Tree-based solutions in the refugee-hosting landscapes of Northwestern Uganda 2017 to 2025

A case study and guidance

CIFOR-ICRAF

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Introduction

This is a report about a project that began in 2017, when many were sceptical that refugees could or would grow trees. Their arguments against it being likely to happen included: refugees lack land for trees despite the plots allocated to them under Uganda's welcoming refugee model; refugees would not see the long-term benefits of the trees and so would not be motivated to plant or maintain them; and trees would interfere with food production.

But gradually such doubts fell away. Global thinking evolved with the ever-growing crises of climate change, biodiversity loss and land degradation, and today agroforestry, restoration and reforestation are part of the refugee response. "Mitigating the impacts of climate change and environmental degradation on forcibly displaced people and their hosts (and) supporting their resilience by preserving and rehabilitating the natural environment, are imperative to fulfil (our) mandate," states one UNHCR document. Summary-Operational Strategy for Climate Resilience-Environmental Sustainability 2022-2025_0.pdf

Meanwhile, on the ground in Uganda, ICRAF has been able to demonstrate that not only will refugees grow a multitude of trees if given the chance, but that trees can fruit in six months and trees and crops flourish together in tree-crop systems called agroforestry. ICRAF has also often heard refugees expressing sentiments like "If I go home, someone here will enjoy the trees I planted. And if we come back, they should be happy to see us, not angry because we have cut all their trees." Today refugee-hosting areas are primed for growing trees and – with refugees and host nationals dependent on natural resources and landscapes that are degrading – this is a golden opportunity.

In late 2017, in Northwestern Uganda, ICRAF set up base in Imvepi and Rhino Camp refugee settlements to first ascertain the need for trees, which trees, and what refugees and hosts wanted. ICRAF then started a programme that raised and distributed seedlings at no cost to refugee and host households, adding institutions such as schools in 2020. The seedlings came with copious support, training and backstopping at a learning centre and in the field. The seedlings were a mix of up to 30 indigenous and exotic species, reflecting the simultaneous goals of addressing human needs for fuelwood, poles, timber, fruit and other tree products, while conserving and restoring biodiversity and tree cover for critical ecosystem services, such as improved microclimate, shade, soil and water conservation.

The project had many successes: thousands of refugees intensified trees on their plots, hundreds of hosts grew woodlots. This report shares what was done, lessons learned and issues to note, and provides a compendium of useful trees and shrubs. It has been a privilege to work with refugees, local government and NGOs on this. We give heartfelt thanks to our donors.

Background

Uganda hosts 1,741,331 refugees, the vast majority of whom live in open settlements, each household receiving a plot of land under a policy to promote refugee-host social and economic integration. Uganda's Office of the Prime Minister (OPM) holds the mandate for refugees and set up the Imvepi and Rhino Camp refugee settlements in 2018 and 1980 in Madi-Okollo and Terego districts, respectively. They have 68,091 and 153,205 residents each, almost exclusively South Sudanese. Like all refugees in Uganda, they have the freedom to move around and work, but are expected to grow much of their own food and build their own homes. The districts also have a combined population of 454,200 Ugandan nationals or hosts, the vast majority of whom also depend on natural resources for their livelihoods and subsistence. The landscapes on which the refugees and hosts reside largely consist of clan land formerly used for hunting, and include a mosaic of cultivated land, grassland, open and closed woodland, and forest.

L-R The project invested in training, including capacity development in tree seed collection and handling in 2021.
A refugee home begins to acquire diverse trees and the benefits they bring.

How it started: "It was a change of mindset"

Joel Adriko, 54, is the project's longest serving staff member, having joined in January 2018. His supervisors were Dr Clement Okia, then head of ICRAF Uganda, and Dr Lalisa Duguma at ICRAF Nairobi. "The whole place was bush with savanna trees like *Ziziphus, Combretum* and acacia," he recalls. "But it was degraded and burned. Many trees had been cut, forcing refugees to go longer distances."

The initial aim was simply to understand. "We did 300 household interviews in Rhino Camp and 300 in Imvepi," says Adriko, who holds a diploma from Nyabyeya Forestry College, Uganda's technical forestry college. "This gave us knowledge. All were very positive and mostly interested in trees that bore fruit or had edible leaves like moringa. Alongside that, living under tarpaulins, they were interested in poles for construction. Our whole idea was that there was something we could do, and it became reality."

"We found that on a plot of 50 m x 50 m, refugees could plant 42–45 trees on their boundary – a tree every 5 m. Then, inside the compound, you could have 12–13 trees, like jackfruit. We gave that design to Clement. It was sent to Nairobi, and that's when it went into practice. The first planting was in Siripi and Ofua 6. People perceived it well. It provided poles but also solved border conflicts when you plant a few centimetres inside."

"For refugees and hosts who did not understand, when they saw the results, they started walking to our nursery to get seedlings," Adriko says. "It became demand driven. The idea was to initiate them into planting so that they could reduce pressure on natural trees as quickly as possible. Resilience came up from what we were doing. The land of the refugees became greener: you'd see crops and trees inside them. We were working with GIZ, which was promoting energy-saving stoves.''

"The papaya started fruiting in six months. *Markhamia* grew very well. N-fixing *Albizia* also never failed. We told refugees that it was one of the best agroforestry species. They saw the leaves dropping and improving their crops. Raising *Afzelia* came with conservation of indigenous trees. There's a threat that they can be wiped out. Species like that and *Vitex doniana* were a surprise to them. They did not know that these things can be grown. It was a change of mindset."

"We gave thorough training to community-based facilitators: they have been so good," he added.

Adriko said that challenges included animal grazing, drought, bush fires and transport: "We walked on foot or borrowed bicycles initially. Later we had motorbikes and a motorbike tricycle." He noted with concern "other partners who were clearing indigenous trees to plant teak woodlots" and highlighted the need to create awareness among people who are lagging.

How it evolved: "ICRAF's model was unique"

Gordon Eneku Adima, 41, started as a UN environment officer in Northwestern Uganda in 2017, which gives him the insights of seven years. Today, he is a strong advocate of restoration and tree growing – the rolling out of far fewer trees with much greater follow-up – rather than the tree planting that characterized the early response to the refugee influx, whereby many seedlings did not survive.

"The model that ICRAF brought was unique," he says, citing community-based facilitators (CBFs) as an example of the support that tree growing requires to be successful. "We think that everyone knows how to grow trees. We don't guide them. That is why we have had a lot of tree projects fail. You need to monitor different households. A CBF is someone who does that and gets to understand the challenges."

