

# Pack #114, Item

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**Backgrounder: Reforestation in the Kolda region of Senegal**

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**Introduction**

***Why is this subject important to listeners?***

Because farmers and conservationists should know:

* Practical ways to reforest a semi-arid or deforested region.
* How to revive tree stumps to grow again.
* How to help small-scale farmers find alternative sources of cooking fuel to reduce their dependence on trees.
* The tree species that are suited to reforesting the semi-arid and deforested Kolda region of Senegal.
* The tree species that can be grown together with crops without interfering with their growth.

***What are some key facts?***

* Reforestation is an effective practice for restoring degraded lands to productivity.
* Farmers and conservationists should select high quality tree seeds that are suited to the climate of the region to be reforested.
* Seedlings for planting in dry or deforested lands must be “hardened” by reducing watering for at least two weeks before planning. This increases their drought-resistance.
* In arid and semi-arid areas, sunken nursery beds are used to conserve soil moisture.
* In dry regions, planting holes for trees range from 30 centimetres in diameter by 30 centimetres in depth to 45 by 45 centimetres.
* Planting holes should be dug and partially covered before the dry season ends so that enough water infiltrates to the bottom of the hole by the start of the rainy season.
* Early preparation of holes is vital if you want to plant a large number of trees.
* To promote long growth periods and good root development, and to enhance survival rates, plant trees when standardized accumulative rainfall has been obtained. Normally, this is about 100 mm.
* To improve survival rates of growing trees, trim branches but retain the top two or three branches to ensure a good balance between transpiration and water absorption for broadleaf trees.
* Experts advise that trees be planted first on degraded lands. Their roots can access water and nutrients inaccessible to plants with shallow roots, and trees provide wood, fuel, fodder, and new income streams when sold.
* Trees help soils on degraded lands to regain their organic matter when leaves fall and decompose into the soil, and the also shade the soil from the hot sun.
* Reforestation leads to an accumulation of leaf litter and humus that allow soil to better absorb moisture and to recharge groundwater.
* The leguminous tree, *Faidherbia albida*, can be intercropped with maize, millet, and sorghum. It fixes nitrogen in the soil that is beneficial to the growing grains and to crops like tomatoes and chili. The tree is used as livestock fodder in dry season since the leaves don’t drop.
* Trees like gum arabic (Senegalia senegal) act as windbreaks. The gum they produce provides income for their communities, as well as decreasing water runoff and stopping wind erosion.
* Trees in arid and semi-arid areas help sequester\*carbon dioxide from the atmosphere.
* Trees have multiple benefits (see below) and bare land should be reforested even if it’s not being used for any purpose. Trees have secondary benefits like being wind breaks.

*For further information, please see documents 5, 6, 7, 8, 9. 10, 11, 14, 15, and 16.*

***What are the big challenges of reforestation in Senegal?***

* The insecurity of land tenure in Senegal has resulted in forest degradation due to encroachment of farmers into land that was previously forested. This has also resulted in an increase in land disputes between farmers and pastoralists.
* Many farmers have migrated to the southern regions of Senegal, resulting in forests and woodlands being cleared for agriculture.
* The fact that Senegal is an arid country with low production of biomass drives demand for wood to be extracted in an unsustainable manner.
* Rising population, charcoal demand, and rapid urbanization is increasing pressure on forest resources in Senegal.

*For further information, please see document 1.*

***Gender aspects of reforestation in Kolda, Senegal***

* In Senegal, women not included in the reforestation project plans with men could be accused of destroying the work done while collecting firewood.
* In Senegal, women are getting involved in trainings on sustainable use of forest resources, including sustainable charcoal production. These activities were formerly dominated by men.
* Even where women have legal rights to access and use forests, they are unaware of these rights or lack access to the resources or legal avenues to claim them.
* Cultural and social norms make women reluctant to claim their rights to forests.

*For further information, please see documents 2, 17, and 18.*

***Predicted impact of climate change on reforestation in Kolda, Senegal***

* Women are vulnerable to the pressures associated with climate change and the resulting biodiversity loss and land degradation due to their high level of dependence on forest products, and their lack of participation in community decision-making.
* In Senegal, climate change has begun to effect economically and ecologically important tropical and woodland forests, which are diminishing because of drought, rising temperatures, and bush fires.
* Rainfall in Senegal has been declining in the last 30 years, resulting in droughts that have caused the degradation of natural resources such as forests.
* In Senegal, overexploitation of resources like water, grazing land, fisheries, forests, and soils has resulted in their degradation and/or scarcity, further exacerbating the effects of climate change.
* Rising temperatures, droughts, bush fires, and poor rains have resulted in the decline of tropical and woodland forests in Senegal.

*For further information, please see documents 3, 12, and 13.*

**Key information about reforestation in Kolda, Senegal**

**Trees species suited for reforesting Kolda**

The following is a list of drought-resilient tree species recommended by reforestation experts for planting in dry or deforested areas. The list gives the scientific name, then a common name.

