

**Air Quality Enhancement Activity – AIR03 – Replace burning of prunings, removals and other crop residues with non-burning alternatives**



**Enhancement Description**

The use of non-burning alternatives to dispose of prunings, removals and other crop residues from orchards, vineyards and other woody perennial crops. Non-burning alternatives include chipping, grinding, shredding, mowing or composting of these materials.

**Land Use Applicability**

Cropland

**Benefits**

Burning prunings, removals and residues produces smoke, as well as other air emissions, including volatile organic compounds (VOCs) and oxides of nitrogen (NO<sub>x</sub>) that are precursors needed for ozone formation, and various forms of particulate matter. By replacing burning with alternatives (chipping, grinding, shredding, mowing or composting), harmful air emissions will be greatly reduced, and the resulting material usually can be used as mulch.

**Conditions Where Enhancement Applies**

This enhancement only applies to acres of orchards, vineyards, and other woody perennial cropping systems that produce significant residues that have used burning in prior years.

**Criteria**

1. A system of burning prunings, removals or residues is currently being utilized on the farm.
2. Burning of such material shall be replaced by one of the non-burning alternatives (chipping, grinding, shredding, mowing or composting).
3. Wood chips and other mulch material resulting from chipping, grinding or shredding shall be used for dust control on unpaved roadways or other farm surfaces, for bio-energy purposes, for composting, or left in orchards for natural decomposition.

**Adoption Requirements**

This enhancement is considered adopted when a non-burning alternatives has been utilized in prior years as a replacement to burning.

**Documentation Requirements**

1. A map showing farm areas where these activities were conducted and applied.
2. Dates, locations and type of non-burning alternatives used.



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## References

Washington State Department of Ecology, Air Quality Program (2004). [Washington State Alternatives to Burning: Agricultural Practices to Help Eliminate or Reduce the Need to Burn](#). Edited by Donna Guske Hansen and John E. Carlson.

[http://www.ecy.wa.gov/programs/air/aginfo/research\\_pdf\\_files/AlternativesAgBurn.pdf](http://www.ecy.wa.gov/programs/air/aginfo/research_pdf_files/AlternativesAgBurn.pdf)

Western Regional Air Partnership, Fire Emissions Joint Forum (2004). [Non-burning Alternatives for Wildlands \(Task 4.3.1.1\)](#). Prepared by Jones and Stokes, Sacramento, CA.

<http://www.wrapair.org/forums/fejf/tasks/FEJFtask3.html>

Western Regional Air Partnership, Fire Emissions Joint Forum (2002). [Non-Burning Alternatives on Agricultural Lands \(Task 4.3.1.1\)](#). Prepared by Eastern Research Group, Inc. (ERG) and Enviro-Tech Communications. ERG No.: 3261.00.005.001. <http://www.wrapair.org/forums/fejf/tasks/FEJFtask4.html>

**Air Quality Enhancement Activity – AIR04 – Use drift reducing nozzles, low pressures, lower boom height, and adjuvants to reduce pesticide drift**



**Enhancement Description**

Use drift reduction technologies to reduce the drift of agricultural chemicals away from the intended target when spraying.

**Land Use Applicability**

Cropland, Pastureland

**Benefits**

Drift reduction will reduce damage to non-target desirable plants and animal habitats and reduce pollution of water bodies. Reducing chemical drift will help to reduce both particulate matter (liquid droplets) in the air and the production of volatile organic compounds, which are an

integral part of the formation of ozone, a pollutant in the lower atmosphere. Reduced chemical drift will improve water quality by minimizing the delivery of chemical compounds through the air to water bodies. This enhancement assumes all chemical applications are done according to label directions.

**Conditions Where Enhancement Applies**

This enhancement applies to all crop or pasture land use acres.

**Criteria**

Implementation of this enhancement to reduce spray drift of agricultural chemicals requires the use of one or more of the following activities:

1. Use drift reduction nozzles, drops, shielding, pressure adjustment, electrostatic spray technology, or re-circulating spray technology to minimize drift of applied chemical away from targeted area while maintaining required efficacy of pesticide application.
2. Reduce sprayer pressures per the nozzle criteria to produce larger spray droplets, which have a lower tendency to drift. Do not exceed 40-45 psi sprayer pressure.
3. Reduce boom height to the minimum amount allowable (where full coverage is achieved just above the top of the plant canopy) to achieve coverage and minimize the amount of time droplets are in the air before contacting plant or soil surfaces.
4. Use spray adjuvants approved for use with the specific pesticide being applied to reduce evaporation of airborne spray droplets, keeping droplets larger so they will settle more quickly onto the targeted plants and soil.

