



# IMPROVING FARMERS LIVELIHOODS THROUGH SUSTAINABLE COOKING FUELS AND RE-FORESTATION FOR CONSERVATION AND FOOD PRODUCTION

**FRONTIERS  
OF CHANGE**

5-7  
NOVEMBER  
2021



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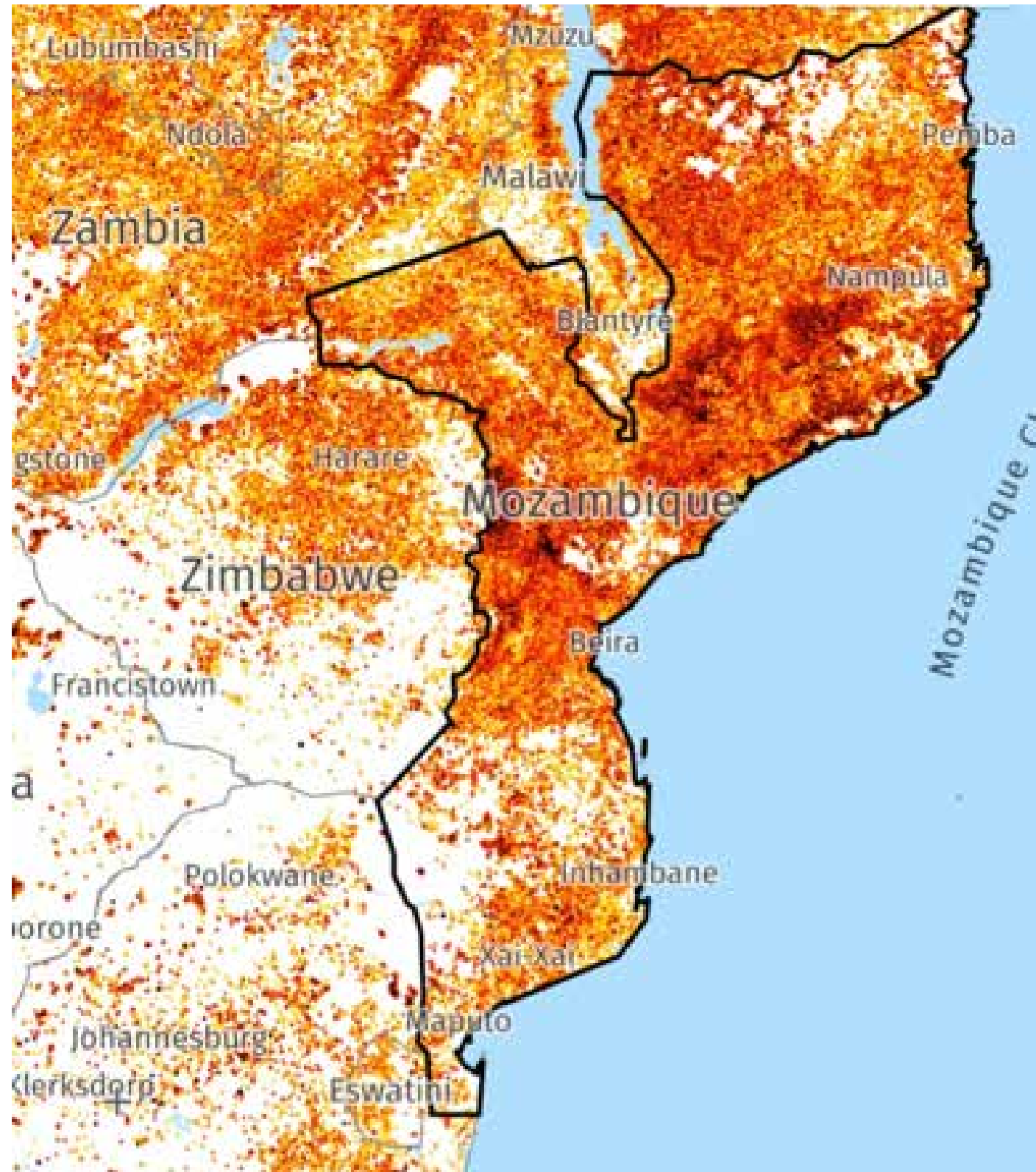
## Background

Since 1980, Mozambique has lost some 370,000 square kilometres of its forests – an area larger than the size of Germany. Much of the loss has been attributed to slash-and-burn agricultural practices, but charcoal making & wood cutting for cooking fuels have also played a part, together with logging.

