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The NRCS Organic Farming Handbook was developed to support NRCS conservation planners and other agricultural professionals as they work with organic producers. The handbook describes organic systems and identifies key resources to guide conservation planning and implementation on organic farms. Producers and other audiences may also find the handbook useful, particularly the resources listed in various sections.

This handbook was developed by a team comprised of NRCS staff and partner organizations from across the country and from a range of disciplines.

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National Organic Farming Handbook

A. Overview of Organic Agriculture

1. Organic Farming System Principles

Organic farming systems reflect several fundamental principles that early innovators established through careful observation of soils, crops, livestock, and life processes in natural and agricultural systems. Practitioners have refined, updated, and expressed these principles in different ways over the past 75 years, yet the foundational principles of organic agriculture remain relatively constant.[1] In addition to over 12,000 USDA-certified organic producers[2], many other U.S. producers implement "sustainable," "ecological," "biological," or "natural" methods derived from these same principles. While many producers may follow similar principals, all certified organic producers must comply with the USDA's Agricultural Marketing Service (AMS) National Organic Program (NOP) regulations – commonly known as the USDA organic regulations. Only those producers following the USDA organic regulations may market their products as organic.

Use Natural Materials

In general, the USDA organic regulations allow the use of natural fertilizers and materials, and exclude synthetic substances. However, organic systems are more complex than this general standard and include broader principles described below. In the words of author and sustainable farming advocate Wendell Berry,

> *"An organic farm, properly speaking, is not one that uses certain methods and substances and avoids others; it is a farm whose structure is formed in imitation of the structure of a natural system that has the integrity, the independence and the benign dependence of an organism."*[3]

Protect the Health of the Soil and Natural Resources

Organic practitioners and researchers emphasize healthy, living, nutritionally balanced soil as the foundation of crop, livestock, and human health, and of sustainable and successful farming.[4] To maintain healthy soil, organic farmers control erosion, feed and protect the soil life, and replenish organic matter as well as plant nutrients. They adopt diverse crop rotations to balance nutrient demands on the soil, protect and enhance soil life, and control erosion by maintaining good tilth, planting cover crops, and adopting other conservation practices. More recently, research findings on the benefits of an active and diverse soil food web have refined this principle and established its importance throughout modern agriculture.

Early leaders of the organic farming movement emphasized that, over the long term, successful farming depends on the health of all natural resources on the farm and in its surroundings. All farming inevitably alters the natural condition of soil and other resources within production areas to some degree, often with some decrease in biodiversity. To sustain biodiversity, organic farmers strive to protect water, wildlife, native plant communities, and other resources from agricultural impacts. In organic crop and livestock production pest, weed, and disease management emphasize cultural and preventative practices before the use of approved organic crop protection products. Producers support biodiversity by providing habitat for wildlife, pollinators and other organisms in cultivated and uncultivated areas of the farming system.

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1 Schonbeck, Mark W. 2014. A Brief History and Philosophy of Organic Farming. Handout (2 pp) originally developed and used for SARE PDP agricultural professional trainings offered by Southern Sustainable Agriculture Working Group, 2011 – 2013; revised June 2014.

2 USDA National Organic Program. This does not include all certified operations (i.e. handling operations). Does not include farms exempt from certification. http://apps.ams.usda.gov/nop/.

3 Berry, Wendell. 1981. The Gift of Good Land: Further Essays Cultural and Agricultural. San Francisco: North Point, 1981.

4 Howard, Sir Albert. 1947. The Soil and Health: a Study of Organic Agriculture. Republished with a foreword by Wendell Berry in 2006, University Press of Kentucky, 307 pp.

Early leaders of the organic farming movement emphasized that, over the long term, successful farming depends on the health of all natural resources on the farm and in its surroundings. All farming inevitably alters the natural condition of soil and other resources within production areas to some degree, often with some decrease in biodiversity. To sustain biodiversity, organic farmers strive to protect water, wildlife, native plant communities, and other resources from agricultural impacts. In organic crop and livestock production, pest, weed, and disease management emphasize cultural and preventative practices before the use of approved organic crop protection products. Producers support biodiversity by providing habitat for wildlife, pollinators, and other organisms in cultivated and uncultivated areas of the farming system.

Simulate Nature in Farming Practices

Organic producers strive to develop farming systems that mimic nature and utilize natural processes and materials to provide for crop and livestock nutrition, manage pests and weeds, and attain production goals, while conserving the biological diversity on which their farm depends.

Crop and nutrient management

Living plants in a natural ecosystem, such as a forest or prairie, derive essential nutrients from the breakdown of plant and animal residues that fall on or are deposited into the soil. As soil organisms decompose organic residues, they release plant-available nutrients to support the next season's growth, and form humus that sustains soil quality. Mimicking this natural cycle, producers replenish soil organic matter and nutrients by returning animal and green manures, crop residues, and other organic sources to the soil, thereby maintaining soil fertility and crop yields. These practices feed the soil, and the soil feeds the crop.

When crops need additional nutrients, organic producers choose plant, animal, and natural mineral-based fertilizers, most of which release nutrients gradually through the action of soil organisms. Synthetic fertilizers are prohibited in organic production systems.

Figure 1 Examining organically managing soil under alfalfa

Pest management

In natural ecosystems, insects, rodents, and other herbivorous organisms feed on vegetation; however, predators and parasites feed on the herbivores, thus helping to limit damage to the plant community. Native plants can fall prey to pathogenic fungi and other microorganisms, but most soil microorganisms play important roles in plant vigor, including disease suppression. The web of relationships among diverse organisms in a healthy, mature forest or prairie creates a balance that generally controls a particular pest from destroying other species. Organic farmers simulate and utilize these natural checks and balances to limit crop damage from pests. Producers establish beneficial habitat plantings to harbor predators of crop pests, build soil health to suppress soil-borne pathogens, diversify crop rotations to disrupt pest cycles, and plant cover crops to suppress weeds.

Resource cycling

Some organic proponents focus on cycling of resources within the farm and minimizing dependence on off-farm inputs. Crop rotations that include cover crops and a mix of deep and shallow-rooted crops may enhance nutrient and water utilization and cycling within the soil

profile. Practices that increase soil organic matter and structure, and hence water and nutrient retention, further improve resource cycling and reduce dependence on off-farm inputs. Integration of crop and livestock production can enhance nutrient cycling, as livestock consume on-farm forages and crop residues, and provide nutrient-rich manure for subsequent crop production.

Biodiversity

Organic systems attempt to mirror nature by maintaining biodiversity on the farm. Producers diversify and rotate crops, and plant field edges with flowering plants to support pollinators and other beneficial organisms. Fields may include hedge and tree rows of varied species, providing wildlife habitat and structural biodiversity above and below ground. Wildlife corridors and wildlife-friendly fences maintain connectivity for wide-ranging wildlife such as deer and predators.

Tillage and weed management

Without access to many herbicides, organic producers often use tillage in annual crop production as a tool to manage weeds and cover crops without herbicides. Recent advances in organic no-till and conservation-tillage systems, such as the roller-crimper, and the use of flame weeders and mulches, have helped organic producers reduce the intensity of soil disturbance in annual crop rotations. In addition, planting "subsoiling" cover crops (deep-rooted plants that can break up a hard pan in the soil) such as tillage radish, sorghum-sudangrass hybrids, and clovers allow producers to accomplish biologically what has traditionally been done with mechanical subsoilers and other deep tillage implements. While it is recognized that tillage to control weeds reduces soil organic carbon, the rotation, cover crop, and manure management practices employed generally increase soil carbon levels in organic production systems.

Adapt to Local Conditions

Selection of crop varieties and crop seed for organic production reflects the organic principles of working with nature (i.e., plant what will grow well locally in an organic system). Organic farmers seek out and plant varieties that tolerate locally prevalent pests and diseases with minimum intervention, and that perform well in the farm's climate and soils. Many prefer locally or regionally produced seed, which may show enhanced adaptation to local conditions.

2. Resource Conservation Needs, Opportunities, and Challenges in Organic Agriculture

As described below, the NOP's definition of organic production codifies the organic movement's historical emphasis on ecologically sound practices and resource conservation: organic production is a system managed to "foster cycling of resources, promote ecological balance, and conserve biodiversity." To achieve these objectives, organic producers commonly implement a number of conservation practices that align well with NRCS conservation activities. For example, the 2008 USDA Organic Production Survey identified frequently used conservation practices such as using green manures and animal manures as nutrient sources (65 percent of respondents), buffer strips (58 percent), water management practices (51 percent), no-till or minimum-till (38 percent), beneficial insect habitat (32 percent), and rotational grazing (21 percent).

As the organic farming sector continues to expand in the United States, both new and established organic farmers will seek NRCS assistance to clarify and meet their resource stewardship goals. The high diversity and emphasis on specialty crops characteristic of many organic farms create both opportunities and challenges for the conservation professional.

Environmental Benefits of Organic Farming System

While the environmental benefits vary by farm, in general organic systems can benefit environmental quality in several ways:

- Soil.—Soil-building practices such as crop rotations, cover crops, organic fertilizers, residue management, and minimum tillage are central to organic practices. These practices replenish soil organic matter, feed soil life, reduce erosion, improve soil structure, and enhance nutrient cycling and water retention.

- Water.—Well-managed organic systems rely mainly on slow-release forms of nutrients, which reduce the risk of nutrient runoff and leaching. Enhanced soil structure, water infiltration, and better nutrient retention also reduce the risk of water quality impairment.
- Air and Climate Change.—Organic farming practices increase the return of carbon to the soil, thus removing carbon dioxide (CO_2) from the atmosphere and mitigating global warming.
- Biodiversity.—Organic systems enhance biodiversity at several levels. A variety of seeds and breeds are preferred for their greater resistance to diseases, climate, and pests. Producers employ diverse combinations and rotations of plants and animals. The maintenance and planting of natural areas within and around organic fields and the minimal use of synthetic inputs create suitable habitats for wildlife.[5]

Environmental Challenges of Organic Farming Systems

Organic farming systems also present some distinct environmental challenges:

- Nutrients.—Organic nutrient sources release slowly, and it is difficult to calibrate application rates for optimum production. A reliance on manure and compost to provide adequate nitrogen (N) for organic crops can lead to nutrient imbalances, especially a buildup of excessive soil phosphorus (P). Inadequate crop-available N, especially in early spring when the soil is cool, is a common production constraint for organic farms. Legume cover crops can address this constraint without adding P or other nutrients.
- Tillage.—Without broad-spectrum herbicides, organic annual crop production is more reliant on tillage and cultivation for weed management and seedbed preparation. This can lead to soil erosion, compaction, and organic matter loss. Integrated, ecological weed management strategies, including cover crops and crop rotation, can reduce reliance on cultivation, and additions of organic matter to the soil can mitigate negative impacts of tillage. Awareness of this issue has led an increasing number of organic farmers to implement flame weeding, mulches, reduced-till, and sometimes no-till systems.
- Residues.—Some specialty crop rotations may not provide sufficient crop residues to replenish soil organic carbon or control erosion. Farmers producing high-value crops on limited acreage may find it difficult to implement a crop rotation with substantial residue return because of financial or logistical constraints.
- Transition.—The required 3 years free of NOP-prohibited materials can create an incentive for a farmer to break sod if existing cropland has had recent use of NOP-prohibited materials, while areas in sod have not (see appendix 2 of this handbook, for information about converting Conservation Reserve Program (CRP) land to production). Breaking sod located on sloping land, highly erodible land (HEL), or high conservation value (HCV) land, such as native grassland or prairie, especially raises concerns about resource degradation.

Resources

Describing Organic Agricultural Production in Virginia: Results of the 2004 Farm Survey (Virginia Tech Rural Economic Analysis Program) http://econpapers.repec.org/paper/agsvpturp/14844.htm.

USDA 2008 Organic Production Survey:
http://www.agcensus.usda.gov/Publications/2007/Online_Highlights/Organics/.

5 Food and Agriculture Organization of the United Nations. "What are the environmental benefits of organic agriculture." http://www.fao.org/organicag/oa-faq/oa-faq6/en/.

B. National Organic Program (NOP)

1. USDA Organic Regulations and Roles

Establishment of the NOP

Consumer demand for assurances regarding products marketed as organic led to the establishment of organic certification programs in the 1970s. These programs were administered by private nonprofit organizations and State departments of agriculture, which developed rules or standards for organic production and handling. Although certification programs shared a common theme of allowing natural materials and methods and largely excluding synthetics, differences among programs caused confusion for producers and consumers. A widely recognized need for a consistent nationwide definition and standards for organic agriculture led to the establishment of the USDA's Organic Program. In addition to regulations, the NOP Handbook provides guidance and instructions to help operations comply with the regulations.

Organic Food Production Act of 1990

Part of the Food, Agriculture, Conservation, and Trade Act of 1990 (1990 Farm Bill), the Organic Food Production Act created the NOP within the USDA AMS. After considerable public input, the USDA published a final rule in December 2000. The rule went into effect in April 2001, and was fully implemented in October 2002 after a waiting period to allow time for producers to comply with the new regulations. Since October 2002, the word organic is regulated and all agricultural products labeled organic must be in compliance with USDA organic regulations. Operations with $5,000 or more in gross sales of organic products must be certified.[6]

According to the 2008 USDA Organic Production Survey, 10,903 USDA-certified organic farms and 3,637 exempt organic farms (annual gross sales <$5,000) managed 4.1 million acres and generated $3.16 billion in annual gross sales. In that survey, 37 percent of organic farmers planned to increase organic production, 41 percent planned to maintain current levels, only 8 percent planned to reduce or discontinue organic production, and 14 percent were undecided. As of 2014, the number of USDA-certified organic producers had increased to approximately 12,000.[7]

NOP Requirements and Conservation

Organic producers and conservation professionals share a commitment to resource protection and environmental stewardship. USDA organic regulations and NRCS technical and program implementation guidelines reflect these commonly shared principles. Organic producers, not NRCS staff, are responsible for ensuring they comply with organic regulations. However, numerous NRCS conservation practices can help producers meet USDA organic regulations. Section D of this handbook for organic production systems includes a table that lists Conservation Stewardship Program (CSP) and Environmental Quality Incentive Program (EQIP) practices that can help producers meet USDA organic regulations.