He adds: "ICRAF showcased to people the different ways of tree planting and that indigenous trees could be raised. Even the jackfruits and papayas that ICRAF supplied to refugees in Ofua 6 in Rhino Camp are part of restoration in the refugee environment. You can see them growing today."

The journey: Five projects united by a common cause

ICRAF's programme in Northwestern Uganda rolled out under five projects, all based on the belief that Uganda's model of making land available to refugees was an opportunity to create resilience with trees, and that agroforestry was the key to growing trees in a context of plots with limited space because of its ability to generate multiple benefits and to complement, rather than compete with, crops.

The first project, **Sustainable use of natural resources and energy in the refugee context in Uganda,** ran November 2017 to June 2018. Funded by a USD 325,682 grant from the UK Department for International Development (DFID), its goal was to develop agroforestry models to meet the needs of refugees and local inhabitants for tree products, particularly fuelwood for cooking and poles for shelter. Beginning with studies, the first documented 81 tree/shrub species, calculated that trees contributed 3.5 kg/day of fuel per refugee, and concluded that "the area faces a severe threat with refugees having to walk further, which could result in conflicts with the local population as well as the collapse of ecosystem services and goods." In the second, refugees estimated that they could plant 32 trees per plot in Imvepi and 57 per plot in Rhino Camp: hosts said they could plant from 863 to 1,249. Both groups strongly preferred exotics "despite a high reliance on natives." "This requires sensitization since indigenous species provide nutrition and underpin ecosystem services and biodiversity," the authors said.
www.worldagroforestry.org/blog/2019/11/19/refugee-crises-its-crucial-maintain-environment-and-trees

The project set up a "learning centre" in Imvepi with a 35-bed tree nursery, which by June 2018, had raised 156,000 seedlings, 120,000 of which were distributed to 420 households (92% refugees). Species numbered 23. "We have shown that it is possible to raise indigenous trees," said ICRAF country representative Clement Okia. "They grow well and are not on the landscape by accident. They are adapted." The team had four Ugandan foresters, six South Sudanese community-based facilitators (CBFs) and – from both communities – 12 nursery workers, and in potting season, 60 casual labourers, mostly women. Government officials were welcoming. "We have been grappling with very huge numbers," said Vivian Oyella, then of OPM. "Social cohesion is broken when land is degraded." Water Resources Commissioner Callist Tindimugaya said: "Refugee settlements are water catchments. How can you separate water from environment?"

Empowering youth through agroforestry to improve natural capital in refugee-hosting areas of Northwestern Uganda ran July 2018 to April 2019. With a USD 46,000 grant from UK NGO Mvule Trust, it enabled ICRAF to raise and distribute 97,500 seedlings of 20 species; train 325 refugees and nationals in tree growing; and host Ugandan interns. A December 2018 report said the project stood out for its focus on tree diversity. "Resilience-building requires, as much as possible, mimicking the actual landscape structure and its components," then-ICRAF scientist Lalisa Duguma explained. Four visiting UK MPs launched the 2019 season by planting Afzelia africana, a vulnerable hardwood on the IUCN Red List.

During this time, the project received its first external feedback, PhD student Evangeline Grosrenaud from Coventry University finding that refugees planted trees to meet the need for shade – followed by poles, firewood and windbreaks – and to "attract rain" and "keep a good relationship" with hosts. She found refugees and hosts deriving "key benefits" such as

L-R: In early 2018, ICRAF clears land for the learning centre; holds an FGD with refugees to understand their planting preferences; and the original ICRAF field team waters seed for the first of the 700,000 or so seedlings the nursery will go on to raise.



L-R: By mid-2018, the nursery is full, field coordinator Joel Adriko takes stock; a community-based facilitator (left) records seedlings being distributed as refugees take the ones they want.

improved livelihoods and nutrition, and that demand for fruit trees was so high that the project was limiting beneficiaries to two papaya and two jackfruit trees. doi.org/10.3390/su13042134

The REHOPE BRIDGE project ran April 2019 to January 2020. Funded by a USD 143,640 grant from UK DFID to support agroforestry for environmental management in the humanitarian response – this time in Rhino Camp and Bidi Bidi – the team produced 170,000 high-quality tree seedlings, 169,378 of which were planted by 1,367 refugees and 343 hosts; led establishment of 197 small woodlots and 50 orchards with 30 mangoes each; trained 404 refugees and hosts to produce honey, beeswax, shea butter and oil from Balanites seed; and raised awareness in person with 2,304 people, reaching about 150,000 more via radio.

Agroforestry with refugees and hosts in Northwestern Uganda ran February 2020 to February 2025. Hosted on GlobalGiving, it raised USD 460,000 and facilitated: core activities; purchase of two motorcycle trailers; training on seed for 24 NGO staff and nursery workers; and outreach to "schools and other institutions, where trees can become permanent fixtures not vulnerable to being cut." One headmaster was quoted as commenting that his mahoganies from ICRAF would soon attract rain and that "pupils can sit under them all day without the sun shining on them. You can have an assembly under such a tree." By October 2021, 29 schools, 19 churches, two health centres and one police post had been reached.

In 2022, in a small evaluative study, intern Sarah Juster found that exposure to ICRAF's intervention was associated with more trees, more fuelwood and higher incomes. Comparing refugees with more than one year of involvement with those with less, she found that more exposed refugees had, on average, 36 trees and harvested 4.1 bundles of firewood per month from their plot. In contrast, the less exposed had, on average, 14 trees and harvested 1.96 bundles. Further, refugees with one or more years of participation earned about USD 13 more per year from selling tree products than those less involved. Refugees with less participation had approximately three fewer fruit/food trees than those longer involved. Juster's participants also appreciated the trees' "services": 81.3% cited windbreak, 72.5% shade, 28.7% attracting rain, and 25% erosion control. Evaluative-report-Uganda.pdf

Scaling up agroforestry and other nature-based solutions in refugee settlement landscapes of Northwestern Uganda ran alongside the previous project, from September 2022 to February 2025, and received over USD 215,000 donated by the Lawson Charitable Trust. In 2023, it raised 117,251 seedlings of 24 species for 945 beneficiaries – 76% of whom were refugees: more than 200 were trained in kitchen gardening, composting, and soil and water conservation. "Thirty to forty trees are totally possible on most refugee plots, especially with planting on boundaries. And when you combine that with this bio-circular economy approach, where all water and organic matter are reused, you maximize what you can get from the plot," said Juster, now a Fulbright fellow. In all, it worked with 720 refugee and host households.

