

ACLA COURSE STUDY GUIDE

Sustainable Agriculture & Food
Systems

Regenerative, water-smart, and climate-resilient farming techniques for African smallholders.

Ms. Fatou Ndiaye · Beginner

6 modules · 30 lessons · 6 weeks

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About This Course

Sustainable Agriculture and Food Systems is a comprehensive, international-standard foundational course designed to build a rigorous, systems-based understanding of how the world grows, moves, and manages food and how it can do so sustainably. The course is intended for learners with no prior formal background in agriculture, including students, early-career professionals, agricultural extension staff, policy and development practitioners, and anyone seeking a structured, credible introduction to the subject. Rather than treating sustainable agriculture as a single topic, this course is built around a systems foundations approach: each module examines a distinct component of the food system soil, water, biodiversity and pest management, value chains and food security, and policy and economics while consistently returning to how these components interact with and depend on one another. Every module pair conceptual content with a real-world case study, a supporting figure or diagram, and curated video resources, and is reinforced with a 15-question multiple-choice quiz. The course culminates in a comprehensive 15-question Final Assessment drawing on all six modules. Learners who achieve a score of 80% or higher (12 out of 15 correct) on the Final Assessment are eligible to receive a Certificate of Completion, described in Section 6 of this guide.

Course information

Course	Sustainable Agriculture & Food Systems
Instructor	Ms. Fatou Ndiaye
Level	Beginner
Structure	6 modules · 30 lessons · 6 weeks
Assessment	Module quizzes (pass mark 60%) and a final test (pass mark 80%). Certificate issued on final success, verifiable at acla.io/verify .

What you will be able to do

1. Explain the three pillars of sustainable agriculture and describe the structure of a modern food system, from production to consumption.
2. Describe the structure and function of healthy soil, identify the drivers of soil degradation, and explain sustainable land management practices.
3. Compare irrigation methods by water-use efficiency, and explain the principles of climate-resilient farming.
4. Define agroecology and Integrated Pest Management, and critically evaluate the evidence around organic and genetically modified crops.
5. Trace a food product's journey through the value chain, explain the causes of food loss and waste, and define the four dimensions of food security.
6. Explain how agricultural policy, subsidies, and economic instruments shape farming practices and food system outcomes at scale.

7. Critically analyse real-world case studies — from the Dust Bowl to the Aral Sea to the EU's Farm to Fork Strategy — using the conceptual tools developed throughout the course.
8. Demonstrate foundational food-systems literacy sufficient for further study, professional application, or informed engagement with agricultural policy and practice.

How to use this study guide

This guide is the complete companion to the Tapi Learn mobile course. Each chapter corresponds to one course module and reproduces every lesson in full, including the key takeaways. Read a lesson in the app, then revisit the same text here to revise; the structure and headings match the in-app lesson reader. After finishing a module, take the module quiz in the app (60% to pass), and after all modules, the final test (80% to pass) to earn your verified ACLA certificate of completion.

Module 1: Foundations of Sustainable Agriculture and Food Systems

Sustainable agriculture is commonly defined as farming that meets society's current food and textile needs without compromising the ability of future generations to meet their own...

5 lessons · 10m

1.1 What Is Sustainable Agriculture?

Sustainable agriculture is commonly defined as farming that meets society's current food and textile needs without compromising the ability of future generations to meet their own needs. This definition, adapted from the 1987 Brundtland Report's broader concept of sustainable development, rests on three interconnected pillars: environmental sustainability (protecting soil, water, and biodiversity), economic viability (ensuring farms remain profitable and farmers can earn a fair living), and social equity (ensuring food security, fair labour conditions, and community wellbeing). A farming system that succeeds on only one or two of these pillars — for example, a highly profitable system that depletes groundwater, or an environmentally sound method that leaves farmers unable to earn a living is not considered genuinely sustainable.

1.2 Understanding Food Systems

A food system encompasses every activity involved in producing, processing, distributing, and consuming food, along with the outcomes of these activities for nutrition, livelihoods, and the environment. This includes farm production, storage and processing, transport and distribution, retail and markets, and finally consumption and waste. Later modules in this course examine each of these stages, but it is important from the outset to understand that agriculture is only one component, albeit a foundational one, of a much larger interconnected system.