For reference, the full USDA National Organic Program Regulations (7 CFR part 205) can be viewed at http://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&sid=3f34f4c22f9aa8e6d9864cc2683cea02&tpl=/ecfrbrowse/Title07/7cfr205_main_02.tpl.

It provides specific definitions and information for implementing the organic program. Selected excerpts from the USDA organic regulations are provided in appendix 1 of this handbook.

Guidance and Instruction

The NOP periodically publishes guidance and instructions on the interpretation of standards to help certified operations comply with regulations. For example, the NOP has published guidance on the regulation covering the use of seeds and planting stock in organic production. The guidance describes practices for certified operations to demonstrate their efforts to procure all organic seeds; clarifies "equivalent variety"; and describes the form, quality, or quantity criteria that need to be met before organic seeds or planting

6 Organic Trade Association. "US Organic Standards" http://ota.com/.
7 USDA National Organic Program. This does not include all certified operations (i.e,. handling operations). http://apps.ams.usda.gov/nop/.

stock for a desired crop or variety can be considered commercially unavailable. Other guidance includes details on recordkeeping procedures and pesticide testing.

New guidance is first published in draft form for public comment. After reviewing all public comments, NOP publishes finalized guidance in the NOP Handbook and in the Federal Register.[8]

National Organic Standards Board

The Organic Foods Production Act established a 15-member National Organic Standards Board (NOSB). Members are appointed by the Secretary of Agriculture to serve a 5-year term. The NOSB must represent the organic community as follows:

- Four farmers or growers
- Three environmentalists or resource conservationists
- Three consumer or public interest advocates
- Two handlers or processors
- One retailer
- One scientist (toxicology, ecology, or biochemistry)
- One USDA-accredited certifying agent

NOSB members also serve on standing subcommittees that develop recommendations for the full NOSB. Subcommittees include: Compliance, Accreditation, and Certification; Crops; Handling; Livestock; Materials; and Policy Development.[9]

NOSB roles

The NOSB's main roles are to make recommendations about whether a substance should be allowed or prohibited in organic production or handling, to assist in the development of standards for substances to be used in organic production, and to advise the Secretary on other aspects of Organic Foods Production Act (OFPA) implementation. In addition to the authority to make recommendations concerning additions to the National List of Allowed and Prohibited Substances (National List), the NOSB must also review each substance on the National List every 5 years to confirm that it continues to meet all required criteria. This is referred to as the "sunset" review. If USDA agrees with the NOSB's recommendation to remove a substance, then it may remove the substance from the National List. Changing the National List requires USDA to complete rulemaking, a process that includes another public comment opportunity. The NOSB makes recommendations on a wide variety of topics such as unannounced inspections at certified operations or criteria for commercial availability when searching for organic seeds.[10]

Accreditation of Organic Certifiers and Organic Certification of Operatio

The NOP itself does not certify farms and other operations as organic; rather a USDA-accredited certifying agent, or certifier, provides the certification. Certifiers, which may be private, State, or foreign entities, are responsible for certification. To become a certifier, an entity must submit a fee and application which includes information relevant to the entity's capacity to conduct organic certification. Once approved, organizations are accredited for 5 years. An additional onsite assessment is conducted halfway through the 5 years and at the end of that period for entities that renew.[11]

8 National Organic Program. "NOP Guidance" http://www.ams.usda.gov/rules-regulations/organic/draft-guidance.

9 National Organic Program. "National Organic Standards Board New Member Guide 2013." www.ams.usda.gov/sites/default/files/media/NOP-NOSB-NewMemberGuide.pdf.

10 National Organic Program. "National Organic Standards Board." http://www.ams.usda.gov/NOSBHome.

11 National Organic Program. "FAQ: Becoming a Certifying Agent." http://www.ams.usda.gov/services/organic-certification/faq-becoming-certifying-agent.

Most farms and businesses that grow, handle, or process products that are sold as organic must be certified to verify that they comply with the USDA organic regulations. If an operation's gross agricultural income from organic sales does not exceed $5,000 per year, it is considered an "exempt" operation. These operations do not need to be certified in order to sell, label, or represent products as organic, but they must follow USDA organic regulations and cannot use the USDA organic seal.

Operations that are interested in certification can work with any certifier to become certified in one or more of four categories of organic products: crops, livestock, processed products, and wild crops. To become certified, operations must complete an organic system plan (OSP) that describes their practices and substances used. An inspector conducts an onsite inspection to determine if the operation complies with USDA organic regulations. The producer must provide an update annually to maintain organic certification, and inspections are conducted annually.[12]

International markets

Several other countries have separate organic standards and labels such as Canada, the European Union, Japan, Korea, Switzerland, and Taiwan. Through trade agreements, organic products grown in the United States may be sold in these countries as organic. There are only a few additional regulations that producers should be aware of if they are interested in these markets; an operation's certifier can help ensure compliance with these regulations. For example, Canada requires livestock (except ruminants) be produced according to specified stocking rates.[13]

Compliance and Enforcement

To ensure the integrity of the organic standards and use of the term "organic," USDA enforces the OFPA and standards in a number of ways. Certifiers verify compliance annually with an on-site inspection which may be either announced or unannounced. Additionally, at least 5 percent of certified organic operations' products are tested for residues of prohibited substances (such as synthetic pesticides) every year. Certifiers and the public also may submit complaints of alleged regulatory violations to the NOP. If the violation is confirmed through investigation, enforcement action may include (depending on the nature and severity of the violation) product label changes, financial penalties of up to $11,000 per violation, and suspension or revocation of the operation's organic certificate.[14]

A certifier can take any of several steps to address instances of noncompliance by USDA certified organic operations. The certifier may issue a notice of noncompliance for minor issues, such as inadequate recordkeeping, or major issues, such as application of a prohibited substance. If necessary, a certifier may issue a notice of proposed suspension to give the operation some time to work on the noncompliance, achieve compliance, and be reinstated. If the noncompliance is deemed egregious, willful, or not correctable, a Notice of Proposed Revocation may be sent. A certified operation may appeal a notice of proposed suspension or revocation of certification directly to the USDA through the AMS Administrator.[15] Finally, a written notification of suspension or revocation may be sent when a certified operation fails to respond to the previous notices.

Resources

The following resources provide additional information about USDA organic regulations including the use of organic seeds and allowed materials.

12 National Organic Program. "Becoming a Certified Operation." http://www.ams.usda.gov/services/organic-certification/faq-becoming-certified.

13 National Organic Program. "Information for International Trade Partners." http://www.ams.usda.gov/NOPInternationalAgreements.

14 National Organic Program. "Compliance and Enforcement." http://www.ams.usda.gov/NOPComplianceandEnforcement.

15 National Organic Program. "Instruction: National Organic Program Enforcement." www.ams.usda.gov/sites/default/files/media/4002.pdf.

Association of Official Seed Certifying Agencies (AOSCA). http://www.organicseedfinder.org/.
Organic Seed Finder (Web site) lists sources of organic seeds and indicates when no organic source of crop varieties with selected characteristics can be found.

Organic Materials Review Institute (OMRI) http://www.omri.org.
OMRI reviews and maintains listings of generic and brand names of fertilizers, soil amendments, pest controls, and other inputs that are allowed, restricted, or prohibited for certified organic production.

USDA AMS National Organic Program http://www.ams.usda.gov/nop.

USDA AMS NOP Program Handbook http://www.ams.usda.gov/NOPProgramHandbook.
Handbook provides supplemental information to facilitate understanding and implementation of the Standards, including Guidance Documents, Instruction Documents, and Policy Memos.

USDA NOP Guidance 5029: Seeds, Annual Seedlings, and Planting Stock in Organic Crop Production
http://www.ams.usda.gov/sites/default/files/media/5029.pdf.
Clarifies the Seeds and Planting Stock Standard (NOP 205.204) and its interpretation.

2. Overview of Organic Certification Process Through NO

Transition to Organic

While production activities and documentation required by the organic regulations must be followed for 36 months prior to the first sale of an organic crop, producers are not required to be certified during this transition period. Producers can, however, discuss organic requirements, including whether specific inputs are allowed, restricted, or prohibited, with an organic certification agency during this transition. In addition, there are numerous organizations that support producers during the transition and provide assistance concerning what activities are required in order to achieve organic certification (see resources in this section).

Land that has had no prohibited materials applied for 36 months is eligible to be certified as organic with no waiting period. Documentation from landowners and operators of how that land has been used and managed must be provided to the organic certification agency to verify there were no prohibited materials applied. If the land is currently in crop production, the operator must document that any inputs, including seeds and seed treatments, meet the organic standards. Certified organic seed is not required during the transition.

Organic certification can be done on a field-by-field basis, as long as there are defined field boundaries. There is no requirement that the entire farm be certified organic; a farmer may choose to manage both organic and nonorganic fields. If a producer grows both organic and nonorganic crops of the same species, the certifier will closely scrutinize the management, harvest, storage, and sale of these organic and nonorganic crops. Buffer zones between organic and nonorganic crop fields need to be in place before the organic part of the operation can receive certification.

There is no nationally recognized definition, labeling category, or market for crops during the 3-year transition period. During this time, crops may not be represented as organic. Producers may state truthfully that they are transitioning when selling direct to consumers, and there are some commodity crop buyers that will pay a small premium for crops that are non-genetically modified organisms (GMOs) or are grown without synthetic inputs.

Typically the producer applies for organic certification the first year they can sell an organic crop. When applying for certification, producers must provide 3 years of land history to the organic certification agency to document that the requirements have been met. If a producer has not had control of the land for all of the 3 transition years, they will need to obtain a signed document from the previous operators of that land describing what materials had been used as well as the crops grown and seeds planted. Many certifiers provide a form that landowners can use to verify this compliance.

Organic Certification Agencie

Producers may work with any certification agency and all use the same USDA organic regulations. Producers seeking organic certification for the first time will need to search and decide which agency meets their needs. Other organic farmers in their region should have knowledge of certification agencies that have provided satisfactory service.

Organic certification agencies are accredited by the USDA to perform organic certification activities by scope: crop, wild crops, livestock, and handling. Producers should discuss which scope a certifier covers to ensure the certifier can provide them with the services they need. Handling refers to any activity beyond raw agricultural production on the farm and includes activities such as grain cleaning and food processing. Some operations may be certified under two or more scopes.

The USDA's AMS Web site lists organic certification agencies alphabetically by name as well as by State, at http://www.ams.usda.gov/services/organic-certification/certifying-agents.

OSP and Application

A producer should begin working with an organic certification agency at least 6 months prior to the planned sale of their first certified organic crop. The agency will send them a packet containing their fee schedules, the organic regulations, and an organic certification application which may also be called the OSP. This OSP covers all aspects of farm management and typically follows the organic regulation section by section, asking questions that can be answered in narrative or multiple-choice formats. The OSP is extensive, including a full description of inputs (ingredients, rates, and dates of use); crop rotations with 3 years of past field histories and projected current year's cropping plans; weed, pest and disease management; adjoining land use and buffer zones; all equipment and storage used; and transportation, labeling, and sales records. Depending on the complexity of the operations, the first OSP may take a farmer 4 to 6 hours to complete. Updating OSPs in subsequent years may only take an hour to complete.

A producer sends their completed OSP along with a base payment to the certification agency. If all farm management information, field maps, and input ingredient information is complete, the certification agency reviews the OSP and then assigns the file to an inspector. If it appears the operation does not meet organic regulations, the certification agency will typically discuss areas of noncompliance with the operator and outline steps that need to be taken before the organic certification process can move forward. Once certified, organic producers must update their OSP throughout the year.

Figure 2 NRCS staff and producers discuss organically managed lettuce seed production

Organic Inspection

To renew certification, the producer must submit an updated OSP and have an onsite organic inspection each year. Many certifiers have shorter forms for the annual OSP update. Organic inspectors may be staff of the organic certification agency or they may be independent contractors that work for a variety of certifiers. Depending on the complexity and size of the operation, an organic inspection typically takes between 3 to 6 hours. The organic inspector will verify the items on the OSP, both with documentation and by physically reviewing the fields, livestock, buildings, and equipment. At the end of the inspection, the inspector will discuss with the producer any areas of concern or items that need to be submitted before organic certification can be granted. The inspector is an objective observer and reporter and

does not make the final decision whether or not to certify an operation. Organic inspections do not always occur the same time of year, although they typically happen when crops are growing or the activity being certified (such as maple syrup production) is occurring. Organic certification agencies are also mandated by the USDA to perform unannounced inspections on 5 percent of certified operations annually.

