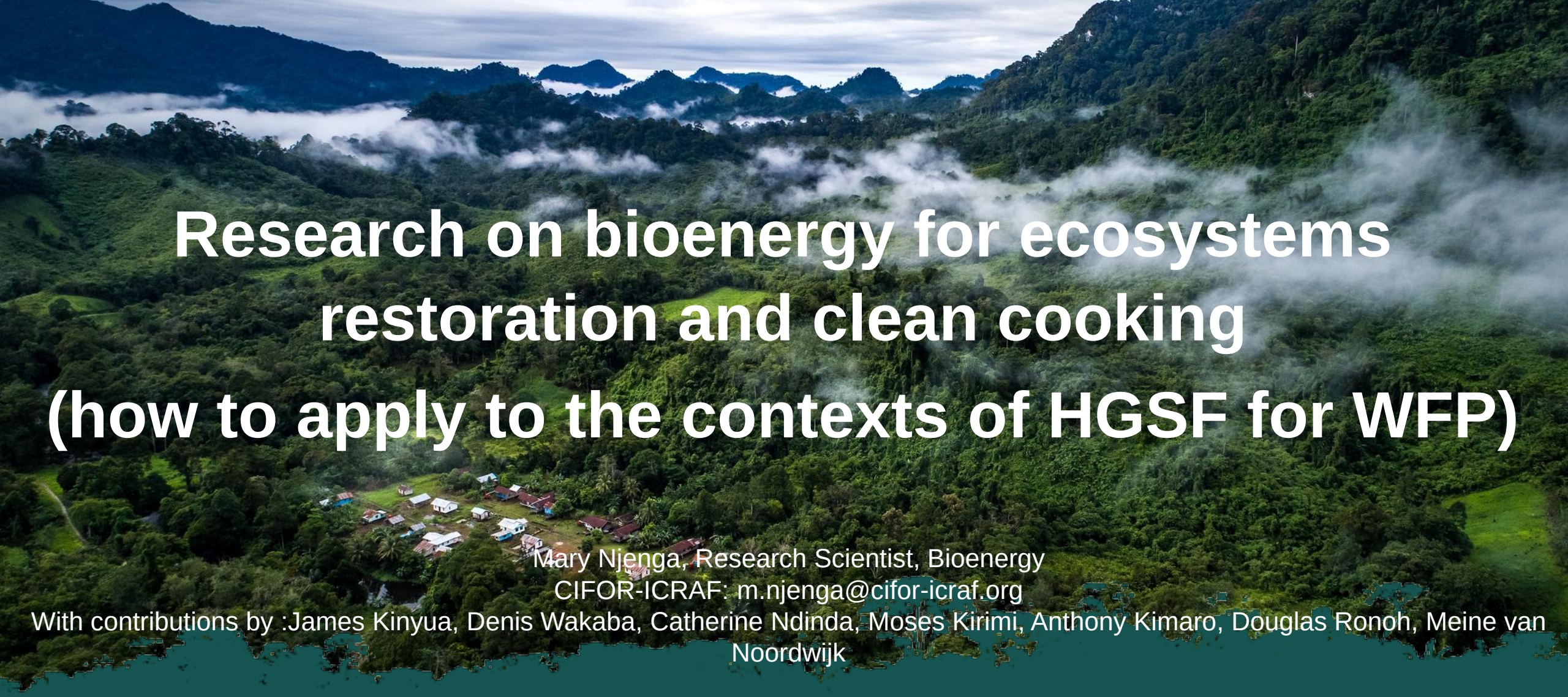

Research on bioenergy for ecosystems restoration and clean cooking (how to apply to the contexts of HGSF for WFP)

Mary Njenga, Research Scientist, Bioenergy
CIFOR-ICRAF: m.njenga@cifor-icraf.org
With contributions by :James Kinyua, Denis Wakaba, Catherine Ndinda, Moses Kirimi, Anthony Kimaro, Douglas Ronoh, Meine van Noordwijk

Webinar on research and data needs for transitioning school feeding programmes to clean cooking in Eastern Africa.
6·3.2025 UNEP and WFP