In late 2024 ICRAF assessed levels of adoption in the two settlements of tree-based approaches via an uptake survey of randomly selected refugees (104) and hosts (76) – 94 male, 86 female. A resounding 64% had participated in an ICRAF – facilitated event, receiving training and/or seedlings, and respondents had on average planted 138 trees. Perhaps most exciting, 29% of refugees and 41% of hosts were found to be harvesting some firewood from their own trees. Refugees and women mostly planted on boundaries to make best use of space, and host communities largely on farmlands.

Refugees grow more trees on their plots than expected

Hoping that refugees would grow trees on the plots they had been allocated – the only land of which refugees can be sure – ICRAF set to work in 2017 raising and distributing seedlings. Over the next seven years, as ICRAF collaborated with households, plots were transformed. However, it was not until September 2024 that a mapping exercise of refugee plots was carried out. It found that the number of trees planted surpassed the original estimate of 32 to 57 trees. Mapped plots had 39 to 252 trees (Table 1).

This was a great endorsement of Uganda's policy of allocating land to refugees and occurred even though plots had far larger expanses of bare ground and more buildings than expected. (Clean-swept earth is a cultural tradition, as are norms that forbid adults and children, girls and boys, and humans and animals from sharing rooms.)

On seeing these results, Lalisa Duguma, lead author of the 2018 studies, said: "It is exciting news that even more trees are possible."

On retained trees – which the mapping picked up on and included threatened indigenous species like *Afzelia africana* and *Balanites aegyptiaca* – Phosiso Sola, who has led the project since 2022, said: "The notion is that refugees will clear everything. But we see on the plots that two to four original trees are still standing. They value them for their various products and services."

On the many huts, she said: "Refugees have been there for a while. The family is growing, children are maturing, getting married. Yet it still manages to keep trees and to plant more, only that the location changes to accommodate the houses." On where refugees plant their trees, she said: "Boundary planting is the easiest. It doesn't take a lot of space and demarcates your land."

A sketch visualized by refugees of how trees might be arranged on a plot: 2018.

Tree diversity was also high on the mapped plots, ranging from nine to 14 species. It tilted strongly, however, towards exotics, with just 14%–20% of the trees being indigenous. On this, Duguma commented: "This is likely influenced by the availability of planting materials and the refugees' immediate needs. Familiarity may also have an effect. If the refugees knew *Senna* in their homeland, they may prefer to pick that one."

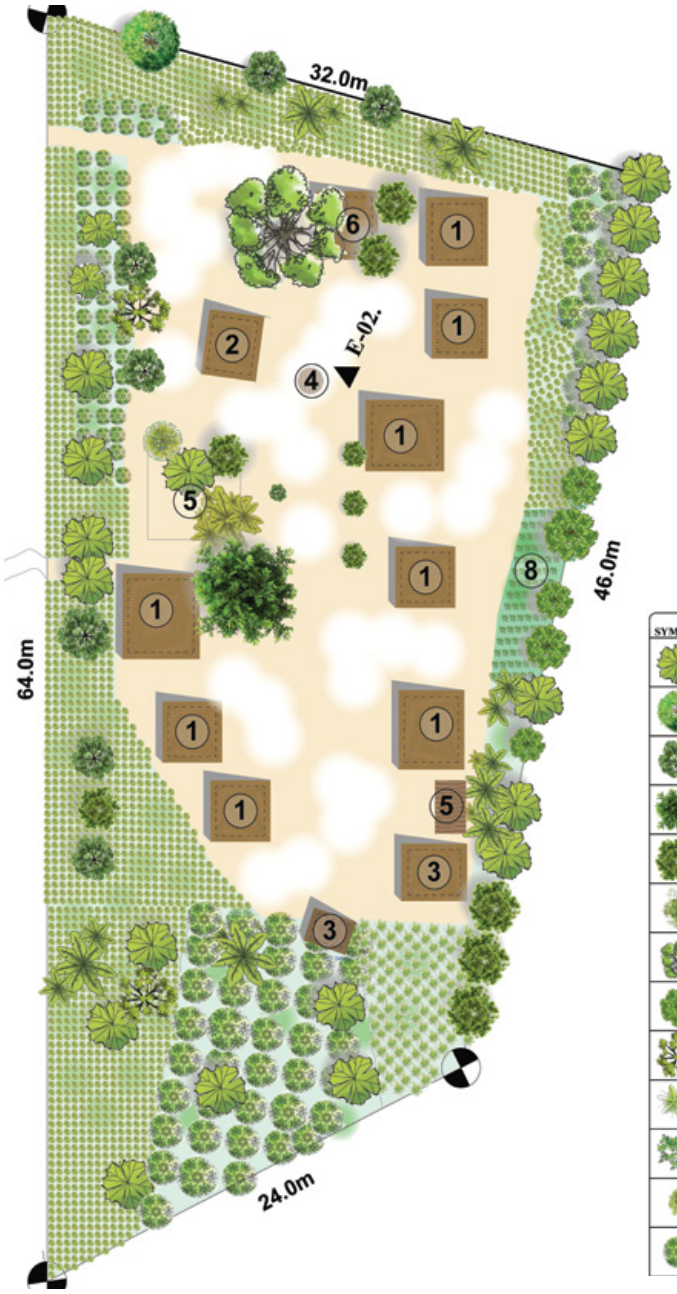
Below are details of one plot. See Appendix 2 for the other four.

Betti lives with her disabled husband and seven children on a small plot of 1,451 m^2 (38 m x 30 m). She has 57 trees of 12 species. She "got the idea to plant trees and was trained". "It was a good idea," she explained "because trees prevent wind and bring rain."

Table 1. How many trees and tree species do plots hold?

	Size of plot m x m	Size of plot in m^2	# of trees	# of which are indigenous planted trees	# of tree species	# of large indigenous trees retained
Model plot imagined by refugees in 2018	30 x 30	900	32	-	8	Not specified
Findings from mapping exercise of 5 plots						
Alice	30 x 31	935	39	1	9	4
Betti	38 x 30	1451	57	8	12	1
Beida	42 x 42	1797	67	11	14	3
Lily	56 x 56	3207	199	43	10	4
Isaac	57 x 57	3278	252	36	12	3

L: Betti with children, her stool made from her family's trees as is all her furniture.
R: Her ICRAF-supplied papaya, gmelina, senna, neem and giant lira trees growing on the boundary and among crops.



Like all refugees and hosts, she has extensive knowledge and thoughts about specific trees. "Mvule is for construction. Papaya strengthens blood. *Annona* is a fruit for children and brings income when you sell it in slices," she says.