Review and Certification Decisio

The organic inspector submits a written report to the organic certification agency along with any further supporting documentation such as input labels or photographs where applicable. An employee of the organic certification agency reviews these items along with the OSP and determines whether the operation complies with USDA organic regulations. The certification agency will then communicate its findings with the producer through a certification determination letter. The letter may grant organic certification, request further information so that a determination can be made, or state a requirement that the farmer must meet in order to receive or retain organic certification. Finally, the letter may deny certification on one or more fields if a prohibited material had been used within 36 months of the planned organic harvest.

The operator may need to pay an additional fee to cover the cost of the inspection before receiving their organic certificate. Once issued, the organic certificate remains in effect until surrendered, suspended, or revoked. Operators typically use their organic certificates as documentation to prove current organic certification to buyers at the wholesale and retail levels. The USDA's AMS also maintains a listing of certified organic operations on their Web site. This list is updated at least annually, and as of September 2015, AMS launched a new version of the database that provides more timely and accurate information about certified operations. The new "Organic Integrity Database" allows users to search for any certified organic farm, ranch or food processor, both domestically and internationally, and to view a new series of summary reports.

There is an appeals process (section A-2 of this handbook) for certified organic operators and operators applying for organic certification if they feel the determination by the organic certifier is not correct.

Resources

List of Certified USDA Organic Operations (USDA AMS NOP) http://apps.ams.usda.gov/nop/.

Guide for Organic Crop Producers (USDA AMS and the National Sustainable Agriculture Information Service/ATTRA http://www.ams.usda.gov/services/organic-certification/is-it-an-option. This publication provides a detailed overview of the certification process for crop producers.

Guide for Organic Livestock Producers (USDA AMS and ATTRA)
http://www.ams.usda.gov/sites/default/files/media/GuideForOrganicLivestockProducers.pdf.
This publication provides a detailed overview of the certification process for livestock producers.

Organic Crop Production Overview (ATTRA)
https://attra.ncat.org/attra-pub/summaries/summary.php?pub=66. This publication provides an overview of conservation practices and principles used on organic farms.

Organic Certification of Farms and Businesses Producing Agricultural Products (USDA AMS and ATTRA)
https://attra.ncat.org/attra-pub/summaries/summary.php?pub=152. This publication provides an overview of the certification process, who needs to be certified, and more.

OSP Template for Crop and/or Livestock Production (USDA AMS and ATTRA)
https://attra.ncat.org/attra-pub/summaries/summary.php?pub=359. This publication provides OSP templates for both crop and livestock production.

Guidebook to Organic Certification (Midwest Organic and Sustainable Education Service (MOSES))
http://mosesorganic.org/publications/guidebook-for-certification/. Along with this guidebook organized in a question and answer format, MOSES has more than 30 fact sheets detailing organic certification requirements for various farming systems as well as describing a variety of organic production activities.

How to Choose a Certification Agency & the Organic Certification Process (MOSES)
http://mosesorganic.org/wp-content/uploads/Publications/Fact_Sheets/07CertificationAgencyprocess.pdf

Organic Education Organizations

Ecological Farming Association-California	http://www.eco-farm.org
California Certified Organic Farmers	http://www.ccof.org/
Carolina Farm Stewardship Association	http://www.carolinafarmstewards.org
Florida Organic Growers	http://www.foginfo.org
Georgia Organics	http://georgiaorganics.org
Illinois Organic Association	http://illinoisorganicgrowers.org/
Iowa Organic Association	http://iowaorganic.org
Louisiana Organic Association	http://www.ibiblio.org/farming-connection/index.html
Maine Organic Farmers and Gardeners Association	www.mofga.org
Maryland Organic Food and Farming Association	http://marylandorganic.org/
Michigan Organic Food and Farm Alliance	http://www.moffa.net
Midwest Organic and Sustainable Education Service	www.mosesorganic.org
Missouri Organic Association	http://www.missouriorganic.org
Montana Organic Association	http://montanaorganicassociation.org
Northeast Organic Farming Association—Chapters in Connecticut, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island and Vermont	www.nofa.org
Northern Plains Sustainable Agriculture Society-North Dakota	http://www.npsas.org
Ohio Ecological Food and Farming Association	http://www.oeffa.org
The Kerr Center for Sustainable Agriculture-Oklahoma	http://www.kerrcenter.com
Oregon Tilth	http://tilth.org/
Pennsylvania Association for Sustainable Agriculture	https://www.pasafarming.org
Texas Organic Farmers and Gardeners Association	http://www.tofga.org
Tilth Producers of Washington	http://tilthproducers.org
Virginia Association for Biological Farming	http://vabf.org
Wild Farm Alliance	www.wildfarmalliance.org

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C. Conservation Planning With Existing Organic and Transitional Producers

1. Nine Steps of Conservation Planning in Organic Systems

USDA organic regulations, organic production principles, and NRCS conservation planning objectives align closely and include many opportunities for conservation objectives and organic regulations to be met simultaneously. Although organic standards regarding natural resources do not set quantitative criteria, they require the producer to maintain (not degrade) natural resources and encourages them to improve the resource condition. The NRCS conservation planning process applies to all types of agricultural operations, including organic farms. There are, however, a few considerations unique to organic systems that may impact the planning process. This section focuses only on the issues and opportunities related to organic systems, not the general conservation planning process.

Conservation Planning Phase I: Collecting and Analyzing Information

Step 1: Identify Problems and Opportunities

Organic farms are subject to the same resource concerns as all farming operations. However, there are some resource problems and opportunities that commonly occur in organic systems (some challenges described in section A of this handbook):

- Natural Resources.—There are a range of opportunities to work with organic producers as they are required to maintain or improve the natural resources of the operation defined as the "physical, hydrological, and biological features of a production operation, including soil, water, wetlands, woodlands, and wildlife."
- Natural Areas.—Organic producers are required to maintain or improve biodiversity and prevent exposure of organic production areas to NOP-prohibited substances. In addition, many producers would like to provide habitat for natural enemies (predators and parasites) of crop pests, and enhance natural areas on the farm through the use of native plants. Conservation plantings such as field borders, hedgerows, and riparian buffers established to protect water and soil resources and provide wildlife and pollinator habitat, may also harbor natural enemies of pests and intercept pesticide and GMO pollen drift from neighboring nonorganic farms.
- Nutrients.—In organic systems that exclude synthetic fertilizers, the use of plant and animal materials for fertility can enhance soil health and biological activity. However, a reliance on manure and compost to provide adequate N for organic crops can lead to nutrient imbalances, especially a buildup of excessive soil P. Legume cover crops can address this constraint. Installing suitable facilities for composting and manure storage can help organic producers meet organic regulatory requirements to protect water quality.
- Livestock and Pasture.—Organic livestock producers must provide ruminant animals with pasture throughout the grazing season, and prevent negative resource impacts from the livestock operation. These requirements offer opportunities to implement livestock-related conservation practices such as prescribed grazing, forage planting, and watering facilities.
- Tillage.—Without a cost-effective choice of allowed herbicides, organic annual crop production is more reliant on tillage and cultivation for weed management and seedbed preparation. This can lead to soil erosion, compaction, and organic matter loss. Integrated, ecological weed management strategies that include cover crops and rotation can reduce reliance on cultivation. Cover crops and other inputs of organic materials to the soil can mitigate negative impacts of tillage. In addition, more organic producers are implementing conservation tillage, including no-till termination of high-biomass cover crops.
- Residues.—Some specialty crop rotations (not limited to organic systems) may not provide sufficient crop residues to replenish soil organic carbon or control erosion. Producers can integrate high residue cover or production crops into the rotation, and can minimize bare soil periods through tight rotation schedules and relay intercropping.

- Transition.—The required 3 years free of NOP-prohibited materials can create an incentive for a farmer in transition to organic production to use formerly idle land for production. Previously unused land may be sloping, HEL, or HCV land, such as native grassland or prairie, all of which raise resource issues.

Step 2: Determine Objectives

USDA organic regulations requires organic producers to protect a wide range of natural resources, and many producers seek to enhance resource conditions beyond the level of nondegradation. At a broad level, the objective of a producer may be to develop an organic production system that addresses all resource concerns and meets organic regulatory requirements. More specifically, a producer may want to develop riparian and other natural areas for enhanced wildlife and beneficial habitat, native plants, or improved water quality and aquatic habitat. Other producers may want to enhance vegetative buffers to increase the biodiversity of the farm by providing habitat for beneficial organisms, produce organic milk from a 100-head jersey dairy and address runoff issues of the farmstead, or produce both edible and feed-grade organic soybeans while enhancing the soil's health.

Step 3: Inventory Resources & Step 4: Analyze Resource Data

- Soil.—Due to the complex nature of many organic cropping systems, the use of the Revised Universal Soil Loss Equation 2 (RUSLE2) and the Wind Erosion Prediction System (WEPS) to calculate soil loss may be challenging. Ensure that appropriate tillage operations are selected. Cover crops and applications of compost and other organic materials can mitigate the negative impacts of tillage. See RUSLE 2 in Organic Systems webinar for more information.
- Water.—Use of slow-release sources of crop nutrients in organic systems can reduce risks to water quality. However, heavy reliance on compost and manure for fertility, especially when application rates are not closely matched to plant needs, may lead to excessive P or soluble N and negative impacts on water quality. Some organic producers use pest control substances such as pyrethrum, azadirachtin, and spinosad, which can present a risk to water quality that should be evaluated with the assessment tool, Windows Pesticide Screening Tool: (WIN-PST).
- Air.—Organic producers near conventionally managed land (farmland, residential, commercial land, etc.) are often concerned about chemical spray drift and airborne soil particulates that could contain prohibited substances.
- Plants.—USDA organic standards require organic growers to emphasize prevention, avoidance, and biological controls to deal with crop pests. This approach can reduce resource impacts of organic pest management practices.
- Animals.—Organic livestock producers are required to have ruminants on pasture for at least 120 days during the grazing season, and to provide 30 percent of dry-matter intake for ruminants during that period. Although USDA organic standards do not specify stocking rates, producers must manage pastures to maintain adequate forage quality and quantity, and to protect water resources.
- Energy, People, and Environmental Law Compliance.—These concerns include many considerations that affect all agricultural producers. NRCS can support producers by providing recommendations or designs that are compatible with USDA organic regulations.

Conservation Planning Phase II: Decision Support

Step 5: Formulate Alternatives & Step 6: Evaluate Alternatives

While developing the list of NRCS conservation practices that might be needed, consider those practices within the context of organic systems whose implementation can be modified for greater conservation benefit. For example, while many organic farmers use cover crops, they may plant only one species, terminate the cover crop before it achieves high biomass, or terminate it by harvest.

When formulating and evaluating alternatives, it is important to consider USDA organic regulations that may limit some options and affect costs of implementation. USDA organic regulations that may impact implementation of conservation practices include:

- Unless specifically allowed, organic producers may not use synthetic substances for weed, insect pest, and disease control; fertility; and seed treatment.
- During transition to organic, the last application of NOP-prohibited materials must be 3 years prior to the harvest of an organic crop.
- Producers must use organically grown seeds and planting stock unless they are not commercially available.
- The USDA organic regulations do not allow use of lumber treated with prohibited materials if the lumber will contact animals, manure, compost, plants, or soil that are parts of the organic production system.

Step 7: Make Decisions

Once a client has selected a practice to implement, encourage the producer to contact their certifying agent. Unless the practice is already included in their OSP, producers should obtain approval from their certifier prior to implementation.

Section D of this handbook, has information and resources related to many conservation activities and practices integral to organic systems. Please see the respective sections for details about implementing those practices in organic systems.

Conservation Planning Phase III: Application and Evaluation

Step 8: Implement the Plan

Many States have developed organic job sheets for a number of practices. If available, use these job sheets when installing practices in organic systems. Section D of this handbook ("Integral Conservation Activities"), also includes implementation guides and other resources to support conservation activities in organic production.

Producers are responsible for contacting their certifier to verify compliance of planned activities with organic standards. They should ensure that plans and specifications for implementation of NRCS practices align with USDA organic regulations.

Step 9: Evaluate the Plan

When evaluating the conservation plan and practices with the producer, assist them as they assess how effectively the plan has utilized opportunities to address both their conservation and USDA organic compliance objectives. In addition, help them look for any barriers to success that are specifically related to the producer's organic certification. Let your supervisor and appropriate technical specialists know if practice standards, specification, designs, or job sheets conflict with organic regulations or organic practices.

Resources

The NRCS Title 180, National Planning Procedures Handbook
http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=36483.wba.

2. Technical Service Providers

In many States, NRCS technical service providers (TSPs) play an important role in conservation planning in organic systems. Unfortunately there is often a lack of TSPs certified to provide this assistance. If your State needs TSPs for conservation activity plans (CAPs) or other conservation work with organic producers (described below), contact EQIP organic program specialists or other NRCS organic contacts listed here: http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/landuse/crops/organic/.

Resources

Becoming a Technical Service Provider for NRCS: An Introduction (Midwest Organic and Sustainable Education Service (MOSES)) http://www.youtube.com/watch?v=mZdq5z5hAu0&feature=youtube.

3. CAP Supporting Organic Transition (CAP 138)

CAP 138 helps farmers who are interested in transitioning from conventional to organic production by addressing the natural resource concerns on their operation. As with all CAPs, to receive financial and technical assistance from NRCS for completion, it must be prepared by NRCS certified TSPs.

CAP 138, which was revised for 2015, consists of three sections: Resource Inventory, Erosion Control Inventory, and Summary Record of Planned NRCS Conservation Practices. The resource inventory section may serve as a portion of an OSP, but it is not a replacement for the OSP. The information included in the resource inventory can be relevant and useful in helping the producer apply for organic certification; however, the producer is responsible for completing all of the OSP requirements not addressed by the resource inventory. The AMS NOP worked closely with NRCS to develop the 2015 CAP 138 resource inventory. The resource inventory, when submitted with the supplemental companion document "Resource Inventory Supplement," contains all of the required components of an OSP. Current USDA organic regulations do not require the use of a specific OSP. The use of the resource inventory and the "Resource Inventory Supplement" is completely optional.