**Adoption Requirements**

This enhancement is considered adopted when one or more of the above criteria have been implemented and documented to satisfy the NRCS State Office list of acceptable methods.



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### **Documentation Requirements**

Each year the following must be supplied:

1. Written documentation for the type of drift reduction technology used, and
2. Acres treated.

### **References**

Ozken, H.E. 2012. New Nozzles for Spray Drift Reduction. Ohio State University Extension Fact Sheet AEX 523-98. <http://ohioline.osu.edu/aex-fact/0523.html>

Witt, J. M. 2012. Agricultural Spray Adjuvants. Oregon State University Extension. <http://psep.cce.cornell.edu/facts-slides-self/facts/gen-peapp-adjuvants.aspx>

**Air Quality Enhancement Activity – AIR07 – GPS, targeted spray application (SmartSprayer), or other chemical application electronic control technology**



**Enhancement Description**

Utilize electronically-controlled or managed chemical spray application technology to more precisely apply agricultural pesticides to their intended targets.

**Land Use Applicability**

Cropland, Pastureland, Rangeland, Forestland

**Benefits**

These activities will provide improvements in water and air quality by reducing the total amount of chemical applied, and reducing the potential for airborne chemical drift when agricultural chemicals are applied. This enhancement can be used only if chemical applications are done according to label

directions. Reducing chemical drift will help to reduce both particulate matter (liquid droplets) in the air and the production of volatile organic compounds, which are an integral part of production of ozone, a pollutant in the lower atmosphere. Reduced chemical drift will improve water quality by minimizing the delivery of chemical compounds through the air to water bodies.

**Conditions Where Enhancement Applies**

This enhancement applies to all crop, pasture, range or forest land use acres.

**Criteria**

The implementation of this enhancement for precision pesticide application technology to reduce spray drift and the total amount of pesticide applied requires the use of GPS data loggers (i.e., devices that record the track, time and location of field trips for download to maps) in order to document site-specific compliance with all label requirements for drift mitigation, and additionally, one or more of the following techniques:

1. Precision guidance systems that reduce ground or aerial spray overlap to less than 12 inches
2. Variable rate technologies (VRT) that allow the rate of pesticide application to dynamically change for site specific applications
3. “Smart sprayers” that utilize automatic sensors and computer controlled nozzles to turn individual nozzles on and off
4. Computer guided application systems that integrate real time meteorological data and computer model guidance to reduce pesticide drift from aerial application
5. Re-circulating spray technologies that capture and reuse overspray to reduce overall pesticide application rate and off-site spray drift



6. Electrostatic spray technologies to reduce overall application rate and off-site spray drift

**Adoption Requirements**

This enhancement is considered adopted when site-specific compliance requirements plus one or more of the above criteria have been implemented and documented to satisfaction of the NRCS State Office.

**Documentation Requirements**

Each year the following must be supplied:

1. Type of electronic spray control technology used,
2. Dates technology is used, and
3. Acres treated.

**References**

Brown D.L., D.K. Giles, M.N. Oliver, P. Klassen. 2008. Targeted spray technology to reduce pesticide in runoff from dormant orchards. *Crop Prot.* 27(3-5):545-52. DOI: 10.1016/j.cropro.2007.08.012

Downey D. and D.K. Giles. 2005. Reducing orchard spray rates and ground deposit by using tree sensors and sprayer control. *Ann Rev Ag Eng.* 4:229-36.

Giles D.K., M.J. Delwiche and R.B. Dodd. 1987. Control of orchard spraying based on electronic sensing of target characteristics. *Trans ASAE.* 30(6):1624-30.

Giles D.K., P. Klassen, F.J.A. Niederholzer and D. Downey. 2011. *California Agriculture.* 65(2):85-89. DOI: 10.3733/ca.v065n02p85.

<http://californiaagriculture.ucanr.org/landingpage.cfm?article=ca.v065n02p85&fulltext=yes>

Tien, L. 2002. Development of a sensor-based precision herbicide application system. *Computers and Electronics in Agriculture,* 36:133-149.

