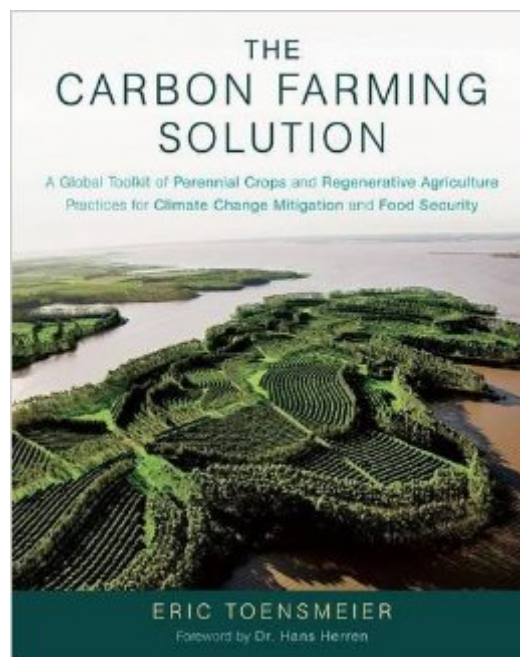


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# The Carbon Farming Solution: A Global Toolkit Of Perennial Crops And Regenerative Agriculture Practices For Climate Change Mitigation And Food Security



## Synopsis

With carbon farming, agriculture ceases to be part of the climate problem and becomes a critical part of the solution. Agriculture is rightly blamed as a major culprit of our climate crisis. But in this groundbreaking new book, Eric Toensmeier argues that agriculture—specifically, the subset of practices known as “carbon farming”—can, and should be, a linchpin of a global climate solutions platform. Carbon farming is a suite of agricultural practices and crops that sequester carbon in the soil and in aboveground biomass. Combined with a massive reduction in fossil fuel emissions—and in concert with adaptation strategies to our changing environment—carbon farming has the potential to bring us back from the brink of disaster and return our atmosphere to the “magic number” of 350 parts per million of carbon dioxide. Toensmeier’s book is the first to bring together these powerful strategies in one place, including in-depth analysis of the available research and, where research is lacking, a discussion of what it will take to get us there. Carbon farming can take many forms. The simplest practices involve modifications to annual crop production. Although many of these modifications have relatively low sequestration potential, they are widely applicable and easily adopted, and thus have excellent potential to mitigate climate change if practiced on a global scale. Likewise, grazing systems such as silvopasture are easily replicable, don’t require significant changes to human diet, and—given the amount of agricultural land worldwide that is devoted to pasture—can be important strategies in the carbon farming arsenal. But by far, agroforestry practices and perennial crops present the best opportunities for sequestration. While many of these systems are challenging to establish and manage, and would require us to change our diets to new and largely unfamiliar perennial crops, they also offer huge potential that has been almost entirely ignored by climate crusaders. Many of these carbon farming practices are already implemented globally on a scale of millions of hectares. These are not minor or marginal efforts, but win-win solutions that provide food, fodder, and feedstocks while fostering community self-reliance, creating jobs, protecting biodiversity, and repairing degraded land—all while sequestering carbon, reducing emissions, and ultimately contributing to a climate that will remain amenable to human civilization. Just as importantly to a livable future, these crops and practices can contribute to broader social goals such as women’s empowerment, food sovereignty, and climate justice. The Carbon Farming Solution does not present a prescription for how cropland should be used and is not, first and foremost, a how-to manual, although following up on references in a given section will frequently provide such information. Instead, The Carbon Farming Solution is—at its root—a toolkit. It is the most complete collection of climate-friendly crops and practices currently available. With this toolkit, farmers,

communities, and governments large and small, can successfully launch carbon farming projects with the most appropriate crops and practices to their climate, locale, and socioeconomic needs. Toensmeier's ultimate goal is to place carbon farming firmly in the center of the climate solutions platform, alongside clean solar and wind energy. With *The Carbon Farming Solution*, Toensmeier wants to change the discussion, impact policy decisions, and steer mitigation funds to the research, projects, and people around the world who envision a future where agriculture becomes the protagonist in this fraught, urgent, and unprecedented drama of our time. Citizens, farmers, and funders will be inspired to use the tools presented in this important new book to transform degraded lands around the world into productive carbon-storing landscapes.

