By MARK HERTSGAARD

The sun is setting on another scorching hot day in the western African nation of Burkina Faso. But here on the farm of Yacouba Sawadogo, the air is noticeably cooler. A hatchet slung over his shoulder, the gray-bearded farmer strides through his woods and fields with the easy grace of a much younger man. “Climate change is a subject I feel I have something to say about,” he says in his tribal language, Moré, which he delivers in a deep, unhurried rumble. Though he cannot read or write, Sawadogo is a pioneer of a tree-based approach to farming that has transformed the western Sahel in recent years, while providing one of the most hopeful examples on earth of how even very poor people can adapt to the ravages of climate change.

Wearing a brown cotton robe and white skullcap, Sawadogo sits beneath acacia and zizyphus trees that shade a pen holding about twenty guinea fowl. Two cows doze at his feet; bleats of goats float through the still evening air. His farm is large by local standards—fifty acres—and much of it has been in his family for generations. The rest of his family abandoned it after the terrible drought of 1972-84, when a 20 percent decline in average annual rainfall slashed food production throughout the Sahel, turned vast stretches of savanna into desert and caused hundreds of thousands of deaths from hunger.

For Sawadogo, leaving the farm was unthinkable. “My father is buried here,” he says simply. In his mind, the droughts of the 1980s marked the beginning of climate change, a term most people here do not recognize. Sawadogo, however, says he has been adapting to a hotter, drier climate for the past twenty years.

“In the drought years, people found themselves in such a terrible situation they had to think in new ways,” says Sawadogo, who prides himself on being an innovator. In this case, he revived a technique local farmers had used for centuries, but he adapted it to the new climate conditions he faced. It had long been the practice among Sahelian farmers to dig zai—shallow pits—that concentrate scarce rainfall onto the roots of crops. Sawadogo increased the size of his zai to capture more rainfall. But his most important innovation, he says, was to add manure to the zai during the dry season, a practice his peers derided as wasteful.

Sawadogo's experiments worked: by concentrating water and fertility in pits, he increased crop yields. But the most significant result was one he hadn't anticipated: tiny trees began to sprout amid his rows of millet and sorghum, thanks to seeds contained in the manure. As one growing season followed another, it became apparent that the trees—now a few feet high—were further increasing crop yields while also restoring soil fertility. “Since I began this technique of rehabilitating degraded land, my family has enjoyed food security in good years and bad,” Sawadogo says.

Sawadogo's struggle may seem small, but it is part of the most important test humanity now faces. No matter what happens at Copenhagen or beyond, the world is locked in to decades of temperature rise and the associated climate impacts: deeper droughts, fiercer floods, more pests. How populations in the global South adapt to these changes will help decide whether millions of people live or die.

The tree-based farming that Sawadogo and hundreds of thousands of other poor farmers in the Sahel have adopted could help millions of their counterparts around the world cope with climate change. Already these practices have spread across vast portions of Burkina Faso and neighboring Niger and Mali, turning millions of acres of what had become semi-desert in the 1980s into more productive land. The transformation is so pervasive that the new greenery is

visible from outer space via satellite pictures. With climate change, much more of the planet's land will be hot and arid like the Sahel. It only makes sense, then, to learn from the quiet green miracle unfolding there.

“This is probably the largest positive environmental transformation in the Sahel and perhaps in all of Africa,” says Chris Reij, a Dutch geographer who has worked in the region for thirty years. Technically, these methods are known as “agro-forestry” or “farmer managed natural regeneration” (FMNR). Scientific studies confirm what Sawadogo already knows: mixing trees and food crops brings a range of significant benefits. The trees shade crops from overwhelming heat, act as windbreaks that protect young crops and help the soil retain moisture. When their leaves fall to the ground, they act as mulch, boosting soil fertility and providing fodder for livestock. In emergencies, people can even eat the leaves to avoid starvation. “In the past, farmers sometimes had to sow their fields four or five times because winds would blow the seeds away,” says Reij, who advocates for FMNR with the zeal of a missionary. “With trees to buffer the wind and anchor the soil, farmers need sow only once.”

