate (70 – 75%), the findings revealed that the forests recovery are highly affected by tree cutting for firewood and poles, illegal crop farming, cattle grazing, dumping garbage in the forests, and inadequate supervision and recordkeeping. Our findings are critical for development of more effective forest restoration planning.

Session 3b: Planted forests in productive, resilient and restored landscapes

Abstract n°32

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Organisation: Norwegian Institute of Bioeconomy Research

Abstract title: Australian tree species and provenances in Ethiopia - The Case of Eucalyptus globulus plantations

Abstract

Introduction of exotic tree species in Ethiopia dates back to the 19th century. “Difficult biology” or “unknown silviculture” of the native tree species was claimed to have driven the introduction of exotics, especially of the genera eucalyptus since the 1890s.

This talk provides 1) a brief history of the introduction of Australian tree species in Ethiopia, of the genera Eucalyptus, acacia, casuarina, and grevillea, and 2) details of the provenance/progeny trial - a tree improvement program for E. globulus plantation in Ethiopia, which was initiated by FAO in collaboration with the Ethiopian Forestry Research Centre in the 1990s. The trail may represent the largest collection of provenance/progenies from an extensive range across the natural range of E. globulus in Tasmania and Victoria.

The aim was to identify superior provenances and establish a breeding population for genetic improvement programs as well as plantations in Ethiopia. The trial tested a total of 299 open-pollinated families from 52 localities within 17 natural sub-races in Australia, and one local landrace from Ethiopian highlands. Nine years after planting, significant ($P < 0.001$) differences in survival, height and dbh per tree were found between sub-races; differences among localities within the sub-races were also significant. Eastern and Western Otways, Cape Patton and Strzelecki Ranges in Victoria were the fastest growing sub-races and also displayed above-average survival. Sub-races from the Tasmanian mainland performed poorly; the Wilsons Promontory sub-race was the slowest-growing and displayed poor survival.

The genetic resources established in this trial have broadened the genetic base of E. globulus ssp. Globulus in Ethiopia available for use in plantations. The results of this trial were used to establish new seed production areas based on the superior sub-races from Otways and Strzelecki Ranges. We will finally discuss the current state of plantations with Australian Trees species in Ethiopia.

Session 3b: Planted forests in productive, resilient and restored landscapes

Abstract n°33

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Organisation: The National Center for Vegetation Cover Development and Combating Desertification

Abstract title: Challenges and opportunities for planted forests in dry ecosystems: the experience of Saudi Arabia

Abstract

The Kingdom of Saudi Arabia occupies an area of approximately 2 million Km2, and it includes +2,000local plant species. Forests constitute 1.1% of the total land area of Saudi Arabia, about 2.7 M ha and are characterized by unique plant diversity. Tree forests dominate the ecosystems in the Kingdom's mountainous regions, particularly the Juniper forests(Juniperus spp.) scattered in the Sarawat Mountains in the Kingdom's southwestern region, where other species such as some Acacia spp. and wild olives(Olea europea) grow. Within the Saudi terrestrial ecosystems, these environments have the highest rates of biological variety. Likewise, Acacias spp. are the dominant species of valley forests spread throughout the Kingdom, whereas mangrove represents the coastal forests in the East and West of the country. Accordingly, the Saudi government has given great attention to preserving and developing the forest sector, based on new legislation, institutional framework and incentive mechanisms, such as the2020 Environmental Law, the establishment of a specialized agency to work on the development and sustainable management of all vegetation cover including forests, which is the National Center for Vegetation Cover Development and Combating Desertification (NCVC); as well as the launching of the ambitious Saudi Green Initiative aiming to restore 40million hectares of degraded land. In this framework Saudi Arabia launched several projects and initiatives, including to plant 60 million trees in forest lands by2030. There is a clear plan to rehabilitate degraded areas and increase forest cover, and several projects are being implemented despite the challenges such as water shortage, poor soil fertility and desertification.

Saudi Arabia is also launching a National Forest Strategy, including a forest fire early warning system, a national forest monitoring and assessment system, and the promotion of assisted natural regeneration of degraded forests. The paper shares the lessons learned in this process that aims to restore 40 million hectares of degraded land by protecting ecosystems and increasing vegetation cover.

Session 3b: Planted forests in productive, resilient and restored landscapes

Abstract n°34

Full name: Peter Angaine **Email:** pangaine@gmail.com

Organisation: Kenya Forestry Research Institute (KEFRI)

Abstract title: Morphometrics of Pinus patula crown and its effect oncome characteristics and seed yield in Kenya

Abstract

Pinus patula like other conifers have cones as an important unit for seed production. Cone production is however not uniform and often varies among compartments and sectors within the crown. This study sought to evaluate within-crown cone production patterns, cone characteristics and seed yield in a Pinus patula clonal seed orchard in Londiani, Kenya. Crown height was divided into 3 equal portions and a further subdivision done for each of the portions into 2 sections. From each crown section 10 mature cones were collected to total 60 cones per tree as a sample size. The cones were put in a preheated oven at temperature 65°C for 24 hours to open for seed extraction. This study observed cones collected from the top portion of the crown yielded the highest amount of seed (33.3±4.91 seeds) ($p<0.05$) while the bottom part had the lowest (14.4±2.76) ($p<0.05$). The study recommends collection of Pinus patula seeds from the upper part of the crown in unmanaged stands and further recommends that management through pollarding be done regularly to minimize within-crown differences.

Session 3b: Planted forests in productive, resilient and restored landscapes

Abstract n°35

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Abstract title: On-farm forestry: A key strategy for enhancing tree cover in the Western Region of Kenya

Abstract

Kenya has committed to achieve 10% tree cover by the year 2030, as part of national efforts to address the challenge of climate change and enhance ecosystem restoration. On-farm forestry contributes significantly to Kenya's tree cover with more than half of the planted tree volume in the country found in farmlands. Subsequently, farmers are now managing a larger resource of planted trees than the Government, hence future efforts to increase tree and forest cover must be geared towards enhancing on-farm tree growing. In the Western region of Kenya, tree growing is widely practised for provision of ecosystem goods and services, ecosystem restoration and livelihood improvement. Tree growing trends however vary based on area specific contexts, with poor agroforestry practices and area specific socio-economic and socio-cultural factors hindering maximum tree productivity. A study was conducted to assess socio-economic and environmental factors that influence tree growing trends in Western Kenya, with the ultimate goal of developing strategies for promoting tree growing and enhancing tree productivity for both ecosystem restoration and livelihood improvement. Data was collected in Vihiga, Kakamega, Busia and Migori Counties using household questionnaires administered to selected households in the four Counties, key-informant interviews were conducted with persons directly involved in promotion of tree growing activities, and Focus Group Discussions held with members of the local communities and local conservation groups. The study established that economic factors such as land sizes and land uses, cultural beliefs, norms and attitudes as well as literacy and awareness levels significantly influenced tree growing levels in the different Counties. It is recommended that awareness creation and sensitization of the public on the environmental and economic values of tree growing, promotion of best agroforestry practices and development of incentive frameworks for promotion of tree growing should be prioritized for Counties with low tree growing levels.

