Agroecology

Sustainable & Successful Agricultural Practices in the United States

Agroecology provides a robust set of solutions to the environmental and economic pressures and crises facing American agriculture in the 21st century

Pesticide Action Network
NORTH AMERICA

Agroecology is the science behind sustainable agriculture. Drawing on both natural and social sciences, agroecology provides a framework for assessing four key systems properties of agriculture: productivity, resilience, sustainability and equity.

Agroecological practices combine scientific inquiry with local knowledge and community-based experimentation, emphasizing technology and innovations that are pragmatic, knowledge-intensive, low cost and readily adaptable by small- and medium-scale producers. These methods are considered likely to advance social equity, sustainability and agricultural productivity over the long-term and are uniquely suited to providing benefits to local communities where food is grown.

Additionally, agroecological farming encourages ecological and economic resilience and maintenance of healthy ecosystem function over reliance on external inputs such as synthetic chemical pesticides, fertilizers and fossil fuels that can have high energy, environmental and health costs. The approach thus strengthens farmers' capacity to withstand environmental and economic stresses posed by climate change, shifting pest pressures and volatility in petroleum and commodity prices.

Farmers across the United States are employing agroecological practices, showing these methods to be productive and profitable, leading to economic resilience and success.

Multifunctional benefits of agroecology

Agroecological farming supports the multifunctional dimensions of agriculture, which include not only food, jobs and economic well-being, but also culture, social and environmental benefits, and important ecosystem services such as pollination; natural pest control; nutrient, carbon and water cycling; and erosion control.

In study after study, agroecological farming has been shown to:

- **Increase ecological resilience**, especially with respect to volatile weather conditions;
- **Improve health & nutrition** through more diverse, nutritious and fresh diets and reduced incidence of pesticide poisonings and pesticide-related diseases;
- **Conserve biodiversity & natural resources** (e.g. soil organic matter, water quality and quantity, crop genetic diversity, natural enemies of pests, ecosystem services and pollinator protection);
- **Improve economic stability** with more diverse sources of income, spread of labor requirements and production benefits over time and reduced vulnerability to single commodity price swings;
- **Mitigate effects of climate change** through reduced reliance on fossil fuel and fossil fuel-based agricultural inputs, increased carbon sequestration and water capture in soil; and
- **Increase social resilience & community capacity** by increasing ecological literacy and social support networks.

Cover crops planted between vine rows reduce erosion, suppress weeds, build soil organic matter, improve soil fertility, reduce nutrient leaching, improve water use efficiency and provide habitat for natural enemies and grazing for livestock. Aurora Fendentz

Agroecological Farming

Native hedgerows provide pollinator habitat & pest control

Singing Frogs Farm, Sebastopol, California

Singing Frogs Farm is an island of biodiversity in a sea of grape monoculture. Paul Kaiser, the farmer, grows fruits and vegetables for the 110 members of his Community Supported Agriculture (CSA) program.

Throughout his fields, Paul has planted flowering hedgerows, comprising thousands of native perennials from several dozen species, selected to ensure blooms year round that provide forage for honeybees and native pollinators. Singing Frogs Farm receives support from the USDA Pollinator Campaign, an initiative designed to assist farmers who diversify their landscapes and restore native pollinator habitat.

As an added benefit, the hedgerows on Paul's farm slow run-off, control erosion, improve soil permeability and infiltration, and help to recharge his aquifer.

Flowering hedgerows provide resources for pollinators and natural enemies. Aurora Fendentz

Hedgerows are also key to Singing Frogs Farm's pest control strategy. As Paul says, "one of the easiest ways to control pests is to create a diverse habitat for natural enemies in your fields." When he first started farming his property, the farm suffered huge outbreaks of aphids and cucumber beetles. These days it has "essentially zero pest issues of any kind." Because his farm is a functioning diverse ecosystem, "Pests never get elevated to the status of being pests. They always stay in low-level populations."

These low-level "pest" populations are a food resource helping to maintain natural enemy populations. On Singing Frogs Farm, even pest insects are beneficial.