The image below shows the amount of fires across Mozambique recorded by NASA satellite over a three month rolling period to October 2021 (red being the longest duration fires and yellow the shortest). These fires are commonly the annual burning of land as farmers clear a new patch as part of the slash and burn cycle. The fires burn off long grasses in the savana and in the process also damages trees, prevents natural re-generation of saplings, and inevitably gets out of control from time to time. The annual burn is the process in which new land is made available for farming as the burn clears the land of weeds and pests. After farming this plot for a few years the farmers leave it to grow back and move onto a new site, repeating the cycle.

An issue with this process is that it causes severe erosion to the soil as it is dried out by the burn. This leaves it more exposed to erosion from wind and rain. As the land is also left without any plant surface cover until the new crops become established it is further prone to erosion.





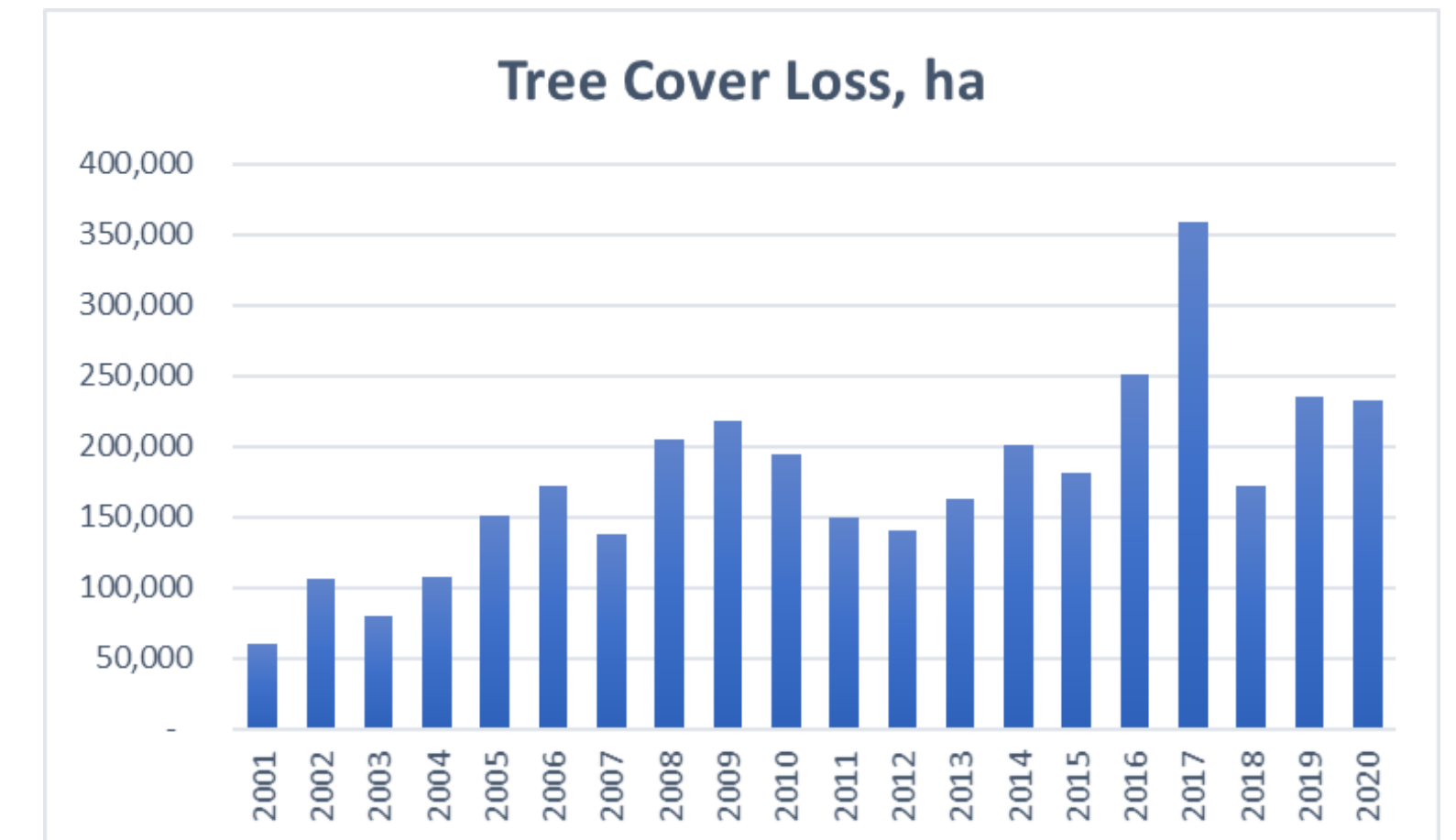
**Image 1. Fires in Mozambique**  
Source: Global Forest Watch

