



National Organic Program

## Biodiversity and Natural Resources Conservation

# Addressing Conservation in Organic Production Systems



National Organic Program

## Biodiversity and Natural Resources Conservation

### A Joint Effort:

**Wild Farm Alliance and International Organic Inspectors Association have teamed up to make biodiversity conservation a foundational principle in organic agriculture production and inspections.**



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## Biodiversity and Natural Resources Conservation

**Biodiversity conservation is part of the NOP definition of Organic Production.**



B. Kersey



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## Organic Production

*As defined by the USDA NOP - 205.2*

### Organic Production:

A production system that is managed in accordance with the Act and regulations in this part to respond to site-specific conditions by integrating cultural, biological, and mechanical practices that foster cycling of resources, promote ecological balance, and *conserve biodiversity*.



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## Biodiversity and Natural Resources Conservation

The preamble of the NOP regulations states producers must initiate practices to conserve biodiversity, and show compliance in their Organic System Plan.



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## Preamble to the Rule

- “We ... have amended the definition of organic production to require that **a producer must conserve biodiversity** on his or her operation.
- The use of ‘conserve’ establishes that the **producer must initiate practices to support biodiversity and avoid, to the extent practicable, any activities that would diminish it.**
- **Compliance** with the requirement to conserve biodiversity requires that a producer **incorporate practices in his or her organic system plan that are beneficial to biodiversity** on his or her operation.”


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**Biodiversity**  
*As defined by the National Organic Standards Board*

**What is biodiversity?**

**Biological diversity includes the variety of all forms of life, from bacteria and fungi to grasses, ferns, trees, insects, and mammals.**

  
Taylor F. Lockwood





  
Jack Kelly Clark, UC

  
USFWS

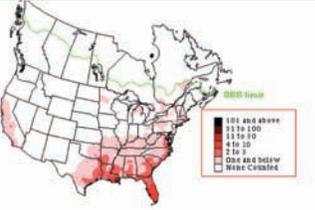

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**Biodiversity**  
*As defined by the National Organic Standards Board*

**Biodiversity includes genetic differences between *individuals and populations* (groups of related individuals) and types of *natural communities* (groups of interacting species) found in a particular area.**

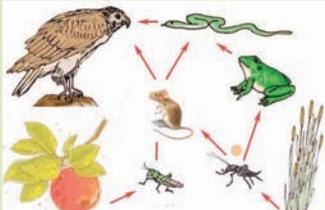
***Example of Avian Biodiversity***

  
J. Clayton

**Individual with Unique Genetics**

  
USFWS

**Populations of Red-shouldered Hawks**



**Farm and Grassland Community**

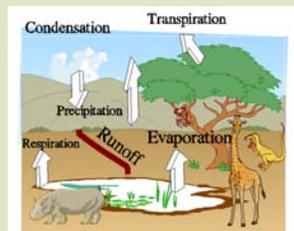


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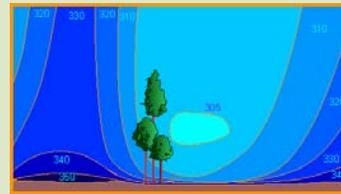
## Biodiversity

*As defined by the National Organic Standards Board*

**Biological diversity also includes the full range of natural processes upon which life depends, such as water cycling, and carbon fixation.**



The Water Cycle



CO<sub>2</sub> Taken up by Trees



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## Natural Resources of the Operation-205.200

**Natural Resources - 205.2** (as defined by NOP)

**Organic Production - 205.2** (as defined by NOP)

**Natural resources of the operation must be maintained or improved.**



Richard Weisser and smokyphotos.com



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## Natural Resources Standard 205.200

Production practices implemented in accordance with this subpart must maintain or improve the **natural resources of the operation**, including soil and water quality.



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## Natural Resources of the Operation

*As defined by the USDA NOP - 205.2*

***Natural resources of the operation.*** The physical, hydrological, and biological features of a production operation, including soil, water, wetlands, woodlands, and wildlife.



## Biodiversity and Natural Resources Conservation in Crop Production



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**Natural Resources of the Operation-205.200**

**Natural Resources - 205.2** (as defined by NOP)

**Organic Production - 205.2** (as defined by NOP)

Organic production practices must **conserve biodiversity** and maintain or improve the natural resources of the operation, including **soil, water, wetlands, woodlands and wildlife**.



Compliance	Issue of Concern?	Noncompliance
<p><b>Ag Benefits:</b> Recharge groundwater, decrease damage to irrigation system from wildlife searching for water, and provide water for livestock.</p> <p><b>Biodiversity Benefits:</b> Riparian areas are wildlife corridors. They have high diversity of plant species, and their numbers depend upon the water flow.</p>		

### Compliance

Water in the stream is used for agriculture but has not been depleted enough to impact native species dependent on this water.

### Issue of Concern?/Opportunity for Improvement

**Issue:** Farm is diverting the creek's water, which in the dry season could mean the creek is completely dewatered.

**Opportunity:** Farm operation switches to drip irrigation, or uses soil moisture tools so that they can use less water and at the same time ensure native species and natural functions dependent on water can survive.