1.3 The Green Revolution and Its Legacy

Beginning in the 1940s and accelerating through the 1960s and 1970s, the Green Revolution introduced high-yielding crop varieties, synthetic fertilisers, irrigation expansion, and mechanisation to agriculture across much of Asia and Latin America. It dramatically increased cereal yields and is credited with helping avert famine for hundreds of millions of people during a period of rapid population growth. However, it also carried significant long-term costs: heavy reliance on irrigation and chemical inputs, declining soil health in some regions, groundwater depletion, and reduced crop genetic diversity. Understanding both the achievements and the costs of the Green Revolution is essential context for why the sustainable agriculture movement developed in response.

1.4 Conventional, Sustainable, and Regenerative Agriculture

It is useful to distinguish between three broad orientations. Conventional agriculture typically emphasises maximising yield and efficiency through synthetic inputs, mechanisation, and specialisation. Sustainable agriculture seeks to maintain productivity while actively managing environmental and social impacts for example, through more efficient input use, soil conservation, and fair labour practices. Regenerative agriculture goes further, aiming not just to reduce harm but to actively rebuild soil health, biodiversity, and ecosystem function over time. These are not always sharply distinct categories in practice many real farms blend elements of all three but the distinction is a useful frame for later modules.

1.5 Systems Thinking Applied to Agriculture

Throughout this course, agriculture and food are treated as an interconnected system rather than a collection of separate topics. A decision made at one point in the system, a farmer's choice of irrigation method, a government subsidy, a retailer's sourcing standard tends to ripple outward, affecting soil, water, farmer income, and consumer nutrition simultaneously. This foundational module introduces the vocabulary (the three pillars, the food system stages, sustainable vs regenerative approaches) that Modules 2 through 6 build on directly. .

Module 2: Soil Health and Sustainable Land Management

Soil health refers to the continued capacity of soil to function as a living ecosystem that sustains plants, animals, and humans. Healthy soil is not simply inert mineral...

5 lessons · 10m

2.1 What Makes Soil “Healthy”?

Soil health refers to the continued capacity of soil to function as a living ecosystem that sustains plants, animals, and humans. Healthy soil is not simply inert mineral material; it is a complex, living system containing billions of microorganisms, fungi, and invertebrates per handful, along with organic matter, air, and water held within its structure. Key indicators of soil health include organic matter content (which supports nutrient cycling and water retention), soil structure (how well soil particles bind into stable aggregates that resist erosion and allow root growth), and biological activity (the presence of earthworms, microbes, and fungi that cycle nutrients).

2.2 The Soil Profile

A cross-section of undisturbed soil, known as a soil profile, typically reveals distinct horizontal layers, or horizons, each with different properties. The uppermost organic layer contains decomposing plant litter; below it, the topsoil (A horizon) is rich in organic matter and biological activity and is where most root growth and nutrient cycling occurs; the subsoil (B horizon) contains more mineral material with less organic matter; and beneath that lies the parent material (C horizon) and, eventually, bedrock. Agricultural practices affect these layers differently, topsoil, the most productive and most vulnerable layer, can take centuries to form naturally but can be lost to erosion within a few growing seasons of poor management.

2.3 Drivers of Soil Degradation

Soil degradation refers to a decline in soil's capacity to function, and it can occur through several mechanisms. Erosion, by wind or water, physically removes topsoil, particularly from bare or poorly vegetated fields. Compaction, often caused by heavy machinery or livestock trampling, reduces pore space needed for root growth, water infiltration, and air exchange. Nutrient depletion occurs when crops remove nutrients faster than they are replenished, often exacerbated by continuous monocropping without adequate replenishment. The Food and Agriculture Organization has estimated that roughly a third of the world's soils are already degraded to some degree, with soil erosion considered one of the most significant threats to long-term global food security.

2.4 Sustainable Land Management Practices

A range of practices can maintain or restore soil health. Cover cropping, planting non-harvested crops between main growing seasons protects soil from erosion and adds organic matter. Reduced or no-till farming minimises soil disturbance, preserving structure and biological activity. Crop rotation interrupts pest and disease cycles while diversifying nutrient demands on the soil. Contour farming and terracing reduce water runoff and erosion on sloped land. Composting and organic amendments return nutrients and organic matter to the soil rather than relying solely on synthetic fertiliser.