Key words: On-farm forestry, tree cover, livelihoods, ecosystem restoration

Session 3b: Planted forests in productive, resilient and restored landscapes

Abstract n°36

Full name: Francis Chilimampunga **Email:** fchilima@gmail.com

Organisation: Department Of Forestry

Abstract title: Planted Forests in Malawi

Abstract

State owned Forest Plantations in Malawi cover approximately 90,000 hectares within protected forests. These are dominated by planted exotic trees. The National Forest Policy (1996) promotes the participation of private sector and other operators in the management of forests in the country. Approximately 56 percent of the 90,000 hectares are managed by the private sector and small-scale operators under concessions that range from 35 to 60years. Local communities and other organisations are supported to replant trees on customary estates and at least 45 million trees of both indigenous and exotic species are planted on customary estates and in state-owned plantations at least 5 million exotic tree species are planted annually .

Challenges faced in the management of planted forests are several. These include illegal charcoal and firewood production, thefts of wood for pole and timber production, forest fires, illegal mining, opening up of gardens and settlements in protected areas, funding issues and inadequate human capacity to provide security to planted trees and extension services to the general public.

Some interventions include rehabilitation efforts implanted forests through tree planting and management, adopt a forest initiative, carbon marketing, national forest landscape restoration strategy (2017), training of staff and conducting forestry research. Protection efforts of planted forests are made through conducting silvicultural operations such weeding and firefighting initiatives, conducting forest camping and routine patrols, enforcement of forest regulations and implementation of strategies e.g., the national charcoal strategy. In terms of funding, the forestry development and management fund and several projects support rehabilitation and protection of planted forests in various ways.

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Abstract n°37

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Organisation: Ministry of Environment and Sustainable Development

Abstract title: Planting eucalyptus: solution to fight against tree cutting as part of the development of the biodiversity mechanism of the Anja Miray Association Ambalavao Madagascar

Abstract

The Anja Miray association was founded in 1999 in response the degradation and deforestation of local forests, the sedimentation of water resources and depletion wildlife, including species such as the lemur Maki catta, the chameleon and tropical birds. Directed by a young team, this association operates an 18-hectare community forest reserve in the Haute Matsiatra region. The community created an eco-tourism initiative financing works projects community: schools, health clinics and education environment, as well as conservation activities continue. Eco-tourism has also provided source revenue for projects supporting livelihoods alternative livelihoods, such as fish farms or nurseries.

To offset the need for fuel from the forest, the association has set up nurseries eucalyptus trees in communities to provide sustainable fuel sources. The association has established itself as a community forest management model in Madagascar.

Although responsible for a small part of what remains of a corridor larger forest, the efforts of the Anja Mira association paid off in regarding reforestation and wildlife conservation. Slash-and-burn agriculture has severely depleted soil nutrients and led to erosion and drought in the region. Thanks to the scope of Anja Miray and the Dina community institution, wildlife and the flora of the reserve was able to enjoy an astonishing convalescence.

The voluntary efforts of the members of the association have made it possible to reforest three hectares with an association of tree species exotic and native: native species have been used to enrich and support forest biodiversity, while exotic species served as a food source for lemurs.

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Abstract n°38

Full name: Nivo Malalatiana RANDRIAMBAO **Email:** malala27@yahoo.fr

Organisation : Ministère de l'Environnement et du Développement Durable

Abstract title: Reforestation in Madagascar

Abstract

Findings

- Alarming degradation of Malagasy forest resources
- Exponential increase in demand for forest products linked to population growth
- Worrying degradation of the soil and its fertility
- Out of phase responses with growing socio-ecosystem needs
- Weak economic performance of the forest sector

Political and legal framework

According to the General Policy of the State, the National Vision of the Ministry of Environment and Sustainable Development is to “Regreen Madagascar”

At the international level: Madagascar's commitment to restore 4 million ha of degraded land and forests by 2030 and to reduce GHG emissions by 14%, as well as to strengthen adaptation capacities and climate resilience (Determined Contribution National 1 of Madagascar)

Goals

Implement Velirano N° 10 (Challenge): Sustainable management of our natural resources

The Ministry has an annual objective of 75,000ha of reforestation and restoration according to the national planning of reforestation and forest restoration

Among the tools used, the national reforestation strategy is used, the objectives of which are:

- Realize the challenge of the state in terms of reforestation and restoration
- Carry out successful reforestation
- Create new forest areas
- Maintain natural forests and existing plantations

Approaches

- Useful reforestation
- Responds to local needs: green economy, green diplomacy
- Adapted to regional conditions
- Harmonized with the reference tools of the regions (SRAT, SAC)
- Local reforestation:
- Land identification
- Establishment of local nurseries
- Valorisation of local materials

Principles

- A long-term commitment
- A landscape approaches
- Consideration of local interests
- Strong local involvement
- An effort to secure land tenure
- Well-planned planting
- A choice of suitable species
- Well-trained workers
- A coordinated approach
- Proper use and reinforcement of available information

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Abstract n°39

Full name: Rachel Wanyoike **Email:** rachel.wanyoike@solidaridadnetwork.org

Co-authors: Alex Amanya and Sheila Garakara

Organisation: Solidaridad East, Central, and Southern Africa (Solidaridad)

Abstract title: Restoring our Forests to Enhance Food Security and Improve the Livelihoods of Smallholder Farmers in East and Southern Africa

Abstract

Solidaridad (www.solidaridadnetwork.org/) is an international civil society organization with over 50 years of experience in developing market-based solutions to make communities more resilient. We enable smallholder farmers and workers to earn a living income, shape their own future, and produce in balance with nature by working throughout the whole supply chain to make sustainability the norm.

Zambia loses 300,000 hectares of forest area annually(FAO, 2020). In the past 20 years, Uganda has lost over a million hectares of tree cover - nearly a third of the country's total (IMF, 2022). The impact of deforestation has contributed to global warming, soil erosion and increasing climate change related disasters such as drought. To address these issues and hence promote active planting and passive restoration practices of native tree species in Uganda and Zambia, since 2022 Solidaridad has been implementing a project under the African Forest Landscape Restoration Initiative (AFR100); a country-led effort to bring 100 million hectares of land in Africa into restoration by 2030 (https://afr100.org/). The project contributes to climate mitigation by enhancing the adoption of agroforestry in tea landscapes in Uganda and improving local management of woodlands in Zambia through Farmer-Managed Natural Regeneration (FMNR) and assisted natural regeneration. To this end, Solidaridad has committed to planting 415,000 trees in Zambia and Uganda by2024.

Solidaridad therefore aims to showcase the current impact and best practices of this project and share lessons learnt through a poster presentation. We will focus on the socio-economic and environmental impact of our approaches. More importantly, our presentation will be centered around the impacts on food security, income, and increased productivity for smallholder farmers and rural communities.