Some TSPs have voluntarily provided additional information needed to meet requirements of an OSP as part of their deliverables for the CAP 138, however, NRCS payment rates do not include or address this extra work. It is important that when approving EQIP CAP agreements that the participant is informed that NRCS will not reimburse producers for any extra work provided by TSP beyond the CAP requirements and the grower will be responsible for any additional charges from the TSP.

After receiving a CAP 138, farmers can develop a full conservation plan with NRCS and apply for financial assistance to implement conservation practices or enhancements.

Resources

Conservation Activity Plan (CAP) 138 and OSP Supplements
http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/programs/financial/eqip/?cid=stelprdb1262227.

4. Conservation Compliance

As with all producers, in order for organic producers to receive some USDA benefits (e.g., NRCS conservation programs, including EQIP Organic Initiative, crop insurance, and farm loans, etc.) they must be in compliance with conservation provisions for HEL conservation and wetland conservation as set forth by the Food Security Act of 1985. USDA organic regulations also align with the intention of these conservation provisions. As described appendix 1 of this handbook, USDA organic regulations require organic producers to “select and implement tillage and cultivation practices that maintain or improve the physical, chemical, and biological condition of soil and minimize soil erosion.” Additionally, producers must “maintain or improve the natural resources of the operation, including soil, water wetlands, woodlands and wildlife.”

As a component of organic certification, all fields are inspected and soil erosion concerns are documented by the organic certification agency in the annual inspection report. The certification agency may require remedial action to address a concern and any mitigating activities will be reviewed and reported in the following year’s organic inspection. In response to concerns regarding appropriate soil conservation practices on organic farms, the AMS NOP began working with certifiers in 2014 to evaluate compliance with the HEL provisions. The effort may result in training, tools, or potentially guidance on the topic. USDA organic regulations do not require the use of tools such as RUSLE2 to measure erosion. To assess this, certifiers typically rely on visual observations at the time of an inspection along with other indicators such as soil tests, and management practices including crop rotations, cover cropping, and compost applications.

Resources

Highly Erodible Land Conservation & Wetland Conservation Compliance (NRCS)
http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/programs/farmbill/?cid=stelprdb1257899.

D. Integral Conservation Activities for Organic Production Systems

Implementation of NRCS conservation activities offered through EQIP and CSP can assist organic producers in meeting a range of USDA organic requirements. Some conservation practices can play an integral role in organic systems and help transitioning organic producers bring their operations into compliance with USDA organic standards. CSP enhancement activities that build upon these practices provide an opportunity for organic producers to attain higher levels of resource stewardship.

The table below lists integral conservation practices for each of several USDA organic standards. Many other NRCS conservation activities can contribute to effective resource conservation on organic farms and ranches and nearly all offer USDA organic-compatible implementation scenarios. NRCS maintains an Organic Crosswalk document for EQIP and CSP that shows the correlation among USDA organic regulations, NRCS resource concerns, and relevant conservation activities.

Table 1 Integral NRCS Conservation Activities for Organic Systems

USDA Organic Standard	Integral Conservation Practice Standards (CPS)
Natural Resources & Biodiversity • Maintain and improve soil, water, woodlands, wetlands, wildlife • Conserve biodiversity	- • CPS 395 Stream Habitat Improvement and Management • CPS 612 Tree/Shrub Establishment • CPS 643 Restoration and Management of Rare and Declining Habitats • CPS 644 Wetland Wildlife Habitat Management • CPS 645 Upland Wildlife Habitat Management • And all practices listed in the following sections
Land Requirements • 3 years without prohibited substances • Buffers and barriers to protect organic production areas	- • CPS 327 Conservation Cover • CPS 362 Diversion • CPS 380 Windbreak/Shelterbelt • CPS 386 Field Border • CPS 390 Riparian Herbaceous Cover • CPS 391 Riparian Forest Buffer • CPS 393 Filter Strip • CPS 422 Hedgerow
Soil Fertility and Crop Nutrient Management • Implement tillage practices that improve soil condition and minimize erosion • Manage nutrients through rotations, cover crops, and use of plant and animal materials • Avoid contamination of crops, soil, water	- • CPS 329 No-till • CPS 332 Contour Buffer Strips • CPS 345 Reduced Till • CPS 585 Stripcropping • CPS 340 Cover Crop • CPS 590 Nutrient Management

USDA Organic Standard	Integral Conservation Practice Standards (CPS)
Crop Rotation	-
• Including sod, cover crops, green manures, catch crops	• CPS 328 Conservation Crop Rotation • CPS 340 Cover Crop
• Control erosion, increase soil organic matter, manage nutrients and pests	
• Alley cropping, intercropping, hedgerows, etc., for perennials	• CPS 311 Alley Cropping • CPS 422 Hedgerow
Crop Pest, Weed, & Disease Management	-
• Crop rotation, cultural practices for crop health	• CPS 595 Integrated Pest Management
• Habitat for natural enemies of pests	• CPS 327 Conservation Cover • CPS 386 Field Border
• Mowing, mulching, grazing, cultivation for weeds	• CPS 484 Mulching
-	• CPS 649 Structures For Wildlife
Livestock Living Conditions	-
• Access to outdoors, sun, shade, clean water, shelter, pasture (ruminants)	• CPS 311 Alley Cropping (shade) • CPS 380 Windbreak (shelter) • CPS 516 Livestock Pipeline • CPS 576 Livestock Shelter • CPS 614 Watering Facility
• Manage manure, outdoor areas to protect water and soil	• CPS 317 Compost Facility • CPS 367 Roofs and Covers • CPS 558 Roof Runoff Structure • CPS 590 Nutrient Management
Pasture (Ruminants)	-
• 30% of dry matter intake • Pasture quality • Minimize diseases and parasites	• CPS 511 Forage Harvest Management • CPS 512 Forage Planting • CPS 550 Range Planting • CPS 381 Silvopasture Establishment • CPS 528 Prescribed Grazing
-	-
• Fencing, shade, water • Protect soil & water quality • Prevent erosion • Protect wetlands and riparian areas	• CPS 382 Fence • CPS 390 Riparian Herbaceous Cover • CPS 391 Riparian Forest Buffer • CPS 657 Wetland Restoration

The following sections include resources that can help producers and NRCS field staff implement the Conservation Practice Standards (CPSs) listed in the table above in the context of organic production systems. The resources listed below are the most comprehensive and relevant to organic systems. In some topic areas, additional resources were identified to provide more information and are included in the appendix.

See appendix 1 of this handbook, USDA Organic Production Requirements Related to Resource Conservation, for the text of applicable regulations. In addition to regulations, the NOP Handbook provides guidance and instructions to help operations comply with the regulations.

1. Nutrient Management

Organic growers rely on a healthy soil food web to release crop-available nutrients from soil organic matter and organic amendments. To support this ecology, they must continually replenish organic materials in the soil. Because synthetic fertilizers are generally not allowed in organic systems, the majority of nutrients must come from plant-derived or animal-derived products, in which nutrients are combined with carbon (C). In organic systems, the N and C cycles are closely linked and nutrients, particularly N, must be managed with this in mind.

Compared to conventional fertilizers, most organic fertilizers have lower concentrations of nutrients and act more slowly because nutrient release depends on the level of soil biological activity in order to digest the applied materials. As a result, some portion of the nutrients will be released in years subsequent to the application. In this context, implementation of CPS Code 590, Nutrient Management, may differ for organic versus conventional systems. NRCS can help organic and transitioning producers to understand nutrient cycling in their soil, develop nutrient budgets, and implement practices that support and build soil health.

Resources

Nutrient Management Plan (590) for Organic Systems: Western State Implementation Guide (Oregon Tilth, National Center for Appropriate Technology (NCAT), NRCS)
http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/landuse/crops/organic/

Figure 3 Roots and soil under organically managed sudan grass cover crop

State-specific versions of this guide are being developed for certain States; final versions will be available here: http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/landuse/crops/organic/. This publication discusses CPS 590 as a tool for meeting the USDA organic regulations' nutrient management requirements and minimizing environmental risks from applied N and P. It covers major and minor nutrients, and how to estimate N release from cover crops, past organic inputs, and soil organic matter.

Soil Fertility in Organic Systems: A Guide for Gardeners and Small Acreage Farmers (Washington State University)
https://pubs.wsu.edu/ItemDetail.aspx?ProductID=15585&SeriesCode=&CategoryID=&Keyword=646.
This guide covers soil and nutrient dynamics in organic systems and provides nutrient management guidelines for wetter and drier parts of the Northwest that take into account N credits for cover crops, soil organic matter, and past inputs, and environmental concerns.

Soil Fertility Management for Organic Crops (University of California) http://anrcatalog.ucdavis.edu/pdf/7249.pdf. Written specifically for California climate, soils, and production systems, this publication offers practical guidance on nutrient sourcing and N mineralization from soil organic matter, cover crops, compost, and purchased organic fertilizers.

Managing Manure Fertilizers in Organic Systems (University of Illinois, eOrganic) http://www.extension.org/pages/18628/managing-manure-fertilizers-in-organic-system. This article covers USDA organic regulations regarding manure as a nutrient source in certified organic crop production. It addresses food safety and environmental considerations, and provides protocols for manure testing and determining application rates based on soil test trends.

Nutrient Management on Organic Vegetable Farms (University of Vermont) http://www.uvm.edu/vtvegandberry/factsheets/Nutrient%20Management%20on%20Organic%20Vegetable%20Farms.pdf. This bulletin covers practical nutrient management for New England organic producers, including crop rotation, cover crops, and instructions for determining N, P, and K application rates, which consider nutrient credits from cover crops, manure, compost, and mineralization from soil organic matter.

Sources of Organic Fertilizers and Amendments (The National Sustainable Agriculture Information Service (ATTRA)) https://attra.ncat.org/attra-pub/org_fert/. Database listing suppliers of organic fertilizers, soil amendments, compost, and mycorrhizal and other inoculants for compost or soil by State.

Using Organic Nutrient Sources (Pennsylvania State University, Sustainable Agriculture Research and Education (SARE)) http://www.sare.org/Learning-Center/SARE-Project-Products/Northeast-SARE-Project-Products/Whole-Farm-Nutrient-Planning-for-Organic-Farms. This resource covers how to: use a soil test report to guide organic nutrient management and compost application rates, account for the slower release of organic sources, provide balanced crop nutrition, optimize cost efficiency, protect water and other resources, and meet USDA organic regulatory requirements.

See appendix 2 of this handbook for additional resources.

2. Cover Crops

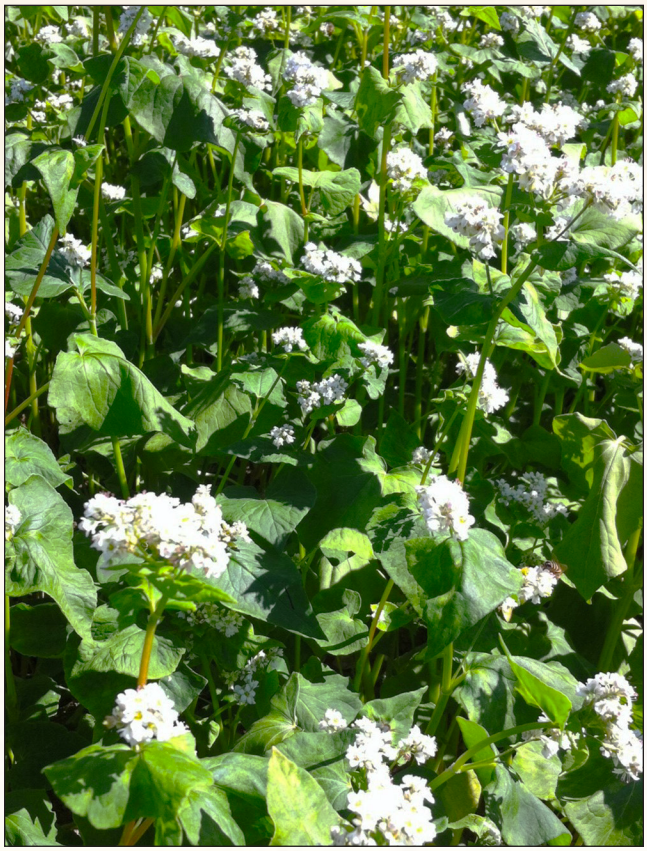
The purposes of cover cropping (CPS Code 340, Cover Crop) in organic systems do not differ from those in conventionally managed systems. However, the multiple functions of cover crops take on greater importance in organic systems in which synthetic chemical fertilizers and pesticides are generally not used. Cover crops can fix N (legumes); improve availability of P, K, and other soil nutrients; add organic matter and feed the soil food web; protect the soil from erosion and compaction; suppress weeds and disrupt pest and disease life cycles; and provide habitat for beneficial organisms. USDA organic standards cite cover cropping as an important component of organic crop rotations and a key practice for soil and nutrient management. NRCS staff can help producers by understanding the farmers' goals for their cover crop, and helping them design a cover crop mix that is manageable, economically viable, and that meets their needs.

Resources

CPS Code 340, Cover Crop, in Organic Systems: Western State Implementation Guide (Oregon Tilth, NCAT, NRCS, Xerces Society) http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/landuse/crops/organic/.