Her trees include an indigenous *Combretum molle* that she found on arrival. Her "ICRAF" trees are important natives mvule (*Milicia excelsa*) -1, and *Afzelia africana* -3; exotics neem (*Azadirachta indica*) -5, *Gmelina arborea* -12 (along right boundary) and *Senna siamea* -24; and fruit/food trees guava -1, Papaya -5, pigeon pea, *Moringa oleifera* -2, and *Annona muricata* -1. Trees from ICRAF not depicted are indigenous: *Albizia gummifera* -1, *Tamarindus indica* -1, *Markhamia lutea* - 2. The plot holds 13 small buildings as well as gardens of tomatoes, maize and cassava.

SYMBOL	NAME	NO.	USE
	Gmelina arborea	22	- Medicine - Shade
	Annona Muricata	01	- Medicine - Fruit
	Azadirachta indica	08	- Medicine - Shade
	Melia azedarach	01	- Medicine - Shade
	Senna siamea	10	- Medicine - Shade
	Milicia excelsa	01	- Medicine - Shade - Soil fertilizer
	Combretum apiculatum	01	- Medicine - Shade
	Afzelia africana	01	- Medicine - Shade
	Pawpaw	05	- Fruit - Medicine
	Maize plant	35m²	- Food
	Tomatoe plants	20m²	- Reduces runoff - Food
	Sesame	491m²	- Reduces runoff - Food
	Cassava	107m²	- Food

Betti's brooms are each made from a different plant and have different purposes.

Doing trees well in refugee-hosting areas of Northwestern Uganda

Learnings

- Include multiple species catering for different purposes in every seedling distribution, and a minimum of five tree species, with zero introductions of new species. (See doi.org/10.1111/gcb.15498)
- Distributing even small numbers of indigenous species bolsters tree diversity if they grow.
- It is more economical, rational and efficient to produce smaller numbers of seedlings that are all planted than to produce a large number, some of which go unplanted or uncared for.
- A plot-based biocircular economy that deploys any organic material, such as food waste as compost and "grey water" for watering crops, can greatly increase tree survival.
- Refugees and hosts have their own deep knowledge. So, always start by asking them: "What is this tree good for?" Once fluent in speaking about the different species, it is easier to offer guidance, such as "Pigeon pea and markhamia grow well with crops. Plant neem and gmelina on boundaries."
- Reticence persists when it comes to growing indigenous trees. Catalyse behavioural change with sensitization on their use and benefits. Demonstration plots can counter long-held perceptions that indigenous trees grow slowly. Also needed are radio shows, billboards and posters.
- Do trees well for everyone. People with special needs (PSN) are far less able to grow trees, if at all. Tree-based interventions need to make special provisions. A compound without trees is barely habitable.

Issues to note

- Most ICRAF trees went to refugees. A new cohort was recruited every year, but the project stayed in touch with households from previous years, often resupplying seedlings.
- Host homesteads are more dispersed and harder to reach but, with many hectares, can absorb 10–15 times more trees.
- Institutions, often fenced, are ideal places for indigenous, rarely planted, and even threatened tree species. In addition, schools need fuelwood, and those with large grounds can absorb thousands of seedlings to reduce reliance on costly truckloads of wood sourced from the bush, with deleterious environmental impacts. In 2022, the project gave 200 fruit trees and 6,000 seedlings of fast-growing trees to Rhino Camp High School, which has 1,500 students and had set aside six hectares (ha) for a woodlot to feed its energy-conserving stoves.
- With 67 tree stumps per ha found by ICRAF's early research on the Rhino Camp and Imvepi area, farmer-managed natural regeneration (FMNR) has vast potential, and project field coordinators and community-based facilitators disseminated the practice. Every tree-based initiative would benefit from a dedicated FMNR promoter.
- Besides free-ranging livestock, harsh climatic conditions were the key threats to ICRAF seedlings once planted. In 2022, Juster measured tree survival at 53.1% on refugee plots and 80% on host land, while the project found 64% overall: 2023 follow-up put survival at 58.6%. Boost survival by ensuring that land is prepared and seedlings delivered by the time the rains start.
- Exotics that grew fast and produced poles and fruit were in high demand. Therefore, they were raised in far greater numbers than native trees. "Attaining tree diversity is not easy," says Makerere University botanist Dr Samuel Ojelel. "There is a strong link between trees planted and their use value. Trees with less-known use values are rarely considered a priority."
- Multiple informed sources report that the distribution of fast-growing exotics often triggers the clearing of indigenous trees. ICRAF's approach

The trees on this plot were planted by the refugees in residence in 2018. Taken in 2021, this photo evidences how fast trees can grow when cared for.

Gender

ICRAF found that female refugees are more committed than males to maintaining trees but are less likely to respond to meetings and training because of household responsibilities. Few females in host communities grow trees as they do not own land.

was to urge recipients of seedlings to leave existing trees standing: "Plant to add on to what you have. If you need wood, prune instead. Do not cut or clear fell," said field coordinator Gertrude Tiko. This needs addressing and awareness raising.

- The practice of marking trees of high conservation value, widespread in the early days of the refugee influx, was "respected for some time" but now needs reviving, says Gordon Eneku Adima. "Mother trees are disappearing," says the UNHCR forester.
- Energy-saving stoves remain vital, reducing fuelwood consumption and lessening drudgery. Research in 2025 found that refugees, mostly women, make on average 2.3 trips for cooking fuel per week, carrying 21.8 kg and walking 4.796 km per trip. See www.refugeeshostsandtrees.com/post/wrapping-up. Also see this publication, which argues that energy saving stoves, solar power, and agroforestry in the refugee-hosting landscape in Arua can together meet energy needs: "An efficient use of wood fuel combined with solar energy could reduce primary energy demand by up to 37%. The remaining wood demand could be realized by agroforestry systems." www.link.springer.com/article/10.1007/s40974-020-00204-z
- Tree-based interventions benefit from employing foresters, agroforesters, biodiversity experts, ecologists and CBFs. No Mpox or tuberculosis programme, for instance, would be expected to succeed without trained health professionals and outreach workers.