* *Eucalyptus grandis*/ Rose gum
* Acacia species/ Various
* *Melia volkensii/* Melia
* *Faidherbia albida/*White acacia
* *Tamarindus indica/*Tamarind
* *Siamese senna/*Cassod tree
* *Azadirachta indica*/Neem
* *Vachellia xanthophloea*/Fever tree
* Sapindus species/Soapberry tree

*For further information, please see documents 4, 5, 11, 15, and 16.*

**Tree planting and management techniques**

For trees to survive in arid and semi-arid climates, seedlings should be high quality. They should also be subjected to a hardening technique. Before planting / reforesting, the following factors should be considered:

* Seedling varieties should be suited to the local climate.
* Seeds should be treated with natural or chemical pesticides before being planted in a nursery.
* Seeds should be planted in sifted soil mixed with manure and sand.
* Watering and weeding should be conducted frequently.

***Trees establishment and propagation techniques***

Trees can be propagated and established by using seeds, cuttings, and wildings.

* Wildings (sometimes called “volunteers”) are seedlings that grow naturally from seeds dropped from mature trees or dispersed by other methods. Wildings can be uprooted when they are 25 centimetres tall and replanted in areas that need reforestation.
* Seeds can be sown directly in the area to be reforested or first raised in a nursery.

***Raising tree seedlings in a nursery***

Tree seedlings raised in nursery beds have higher survival rates because of the care they get at early stage of growth. The seedlings can be raised in polythene containers or grown “bare root “in nursery beds. Alternatively, seeds can be sown on seedbeds and the young seedlings transplanted later into containers.

* When reforesting arid and semi-arid regions, start tree seedlings in the nursery six months before transplanting them.
* Containers are suitable for raising trees to be grown in arid and semi arid lands as well as marginal lands, that is, lands that are unsuitable for farming.
* Tree seeds can be planted in a variety of starter containers, including: old milk packets opened on both ends, polythene tubes, tin cans, and containers made from maize husks and tied banana leaves.
* When tree seedlings in a nursery are weak, apply livestock manure or fertilizers like NPK and DAP.
* Yellowing of seedling leaves can indicate nutrient deficiency and hence the need for fertilizers, including manure. It can also result from over watering.
* As transplanted trees grow, farmers should apply readily available organic manure or compost if they observe stunted growth, yellow leaves, or if some tree seedlings are dying off in the field.

*For further information, please see documents 4, 7, 8, 11, and 15.*

***Advantages of raising seedlings in containers***

* The seedlings have high rate of survival.
* Seedlings develop better root systems.
* Because they’re in containers, seedlings can be transported to planting sites in advance for transplanting, which means that they have a longer period to acclimatize to the new location.
* Seedling diseases are more easily addressed in containers, and infected seedlings can be more easily isolated from healthy ones.
* Before seeds or seedlings are planted in containers, they should be sprayed with a soap solution to manage aphids.

***Sowing seeds in containers***

* Fill containers with a mixture of soil, manure, and sand in equal proportions. The ideal soil for raising seedlings in containers is light clay loam or sandy loam. Such soils are “sticky” and don’t fall off from open-ended containers. They also allow for aeration and are nutrient-rich. Such soils can be sourced from under acacia trees, in forested woodlands, and in old or abandoned livestock pens.
* Arrange containers in a line in the shade.
* Water the soil before planting the seeds.
* Prick a shallow hole in the soil and plant the seed.
* Put at least two seeds in each container. If both germinate, transfer one to another container when they develop good root structure.
* Water seeds daily if there is no rain, and decrease watering as transplanting time nears.
* When transplanting, remove the container if it’s not biodegradable.

*For further information, please see documents 4, 8, and 11.*

***Pest and disease management in tree seedlings***

Growing trees are vulnerable to attack by pests and diseases. Farmers should frequently scout for pests and diseases to prevent the spread of pests and diseases to other seedlings.

*Pests*

In nurseries, gall flies can attack seedlings if they are water-stressed. If seedlings receive enough water, the risk of gall fly damage is reduced.

*Diseases*

A disease called *damping off* occurs when young tree seedlings rot at the root collar\*and die off. This indicates the seedlings are getting too much water. At the first signs of damping off, reduce watering until the problem is fully controlled.

*Wilting*

Wilting causes the bark of the seedling to die off. It is caused by overcrowding of seedlings and can be prevented by increasing the distance between containers or immediately planting out.

*For further information, please see document 4.*

***Hardening seedlings***

Hardening tree seedlings makes them drought-resistant by strengthening the stems and leaves and enhancing the development of cuticle\* layer of leaves. Farmers can harden plants by reducing water to half or two-thirds of the normal amount and increasing exposure to sun. The hardening process starts at least two weeks before planting the seedlings.

