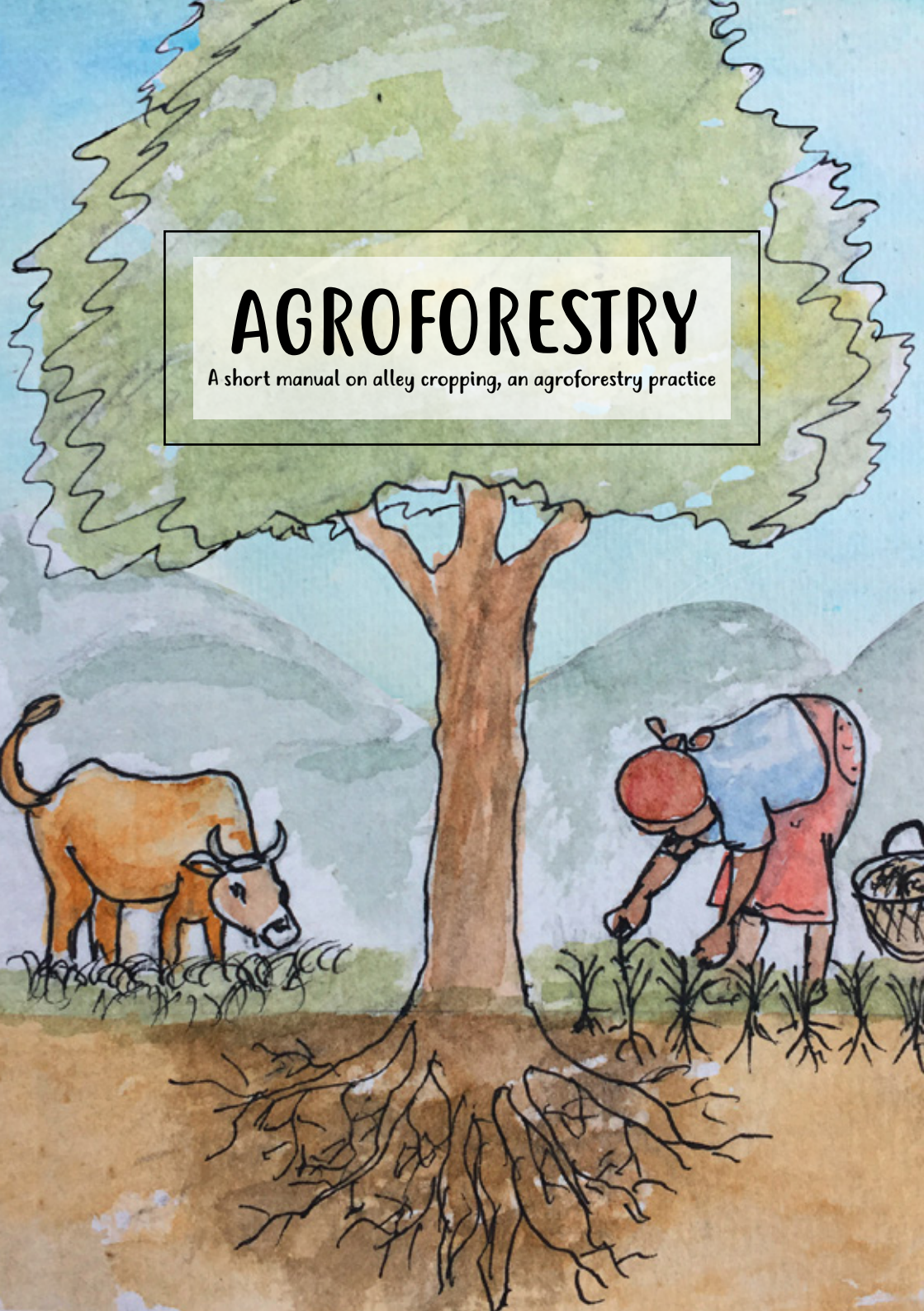


AGROFORESTRY

A short manual on alley cropping, an agroforestry practice



**This manual is dedicated
to Raimondo Capitanio**

SUMMARY

<i>Introduction</i>	5
1. Deforestation	7
2. Tree importance	10
3. Sustainable agriculture	14
4. Alley cropping	21
5. How it works	25

This manual belongs to:

Name

Address

This manual has been published with the support of:





INTRODUCTION

The Kilombero valley is a rich and fertile area. The fertility of its soils and the abundance of water are mainly due to its vicinity to the Udzungwa Mountains forest.