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CIFOR-ICRAF: Who we are

Vision, mission and values

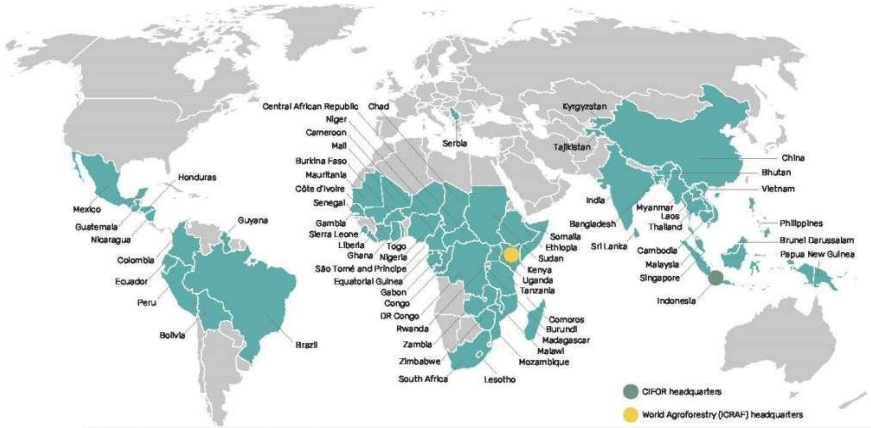
Vision – an equitable world in which viable livelihoods in resilient landscapes foster well-being for people, trees and the environment

Mission – to harness the power of science and innovation to improve the benefits that forests, trees, soils and their sustainable management can provide to all of humankind, for a more resilient, equitable and prosperous future

Values

- Working with nature
- Commitment to research for impact
- Integrity and professionalism
- Respect, partnership and collaboration
- Innovation
- Efficiency and effectiveness

Regional priorities



Partnerships at a glance

More than **2,200** projects completed

More than **90** countries

Currently active in more than **60** countries

More than **190** active partnerships

USD 1.8 billion invested in research

800 staff

10-year collaboration with FTA partners

Transformative Partnership Platforms – alliances focused on critically important challenges

Engagement Landscapes – geographic locations where we carry out concentrated, long-term transformative work with diverse and committed partners

Flagship Products – initiatives that provide action-oriented insights into key global issues

The five challenges

CIFOR-ICRAF provides actionable, game-changing solutions to five major global challenges:

- Deforestation and biodiversity loss
- A climate in crisis
- Transforming food systems
- Unsustainable supply and value chains
- Extreme inequality

Research Themes

- Trees and forest genetic resources and biodiversity
- Livelihood systems
- Sustainable value chains and investments
- Governance, gender, justice, and wellbeing
- Climate change, energy and low carbon development

