Food and Agriculture Organization of the United Nations

Forest and Landscape Restoration Mechanism

Restoring Landscapes for Enhanced Livelihoods

Good Practice 2

Afforestation of sand dunes with poplars in China

Combating sand encroachment in drylands

Dune stabilization and afforestation is an essential practice for protecting soils from wind erosion in drylands and a first crucial step in landscape restoration. It helps ensure the availability of land for agriculture and livestock and provides opportunities for food production in areas that may be under heavy population pressure. Afforested dunes, if well managed, support local farmers by providing additional sources of woodfuel, non-wood forest products and fodder for livestock.

LOCATION: The practice of dune stabilization and afforestation has been used and replicated in drylands worldwide, including tropical Asia, temperate Central Asia, tropical Latin America, subtropical and tropical Africa, the Mediterranean and the Near East. It was also recently introduced to the Aral Sea as a way of greening the former sea floor, producing oxygen and reversing the desertification process and soil loss.

TARGET GROUP: Stakeholders include decision-makers, extension agents, smallholders, local communities and farmer associations.

POTENTIAL DONORS: Interested donor countries and funding organizations such as the World Bank and the International Fund for Agricultural Development.

IMPLEMENTING ORGANIZATION: The Food and Agriculture Organization of the United Nations (FAO).

CLIMATE CHANGE: Dune stabilization and afforestation is a restoration practice for exceptionally degraded lands to accelerate natural recovery by planting native or introduced trees in single-species or mixed-species plantations. Dune stabilization and afforestation practices can contribute to climate change adaptation by improving environmental quality and reducing the vulnerability of people, crops and livestock to extreme weather. Planting also contributes to carbon fixation, both in the biomass and the soil, and reduces forest degradation.

IN BRIEF - DUNE STABILIZATION AND AFFORESTATION: Dune stabilization and afforestation is a traditional practice used by people living in drylands to defend their farmlands, rangelands and infrastructure (e.g. houses,

CONTEXT

Sand dune encroachment

Land degradation and desertification are major economic, social and environmental concerns in many regions worldwide. Drylands are particularly at risk of degradation because they are characterized by **water scarcity, are poorly covered by vegetation, and are vulnerable to wind erosion.** Drylands occupy buffer zones between deserts and shrublands and are often affected by unsustainable and uncontrolled land use. They may be subject to influxes of people displaced by, for example, environmental disasters or political crises. Population growth can contribute to land degradation, aggravate existing desertification processes, and reduce the capacity of the land to support forests and agriculture, thereby posing serious risks to the production of forage, fuelwood and food.

Soils in degraded drylands tend to lack organic matter; they are also often fragile and easily eroded by winds, which can cause dust and sand storms. **Winds transport soils in the form of fine, medium-sized and large particles, which, when stopped by obstacles, contribute to forming dunes.** Such dunes shift continuously, are difficult to control and stabilize, and pose risks to agricultural lands and pastures.

Dune stabilization and afforestation is an essential practice for protecting soils from wind erosion in drylands and a first crucial step in landscape restoration. Techniques have changed little over time, and they involve **primary and secondary practices. Primary stabilization** aims to prevent or reduce the movement of dunes long enough to enable either natural or planted vegetation to become established. **Secondary practices** are applied to the temporarily stabilized dune, which is "biologically fixed" – that is, planted with several species of plant, such as pioneer grasses (e.g. *Aloe vera*, *Carpobrotus edulis*), woody bushes (e.g. *Nitraria retusa*, *Tamarix aphylla*, *Tamarix senegalensis*, *Casuarina equisetifolia*, *Atriplex halimus*) and trees (e.g. *Prosopis juliflora*, *Acacia raddiana*, *Acacia senegal*, *Acacia saligna*, *Balanites aegyptiaca*, *Euphorbia balsamifera*, *Persica salvadora*).

CHALLENGE

Supporting communities to become more resilient and improving food security in desert areas.

wells, barns, roads and utility poles). It involves stabilizing dunes through the use of living or non-living vegetative materials or other objects to temporarily stabilize dunes while vegetation is established. Soil stabilization allows soil enrichment through the accumulation of organic matter, helps conserve water and increases productivity. Restored dunes can produce wood and non-wood forest products and fodder and provide shade for livestock, thereby supporting people's livelihoods.