The main crops of the valley are sugar cane, rice, maize, fruits and vegetables.

A great percentage of the fertile land is cultivated with monocultures of sugar cane and rice paddies. Because of this, people often complain about the scarcity of land to cultivate other crops, the chance to diversify production and plant trees.

In addition to monocultures and intensive agriculture, most people of the valley still rely on firewood for cooking. Since access to Udzungwa Mountains National Park (UMNP) is forbidden, the community is forced to cut down trees in villages and nearby forests such as Magombera Forest. This contributes to environmental degradation and deforestation.





1. DEFORESTATION

Much deforestation has occurred in the last 60 years in Tanzania. This has been due to the rapid population increase.

The following activities have contributed to deforestation:

- Clearing forests for agriculture and settlement
- Felling trees for charcoal production
- Collecting firewood for domestic as well as commercial purposes
- Burning forests
- Overgrazing by livestock in some areas.



Deforestation is devastating, a danger and a plague!
It should stop!



Some of the consequences of these activities are:

- Shortage of water
- Shortage of construction poles and timber
- Scarcity of fuel wood in some areas
- Shortage of fodder during the dry season
- Silting and flooding of rivers and streams
- Reducing soil fertility leading to low crop yields
- Increased soil erosion



2. TREE IMPORTANCE

Trees are important and necessary for many reasons



FIREWOOD



**TIMBER, POLES,
POSTS**



FODDER



FRUITS



PRODUCTS

HONEY, GUMS,
TANNINGS, OIL, DYE



MEDICINES



CHARCOAL



GAME



UTENSILS AND
HANDCRAFT





BIODIVERSITY



CULTURAL, RITUAL, SOCIAL FUNCTIONS



SOIL PROTECTION, SOIL EROSION CONTROL



TOURISM



RAIN, WATER, STREAMS, RIVERS





SERVICES

Fertilization

Mulch

Nitrogen Fixation

3. SUSTAINABLE AGRICULTURE

In order to overcome the lack of fertile land sacrificed to industrial and intensive monocultures, Mazingira is trying to introduce smart and sustainable agricultural practices in the Kilombero valley.

The capacity of trees and other plants to restore or improve soil fertility was long utilized in traditional African agricultural systems, based on shifting cultivation. Farmers still grow or leave trees on their land often noting that this has beneficial effects for the soil and crop yields.



One type of sustainable, climate-smart agriculture is

AGROFORESTRY

In simple terms, agroforestry involves intensive land-use management combining trees and/or shrubs with crops and/or livestock: a land use system in which trees and other crops are planted on the same piece of land. This type of agriculture provides a straightforward solution to the problem of land shortage and energy for cooking.





TRADITIONAL AGRICULTURE



INTENSIVE AGRICULTURE

AGROFORESTRY



BENEFITS OF AGROFORESTRY

Agroforestry is very effective in rural areas with shortages of land for cultivation and need for firewood for cooking. It also helps farmers to diversify products and increase farming income. In a changing climate, it can be designed and strategically located to continue production even in extreme weather events (e.g., drought, floods). Tree-based practices sequester significant amounts of carbon reducing greenhouse gases.