**Air Quality Enhancement Activity– AIR08 –Nitrification inhibitors or urease inhibitors**



**Enhancement Description**

The use of an ammonia or ammonium fertilizers with a substance that inhibits the biological oxidations of ammoniacal nitrogen to nitrate nitrogen or the use of surface applied urea products with a substance that inhibits hydrolytic action on urea by urease enzyme that when applied to soils results in less urea nitrogen lost by ammonia volatilization (AAPFCO). This enhancement is only applicable to nitrogen applied within 30 days of planting. This does not apply to “pop-up” or starter nitrogen sources applied at planting time.

**Land Use Applicability**

Cropland, Pastureland

**Benefits**

When ammonia or ammonium N is added to the soil, it is subject to a process called nitrification. Soil bacteria called nitrosomonas convert the ammonia (NH<sub>3</sub>) or ammonium (NH<sub>4</sub>) to nitrate (NO<sub>3</sub>). This conversion is strongly temperature dependent and occurs quickly under warm soil temperature conditions. Using a nitrification inhibitor with early spring applications of ammonia or ammonium nitrogen will slow the conversion to nitrate until it can be readily used by crops. This will allow the crop to take up more of the N and ultimately reduce the release of nitric oxide (an ozone precursor) and nitrous oxide (a greenhouse gas) to the atmosphere. These conversion processes can produce nitrous oxide as a byproduct due to inefficiencies in the conversion processes. Nitrous oxide is a potent greenhouse gas which, on a molecular basis, has 310 times the global warming potential of carbon dioxide.

Using a urease inhibitor (with surface applied urea products) will reduce the volatilization and release of ammonia into the atmosphere that occurs as urea hydrolyzes. Urease is an enzyme produced by bacteria in the soil. It catalyzes the hydrolysis of urea into carbon dioxide and ammonia. Ammonia released to the atmosphere is a pre-cursor to PM<sub>2.5</sub> particulate matter.

**Conditions Where Enhancement Applies**

This enhancement applies to climatic areas and soils on cropland or pastureland where nitrogen fertilizer is applied AND where either nitrification inhibitors or urease inhibitors are recommended by the Land Grant University.

**Criteria**

Use either a nitrification inhibitor or urease inhibitor product (depending upon the type of nitrogen fertilizer or manure used) on the treatment acres.



1. Nutrient application rates must be within Land Grant University recommendations based on soil tests and established yield goals considering all nutrient sources. The nutrient application rate must take into account the additional nitrogen that will remain available to the plant due to the inhibition of the nitrification processes.
2. Apply the nitrification inhibitor or urease inhibitor according to manufacturer recommendations.
3. The methods used to apply the nitrification inhibitor or urease inhibitor must not increase soil surface disturbance.
4. This enhancement is only applicable for nitrogen applications that take place within 30 days prior to planting time.
5. Materials which are acceptable for this enhancement must be defined by the Association of American Plant Food Control Officials (AAPFCO) and be accepted for use by the State fertilizer control official, or similar authority, with responsibility for verification of product guarantees, ingredients (by AAPFCO definition) and label claims.

### **Adoption Requirements**

This enhancement is considered adopted when ammonia or ammonium fertilizers or urea products that contain a substance as described in the Enhancement Description above have been utilized in accordance with the Criteria of this job sheet on the land use acreage.

### **Documentation Requirements**

1. A map showing where the enhancement was applied,
2. Date(s) of application of fertilizer with inhibitor,
3. Acres of land treated,
4. Soil test results,
5. Manure analysis results (where applicable),
6. Crops grown and yields (both yield goals and measured yield), and
7. Calibration of application equipment.

Note: In lieu of documenting each individual item listed in the Documentation Requirements, a Certified Crop Advisor plan that contains each of the items may be substituted.

### **References**

Nelson, D. R. and D. Huber. 2001. Nitrification Inhibitors for Corn Production. National Corn Handbook, Iowa State University. <http://www.extension.iastate.edu/Publications/NCH55.pdf>

Rankin, M. 2011. Nitrification Inhibitors and Use. University of Wisconsin Extension. <http://www.uwex.edu/ces/crops/ninhib.htm>

The Pennsylvania State University. 2003. Starter Fertilizer. Agronomy Facts 51. <http://cropsoil.psu.edu/extension/facts/agfacts51.cfm>

AAPFCO. 2011. Association of American Plant Food Control Officials. Official Publication No. 64. AAPFCO Inc., Little Rock, Arkansas.