## Book Information

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## Customer Reviews

In all the time I've been reviewing books for permies.com, I've always said that I would never give a score of 10 out of 10 acorns. But now a book has turned up which is so important and has such a capacity to change the world for the better, that I have to eat my words. Eric Toensmeier's new book, *The Carbon Farming Solution*, is subtitled *A Global Toolkit of Perennial Crops and Regenerative Agriculture Practices for Climate Change Mitigation and Food Security*. That's quite an ambitious aim, but this book really does measure up. There are nearly 500 pages of comprehensive, meticulously researched information with full color photos, charts, tables and references, all perfectly organized, well laid out, clearly written, and presented in a way that is both completely accessible to the layman and also appropriate to use as a text book for courses or college studies. In

the introduction, Eric tells us that "Carbon farming alone is not enough to avoid catastrophic climate change, even if it were practiced on every square meter of farmland. But it does belong at the center of our transformation as a civilization. Along with new economic priorities, a massive switch to clean energy, and big changes to much of the rest of the way our societies work, carbon farming offers a pathway out of destruction and a route to hope. Along the way it can help address food insecurity, injustice, environmental degradation, and some of the core problems with the global food system. In the pages to come we'll explore the promise and pitfalls of this timely climate change solution."The book itself is divided into five main parts, each containing several chapters.Part 1: The Big Idea introduces the concepts and science behind how increased carbon in the atmosphere is effecting climate, and the need to put it back in the soil where it belongs. The chapter on carbon sequestration gives us some idea of how different agricultural practices differ widely in their potential to do this, and that while our understanding of the fine details is still lacking, there is sufficient data already available to guide us to choose the best core practices. Then the idea of agroforestry is introduced, where trees may be integrated with annual crops, livestock systems or complete forest gardens. The benefits of perennial crops, which live for several years and are non destructively harvested, are explained. The final chapter in this section discusses the concept that we permaculturists know as function stacking, where each element in a system performs many functions. Eric acknowledges the value of permaculture, but is also not afraid to point out where he feels we might be starting to go astray. The main concept he's trying to impress on us is that when we design systems to sequester carbon, then we should design them to also perform other functions such as producing food or stabilizing slopes. He discusses compatible functions such as ecosystem services, soil improvement, and socioeconomic benefits.Much of the rest of the book is concerned with choosing the most appropriate growing systems for your situation, and the best perennial plants to use in those systems.Part 2: A Global Toolkit of Practices and Species is to me the most interesting section, discussing different types of system and the pros and cons of each one.The three main types of systems discussed are annual cropping systems, livestock systems and perennial cropping systems.Although annual cropping offers the least potential to sequester carbon, it currently accounts for 89 percent of all cropland, so finding ways to transition this from being a net emitter to a net sequesterer of carbon while allowing us to grow the annual crops with which we are all so familiar would make a tremendous difference overall. Various annual systems are discussed, including conservation agriculture, strip intercropping, alley cropping, swidden and successional intercropping, among others. Each is presented separately, described accurately, placed into context, and the pros, cons and relative potential for carbon sequestration discussed,

allowing the reader to make comparisons and select the ones most appropriate to their own situation. The chapters on livestock systems and perennial cropping systems are laid out in much the same way. Livestock systems are controversial and Eric takes care to present as much information as possible to help us understand the controversy. 70 percent of farmland is devoted to pasture, and a third of cropland is used to grow food for livestock, so, again, any improvements in the way we raise and feed livestock can have a huge overall impact on carbon sequestration. Whatever our personal views on the matter, it is important that better systems are implemented globally. Some of the livestock systems discussed include livestock integration, silvopasture, fodder banks, outdoor living barns and green corrals, and restoration agriculture. Perennial cropping systems offer no controversy, but they do require more change to both our diets and food systems. Systems discussed include multistrata agroforests, which Eric believes should be a priority, perennial monocultures, managed bamboo, coppice, herbaceous biomass crops, woody agriculture and perennial grains. A short chapter on additional tools, not directly related to growing crops, looks at rainwater harvesting, terraces, keyline, biochar, productive restoration and, my own favorite, indigenous land management. And finally this section is rounded off by a look at plant species, breeding, perennializing, GMOs, and invasives. He also reminds us that there whilst there are no intrinsically "bad plants", neither are there any "superplants" waiting to save us, nor any excuse to clear healthy forest to plant any of them.