State-specific versions of this guide are being developed for certain States; final versions will be available here: http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/landuse/crops/organic/. This guide discusses the selection and management of cover crops for various objectives (N, organic matter, beneficial insects, etc.), soils and climates, cropping systems, and seasonal niches in the crop rotation. It covers seeding rates, planting dates, field preparation, and planting and termination methods.

Figure 4 Organically managed buckwheat cover crop.



Cover Cropping in Organic Farming Systems (eOrganic)
http://www.extension.org/pages/59454/cover-cropping-in-organic-farming-systems. This Web site houses an extensive list of guides, videos, webinars, and other resources organized by cover crop species and cover cropping purpose.

Cover Crops for Organic Farms (Center for Environmental Farming Systems)
http://www.cefs.ncsu.edu/resources/organicproductionguide/covercropsfinaljan2009.pdf. This publication discusses cover crop species best suited for the Southeast and their benefits and drawbacks in relation to the region's soils, climates, and prevalent insects, pest nematodes, and crop diseases. It also offers instruction on cover crop planting and termination, and estimating cover crop biomass, total and available N.

Managing Cover Crops Profitably, 3rd edition (SARE)
http://www.sare.org/Learning-Center/Books/Managing-Cover-Crops-Profitably-3rd-Edition. This handbook describes how cover crops work and how to integrate them into various cropping systems for soil fertility, pest management, and other purposes. A set of charts summarizes best cover crops for different regions, seasons, and objectives; and advantages, drawbacks, planting rates and methods for each cover crop species. Detailed chapters cover 20 of the most widely used cover crops.

Midwest Cover Crop Council www.mccc.msu.edu. Resource for cover cropping in the Midwest which includes research, info sheets, cover crop selector tools, and farmer profiles about cover crop use in crop rotations, including a few on organic farms.

Northern Great Plains Cover Crop Chart (USDA, ARS)
http://www.ars.usda.gov/Services/docs.htm?docid=20323. Chart organized by cover crop species which links to a summary of information about that species.

Cover Crops for All Seasons: expanding the cover crop tool box for organic vegetable producers (Virginia Association for Biological Farming (VABF))
http://vabf.files.wordpress.com/2012/03/seasonalcovercrops_sm.pdf. Information in narrative and tabular form on the performance, benefits, and best planting and management methods for over 30 cover crops evaluated for organic vegetable cropping systems in the mid-Atlantic and upper Southeast.

Reduced Tillage and Cover Cropping Systems for Organic Vegetable Production (VABF)
http://vabf.files.wordpress.com/2012/03/reducedtillage_sm.pdf. Recommendations for cover crop management and no-till cover crop termination and cash crop planting for organic vegetable production, based on research conducted at Virginia Tech as well as the mid-Atlantic and upper Southeast.

2013 Cover Crop Innovations Webinar Series (Pennsylvania State University)
http://www.sare.org/Learning-Center/SARE-Project-Products/Northeast-SARE-Project-Products/2013-Cover-Crop-Innovations-Webinar-Series.
This webinar series includes cover crops for organic no-till and reduced-till systems, interseeding, cover

crops for small dairy farms, managing beneficial and pest insects, nutrient and weed management in organic no-till cover crop systems, and managing N with cover crop mixtures.

NRCS Cover Crop Termination Guidelines (NRCS)
www.nrcs.usda.gov/wps/PA_NRCSConsumption/download?cid=STELPRDB1263099&ext=pdf. This document describes guidelines applicable to all USDA programs that were developed by NRCS, RMA and FSA.

See Section 4, "Crop Rotation," of this handbook, for additional resources.

3. Compost

Compost is an important soil amendment for many organic farms because it provides an inoculum of beneficial soil organisms as well as humus, micronutrients, and slow-release N, P, and K. When farms or fields with poor soil health and low nutrient levels are first brought into organic production, heavy compost applications (10–20 tons per acre) can be the quickest way to improve soil fertility. Manure-based compost may have relatively high levels of salts, as well as P, so the producer should ask the supplier to provide information about levels of nutrients and salts, and conduct soil tests regularly to determine appropriate compost application rates.

Organic livestock producers can optimize nutrient cycling and protect water and other resources through proper composting of manure. NRCS can assist organic producers in constructing a suitable composting facility (CPS Code 317) and applying compost in a manner consistent with sound nutrient management (CPS Code 590).

Resources

Making and Using Compost for Organic Farming (University of Illinois, eOrganic)
http://www.extension.org/pages/18567/making-and-using-compost-for-organic-farming. This article discusses USDA organic regulations and guidance regarding composition, production, and use of compost on organic farms and briefly summarizes the composting process and farm-scale composting methods (windrow, aerated static pile, in-vessel) with links to other resources.

Guidance: Compost and Vermicompost in Organic Crop Production (AMS NOP)
http://www.ams.usda.gov/NOPProgramHandbook. This publication reviews USDA organic regulations and includes guidance about compost and vermicompost in organic systems.

4. Crop rotations

Crop rotations are required on organic farms and are used to reduce pest and disease problems, reduce weed pressure, reduce soil erosion, build organic matter, and support a diverse soil microbial community. Rotations that include several crops of different plant families support better soil health than simpler rotations. A diverse crop rotation that includes legumes and deep rooted crops can enhance the efficient cycling and utilization of crop nutrients. On sloping land, integrating a conservation crop rotation (CPS Code 328) with other practices such as strip cropping (CPS Code 585) or contour buffer strips (CPS Code 332) can greatly reduce soil erosion and protect soil health.

Resources

Crop Rotation on Organic Farms: A Planning Manual (SARE, Natural Resource, Agriculture, and Engineering Service (NRAES)) http://www.sare.org/Learning-Center/Books/Crop-Rotation-on-Organic-Farms. Utilizing input from experienced organic farmers, this manual gives detailed guidance in designing a crop rotation to improve soil health under different field conditions; manage pests, diseases, and weeds for various crops; and support the transition to organic farming. The book lists problems and opportunities for over 500 crop sequences, outlines pest and disease considerations for more than 60 crops and 70 weed species, and provides 13 examples of crop rotations from working organic farms.

Crop Rotations on Organic Farms (Center for Environmental Farming Systems)
http://www.cefs.ncsu.edu/resources/organicproductionguide/croprotationsfinaljan09.pdf. This publication

offers practical information on designing and implementing crop rotations to provide for soil fertility; enhance organic matter; and manage crop pathogens, plant-parasitic nematodes, insect pests, and weeds prevalent in North Carolina and elsewhere in the Southeast.

See appendix 2 of this handbook for additional resources.

5. Tillage and Residue Management

Without a cost-effective choice of allowed herbicides, organic annual crop production is more reliant on tillage and cultivation for weed management and seedbed preparation. However, excessive tillage is harmful to soil, accelerating organic matter degradation, disturbing and killing soil organisms, creating compaction layers, and bringing weed seeds to germination depth. Residue management is closely connected with tillage and there is an increasing focus on organic no-till or reduced till to support soil health. NRCS staff can support organic farmers by advising them on reduced till and no-till financial assistance opportunities (CPS Codes 345 and 329), as well as providing information on effective tillage implements.

Resources

Use of Tillage in Organic Farming Systems: The Basics (University of Illinois, eOrganic) http://www.extension.org/pages/18634/use-of-tillage-in-organic-farming-systems:-the-basics. This article describes the benefits and drawbacks of different forms of tillage and considerations when making decisions about tillage and tillage implements. Conservation tillage and no-till are also discussed briefly.

Figure 5 Diverse mixture of vegetable crops on an organic farm

Cover Crops and No-Till Management for Organic Systems (Rodale Institute, SARE) http://www.sare.org/Learning-Center/Project-Products/Northeast-SARE-Project-Products/Cover-Crops-and-No-Till-Management-for-Organic-Systems. Description of cover crop-based organic no-till systems developed at the Rodale Institute for the Northeast and mid-Atlantic regions including vegetable and agronomic crop rotations, cover crop selection, roller-crimpers for cover crop termination, no-till planting equipment, and energy and financial budgets for no-till versus tilled systems.

Pursuing Conservation Tillage Systems for Organic Crop Production (ATTRA) https://attra.ncat.org/attra-pub/viewhtml.php?id=107. This bulletin provides an overview of organic conservation tillage options, including mulch till, ridge till, ridge zone/ strip till, killed cover crop mulch for no-till, and living mulch systems. Examples of innovative farmer applications of organic conservation tillage are included.

See appendix 2 of this handbook for additional resources.

6. Integrated Pest Management

Pest management on organic or transitioning farms relies on the "PAMS" strategy: prevention, avoidance, monitoring and suppression, with a strong emphasis on prevention and avoidance. USDA organic regulations allow use of certain botanical and other natural pesticides as a last resort. NRCS conservation planners can help farmers protect resources, manage pests, and minimize their need for pesticides by supporting good soil management practices, which in turn support healthy, resilient plants. Crop rotation, cover crops, organic mulches, and various conservation tillage practices are all part of an ecological pest management system, as is supporting biodiversity above ground.

The goal of the CPS Code 595, Integrated Pest Management (IPM), is to reduce or mitigate the risks associated with a particular pest suppression technique to specific natural resources (e.g. water, pollinators and other beneficial organisms). This standard defines IPM differently than some producers, who may think of IPM as a long-term system that focuses on prevention of pests through a combination of strategies such as biological controls, cultural practices and resistant varieties. Some pesticides allowed in organic farming can pose significant risks to natural resources, such as pyrethrum to fish, spinosad to bees, or any botanical or soap-based pesticide to nontarget and beneficial arthropods. Implementation of CPS Code 595 in conjunction with other practices can help the organic producer eliminate or mitigate these risks. Producers should work closely with their organic certifier to ensure their pest suppression and mitigation practices are consistent with their OSP and USDA organic regulations.

The organic approach of prevention and avoidance is consistent with the definition of IPM. In addition, organic producers can avoid or reduce many pest and disease problems through other NRCS conservation activities such as CPS Codes 328, Conservation Crop Rotation; 340, Cover Crop; 386, Field Border; 422, Hedgerow; Water Quality Enhancement Activity (WQL21) IPM for Organic Farming; and many others.

The last purpose in CPS Code 595, IPM, addresses the risk that a cultural, mechanical, or biological mitigation technique used in lieu of chemical methods to protect one resource may cause an impact on other resources. An example would be tillage for weed control which replaces herbicide applications, but which could adversely impact soil health. To maintain soil health, other practices such as CPS Codes 484, Mulching; 328, Conservation Crop Rotation; 340, Cover Crops; or any of the residue management practices could be used as well.

Resources

Common NRCS Practices Related to Pest Management on Organic Farms (Oregon Tilth) http://tilth.org/resources/common-nrcs-practices-related-to-pest-management-on-organic-farms-2/. This publication outlines the application of CPS Code 595, IPM, to organic systems and describes how several other key NRCS practices that have primary resource protection benefits can also offer significant benefits to organic producers.

Figure 6 Roller crimper

Biorationals: Ecological Pest Management Database (ATTRA) https://attra.ncat.org/attra-pub/biorationals/. This tool provides information on organic and other pesticides as well as preventive measures for common pests; allows searches by pest, trade name, or active ingredient; has links to labels and manufacturer information; and notes which materials are listed by OMRI (Organic Materials Review Institute). Because OMRI listings are frequently updated, organic producers should check with their certifiers prior to applying any materials to their crops or livestock.

Farming with Native Beneficial Insects (Xerces Society)
http://www.xerces.org/farming-with-native-beneficial-insects/. A comprehensive guide that discusses the ecology of native beneficial insects and demonstrates how to create a farm or garden habitat that will attract beneficial insects.

Manage Insects on Your Farm: A Guide to Ecological Strategies (SARE)
http://www.sare.org/Learning-Center/Books/Manage-Insects-on-Your-Farm. This book covers ecological pest management practices used on organic farms such as improving soil health, building and managing plant and microbial biodiversity, cover cropping, beneficial habitat, hedgerows, and trap cropping. It includes photo illustrations of pests and their natural enemies and many farm stories of successful practical applications.

A Whole-Farm Approach to Managing Pests (SARE)
http://www.sare.org/Learning-Center/Bulletins/A-Whole-Farm-Approach-to-Managing-Pests. This bulletin covers field border plantings and other farmscaping methods among a full range of ecological pest management practices such as crop rotation, cover cropping, and tillage and residue management. It showcases successful field applications by farmers from different regions.

Steel in the Field: a Farmer's Guide to Weed Management Tools (SARE)
http://www.sare.org/Learning-Center/Books/Steel-in-the-Field. Describes a wide range of cultivation tools available for mechanical weed control. The book also covers cost-effective weed-management strategies that integrate improved cultivation tools with cover crops and crop rotations that can help organic producers get the most weed suppression for the least soil disturbance.

Resource Guide for Organic Insect and Disease Management, 2nd Edition (SARE)
http://www.sare.org/Learning-Center/Project-Products/Northeast-SARE-Project-Products/Resource-Guide-for-Organic-Insect-and-Disease-Management. This manual provides in-depth information on organic management of vegetable crop pests and diseases in the Northeast, including cultural controls and NOP-allowed materials for each major pest and pathogen; a photo section to assist identification; and material fact sheets for 17 classes of biological, botanical, mineral, and other NOP-approved materials.