Conclusion

By early 2025, ICRAF could say that the combined efforts of these five projects had:

- distributed well over 700,000 seedlings, of which an estimated 60% survived, many of which have since been repeatedly pruned for firewood and coppiced for poles and timber;
- helped green the plots of more than 2,000 refugee and host households and over 100 institutions;
- developed a tree-based intervention model that lifts incomes, increases fruit consumption, brings fuelwood closer, and takes pressure off natural vegetation: 34% of beneficiaries (29% of refugees and 41% of hosts) became able to source firewood from trees they had planted;
- managed the only nursery in Northwestern Uganda that raised a wide range of tree species, with an estimated 50% of species and 25% of seedlings indigenous;
- demonstrated that refugees will grow trees and that Uganda's model of making plots of land available to refugees is a way to improve well-being, build resilience, safeguard biodiversity and maintain ecosystem services.

On radio, project forester talks about wild fruits: "They are disappearing," a caller laments.

Given seedlings, beneficiaries may decide to cut natives trees to make charcoal.

Tree growing is complex; bring in knowledgeable advisors.

To help protect irreplaceable trees, mark them with paint.

"When you lose or reduce any species in nature, it destabilizes."

Never cut mature or indigenous trees to plant seedlings. Mature trees generate most ecosystem services, while indigenous trees generate ecological health. "Keep the balance of nature. When you reduce or lose any species, it destabilizes," says Phosiso Sola.

In Northwestern Uganda, daily life and well-being are intimately linked to natural vegetation: refugees and hosts in Imvepi have been documented to collect parts of 164 different plants and trees for food, medicine and twine. (www.refugeeshostsandtrees.com/post/backto-thebush)

The diminution of these on the landscape means not just the loss of those products but also – among other things – of pollinators and natural pest controllers, which affects farming. Maintain a habitat for beneficial insects and birds: pests and diseases are increasing for trees and crops.

Phosiso Sola is an expert in bioenergy, natural resources governance, and agroforestry value chains.

Appendix 1: Useful trees and shrubs for Northwestern Uganda

Download Useful Trees and Shrubs for Uganda

https://www.cifor-icraf.org/publications/downloads/Publications/PDFS/b09383.pdf"

Below are over 30 trees that ICRAF would recommend to others addressing land degradation, climate change, biodiversity loss and the water-soil-nutrition-energy nexus in Northwestern Uganda. Applicable across the rest of the north, the list is not exhaustive: more tree species need trialling and to be agreed upon by botanists and communities. The text draws on Useful Trees and Shrubs for Uganda (1995) with permission.

Multipurpose shrub

Cajanus cajan (pigeon pea): A win-win-win, deep-rooted, nitrogen-fixing shrub that improves soil and produces protein-rich peas, fodder, green manure, bee forage, and fuelwood from stems. Direct seed. One cup per homestead to start. A "must-have."



Pigeon pea.

Fruit/food trees

Exotics

Mangifera indica (mango): Protect with sticks and dust with dry animal manure to deter browsing livestock.

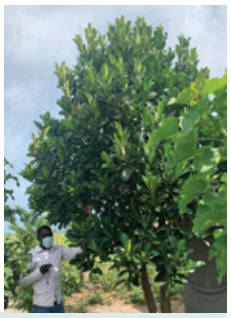
Carica papaya (pawpaw, papaya): Fruits can be eaten, sold or cooked when green as a vegetable. Mealybug infestation can be devastating. Avoid planting in monoculture. A must-have.

Artocarpus heterophyllus (jackfruit): Needs protection from livestock when young but reached 4 metres and fruited in three years, while providing shade and windbreak. One per refugee plot is adequate.



Refugee with mango in mini-ochard, and protection of mango seedlings with sticks and dry manure.


Fruit of Annona muricata (top) and Annona squamosa.

Refugee with jackfruit in 2018, a three year old jackfruit 2021 .

Annona muricata (soursop): Related to indigenous *Annona senegalensis* ('elipo' in Lugbara), fruited in three years. A "desirable tree in home gardens," says Useful Trees.

Moringa oleifera (moringa): With nutritious leaves and multiple other uses, moringa grows well with crops. A must-have.

The project also distributed small quantities of avocado, lemon, tangerine, guava, and the vine passionfruit.

Indigenous

Vitex doniana ('odogo' in Lugbara): Produces black fruit, medicine (bark, leaves, roots, fruit), fodder (leaves, fruit), and bee forage. Uptake by refugees, hosts and schools is a win for nutrition, culture and biodiversity. With a clear bole, grows well with crops. A must-have.

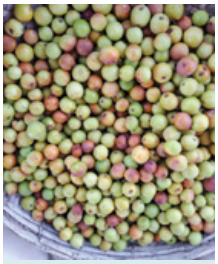


A moringa tree in Rhino Camp dating from the 1990s refugee influx. Moringa growing with okra, maize and cowpeas. A refugee prepares the leaves.

Borassus aethiopum ('itu' in Lugbara): A socioeconomically important agroforestry palm with large edible fruits and an edible shoot from the seed. Leaves provide fibre for thatch, mats, baskets, brooms and furniture. Increases cereal harvest in fields. Unsuited to nursery propagation, protect mature and young ones naturally regenerating.

Balanites aegyptiaca ('loba' or 'logba' in Lugbara and Madi), ***Tamarindus indica*** (tamarind, 'iti' in Lugbara and Madi), ***Vitellaria paradoxa*** (shea, 'kamiro' in Lugbara, 'awa' in Madi): vital fruit/food trees at risk from charcoal making. Easy to raise but slow growing. Sensitize communities to protect and recover through FMNR.

Fruit trees and shrubs playing a key role in dietary diversity and micronutrient intake include ***Grewia spp, Ximenia americana*** ('ochik' in Lugbara), ***Parinari curatellifolia, Strychnos spp, Vangueria apiculata, Sclerocarya birrea*** and ***Ziziphus abyssinica*** ('ela' in Lugbara), the last of which the project raised for an edible hedge. Trial planting and discourage removal during field opening.

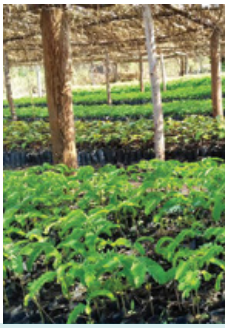


Ziziphus spp.

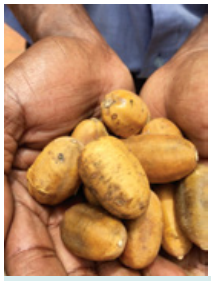
Vitex doniana.

Ximenia americana.

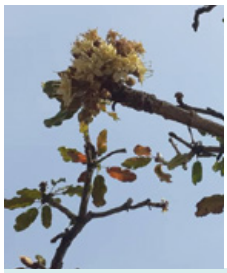
Borassus aethiopum with fruit, and a winnowing basket from its leaves.



