Carbon Sequestration Potential Of Agroforestry Systems Opportunities And Challenges Advances In Agroforestry

A comprehensive book on basic processes of soil C dynamics and the underlying factors and causes which determine the technical and economic potential of soil C sequestration. The book provides information on the dynamics of both inorganic (lithogenic and pedogenic carbonates) and organic C (labile, intermediate and passive). It describes different types of agroecosystems, and lists questions at the end of each chapter to stimulate thinking and promote academic dialogue. Each chapter has a bibliography containing up-to-date references on the current research, and provides the state-of-the-knowledge while also identifying the knowledge gaps for future research. The critical need for restoring C stocks in world soils is discussed in terms of provisioning of essential ecosystem services (food security, carbon sequestration, water quality and renewability, and biodiversity). It is of interest to students, scientists, and policy makers.

• New York Times bestseller • The 100 most substantive solutions to reverse global warming, based on meticulous research by leading scientists and policymakers around the world "At this point in time, the Drawdown book is exactly what is needed; a credible, conservative solution-by-solution narrative that we can do it. Reading it is an effective inoculation against the widespread perception of doom that humanity cannot and will not solve the climate crisis. Reported by-effects include increased determination and a sense of grounded hope." —Per Espen Stoknes, Author, What We Think About When We Try Not To Think About Global Warming "There's been no real way for ordinary people to get an understanding of what they can do and what impact it can have. There remains no single, comprehensive, reliable compendium of carbon-reduction solutions across sectors. At least until now. . . . The public is hungry for this kind of practical wisdom." —David Roberts, Vox "This is the ideal environmental sciences textbook—only it is too interesting and inspiring to be called a textbook." —Peter Kareiva, Director of the Institute of the Environment and Sustainability, UCLA In the face of widespread fear and apathy, an international coalition of researchers, professionals, and scientists have come together to offer a set of realistic and bold solutions to climate change. One hundred techniques and practices are described here—some are well known; some you may have never heard of. They range from clean energy to educating girls in lower-income countries to land use practices that pull carbon out of the air. The solutions exist, are economically viable, and communities throughout the world are currently enacting them with skill and determination. If deployed collectively on a global scale over the next thirty years, they represent a credible path forward, not just to slow the earth's warming but to reach drawdown, that point in time when greenhouse gases in the atmosphere peak and begin to decline. These measures promise cascading benefits to human health, security, prosperity, and well-being—giving us every reason to see this planetary crisis as an opportunity to create a just and livable world.

Building on FAO policy advice and incorporating lessons from ongoing agricultural carbon finance projects of FAO and other organizations, this document will provide an overview of potential mitigation finance opportunities for soil carbon sequestration. The first part provides an overview of the opportunities for climate

change mitigation from agricultural soil carbon sequestration. The second part is aimed primarily at carbon projects developers and decision makers at national level concerned with environmental and agriculture policies and incentives and farmers' associations working towards rural development and poverty alleviation.

Tropical Agroforestry

Tropical Homegardens

Carbon Management in Tropical and Sub-Tropical Terrestrial Systems

The Carbon Farming Solution

Carbon Sequestration Potential of Agroforestry Systems

Explore the many benefits of alternative land-use systems with this incisive resource Humanity has become a victim of its own success. While we've managed to meet the needs—to one extent or another—of a large portion of the human population, we've often done so by ignoring the health of the natural environment we rely on to sustain our planet. And by deteriorating the quality of our air, water, and land, we've put into motion consequences we'll be dealing with for generations. In the newly revised Third Edition of North American Agroforestry, an expert team of researchers delivers an authoritative and insightful exploration of an alternative land-use system that exploits the positive interactions between trees and crops when they are grown together and bridges the gap between production agriculture and natural resource management. This latest edition includes new material on urban food forests, as well as the air and soil quality benefits of agroforestry, agroforestry's relevance in the Mexican context, and agroforestry training and education. The book also offers: A thorough introduction to the development of agroforestry as an integrated land use management strategy Comprehensive explorations of agroforestry nomenclature, concepts, and practices, as well as an agroecological foundation for temperate agroforestry Practical discussions of tree-crop interactions in temperate agroforestry, including in systems such as windbreak practices, silvopasture practices, and alley cropping practices In-depth examinations of vegetative environmental buffers for air quality benefits, agroforestry for wildlife habitat, agroforestry at the landscape level, and the impact of agroforestry on soil health Perfect for environmental scientists, natural resource professionals and ecologists, North American Agroforestry will also earn a place in the libraries of students and scholars of agricultural sciences interested in the potential benefits of agroforestry.