## Tree Loss due to land burning

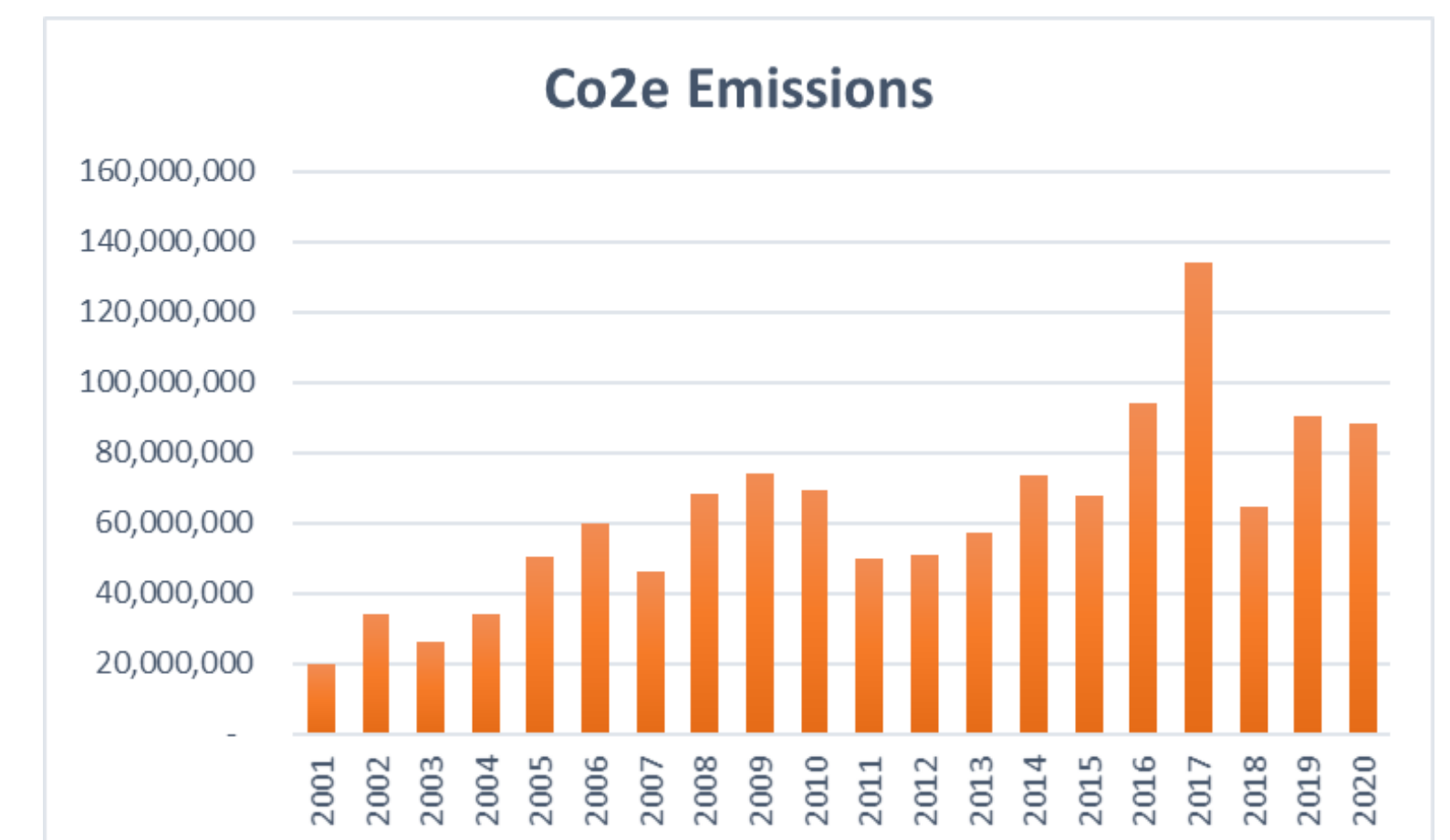
**Left:** Satellite mapping data from NASA shows the extend of the annual burn of land across Mozambique. Red is longer burning fires (up to three months, and yellow shorter burn).