Pesticide-free & profitable corn and soy farming

A-Frame Farm, Madison, Minnesota

Carmen Fernholz has grown organic corn and soybean on his 450 acres near Madison, Minnesota, since before there was a market for them. Initially motivated by his aversion to chemi-

Intercropping and crop rotations are key strategies used to maximize nutrient efficiency and fight pests. Aurora Fendentz

cal pesticides, his goal was to prove that his organic fields could match the productivity and profitability of his neighbors' conventional cornfields.

To achieve the long-term productivity he sought, he employed agroecological strategies like cover cropping and crop rotation to build soil and soil fertility and to diversify his crops and landscape.

For four decades, his enterprise—A-Frame Farm—has proven remarkably resilient. This is in part because Carmen relies on human resources rather than capital inputs that are vulnerable to price swings and erode soil and water quality and other essential farm resources. His knowledge- and labor-intensive organic system prevented the indebtedness that typically accompanies over-expansion. Meanwhile, the organic premium on his crops—including flax and alfalfa—has grown faster than the price of their conventional counterparts.

Carmen says his highest benchmark of success came ten years ago when a neighbor stopped by and asked him if he would help him transition to organic. "In your own neighborhood, you're never an expert," Carmen said. "I thought that after that many years, if people who have seen my system and watched me over time were willing to sit down and try it themselves, that to me was the beginning of what I felt was a success story."

Building healthy soils for healthy cows

Choiniere Family Farm, Highgate Center, Vermont

"My job is to feed people," says organic dairy farmer Guy Choiniere. In order to feed people, Guy begins by feeding his soil. As a conventional farmer, he had to use increasing amounts of fertilizer to maintain yields and pharmaceuticals to treat his cows. His gut told him none of this was sustainable. "All I wanted was healthier cows," he said.

Guy uses cover crops of deep-rooted radish and rotations of alfalfa to address soil compaction and provide space for air and water to permeate. He also produces 800 tons of composted manure every year to spread onto his pasture and fields. This organic matter moderates drought and flood, improving both infiltration and water holding capacity. The dry, sandy soils in his very hilly corner of Vermont now retain moisture after rain "like a sponge."

Composted manure supplies microbial life that soils need for nutrient cycling and stable forms of nitrogen that are slowly released to plants. Legumes in Guy's pastures and in his field rotations add both nitrogen and organic matter to his soils.

Manure plays a critical role in recycling mineral nutrients into his soils. Soil organic matter holds onto mineral nutrients better than his sandy soils would have, and balances soil pH so that these mineral nutrients are efficiently taken up by plants. His cover crops draw up nutrients that his grasses cannot access and are left as mulch, feeding his grasses as they decay. The grasses, legumes and small grains all have different root depths enabling them to capture nutrients from different parts of the soil. Together these plants provide a balanced diet for his cows, boosting their immune systems.

There is a direct connection between soil health and animal health. "As soon as I concentrated on building these soils, I started seeing better crops." After two years of employing these methods, Guy started seeing healthier animals. Disease was reduced by 75%. For Guy, managing the fertility of his soils and the health of his cows are the same process.

Animals are used on farms to close ecological loops and improve ecosystem function, while their manure supplies nutrient rich fertilizer.

Crop rotation: Fumigant-free strawberries

Swanton Berry Farms, Davenport, California

Organic strawberry grower Jim Cochran has been growing strawberries along the central coast of California for nearly thirty years. Jim uses agroecological methods to combat the plant fungus, *Verticillium dahliae*, which can devastate strawberry production. Crop rotation enables Jim to avoid dangerous soil fumigants such as cancer-causing methyl iodide and ozone-depleting methyl bromide, which nearly all conventional strawberry producers in California rely on.

The fungus can survive ten years or more in soil without a host. When strawberries are planted in infected soil, the fungus chokes strawberry plants of water and nutrients, resulting in wilting and death. However, Jim discovered that seasonal rotations of broccoli in strawberry fields suppress the fungal disease, thus maintaining competitive organic strawberry yields while safeguarding the health of farmworkers, rural communities and the environment.

Broccoli and other *Brassica* crops are used in rotation with strawberries to fight soil-borne pathogens without toxic fungicides. Aurora Fendentz

The possible mechanisms controlling *V. dahliae* include biofumigation, decomposition and induction of disease resistance. Broccoli and other members of the *Brassica* family produce glucosinolates, which have a suppressive effect on soil-borne pathogens. This biofumigation reduces *V. dahliae* populations in the soil. Jim's soil is rich in organic matter from composts, green manures and cover crops. Soil managed in this way is known to have greater diversity of soil microbes. Diverse soil microbial communities may keep *V. dahliae* in check, preventing any large outbreak of the disease in the strawberry crop. Crops grown in such soil are known to exhibit stronger disease resistance properties.