Agroforestry, the word coined in early seventies, has made its place in all the developed and the developing countries of the world and is now recognized as an important approach to ensuring food security and rebuilding resilient rural environments. India has been an all-time

leader in agroforestry. The South and Southeast Asia region comprising India is often described as the cradle of agroforestry. Almost all forms of agroforestry systems exist across India in ecozones ranging from humid tropical lowlands to high-altitude and temperate biomes, and perhumid rainforest zones to parched drylands. The country ranks foremost among the community of nations not only in terms of this enormous diversity and long tradition of the practice of agroforestry, but also in fostering scientific developments in the subject. Agroforestry applies to private agricultural and forest lands and communities that also include highly erodible, flood-prone, economically marginal and environmentally sensitive lands. The typical situation is agricultural, where trees are added to create desired benefits. Agroforestry allows for the diversification of farm activities and makes better use of environmental resources. Owing to an increase in the population of human and cattle, there is increasing demand of food as well as fodder, particularly in developing countries like India. So far, there is no policy that deals with specifics in agroforestry in India. But, the Indian Council of Agricultural Research has been discussing on the scope of having a National Agroforestry Policy in appropriate platforms. However, evolving a policy requires good and reliable datasets from different corners of the country on the subject matter. This synthesis volume containing 13 chapters is an attempt to collate available information in a classified manner into different system ecologies, problems and solutions, and converging them into a policy support.

'Homegardens' are integrated tree–crop–animal production systems, often established on small parcels of land surrounding homesteads, and primarily found in tropical environments. This multi-authored volume contains peer-reviewed chapters from the world's leading researchers and professionals in this topic. It summarizes the current state of knowledge on homegarden systems, with a view to using this knowledge as a basis for improving both homegardens and other similar multistrata agroforestry systems.

Issues and Challenges

An Assessment of Biological and Socioeconomic Feasibility

The hidden potential

A Research Agenda

Appraisal of Agroforestry Land Use Systems for Their Carbon Sequestration Potential

Agroforestry refers to land use systems in which trees or shrubs are grown in association with agricultural crops, or pastures and livestock. From its inception, it has contained a strong element of soil management. Well-designed and managed

agroforestry systems have the potential to control run-off and erosion, maintain soil organic matter and physical properties, and promote nutrient cycling. By these means, agroforestry can make a major contribution to sustainable land use. The previous edition of this book, entitled Agroforestry for Soil Conservation (1989), was based on indirect evidence from agriculture, forestry and soil science. The present work provides a new synthesis, drawing on over 700 published sources dating largely from the 1990s. These include both results of field trials of agronomy systems, and research into the plant-soil processes which take place within them. Soil conservation in its narrower sense, the control of erosion, is treated alongside other equally important aspects of soil management, such as nutrient cycling. The new edition summarizes the present state of knowledge and indicates needs for research. It is essential reading for all concerned with agroforestry, whether as students, research scientists, or for practical purposes of development. It is also of interest to soil scientists, agronomists and foresters. Anthony Young was for nine years a Principal Scientist with the International Centre for Research in Agroforestry (ICRAF), Nairobi, Kenya. He was previously Professor of Environmental Sciences at the University of East Anglia, Norwich, UK, from which he received the degree of Doctor of Science. He was a joint author of the FAO standard texts on land evaluation and land use planning. Besides these, his other books include Soil Survey and Land Evaluation (1981) and Land Resources: Now and for the Future (1998). He is now Honorary Research Fellow in Environmental Sciences at the University of East Anglia.