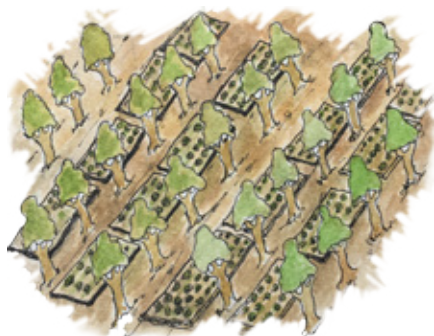
TYPES OF AGROFORESTRY



BOUNDARY PLANTING



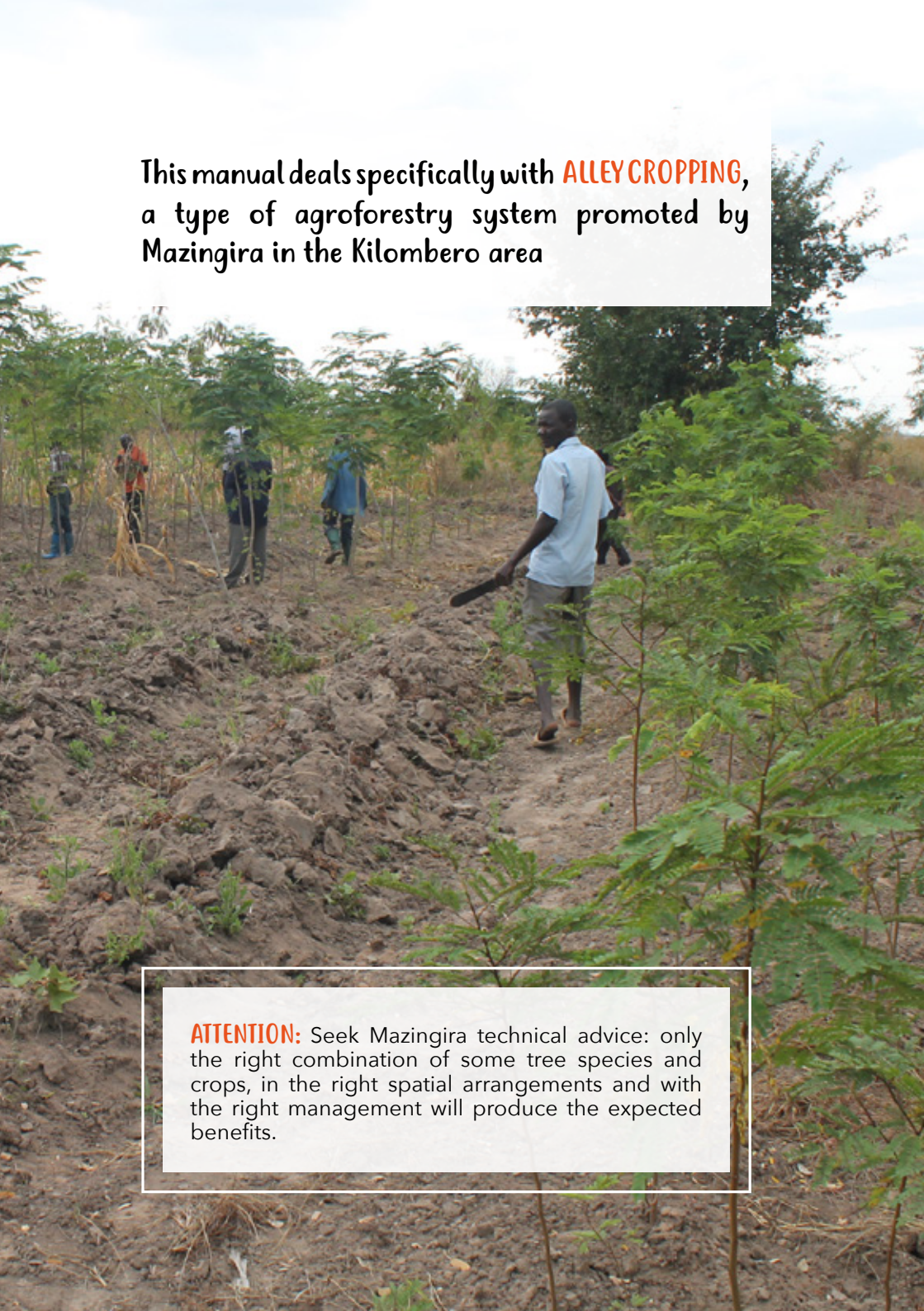
RIPARIAN BUFFER



ALLEY CROPPING

There are different types of agroforestry (agroforestry systems) in use throughout the world depending on the location and requirement.