### Noncompliance (Corrective Action Required)

Creek is dewatered by farming operation and many species dependent on it die.

### Benefits that Directly Support this Regulatory Requirement

-Conserve biodiversity and maintain natural resources, including soil, water, wetlands, woodlands and wildlife.

### Benefits to Agriculture

- Recharge groundwater.
- Decrease damage to irrigation system from wildlife coming into crop fields in search of water.
- Provide water for livestock.

### Fundamental Biodiversity Conservation Benefits

- Share water with human and wild neighbors, including migratory species.
- Efficiently and uniformly apply irrigation water and maintain soil moisture for plant growth.
- Conserve streamflow and ground water and protect water quality down stream.

### Ecological Principles

-Fundamental qualities of riparian systems:

- (a)The riparian system is a transition zone between land and water ecosystems and is disproportionately plant species-rich when compared to surrounding ecosystems.
- (b)The flow regime determines the successional evolution of riparian plant communities and ecological processes.
- (c)The riparian corridor serves as a pathway for animals, plants, and abiotic material that influence plant communities along rivers.

### Resources

- Nilsson, C. and M. Svedmark. Basic principles and ecological consequences of changing water regimes: riparian plant communities. Environ. Management. 2002 Oct;30(4):468-80.
- NRCS Conservation Practice Standard – Microirrigation (441). [www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/references/](http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/references/)

## Biodiversity and Natural Resources Conservation in Crop Production



National Organic Program

**Natural Resources of the Operation-205.200**

**Natural Resources - 205.2** (as defined by NOP)

**Organic Production - 205.2** (as defined by NOP)

**Organic production practices must conserve biodiversity and maintain or improve the natural resources of the operation.**



Compliance	Issue of Concern?	Noncompliance
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**Ag Benefits:** Support pollinator and pest-eating insects.

**Biodiversity Benefits:** Remnants, like this rare Kentucky tall grass prairie plant community, need protection. Biodiversity conservation leads to new medicines, and a greater buffer to natural disasters and climate change.

### Compliance

One of the few remnants left of Kentucky's tall grass prairie on land with organic certification is conserved.

### Issue of Concern?/Opportunity for Improvement

Issue: Rare plant community on certified land might be destroyed.

Opportunity: Stake off rare plant area so that it will not be accidentally destroyed by farm work. If possible, put natural area in a conservation easement so that it is conserved in perpetuity.

### Noncompliance (Corrective Action Required)

Converting a high conservation value rare plant community on certified land into soybeans is not conserving the natural resource.

### Benefits that Directly Support this Regulatory Requirements

-Conserve biodiversity and maintain the natural resources of the operation.

### Benefits to Agriculture

-Flowering habitat supports pollinators and other beneficial insects.

### Fundamental Biodiversity Conservation Benefits

-Biodiversity conservation leads to new medicines, and a greater buffer to natural disasters and climate change.

-Conserve ecosystem in its original or usable and functioning condition.

### Ecological Principles

-Island biogeography-The number of species found on an undisturbed island (or any fragmented parcel) is determined by immigration and extinction.

Land development can create habitat islands causing fragmentation which isolates plants and animals from others of their kind; this decreases genetic diversity.

### Resources

-Natureserve – A network connecting science with conservation. [www.natureserve.org](http://www.natureserve.org)

-Endangered Species International – An organization strongly committed to reversing the trend of human-induced species extinction, saving endangered animals, and preserving wild places. [www.endangeredspeciesinternational.org](http://www.endangeredspeciesinternational.org)

-The Nature Conservancy – Protecting nature; preserving life. [www.nature.org](http://www.nature.org)

-Kentucky Natural Lands Trust – Protecting, restoring, and connecting wildlands. [www.knlt.org](http://www.knlt.org)

## Biodiversity and Natural Resources Conservation in Crop Production


National Organic Program  
**Natural Resources of the Operation-205.200**  
**Natural Resources - 205.2** (as defined by NOP)  
**Organic Production - 205.2** (as defined by NOP)

Organic production practices must **conserve biodiversity** and maintain or improve the natural resources of the operation, including **wildlife**.

 Red-cockaded Woodpecker USFWS and Mark Rainey	 ABC	
<b>Compliance</b>	<b>Issue of Concern?</b>	<b>Noncompliance</b>

Ag Benefits: Support birds that eat pest insects.  
Biodiversity Benefits: Woodpeckers are keystone – their nest-holes become nests for many birds and small mammals. “To keep every cog and wheel is the first precaution of intelligent tinkering.” (Aldo Leopold)

### Compliance

Habitat for the red-cockaded woodpecker, which is listed as endangered in Kentucky, is conserved.

### Issue of Concern?/Opportunity for Improvement

Issue: A dead tree that serves as habitat might be cut down.

Opportunity: Saving snags that this bird may nest in helps maintain the species.

### Noncompliance (Corrective Action Required)

Habitat for at-risk priority and keystone species is destroyed.

### Benefits that Directly Support this Regulatory Requirement

-Conserve biodiversity and maintain the natural resources of the operation, including wildlife.