This process leaves the soil exposed to erosion, and more susceptible to climate change. Over time the soil gets thinner and thinner.

**Below:** Charts show the annual loss of tree cover and resultant CO<sub>2</sub>e emissions from 2001 to 2020, according to data from Global Forest Watch. Mozambique lost 3.52Mha of tree cover, equivalent to a 12% decrease in tree cover since 2000, and 1.25Gt of CO<sub>2</sub>e emissions. Loss of tree cover is attributable to the annual burn as well as cutting trees for charcoal and cooking fuel.



Source: Global Forest Watch



Source: Global Forest Watch



In Changalane district where Mozambique Renewables is carrying out a sustainable cooking fuel project the images below show the loss of tree and biomass cover from 1984 compared to 2020 .



**Image 2. Tree and biomass cover 1984**  
Source: Google Earth



**Image 3. Tree and biomass cover 2020**  
Source: Google Earth

## Help to move to a more sustainable model

Mozambique Renewables is working on two ways to reduce land burning and tree cutting:

### Tree Cutting

A key driver of tree loss is cutting trees for use as a cooking fuel, or to feed wood into the charcoal making process. These fuels are also highly polluting and kill more people worldwide than malaria, HIV and tuberculosis combined. (>4.5 millions). By supplementing wood with alternative agri-residues there is no need to use wood. This agri-residue fuel is made from things like nut shells, and plant stems, so does not reduce food production. It is also up to 1/3 the price of charcoal so affordable to most households. It offers additional revenue to the farmers as they can sell the residues to Mozambique Renewables as a bi-product and we make it into renewable fuel.

The agri-residues are burnt in hybrid cooking stoves with a fan system that allows the fuel to be heated to much higher temperatures which then burns as a gas. This makes the fuel smoke free and hence deliver huge health benefits to the users.