**WINDBREAKS****FOREST FARMING****SILVOPASTURE**

A photograph showing a group of people working in a field. In the foreground, a man in a light blue shirt and grey shorts is walking away from the camera, holding a machete. Behind him, several other people are standing or walking among young trees. The ground is dark brown and has been furrowed into rows. The sky is overcast.

This manual deals specifically with **ALLEY CROPPING**, a type of agroforestry system promoted by Mazingira in the Kilombero area

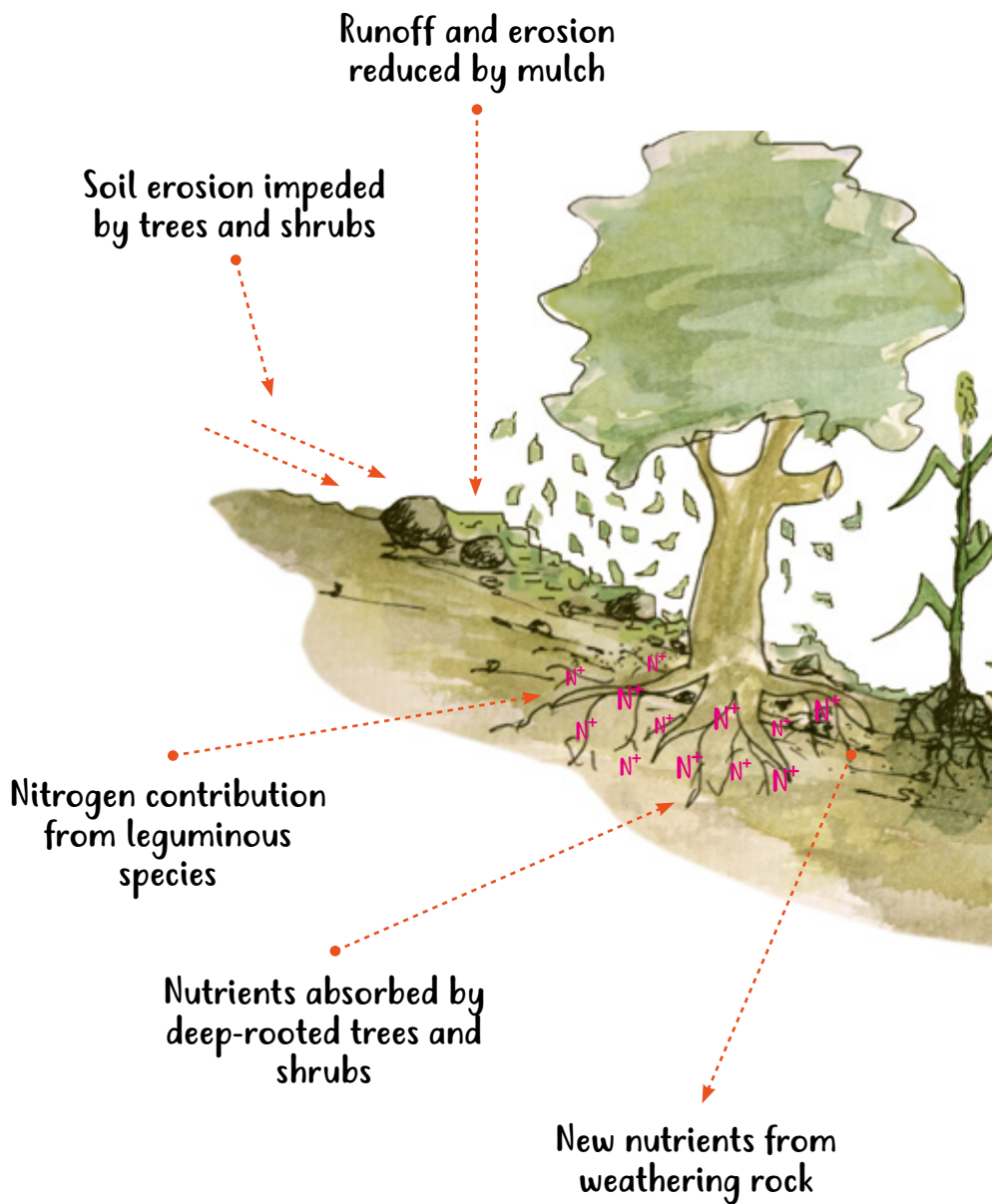
ATTENTION: Seek Mazingira technical advice: only the right combination of some tree species and crops, in the right spatial arrangements and with the right management will produce the expected benefits.