### Benefits to Agriculture

-Many bird species consume pest insects. Arboreal birds that spend their life in trees eat foliage insects, wood boring beetles and overwintering moths. Birds that spend most of their time in brush or on the ground eat pests insects in the lower foliage, and also insects and weed seeds on the ground.

### Fundamental Biodiversity Conservation Benefits

-Woodpeckers are keystone species because of their crucial role in creating habitat suited to other woodland wildlife. Abandoned woodpecker nest-holes become nests or roosts for small birds and mammals.

### Ecological Principle

-Saving rare species has value. According to Aldo Leopold, one of the fathers of the conservation movement, “To keep every cog and wheel is the first precaution of intelligent tinkering.”

### Resources

-Natureserve – A network connecting science with conservation. [www.natureserve.org](http://www.natureserve.org)

-Endangered Species International – An organization committed to reversing the trend of human-induced species extinction, saving endangered animals, and preserving wild places. [www.endangeredspeciesinternational.org](http://www.endangeredspeciesinternational.org)

-USDA Natural Resources Conservation Service’s Conservation Practice Standard on Restoration of Rare or Declining Habitats (643). [www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/references/](http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/references/)

## Biodiversity and Natural Resources Conservation in Organic Production

 National Organic Program

**Natural Resources of the Operation-205.200**  
**Natural Resources - 205.2** (as defined by NOP)  
**Organic Production - 205.2** (as defined by NOP)

Organic production practices must **conserve biodiversity** and maintain or improve the natural resources of the operation, including **wildlife**.

 <small>www.bearsmart.com</small>		
<b>Compliance</b>	<b>Issue of Concern?</b>	<b>Noncompliance</b>

**Ag Benefits:** Bears consume insects and sometimes rabbit and deer.

**Biodiversity Benefits:** As hunters, bears cull the weak and sickly animals, thus contributing to natural selection. As scavengers, they help clean up animal carcasses which would otherwise spread disease.

### Compliance

The American black bear, which is categorized as a sensitive species in Kentucky, is able to co-exist with farm operations with the use of fencing.

### Issue of Concern?/Opportunity for Improvement

**Issue:** Bears should be discouraged from eating apples. Doing nothing to dissuade the animals causes problems in the future.

**Opportunity:** The operator makes the crop inaccessible to the bear with the use of a fence, so that it does not need to be killed. If fencing is not warranted because bears are rarely a problem, fruit should be picked as it ripens; and not allowed to accumulate on the ground. Culls and garbage should be discarded.

### Noncompliance (Corrective Action Required)

The operator does not first try to dissuade problem bears, using methods that promote co-existence before killing them.

### Benefits that Directly Support this Regulatory Requirement

-Conserve biodiversity and maintain the natural resources of the operation, including **wildlife**.

### Benefits to Agriculture

-Bears consume termites, moths and sometimes rabbit and deer.

### Fundamental Biodiversity Conservation Benefits

-Black bears are important in ecosystems because they help to disperse the seeds of the plants they eat. The flowers of the native shrub seeds they eat support pollinators and other beneficial insects. As hunters, bears cull the weak and sickly animals. As scavengers, they help clean up animal carcasses which would otherwise spread disease.

### Ecological Principles

-Territory needs of wildlife. Bears have different habitat requirements at different times, so their range is relatively large.

-Natural selection. By culling weak and sick animals, bears contribute to natural selection.

### Resources

-Bear Aware British Columbia Conservation Foundation. [www.bearaware.bc.ca](http://www.bearaware.bc.ca)

-Gegner, L. E. Predator Control for Sustainable and Organic Livestock Production. NCAT/ATTRA. April 2002. <https://attra.ncat.org/attra-pub/summaries/summary.php?pub=189>

## Biodiversity and Natural Resources Conservation in Crop Production



National Organic Program

### Land Requirements Buffer Zones 205.202(c)

**Any field or farm parcel must have **distinct, defined buffer zones** such as runoff diversions to prevent the **unintended** application of a prohibited substance.**



Compliance	Issue of Concern?	Noncompliance
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**Ag Benefits:** Windbreaks protect plants and soil from wind-related damage, provide shelter for animals, and improve irrigation efficiency.

**Biodiversity Benefits:** Buffer zones serve as roosting, nesting, cover and corridors for wildlife, and increase carbon storage in biomass and soils.

### Compliance

A windbreak currently intercepts pesticide drift.

### Issue of Concern?/Opportunity for Improvement

Issue: The farm's border has no vegetative buffer present to intercept pesticide drift.

Opportunity: If a windbreak is carefully designed on the farm's border, it can intercept future pesticide drift that may occur when the neighbor plants and sprays a crop nearby.

### Noncompliance (Corrective Action Required)

Pesticides drift onto the crop.

### Benefits that Directly Support this Regulatory Requirement

-Intercept airborne contamination.

### Benefits to Agriculture

- Reduce soil erosion from wind.
- Protect plants from wind related damage.
- Alter the microenvironment for enhancing plant growth.
- Provide shelter for structures, animals, and people.
- Improve irrigation efficiency.
- Prevent weed seed migration into the field.