ABSTRACT: In recent years, carbon (C) sequestration potential of agroforestry systems has attracted attention, especially following Kyoto Protocol's recognition of agroforestry as an option for mitigating green house gasses. Although the possible benefits of agroforestry in carbon (C) sequestration have been conceptually discussed, field measurements to validate these concepts have not been undertaken to any significant extent. In addition to the traditional agroforestry systems, improved practices and technologies are now being expanded into the dry regions such as the West African Sahel for perceived benefits such as arresting desertification, reducing water and wind erosion hazards, and improving biodiversity. Thus, it is imperative to investigate C sequestration potential of agroforestry practices in these regions. My research hypothesizes that the tree-based systems will retain more C in the systems both above- and below-ground than tree-less land-use systems. By joining the C credit market, the landowners could

sell the C sequestered in their agroforestry systems. My research consisted of three components. The first examined C (biomass + soil) stored in five target land-use systems: two traditional parkland systems involving Faidherbia albida and Vitellaria paradoxa trees as the dominant species, two improved agroforestry systems (live.

The increasing scientific consensus on global warming, together with the precautionary principle and the fear of non-linear climate transitions is leading to increasing action to mitigate global warming. To help mitigate global warming, carbon storage by forests is often mentioned as the only or the best way to reduce the CO2 concentration in the atmosphere.This book presents evidence that tropical grasslands, which cover 50% of the earth's surface, are as important as forests for the sequestration of carbon.Results are reported of a large five year on-farm research project carried out in Latin America (Colombia, Costa Rica). Soil and vegetation carbon stocks of long-established pasture, fodder bank and silvopastoral systems on commercial farms were compared with those of adjacent forest and degraded land. The objective was to identify production systems that both increase livestock productivity and farm income and, at the same time, contribute to a reduction of carbon accumulation in the atmosphere.The project was carried out in four ecosystems: the Andean hillsides of the semi-evergreen forest in Colombia; the Colombian humid Amazonian tropical forest ecosystem; the sub-humid tropical forest ecosystem on the Pacific Coast of Costa Rica; and the humid tropical forest ecosystem on the Atlantic Coast of Costa Rica.The book is recommended reading for research and teaching scientists and policy makers with an interest to mitigating global warming.

The Most Comprehensive Plan Ever Proposed to Reverse Global Warming

Climate Change and Agroforestry Systems

Carbon Stocks and Sequestration Potential in Agroforestry System

Modelling Biomass and Carbon Sequestration Potential in Poplar (Populus Deltoides) and Eucalypts (Eucalyptus Tereticornis) Based Agroforestry Systems [With CD Copy]

A Time-Tested Example of Sustainable Agroforestry

This document attempts to present the current state of knowledge on agroforestry parkland systems. These systems, which for many local populations are very important for food security, income generation and environmental protection, are found primarily in the semi-arid and sub-humid zones of West Africa. The document first provides a thorough description of their distribution and diversity and discusses different ways of classifying them. It also presents data on current trends in parkland development and assesses determining factors. The document

then provides an in-depth analysis of biophysical tree-soil-crop interactions and the factors regulating them, and describes various improved parkland management techniques. It goes on to examine the strength and limitations of institutional arrangements as well as the constraints imposed by Sahelian forest policies on the sustainable management of parklands. The production, use and marketing of parkland products is reviewed with an emphasis on their contribution to food security, local and national income as well as social values. Overall costs and benefits of the practice of parkland agroforestry are evaluated. In conclusion, the document identifies crucial research needs and promising avenues for promoting sustainable management of parkland systems.

Organic animal production has increased rapidly in recent years to keep up with the increasing consumer demand for organic meats. There are many guidelines and restrictions on what should go into the feedstuffs of organically farmed animals, from which difficulties arise when trying to ensure a well-balanced, nutritious diet without the use of any supplements. The book has been completely updated and revised to address how to formulate organic diets in situations where there is a declining supply of organic feed, as well as the feasibility of utilizing novel feedstuffs and their acceptability by consumers of organic meat products. Including the experiences of producers in relation to appropriate breeds and production systems for forage-based organic production, this book is an important read for researchers and students of organic food animal production, veterinary sciences and food; as well as food industry personnel and organic farmers.