Tamarind: Children benefit from the vitamin-rich pulp, the pod is sold on roadsides, and tamarind seed germinated well in the ICRAF nursery.



The fruits of Balanites, a refugee collects the leaves, and the leaves served as a green.



The shea tree in flower. A young woman sells shea oil by the road.

Mature Vitex doniana tree.

Timber, pole, fuelwood species

Exotic

Seeking less water-demanding and more crop compatible trees, the project excluded Eucalyptus, only distributed teak once, and focused on the trees below. Always promote them as part of a **mix** of trees.

Azadirachta indica (neem): Uses include firewood, charcoal, timber, poles, medicine (bark), fodder (leaves, oil-seed cake), bee forage, soil conservation, shade, windbreak, insecticide, oil and soap. Easily raised and fast-growing, can be lopped and pollarded. Resists decay and termites. "Spreads easily, may become a weed," says Useful Trees.

Gmelina arborea (gmelina): A fast-growing tree from lowland India that is moderately drought-resistant once established but needs protection from livestock. Can be pruned and coppiced. "Competes with crops, so should not be grown near cultivated land," says Useful Trees.

Melia azedarach (Giant lira, 'lira' in Lugbara): Provides fuelwood, charcoal, tool handles, poles, posts, medicine (bark), bee forage and windbreak. A prolific seeder with a high germination rate. Berries are poisonous. Moderately termite-resistant, provides quick shade and building poles. May become "weedy."

Senna siamea (cassia): A small evergreen yellow-flowering tree. Used for fuelwood, charcoal, poles, furniture, medicine, bee forage, shade, mulch, soil conservation and windbreak. Easy to raise with 39,000


At a school and in a field, young trees of Khaya (African Mahogany).



A mature Afzelia, a two-year-old Afzelia in ICRAF's demo plot at the Learning Centre, and the Afzelia seeds.

seeds a kilo requiring no pretreatment. Grows fast and can be coppiced. Do not mix with crops "as it competes with them," says Useful Trees. Distinct from the highly invasive Senna spectabilis.

Indigenous

Albizia gummifera, Albizia coriaria: Large flat-topped, fast-growing trees that fix nitrogen, improving soil, including water-holding capacity. Used for timber, fuelwood, charcoal, utensils (mortars), beehives, medicine (pods, roots, bark), fodder (leaves), bee forage, shade and windbreak. Must-haves.

Markhamia lutea (markhamia, 'abonigo' in Lugbara): A must-have with 75,000 seeds/kg and a high germination rate. Fast-growing and coppicing, produces poles and mulch, and grows well with crops. "In a woodlot, it disappoints. But when you plant it with maize, its leaves retain water, and the maize harvest increases by 25%," said former district forester Chale Achia, who advised the project. Must-have.


An avenue of mvule trees, and a three-year-old mvule thriving on a refugee plot.

Afzelia africana ('meli' in Lugbara, 'azza' in Madi): Threatened by illegal harvesting, a hardwood reaching 30 m. Grew well as a single tree on refugee plots. Useful Trees says: "Can be planted for erosion control on slopes and improvement of degraded savannahs." Must-have.

Khaya grandifoliola (African mahogany, 'mario' in Lugbara, 'eri' in Madi): Also threatened, it proved popular and was planted in considerable numbers. Useful Trees says: "Suited for Kitgum, Gulu, Moyo, Arua and Nebbi. Particularly recommended for riverbank restoration." Must-have.

Milicia excelsa (mvule, 'vundi' in Madi): A "giant deciduous tree that grows well with rainfall as low as 700 mm," says Useful Trees. Provides mulch, soil conservation, shade and valuable timber. Medium growth rate (slower than Khaya spp.) Flourishing on refugee plots, this threatened tree is a must-have, particularly for institutions.

Kigelia africana ('odolo' in Lugbara, 'lado' in Madi): Famous for its large pods, a culturally important tree needing protection, more planting, and FMNR. Useful Trees says: "does not compete with crops and is conserved around homes and gardens for medicinal purposes (fruit, bark) (and) provides firewood, timber, dye (boiled fruit), local honey beer."

Markhamia making a sturdy living fence.

Albizia gummifera in flower.

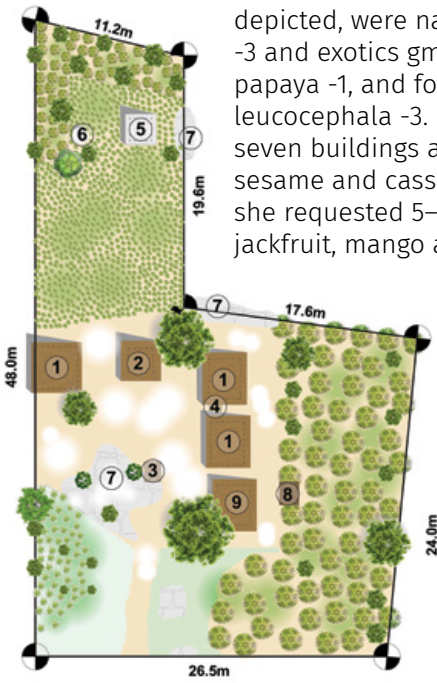

ICRAF team member with Kigelia pod, and a Kigelia growing in open woodland.

Appendix 2: Inventories and sketched refugee plots

In the mapping, landscape architect Rehema Kalule measured the distances and field coordinator Joel Adriko counted and identified trees. Other staff sometimes found additional trees and species; these are noted in the narrative about each plot.

Alice with granddaughter, and her senna carefully sculpted for shade.

Alice, 45, has a plot of 935 m2, almost exactly 30 m x 30 m, the smallest of the five surveyed. Suffering from elephantiasis, the grandmother of three says she has had to cut some "ICRAF" trees because on some days she lacks the strength to fetch fuelwood. But she still has 39 trees of nine species, including four indigenous ones that she retained: Steganotaenia araliacea -1, Combretum collinum -1, tamarind -1 and Bridelia scleroneura -1. Exotics planted from ICRAF were Senna -26. Also from ICRAF, but not depicted, were native tree markhamia -3 and exotics gmelina -1, giant Lira -1, papaya -1, and fodder shrub Leucaena leucocephala -3. Her plot also contains seven buildings and gardens of maize, sesame and cassava. As the team left, she requested 5–10 more fruit trees, jackfruit, mango and moringa.