### Fundamental Biodiversity Conservation Benefits

- Beneficial insects and pollinator habitat.
- Enhances other wildlife habitat.
- Woody plants sequester carbon in biomass and in soils.
- Provide noise and visual screens.

### Ecological Principle

-Increase landscape connectivity by providing wildlife movement corridors through the farm to natural or undeveloped areas, reducing the effects of fragmentation.

### Resources

- USDA National Agroforestry Center. Windbreak density: Rules of thumb for design. AF Note 36. September 2007. {URT Sec.II.D.3}
- USDA Natural Resources Conservation Service's Conservation Practice Standards on Windbreak Establishment (380) and Hedgerows (422). [www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/references/](http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/references/)

## Biodiversity and Natural Resources Conservation in Crop Production



National Organic Program

### Soil Fertility and Crop Nutrients - 205.203(a)

**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.**



Compliance	Issue of Concern?	Noncompliance
<b>Ag Benefits:</b> Conserve farm's fertile topsoil, improve soil organic matter content, tilth, microbial diversity and water holding capacity of soil.		
<b>Biodiversity Benefits:</b> Reduce carbon dioxide losses from the soil. May provide food, breeding habitat and escape cover for wildlife on edges.		

### Compliance

Use of the cover-crop roller allows the knock down of a weed-suppressing mat at the same time the next crop is planted and this helps maintain the soil condition and reduce erosion. Operations should be timed so as not to interfere with breeding and nesting of ground birds.

### Issue of Concern?/Opportunity for Improvement

Issue: Too much tillage can lead to soil erosion.

Opportunity: If no-till practices are instituted, they can help to maintain the physical, chemical, and biological condition of the soil and protect against erosion.

### Noncompliance (Corrective Action Required)

Soil is significantly eroding in farm field.

### Benefits that Directly Support this Regulatory Requirement

-Tillage and cultivation practices maintain and improve soil characteristics.

### Benefits to Agriculture

- Reduce sheet and rill erosion.
- Reduce wind erosion.
- Improve soil organic matter content.
- Reduce soil particulate emissions.
- Increase plant-available moisture.
- Improve soil tilth, microbial diversity, and water holding capacity.

### Fundamental Biodiversity Conservation Benefits

- Reduce off-site transport of sediment and nutrients.
- Reduce CO<sub>2</sub> losses from the soil.
- Provide food, breeding habitat and escape cover for wildlife. Leaving one or two rows of unharvested crop standing at intervals across the field can enhance the value of residue for wildlife habitat. Unharvested crop rows have the greatest value when they are adjacent to other cover types, such as grassy or brushy areas or woodland.

### Resources

- Rodale Institute on organic no-till. <http://rodaleinstitute.org/our-work/organic-no-till/>
- USDA Natural Resources Conservation Service's Conservation Practice Standard on Residue Tillage Management/No Till (329). [www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/references/](http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/references/)

## Biodiversity and Natural Resources Conservation in Crop Production



National Organic Program

### Soil Fertility and Crop Nutrients - 205.203(c)

Producer **MUST** 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 by **plant nutrients, pathogenic organisms, heavy metals, or residues of prohibited substances.**

 <small>Full Belly Farm</small>	 <small>EGCSCM.org</small>	 <small>D. Orlick</small>
<b>Compliance</b>	<b>Issue of Concern?</b>	<b>Noncompliance</b>

**Ag Benefits:** Using compost reduces pathogens in the soil. Applying manure when the ground is not frozen protects water during spring thaw.

**Biodiversity Benefits:** Diverse soil microorganisms foster predation, competition, and antagonism of plant and human pathogens in the soil.

### Compliance

Manure or composted manure is applied to the soil at the proper rate for the next crop when there are no adverse weather conditions.

### Issue of Concern?/Opportunity for Improvement

Issue: Manure is applied to frozen ground.

Opportunity: Manure or compost is applied and immediately worked into the soil before the ground freezes to reduce off-site contamination.

### Noncompliance (Corrective Action Required)

During spring thaw, runoff contains manure that was applied in the winter.

### Benefits that Directly Support this Regulatory Requirement

Soil amendments made of plant and animal products do not contaminate crops, soil or water.

### Benefits to Agriculture

- Use of compost reduces plant and human pathogens in the soil.
- Applying compost or manure when the ground is not frozen protects water quality during spring thaw.
- Budgets nutrients for production.
- Maintains physical, chemical and biological condition of soil.

### Fundamental Biodiversity Conservation Benefits

- Diverse soil microbial organisms foster predation, competition, and antagonism of plant and human pathogens in the soil.
- Microbial soil diversity also leads to soil fertility, water availability, disease free plants, and food safety.

Wild Farm Alliance  
IOIA

National Organic Program

## Continued from last slide

### Soil Fertility and Crop Nutrients - 205.203(c)



Compliance	Issue of Concern?	Noncompliance
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#### Ecological Principle

-Ecological niche. How a species or population responds to the abundance of its resources and enemies (e. g., by growing when resources are abundant, and predators, parasites and pathogens are scarce) and how it affects those same factors (e. g., by reducing the abundance of resources through consumption and contributing to the population growth of enemies by falling prey to them).