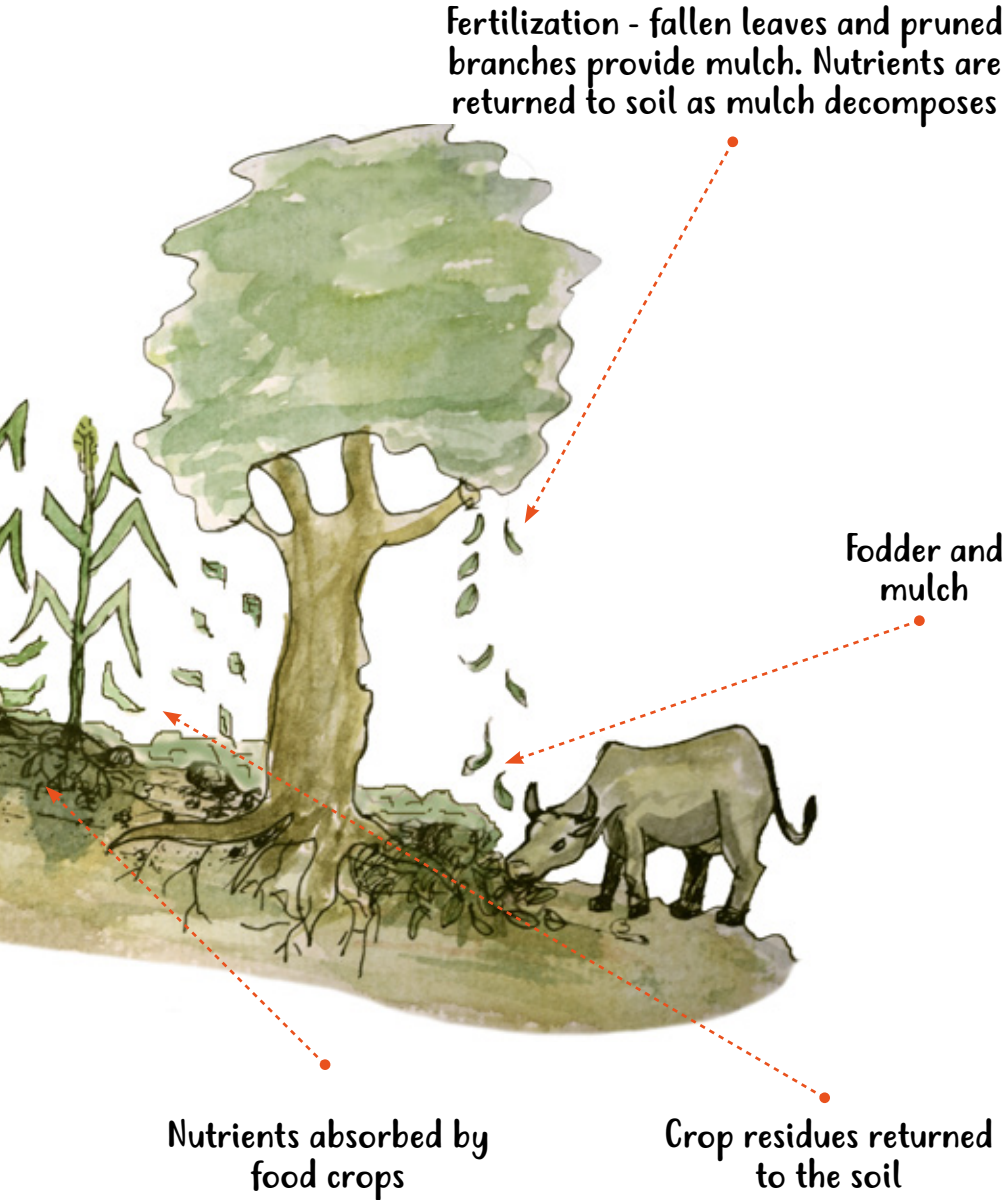
4. ALLEY CROPPING: DEFINITION

Alley cropping is an agroforestry practice combining trees planted in single or multiple rows with agricultural or horticultural crops cultivated in wide alleys between rows of trees.

ALLEY CROPPING BENEFITS INCLUDE TO:

- Maximize land use
- Utilize waste and degraded land
- Protect soil from erosion
- Increase nutrients in the soil
- Increase crop production and farm income
- Reduce wind and thus evaporation
- Restore or improve soil fertility by decomposition of tree litter
- Encourage leaf litter which acts as a mulch, conserve soil moisture, improve water infiltration and suppress weeds
- Protect crops from wind, parasites and drought
- Increase food security