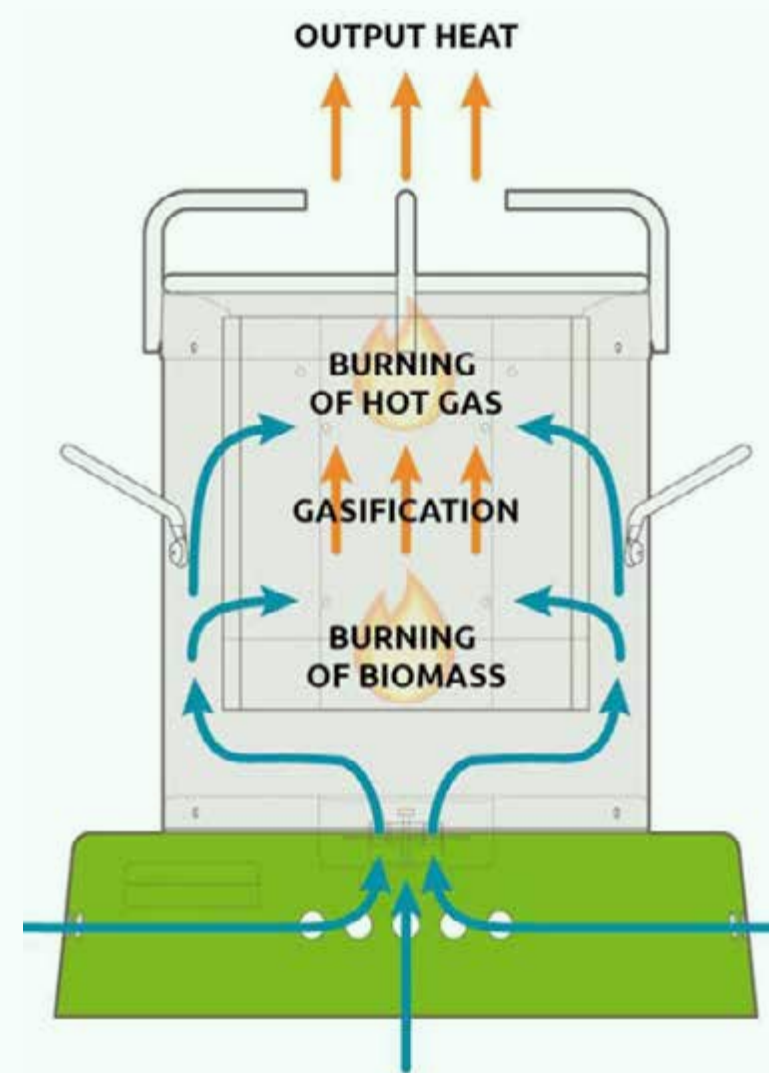
In our trial project with the Changalane Women's Farming Association in southern Mozambique the farmers have tested out the benefits of moving to the new fuel in the hybrid pot. Results show that 100% of the women are highly satisfied with the new method and wish to continue with the fuel as a permanent replacement. The trial highlighted other benefits as the group reported they no longer need to spend up to 1/3 of their day gathering wood, so spend more time on the farm and with their families. It also reveals wood collection involves high risk of getting bitten by snakes and so they are safer.



**Below:** Hybrid cooking stove

This permits clean combustion of solid fuel by separating the processes of gasification and combustion. A fan blows air into the burn chamber at both the top and bottom.

The solid fuel is converted by a mix of high temperature and air into combustible gases inside the burn chamber. Hot gases float towards the top where they are mixed with more air, and combust completely.



Source: African Clean Energy

## Forestry and Agroforestry

Once the tree cutting is reduced there is an opportunity to start effective tree regeneration. Mozambique Renewables has developed a restoration model for food production, amenity, and conservation based on forestry with agro-forestry.

It is designed to allow farmers to establish farming in one place without the need to continue slash and burn practices. This is achieved through the system of alley farming in which environmental services are provided by trees to the cropping enterprises between the rows or alleys. Selection of appropriate tree types such as Accacia can results in nitrogen fixation of the tree roots by specialist bacteria. At the appropriate densities this provide a natural nitrogen supply to the crops so the yields increase and the farmer is encouraged to stay on the plot. Leaf fall from the trees results in more biomass returning to the soil, increasing nutrient supply and helping worms and bacteria to build the soil depth.