-Competitive exclusion. No two species can occupy the same niche in the same environment for a long time

#### Resources

-Baumgartner, J. 2013. Food Safety and Conservation: Facts, Tips and Frequently Asked Questions. Wild Farm Alliance. [www.wildfarmalliance.org](http://www.wildfarmalliance.org)

-USDA Natural Resources Conservation Service's Conservation Practice Standard on Nutrient Management (590). [www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/references/](http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/references/)

## Biodiversity and Natural Resources Conservation in Crop Production



National Organic Program

**Soil Fertility and Crop Nutrients - 205.203(e)(3)**

The producer must not use burning as a means of disposal for crop residues produced on the operation:  
**Except, That burning may be used to suppress the spread of disease or to stimulate seed germination.**





**Compliance**

**Issue of Concern?**

**Noncompliance**

**Ag Benefits:** Suppress plant disease, enhance seed germination, reduce wildfire hazards, and improve air quality for farm and community.

**Biodiversity Benefits:** Fire is a natural ecological process that maintains and preserves the health of grasslands and other ecosystems.

### Compliance

A grassland is burned to stimulate seed germination.

### Issue of Concern?/Opportunity for Improvement

Issue: Tree prunings may not be burned in order to destroy crop residue.

Opportunity: Instead of burning tree prunings, they can be piled producers can pile them along a newly planted hedgerow for protection against deer browsing, or chipped and used as a mulch under permanent crops.

### Noncompliance (Corrective Action Required)

A brush pile is burned to dispose of of prunings quickly.

### Benefits that directly support this regulatory requirement

Suppress plant disease and stimulate seed germination.

### Benefits to Agriculture

- Reduce plant disease.
- Enhance seed and seedling production.
- Reduce wildfire hazards.
- Improve air quality for farm and community.

### Fundamental Biodiversity Conservation Benefits

- Restore and maintain ecological sites.
- Improve wildlife habitat.

### Ecological Principle

-Fire is a natural ecological process that maintains and preserves the health of grasslands and other ecosystems.

### Resources

-USDA Natural Resources Conservation Service's Conservation Practice Standard on Prescribed Burning (338).  
[www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/references/](http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/references/)



National Organic Program

## Crop Rotation

As defined by the USDA National Organic Program -  
205.2

“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. (and)

**Perennial cropping systems** employ means such as alley cropping, intercropping, and hedgerows to introduce biological diversity in lieu of crop rotation. ”

## Biodiversity and Natural Resources Conservation in Crop Production

**National Organic Program**

**Crop Rotation Practice Standard 205.205(a)**

The producer must maintain or improve soil **organic matter** content with **rotation**.

**Rotation**

- 1st Year Corn
- 2nd Year Beans
- 3rd Year Corn
- 4th Year Beans

**No Rotation**

- 1st Year Corn
- 2nd Year Corn
- 3rd Year Corn
- 4th Year Corn

**Compliance**      **Issue of Concern?**      **Noncompliance**

**Ag Benefits:** Increase in soil nutrient and water holding capacity, promote nitrogen fixation and microbial diversity, suppress weeds and pathogens.

**Biodiversity Benefits:** Increase biodiversity and support nitrogen cycling and redistribution of nutrients in the soil profile.

### Compliance

Rotate crop with a cover crop, such as this red clover, to improve soil organic matter content.

### Issue of Concern?/Opportunity for Improvement

**Issue:** Corn and soybeans are rotated with each other, but not with a cover crop.

**Opportunity:** Adding a cover crop in the rotation mix increases soil organic matter, which then improves soil structure/tilth and supports a diverse microbial community antagonistic to pathogens. If a legume cover crop is used, it will also fix nitrogen.

### Noncompliance (Corrective Action Required)

Corn is planted on the same field every year with no rotation.

### Benefits that Directly Support this Regulatory Requirement

-Increase soil organic matter content.

### Benefits to Agriculture

- Reduce erosion from wind and water.
- Promote biological nitrogen fixation.
- Weed suppression
- Pathogen suppression
- Soil moisture management.
- Minimize and reduce soil compaction.

### Fundamental Biodiversity Conservation Benefits

- Increase biodiversity in the soil.
- Support nitrogen cycling and redistribution of nutrients in the soil profile.

## Biodiversity and Natural Resources Conservation in Crop Production

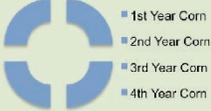
  


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#### Crop Rotation Practice Standard 205.205(a)



	Rotation	No Rotation
		
<b>Compliance</b>	<b>Issue of Concern?</b>	<b>Noncompliance</b>

### Ecological Principles

Biodiversity encompasses the nitrogen cycle as an ecological process. It includes:

- Rain storms contribute atmospheric nitrogen to the soil.
- Plant and animal wastes decompose, adding nitrogen to the soil.
- Bacteria in the soil convert those forms of nitrogen into forms plants can use.
- Legumes, such as soybeans, alfalfa and clovers, are plants that can convert atmospheric nitrogen into plant-usable nitrogen.
- Plants use the nitrogen in the soil to grow.
- People and animals eat the plants; then animal and plant residues return nitrogen to the soil again, completing the cycle.