Soil organic carbon (SOC), a key component of the global carbon (C) pool, plays an important role in C cycling, regulating climate, water supplies and biodiversity, and therefore in providing the ecosystem services that are essential to human well-being. Most agricultural soils in temperate regions have now lost as much as 60% of their SOC, and as much as 75% in tropical regions, due to conversion from natural ecosystems to agricultural uses and mainly due to continuous soil degradation. Sequestering C can help to offset C emissions from fossil fuel combustion and other C-emitting activities, while also enhancing soil quality and long-term agronomic productivity. However, developing effective policies for creating terrestrial C sinks is a serious challenge in tropical and subtropical soils, due to the high average annual temperatures in these regions. It can be accomplished by implementing improved land management practices that add substantial amounts of biomass to soil, cause minimal soil disturbance, conserve soil and water, improve soil structure, and enhance soil fauna activity. Continuous no-till crop production is arguably the best example. These soils need technically sound and economically feasible strategies to sustainably enhance their SOC pools. Hence, this book provides comprehensive information on SOC and its management in different land-use systems, with a focus on preserving soils and their ecosystem services. The only book of its kind, it offers a valuable asset for students, researchers, policymakers and other stakeholders involved in the sustainable development and management of natural resources at the global level.

Soil Organic Carbon
Adaptation and Mitigation Strategies
Agroforestry in Europe
Negative Emissions Technologies and Reliable Sequestration
Current Status and Future Prospects

Agroforestry is the cultivation, by farmers, of trees or other woody plants with crops or pasture. Its scientific study is attracting great interest and increasing funding because of its potential to produce sustainable agricultural systems and agroforestry is now included in most university and college courses covering land use subjects. Tropical Agroforestry is the first book that provides an analytical account of the principles, as well as the practices, of agroforestry within the context of the needs of land occupiers and, in so doing, describes the various specialist aspects that are now emerging as part of this discipline. The main objective throughout the book is to present, in a readable way, the underlying functional basis of woody/non-woody plant mixtures and to give a balanced account of how agroforestry can contribute to sustainable production from land. Understanding the biology of multipurpose trees is a key to this.

??This book provides standards and guidelines for quantifying greenhouse gas emissions and removals in smallholder agricultural systems and comparing options for climate change mitigation based on emission reductions and livelihood trade-offs. Globally, agriculture is directly responsible for about 11% of annual greenhouse gas (GHG) emissions and induces an additional 17% through land use change, mostly in developing countries. Farms in the developing countries of sub-Saharan Africa and Asia are predominately managed by smallholders, with 80% of land holdings smaller than ten hectares. However, little to no information exists on greenhouse gas emissions and mitigation potentials in smallholder agriculture. Greenhouse gas measurements in agriculture are expensive, time consuming, and error prone, challenges only exacerbated by the heterogeneity of smallholder systems and landscapes. Concerns over methodological rigor, measurement costs, and the diversity of approaches, coupled with the demand for robust information suggest it is germane for the scientific community to establish standards of measurements for quantifying GHG emissions from smallholder agriculture. Standard guidelines for use by scientists, development organizations will help generate reliable data on emissions baselines and allow rigorous comparisons of mitigation options. The guidelines described in this book, developed by the CGIAR Research Program on Climate Change, Agriculture, and Food Security (CCAFS) and partners, are intended to inform anyone conducting field measurements of agricultural greenhouse gas sources and sinks, especially to develop IPCC Tier 2 emission factors or to compare mitigation options in smallholder systems.