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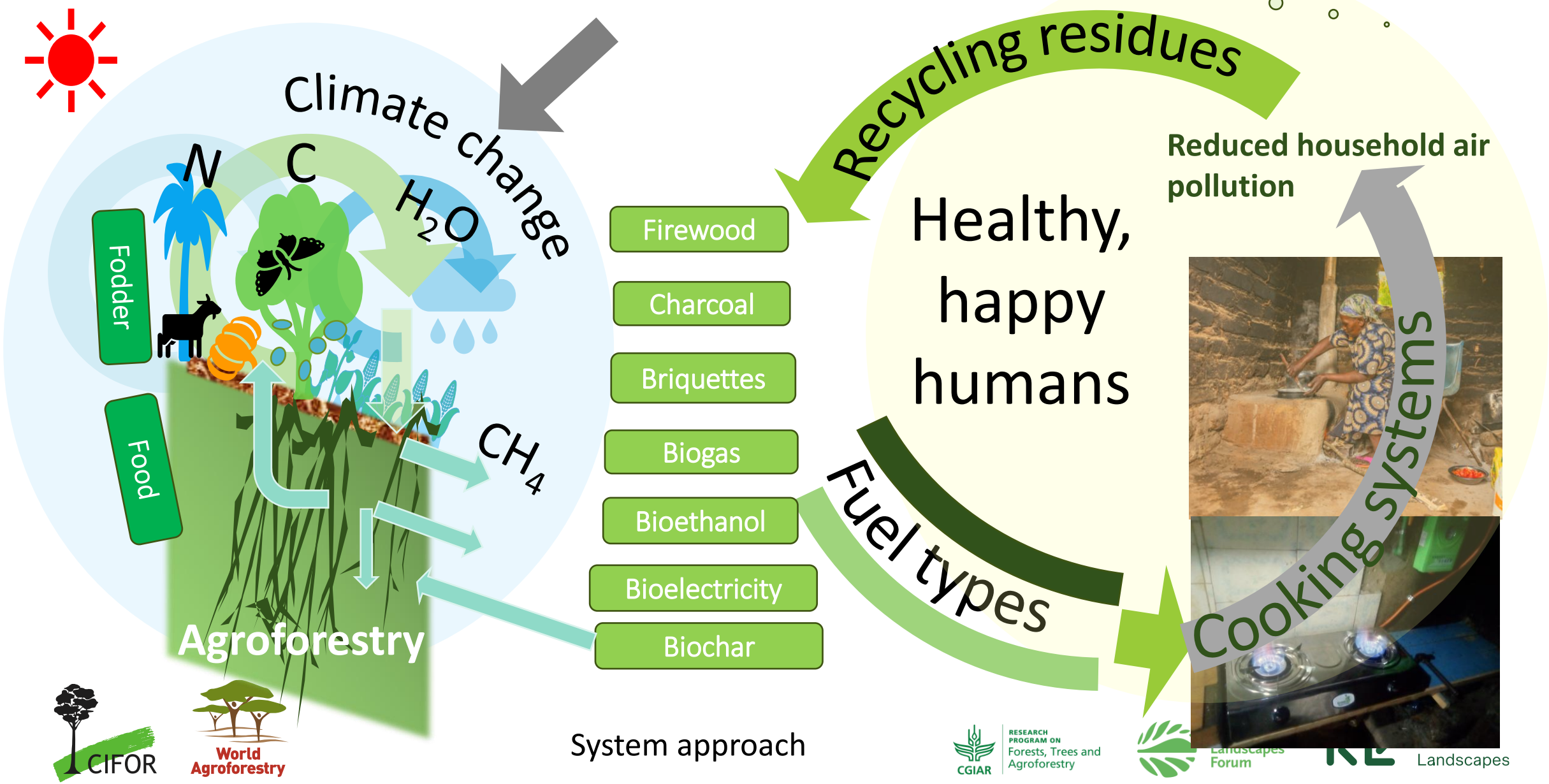
Resilient social-ecological bioenergy systems: Multidisplinary agenda



System approach

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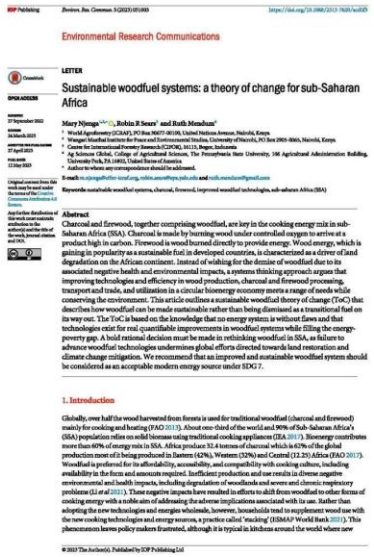
Landscapes

Sustainable woodfuel systems: A theory of change for sub-Saharan Africa (SSA)

Enhancing efficiency and resource recovery and reuse (RRR) at every stage


Environmental Research Communications

LETTER

Sustainable woodfuel systems: a theory of change for sub-Saharan Africa

Mary Njenga, Robin R Sears and Ruth Mendum

Abstract

Charcoal and firewood, together comprising woodfuel, are key in the cooking energy mix in sub-Saharan Africa (SSA). Charcoal is made by burning wood under controlled oxygen to arrive at a product high in carbon. Firewood is wood burned directly to provide energy. Wood energy, which is gaining in popularity as a sustainable fuel in developed countries, is characterized as a driver of land degradation on the African continent. Instead of wishing for the demise of woodfuel due to its associated negative health and environmental impacts, a systems thinking approach argues that improving technologies and efficiency in wood production, charcoal and firewood processing, transport and trade, and utilization in a circular bioenergy economy meets a range of needs while conserving the environment. This article outlines a sustainable woodfuel theory of change (ToC) that describes how woodfuel can be made sustainable rather than being dismissed as a transitional fuel on its way out. The ToC is based on the knowledge that no energy system is without flaws and that technologies exist for real, quantifiable improvements in woodfuel systems while filling the energy-poverty gap. A bold rational decision must be made in rethinking woodfuel in SSA, as failure to advance woodfuel technologies undermines global efforts directed towards land restoration and climate change mitigation. We recommend that an improved and sustainable woodfuel system should be considered as an acceptable modern energy source under SDG 7.