Session 4: Planted forests in a decarbonized bioeconomy

Abstract n°40

Full name: Nick Embden **Email:** nick.embden@gatsbyafrica.org.uk

Organisation: Gatsby Africa

Abstract title: Africa's housing needs as an opportunity to drive investment at scale into sustainable forestry

Abstract

Gatsby Africa in partnership with Arup - the multinational design, engineering, and architectural firm - is undertaking an assessment of mainstream building typologies in East Africa. The study will analyse opportunities for sustainable timber innovations to support more cost-effective buildings for the growing populations of the region. It will consider a range of different timber products such as structurally graded timber through to mass timber products, such as glulam and CLT, and compare the cost-benefit of using such products to traditional building materials, and the impact this could have in terms of climate impact.

The study will be completed in August 2023 and results could be presented at ICPF 2023. The findings would be presented by Gatsby Africa, but could include contributions from a variety of stakeholders involved in the study from both the private sector and public sector.

Session 4: Planted forests in a decarbonized bioeconomy

Abstract n°41

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Organisation: Kenya Forestry Research Institute

Abstract title: Allometric equations to estimate potential biomass and carbon stocks for on-farm bamboo species in agricultural landscapes of Kenya

Abstract

Accurate estimates of above ground biomass are critical for characterizing ecosystem function and accounting for carbon stocks. Despite massive planting of bamboo species in Kenya's agricultural landscapes, allometric equations to estimate the potential biomass and carbon is not available. The study aimed to develop (1) species-specific allometric equations for estimating the above ground biomass for major bamboo species in agricultural landscapes of Kenya and (2) multi-species allometric equations using pooled data of three major bamboo species namely *Bambusa vulgaris var. vittata, Dendrocalamas giganteus* and *Dendrocalamus asper*. The study was done in selected farms covering different agro-ecological zones of Kenya where bamboo has been planted widely. One hundred and thirteen (113) bamboo culms were randomly selected with diameter at breast height (DBH) ranging from 4.2 to 9.5 cm and height (H) from 7.8 to 12.0 m. The sampled culms were harvested and culm length, fresh weights of the stem, branches, and leaves measured. The sub-samples of each component were dried and the dry to green weight ratio used to estimate above ground biomass (AGB). We developed species-specific allometric equations by regressing DBH, height and wood density variables against AGB using seven non-linear functions. We used 70% and 30% on development and validation of the models respectively. This was followed by using the pooled data in developing multi-species allometric equations. Our findings indicated a combination of DBH and H achieved the best performance by having high coefficient of determination (R2) and low Akaike information criterion (AIC). Further, log-transformation improved our allometric models significantly. Addition of wood density did not improve our models. During validation, selected models had low percentage bias and low Root Mean Squared Error (RMSE) indicating their robustness in predicting biomass. The developed species-specific and multi-species allometric equations will help in improved estimates of future carbon stocks.

Key words: Allometric equations, Bamboo, Biomass, Carbon stock, non-linear models

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Abstract n°42

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Abstract title: Bio-pesticide activity of *Commiphora africana* dichloromethane resin extract against *Cimex lectularius* (bedbugs)

Abstract

Bedbugs are blood-feeding arthropods that cause anaemia in humans upon heavy feeding. Control measures are unsuccessful due to development of resistance, environmental pollution, and cost. There is a need to explore a bio-pesticide to combat bedbugs. In this study, compounds from *Commiphora africana* resin were sequentially extracted, fractionated, identified, and evaluated against bedbugs as individual compounds and in combinations. The chemical constituents of the most active fraction were identified using Gas Chromatography-Mass Spectrometry. Results showed that the dichloromethane crude extract had the highest mean repellency (98.5% with an LC50 of 4.96 mg/L after 24 and 72 h of exposure time, respectively), similar to the positive control (neocidol). Column chromatographic separation of the dichloromethane extract yielded 9 fractions where "FR7" (eluted with 60% n-hexane in ethyl acetate) demonstrated the highest mean repellency of 79.0% with an LC50 of 10.12 mg/L after 2 and 24 h exposure times, respectively. From the identified compounds of FR7, cedrol had significantly ($P < .05$) higher mean repellency (80.5%) after 6 h of exposure and toxicity (27.43 mg/L) after 24 h exposure. A six-constituent blend of compounds from FR7 [9-octadecenoic acid-ethyl-ester, octadecadien-1-ol, citronellyl formate, cedrol, n-hexadecenoic acid, (1, 2)-dihydro-6-methoxy-naphthalene] had the highest mean repellency (93.4% after 12 h exposure) and toxicity (8.83 mg/L after 72 h exposure) than the other blends and individual compounds. The study reports fractions/compounds that can be used in bedbug control measures. The findings will lay a strong background in the development of an effective and safe bedbug control measures by formulating an eco-friendly bio-pesticide as alternative to commonly used petrochemical based pesticides.

Keywords: *Commiphora africana*, bedbugs, resin, bio-pesticide.

Session 4: Planted forests in a decarbonized bioeconomy

Abstract n°43

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Organisation: CIFOR-ICRAF

Abstract title: Bioeconomy development and planted forests

Abstract

This presentation aims to frame the dynamics between bioeconomy development and the sustainable growth of planted forests and associated value chains. It will first consider the potential demand that could drive bioeconomy development, the opportunities and constraints for sustainable growth in forestry and forest value chains to identify potential pathways. Demand for raw materials is expected to grow considerably, including for biomass-based products. Combined with calls for sustainable sourcing it creates considerable opportunities for bio-economy development. Current forestry systems are unable to satisfy such an increase in demand without compromising their sustainability. The development of planted forests is indispensable to ensure the development of bioeconomy, which in turn will stimulate the development of planted forests. To increase synergies and facilitate common development one promising pathway is to optimize matches between the different tree production systems (including smallholder production), the different wood products, and the different intermediate and final uses. The right system, for the right tree, for the right wood, for the right use and reuse. It requires to develop sustainable business models for different actors and the value chain, to organize logistics (including spatial logistics, physical markets and infrastructure), and to support capacity of building of the different actors including final users(for instance in construction). Some key aspects need immediate and priority attention. First, how to grow resources through planted forests, including faster growing species. Second, consider the full range of different value chains, that all need a different tailored approach. Third, put the enabling environment high on the agenda. The development of value chains it is not just a private sector issue. A range of policies and instruments are needed to shape the bioeconomy, from production to consumption, including to fully ensure social and environmental objectives. There is also a key role for research and innovation.

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Abstract n°44

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Abstract title: Can prolonged rotation in combination of forest drainage be a solution to increased carbon storage in Scots pine forests on organic soils of hemiboreal region

Abstract

Forests are expected to increase carbon removal from the atmosphere. Some studies have demonstrated that old-growth forests (prolonged rotation) can be significant carbon storage; however, natural disturbances can have a notable impact on the longevity of high carbon stock. The aim of the study is to quantify the long-term effect of forest management(drainage) by assessing carbon stock differences of drained and periodically wet Scots pine forest on organic soils with prolonged and regular rotation periods.