Part 3: Perennial Staple Crops and Part 4: Perennial Industrial Crops

These two sections speak for themselves really. Each has an introductory chapter outlining the potential and any problems of such crops, followed by chapters on more specific crop types. According to Eric, "Perennial staple crops are trees and other long-lived perennial plants that provide these basic proteins carbohydrates, and fats. They include cereal grains, pulses (dry beans), nuts, dry pods, starchy fruits, oil-seeds, leaf protein concentrate starch-filled trunks, sugary saps, and aerial tubers." Examples of each are discussed in the following chapters, some species being described in detail while comprehensive tables provide basic details on virtually all known examples of appropriate plants to use. I'll leave you all to discover your own favorites, but if anyone knows where I can get hold of some bunya nut, I'd like to hear from them!

The section on perennial industrial crops was the most eye-opening for me. Here are a few quotes which hit home pretty hard.

"an eighth of petroleum is used to synthesize materials and chemicals. A full 10 percent of petroleum is used as feedstock to synthesize chemicals, with another 10 percent used to power the process."

"there simply isn't enough land to grow both food and fuel"

"One barrel of oil yields as much energy as twenty-five thousand hours of human manual labor - more than a decade of human labor per barrel."

"My proposal is that we reduce our consumption, acquire most of our energy from wind,

water, and solar (WWS), and produce materials and chemicals from non-destructively harvested perennials." "A large-scale wind water and solar energy system can reliably supply the world's needs, significantly benefiting climate, air quality, ecology and energy security ... the obstacles are primarily political, not technical." "I don't have the road map laid out from here to a full proposal to replace petroleum and all its uses, but I think these species and practices are the building blocks of a post-petroleum civilization." The chapters that follow cover biomass, industrial starch, industrial oil, hydrocarbon and fiber crops, followed by a chapter on other industrial uses such as dyes, cork, tannins, waxes, gums, pesticides, medicinal plants and soaps, again with detailed descriptions of some plants and comprehensive tables outlining any others of interest. Finally, Eric rounds off the book with Part 5: Road Map to Implementation in which he presents chapters about a three-point plan to scale up carbon farming, how to support farmers and farming organizations to make the transition, how to effectively finance carbon farming, the importance of removing national and international policy barriers, and strategic next steps, including the need to provide examples of carbon farming in action in our own neighborhoods so that people can learn what carbon farming is and understand its potential. Which is, of course, where every single one of us reading these words has a role to play. Three substantial appendices provide a global species matrix, clean dry weight yield calculations and carbon sequestration rates. To say I am impressed by this book would be an understatement. In my opinion, this is a book that belongs in every library, every school, every college, and in the hands of everyone with access to land or the desire to heal the Earth. Let's try to make that happen. In short, for the first time ever - I give this book 10 out of 10 acorns Eric Toensmeier, I salute you!

This is a very good book. It lays out the challenge of climate change (which is currently very much in the forefront, as the northern hemisphere is currently at 2 degrees centigrade above the baseline) and the necessity for carbon farming to sequester a great deal of carbon over the next few decades. It also explains why carbon farming alone cannot solve our problems. The book discusses many solutions which can sequester some carbon, but the star methods which can sequester a lot of carbon per acre (or hectare) all involve trees. Not a forest, but a multifunctional landscape which includes trees. While the methods applicable to the tropics are pretty well defined, the methods applicable to the temperate zone are less certain. The book also gives a balanced view of solutions such as rotational grazing....the scientific studies tend not to support the claims of enthusiastic non-scientific studies. Yet the results of real world experiments are considerably more positive than the 'scientific' studies. Toensmeier calls for intensive study of why the 'scientific' studies yield results

much less positive than the experience of real world rotational grazing enthusiasts. My own guess is that the 'scientific' studies start out with a procedure cast in stone, while the real world people engage in the art of grazing. And my guess is that grazing for carbon sequestration will always be an art more than it is a science. Don Stewart