Biointensive Integrated Pest Management (ATTRA) https://attra.ncat.org/organic.html#pests. Includes biointensive or high-level IPM that utilizes ecological principles to understand and manage pests within the context of the whole farm, including crops, pests and their natural enemies, soil life, livestock, etc. This manual covers planning based on knowledge of pest and beneficial life cycles, cropping system design, sanitation and other preventive cultural practices, and physical, mechanical, biological, and chemical controls.

Figure 7 Flowers from dill

Farmscaping to Enhance Biological Control (ATTRA) https://attra.ncat.org/organic.html#pests. This bulletin gives in-depth guidance on developing a beneficial insect habitat based on farmer objectives, crops grown, prevalent pests and natural enemies, and characteristics of various annual and perennial insectary plants. It also covers habitat for predatory birds and bats, and includes an annotated bibliography of information resources.

See appendix 2 of this handbook for additional resources that address mammal pest management, weed and invasive species control, solarization for site preparation, and prescribed grazing for invasive plant control.

7. Buffers and Natural Areas

Conservation buffers and natural areas support compliance with USDA organic regulations concerning natural resources and biodiversity while aiding in production goals. Although buffers are generally designed for other purposes, such as erosion control, some organic producers also use them to reduce pesticide and pollen transport. There are several NRCS buffer practices listed in table 1 that can help producers meet their objectives such as CPS Codes 422, Hedgerows, and 386, Field Borders. CPS Codes 362, Diversions, and 412, Grassed Waterways, are used to divert and convey runoff water, and are relevant because they can help organic growers meet USDA organic regulatory requirements to protect organic crops against prohibited substances or other pollutants from off-farm sources.

Natural areas are nonagricultural areas that support ecological processes and native species. Since not all organic growers enroll their natural areas in organic certification, the requirement to meet the USDA organic regulations for maintaining and improving soil, water, wetlands, woodlands, and wildlife in these areas depends on the certification status. Conservation of the natural areas may significantly improve food, shelter, and reproduction sites for wildlife, sequester carbon in woody biomass, filter pollutants, conserve water, dissipate floodwaters, serve as wildlife corridors, and support rare species. Several NRCS buffer practices listed in table 1 can help producers meet their objectives, such as CPS Codes 395, Stream Habitat Improvement and Management, and 612, Tree/Shrub Establishment.

A number of practices can be used to prevent or control invasive species and weeds, such as CPS Codes 314, Brush Management, and 315, Herbaceous Weed Control.

While buffers and natural areas do not typically produce organic food and fiber, producers must ensure they comply with USDA organic regulations. They should recognize the restrictions on synthetic pesticides, treated wood, plastic mulches, and burning under certain conditions. By first checking in with the certifier before planting the buffer or restoring the natural area, the producer will ensure they are in compliance.

Resources

Biodiversity and Natural Resources Management

Biodiversity Conservation: An Organic Farmer's Guide (Wild Farm Alliance (WFA)) http://wildfarmalliance.org/resources/BD%20Guide%20Organic%20Farmers%20.pdf. Includes a range of farm management practices that maintain and enhance biodiversity as they relate to the USDA organic regulations.

How NRCS TSPs Support Biodiversity in Organic Systems (WFA, MOSES, Hedgerows Unlimited) http://www.wildfarmalliance.org/resources/organic_BD.htm#WebinarTSPs. This webinar covers how TSPs can write conservation plans for practices that address the biodiversity conservation needs of the farm including those offered in the CAP 138 development criteria list for transitioning farmers, and others that support woodland, wetlands, and wildlife habitat.

Increasing Plant and Soil Biodiversity on Organic Farmscapes (University of California at Davis, eOrganic) http://www.extension.org/pages/27049/increasing-plant-and-soil-biodiversity-on-organic-farmscapes-webinar#.U-0yukj8W58. This webinar examines research results from a case study in California on an organic farm with hedgerows, preservation of a riparian corridor, and tailwater ponds.

Linking Biodiversity Requirements, Organic Systems, and NRCS Conservation Practice Standards (WFA, University of Minnesota, Live Earth Farm) http://wildfarmalliance.org/resources/organic_BD.htm#Webinar-1. CPSs that improve soil and water resources, support beneficial organisms and natural functions, and protect and restore wildlife habitat are covered in this webinar, and real-life examples of practices used by an organic farmer on his operations.

Promoting High Quality Conservation on the Organic Farm (WFA, MOSES) https://www.youtube.com/watch?v=HENSvtveY0U&feature=youtu.be. This webinar describes how NRCS

conservation practices and enhancements can provide high-value production and biodiversity benefits while at the same time aiding producers in obtaining or maintaining their USDA organic status.

Buffers

Conservation Buffers in Organic Systems (NCAT, Oregon Tilth, Xerces Society) http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/landuse/crops/organic/. This publication covers design, preparation and maintenance of NRCS field borders, hedgerow plantings, herbaceous wind barriers, windbreaks/shelterbelt establishment, riparian forest buffers, and conservation cover.

Conservation Buffers: Design Guidelines for Buffers, Corridors, and Greenways (National Agroforestry Center) http://nac.unl.edu/buffers/index.html. This publication provides over 80 illustrated design guidelines which describe how a vegetative buffer can be applied to protect soil, improve air and water quality, enhance fish and wildlife habitat, or meet other objectives.

Hedgerows for California Agriculture (Community Alliance with Family Farmers) http://caff.org/wp-content/uploads/2010/07/Hedgerow_manual.pdf. This manual helps growers choose and care for appropriate plants that attract beneficial insects and prevent erosion.

Protecting Riparian Areas: Farmland Management Strategies (ATTRA) https://attra.ncat.org/attra-pub/summaries/summary.php?pub=115. This publication is designed to help farmers, watershed managers, and environmentalists understand what healthy riparian areas look like, how they operate, and why they are important for the environment and society. It also discusses the costs and benefits of riparian management, and how watershed residents can work together to protect this vital resource.

Figure 8 Plants in a buffer area attracting beneficial goldenrod soldier beetles

Co-Managing Food Safety and Conservation

A Farmer's Guide to Food Safety and Conservation: Facts, Tips and Frequently Asked Questions (WFA, CAFF) http://www.wildfarmalliance.org/resources/FS_FactsTipsFAQ.pdf. This publication discusses basic factors that affect the survival and movement of food borne pathogens on the farm, and how healthy diverse ecosystems can help to keep pathogens in check. A set of frequently asked questions addresses topics from wildlife and compost issues to visitors on the farm. It provides tips on how to have a successful food safety inspection, and the resources list includes links to Web pages where your auditor can learn about the co-management of food safety and conservation.

On-Farm Food Safety and Conservation (WFA) http://www.conservationwebinars.net/webinars/on-farm-food-safety-and-conservation. This webinar covers how pathogens get on the farm, their prevalence in animals, and environmental factors that influence pathogen reduction. A multibarrier approach is discussed where conservation practices and food safety good agricultural practices (GAPs) are used to minimize food safety concerns.

Pollinator Habitat

Pollinator Habitat Assessment Form and Guide for Organic Farmers (Xerces Society) http://www.xerces.org/wp-content/uploads/2009/11/OrganicPollinatorHabitatAssessment.pdf. This guide assesses pollinator habitat in orchards and field crop settings.

Organic Farming for Bees Toolkit (Xerces Society) http://www.sare.org/Learning-Center/Books/Managing-Alternative-Pollinators. This guide contains both fact sheets, as well as information about native bee biology, artificial nest management, and regional plant lists for pollinator habitat restoration.

Pollinator Conservation Resource Center (Xerces Society) www.xerces.org/pollinator-resource-center. This Web site provides information on pollinator plant lists, conservation guides, pesticide protection, seed venders, nurseries, and more.

Managing Alternative Pollinators: a Handbook for Beekeepers, Growers, and Conservationists (SARE) http://www.sare.org/Learning-Center/Books/Managing-Alternative-Pollinators. The book includes expert information on the business and biology of pollination, and color-illustrated how-to guidance on rearing and managing bumble bees, mason bees, leafcutter bees, and other bee species that provide pollination alternatives to the rapidly declining honey bee.

See appendix 2 of this handbook for additional resources including the IPM section for resources on weed and invasive species control, solarization for site preparation, and prescribed grazing for invasive plant control.

8. Organic Grazing

The USDA organic pasture standard requires the livestock producer to provide pasture of sufficient quantity and quality to meet 30 percent of the dry matter (DM) nutritional needs of ruminants (cattle, goats, sheep, etc.) for at least 120 days during the grazing season. The producer must provide, as part of the OSP, a detailed pasture management plan adequate to meet these criteria, prevent erosion, and protect soil and water resources, wetlands, and riparian areas. Implementation of CPS Code 528, Prescribed Grazing, can help the organic producer meet USDA organic pasture requirements. Grazing plans under CPS Code 528 include pasture system maps, soils maps and information, typical grazing season or seasons, tools to ensure and document adequate herd DM intake from pasture, and contingency management measures such as reduced stocking rates, temporary removal from pasture due to weather, and supplemental feed. Other conservation practices, such as CPS Codes 512, Forage and Biomass Planting; 511, Forage Harvest Management; 550, Range Planting; and 381, Silvopasture Establishment, can help the grower meet USDA organic requirements for adequate pasture and forage. Practices such as CPS Codes 390, Riparian Herbaceous Cover; 391, Riparian Forest Buffer; and 382, Fence, in conjunction with CPS Code 614, Livestock Watering Facilities, to keep animals away from streams, can help protect water quality and prevent streambank erosion.

Pastures, regardless of organic status, can become overgrazed, which can contribute to livestock internal parasite problems, nutritional deficiencies, soil compaction, erosion, degradation of forage diversity and vigor, spread of diseases to wildlife, and water quality problems; all of which an organic producer must address. USDA organic standards require the producer to maintain pasture in a state of good health and productivity through management strategies that promote good forage quality and quantity, weed control, infiltration of precipitation, and erosion control. Some conservation practices for developing and maintaining healthy and productive pastures include—

- Rotational grazing system and nutrient management appropriate for the climate and terrain. This is not particular to organic, but rotation is vital to pasture health and reduced environmental impacts, as required by NOP.
- Occasional mowing or mixed-species grazing to reduce weeds and stimulate growth of desirable species. Avoid prescribing forage species that require burning for germination or maintenance, or allow for alternatives such as grazing and tillage.

- Establishment of desirable or more productive forages as needed. Some producers may include annual plantings to extend the grazing season, provide forages during seasons when perennials are typically less productive, or have animals deposit manure on cropland.
- Use of infrastructure such as animal trails and strategic locations of watering facilities, minerals, shade, and supplemental feed to support pasture rotation and utilization.
- Infrastructure and management practices may also be used to meet USDA organic requirements to protect environmentally sensitive areas in or adjacent to the pasture.

Ideally, a grazing system includes sufficient acreage to meet the maximum DM intake needs of the herd. In instances where there is insufficient acreage, and where a reduction in stocking rate is not possible, daily supplemental feeding will be required. In addition, diligent pasture management and rotational grazing are essential to prevent overgrazing while maintaining as high a DM intake as practical. Animals must be moved frequently and in accordance with planned target grazing heights, DM estimates, and targeted postgrazing residuals. When circumstances beyond the producer's control result in less than the required 30 percent of total seasonal DM intake being obtained from pasture, the organic producer must request a written variance from the certifying agent.

See section 9 of this handbook for a discussion of USDA organic regulations related to fences.

Resources

Organic Standards for Livestock Production (ATTRA)
https://attra.ncat.org/attra-pub/summaries/summary.php?pub=159. This collection of standards from the USDA AMS NOP provides the reader with key standards relevant to certified organic livestock production.

Pastures: Going Organic (ATTRA): https://attra.ncat.org/attra-pub/summaries/summary.php?pub=179. This guide discusses relevant USDA organic regulations, including recordkeeping; and fertility, weed, and insect pest management.

Pasture for Organic Ruminant Livestock – Understanding and Implementing the USDA Organic Pasture Rule (NCAT, USDA AMS NOP):
http://prod.ams.usda.gov/sites/default/files/media/NOP-UnderstandingOrganicPastureRule.pdf. This publication explains the pasture rule and includes information on determining available DM on both pasture and rangeland.

Calculating Dry Matter Intake from Pasture (USDA AMS NOP):
http://prod.ams.usda.gov/sites/default/files/media/5017-1.pdf. This publication describes DM intake and a method to estimate it.

Grazing Management on Organic Farms (eOrganic):
https://www.extension.org/pages/59464/grazing-management-on-organic-farms. This Web site provides an extensive library of fact sheets and webinars on organic grazing.

Guide for Organic Livestock Producers (NCAT, USDA AMS NOP): http://www.ams.usda.gov/organicinfo. This extensive publication includes discussions about hay, silage, and haylage harvest; seeds and planting stock; the USDA organic pasture rule; organic soil and weed management for pasture and hayland; and grazing for parasite management.

9. Livestock Living Conditions, Facilities, and Structures

The USDA organic standard for livestock living conditions requires producers to provide all livestock and poultry with year-round access to the outdoors, sunlight, shade, shelter, fresh air, exercise areas, clean water, and adequate nutrition. Temporary confinement is allowed under certain circumstances such as severe weather. Producers can implement practices such as CPS Codes 614, Livestock Watering Facility; 516, Livestock Pipeline; 380, Windbreak Planting; 381, Silvopasture Establishment; and 576, Livestock Shelter Structure, as part of their plan to meet USDA organic requirements regarding water, shade, and shelter.

