Taking root

by Rachel Cernansky, Science, 11 Feb 2021

A farmer in Niger tends to his nursery. Researchers say such community-led efforts will be key to completing the Great Green Wall. David Rose/Panos Pictures

After returning home from college to northwest Cameroon in 2004, Tabi Joda felt a sense of profound loss. Trees that once bore fruit, provided medicine, and created shade had been cut down. Rich soils had turned to dust. "The land I used to know as a forest was no longer a forest," he recalls. Joda, a business consultant, got to work, calling on what he'd learned in school and from local knowledge passed down over generations. He collected seeds, started a tree nursery, and launched an agroforestry initiative that enlisted local people in planting trees. They chose species that provided food and timber, supported livelihoods, and helped wildlife thrive. The effort soon spread to nearby communities. And Joda ultimately became a vocal advocate for an even bigger dream: the Great Green Wall, which aims to transform the lives of some 100 million people by planting a mosaic of trees, shrubs, and grasses along a corridor stretching some 8000 kilometers across Africa by 2030.

Since the African Union first launched the Great Green Wall in 2007, the initiative has struggled to make headway. Made up of local efforts across 11 countries, it has reached just 16% of its overall goal to vegetate 150 million hectares. But last month, the project—which analysts estimate will cost at least $30 billion—got a major boost: a pledge of $14 billion in funding over the next 5 years from a coalition of international development banks and governments. The money is meant to accelerate the effort to sustain livelihoods, conserve biodiversity, and combat desertification and climate change, French President Emmanuel Macron said in announcing the pledges on 11 January.

Environmental restoration and community development specialists welcomed the news. But many are also apprehensive. In recent years, research by ecologists, economists, and social scientists has shown that many forestry projects around the world have failed because they didn't adequately address fundamental social and ecological issues. Project leaders often didn't ask communities what kinds of trees they wanted, planted species in places where they didn't belong, and did little to help the saplings survive. "Tree planting is often viewed as the simple act of digging a hole," forest scientists Pedro Brancalion of the University of São Paulo, Piracicaba, and Karen Holl of the University of California, Santa Cruz, noted last year in a review of agroforestry projects in the *Journal of Applied Ecology*. "But this short-term, naïve view has resulted in large quantities of money being spent on ... efforts that have failed almost entirely."

It's a problem that Joda knows well. "I have traveled the breadth of Africa and seen it everywhere," he says. "Trees are planted, but they are not taken care of and so they never grow." The question now, he and others say, is whether Great Green Wall projects fueled by the fresh burst of cash will heed those hard-learned lessons.

THERE'S LITTLE DOUBT that well-executed agroforestry initiatives can deliver hefty economic and ecological benefits. In the Brazilian Amazon, for example, Brancalion and other researchers have documented projects that have helped restore native plants, improve soil's ability to store carbon, and boost the quality of drinking water. Local residents report restoration projects have even fostered tourism.

A green corridor

In 2007, the African Union proposed planting a mosaic of trees, shrubs, and grasses along an 8000-kilometer-long corridor across the continent by 2030. The project has made modest headway since then, but new funding could help.

In Africa, the adoption of one approach, called farmer-managed natural regeneration (FMNR), is credited with regreening a notable portion of the Sahel, the semiarid region south of the Sahara. The low-cost, low-tech restoration technique took off in Niger in the

1980s and has since spread to other nations. It relies on farmers to protect and nurture shrubs and trees that sprout from stumps, or grow from existing root systems and seeds in the soil. Over decades, FMNR has led to greater tree cover and other ecological benefits, such as higher soil carbon content, researchers have found. It has also helped increase crop yields and improve the diversity of household diets, as well as boost incomes.

But many efforts, particularly those not led by local communities, stumble. Newly planted trees can die of neglect when planners don't engage communities from the start in discussions about which species to plant, as well as whether residents are willing and able to provide the water, fertilizer, and protection from grazing animals that saplings need. Farmers are often busy and have their own priorities; they "will not … manage trees that they do not value," forest specialist Abayneh Derero of Ethiopia's Environment and Forest Research Institute and colleagues concluded in a study of Ethiopian tree-planting projects published last year in *Agroforestry Systems.*

A lack of community input is a leading cause of failure, according to a survey of agroforestry projects in 66 nations published last year in *Forests* by a team led by forest scientist Markus Höhl of the Thünen Institute of Forest Ecosystems. "The most important thing is that the local stakeholders are engaged," Holl says, "and that the right species are located for both the goal of the project and the site."

Other research has highlighted the problematic ecological consequences of flawed projects. For example, many have used easily available, fast-growing species that are not native to project sites, such as eucalyptus and pine. In some cases, the results have been counterproductive: The poorly adapted saplings wither, or become invasive weeds that crowd out native species and suck up scarce water.

"We do see a gap there … in terms of planting the right tree for the right purpose in the right place," says Ian Dawson, a senior scientist at the World Agroforestry Centre. Too often, he says, "The emphasis is on numbers, not quality."

Elvis Paul Tangem, who coordinates the Great Green Wall Initiative for the African Union Commission, agrees. He says promises to plant huge numbers of trees at low cost, for example at $1 per seedling, can distract from the real challenge. "You can plant a tree for $1," he says, "but you cannot grow a tree for $1."

Failing to account for social and economic concerns can also lead to misleading perceptions of how much degraded land is realistically available for restoration. For example, when forest researchers led by Lian Pin Koh and Yiwen Zeng of the National University of Singapore mapped degraded forests in Southeast Asia, they found 121 million

hectares might benefit from restoration, they reported in *Nature* last year. But after they considered a range of practical constraints—such as cost, available infrastructure, and whether the land had been converted to uses that were unlikely to be abandoned—they concluded that less than 18% of that area was likely viable for restoration. "Most of the emphasis has been on the potential [for restoration] because we want to stimulate people to do this, but the actual is much more poorly understood," says forest scientist Robin Chazdon of the World Resources Institute Global Restoration Initiative.

DESPITE SUCH PROBLEMS, analysts say there are promising models. One is in Ethiopia. Called PATSPO, for Provision of Adequate Tree Seed Portfolio, it has scientists working with local institutions and communities to identify desirable tree species that are well adapted to local conditions. The goal is to expand the production, distribution, and planting of high-quality seeds of desired varieties, many of which are now in short supply, says PATSPO's lead investigator, Lars Graudal, a forester at the World Agroforestry Centre.

PATSPO is "an example that we want to see scaled up and scaled out across the whole of the Great Green Wall," Dawson says. And many of the institutions funding the wall—including the World Bank, the United Nations Food and Agriculture Organization, and the U.N. Convention to Combat Desertification—say they are committed to avoiding past missteps.

Those vows will now be tested, as new funding flows to projects along the corridor. Researchers say there's more than money at stake. The ecological consequences of failed projects could be long lasting. And projects that flop could cost small-scale farmers their investments of time and resources, and reduce their trust in future efforts.

"When you make a mistake, it's not the [project funder] that's going to pay for that error," says Jens-Peter Barnekow Lillesø, a forest researcher at the University of Copenhagen who's involved in PATSPO. "It's the tree planter. These small farmers will pay the price."