- Reduce the need of fertilizers
- Allow nitrogen-fixing trees to convert atmospheric nitrogen into a form usable by plants
- Provide employment opportunities
- Improve the quality of the environment







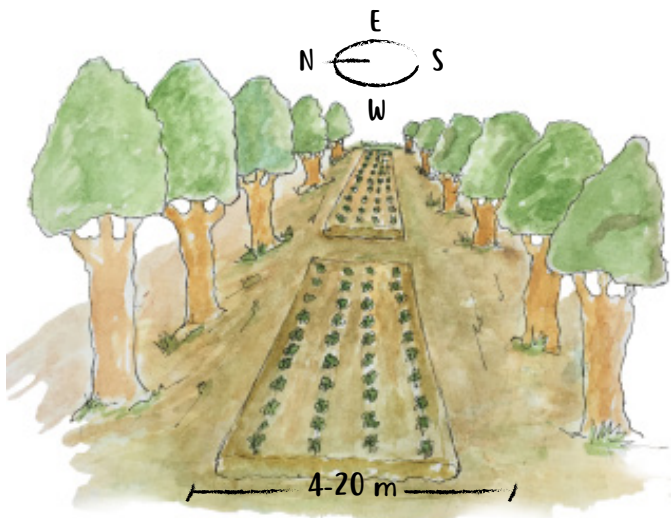
5. HOW IT WORKS

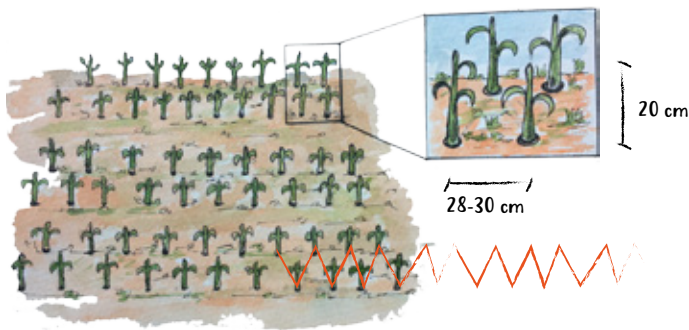
Contact Mazingira staff for implementing alley cropping in your farm!

5.1 ORIENTATION AND DIMENSIONING

Identify the east-west direction of your farm. You can use the position of the sun to identify the orientation of this line. Trees need to be planted along E-W rows. This allows the sun to shine along all the rows of the field. If the rows are planted perpendicular to the path of the sun, then the crops will not receive enough sunlight.