Organic livestock producers must manage animal wastes and outdoor access areas in a way that protects soil and water quality. In some locations at certain times of the year, it can be a challenge to provide livestock outdoor access "in a manner that does not put soil or water quality at risk." Outdoor feeding and confinement areas may require CPS Code 561, Heavy Use Area Protection, and other practices to protect groundwater and surface water, and to allow for removal and management of wastes. A suitable composting facility (CPS Code 317) can provide improved waste management and stabilize manure nutrients.

Some sites may not have sufficient separation from groundwater and surface water to provide treatment of contaminated runoff from these facilities. In such cases, a roof (CPS Code 367, Roofs and Covers), or CPS Code 588, Roof Runoff Structure, may be needed to prevent runoff from transporting contaminants into nearby streams or lakes. In the event that site conditions demand a roofed heavy-use area to prevent environmental impacts from a livestock confinement area, it is very important to work with the certifying agency to ensure that the design does not conflict with the agent's interpretation of livestock access to the outdoors or to direct sunlight. In some cases, the producer may need to consider moving the livestock to another site where they can be managed in a manner that will meet USDA organic requirements for both livestock outdoor access and protection of water resources.

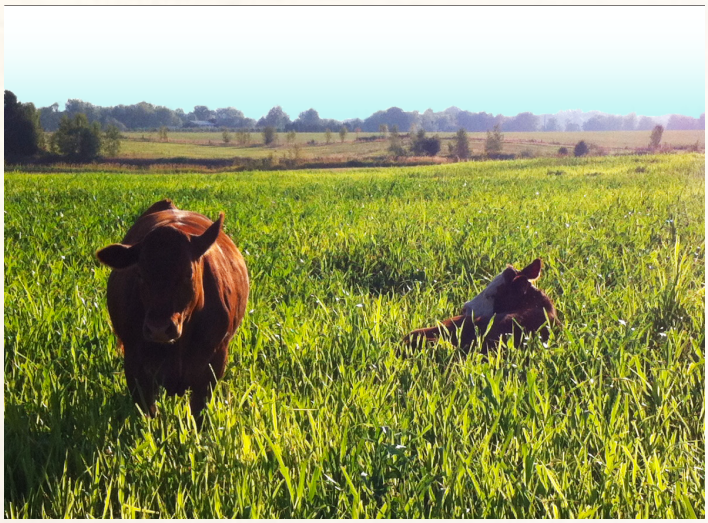
The USDA organic crop pest, weed, and disease management practice standard does not allow the use of lumber treated with prohibited materials if the lumber will contact animals, manure, compost, plants, or soil that are parts of the organic production system. New or replacement fence posts for pastures, and building materials for animal shade, shelter or confinement structures, and composting and waste storage facilities must be comprised of materials such as naturally rot-resistant wood, wood treated with NOP-allowed materials, metal, concrete, fiberglass, composite, or other accepted materials. At the time of this printing, raw linseed oil is the only NOP-approved wood preservative, but other products could become available in the future.

When chromated copper arsenate (CCA) pressure-treated lumber or other treated materials must be used for structures, the producer must provide a protective sheathing or setback to prevent livestock, feed, hay, manure, or compost from coming into direct contact with the materials. When planning a structural conservation practice on an organic livestock operation, it is very important to communicate with the certifying agency to ensure that the design and materials will not place the producer in conflict with USDA organic regulations.

Resources

Guide for Organic Livestock Producers (NCAT, USDA AMS NOP): http://www.ams.usda.gov/organicinfo. This extensive publication includes discussions about hay, silage, and haylage harvest; seeds and planting stock; the USDA organic pasture rule; organic soil and weed management for pasture and hayland; and grazing for parasite management.

Figure 9 Cows in sudan grass on an organic farm



Treated Wood on Organic Farms (University of Tennessee): https://utextension.tennessee.edu/publications/Documents/W235-H.pdf. This publication discusses the USDA organic rule, alternative materials, and other topics.

Treated Lumber and Wood (Ohio Ecological Food and Farm Association): http://certification.oeffa.org/certfiles/facts/Treated%20Wood.pdf. This fact sheet discusses common issues, alternatives, and other topics.

Appendix 1

USDA Organic Regulatory Production Requirements Related to Resource Conservation

The following excerpts from the USDA organic regulations highlight those that relate to resource conservation. Organic producers, not NRCS staff, are responsible for ensuring they comply with organic regulations. The regulations listed below are for reference to illustrate opportunities to work with organic producers and help NRCS staff better understand the regulations organic producers follow.

The full USDA organic regulations (7 CFR Part 205) can be viewed at http://www.ecfr.gov/cgi-bin/text-idx?SID=cbc7174c2bae4dac67b0935617cfa740&mc=true&node=pt7.3.205&rgn=div5.

NATURAL RESOURCES AND BIODIVERSITY

205.200—Production practices "must maintain or improve the natural resources of the operation, including soil and water quality."

205.2—Natural resources are defined as "the physical, hydrological, and biological features of a production operation, including soil, water, wetlands, woodlands, and wildlife."

205.2—Organic production is a "system that is managed in accordance with…regulations…to respond to site-specific conditions by integrating cultural, biological, and mechanical practices that foster cycling of resources, promote ecological balance, and conserve biodiversity."

LAND AND BUFFERS

205.202—"Any field or farm parcel from which harvested crops are intended to be sold, labeled, or represented as 'organic,' must: Have had no prohibited substances … applied to it for a period of 3 years immediately preceding harvest of the crop; and Have distinct, defined boundaries and buffer zones such as runoff diversions to prevent the unintended application of a prohibited substance to the crop or contact with a prohibited substance applied to adjoining land that is not under organic management."

SOIL AND CROP FERTILITY MANAGEMENT

205.203—The producer must: "select and implement tillage and cultivation practices that maintain or improve the physical, chemical, and biological condition of soil and minimize soil erosion"; "manage crop nutrients and soil fertility through rotations, cover crops, and the application of plant and animal materials"; and "manage plant and animal materials to maintain or improve soil organic matter content in a manner that does not contribute to contamination of crops, soil, or water."

Raw animal manure must be "incorporated into the soil not less than 120 days prior to the harvest of a product whose edible portion has direct contact with the soil surface or soil particles; or incorporated into the soil not less than 90 days prior to the harvest of a product whose edible portion does not have direct contact with the soil surface or soil particles."

Animal manure may be applied at any time if it is composted through a process that "established an initial C:N ratio of between 25:1 and 40:1; and maintained a temperature of between 131 °F and 170 °F for 3 days using an in-vessel or static aerated pile system; or maintained a temperature of between 131 °F and 170 °F for 15 days using a windrow composting system, during which period, the materials must be turned a minimum of five times." Producers must not use "sewage sludge (biosolids)."

SEEDS AND PLANTING STOCK

205.204—"The producer must use organically grown seeds, annual seedlings, and planting stock." However, when "an equivalent organically produced variety is not commercially available," producers may use nonorganically produced seeds. However, "organically produced seed must be used for the production of edible sprouts."

CROP ROTATION

205.205—"The producer must implement a crop rotation including but not limited to sod, cover crops, green manure crops, and catch crops that provide the following functions that are applicable to the operation: maintain or improve soil organic matter content; provide for pest management in annual and perennial crops; manage deficient or excess plant nutrients; and provide erosion control."

205.2—Crop rotation is defined as the "practice of alternating the annual crops grown on a specific field in a planned pattern or sequence in successive crop years so that crops of the same species or family are not grown repeatedly without interruption on the same field. Perennial cropping systems employ means such as alley cropping, intercropping, and hedgerows to introduce biological diversity in lieu of crop rotation."

CROP PEST, WEED, AND DISEASE MANAGEMENT

205.206—"The producer must use management practices to prevent crop pests, weeds, and diseases including but not limited to: crop rotation and soil and crop nutrient management practices…sanitation measures to remove disease vectors, weed seeds, and habitat for pest organisms; and cultural practices that enhance crop health, including selection of plant species and varieties with regard to suitability to site-specific conditions and resistance to prevalent pests, weeds, and diseases."

Pests, weeds and diseases may be controlled through mechanical or physical methods, such as development of habitat for natural enemies of pests, mowing, and livestock grazing. If these methods are "insufficient to prevent or control crop pests, weeds, and diseases, a biological or botanical substance or a substance included on the National List of synthetic substances allowed for use in organic crop production may be applied to prevent, suppress, or control pests, weeds, or diseases."

WILD CROP

205.207—A wild crop "represented as organic must be harvested from a designated area that has had no prohibited substance…for a period of 3 years immediately preceding the harvest." A wild crop must be harvested in a manner is not "destructive to the environment and will sustain the growth and production of the wild crop."

LIVESTOCK ORIGIN

205.236—Livestock products that are "represented as organic must be from livestock under continuous organic management from the last third of gestation or hatching." Except, "poultry or edible poultry products must be from poultry that has been under continuous organic management beginning no later than the second day of life," and "milk or milk products must be from animals that have been under continuous organic management beginning no later than 1 year prior to the production of the milk or milk products."

LIVESTOCK FEED AND PASTURE

205.237:—The producer "must provide livestock with a total feed ration composed of agricultural products, including pasture and forage, that are organically produced and handled by operations certified to the NOP." "The producer of an organic operation must not: use animal drugs, including hormones, to promote growth; provide feed supplements or additives in amounts above those needed for adequate nutrition and health."

"Ruminant animals must be grazed throughout the entire grazing season for the geographical region, which shall be not less than 120 days per calendar year." Producers must "provide pasture of a sufficient quality and quantity to graze" and to provide ruminants "with an average of not less than 30 percent of their dry matter intake from grazing throughout the grazing season."

PASTURE MANAGEMENT

205.240—The producer must have "a functioning management plan for pasture." The plan must include a description of the "cultural and management practices to be used to ensure pasture of a sufficient quality and quantity is available to graze throughout the grazing season…; the types of grazing methods to be used in the pasture system; location and types of fences"; location and source of shade and water; "soil fertility and seeding systems; erosion control and protection of natural wetlands and riparian areas practices." Pasture must be managed "to refrain from putting soil or water quality at risk."

LIVESTOCK HEALTH CARE

205.238—"The producer must establish and maintain preventive livestock health care practices, including: selection of species and types of livestock with regard to suitability for site-specific conditions and resistance to prevalent diseases and parasites; provision of a feed ration sufficient to meet nutritional requirements"; "appropriate housing, pasture conditions, and sanitation practices to minimize the occurrence and spread of diseases and parasites"; "vaccines and other veterinary biologics."

"When preventive practices and veterinary biologics are inadequate to prevent sickness, a producer may administer synthetic medications." However, a producer may not use any antibiotics, any substance that contains a synthetic substance not allowed on the National List, any animal drug "in the absence of illness, hormones for growth promotion…or withhold medical treatment from a sick animal in an effort to preserve its organic status. All appropriate medications must be used to restore an animal to health when methods acceptable to organic production fail. Livestock treated with a prohibited substance must be clearly identified and shall not be sold, labeled, or represented as organically produced."

LIVESTOCK LIVING CONDITIONS

205.239—The producer of an organic livestock operation must establish and maintain year-round livestock living conditions which accommodate the health and natural behavior of animals suitable to the species, its stage of life, the climate, and the environment. Including, but not limited to, year-round access for all animals to the outdoors, shade, shelter, exercise areas, fresh air, clean water for drinking, direct sunlight, and appropriate clean, dry bedding. Roughages used as bedding must be organically produced. The producer of an organic livestock operation may provide temporary confinement or shelter for an animal due to inclement weather; the animal's stage of life; to protect the health, safety, or well-being of the animal; to protect soil or water quality; breeding; shipping; or youth projects.

"The producer of an organic livestock operation must manage manure in a manner that does not contribute to contamination of crops, soil, or water by plant nutrients, heavy metals, or pathogenic organisms and optimizes recycling of nutrients, and must manage pastures and other outdoor access areas in a manner that does not put soil or water quality at risk."

Additional USDA Organic Regulations and Guidance

The following paragraphs describe several other aspects of the USDA organic regulations that may have a bearing on implementation of NRCS conservation programs and practices on organic farms.

COMMINGLING

205.272—"The handler of an organic handling operation must implement measures necessary to prevent the commingling of organic and nonorganic products and protect organic products from contact with prohibited substances."

RECORD KEEPING

205.103—"A certified operation must maintain records concerning the production, harvesting, and handling of agricultural products that are or that are intended to be sold, labeled, or represented as…'organic'." Records must "be maintained for not less than 5 years beyond their creation;" and "be sufficient to demonstrate compliance with the…regulations."

THE NATIONAL LIST OF ALLOWED AND PROHIBITED SUBSTANCES

205.601–604—Nonsynthetic or "natural" substances are allowed in organic crop and livestock production unless they are specifically prohibited on the National List. Synthetic substances are prohibited unless they are specifically allowed. The National List of Allowed and Prohibited Substances identifies these two groups of exceptions to the rule that synthetic substances are prohibited and nonsynthetic materials are allowed. For example, arsenic is a natural or nonsynthetic substance, but it is prohibited and thus on the National List. Aspirin is included on the National List as a synthetic substance allowed in organic livestock production to reduce inflammation. Some substances on the National List may only be used in specific situations or up to a maximum amount. For example, when used as an algicide in aquatic rice production, copper sulfate is limited to one application per field during any 24-month period.[16]

EXCLUDED METHODS: GENETICALLY ENGINEERED SEEDS AND INPUTS

205.2—In addition to being free from prohibited substances, products sold as organic must be produced and processed without the use of "excluded methods." Excluded methods include genetically engineered crop seeds, seedlings, and planting stock, and biopesticides and other agricultural inputs based on or derived from genetically modified organisms (or GMOs).