Agroforestry systems are believed to provide a number of ecosystem services; however, until recently evidence in the agroforestry literature supporting these perceived benefits has been lacking. This volume brings together a series of

papers from around the globe to address recent findings on the ecosystem services and environmental benefits provided by agroforestry. Specifically, this volume examines four major ecosystem services and environmental benefits: (1) carbon sequestration, (2) biodiversity conservation, (3) soil enrichment and (4) air and water quality. Past and present evidence clearly indicates that agroforestry, as part of a multifunctional working landscape, can be a viable land-use option that, in addition to alleviating poverty, offers a number of ecosystem services and environmental benefits. This realization should help promote agroforestry and its role as an integral part of a multifunctional working landscape the world over. The book should be particularly useful to students, professionals, researchers and policy makers involved in natural resource management, agroforestry, biodiversity conservation, and environmental management. Reprinted from Agroforestry Systems, Volume 76, No. 1 (2009)

Agroforestry for Ecosystem Services and Environmental Benefits

Agroforestry for Soil Management

Agroforestry and Climate Change

Carbon Capture, Utilization and Sequestration

Temperate Agroforestry Systems

Large potential for agroforestry as a mitigation option hasgiven rise to scientific and policy questions. This paper addressesmethodological issues in estimating carbon sequestration potential, baseline determination, additionality and leakage in Khammam district, Andhra Pradesh, southern part of India. Technical potential forafforestation was determined considering the various landuse options. Forestimating the technical potential, culturable wastelands, fallow andmarginal croplands were considered for Eucalyptus clonal plantations. Field studies for aboveground and below ground biomass, woody litter andsoil organic carbon for baseline and project scenario were conducted toestimate the carbon sequestration potential. The baseline carbon stockwas estimated to be 45.33 tC/ha. The additional carbon sequestrationpotential under the project scenario for 30 years is estimated to be12.82 tC/ha/year inclusive of harvest regimes and carbon emissions due tobiomass burning and fertilizer application. The project scenario thoughhas a higher benefit cost ratio compared to baseline scenario, initialinvestment cost is high. Investment barrier exists for adoptingagroforestry in thedistrict.

Grazing lands represent the largest and most diverse land resource-taking up over half the earth's land surface. The large area grazing land occupies, its diversity of climates and soils, and the potential to improve its use and productivity all contribute to its importance for sequestering C and mitigating the greenhouse effect and other conditions brought about by climate change. The Potential of U.S. Grazing Lands to Sequester Carbon and Mitigate the Greenhouse Effect gives you an in-depth look at this possibility.

This book is divided in two sections. Several chapters in the first section provide a state-of-the-art review of various carbon sinks for CO2 sequestration such as soil and oceans. Other chapters discuss the carbon sequestration achieved by storage in kerogen nanopores, CO2 miscible flooding and generation of energy efficient solvents for postcombustion CO2 capture. The chapters in the second section focus on monitoring and tracking of CO2 migration in various types of storage sites, as well as important physical parameters relevant to sequestration. Both researchers and students should find the material useful in their work.

North American Agroforestry

The Potential of U.S. Grazing Lands to Sequester Carbon and Mitigate the Greenhouse Effect

Carbon Sequestration Potential of Agroforestry System-an Evaluation in Low and Mid Hills of Western Himalayas

Carbon sequestration in tropical grassland ecosystems

Tree based production systems abound especially in the tropics. Despite the pervasiveness of such multipurpose "trees-outside-forest" resources, they have not attracted adequate attention in the development paradigms of many nation states. These multispecies production systems impact the ecosystem processes favourably. Yet, our understanding of the diversity attributes and carbon dynamics under agroforestry is not adequate. This book focuses on the role of multispecies production systems involving tree and crop species as a means for carbon sequestration and thereby reduce atmospheric carbon dioxide levels. Sixteen chapters organized into three broad sections titled: Measurement and Estimation, Agrobiodiversity and Tree Management, and Policy and Socioeconomic Aspects represent a cross section of the opportunities and challenges in current research and emerging issues in harnessing carbon sequestration potential of agroforestry systems.