1. Introduction

Globally, over half the wood harvested from forests is used for traditional woodfuel (charcoal and firewood) mainly for cooking and heating (FAO 2013). About one-third of the world and 90% of Sub-Saharan Africa's (SSA) population relies on solid biomass using traditional cooking appliances (IEA 2017). Bioenergy contributes more than 60% of energy mix in SSA. Africa produce 32.4 tonnes of charcoal which is 62% of the global production most of it being produced in Eastern (42%), Western (32%) and Central (12.2%) Africa (FAO 2017). Woodfuel is preferred for its affordability, accessibility, and compatibility with cooking culture, including availability in the form and amounts required. Inefficient production and use results in diverse negative environmental and health impacts, including degradation of woodlands and severe and chronic respiratory problems (Li et al 2016). These negative impacts have resulted in efforts to shift from woodfuel to other forms of cooking energy with a noble aim of addressing the adverse implications associated with its use. Rather than adopting the new technologies and energies wholesale, however, households tend to supplement wood use with the new cooking technologies and energy sources, a practice called 'stacking' (ESMAP World Bank 2020). This phenomenon leaves policy makers frustrated, although it is typical in kitchens around the world where new

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Njenga et al: 2023: https://iopscience.iop.org/article/10.1088/2515-7620/acd0f3

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Woody biomass production by farmers

Wood yields and consumption time (months) for different agroforestry technologies with and without improved cooking stoves (ICS) in Tanzania

Technology	Tree species	Spacing (m)	Wood (t ha^{-1})	ICS*	TFS*
Boundary	Acacia polyacantha	2 x 2	4.41	3.5	2.4
	Eucalyptus camadulensis	2 x 2	7.70	6.1	4.2
Woodlots	Grevillea robusta	2 x 2	2.64	2.1	1.4
	Senna siamea	3 x 3	1.01	0.8	0.6
	Melia azadarachta	4 x 4	0.84	0.7	0.5
Shelterbelt	Grevillea robusta	3 x 3	0.46	0.4	0.3
	Gliricidia sepium	1 x 2	2.08	1.6	1.1
Intercropping	Gliricidia sepium	3 x 3	1.34	1.1	0.7

Outputs and outcomes:

- Developed biomass equation for estimating G. sepium yield on-farm (Hafner et al. 2021; Energy, Sustainability and Society).
- Build capacity of farmers to produce high quality seedling to integrate into agroforestry technologies
- On-farm restoration with a component on **bioeconomy of biomass energy** to inform USAID's mission program on landscape restoration in Tanzania. October 2023-September 2024

Contact: A.Kimaro@cifor-icraf.org

Tree growing in refugee settings for energy, food and other ecosystems service

- Agroforestry Training Centre, Rhino-Imvepi set up in 2018
- 120,000 seedlings
- Trainings: Foresters, community facilitators
- Tree seed collection and seedlings production

Results

- Firewood for institutions: Annex primary school, Imvepi
- 30% of households firewood from agroforestry tre

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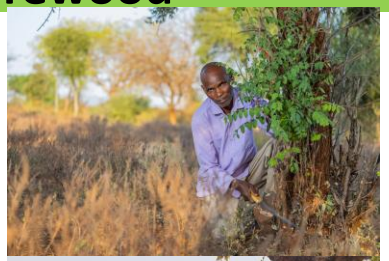
Management of native trees in drylands for firewood