***Root pruning***

In regions with poor rains, seedlings should be nurtured in sunken beds to help conserve soil moisture. As they grow, thick roots develop on the soil between the seedling pots. To ensure a high percentage of seedling survival, these thick roots should not be cut. But to ensure the thick roots from growing, the position of the seedlings pot should be changed regularly. Any roots that extend outside pots should be cut before they thicken.

***Planting density***

The amount of rain will determine tree spacing and the number of trees to be planted in a piece of land. For example, the drought-resistant species *Melia volkensii* is spaced at five metre by five metre intervals in areas with an annual rainfall below 900 millimeters. In areas with annual rains of about 450 millimetres, they are spaced at 15-20 metres X 5 metres.

***Planting holes***

Planting holes for seedlings typically range from 30 to 45 centimetres in diameter and 30 to 45 centimetres deep. Holes should be dug and partially covered before the end of dry season to ensure that enough water infiltrates to the bottom of the hole by the start of the rainy season. If the number of trees to be planted is large, the holes should be prepared earlier. Digging planting holes before rainy seasons allows water to collect in them, and it increases the transplanted seedlings, survival chances.

***Planting***

For tree seedlings to have long periods of growth, develop sufficiently extensive and healthy roots, and have high survival rates, they should be planted when the soil is moist to a depth of 30 centimetres. To improve survival where rains are irregular, it’s recommended to trim some branches, leaving only the top two or three branches. Trimming ensures a good balance between transpiration\* and water absorption. Tree seedlings should be planted after it has rained for at least two weeks, or when the soil has soaked water for a depth of 30 centimeters from the soil surface.

*For further information, please see documents 4, 6, and 7.*

***Regenerating old trees and stumps***

As well as planting new seedlings, areas can be reforested by rejuvenating existing trees that have been cut down. Trees cut down and stumps left behind can be revived through a practice called Farmer Managed Natural Regeneration (FMNR). FMNR stimulates root growth in woody areas and re-growth of tree stumps. FMNR can be implemented on degraded forests or on agricultural and grazing lands, and helps regenerate trees. FMNR often recommended regenerating indigenous trees.

FMNR includes the following three steps:

* Select the desired tree stumps to regenerate. The stumps should have tall and straight stems that will grow into mature trees.
* Prune all unwanted stems and side branches and remove any competing vegetation and weeds. Ensure that the is not accessible to livestock, and vulnerable to accidental fires.
* From time to time, cull any lower stems and side branches that emerge.

Importance of FMNR

* Regenerated trees help restore soil structure and fertility, reduce erosion and evaporation of soil moisture, and can help rehabilitate springs and the water table and increase local biodiversity.
* Some indigenous tree species feed nutrients like nitrogen to the soil.
* Trees being regenerated can be used to provide firewood from pruned branches, and can be used as livestock fodder.

*For further information, please see documents 9 and 18.*

**Benefits of various tree species**

Trees offer various benefits to farmers, including:

Food: Trees can provide nutrient-rich fruits. Examples include mango, tamarind, avocado, conkerberry (*Carissa spinarum*), hog plum (*Spondias mombin)*, and pawpaw.

Fuel: Most farmers use wood for fuel. Examples including eucalyptus, grevillea, croton, and *Delonix regia* (flamboyant or royal poinciana)**.**

Timber: For poles, houses, and other kinds of construction. Examples include eucalyptus, grevillea, gamhar (*Gmelina arborea*), and the umbrella tree.

Soil fertility: Farmers can grow leguminous trees which both improve fertility by fixing nitrogen in the soil and can be used as livestock fodder. Leguminous trees like *L*eucaena leucocephala, *Gliricidia sepium, Faidherbia albida,* and *Calliandra calothyrsus* fix nitrogen in the soil and have protein-rich leaves. The leaves can be used as fodder for ruminants, and when shed, they add nitrogen to the soil. Trees also act as windbreaks and shelter the soil and growing crops from hot sun.

Carbon sequestration: Trees absorb greenhouse gases like carbon dioxide from the atmosphere and act as sinks for the atmospheric carbon dioxide that causes climate change.

*For further information, please see documents 5, 6, 7, 8, 9, 10, 11, 14, 15, and 16.*

**Definitions**

*Carbon sequestration*: The process of removing carbon from the atmosphere and storing it in carbon sinks such as trees, oceans, or soil.

*Cuticle*: Waxy outer layer that covers the epidermis and prevents uncontrolled water loss from leaves.

*Hardening technique*: A technique of progressively exposing seedlings to the conditions they will experience in their eventual growing environment, whether that be dry, warm, cool, wet, or otherwise.

*Root collar*: Part of tree where the roots join the main stem or trunk.

*Transpiration*: Loss of water through plant leaves through evaporation in the form of water vapour.

**Where can I find other resources on this topic?**

*Documents*

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