THIS IS an EXCERPT FROM MY BLOG ON THE BOOK: [...]Regenerative agriculture can reverse climate change within our lifetime. That's the inspiring, well-documented message of longtime farmer and author Eric Toensmeier in his new book *The Carbon Farming Solution*. Deftly integrating explanations of science, local knowledge and public policy opportunities, Toensmeier shows how regenerative agriculture can and must be central to collective global action to address climate change. Toensmeier presents solid, scientific evidence of the great potential for highly diverse agriculture to both mitigate and reverse the current trajectory of climate change. The data show that if implemented on a larger scale than currently practiced, regenerative agriculture "from tropical home gardens to temperate permaculture" could draw down more than 100 billion tons of carbon into the soil. That's equal to 367 billion tons of carbon dioxide (CO<sub>2</sub>) which would indeed bring us back from our current climate change tipping point. Climate scientists report that to reverse the disastrous course we're now on, we need to draw down an estimated 200 billion metric tons of CO<sub>2</sub>. Not only can carbon farming sequester great quantities of carbon currently in the atmosphere, it also offers resilience in the face of drought and flooding "and it's multifunctional. Bringing carbon into soil builds soil organic matter, which improves the soil's ability to capture water. This can help prevent runoff during floods and increase water retention during times of drought. Soil organic matter content ranges from one percent in poor, arid soils, to about eight percent in the richest prairie soils" with most agricultural soils in the low end of the range. For every 21 tons of carbon sequestered per hectare (2.5 acres), soil organic matter goes up about one percent, which in turn increases the soil's ability to hold water by 25,000 gallons. Even small increases in carbon content can have tremendous positive impacts when adopted over large areas. For example, about 70 percent of the world's 2.5 billion acres of farmland are pastures. While "improved pasture" practices sequester only low to medium amounts of carbon, they are relatively easy to adopt. Minor increases in soil carbon on 70 percent of the Earth's farmland can make a huge difference in reversing climate change. More intensive silvopastoral systems (planned incorporation of trees into pasture systems) can sequester much more, while also providing such benefits as fuel or fodder for animals. In contrast to well-managed pastureland, most annual cropping systems are greenhouse gas (GHG) emitters.

Annual crops constitute about 89 percent of non-pasture farmland, and just four crops occupy the vast majority: wheat, corn, rice and soybeans. Though conservation practices already exist on 10 percent of cropland, they generally have very low carbon sequestration rates, with the possible exception of regenerative organic farming. Perennial grain systems and agroforestry are at the heart of carbon farming. There are about 20,000 edible perennial crops, 6,000 of which are currently cultivated for food, fodder, materials, chemical and energy. Only about 100 of these are fully domesticated for food, along with about 30 industrial crops. Many perennial staple crops – cereals, pulses (including beans), oilseeds, tubers – are economically competitive with annual staples, especially in humid and tropical climates. In colder, drier climates, the yields of most perennial staples still fall below those of annual crops, although current efforts to improve perennial grains show promise. Agroforestry systems offer the most robust version of carbon farming, sequestering by far the greatest amount of carbon at 10-40 times the best annual cropping or managed grazing systems. Agroforestry is described in some detail in *The Carbon Farming Solution*, not as a random incorporation of trees on farms, but rather as “intentional, intensive, integrated and interactive” system of farming. In addition to carbon sequestration, agroforestry systems can reduce need for fuel, fertilizers and pesticides. Agroforestry is currently practiced on about 250 million acres globally... and there’s a lot more ... including a discussion of the transformative policies necessary to support widespread implementation of carbon farming practices. These policies must be rooted in community development, community self-reliance and food sovereignty as modeled by the likes of Brazil’s Landless Workers’ Movement (MST) and the International Peasant Movement (La Via Campesina).

Eric does a great job detailing a complex issue that will directly affect the lives of all of the earth’s citizens. The book details a large group of strategies for making the future a safer and better place. This book is well worth the investment, Thank you Eric

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