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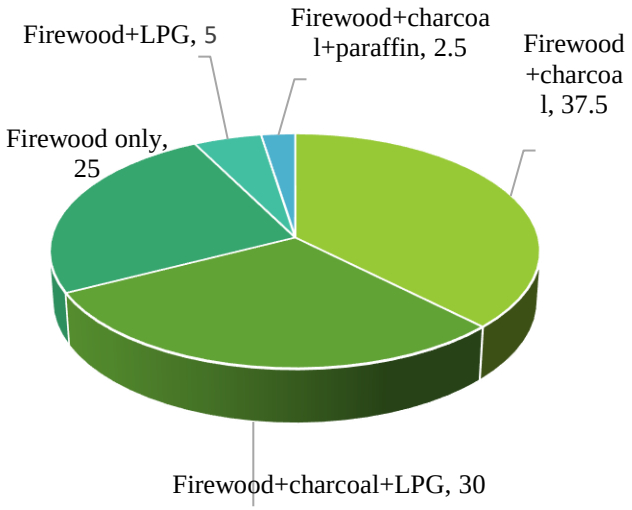
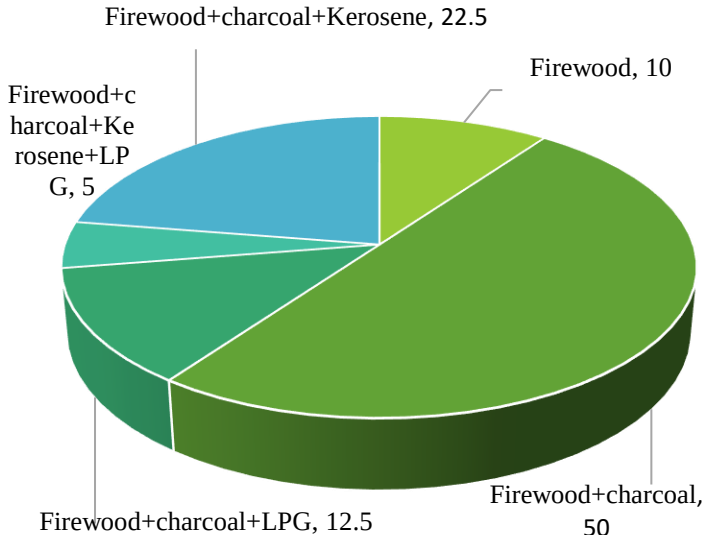
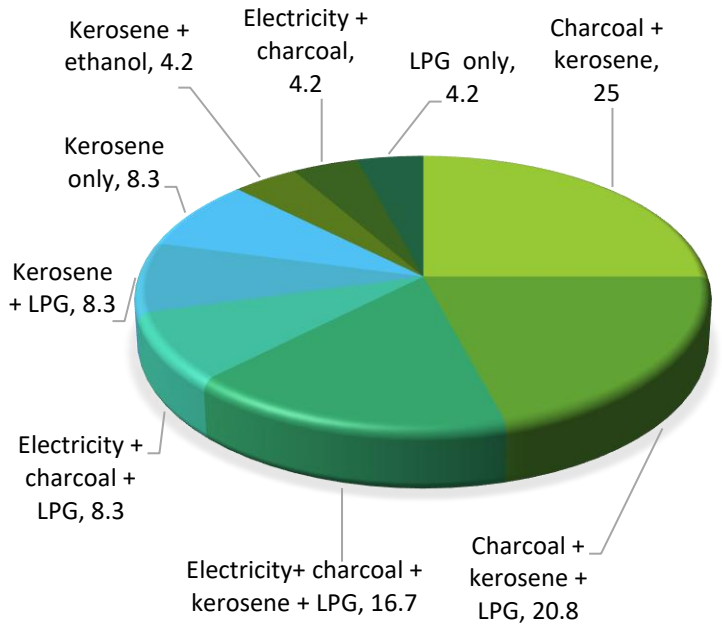
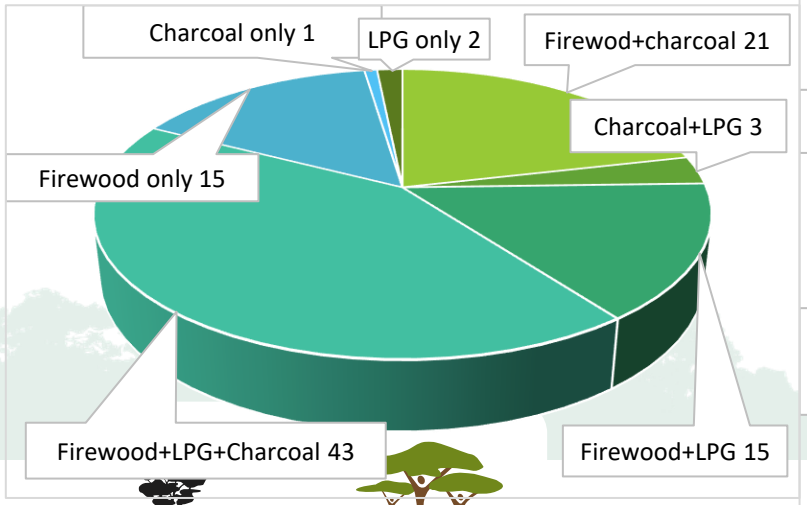
Clean cooking stacked with traditional fuels