Over the past decade the potential of agroforestry systems to sequester carbon and their role in providing ecosystem services has become the forefront of research as a result of global climate change. Agroforestry, that unambiguously integrates trees into land use systems, has traditionally contributed to global climate change adaptation. Hence, the promotion of Agroforestry is vitally vital to reinforce the resiliency of the country to future global climate change.Agroforestry and Climate Change provides a wide-ranging coverage of comprehensive information on emerging eco-friendly technology and its prospective role in contesting climate change through agroforestry. The book starts with highlights three ways agroforestry can be part of a climate change response: adapt to increased risks and uncertainties, facilitate an energy transition, and restoring landscape multifunctionality to allow current human resource appropriation to become sustainable, fitting sustainable development goals within planetary boundaries. Next, this book covers a study that presents how to use local agroecological knowledge in climate change adaptation. Further, this book presents a literature review to shed light on the social, environmental and economic benefits and challenges of using agroforestry systems for the purposes of conservation and restoration. The book also focuses on - carbon revenue in the profitability of agroforestry relative to monocultures; carbon sequestration potential of agroforestry systems in India; estimating carbon storage in windbreak trees on U.S. agricultural lands; agroforestry practices and carbon sequestration cost estimates among forest land dependent households in Nigeria; and reducing subsistence farmers' vulnerability to climate change: evaluating the potential contributions of agroforestry in western Kenya. Additionally, the

book reviews the literature and discusses the adverse impacts of climate change on agriculture and forestry, the effects of adapting agroforestry on climate changes, and important policies for promoting agroforestry adaptation. Climate change may significantly reduce the productivity of farms globally. Potential impact of climate change on farm productivity is a significant concern given that agriculture represents the primary livelihood strategy for most rural poor in tropical developing countries. In the last, therefore, this book presents contribution of agroforestry to climate change mitigation and livelihoods in developing countries.

The publication was launched at the Global Symposium on Soil Organic Carbon (GSOC) held at FAO headquarters (Rome, 21-23 March 2017). It provides an overview to decision-makers and practitioners of the main scientific facts and information regarding the current knowledge and knowledge gaps on Soil Organic Carbon. It highlights how better information and good practices may be implemented to support ending hunger, adapting to and mitigating climate change and achieving overall sustainable development.

Carbon Sequestration Potential of Agroforestry Practices in the L'Ormière River Watershed in Québec

The Potential of U.S. Forest Soils to Sequester Carbon and Mitigate the Greenhouse Effect

Assessing Carbon Stocks and Modelling Win-win Scenarios of Carbon Sequestration Through Land-use Changes

Drawdown

A Guide Book to Harvesting Soil Carbon Sequestration Benefits

Carbon Sequestration Potential of Agroforestry SystemsOpportunities and ChallengesSpringer Science & Business Media

Agroforestry is recognized as a sustainable land-use management in the tropics, as it provides environmental-friendly ecosystems; it also provides people with their every day need for food and cash. Since the recognition of agroforestry as a science, curricula have been developed for agroforestry programs for undergraduate and graduate trainings in Universities. Therefore, there is an urgent need to develop and make available educational material. This textbook strives to provide up-to-date information on tropical agroforestry to serve as educational material in the tropical context. The authoritative textbook of Nair (1993) on agroforestry was published 18 years ago, and before the advent of tree domestication, an important agroforestry practice today. In addition, many other research activities, such as carbon sequestration and integrated pest management, have been included in the agroforestry agenda. This textbook is intended for agroforestry students, teachers, and practitioners.

Much attention has been given to above ground biomass and its potential as a carbon sink, but in a mature forest ecosystem 40 to 60 percent of the stored carbon is below ground. As increasing numbers of forests are managed in a wide diversity of climates and soils, the importance of forest soils as a potential carbon sink grows. The Potenti

Inside Agroforestry

Carbon Sequestration in Agricultural Ecosystems

Assessment of Tree Diversity, Productivity and Carbon Sequestration Potential of

Different Agroforestry Systems
Agroforestry Systems in India: Livelihood Security & Ecosystem Services
A Global Toolkit of Perennial Crops and Regenerative Agriculture Practices for Climate Change Mitigation and Food Security

This publication contains a methodology and software tools for assessing carbon stocks and modelling scenarios of carbon sequestration developed and tested in pilot field studies in Mexico and Cuba. The models and tools enable the analysis of land use change scenarios in order to identify in a given area (watershed or district) land use alternatives and land management practices that can both maximise food production, soil carbon sequestration and biodiversity and minimize land degradation. The aims is to develop and implement "win-win" options that satisfy the multiple goals of farmers, land users and other stakeholders in relation to food security, carbon sequestration, biodiversity and land conservation. The publication also contains a CD-ROM including three case studies and a Soil-C program demo, program and user manual.