Equally important, the zai and other water-harvesting techniques have helped recharge underground water tables. “In the 1980s water tables were falling by an average of one meter a year,” Reij says. “Since FMNR and the water-harvesting techniques began to take hold, water tables have risen by five meters, despite a growing population.” In some areas, the water table has risen by as much as seventeen meters. Some analysts have credited increased rainfall beginning in 1994. Reij says that can't explain it: “The water tables began rising well before that. The effect is felt within one or two years' time.” Studies have documented the same replenishing effects in Niger.

Over time, Sawadogo grew more and more enamored of trees; now his land looks less like a farm than a forest, albeit one made up of trees that, to my California eyes, often seem rather thin. “In the beginning I mixed trees and crops,” he says. “But later I came to prefer trees, because they provide other benefits.” Trees can be harvested—their branches pruned and sold—and then they grow back, and their benefits for the soil make it easier for additional trees to grow. “The more trees you have, the more you get,” Sawadogo explains.

Wood is still the main source of energy in rural Africa, and as tree cover expanded on his land, Sawadogo was in a position to sell wood for cooking, furniture-making and construction, thus increasing and diversifying his income—a key tactic for adapting to climate change. Trees are also a source of natural medicines, no small advantage in an area where modern healthcare is scarce and expensive. And of course, trees keep people and livestock cooler than they otherwise would be in the brutal heat of the Sahel.

“I think trees are at least a partial answer to climate change, and I've tried to share this information with others,” Sawadogo adds. “I've used my motorbike to visit about a hundred villages, and others have come to visit me and learn. I must say, I'm very proud these ideas are spreading.”

To be clear, these farmers are not planting trees, as Nobel Prize-winning activist Wangari Maathai has promoted in Kenya with her Greenbelt Movement. They are simply growing and nurturing the ones that sprout naturally. Planting trees is much too expensive and risky for really poor farmers. Studies in the western Sahel have found that about 80 percent of planted trees die within a year or two. By contrast, trees that sprout naturally are native species and thus more resilient. And of course they cost nothing.

In Mali, too, I saw trees growing amid cropland seemingly everywhere. For example, in the

grindingly poor village of Sokoura, the houses are made of sticks covered in mud; there is no electricity or running water; children wear dirty, torn clothes; and many of them have distended bellies from malnutrition. Yet to hear locals tell it, life is improving, in large part thanks to trees.

It's a five-minute walk from the village to the land of Oumar Guindo. Missing a front tooth and wearing a black smock over green slacks, Guindo says he owns fifteen acres, where he cultivates millet and sorghum. Ten years ago he began taking advice from Sahel Eco, a Malian-British NGO that promotes agro-forestry. Now Guindo's land is dotted with trees, one every five meters or so. Most are young, with such spindly branches that they resemble bushes, but there are also a few specimens with trunks the diameter of fire hydrants.

We sit beneath a large tree known as the “Apple of the Sahel,” whose twigs sport inchlong thorns. The soil is sandy in color and consistency—not a farmer's ideal—but water availability and crop yields have increased substantially since Guindo began nurturing trees among his crops. “Before, this field couldn't fill even one granary,” he says. “Now it can fill one granary and half of another“—roughly a 50 percent increase in production.

Back in the village we examine the oblong granaries, which like the houses are constructed by slathering mud over stick frames. Their sides are six feet wide and fifteen feet tall. A notched tree trunk serves as a ladder to an opening near the top. All contain good amounts of millet: food security until the next harvest or even beyond.

“Twenty years ago, after the drought, our situation here was quite desperate, but now we live much better,” explains one of the farmers. “Before, most families had only one granary each. Now they have three or four, though their land has not increased. We have more livestock as well.” He adds that all the farmers in this area are cultivating trees now.

The agro-forestry that is greening the Sahel is not only the product of farmer-to-farmer information-sharing and small-scale NGO assistance. Changes in government policy have also been very important.
In Mali, tree management had been part of traditional agriculture. Salif Guindo (no relation to Oumar), a farmer from the village of Endé, explains how they revived an ancient voluntary association of farmers, called Barahogon, that had encouraged tree stewardship for generations. But using trees was abandoned when cutting wood became a crime. First the French colonial government declared all trees to be state property, enabling government officials to sell timber rights to woodcutters. Similar arrangements continued after independence. Meanwhile, farmers caught pruning or cutting trees were punished. As a result they would uproot seedlings to avoid later hassles. Needless to say, several generations of this left the land denuded and increasingly desiccated.