### Resources

- McGrady-Steed et al. 1997. "Biodiversity regulates ecosystem predictability." *Nature* 390(6656): 162-165.
- Nitrogen cycle: <http://extension.missouri.edu/publications/DisplayPub.aspx?P=WQ252>
- USDA Natural Resources Conservation Service's Conservation Practice Standard on Cover Crop (340). [www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/references/](http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/references/)
- van Bruggen, A. et al. 2003. "Integrated approaches to root disease management in organic farming systems." *Australasian Plant Pathology* 32 (2003)2. p. 141 - 156.

## Biodiversity and Natural Resources Conservation in Crop Production



National Organic Program

### Crop Rotation Practice Standard 205.205(b)

The producer must provide for **pest management in lieu of rotation** in perennial systems.



Compliance	Issue of Concern?	Noncompliance
<p><b>Ag Benefits:</b> Increase pollen, nectar and nesting habitat for predatory and parasitic insects and pollinators. Provide weed suppression, reduce erosion from wind and water, and increase soil organic matter content.</p> <p><b>Biodiversity Benefits:</b> Increase habitat, including food, cover and corridors for terrestrial wildlife.</p>		

### Compliance

A flowering cover crop or native grasses and forbs are planted in between the rows of a vineyard.

### Issue of Concern?/Opportunity for Improvement

Issue: The only diversity in the perennial crop are weeds.

Opportunity: Weeds grow in between the vineyard rows, when a cover crop or native habitat could be planted there.

### Noncompliance (Corrective Action Required)

Nothing is allowed to grow but the perennial crop in the field.

### Benefits that Directly Support this Regulatory Requirement

Perennial cropping system employs alley cropping to introduce biological diversity in lieu of crop rotation.

### Benefits to Agriculture

- Provide habitat for beneficial insects.
- Increase pollen, nectar and nesting habitat for pollinators.
- Reduce erosion from wind and water.
- Capture and recycle or redistribute nutrients in the soil profile.
- Promote biological nitrogen fixation.
- Weed suppression.
- Soil moisture management.
- Reduce particulate emissions into the atmosphere.
- Minimize and reduce soil compaction.
- Increase soil organic matter content.

### Fundamental Biodiversity Conservation Benefits

- Increase habitat, including food, cover and corridors for terrestrial wildlife.



National Organic Program

## Continued from last slide

### Crop Rotation Practice Standard 205.205(b)



NRCS

Compliance	Issue of Concern?	Noncompliance
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#### Ecological Principle

-Nature loves variety. The number and mix of species present influence the type and amount of biodiversity present.

#### Resources

-Canada - British Columbia Environmental Farm Plan Program. Planning for Biodiversity. A Guide for BC Farmers and Ranchers. <https://www.bcac.bc.ca/ardcorp/program/biodiversity>

-Thrupp, A. et al. 2008. Biodiversity Conservation Practices in California Vineyards: Learning from Experiences. California Sustainable Winegrowing Program. [http://www.sustainablewinegrowing.org/docs/2008-Biodiversity\\_in\\_Vineyards.pdf](http://www.sustainablewinegrowing.org/docs/2008-Biodiversity_in_Vineyards.pdf)

-USDA Natural Resources Conservation Service's Conservation Practice Standards: Alley Crop (311), Cover Crops (340) and Hedgerow (422). [www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/references/](http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/references/)

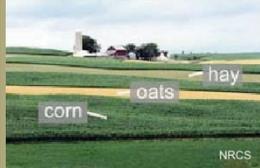
## Biodiversity and Natural Resources Conservation in Crop Production



National Organic Program

### Crop Rotation Practice Standard 205.205(d)

**The producer must provide erosion control with rotation.**



Compliance	Issue of Concern?	Noncompliance
<b>Ag Benefits:</b> Crop rotation improves soil quality, and helps manage the balance of plant nutrients and plant pests (weeds, insects, and diseases).		
<b>Biodiversity Benefits:</b> When water is conserved and water quality is protected, many types of aquatic and terrestrial wildlife are supported.		

### Compliance

Strips of oats and hay are interspersed with strips of corn and rotated with each other each year to save soil and improve water quality.

### Issue of Concern?/Opportunity for Improvement

Issue: Corn planted on a slope is not rotated very often.

Opportunity: Corn planted on sloping land should be rotated with other crops to reduce sheet and rill erosion.

### Noncompliance (Corrective Action Required)

The same crop is planted every year and erosion occurs.

### Benefits that Directly Support this Regulatory Requirement

Provide erosion control with rotation.

### Benefits to Agriculture

- Improve soil quality.
- Manage the balance of plant nutrients.
- Increase cropping system diversity.
- Manage crop consumptive use of water.
- Manage plant pests (weeds, insects, and diseases).

### Fundamental Biodiversity Conservation Benefits

-When water is conserved and water quality is protected, many types of aquatic and terrestrial wildlife are supported.