2.5 Soil as a Climate Solution

Soil is not only a foundation for food production but also one of the largest terrestrial reservoirs of carbon, connecting this module directly to the carbon cycle concepts relevant to broader climate and sustainability discussions. Healthy soils, rich in organic matter, can sequester substantial amounts of atmospheric carbon; degraded soils, by contrast, release stored carbon back into the atmosphere. This dual role supporting food production while also regulating climate is a key reason soil health has become a central focus of sustainable agriculture and climate policy alike. .

Module 3: Water Management and Climate-Resilient Farming

Agriculture is by far the largest human use of freshwater globally, accounting for roughly 70% of global freshwater withdrawals. Water availability, more than almost any other...

5 lessons · 10m

3.1 Water as Agriculture's Limiting Resource

Agriculture is by far the largest human use of freshwater globally, accounting for roughly 70% of global freshwater withdrawals. Water availability, more than almost any other single factor, determines what can be grown where, and increasing pressure from population growth, competing urban and industrial demand, and more erratic rainfall patterns has made efficient water management an urgent priority for sustainable agriculture, rather than a secondary concern.

3.2 Irrigation Methods and Water-Use Efficiency

Different irrigation methods vary substantially in how efficiently they deliver water to crops. Flood or furrow irrigation, the oldest and still most widely used method globally, is simple and low-cost but typically achieves only moderate water-use efficiency, since much water is lost to runoff, evaporation, and deep percolation beyond the root zone. Sprinkler irrigation improves on this by distributing water more evenly and with less runoff. Drip (or micro-) irrigation, which delivers water directly to the root zone through a network of tubes and emitters, achieves the highest efficiency of the common methods, though it requires greater upfront investment and maintenance.

3.3 What Is Climate-Resilient Farming?

Climate-resilient farming refers to agricultural practices designed to maintain productivity and farmer livelihoods despite increasingly variable and extreme weather — more intense droughts, erratic rainfall, and heat stress. This includes selecting drought-tolerant or flood-tolerant crop varieties, diversifying crops and income sources to spread risk, improving soil's water-holding capacity through the organic-matter practices covered in Module 2, and using early warning and weather information systems to guide planting and harvest decisions.

3.4 Strategies for Improving Water-Use Efficiency

Beyond choosing an efficient irrigation method, several complementary strategies can substantially improve agricultural water-use efficiency: scheduling irrigation based on actual soil moisture and crop water needs rather than fixed calendars; mulching, which reduces evaporation from the soil surface; selecting crop varieties suited to local water availability rather than importing water-intensive varieties into water-scarce regions; and rainwater harvesting, which captures and stores rainfall for use during dry periods.

3.5 Water Governance and Shared Resources

Because water frequently crosses farm, regional, and even national boundaries, effective water management is rarely purely a technical or farm-level matter — it is also a governance challenge. Decisions about how much water to allocate to agriculture versus cities, how to price water use, and how to manage shared rivers, lakes, and aquifers between multiple users or countries can determine whether a water-dependent agricultural system remains viable over the long term, as this module's case study illustrates in stark terms. . Drip irrigation delivers water directly to the root zone, substantially reducing losses to evaporation and runoff compared with flood irrigation.

Module 4: Agroecology, Biodiversity, and Integrated Pest Management

Agroecology applies ecological concepts and principles to the design and management of agricultural systems, treating a farm as an ecosystem rather than simply a production...

5 lessons · 10m

4.1 What Is Agroecology?

Agroecology applies ecological concepts and principles to the design and management of agricultural systems, treating a farm as an ecosystem rather than simply a production facility. Rather than relying primarily on external inputs (synthetic fertiliser, pesticide) to control every variable, agroecological approaches work with natural processes; nutrient cycling, pest predation, pollination to build resilience and reduce dependence on inputs over time.