In order to assess the long-term effect of forest melioration, we selected 13 Scots pine-dominated stands with drainage systems established >60 years ago, and 13 stands without drainage systems (in total156 sample plots). Studied stands have currently reached >130 years growing on deep organic soil(peat layer >30cm). The effect of prolonged rotation and drainage on carbon stock was obtained while comparing to the control stands with a mean age of 90years (data from the National Forest Inventory-NFI).The aggregate effect of natural disturbances was estimated as mortality over time based on data from NFI.

Scots pine forests with prolonged rotation on drained organic soils have higher average carbon stock compared to stands without drainage systems; the same was true for control stands . Control stands with regular rotation had lower carbon stock than the measured overmature stands. Thus, drainage resulting in improved tree growth in combination with prolonged rotation results in increased carbon storage. The estimated effect of natural disturbance leads to a significant reduction of carbon stock gains from prolonged rotation. Deadwood carbon stock was small and was similar between drained and periodically wet stands with prolonged rotation. The decreasing trend of carbon storage efficiency (annual carbon storage)with aging suggests the potential for effective forest management to increase climate change mitigation capacity.

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Abstract n°45

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Organisation: Scion - New Zealand Forest Research Institute

Abstract title: Carbon sequestration potential of plantation forests tree species in New Zealand: A comparative study

Abstract

Planting forests is a nature-based solution to sequester atmospheric carbon and, therefore, slow anthropogenic climate change. However, there is a lack of scientific knowledge about the carbon sequestration capabilities of different plantation tree species. We used a widely applied Eco physiological model (3-PG) to simulate above and below ground carbon sequestrations rates of five exotic and one native tree in New Zealand. We simulated different silvicultural regimes as well as different management scenarios. Carbon sequestration rates varied according to species and site and silvicultural regimes. Indigenous Podocarpus totara or exotic Sequoia sempervirens can provide plausible options for long-term carbon sequestration. At the same time, widespread planting of exotic Pinus radiata, Pseudotsuga menziesii and Eucalyptus species can rapidly sequester carbon in the short-term. The results of this study will contribute to more efficient decision-making beyond business-as-usual practices.

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Abstract n°46

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Organisation: Kenya Forestry Research Institute

Abstract title: Isolation and chemical characterization of biopesticides from Melia volkensii against fall armyworm, Spodoptera frugiperda, and red flour beetle, Tribolium castaneum

Abstract

The fall armyworm, Spodoptera frugiperda, and red flour beetle, Tribolium castaneum are insect pests of economic importance that have a negative impact on maize production and stored grains, respectively. The continued use of synthetic insecticides has been reported to cause undesirable effects and negative consequences on the environment, human and other non-target organisms leading to renewed interest in botanical pesticides as a safer alternative. In this study, we employed a bioactivity-guided strategy to isolate and identify insect antifeedants from Melia volkensii, an indigenous tree species native to drylands of East Africa. Laboratory screening of methanolic extracts from the bark, leaves, nuts and pulp showed that M. volkensii nuts and pulp extracts had higher antifeedant activity against fall armyworm and red flour beetle. Further fractionation of the nut and pulp extracts was done using solvents of increasing polarity. Biotesting of the solvent fractions showed that antifeedant activity was retained in the dichloromethane fraction, which was subsequently purified using column chromatography. The respective chromatographic subfractions were tested against the insects to identify bioactive fractions. The bioactive nut subfractions were subjected to preparative-HPLC and preparative-TLC to yield pure toosendanin. Recrystallization of the bioactive fraction from pulp yielded pure salanninolide. The limonoid compounds were positively identified using LC-MS and NMR spectroscopy. This study provides new leads for development of insect control compounds and shows that M. volkensii extracts could be incorporated in integrated pest management.

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Abstract n°47

Full name: Sara Bergante **Email:** sara.bergante@crea.gov.it

Organisation: Consiglio per la ricerca in agricoltura e l'economia agraria- Centro di ricerca Foreste e Legno

Abstract title: Life Cycle Assessment (LCA): new poplar clones allow an environmentally sustainable cultivation

Abstract

Among the most valuable products that can be obtained from the specialized cultivation of poplars, peeled wood for the production of plywood panels is the assortment that ensures the greatest profit in Italy. For this reason, most of the cultivation is carried out with techniques that ensure the best quality of the first 5-7 m of the trunk (straightness, circular trunk section, absence of knots). Considering poplar genotypes, Italy is involved in an intense breeding activity; the old P. ×canadensis clone 'I-214' largely cultivated, was recently joined by new clones (named MSA – 'Maggior Sostenibilità Ambientale' that is 'Greater Environmental Sustainability') includes genotypes with very high resistance to all the main diseases and to one insect. Fast growth and disease resistance allow to produce quality wood with low environmental and economic costs. To better understand the environmental advantages deriving from the cultivation and use of these clones to produce plywood, in comparison with the old genotype, a 'Life Cycle Analysis' (LCA) was applied to whole chain considering as impact the CO2 eq. emissions. From stool bed to commercial stand and plywood production, real data were collected from Italian experiences. Firstly, with the Inventory Analysis all the raw material, energy, wastes and emissions related were collected for each cultivation phase and from industry. The Analysis showed a reduction of 9%of CO2 eq. ha-1 emitted growing MSA instead of 'I-214' but the plywood production operations still account for the majority of emissions.

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Abstract n°48

Full name: Koen Kramer **Email:** k.kramer@landlifecompany.com

Organisation: Landlife Company

Abstract title: Modelling carbon capture by line seeded reforestation sites in Australia**.**

Abstract

The Australian government has committed itself to the large-scale reforestation of deforested lands, thus, restoring forest ecosystems and their biodiversity and sequestering carbon to mitigate climate change. Many of these projects are funded by the carbon market. An accurate projection of the carbon capture over a 40-year time horizon is therefore essential to assess the economic feasibility of the project. Characteristics of Southern Australian reforestation projects are that line seeding is used, often in combination with planted trees in a wide spacing (10x10 m or more). For the line seeding, a mix of species is used whilst the regular planting is based on fast growing Eucalypt species to ascertain productivity in case the emergence of the seeds is low.

This type of reforestation poses challenges to carbon capture modelling in terms of the emergence rate of the different species, the spatial configuration, and dynamics in tree density. Here we present a specification of the FastTrack model that picks up this challenge. The FastTrack model is a data driven forest growth model based on the IPCC Tier 2 architecture with crown competition to simulate mixed species forests. We selected representative sites from the Australian NFI database (i.e., the Stem Diameter Database, SDD) to calibrate the growth parameters of the model. In collaboration with the University of Melbourne, a Site Productivity Analysis (SPA) was performed on 14 sites, containing 100 x 5m transects with 48 in total. The SPA included SDD sites with a known age reforested both by line seeding and tube stock. Additionally, we collected height, DBH, and crown dimension data on line seeded sites with an age ranging from 21 35 years since establishment. The SPA and measurements on the line seeded sites are used for the validation of the carbon capture projection to independent data.