ECONOMIC AND POLICY CONSIDERATIONS:

Research institutions and extension agencies are crucial for ensuring the transfer of knowledge in the field. Their support can improve practices such as seed collection of adapted species, nursery management, planting and livestock management. **Policy institutions should support the transfer of funds** from central governments to the entities that carry out field activities, such as local government institutions, non-governmental organizations and farmer associations. **The cost of dune stabilization and afforestation** is determined mainly by the cost of labour because the process is labour intensive. The cost of labour varies by country; in developing countries it may be in the range of US$10–20 per day. In Mauritania – a country with considerable experience in dune stabilization and afforestation – the cost is about US$500 per hectare, with a success rate of 60–80 percent if local species are used. Chile has reported that dune stabilization and afforestation costs around US$1270 per hectare. In harsh dryland environments, women play crucial roles in the food security of their families, but the **involvement of women in dune stabilization and afforestation needs to be increased.**

REPLICABILITY AND UPSCALING:

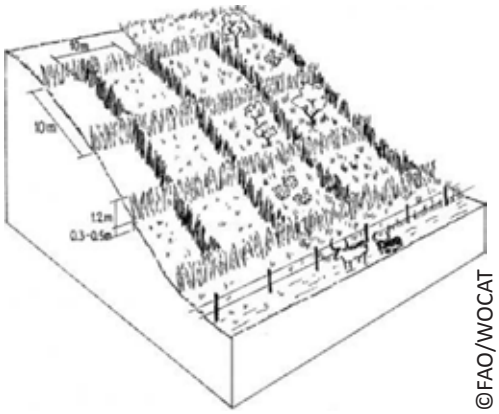
The practice of dune stabilization and afforestation has strong potential for extension for several reasons. It is the only available measure to prevent dune-shifting, and it can be disseminated and replicated easily because it is well known by rural people in drylands, across a range of countries and environmental conditions, including tropical, subtropical and temperate deserts and coastal areas. The beneficial impacts of dune stabilization and afforestation have been demonstrated in widely varying environments, such as those in Mauritania, Kazakhstan and the United Kingdom. Replication and scaling up require:

- government policies and subsidies that support afforestation practices
- strong commitment of all stakeholders
- the involvement of research institutions and extension agents to ensure the transfer of knowledge on applying good practices

METHODOLOGICAL APPROACH

Preliminary steps

- Raise awareness in rural communities of the risks posed by shifting dunes. Extension agents organize meetings with local people to explain the importance of fighting dune encroachment.
- Involve local communities, farmer associations and local non-governmental organizations to ensure the transfer of technologies and knowledge on dune fixation and afforestation.
- Involve all stakeholders, including local governments and research institutions, to ensure success.



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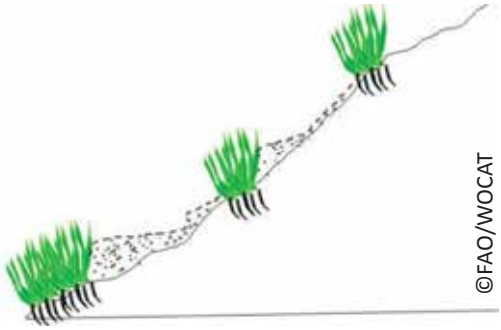
Primary stabilization

Establish mechanical barriers on dunes to reduce wind speed and sand erosion and thereby allow seedlings to fix their roots in the soil. Potential mechanical barriers include:

- Living or non-living vegetative materials (e.g. twigs, brushwood, grass sheaves, reeds, brushes, grids of canes and fences of palm leaves).
- Other available materials, such as old railway sleepers, tyres, poles and used oil drums.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Secondary stabilization

- Design the approach for planting, including the methodologies to be used based on site needs.
- In nurseries, grow the seedlings to be planted for sand dune fixation.
- Establish plantations with one or more plant species, according to the project design.
- Ensure root growth and seedling survival by using appropriate techniques for afforestation in drylands, such as mulching and organic fertilization.[1]

IMPACT

The afforestation of drylands dominated by shifting dunes can have huge positive impacts by increasing the availability of land, forests, shelterbelts and agricultural fields and supporting food security. The increase in forest area protects soils and provides shade and fodder for livestock, as well as wood and non-wood forest products, with benefits for people's livelihoods. This increases the resilience of both the environment and people.


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FOR MORE INFORMATION

www.fao.org/forestry/aridzone

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1 Sand dune stabilization, shelterbelts and afforestation in dry zones. FAO Conservation guide No. 10.