4.2 Biodiversity in Agricultural Systems

Biodiversity within and around farms including crop diversity, soil organisms, pollinators, and natural pest predators contributes directly to resilience and productivity. Diverse cropping systems (through practices such as intercropping, agroforestry, and crop rotation, introduced in Module 2) are generally less vulnerable to a single pest, disease, or weather event wiping out an entire harvest than monocultures are. Pollinators, particularly bees, are essential to the production of a large share of the world's fruit, vegetable, and nut crops, making pollinator-friendly practices a direct agricultural, not just environmental, concern.

4.3 Integrated Pest Management (IPM)

Integrated Pest Management is a widely endorsed, systems-based approach to controlling agricultural pests that prioritises prevention and monitoring over routine chemical treatment. IPM is generally organised into a hierarchy: first, prevention through crop rotation, resistant varieties, and healthy soil; second, regular monitoring and scouting to identify pests before they reach damaging levels; third, mechanical and biological controls, such as traps and natural predators; fourth, targeted, selective treatments applied only when monitoring indicates a genuine threshold has been crossed; and finally, broad-spectrum chemical pesticides, reserved as a last resort rather than a default first response.

4.4 Organic Farming and Genetically Modified Crops: A Systems View

Organic farming and genetically modified (GM) crops are often discussed as opposing approaches, but a systems perspective suggests a more nuanced picture. Organic farming avoids synthetic fertilisers and pesticides, relying instead on practices like composting and biological pest control; research comparing organic and conventional yields and environmental outcomes shows a genuinely mixed picture, with organic systems often supporting greater on-farm biodiversity but sometimes requiring more land to produce equivalent yields. GM crops, meanwhile, have been extensively studied for food safety and, according to major scientific bodies, found to pose no greater health risk than their conventional counterparts; specific GM traits (such as pest resistance or drought tolerance) can reduce pesticide use or improve resilience in some contexts, while raising separate questions around seed access, cost, and corporate concentration in others. Neither approach is inherently “sustainable” or “unsustainable” in isolation, outcomes depend heavily on how each is implemented within a given system.

4.5 Pollinators and Natural Pest Predators

A well-designed agroecological system actively supports the natural allies that reduce the need for chemical inputs. Hedgerows, flower strips, and reduced pesticide use can support populations of pollinators and predatory insects (such as ladybirds and parasitic wasps) that control pest populations naturally. This is not simply an environmental co-benefit; it directly reduces a farm's reliance on and expenditure on external chemical inputs, connecting the ecological and economic pillars of sustainability introduced in Module 1. .

Module 5: Food Systems, Value Chains, and Food Security

A food value chain describes the full sequence of stages a food product passes through from farm to consumer: production, storage and handling, processing, distribution and...

5 lessons · 10m

5.1 The Food Value Chain

A food value chain describes the full sequence of stages a food product passes through from farm to consumer: production, storage and handling, processing, distribution and transport, retail and markets, and finally consumption. Value is added, and risk is introduced, at every stage, a delay in transport, inadequate storage, or a processing bottleneck can each affect a product's quality, price, and ultimate availability to consumers.

5.2 Food Loss and Food Waste

It is useful to distinguish food loss (which occurs during production, storage, and processing, often before food reaches a retail environment, frequently in lower-income countries due to inadequate storage or transport infrastructure) from food waste (which occurs at the retail and consumer level, often in higher-income countries, through overproduction, appearance standards, and household discard). Combined, an estimated one-third of all food produced globally for human consumption is lost or wasted each year, a scale of inefficiency that represents wasted water, land, labour, and greenhouse gas emissions embedded in food that is never eaten.

5.3 Defining Food Security

Food security is commonly defined around four dimensions, all of which must be met simultaneously: availability (sufficient quantities of food are physically present), access (people have the economic and physical means to obtain that food), utilisation (food is used appropriately, with adequate diet quality, water, and sanitation to achieve nutritional wellbeing), and stability (these first three dimensions are maintained reliably over time, without being disrupted by shocks such as conflict, extreme weather, or economic crisis). A population can face food insecurity even where overall food availability is adequate, if access or stability is compromised.