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Abstract n°49

Full name: Jessica Richter **Email:** Jessica.Richter@wri.org

Organisation: World Resources Institute

Abstract title: Spatial Database of Planted Trees v2.0

Abstract

The Global Forest Watch (GFW) platform has become integral to how the international community understands and interacts with forest information. While most international policy frameworks and private sector commitments refer to monitoring “forests” or «natural forests,” GFW’s core datasets monitor global «tree cover” and “tree cover change.” “Tree cover” on the GFW platform includes natural and planted forests, as well as tree crops that are not typically considered forest. To better monitor the world’s forests, GFW released the Spatial Database of Planted Trees (SDPT)in 2019, a harmonized compilation of local and regional datasets on planted trees. By identifying and eliminating these areas from GFW’s global map of tree cover, “natural forest” areas could be more readily isolated, leading to more effective tracking of national and global progress toward major international commitments that relate to forests, climate, and biodiversity. We conducted extensive outreach to compile, synthesize, and harmonize new national maps of the world’s planted forests and tree crops with the existing SDPT v1.0. Now, a newly updatedv2.0 is available, with updated or new sources for 143countries, reaching global coverage. Results show a global total of 264 million hectares of planted forests in 2020, or 6.5% of total tree cover. An additional 65million hectares were mapped as tree crops. The SDPT will continue to be updated periodically as new data are produced, allowing for continued monitoring of planted tree cover over time.

Session 5: Planted forests facing global change risks

Abstract n°50

Full name: Jane Njuguna **Email:** jnjuguna@kefri.org

Organisation: Kenya Forestry Research Institute

Abstract title: Declining Tree Health in Exotic Forest Plantations: Exploring the Potential for Indigenous Tree Species for Sustainable Forest Plantation Development in Kenya

Abstract

Planted forests are aimed at primarily providing commercial goods and services in addition to other ecosystem services. However, they continually face health challenges from diseases and pest occurrences due to their uniform genetic make-up. The years 2018to 2023 have been characterised by increased occurrences of stem cankers and dieback symptoms caused by the Botryosphaeriaceae and Teratosphaeriadisease complexes in plantations and farm forests in Kenya. In some cases, massive mortalities were witnessed. The disease symptoms seem to closely relate with prevailing local conditions being most severe during hot and dry conditions especially in plantations of pines, cypresses, eucalypts, Acaciamearnsii and Grevillea robusta. These symptoms are reported to have gradually increased from the late1990s noting that the period has been occasioned by unpredictable climatic conditions and droughts. Apart from Dothistroma blight that attacked Pinus radiata in the 1960s leading to its suspension, the cypress canker caused by Seiridium sp., was also detected attacked Cupressus maculata also leading to its discontinuation. The disease has currently resurfaced and is threatening growth of C. lusitanica. The occurrence of these diseases, coupled with increasingly dry conditions threaten the survival of exotic planted forests in the region. An extensive pathological study screened twenty-nine indigenous tree species for canker and dieback disease symptoms in Eastern and Coastal Kenya. Five detailed pathological studies revealed that, of the tested species, twelve were tolerant indicating a possible co-evolution with the canker and dieback pathogens. These included Melia volkensii, Acacia xanthophloea, A. tortilis, Sclerocarya birrea, Adansonia digitata, Croton megalocarpus, Vangueria rotundata, Berchemiadiscolor, Azadirachta indica, Tamarindus indica, Oleaeuropaea and Calodendrum capense. These results offer hope for plantation development in the arid and semi-arid areas which also offer the greatest opportunity for restoration and achieving the 30% tree cover, socio-economic development and climate change mitigation in Kenya.

Session 5: Planted forests facing global change risks

Abstract n°51

Full name: Jean-Paul Laclau **Email:** Jean-paul.laclau@cirad.fr

Organisation : CIRAD

Abstract title: Drought-adaptive mechanisms in Eucalyptus grandis plantations: key findings from 10 years of intensive monitoring in a throughfall exclusion experiment

Abstract

To improve forest management practices in a future drier climate, the effects of nutrition on the mechanisms involved in tree response to drought need to be better understood. A 2 ha throughfall exclusion experiment was conducted in Brazil to understand the effects of potassium (K) and sodium (Na) nutrition on tree structural and physiological adaptation to water deficit. Throughout the 6-year rotation, K and Na supplementation significantly increased growth and leaf area index (LAI) of Eucalyptus grandis trees, independent of water supply. Exclusion of 1/3 of the rainfall reduced aboveground biomass accumulation only for K-supplied trees. E. grandis trees were less sensitive to drought than expected as a result of the use of water stored in deep soil layers after clearing the previous stand. Trees coped with water limitation by stomatal closure, osmotic adjustment, reduction of LAI and rapid exploration of very deep soil layers by fine roots (down to the water table at a depth of 16 m).In addition, K fertilisation increased the water use efficiency for stem wood production. The seasonal dynamics of fine root growth were highly dependent on depth. Surprisingly, fine root mortality was very low after clear cutting, regardless of depth. This contributed to the rapid early growth of shoots in the coppice. Addition of K and Na increased maximum stomatal conductance, and the high-water requirements of fertilised trees increased water stress during dry periods. While K fertilisation is generally considered to be beneficial for plants to cope with water stress, weighted gene co-expression network analysis and Mix Omics-based co-regulatory networks, used in this experiment to integrate xylem and leaf transcriptomes, confirmed higher water stress in K- supplied trees than in K-deficient trees. Fertiliser regimes should be revisited in future drier climates to find the right balance between tree growth improvement and water stress limitation.

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Abstract n°52

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Organisation : [1] Kenya Forestry Research Institute

Abstract title: Pest risk survey of *Cupressus lusitanica* in Rift Valley region of Kenya.

Abstract

Cupressaceae species are a major plantation species in Kenya that were introduced in the early 1900s by British foresters to address timber and wood products shortage in the British protectorate. Among the first species introduced were *Cupressus macrocarpa*, *Widdringtonia whytei* and *Cupressus torulosa*. The three species have since been abandoned due to pest and disease attack. *Cupressus lusitanica* replaced C. macrocarpa which was badly affected by *Monochaetia unicornis* canker which was first reported in 1952. The present study was conducted to identify causes of blight on *C. lusitanica* in the Rift Valley region of Kenya. Fifty-six (56) stands of cypress ranging between 3 to 10 hectares (ha) in size were surveyed and disease incidence and severity scored in the dry and wet seasons. The plantations surveyed were also checked for insect pest attack. Samples of twigs and seeds of affected trees were collected and packed in cooler boxes for analysis in the lab. No insect pests were recorded in all stands surveyed but disease severity ranged from category 1 (healthy) to 5 (dead). Fungal isolation was carried out using moist chambering and agar methods on 2% malt extract agar (MEA). *Botryosphaeria sp. 45%, Pestalotia sp*. 33%, and Fusarium sp. 10% were the most commonly isolated fungal species. The identified fungal species were then tested for pathogenicity and developed similar symptoms as those recorded in the field. The fungal species *Botryosphaeria sp*. and *Pestalotia sp*. were re-isolated from the inoculated tree branches. Molecular identification of the fungal species to species level is ongoing. The study identifies a major threat to large scale planting of cypress in the country necessitating selection of resistant varieties of *C. lusitanica*. Changes in climate have created a major risk of susceptibility to pests and diseases from tree species that were previously thought to be resistant. Continuous monitoring for diseases and insect pests attack will identify high risk areas in a timely manner for proactive management and control of tree damage and mortality in plantation forestry.