**Animal Enhancement Activity – ANM03 - Incorporate native grasses and/or legumes to 15% or more of herbage dry matter productivity**



**Enhancement Description**

Improve pasture by increasing native grasses and/or legumes to 15% of herbage dry matter (productivity by weight) using adapted species and varieties, appropriate seeding rates, and timing of seeding. Pastures containing about 15% native grasses and/or legumes by weight dry matter are approximately equal to 30% foliar cover.

**Land Use Applicability**

Pastureland

**Benefits**

Enhancing existing pasture by incorporating native grasses and legumes can provide:

1. Improved forage quality and quantity
2. Improved soil fertility (legumes fix nitrogen in the soil), increase organic matter
3. Increased plant diversity and promote wildlife habitat
4. Additional forage during seasonal slump periods
5. Extended grazing season
6. Food source for pollinating insects

**Conditions Where Enhancement Applies**

This enhancement only applies to acres of pasture land use that DO NOT currently have a mixed stand of native grasses and/or legumes.

**Criteria**

A written grazing management plan that outlines specific goals and objectives, including:

1. Utilize adapted species, seeding rates and seeding dates according to local NRCS practice standards.
2. Determine species composition before and after seeding. Species composition must be 15% or more of native grasses and/or legumes.
3. If legumes are incorporated, a current soil test is required. Apply lime and fertilizer to facilitate establishment and persistence of legumes as required by the current soil test report.
4. Livestock stocking rates that will allow for proper forage utilization.

**Note:** Bloat can be a risk to grazing livestock where legumes make up greater than 50% of the total forage. Legumes with the highest likelihood to cause bloat include white clover, alfalfa, annual medics and Persian clover. Red clover, crimson clover and subterranean clover would be classified as moderately likely to cause bloat, while berseem clover and arrowleaf clover are low risks for causing bloat. Legumes that don't cause bloat are birdsfoot trefoil, sainfoin and



crownvetch. Livestock producers grazing alfalfa aftermath in the fall months should be cautioned of bloat, especially following a killing frost. The recommendation for grazing frost killed alfalfa is to wait 5 to 7 days after the killing frost (less than 28 degrees Fahrenheit) before grazing. This will allow the live tissue to fully break down, minimizing the soluble leaf proteins, and making a much safer feed base for ruminant livestock. If bloat is a concern, there are several precautions that can be taken. (A technical reference sheet will be available to address these issues).

### **Adoption Requirements**

This enhancement is considered adopted when the subject pasture acre(s) contain 30% or more foliar coverage of native grasses and/or legumes.

### **Documentation Requirements**

1. A written planting specifications plan identifying:
  - a. Plant species' to be seeded,
  - b. Seeding rates and dates,
  - c. Site preparations and planting method, and
  - d. Amounts of fertilizer and lime to be applied.
2. Map showing locations where seeding activity is applied.
3. Copy of the grazing management plan.

### **References**

Ball, D.M., C.S. Hoveland and G.D. Lacefield. 2007. Southern Forages, 4<sup>th</sup> Edition. International Plant Nutrition Institute, Norcross, GA.

Bartholomew, P.W. 2005. Comparison of Conventional and Minimal Tillage for Low-input Pasture Improvement. Online-Forage and Grazinglands – Plant Management Network.

Ruffin, B.G. 1994. Controlling Bloat in Cattle. Alabama Cooperative Extension System, Pub. ANR-148.

USDA-NRCS. 2010. Conservation Practice Standard: Forage and Biomass Planting-Code 512.

**Animal Enhancement Activity – ANM05 - Extending riparian forest buffers for water quality protection and wildlife habitat**



**Enhancement Description**

Where existing riparian forest buffers (i.e., buffers) are utilized, extend them to gain more efficiency in intercepting overland flow, reducing the transport of nutrients, pesticides and agro-chemicals, and for wildlife habitat.

**Land Use Applicability**

Cropland, Pastureland, Rangeland

**Benefits**

Widening existing riparian forest buffers can provide food and cover for native and game species as well as enhancing aquatic habitat by providing shade, input of wood or carbon to the stream, and stabilizing streambank conditions. Extended buffers offer more

surface area to filter out sediments and agro-chemicals. Riparian forest buffers can also mitigate pesticide drift during pesticide applications and pollen drift where the mixing of plant varieties is not desired.