This alley cropping zone is dedicated to local farmers production for their exclusive benefit. The land title is also registered in their name by Mozambique Renewables so that they build up a permanent asset base for future investment.

As well as an area zoned for alley cropping we also create agroforestry zones. Modern-day conventional agriculture relies upon the application of synthetic fertilisers and agrochemicals that can cause pollution of the soil and watercourses. It is dependent on large scale mono-crop production methods that leave crops vulnerable to pest and disease infestations, increasing the need for costly artificial inputs. Land is often ploughed or cultivated annually exposing it to erosion from the wind and rain, as well as drying out in the sun.

We apply agroforestry principles to produce healthy food without having to do any of these things. By planting long-term food producing trees there is no longer a need to cultivate the soil every year, so it becomes protected from erosion. As the soil is not inverted it builds its own internal infrastructure of



organisms and roots that make it more productive over time. By carefully selecting a mixture of different tree species there is a greater resilience to individual pest and disease attacks. Even if one species is damaged from pests it will not affect other types and hence the production from the site overall continues.

We have identified a range of trees that can be used to grow different nuts and fruits to supply local families and local markets. By mixing these trees with nitrogen-fixing trees (like those used in alley cropping) a symbiotic relationship is developed in which one category produces nitrogen from bacterial nodules in its roots that help to feed the other trees. In this way, the need to apply nitrogen chemical fertilisers is eliminated and there is no pollution. As well as producing good food the trees form a new habitat for bees and insects which in turn support bird life and greater bio-diversity. In this way, we aim to achieve a more sustainable food production system that works for local people and local wildlife.

Here is an example of the zoning system that we are working on together with the local community in Cobue in Niassa Province, northern Mozambique.