SYMBOL	NAME	NO.	USE
	Steganotaenia araliacea	01	- Medicine - Shade
	Bridelia scleroneura	02	- Medicine - Fruit
	Tamarindus indica	01	- Fruit - Medicine - Shade
	Senna siamea	35	- Medicine - Shade
	Maize plant	35m²	- Food
	Sesame	172m²	- Reduces runoff - Food
	Cassava	321m²	- Food

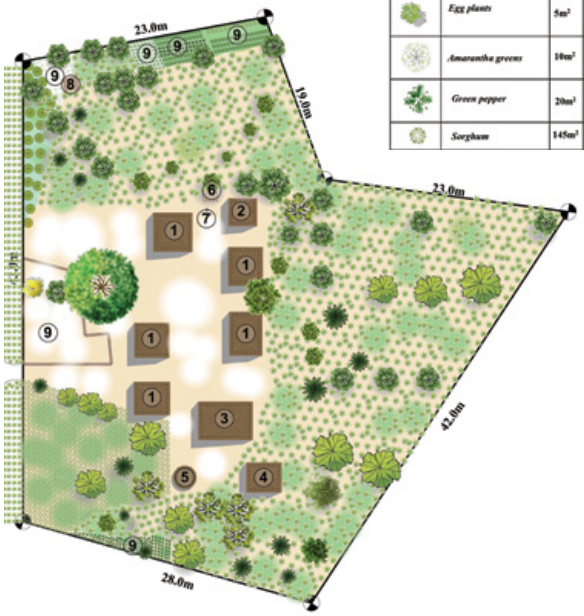
Beida's vegetable patch is fenced with heavily pruned trees and shrubs, including markhamia, mvule, neem, pigeon pea and Jatropha. Her Annona muricata is fruiting.

The plot of **Beida**, 30, totals 1,797 m2 (42 m x 42 m) and has 67 trees of 14 species. A refugee in Uganda 1995-2006, and today an ICRAF CBF, Beida has considerable knowledge. She says senna "brings rain and grows fast"; gmelina is debarked by goats; and teak "stops crops growing when many are planted but is OK on boundaries." Her children "eat cooked moringa leaves twice weekly for a balanced diet."

Her plot has three mature indigenous trees: Bridelia scleroneura -1 and Gymnosporia senegalensis -2. Planted from ICRAF are natives mvule -2, Albizia -3 and markhamia -4; exotics senna -10, gmelina -12, giant lira -3, neem -25; and fruit/food trees Annona muricata -, pigeon peas, moringa -2 and papaya -2. Indigenous "ICRAF" trees not shown are Afzelia -1 and tamarind -1.

A war widow with three children, Beida also grows eggplant, tomatoes, onions, okra, green amaranth, Cleome, red peppers, sweet potatoes, cassava and sorghum, and raises poultry. Her plot has 11 constructions.

SYMBOL	NAME	NO.	USE
	Gmelina arborea	12	- Medicine - Shade
	Annona muricata.	01	- Medicine - Fruit
	Azadirachta indica	25	- Medicine - Shade
	Melia azedarach	01	- Medicine - Shade
	Senna siamea.	05	- Medicine - Shade
	Millicia excelsa	01	- Medicine - Shade - Soil fertilizer
	Pawpaw	05	- Fruit - Medicine
	Pigeon peas	15	- Food
	Sweet potato mounds	35m²	- Food
	Maize plant	1,050m²	- Food
	Onion plant	5m²	- Reduces runoff - Ground cover
	Tomatoe plants	14m²	- Reduces runoff - Food
	Egg plants	5m²	- Food
	Amaranths greens	10m²	- Food
	Green pepper	20m²	- Food
	Sorghum	145m²	- Food



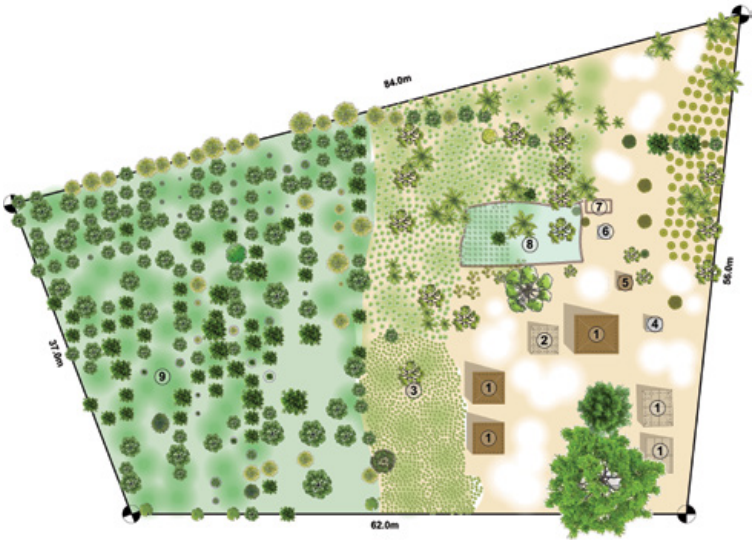
The plot of the family of **Godfrey** is 3,207 m2 (56 m x 56 m), so larger than average. It has a remarkable 199 trees of 10 species. The family retained four mature native trees: Piliostigma thonningii - 2 and Sclerocarya birrea -2. Well-established trees from ICRAF are natives mvule -2 and markhamia -41; exotics senna -9, gmelina -17, giant lira -31, neem -52; and fruit trees guava -3 and papaya -7.

They also have gardens of tomatoes, sweet potatoes and maize, and 12 single-storey mud and wattle buildings. Some are coops and hutches for livestock. Others accommodate the 14 family members. Each sleeping hut has a senna in front of it: "In South Sudan, we use it for shade," said the 25-yearold who was a student before he fled South Sudan.

SYMBOL	NAME	NO.	USE
	Gmelina arborea	17	- Medicine - Shade - Timber
	Piliostigma thonningii	03	- Medicine - Shade - Fruit
	Sclerocarya birrea	02	- Shade - Rope making
	Guava tree	03	- Fruit - Medicine
	Azadirachta indica	52	- Medicine - Shade
	Markhamia lutea	41	- Medicine - Shade - Wind breaker
	Milicia excelsa	02	- Medicine - Shade - Soil fertiliser - Medicine
	Melia azedarach	31	- Medicine - Shade
	Senna siamea	09	- Medicine - Shade
	Banana plant	45	- Food
	Maize plant	1,125m²	- Food
	Pawpaw	07	- Fruit - Medicine
	Sweet potato mounds	295m²	- Food
	Grass	230m²	- Reduces runoff - Ground cover
	Tomatoe plants	100m²	- Reduces runoff - Food

Godfrey, and robust planting with markhamia next to one of the family's vegetable patches and along the plot border.