### Ecological Principle

-Habitats with more complex vegetative structures have been found to contain a greater diversity of species, including insect-eaters, but fewer pest species, such as invasive non-native plants.

### Resources

-Environment Canada. 2002. Hedgerows a Final Frontier on Farms. The Science and the Environment Bulletin. March/April.

-USDA Natural Resources Conservation Service's Conservation Practice Standard on Conservation Crop Rotation (328). [www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/references/](http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/references/)

## Biodiversity and Natural Resources Conservation in Crop Production



National Organic Program

### Crop pest, weed, and disease prevention - 205.206 (a)(2)

The producer must use management practices to prevent crop pests, weeds, and diseases including but not limited to **sanitation measures to remove disease vectors, weed seeds, and habitat for pest organisms.**



J. Cardina / Ohio Ag Research and Dev. CenterJames H. Miller

Compliance	Issue of Concern?	Noncompliance
Ag Benefits: Removing invasive species before they spread makes them much easier control.		
Biodiversity Benefits: Keeping an invasive species from monopolizing habitat means resources are available for native species.		

### Compliance

The invasive, non-native, multi-flora rose was present but is now under control. Periodic monitoring occurs and any of this weed that found is removed immediately.

### Issue of Concern?/Opportunity for Improvement

Issue: Multi-flora rose is a major invasive species in parts of Kentucky. It is impacting the pasture quality and threatens to spread to natural areas.

Opportunity: The invasive multi-flora rose should be removed before it becomes well established and is harder to control.

### Noncompliance (Corrective Action Required)

The multi-flora rose is well-established and has taken over natural areas that had been used by native species.

### Benefits that Directly Support this Regulatory Requirement

-Sanitation measures are used to remove invasive weed species before they threaten natural areas.

### Benefits to Agriculture

-Removing invasive species before they spread makes them much easier control.

### Fundamental Biodiversity Conservation Benefit

-Keeping an invasive species from aggressively spreading and monopolizing essential habitat resources means that light, nutrients, water, and space are available for native species.

### Ecological Principles

-Diversity resists invasion. Resistance against invasive species can occur with plant species diversity, because there are no vacant niches to be occupied by invading plants.

-Plant succession (a change in plant communities over time). Just as plant communities can change from annual weeds to a final community of oaks and hickories, animal communities also change from those that eat the annual weeds seeds to those that use the many food, cover and nesting resources in oak/hickory woodlands.

### Resources

-Funk, F. 2007. The Importance of Removing Invasive Plants. <http://greendecade.org/download/environmentpage/invasives.pdf>

-Yarrow, G. Basic Ecological Principles: Understanding How the System Works. Clemons University Cooperative Extension. [http://www.clemson.edu/extension/natural\\_resources/wildlife/publications/fs5\\_basic\\_ecological\\_principles.html](http://www.clemson.edu/extension/natural_resources/wildlife/publications/fs5_basic_ecological_principles.html)

## Biodiversity and Natural Resources Conservation in Crop Production



National Organic Program

### Crop pest, weed, and disease prevention - 205.206 (a)(3)

The producer must use **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**.



Compliance	Issue of Concern?	Noncompliance
Ag Benefits: Reduce need to use off-farm inputs.		
Biodiversity Benefits: Traits that evolved to keep the plant healthy provide an ecological balance between the plant and the disease.		

### Compliance

The tomato variety was selected for climate appropriateness and resistance to prevalent diseases.

### Issue of Concern?/Opportunity for Improvement

Issue: Tomato plants were not selected for resistance to *Fusarium* wilt.

Opportunity: In the future, the producer should plan to purchase disease resistant tomato varieties.

### Noncompliance (Corrective Action Required)

The crop variety is susceptible to disease and requires the producer to continually use pesticides or lose the crop.

### Benefits that Directly Support this Regulatory Requirement

-Selection of plant species and variety was done with regard to suitability to site-specific conditions and resistance to prevalent diseases.

### Benefits to Agriculture

-Reduce need to use off-farm inputs.

### Fundamental Biodiversity Conservation Benefits

-Traits that evolved to keep the plant healthy, provide an ecological balance between the plant and the disease.

### Ecological Principles

“Our planet's life forms co-evolved over millions of years as complex, interdependent communities of organisms called ecosystems. Each species within an ecosystem depends on other species to provide nutrients, circumstances necessary for reproduction, and limits to its expansion. Many plants rely on fungi and other soil organisms to decompose dead plants and animals, thereby releasing nitrogen and other nutrients into the soil. Specific plants often depend on specific insect species to pollinate their flowers so that they produce seeds, and they depend on other animals to help disperse those seeds. The community of organisms that make up an ecosystem includes a variety of herbivores, predators, fungi, bacteria and other pathogens that help an ecosystem stay in balance by preventing one species from increasing to the point of extirpating others. When biodiversity is reduced, this compromises the ability of an ecosystem to withstand drought, disease and other environmental stresses.” (Scherer-Lorenzen)

### Resources

-Scherer-Lorenzen, M. Biodiversity and Ecosystem Functioning: Basic Principles. Encyclopedia of Life Support Systems. <http://www.eolss.net/sample-chapters/c09/e4-27-02-01.pdf>

## Biodiversity and Natural Resources Conservation in Crop Production



National Organic Program

### Crop pest, weed, and disease prevention - 205.206 (b)(2)

**Pest problems** may be controlled through mechanical or physical methods including but not limited to development of **habitat for natural enemies of pests.**



Compliance	Issue of Concern?	Noncompliance
<p><b>Ag Benefits:</b> Provide habitat for natural enemy and pollinator insects, and reduce weed pressure and erosion from wind and water.</p> <p><b>Biodiversity Benefits:</b> Helps to support pollinator and beneficial insect populations in the larger landscape, which benefits natural areas.</p>		

### Compliance

A native plant hedgerow provides habitat for natural enemy insects.