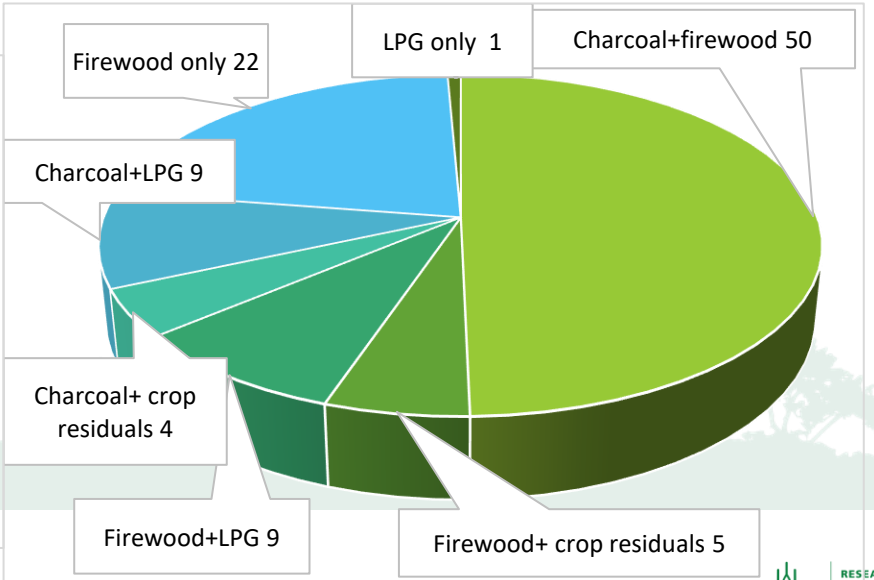




Household cooking and heating energy **stacking** in rural Kiambu and Embu Counties, Kenya. LPG=liquid petroleum gas: Njenga et al., 2021: https://doi.org/10.1016/j.erss.2021.102071



Drylands-Laikipia2024



Drylands- Makueni 2024

Kirimi et al., 2023: Cleaner Cooking with Charcoal in Kibera Informal Settlement Energies 16, (19) 6808 https://doi.org/10.3390/en16196808

1 MSc and 2 PhD on urban energy and 1 PhD on rural energy

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Management by utilization of *Prosopis juliflora* for bioenergy in Kakuma-Kalobeyei refugee settlement (Municipality)