Key words: Cypress decline, Fungal isolation, *Botryosphaeria sp., Pestalotia sp.*

Session 5: Planted forests facing global change risks

Abstract n°53

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Abstract title: Physical and biotic factors for modelling site selection of rosewood plantation and seed orchards establishment in Ghana.

Abstract

The demand of China's middle class for products from rosewood cannot be catered for by timber from natural forests in either Western and Central Africa or even in China itself. Case evidence of the negative ecological and environmental impacts of the unsustainable exploitation of the species from natural forests in the savanna of range states in Western and Central Africa, is shown in the 50% drop in Ghana's rosewood stem numbers inventories between 2012-2017. The Forestry Commission (FC) of Ghana under the Ghana Forest Plantation Strategy Document 2016-2040, strives to cater for the anticipated shortfall in rosewood timber supply via rosewood plantation establishment to meet both international and growing local demand for timber products from the species, and to diminish pressure on savanna forests containing the species. To achieve that aim, the FChas since 2016 established a total of 87.2ha of rosewood plantations. The paper develops a model to be utilised as a planning tool for decision makers in the establishment of rosewood plantation across the various vegetative zones of Ghana. Using the weighted linear combination under the multi-criteria decision analysis framework, the study integrates climatic factors, plant health data, germination and growth data, edaphic and topographic factors to assist decision makers in site selection and site species matching. Land suitability maps for the species produced were combined through the multi-objective land allocation (MOLA) approach under three (3)scenarios: Species growth rate, incidence of fire and potential plant health problems that could affect the plantation in its life time. The results show that over65% of the area available for rosewood plantations has medium, high or very high land suitability for growth of the species. The suitability maps produced may also be useful to both public and private sector led rosewood plantation initiatives.

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Abstract n°54

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Abstract title: Pests and Diseases Affecting Mangrove Forests: A Case of Lamu and Kilifi Counties, Kenya

Abstract

Mangroves render numerous socio-economic ecosystem services including poles; timber, fruits, medicine, and breeding zones for aquatic creatures. The role of blue forests in climate change mitigation cannot be underrated as they sequester more carbon compared to terrestrial species and help control erosion and ocean winds. Globally, mangroves health is threatened by both biotic and abiotic factors reducing forest cover hence need for this study. From literature, several pathogens including *Ceriospora rhizophorae, Colletotrichum sp., Pestalotiopsis sp., Polystigma sonneratiae Botrosphaeria ribis* have been reported to attack mangroves with little to no data for Kenya. A pest and disease survey was carried out in Lamu and Kilifi mangrove ecosystems to identify pests and diseases affecting mangroves. The study focused on identification, species specificity, occurrences and severity of infestation and infection. Sediment from affected mangroves sites were also analyzed. The surveyed areas were dominated by *S. alba*, *C. tagal*, *R. mucronata*, *A. marina, B. gymnorhiza*, *L. racemosa*, and *X . moluccensis* in mixed or pure stands. From results; *S. alba* was highly infested by the metabellid larvae moth (*Salagena obsolescens*) and wood boring beetle (*Bottegia rubra)* resulting in massive dieback with severity reaching 90% of sampled population. Snail infestation was more prevalent in *A. marina* and *R. mucronata* and very severe (80%) in dry season. Barnacles, bagworms, and lichen infestation were pronounced in *R. mucronata* and *C. tagal* especially the young sapling and planted seedlings resulting. Incidences of *A. marina* infested by crabs was reported. Sediment quality tests showed high levels of nutrients like phosphorus, nitrogen and heavy metals resulting from soil erosion. In conclusion, most pests and diseases were reported in *R. mucronata*, *A. marina* and *S. alba* and therefore more research on epidemiology to avail critical information on their impacts and management as this is a major emerging problem threatening benefits from blue economy and conservation efforts.

Key words: Mangroves, Pests, Diseases, Management, Kenya

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Abstract n°55

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Abstract title: Resilience of commercial tree species in planted forests of Kenya

Abstract

Ecosystem resilience of planted forests to climate change stressors is key to the future as a mitigation measure of climate change and to enhance reliability of multi-functions of these forests. Commercial forestry in Kenya is practiced by both state-owned and private stakeholders. There are three main commercial tree species in Kenya, on state plantations which are about 136,000Ha is composed of Pine and Cypress at 86% and Eucalyptus at 10% with the rest4% as indigenous forests (FAO, 2015). These commercial plantations are important for main forest products of pulpwood, sawlogs and transmission poles to cumulative value of 2,181,400m3 of wood products annually (Ototo, & Vlosky, 2018). This article focuses on a systematic review of literature of the past 10 (ten)years on status of commercial tree species resilience amidst the prolonged climate extremes experienced across East Africa. A series of related papers published were reviewed based on planted forests 'survival and canopy structural complexity. This were then correlated with the 30-year rainfall and temperature trends to show changing climates of these zones. The study designs were mixed methods at data collection and analysis levels. The study will show forest survival results and canopy structural complexity; a review of trends from articles studied to show survival, composition and expounding on canopy complexity of planted forests. The gaps inferred were on exploring optimal integrated effects of climate stressors on commercial forestry tree species and their ecosystem. This review paper will be useful to policy makers in informing key priority areas of ecological laws, budgetary allocations and to scholars on commercial forestry sector on concerns of research, species site matching, forest management and socio-economic development in plantation forestry.

Keywords: Planted forests; climate change; commercial forestry; resilience; tree survival; canopy structural complexity.

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Abstract n°56

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Abstract title: Simulating the impact of insect defoliations to assist forest management in eucalypt plantations in Portugal

Abstract

One of the major causes of growth losses in Portuguese Eucalypt plantations is defoliation by the Eucalyptus snout beetle *Gonipterus platensis*. Nevertheless, quantifying these losses to assist forest management has been difficult.

The 3-PG is a light-use efficiency stand-level model that produces good estimates for biomass components. Running on a monthly time-step it seemed suited to simulate the impact of seasonal *G. platensis* activity on volume harvested and on economic return. Thus, over the past years, the model was improved (3-PG.d) to be able to mimic different levels of spring or spring and autumn defoliation attacks by removing different amounts of leaf biomass. The 3-PG.d was run applying different defoliation scenarios to 9 virtual sites representing different productivities (3 Fertility Rating (FR) x 3 Available Soil Water (ASW)). The different defoliation scenarios combine defoliation intensities (25, 50, 75, 100%), with monthly defoliations defined based on expert knowledge and field monitoring data.