In the early 1990s, a new Mali government—perhaps mindful that farmers furious about mistreatment had killed Forestry Agency officials in some villages—passed a law giving farmers ownership of trees on their land. Farmers did not hear about the law until Sahel Eco mounted a campaign to inform them via radio and word of mouth. Since then, FMNR has spread rapidly, including across borders. Salif recalls a recent visit from twenty mayors and provincial directors of agricultural and environmental agencies from Burkina Faso. “They seemed astonished to hear our story and see the evidence,” Salif says. “They asked, Is this really possible?”

In Niger, too, FMNR had a hard time gaining traction, in part because it involves some counterintuitive elements: namely, to grow trees farmers must be allowed to cut them down as well. Tony Rinaudo, an Australian agronomist and missionary and one of the original champions of FMNR, explains that only after Niger government officials suspended enforcement of

regulations against cutting trees did tree-growing gather momentum. “Once farmers felt they owned the trees in their fields, FMNR took off,” he says. “They stopped seeing trees as weeds and started seeing them as assets.”

The pattern has been the same throughout the western Sahel: FMNR has spread largely by itself, from farmer to farmer and village to village, as people see the results with their own eyes and move to adopt the practice. Thanks to agro-forestry, satellite photos analyzed by the US Geological Survey can now discern the border between Niger and Nigeria. On the Niger side, where farmers are allowed to own trees and FMNR is commonplace, there is abundant tree cover; on the Nigeria side, where big tree-planting schemes have failed dramatically, the land is almost barren.

When these images became available in 2008, even FMNR advocates like Reij and Rinaudo were shocked: they had no idea so many farmers had grown so many trees. Combining the satellite evidence with ground surveys and anecdotal evidence, Reij estimates that in Niger alone farmers have grown 200 million trees and rehabilitated 12.5 million acres of degraded land.

What makes FMNR so empowering, and sustainable, is that Africans themselves own the technology, which is simply the knowledge that growing trees amid crops brings many benefits. What's more, this knowledge is free. It's hard to overstate how important that is to poor farmers—and nations. It means they can use the technology now, without waiting or relying on capital infusions from foreign governments or humanitarian organizations.

This makes FMNR very different, says Reij, from the Millennium Villages model of development promoted by Jeffrey Sachs, the high-profile director of Columbia University's Earth Institute. Millennium Villages provides villages, free of charge, with what are considered the building blocks of development: modern seeds and fertilizer, boreholes for clean water, clinics. “It's beautiful, their vision of ending hunger in Africa,” says Reij. “The problem is, it doesn't work. Millennium Villages require a heavy investment per village, as well as a flow of external support for some years, and that is not a sustainable solution. It's hard to believe the outside world will provide the billions of dollars necessary to create tens of thousands of Millennium Villages in Africa.” Indeed, foreign aid flows collapsed after the financial crash of 2008.

Outsiders do have a role, however. They can encourage the necessary policy changes by national governments, such as granting farmers legal ownership of trees. And they can fund, at very low cost, the grassroots information-sharing that has spread FMNR so effectively in western Sahel. Although farmers have done the most to alert their peers to FMNR's benefits, they have received crucial assistance from a handful of activists and NGOs such as Rinaudo, Reij and Sahel Eco. These advocates hope to spread FMNR to other African countries through what is called “African Re-Greening Initiatives,” says Reij, who has briefed the president of Ethiopia on the idea. The point is that tree-based crop systems are a win-win: they help farmers adapt to climate change even as they boost food security and reduce rural poverty.

Above all, the world must act in Copenhagen and beyond to reverse the global warming that is making the Sahel such an inhospitable place. Every form of adaptation has limits; if the amount of greenhouse gases in the atmosphere is not reduced, increasing temperatures will eventually overwhelm even the most ingenious coping mechanisms. Trees help on this front as well: as they grow, they remove carbon dioxide from the air through photosynthesis. Thus the Copenhagen talks must include a strong commitment to protecting and expanding forests under the REDD program (Reducing Emissions from Deforestation and Forest Degradation in Developing Countries, a UN program).

Meanwhile, Sawadogo is putting his faith in trees. “My conviction, based on personal experience, is that trees are like lungs,” he says. “If we do not protect them, and increase their numbers, it will be the end of the world.”

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