FAO, UNHCR, WFP, CIFOR-ICRAF, ECO CHARCOAL, KEFRI and other partners

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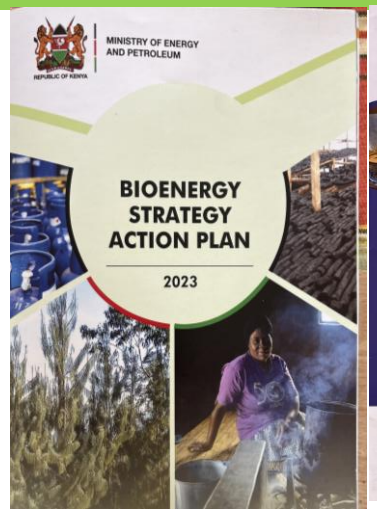
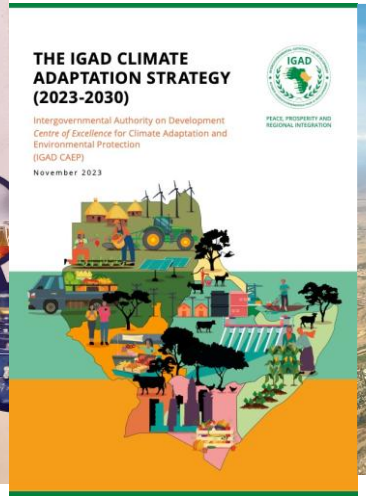
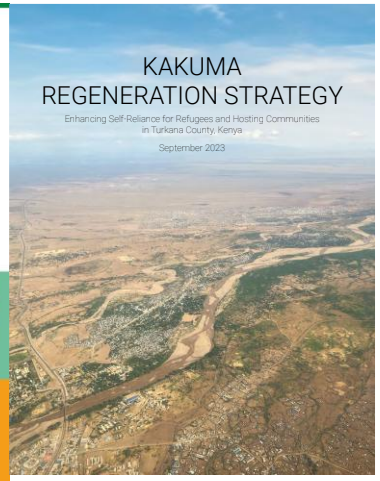
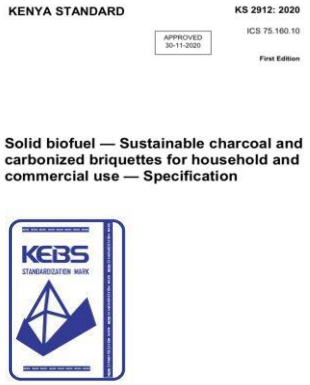
Role of science in climate resilience and energy policy and programming



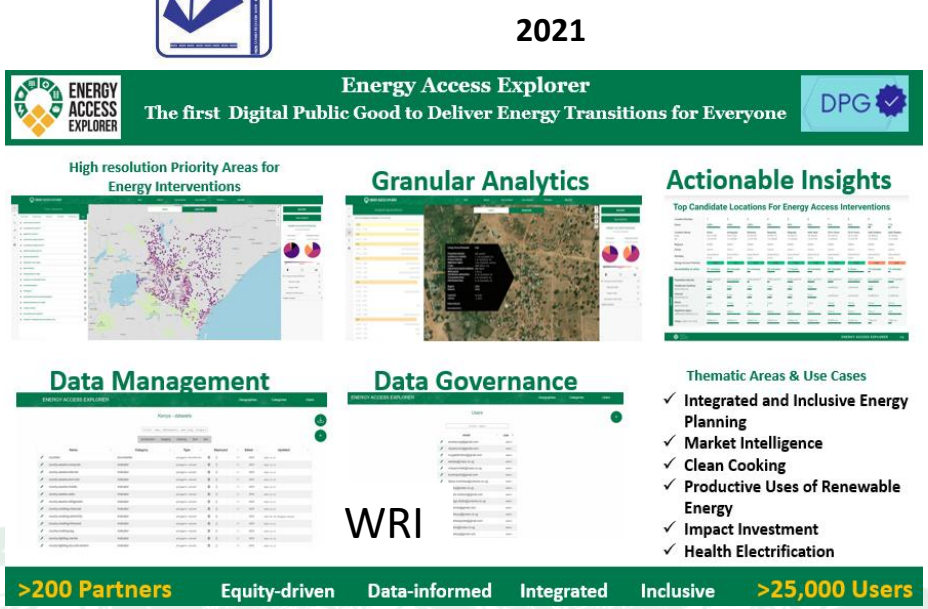






Value Added Tax (VAT) exception on sustainable briquettes, biogas, biothermal 2021

Climate Action Plan for the East and Horn of Africa and Great Lakes Region
2023-2028



https://www.energyaccessexplorer.org

Evidence in appropriate form, planning tools and championing policy outcome

Let us all do this: Thank you

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Thank you

CIFOR-ICRAF: Research themes and programmes with bioenergy components

- https://www.cifor-icraf.org/research/theme/climate-change-energy-and-low-carbon-development/
- https://www.cifor-icraf.org/research/topic/bioenergy/
- https://www.cifor.org/cbe
- https://www.cifor-icraf.org/refugee-hosting-landscapes/
- https://www.cifor-icraf.org/yangambi-engagement-landscape/

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