Some simulation results show that the highest and lowest harvested volumes at age 10 were observed for the highest and lowest productivity sites, respectively. For the intermediate productivity sites, ASW seems to play a major role than FR. Additionally, lighter defoliations seem to have a marginal effect regardless of site productivity. As expected, increasing defoliation reduced volume harvested and bigger losses occur when spring and autumn defoliations were combined in the same year.

The 3-PG.d model can be used to assist management decisions such as when to apply a specific control measure or assess the impact of fluctuations in insect activity due to environmental climate changes.

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Abstract n°57

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Abstract title: Successes, challenges and future prospects for forest pest surveillance and management to protect Africa's Forest resources

Abstract

Insect pests and diseases pose a substantial threat to the sustainability of plantation forests in Africa. The rate of introduction of alien invasive species as well new host associations of native insects and pathogens with plantation forest species is increasing. Some of these pest incursions have caused severe losses, restricting the planting of valuable tree varieties and discouraging investment in plantation forestry by local communities. Coordinated forest pest surveillance within countries and the region is needed for early detection and to inform management responses. This includes communication between countries and sharing knowledge on new pest incursions and management options. Initiatives such as the Forest Invasive Species Network for Africa (FISNA) of the Food and Agricultural Organization (FAO) can play an important role in such communication, as can academic and other research institutions and their global research partners. Here I provide an overview of some of the successes, challenges and future prospects for forest pest surveillance and management to protect Africa's Forest resources.

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Abstract n°58

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Abstract title: The Right Tree in the Right Place: Mapping and Predicting Global-scale Suitable Areas for Marula tree, Sclerocarya birrea, (A. Rich.) Horchst, subspecies Cultivation, Conservation, and Use in Restoring Global Drylands

Abstract

Marula, Sclerocarya birrea (S. birrea) (A. Rich.) Horchst, is a drought-tolerant and multipurpose tree native to Africa whose population is currently declining. The S. birrea subspecies have been used to restore drylands and introduced outside Africa as a pilot towards commercial cultivation. However, there is a global paucity of information regarding where subspecies can successfully establish themselves beyond Africa. We aimed to model, predict and quantify global-scale suitable areas for S. birrea and its subspecies beyond their native ranges under the current and future climates. Areas were modeled and predicted by using MaxEnt algorithm using occurrence data from Africa and, climatic and topographical environmental variables, and the Max Planck Institute for Meteorology and Hadley Climate Center's Earth Systems Models climate data under shared socio-economic pathways (SSPs) greenhouse gas concentrations, SSP3-7.0, for the year 2050 and 2080. The results show that models' predictive power was robust, with Areas under the Curves (AUCs) ranging from 0.90-0.98. Suitable areas for S. birrea and its subspecies area mainly defined by potential evapotranspiration, continentality, temperature and, precipitation seasonality. Currently, suitable areas for S. birrea and its subspecies exist in all continents except Europe and Antarctica and, occupy 3,751,057 km2 to 24,632,452 km2 of earth's terrestrial area scattered in 54 to 107 countries predominantly in global biomes with climatic conditions ranging from desert tropical to temperate humid. Under future climates, the areas will retract by 64-100%, shifting to high latitudes and being limited to tropical desert-to-desert temperate, Mediterranean warm global biomes, and some regions of Eastern Europe will become suitable. Suitable areas for S. birrea and its subspecies exist beyond Africa, and they will retract and migrate to high latitudes under future warming climates. The knowledge is important for guiding commercial cultivation, conservation efforts, and the use of the S. birrea subspecies in global drylands restoration.

Session 6: Optimizing trade-offs across ecosystem services: towards new models of management

Abstract n°59

Full name: Rishav Rawal **Email:** rawalrishav1@gmail.com

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Abstract title: Assessment of resilient restoration practices for biodiversity conservation by plantation of community forest in Darma valley of Kailash Sacred Landscape, India

Abstract

Communities across the globe are facing crises due to Climate Change (CC) , which has harsh environmental impacts that are evidential in various forms like increasing pollution, changing weather conditions, unpredicted natural calamities. The impacts are more severe in context of Himalayas where the magnitude of climate change (CC) is higher in comparison to other part of world , that is putting identity of indigenous communities vulnerable. However, throughout Himalayas we can witness tradition of planting trees as per there sacred values which is acting as restoration practices for creating resilient shield against climatic hazards.

The present study focuses on one such indigenous Shauka communities residing in highlands of Kumaun Himalayas in Uttarakhand state, India popularly known as Rung. The Rungs had adapted to variation in climate by passing time and had able to survive against unpredicted climatic insecurity in such tough terrain.

Rung cultural zone is the part of Kailash sacred landscape, India and spreads along the three valleys of Darma, Byans and Chaudans along the watershed of Dhauli and Kali river. In this study we conduct study in Darma valley where the inhabitants are able to face climatic hazards through various measures amongst which restoration of community forest have important place in guarding landscape against climatic tensions Various field-based surveys followed by consultation and interviews takes place with the community representatives from the valleys for making a robust documentation in a concern issue.

The present study aims to assess the mitigation and adaptation planning of the community by restoration of biodiversity in form of forest against natural calamity that had helped community to survive in tough landscape for long run of time and try to find the role of these adaptation planning in rich culture of community. In addition, this study also tries to lay down suggestive measures for mare resilient restoration plan against Climate Change(CC) in the landscape.

The study is helpful in providing comprehensive information about the various adaptation methods, with the help of which people of community are able to remain settled in this kind of harsh terrain, however the assessment also mentions about the challenges and problems that community faces due to continues climatic variations.

The study is able to gather useful information on different resilient plans and method, helping the residents of landscape to reside there for centuries in tough landscape. The study also highlighted the challenges that these residents had to face in present times when climate change is happening in rapid manner.

Session 6: Optimizing trade-offs across ecosystem services: towards new models of management

Abstract n°60

Full name: Michael Likoswe **Email:** mlikoswe@gmail.com

Organisation : Forestry Research Institute of Malawi

Abstract title: Building resilience of ecosystems and people's livelihood through afforestation: The case of Lake Chilwa Basin in Malawi

Abstract

Lake Chilwa Basin Climate Change Adaptation Programme (LCBCCAP) was a seven-year research and development programme in Malawi, designed to protect the livelihoods of the population and enhance resilience of the natural resource base upon which it depends. High and increasing population density in the basin has created a soaring demand for forest products and other ecosystem services resulting in high levels of deforestation and forest degradation. In order to address the widespread deforestation as a problem, LCBCCAP adopted the Drivers-Pressures–State–Impact–Responses (DPSIR) framework that describes a problem as a chain of casual links where responses are easily identified and implemented at each of these steps of the casual links. Two themes were selected based on the DPSIR framework: ecosystem restoration and provision of forest products for improved community livelihoods. Selection of these interventions was made after a wider community consultation; notably awareness campaigns, meetings, trainings, and community choices. Specific interventions were selected based on identified community priorities in relevant hotspots. The interventions implemented include: tree planting (seedlings and truncheons) including fruit trees and fire management; bamboo planting; honey production; testing, selection and growing of fine hardwood tree species for timber and firewood and woodlots establishment. Tree planting was undertaken through the Village Natural Resources Management Committee (VNRM). The programme supported the planting of 3.5 million trees with 71% survival rate, 30,000 fruit trees, 5,400 truncheons. High survival rate was achieved as there was ownership by communities, good management, good governance structures and use of high-quality seeds and seedlings. Test plantation of selected fine hard wood indigenous tree species showed that Khaya anthotheca can be grown as a plantation unlike Afzelia quanzensis. Currently Forestry Research Institute of Malawi is annually supplying tree seed that produce over 30 million trees countrywide through lessons learnt from the programme.