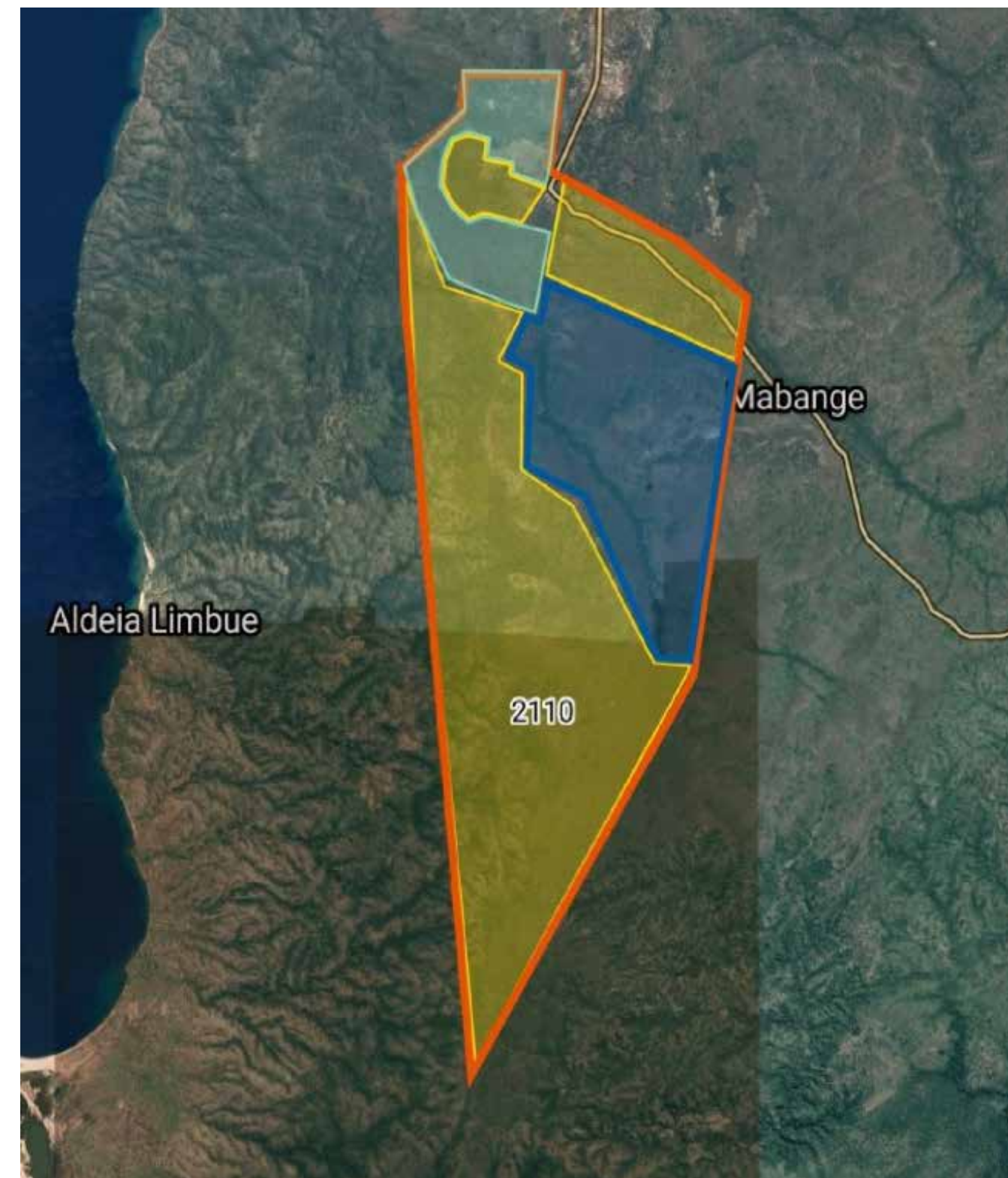


Image 4. Cobue District, Niassa Province  
Mozambique Renewables Ltd

### Cobue District, Niassa Province.

Land Area is divided into different Land Use Zones, each with a specific purpose:

- **Zone Category 1, Yellow: Forest Conservation**  
**Zones:** These are to be preserved for conservation where the trees are protected by the community from felling. The areas can be left to naturally regenerate into mature forest and/or new native tree saplings planted where natural regenerative is unlikely to succeed.
- **Zone Category 2, Green: Nitrogen Fixing Zone.**  
Here nitrogen fixing tree saplings are planted in rows spaced 4-6 meters apart. Between these rows local farmers plant crops for home consumption and cash sales. The trees fix nitrogen into the soil making it more productive for the farmers. Leaf fall from the trees also returns a proportion of organic matter to the soil and tree roots return deeper minerals to the surface.
- **Zone Category 3, Blue: Agroforestry + New Conservation.** Area committed to agroforestry trees for production of fruit and nuts mixed with conservation tree planting





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## GLOBAL LANDSCAPES FORUM

The Global Landscapes Forum (GLF) is the world's largest knowledge-led platform on integrated land use, dedicated to achieving the Sustainable Development Goals and Paris Climate Agreement. The Forum takes a holistic approach to create sustainable landscapes that are productive, prosperous, equitable and resilient and considers five cohesive themes of food and livelihoods, landscape restoration, rights, finance and measuring progress. It is led by the Center for International Forestry Research (CIFOR), in collaboration with its co-founders UNEP and the World Bank and Charter Members.

**Charter Members:** CIAT, CIFOR, CIRAD, Climate Focus, Conservation International, Crop Trust, Ecoagriculture Partners, The European Forest Institute, Evergreen Agriculture, FSC, GEF, GIZ, ICIMOD, IFOAM - Organics International, The International Livestock Research Institute, INBAR, IPMG, IUFRO, Rainforest Alliance, Rare, Rights and Resources Initiative, SAN, TMG-Think Tank for Sustainability, UNEP, Wageningen Centre for Development Innovation part of Wageningen Research, World Farmer Organization, World Agroforestry, World Bank Group, World Resources Institute, WWF International, Youth in Landscapes Initiative (YIL)

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