Isaac exudes entrepreneurial spirit, his dwellings emerge from a sesame field, and a mature tamarind and Balanites at right offer services that new trees would take decades to provide.



SYMBOL	NAME	NO.	USE
	Combretum apiculatum	01	- Medicine - Shade
	Tamarind indica	01	- Fruit - Medicine
	Markhamia lutea	34	- Shade - Medicine
	Azadirachta indica	132	- Shade - Medicine
	Balanites aegyptiaca	01	- Medicine - Shade
	Melia azedarach	57	- Medicine - Shade
	Borrassus palm	01	- Medicine - Shade
	Albizia coriaria	04	- Medicine - Shade
	Moringa oleifera.	03	- Food - Medicine
	Sweet potato mound	104m²	- Food
	Yams	07	- Food
	Banana plant	59	- Food
	Paw paw	17	- Fruit - Medicine
	Maize plant	470m²	- Food
	Tomato plant	35m²	- Food
	Sesame	210m²	- Food
	Guava tree	08	- Fruit
	Jack fruit tree	01	- Fruit

The plot of **Isaac**, 35, is the largest at 3,278 m2 (57 m x 57 m). With 252 trees of 12 species, Isaac has a booming business making furniture from neem and the leaves of Borassus palms from fields nearby. In addition, he says: "We make juice from tamarind pulp and oil from the seeds of Balanites, eat raw moringa seeds, and make medicine from its roots."

He has three large indigenous trees that he found: Balanites -1, Borassus - 1, Combretum spp -1. Planted from ICRAF are natives Afzelia -1; mvule -2, Albizia gummifera -4, markhamia -30; exotics gmelina -5, senna -24, giant lira -60, neem -105; and fruit/food trees tamarind -1, moringa -2, Annona muricata -3, guava -5, papaya -30, and pigeon peas. The plot contains 11 constructions, patches of grass, and gardens of mixed vegetables, sweet potatoes and maize. Isaac previously found safety in Uganda during instability in Sudan 1994 - 1997. From his papaya orchard, he sells and provides his family with fruit.

Appendix 3: The case of trees for schools

A similar mapping exercise in Imvepi at Annex Primary School found 470 gmelina from ICRAF planted in a woodlot making a significant contribution, providing kindling for the school's stoves. "It helps us a lot," said math teacher Ephraim Lombe, 38, who also manages the school's environment club.

Other "ICRAF" trees thriving on the school's 1.25 ha were exotics senna -34, neem -24; natives Albizia spp. -37 and markhamia -6; exotic fruit trees mango -4 and guava -3; and indigenous fruit tree Vitex doniana -6. The school had retained mature indigenous trees that are still the main source of shade: Combretum molle -4, shea -3, Bridelia scleroneura -3, and Combretum collinum -2. "We need trees because the land was almost bare. Even now part of our roof is about to blow off," said Lombe.

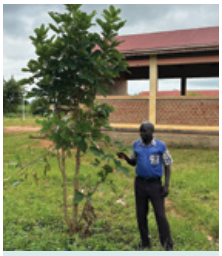
ICRAF helped at least 100 schools with trees, including over 20 schools in Bidi Bidi refugee settlement being built by HYT Uganda, which promotes construction with stabilised soil blocks rather than burnt bricks. The UK NGO paid school watchmen 10 UGX per tree each time it was watered even through school holidays, leading to excellent survival rates.

With schools overwhelmingly welcoming of trees, no school needs to lack shade, windbreaks, a firewood source even if minimal, indigenous trees for culture, fruit trees, and biodiversity: schools can be refugia.

Children under Albizia trees at HYT school in Bidi Bidi.

At Annex PS, a grove of ICRAF-supplied Albizia gummifera.

Every school needs a big tree.



Teacher Lombe with *Vitex doniana* from ICRAF.

SYMBOL	NAME	NO.	USE
	Gmelina arborea	218	- Medicine - Shade
	Combretum apiculatum	12	- Medicine - Shade
	Azadirachta indica	23	- Medicine - Shade
	Melia azedarach	09	- Medicine - Shade
	Senna siamea	25	- Medicine - Shade
	Vitex doniana	01	- Medicine - Shade - Soil fertilizer
	Bridelia micrantha	03	- Shade - Medicine
	Guava tree	03	- Medicine - Fruit
	Markhamia lutea	03	- Food
	Mangifera indica	03	- Fruit - Medicine
	Grevia bicolar	02	- Reduces runoff - Ground cover
	Albizia coriaria	19	- Shade - Medicine
	Vitellaria paradoxa	02	- Shade - Oil
	Egg plants	38m²	- Food
	Sorghum	1,897m²	- Food
	Maize plant	180m²	- Food

Helper at Annex PS carries kindling from ICRAF trees.

To flourish, trees at schools require a watering regime.

L-R: Fields of food crops with indigenous trees deliberately retained by the farmer: agroforestry is traditional across Uganda's north.
A refugee plot grows sesame with pigeon pea and markhamia: giant lira, senna and neem in background. A host's gmelina woodlot with cassava.

L-R: Outreach was a project strength: an forester listens to a farmer, a CBF interacts with a refugee. Nursery workers raised over 28 different species. Living locally, retired senior forester and botanist Chalia Achia was huge asset, providing indigenous and scientific knowledge.

L-R: No seed, no seedlings: the project went to great lengths to find seed sources. Turning trees into furniture was an income stream for refugee Isaac. Vital in displacement settings, a school cook uses an improved stove, a project billboard promotes them.

Cover page, clockwise: A community-based facilitator, a three-year-old Albizia on a refugee's plot, a seed pod of Afzelia, trees growing well with sesame and maize at a host national's home, an agroforestry training for farmers convened by ICRAF, and two mvule trees thriving on a refugee plot. Photos C Watson/J Osidi/CIFOR-ICRAF

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Projects: Sustainable use of natural resources and energy in the refugee context in Uganda, Empowering youth through agroforestry to improve natural capital in refugee-hosting areas of Northwestern Uganda, REHOPE BRIDGE, Agroforestry with refugees and hosts in Northwestern Uganda, and scaling up agroforestry and other nature-based solutions in refugee settlement landscapes of Northwestern Uganda are part of CIFOR-ICRAF's Refugee-Hosting Engagement Landscape programme. **www.cifor-icraf.org/refugee-hosting-landscapes/**

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Project websites: CIFOR-ICRAF Project Webpage | Global Living Project Page