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Abstract n°61

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Organisation : Forestry Commission

Abstract title: Estate plantations and small-scale woodlots: two models of planted forests with different implications for sustainability and livelihoods in Zimbabwe

Abstract

Planted forests are an important component of the forest sector in Zimbabwe, providing timber, fuelwood, and other ecosystem services. The country has about 15.6 million hectares of forests, of which only 108,000 hectares (representing 2% of the country's total land area) are planted forests. However, the state of planted forests in Zimbabwe is poorly understood regarding its contribution to the national economy and environmental goals. Zimbabwe adopted a small-scale woodlot model in 2012 specifically for wood energy in the agriculture sector. The model was implemented through a Statutory Instrument to compel tobacco farmers to grow their own woodlots for wood energy. This paper reviews the available literature on estate plantation and small-scale woodlots in Zimbabwe, focusing on their history, current status, challenges, and opportunities. The paper also discusses the potential role of planted forests in mitigating climate change and enhancing biodiversity conservation. This study also aims to review extent, composition, management, and ecological impacts of planted forests in Zimbabwe. The paper will also discuss the policy and institutional frameworks that govern planted forests in Zimbabwe, and the role of different stakeholders such as the government, private sector, communities and civil society. The paper concludes that planted forests have a significant potential to improve the livelihoods of rural communities and contribute to the sustainable development of Zimbabwe, but they face several threats such as land degradation, fire, pests and diseases, and policy and institutional constraints. The paper recommends further research on the socio-economic and ecological impacts of planted forests, as well as the development of a comprehensive national forest inventory and monitoring system. The study suggests that estate plantation and small-scale woodlot have different roles and functions in the context of Zimbabwe's forestry sector, and that a balanced approach is needed to promote both models in a sustainable and equitable way.

Session 6: Optimizing trade-offs across ecosystem services: towards new models of management

Abstract n°62

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Abstract title: Revisiting ecosystem services from planted forests

Abstract

Planted forests receive both scepticism and support in international forestry policy and management forums. Globally, plantations are increasing but there has been little assessment of the impact on ecosystem services. Our research examines this gap in the role of planted forests, including piloting a framework for assessment of ecosystem services; the challenges and opportunities of mixed-species' plantations for commercial and restoration purposes; the multiple benefits from community-based forest restoration; and the relative supply capacity of ecosystem services from bamboo forests. We present case studies from Africa, Asia and Latin America.

Key words: ecosystem services, planted forest, framework,

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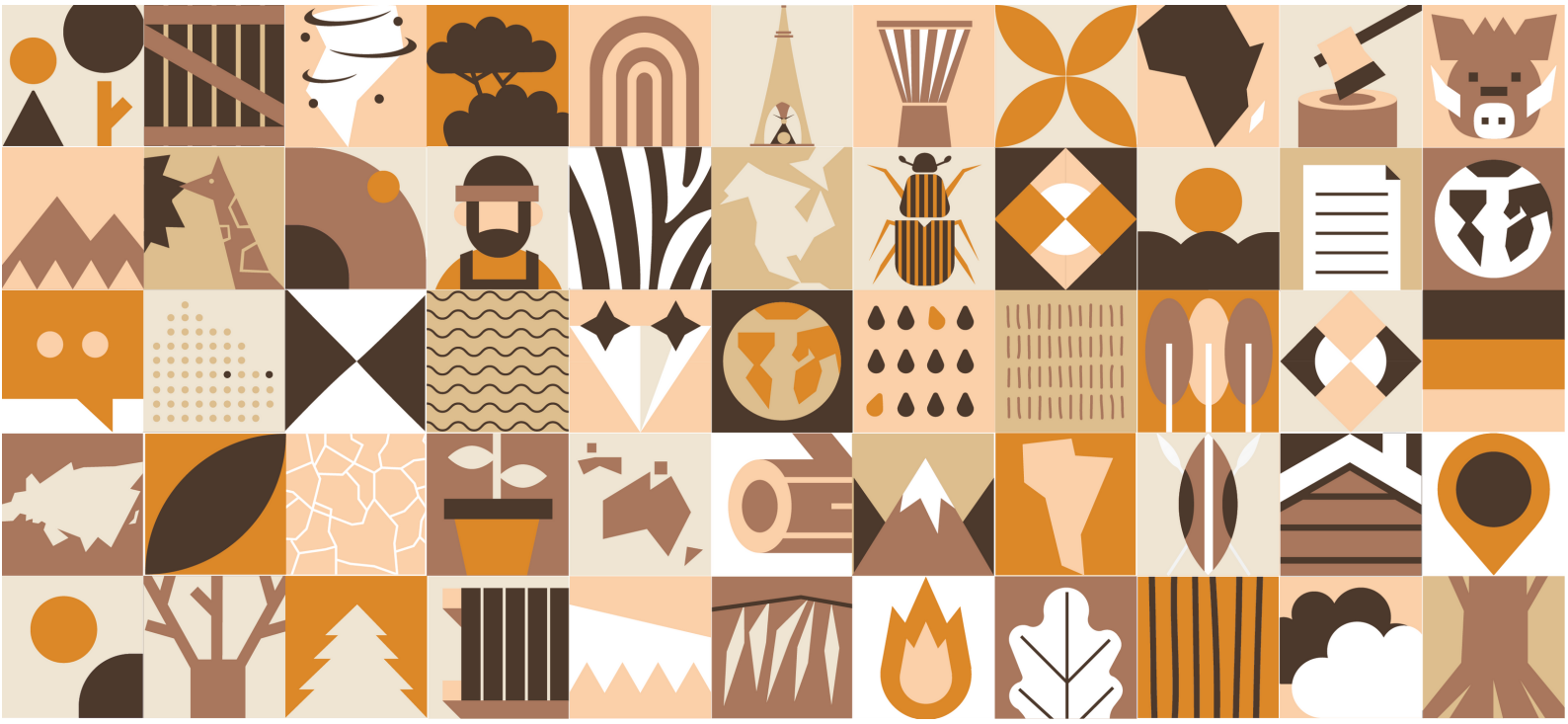

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