### Issue of Concern?/Opportunity for Improvement

Issue: Pest control of crop is lacking.

Opportunity: If beneficial insect habitat is established on farm, it will support natural enemies, reducing or eliminating the need for pesticides.

### Noncompliance (Corrective Action Required)

A prohibited material is used instead of supporting natural enemy insects with native habitat.

### Benefits that Directly Support this Regulatory Requirement

-Support beneficial predator and parasitic insects that attack pest insects.

### Benefits to Agriculture

- Provide habitat for natural enemy and pollinator insects.
- Reduce weed pressure.
- Reduce erosion from wind and water.
- Increase soil organic matter content.
- Capture and recycle or redistribute nutrients in the soil profile.
- Soil moisture management
- Reduce particulate emissions into the atmosphere.
- Minimize and reduce soil compaction.

### Fundamental Biodiversity Conservation Benefits

- May increase landscape connectivity by providing wildlife movement corridors through the farm to wilder areas.
- Build pollinator and beneficial insect populations in the larger landscape, which results in healthier natural areas.

## Biodiversity and Natural Resources Conservation in Crop Production



National Organic Program

# Continued from last slide

## Crop pest, weed, and disease prevention - 205.206 (b)(2)



**Compliance****Issue of Concern?****Noncompliance**

### Ecological Principles

**Predation.** The predator (an organism that is hunting) feeds on its prey (the organism that is attacked).

**Population dynamics.** As populations of pest insects increase, beneficial insects begin feeding on them and increasing their populations so that they overtake the pests before a threshold is reached where yields are affected.

**Trophic cascades.** These occur when predators limit the density and/or behavior of their prey and thereby enhance survival of the next lower trophic level – in this case, the crop.

**Resilience.** As global warming affects pest pressures, beneficial insect habitat will help the farm withstand the changes.

**Co-evolution.** Natural enemy insects and native plants have co-evolved together over thousands of generations.

### Resources

-Attracting Beneficial Insects with Native Flowering Plants from Michigan State University Extension: <http://migarden.msu.edu/uploads/files/e2973.pdf>

-Hedgerows for California Agriculture: A Resource Guide. 2004. Community Alliance with Family Farmers. [caff.org/programs/bio-ag/hedgerows/](http://caff.org/programs/bio-ag/hedgerows/)

-Native Plants for Landscape Use In Kentucky (Chapter 4): <http://www.louisvilleky.gov/NR/rdonlyres/69C2F0F7-B4D9-4F90-A301-D408CC029675/0/Chapter4NativePlants.pdf>

-Pocket Field Guide: Recognizing Beneficial Insects in the Yard. Louisville Water Company. <http://www.louisvilleky.gov/NR/rdonlyres/EDC5CAED-A390-45CC-977C-3FB815CB138E/0/SRAG900RecognizingBeneficialInsects.pdf>

## Biodiversity and Natural Resources Conservation in Crop Production



National Organic Program

### Wild-crop harvesting - 205.207(b)

**A wild crop must be harvested in a manner that ensures that such harvesting or gathering will not be destructive to the environment and will sustain the growth and production of the wild crop.**



Compliance	Issue of Concern?	Noncompliance
Ag Benefits: Ensures supply for future harvests.		
Biodiversity Benefits: Part of the natural ecosystem is maintained.		

### Compliance

Ginseng is being harvested in a sustainable manner determined by careful research of what is best for the plant.

### Issue of Concern?/Opportunity for Improvement

Issue: Not enough ginseng is left to sustain growth in the coming years.

Opportunity: The wild crop is surveyed and a plan is created to harvest different areas over the years.

### Noncompliance (Corrective Action Required)

All ginseng is removed and soil erosion will occur from the harvest.

### Benefits that Directly Support this Regulatory Requirement

-Harvesting or gathering the wild crop will not be destructive to the environment and will sustain its the growth and production.

### Benefits to Agriculture

-Ensures supply for future harvests.

### Fundamental Biodiversity Conservation Benefits

-Part of the natural ecosystem is maintained.

### Resources

-Riddle, J., and J. Ford, eds. "Section 4.8: Inspection of Wild Harvest Operations." International Organic Inspection Manual. International Federation of Organic Agricultural Movements and Independent Organic Inspectors Association. 2000.

-Center for Plant Conservation - Conserving and Restoring America's Native Plants. <http://www.centerforplantconservation.org/Education/publications/publications.asp>