The interline distance between one strip and another run from four to twenty meters depending on the crop between rows.





Decide the spacing between the trees and make holes. Between the tree rows, seedlings are planted along in two parallel lines, set closely apart, in an alternating scheme. Within each line, seedlings are planted 28-30 cm apart. Between parallel rows the interline distance should be 20 cm apart. Seedlings are provided by specific Mazingira tree nurseries (Mwaya, UEMC, Kisawasawa, Ichonde, Mang'ula A).



5.2 PLANTING

Planting should be done any time from mid-December to early April, when the top 30 cm of the soil is moist and the rains are well established. Seedlings should be planted when they reach the right size as assessed by the tree nursery technicians, depending on the species. Water them well the day before planting. Remove the seedlings from the polythene tubes before planting.

If small-sized poles or firewood are in high demand, plant them at high density. Dig a big hole (30 cm x 30 cm x 30 cm) so that the roots can establish easily. All dead or dying plants should be replaced 3-4 weeks after planting.

To help your trees grow well, apply organic manure and compost instead of expensive inorganic fertilizers.



5.3 WEEDING

Weeding is an important tending operation for the following reasons:

- It reduces competition for moisture and nutrients so boosting early growth of the trees and crops
- It reduces the risk of fire to both trees and crops
- Proper weeding combined with loosening of the soil surface facilitates percolation of water and reduces evaporation from the soil surface thus contributing to good plant development

Young trees should begin the dry season completely weed-free. Weeding should be continued until the seedlings are well established.



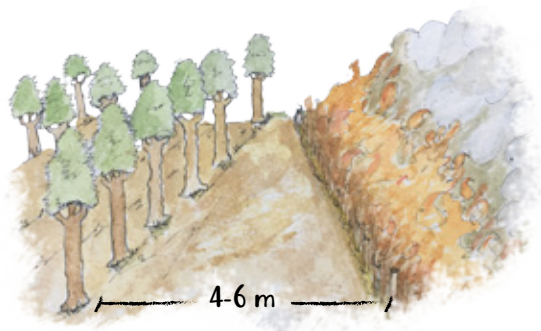
5.4 PROTECTION OF YOUNG TREES

Newly planted seedlings and young trees are very sensitive and need to be protected against livestock, fire and termites.

LIVESTOCK - Trees need protection from livestock until they are sufficiently high enough for at least part of the crown to be out of reach of browsing livestock, which normally takes at least 2-3 years. The most common way of protecting young trees from livestock is by fencing. Various materials can be used for fencing such as thorny branches, sticks and poles. Yet another method of protecting trees against livestock is to use the animal's dung or urine. Fresh dung is mixed with water and soap to make a solution which is then allowed to stand for three days. The mixture is then painted or spread around the trees.



FIRE - If young trees are weed-free there is no grass to fuel a fire. Therefore, weeding is very important. Construction of a firebreak also helps to protect trees against fire. A firebreak should be 4-6 m wide and must be free of grass and dead wood.



TERMITES - Termites are among the most serious pests causing damage to growing trees. Termites eat practically any plant material containing cellulose. Growing of termite-resistant species is recommended in areas with a serious termite problem. A cheap method of control is to use natural pesticides. Application of rice husk ashes in a planting hole and around the base of a tree has been reported to be effective against termites. However best to avoid planting trees in a termite-infested field in the first place.



5.5 HARVESTING

Harvest your trees when they get to 100 cm and above. Use branches for fuel wood and construction. Mix leaves with soil to decompose and so create an organic fertilizer. You can use leaves to feed your animals too.



The most important management techniques are pollarding, thinning, pruning, coppicing and lopping. These management practices are described in the next pages.

POLLARDING - Pollarding is the cutting back of the crown of the tree at a height of 2 m or more from the ground. The main purpose of pollarding is to harvest the branches or leaves and to stimulate the growth of a new, well-formed productive crown at a height where livestock cannot reach the new shoots. The entire crown of the tree is cut. The branches and twigs can be laid on the ground and left to dry to remove the leaves and small twigs and then used as fuel wood or poles. Not all species can withstand pollarding.