16 National Organic Program. "About the National List." http://www.ams.usda.gov/AMSv1.0/ams.fetchTemplateData.do?template=TemplateJ&leftNav=NationalOrganicProgram&page=NOPNationalList&description=National%20List%20of%20Allowed%20and%20Prohibited%20Substances&acct=nopgeninfo.

Appendix 2

Additional Resources

Webinars on multiple relevant topics can be found at the NRCS Science and Technology Training Library located at ConservationWebinars.net.

The following additional resources are also available on the topics listed below.

Section A. Overview of Organic Agriculture:

Resources concerning the conversion of Conservation Reserve Program (CRP) into production: Conservation Reserve Program: Alternatives and Options (NRCS): http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_019293.pdf.

Factors to Consider when Bringing Conservation Reserve Program (CRP) Land or Idle Land Back into Production (University of Kentucky): http://www2.ca.uky.edu/agc/pubs/id/id124/id124.htm.

Converting CRP Land to Cropland or Pasture/Hayland: Agronomic and Weed Control Consideration (Ohio State University): http://ohioline.osu.edu/agf-fact/0024.html.

Converting CRP Fields to Grain Crop Production (University of Missouri) http://extension.missouri.edu/p/G1651.

Options for Expiring Conservation Reserve Program (CRP) Land (Oklahoma State University): http://pods.dasnr.okstate.edu/docushare/dsweb/Get/Document-7247/NREM%209016web.pdf.

Section D. Integral Conservation Activities for Organic Production Systems

1. Nutrient Management

Managing Soil Fertility and Organic Matter (MOSES): https://mosesorganic.org/wp-content/uploads/Publications/Fact_Sheets/08ImportanceOrganicMatterToFertility.pdf. Succinct summary of organic soil and nutrient management practices.

Manures for Organic Production (ATTRA): https://attra.ncat.org/attra-pub/summaries/summary.php?pub=182. This publication discusses the use of raw and composted manures in organic vegetable production, including, environmental and human health considerations, USDA organic regulations, and nutrient management for optimum, cost effective crop nutrition.

Interpreting Soil Health Tests in New Hampshire (NRCS): http://soilhealth.cals.cornell.edu/extension/pdfs/NH_NRCS_SoilHealthManagementOptionsTable.pdf. This two-page table lists various soil-related physical, biological and chemical concerns, and short- and long-term management practices including NRCS cost-share practices to address each concern.

4. Crop Rotations

Northern Great Plains Crop Sequence Calculator (USDA, ARS): http://www.ars.usda.gov/Services/docs.htm?docid=10791. Program that includes information on crop production, economics, plant diseases, weeds, water use, and surface soil properties to evaluate management risks associated with different crop sequences.

5. Tillage & Residue Management

Manitoba – North Dakota Zero Tillage Farmers Association: http://mandakzerotill.org/. Extensive Web site with a strong focus on soil health, but not specific to organic systems. The Web site includes a link to proceedings of annual conferences.

6. Integrated Pest Management

Agronomy Technical Note 5 (NRCS):
http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1043138.pdf. This note discusses practices to reduce risks including measures to reduce the need for pesticide applications.

Agronomy Technical Note 9 (NRCS):
http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=32935.wba. This note provides additional information on pollinators and pollinator conservation.

A Quick Guide to Establishing Wildflower Plantings for the Conservation of Beneficial Insects (SARE):
http://www.sare.org/Learning-Center/SARE-Project-Products/North-Central-SARE-Project-Products/Video-A-Quick-Guide-to-Establishing-Wildflower-Plantings-for-the-Conservation-of-Beneficial-Insects. This video is an introductory guide to help establish wildflower plantings for the conservation of beneficial insects.

Ecological Farm Design for Pest Management in Organic Vegetable Production: Successes and Challenges on Two Farms (eOrganic):
http://www.extension.org/pages/61953/ecological-farm-design-for-pest-management-in-organic-vegetable-production:-successes-and-challenges#.U_KlpUj8X6R. This webinar describes how two farms increased plant diversity though practices such as planting insectaries and hedgerows, and employed reduced tillage, pest thresholds and crop planting timing to manage pests in vegetable crops with minimal or no spraying.

Ecological Understanding of Insects in Organic Farming Systems: Insects in Communities (Pennsylvania State University, eOrganic):
https://www.extension.org/pages/18908/ecological-understanding-of-insects-in-organic-farming-systems:-insects-in-communities#.U_Jm0kj8W58. This article describes ecological principles and community interactions of insects.

Farmscaping to Manage Insect Pests (Michigan State University, SARE):
http://www.sare.org/Learning-Center/Conference-Materials/The-New-American-Farm-Conference/Breakout-Sessions/Farmscaping-to-Manage-Insects. This PowerPoint presentation describes how to control insect pests by arranging fields, forests and borders into an insect-managing "farmscape" that helps grow healthier, more productive crops.

Farmscaping: Making Use of Nature's Pest Management Services (Clemson University, eOrganic):
http://www.extension.org/pages/18573/farmscaping:-making-use-of-natures-pest-management-services#.U-01rUj8W58. This publication covers farmscaping methods including the use of insectary plants, hedgerows, cover crops, and water reservoirs to attract and support populations of beneficial organisms such as insects, spiders, amphibians, reptiles, bats, and birds that parasitize or prey upon insect pests.

Managing the Soil to Reduce Insect Pests (Clemson University, eOrganic):
https://www.extension.org/pages/18574/managing-the-soil-to-reduce-insect-pests. This article addresses some of the main elements of soil management that can help to reduce insect pest problems, including soil and fertility management, below-ground biodiversity (enhancing the soil food web), use of mulches, and sanitation.

Mammal Pest Management

How to Manage Pests (University of California)

- Pocket gopher: http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1058&context=vpc14.

- Deer Mouse: http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn74161.html.
- Vole: http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7439.html.
- Rabbit: http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7447.html.
- Ground Squirrel: http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7438.html.

Exclusionary Methods and Materials to Protect Plants from Pest Mammals—A Review (University of Nebraska): http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1058&context=vpc14. This paper covers pest mammal management methods for organic and sustainable agriculture. It includes various materials wrapped or tied directly on tree trunks; the larger loose-fitting protective cylinders or other individual exclosures, shields, or bands to prevent access to the upper tree portions via the trunk; mounding soil; or other materials around the base of trees to restrict feeding or to make the habitat less favorable to pest species.

How can I control rodents organically? (ATTRA): https://attra.ncat.org/calendar/question.php/2007/03/12/how_can_i_control_rodents_organically. This article discusses trapping, habitat modification, predator control, and approved organically rodenticide materials.

Wildlife Compatible Fencing (Arizona Game and Fish Department: http://www.azgfd.gov/hgis/documents/110125_AGFD_fencing_guidelines.pdf. Describes fence design for landowners.

Wildlife Friendly Fencing (Montanans for Safe Wildlife Passage): http://www.montanans4wildlife.org/wildlife-friendly-fencing/. This Web site has many publications on the topic of wildlife friendly fencing and its role in maintaining habitat connectivity.

Weed and Invasive Species Control

A Management Guide for Invasive Plants in Southern Forests (US Forest Service): http://www.srs.fs.fed.us/pubs/gtr/gtr_srs131.pdf. This publication contains thorough discussion of all methods for controlling invasive plants, including mulching and other nonchemical methods.

Policy Memorandum: Biodegradable Biobased Mulch Film (USDA AMS NOP): http://www.ams.usda.gov/NOPProgramHandbook. This 2015 policy memo describes how the USDA organic regulations were amended to allow the use of biodegradable biobased mulch film in organic crop production.

Solarization for Site Preparation

Introduction to Soil Solarization (University of Florida): http://edis.ifas.ufl.edu/in856. This publication includes steps, photos and frequently asked questions.

Soil solarization (University of California Agriculture and Natural Resources): http://www.ipm.ucdavis.edu/TOOLS/TURF/SITEPREP/soilsolar.html. This site includes a listing of weeds commonly controlled through solarization.

Soil Solarization, an Alternative to Soil Fumigants (Colorado State University): http://www.ipm.ucdavis.edu/TOOLS/TURF/SITEPREP/soilsolar.html. This publication described the method and includes a discussion of the impacts on weed, nutrients, and microbes.

Prescribed Grazing for Invasive Plant Control

Targeted Grazing: A Natural Approach to Vegetation Management and Landscape Enhancement (University of Idaho): http://www.webpages.uidaho.edu/rx-grazing/Handbook.htm. A handbook on grazing as a new ecological service.

Goat-powered Invasive Removal (Clemson University): http://www.clemson.edu/public/hunnicutt/goats.html. Features ongoing research.

Prescribed Grazing in Practice (US Fish and Wildlife Service): http://www.fws.gov/invasives/stafftrainingmodule/methods/grazing/practice.html. This site includes foraging behavior, dietary preferences, and management for grazing animals.

7. Buffers and Natural Areas

Biodiversity and Natural Resources Management

Biodiversity and Natural Resources Conservation Guidance (USDA AMS NOP): http://www.ams.usda.gov/NOP. New guidance expected in 2015.

Biodiversity and Organic Agriculture (University of Nebraska, eOrganic): http://www.extension.org/pages/67368/organic-farming-systems-research-at-the-university-of-nebraska#part%205. Brief webinar on research related to the topic; part of series on organic farming.

Biodiversity Compliance Assessment in Organic Agricultural Systems (WFA): http://www.wildfarmalliance.org/resources/Biodiversity%20Compliance.pdf. Publication that summarizes major biodiversity noncompliance (with USDA organic regulations) indicators and details guidance outlining positive compliance approaches.

Biodiversity Principles (BC Agricultural Council): http://www.agf.gov.bc.ca/resmgmt/EnviroFarmPlanning/EFP_Biodiversity_Guide/2010_Web_PDF_Documents/BiodiversityGuide2010_Chapter2_BiodiversityPrinciples.pdf. This document describes eight agricultural biodiversity principles including importance of location and connections.

Incorporating Prairies into Multifunctional Landscapes (SARE): http://www.sare.org/Learning-Center/SARE-Project-Products/North-Central-SARE-Project-Products/Incorporating-Prairies-into-Multifunctional-Landscapes. This publication describes how prairies can be incorporated into farms and how they affect nearby crops. Necessary steps and resources to establish and manage prairies are covered, as are the various uses for prairies: livestock grazing, hay production, biomass feedstocks, and carbon sequestering.

Agroforestry Planning, Practices, and Design (SARE): http://www.extension.org/pages/67368/organic-farming-systems-research-at-the-university-of-nebraska#part%205. Resource includes a Handbook for Agroforestry Practices and Design, and a Training Manual for Applied Agroforestry Practices.

Biodiversity for Climate Resilience (California Climate& Agriculture Network, CalCAN): http://vimeo.com/90807898. This webinar discusses the climate benefits and additional environmental and economic benefits of on-farm biological diversity in farm products and in the landscape, as well as some tools and practical considerations.

Climate Change Benefits of Farmscaping in Yolo County (University of California at Davis): http://agadapt.ucdavis.edu/farmscaping/. This Web page covers many specific ways in which farmscaping can enhance system resilience to climate change, including carbon storage and greenhouse gas mitigation; biodiversity, resilience, and adaptation; and practical constraints to successful farmscaping.

Effects of Climate Change on Insect Communities in Organic Farming Systems (Washington State University, eOrganic): http://www.extension.org/pages/66899/effects-of-climate-change-on-insect-communities-in-organic-farming-systems-webinar#.U-00KUj8W58. This webinar outlines the potential for climate change to affect insect communities, and their interactions with plants, in cropping systems. Topics covered include the effects of climate change on biodiversity and the functioning of agricultural ecosystems, and the role of organic farming practices in mitigating negative effects of climate change.

Farming for Success in the 21st Century: Increasing Biodiversity (CalCAN): http://calclimateag.org/wp-content/uploads/2013/04/BIodiversity-Fact-Sheet.pdf. This fact sheet covers crop, landscape and species diversity practices related to climate change adaption and mitigation.

Buffers

Planting Habitat on Farms: Design, Techniques and Issues (Community Alliance for Family Farmers): http://www.youtube.com/watch?v=A4YwpkOSVTA&feature=youtu.be&noredirect=1. This webinar shows a diversity of projects, focusing on established practices and lessons learned from 20 years of planting habitat on farms.

Pollinator Habitat

Xerces Society Pollinator Short Course (SARE): http://www.sare.org/Learning-Center/SARE-Project-Products/Southern-SARE-Project-Products/Xerces-Society-Pollinator-Short-Course. This presentation (PowerPoint slides) provides training on topics such as principles of pollinator biology, the economics of insect pollination, basic bee field identification, and pollinator conservation through land management practices, habitat restoration, and plant selection.

Maintenance of Natural Sustainable Riparian Communities Fact Sheet Series (SARE): http://www.sare.org/Learning-Center/SARE-Project-Products/North-Central-SARE-Project-Products/Maintenance-of-Natural-Sustainable-Riparian-Communities-Fact-Sheets-Series. Five extension fact sheets based on a study of riparian ecosystems along the Middle Sheyenne River of North Dakota. Four of them relate to proper grazing management of these ecosystems.

Establishing Native Pollinator Habitat Organically: Tips from our Experience at Kerr Center (Kerr Center for Sustainable Agriculture): http://kerrcenter.com/publication/establishing-native-pollinator-habitat-organically-tips-from-our-experience-at-kerr-center/. The Kerr Center faced many challenges and learned many lessons. They summarize their work and recommendations based on their experience.