5.4 Shocks to Global Food Value Chains

Because modern food value chains are often long, globally interconnected, and dependent on relatively few major exporting countries for key staple crops, they can be vulnerable to shocks that originate far from the communities ultimately affected a war disrupting a major grain-exporting region, an extreme weather event damaging a key harvest, or an economic crisis restricting purchasing power can each cascade into food insecurity in entirely different parts of the world within a single growing season.

5.5 Building More Resilient and Equitable Value Chains

Strategies to strengthen food value chains against shocks include diversifying import sources and domestic production rather than relying on a small number of suppliers, investing in storage and transport infrastructure to reduce post-harvest loss (directly connecting to Section 5.2), strengthening local and regional markets to reduce dependence on distant supply chains, and supporting smallholder farmers' access to fair prices and markets, since smallholders produce a substantial share of food in many low- and middle-income countries but often capture a disproportionately small share of the value chain's final value. .

Module 6: Policy, Economics, and the Future of Sustainable Food Systems

Government policy including subsidies, trade rules, environmental regulation, and research funding has an outsized influence on what farmers grow, how they grow it, and who...

5 lessons · 10m

6.1 How Policy Shapes Agriculture

Government policy including subsidies, trade rules, environmental regulation, and research funding has an outsized influence on what farmers grow, how they grow it, and who profits from the resulting food system. Subsidies in particular can either reinforce unsustainable practices (for example, by rewarding maximum output of a small number of staple crops regardless of environmental cost) or actively support sustainable transitions (for example, by rewarding soil conservation or reduced input use), depending on how they are designed. This makes policy design, not just farm-level technique, a central lever for achieving the systems-level outcomes discussed throughout this course.

6.2 Smallholder Farmers in the Global Food System

Smallholder farmers, typically defined as those farming on a small area of land, often under two hectares, produce a substantial share of the food consumed in many low- and middle-income countries, yet frequently face disproportionate barriers: limited access to credit, storage, and markets; vulnerability to price volatility; and, as noted in Module 5, a disproportionately small share of the value ultimately captured by the food value chains their production feeds into. Policies and market mechanisms that improve smallholders' access to fair prices, credit, and information are widely regarded as essential to a genuinely equitable, sustainable food system.

6.3 Economic Instruments for Sustainability

Beyond direct subsidies, governments and markets use a range of economic instruments to influence food system sustainability, including certification and labelling schemes (such as organic or fair trade certification, which allow consumers to pay a premium for verified practices), payments for ecosystem services (compensating farmers directly for practices that deliver public benefits like carbon sequestration or water quality protection), and regulatory standards (such as limits on pesticide residues or nutrient runoff).

6.4 Emerging Approaches and Technologies

Several emerging approaches are shaping discussions about the future of sustainable agriculture. Precision agriculture uses sensors, satellite data, and analytics to apply water, fertiliser, and pesticide only where and when needed, reducing waste. Vertical farming and controlled-environment agriculture grow crops in stacked, climate-controlled indoor systems, potentially reducing land and water use for certain crops, particularly near urban centres. Alternative proteins, including plant-based and lab-cultivated products, are being explored partly in response to the substantial land, water, and greenhouse gas footprint of conventional livestock production. Each of these approaches carries its own tradeoffs and is best evaluated, consistent with this course's systems approach, on its full environmental, economic, and social impact rather than on novelty alone.

6.5 Synthesis: A Systems View of Sustainable Food Policy

This closing module brings together the course's core threads: sustainable agriculture depends on the interaction of environmental practices (Modules 2–4), functioning and resilient value chains (Module 5), and policy and economic structures that shape farmer incentives at scale (this module). No single technology, farming method, or policy instrument is sufficient on its own; durable progress toward sustainable food systems requires coordinated attention to all of these levels simultaneously, the same systems-thinking principle introduced in Module 1 and reinforced throughout this course. .

Final Assessment & Certificate

The final test draws on questions from every module. The pass mark is 80%. When you pass, Tapi Learn issues a certificate of completion bearing your name, the course title, your final score, a unique certificate number and the signature of the CEO of the Pan African Network for Climate Action (PANFCA). Each certificate carries a verification URL (acla.io/verify/<number>) so employers and partners can confirm its authenticity. You can download the certificate as a PDF directly from the app at any time, and your progress and certificates are backed up to the cloud under your email address.

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