A rotational planting schedule is another key management strategy. Jim plants fields with strawberries only once every three years, preventing *V. dahliae* populations from building up. The remainder of the time the fields are planted in broccoli or a cover crop. Organic broccoli provides an additional source of income and crop residues are incorporated into the soil as green manure, providing the pathogen-fighting benefits of decomposition and biofumigation.

Productive & Profitable

Farmers adopting agroecological methods have produced equal and sometimes substantially increased yields per unit area compared to those using conventional methods in many parts of the world, although research challenges in specific crops and some agroecosystems remain.

A comprehensive examination of nearly 300 studies worldwide by the University of Michigan concluded that organic agriculture could produce enough food, on a per capita basis, to provide 2,640 to 4,380 kilocalories per person per day (more than the suggested intake for healthy adults). Organic farms in developing countries were found to outperform conventional practices by 57%.

These promising findings may underestimate the full potential of agroecological farming to contribute to increased farm-level productivity, household income and food security, as only a very small fraction of public and private sector agricultural investment has thus far gone towards agroecological research.

U.S. Policy Recommendations

How to build local & national capacity in sustainable farming

Sustainable agriculture in the 21st century requires a redirection of institutional and policy support towards ecologically-sound decision-making by farmers; stronger and enforceable regulatory frameworks to reverse the damaging effects of chemical-intensive, resource-extractive agriculture; and significant new investments by public sector, donor and commercial agencies in agroecological research, extension, education, product innovation and marketing.

Concrete actions toward these goals include:

1. **Redirect public investments in agricultural research, extension and education to support a transition to ecologically and economically sustainable farming**

    - Revise institutional and program priorities, professional incentives and budget allocations to support a transition toward ecologically diverse and resilient agricultural systems.
    - Encourage collaboration among farmers, extensionists, educators and researchers in problem-identification, experimentation and innovation.
    - Increase technical and site-specific support for farmers practicing or transitioning to agroecological farming methods. (Expand, for example, the USDA Organic Agriculture Research and Extension Initiative to support whole farm planning, ecosystem integration and diversification of landscapes and production systems).
    - Adopt policies and establish initiatives to increase farmers' and independent researchers' access to and public sector funding and development of locally adapted, non-genetically engineered seeds and livestock breeds.

2. **Establish economic policies and financial incentives in support of agroecological farming**

    - Use full-cost accounting measures to evaluate and compare the social, environmental and economic costs of different agricultural production systems.
    - Provide financial incentives (credit, crop insurance, income tax exemptions, payment for ecosystem services) for resource-conserving practices, and for reducing reliance on chemical-, fossil fuel- and water-intensive production methods.
    - Reinstate the requirement that receipt of federal crop insurance subsidies be linked to implementation of basic conservation practices.
    - Expand the number and type of farming and ranching practices eligible for payments under the Environmental Quality Incentives Program (EQIP) and Conservation Stewardship Program (CSP) to include practices that enhance air and water quality; conserve soil and water resources; maintain wildlife habitat; and protect wetland, riparian or prairie ecosystems.

3. **Revitalize local and regional food systems and increase market opportunities for farmers adopting agroecological practices.**

    - Revitalize local and regional food systems: establish democratic food policy councils; encourage urban and peri-urban agriculture projects; regionalize food procurement.
    - Establish social and environmental standards for production, food quality and procurement, with liability mechanisms to address health or environmental harms arising when standards are not applied or when production processes are compromised, e.g. by genetic or chemical contamination.
    - Reward private sector investment in safe, sustainable products, technologies, *in situ* reserves and markets; initiate competitive bidding for public funding based on capacity to meet equitable, sustainable farming goals; implement anti-trust and fair competition regulations.
    - Support public agency (schools, hospitals, prisons) purchase of local organic produce.
    - Encourage fair and sustainable production labels, affordable third-party certification, and increased market opportunities for farmers adopting agroecological practices.

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