To achieve goals for climate and economic growth, "negative emissions technologies" (NETs) that remove and sequester carbon dioxide from the air will need to play a significant role in mitigating climate change. Unlike carbon capture and storage technologies that remove carbon dioxide emissions directly from large point sources such as coal power plants, NETs remove carbon dioxide directly from the atmosphere or enhance natural carbon sinks. Storing the carbon dioxide from NETs has the same impact on the atmosphere and climate as simultaneously preventing an equal amount of carbon dioxide from being emitted. Recent analyses found that deploying NETs may be less expensive and less disruptive than reducing some emissions, such as a substantial portion of agricultural and land-use emissions and some transportation emissions. In 2015, the National Academies published Climate Intervention: Carbon Dioxide Removal and Reliable Sequestration, which described and initially assessed NETs and sequestration technologies. This report acknowledged the relative paucity of research on NETs and recommended development of a research agenda that covers all aspects of NETs from fundamental science to full-scale deployment. To address this need, Negative Emissions Technologies and Reliable Sequestration: A Research Agenda assesses the benefits, risks, and "sustainable scale potential" for NETs and sequestration. This report also defines the essential components of a research and development program, including its estimated costs and potential impact.

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.

Community Forest Management as a Carbon Mitigation Option: Case Studies

Climate Change Mitigation Finance for Smallholder Agriculture

Carbon Sequestration Potential of Agroforestry Systems in the West African Sahel

Development Of An Agroforestry Sequestration Project In KhammamDistrict Of India

Agroforestry Parklands in Sub-Saharan Africa

Agroforestry has come of age during the past three decades. The age-old practice of growing trees and crops and sometimes animals in interacting combinations – that has been ignored in the single-commodity-oriented agricultural and forestry development paradigms – has been brought into the realm of modern land-use. Today agroforestry is well on its way to becoming a specialized science at a level similar to those of crop science and forestry science. To most land-use experts, however, agroforestry has a tropical connotation. They consider agroforestry as something that can and can only be identified with the tropics. That is a wrong perception. While it is true that the tropics, compared to the temperate regions, have a wider array of agroforestry systems and hold greater promise for potential agroforestry interventions, it is also true that agroforestry has several opportunities in the temperate regions too. Indeed, the role of agroforestry is now recognized in Europe as exemplified by this book, North America, and elsewhere in the temperate zone. Current interest in ecosystem management in industrialized countries strongly suggests that there is a need to embrace and apply agroforestry principles to help mitigate the environmental problems caused or exacerbated by commercial agricultural and forestry production enterprises.

The book discusses in depth the impact of climate change on forests and other agroecosystems. It presents new research on mitigation strategies, looking at carbon sequestration in agricultural soils, environmental greening,

natural resource management, and livelihood security.

This volume provides an abundance of valuable information on emerging eco-friendly technology and its potential role in combating climate change via agroforesty. The volume begins by describing the recent understanding of the scenario of climate change and its issues and challenges and provides an in-depth analysis of the potential of agroforestry toward climate change mitigation and adaptation. Chapters address a wide range of techniques and methods for mitigating the negative aspects of climate change through agroforesty, such as vermicomposting, carbon sequestration, horticulture techniques, nutrient sequestration and soil sustainability, conservation of medicinal plant resources, silvipastoral systems, phytoremediation techniques, and more. The book also looks at livelihood security and the role of agroforestry. Key features: Provides updated information and recent developments in the field of climate change and agroforestry Looks at a variety of eco-friendly methods being employed to help mitigate climate change through agroforesty Provides recommendations and suggestions to build harmony between agroforestry and climate change Discusses new insights on the role of agroforestry toward combating climate change as well as maintaining the sustainability of ecosystems

Methods for Measuring Greenhouse Gas Balances and Evaluating Mitigation Options in Smallholder Agriculture

Opportunities and Challenges