THINNING - Thinning is a planned operation where closely planted trees are selectively cut out. This requires the removal of about one-third of the trees leaving the best ones to grow with sufficient space. In stands where trees are densely planted, thinning will occur naturally, but if active thinning is done the growth of the remaining trees will be promoted. The thinned stems can be used on the farm or sold, making thinning a profitable operation.



PRUNING - Pruning is the removal of the lower branches of a tree. It is mainly done to:

- Reduce shading the agricultural crop
- Harvest branches for fodder, fuel wood, etc.
- Produce knot-free poles or sawn timber
- Allow passage through a woodlot

Pruning should be done before planting the crop or during the cropping season when the trees have a shading effect on the crops. When pruning a branch, cut at an angle so that rainwater drains away from the cut surface, thus reducing the possibility of fungal attack. Trees for timber and pole production should be pruned close to the stem.



COPPICING - Coppicing is the cutting of a tree near the base to stimulate production of new shoots and reduce shading the agricultural crop. When carrying out coppicing, follow these steps:

- The cut should be clean and slanting and at 10-30 cm above ground level
- The bark of the stump should not be damaged

Coppicing, preferably, should not be done during the rainy season. Many timber trees sprout prolifically if cut during the hot, dry season just before the onset of the rains.

When the shoots are about a metre tall, all except the best one should be removed to reduce competition. Slash the grass to avoid uncontrolled fire in the area under coppice management. However, not all trees coppice.



LOPPING - This technique involves cutting one or more branches from the trunk or stem of the tree, usually for fuel and/or fodder.



MAZINGIRA ALLEY CROPPING

Save Money! Save Time! Good Profits!

Tree species in Mazingira alley cropping	Common crops produced in Mazingira alley cropping	Recommended crops to save money and time and get good profits	Comments
<i>Grevillea robusta</i>	Maize and banana	Maize and banana	For quick production maize may be harvested in 3 months while banana requires 1 year.
<i>Leucaena leucocephala</i>	Maize, banana, rice, beans, pigeon peas, groundnuts, cowpea, sweet potatoes and Irish potatoes	Maize, banana, rice, sweet potatoes, Irish potatoes, pigeon peas, groundnuts and cowpea	Since the target is to increase production and food security sweet potatoes, ground nuts, cowpea and maize are good crops to be planted, taking little time till harvesting. Also maize, groundnuts and cowpea can be mixed in an area as a form of agroforestry very cheaply.
<i>Albizia spp.</i>	Maize, banana, beans, pigeon peas, groundnuts, cowpea	Maize, banana, beans, pigeon peas, groundnuts, cowpea	Maize should be mixed with pigeon peas as a form of agroforestry making better use of land.
<i>Gliricidia sepium</i>	Maize, banana, beans, pigeon peas, groundnuts, cowpea	Maize, banana, pigeon peas, groundnuts, cowpea, sweet potatoes	Maize and pigeon peas should be mixed together at the same time so as to utilize the land better and lower costs.

We don't recommend cultivating rice since it is very expensive and time consuming.





This manual has been funded by:

Servizio Attività Internazionali - Provincia Autonoma di Trento

Otto per mille - Waldesian Church

Ufficio per l'integrazione europea e gli aiuti umanitari -

Regione Trentino Alto Adige

Fondazione Foresta Futura

Associazione Mazingira Onlus

Texts and translations in English: Silvia Ricci, Scola Mwasenga, Oscar Nyenza, Shabani Mtonda, Pima Nyenga

Translations in Swahili: Oscar Nyenza, Andekile Mlenga, Nestory Katwiga, Pima Nyenga

Illustrations: Mihayo Lucas

Photographs: Silvia Ricci and Rasmus Gren Havmøller

Proofreading of English texts: Anna Smyth

Graphic layout: Flavio Ridolfi and Giba Comunicazione

Project partners:





Project - Udzungwa:
a forest for all