Riparian habitats are important transition zones between terrestrial landscapes and aquatic zones. Wildlife species utilize these transition zones because they provide a unique combination of cover, access to water and often provide important travel corridors. Extending existing buffers not only enhances wildlife habitat but it increases the effectiveness of water quality protection they provide to the streams.

**Conditions Where Enhancement Applies**

This enhancement only applies to acres of existing riparian forest buffer(s) on crop, pasture or range land uses.

**Criteria**

1. Extend the existing buffer for a total of 60 feet or more to enhance habitat and water quality functions.
2. The extended buffers must be composed of at least 5 species of non-noxious, wildlife friendly trees and shrubs best suited to site conditions. Include species that provide pollinator food and habitat where possible.
3. All site preparation and plant establishment shall be accomplished according to the appropriate NRCS conservation practice standard criteria and specifications.



4. Forest riparian buffers shall consist of a diversity of tree and shrub species of which the majority is capable of producing fruit or nuts and trees, when mature, will achieve heights of at least 60 feet and 60% canopy closure.
5. Any use of the buffer must not compromise its intended purpose.
6. To the extent possible the buffer areas and extended buffer areas will be shaped and vegetated to increase overland flow interception and increase water quality values of the stream or water body.
7. The extension of buffers can incorporate other buffer types (filter strips or riparian herbaceous cover) where applicable to meet specific operator management goals.

#### Operation and Maintenance

1. Once established, buffers must not be mowed, disked, grazed, or otherwise disturbed during the primary wildlife ground nesting period.
2. Buffers will be regularly maintained for the intended purpose through the life of the contract. This includes any removal of vegetation, including grazing.
  - a. Grazing is not permitted unless a grazing management plan is in effect.
  - b. The grazing management plan must protect the integrity, diversity and function of the riparian area.
3. Buffers will have a wildlife management plan to maintain established plant communities through the life of the contract. The wildlife plan will maintain the plant community and its structural diversity and provide habitat for intended species, remove duff, and control woody vegetation.
4. The grazing management plan and the wildlife management plan shall complement each other.

#### Adoption Requirements

This enhancement is considered adopted when the buffer has a total width of 60 feet or more for the selected land use.

#### Documentation Requirements

1. A map showing the location and size of existing and enhanced riparian forest buffer(s).
2. Documentation of the type and rates of vegetation planted in the new riparian forest buffers.

#### References

Bentrup, G. 2008. Conservation buffers: design guidelines for buffers, corridors, and greenways. Gen. Tech. Rep. SRS-109. Asheville, NC: Department of Agriculture, Forest Service, Southern Research Station. pp110.

<http://nac.unl.edu/bufferguidelines/index.html>

Wenger, S. 1999. A review of the scientific literature on riparian buffer width, extent, and vegetation. Athens, GA: University of Georgia, Institute of Ecology, Office of Public Service and Outreach. pp 59.

[http://www.rivercenter.uga.edu/service/tools/buffers/buffer\\_lit\\_review.pdf](http://www.rivercenter.uga.edu/service/tools/buffers/buffer_lit_review.pdf)

Palone, R.S., and A.H. Todd. 1997. Chesapeake Bay riparian handbook: a guide for establishing and maintaining riparian forest buffers. NA-TP-02-97. Randor, PA: U.S. Department of Agriculture, Forest Service, Northeastern State and Private Forestry.

[http://www.na.fs.fed.us/pubs/misc/riparian\\_handbook/chesapeake\\_bay\\_riparian\\_handbook.pdf](http://www.na.fs.fed.us/pubs/misc/riparian_handbook/chesapeake_bay_riparian_handbook.pdf)

**Animal Enhancement Activity – ANM07- Extending existing field borders for water quality protection and wildlife habitat**



**Enhancement Description**

Where existing field borders are utilized, extend them to gain more efficiency in intercepting overland flow and reducing the transport of nutrients, pesticides and agro-chemicals, and for wildlife habitat.

**Land Use Applicability**

Cropland, Pastureland

**Benefits**

Widening existing field borders can provide food and cover for native and game species as well as enhancing wildlife habitat. Extended field borders offer more surface area to filter out sediments and agro-chemicals. Field borders can also offer buffers to mitigate pesticide drift during pesticide applications and pollen drift where the mixing of plant varieties is not desired.

Wildlife species utilize transition zones between agricultural fields because they provide a unique combination of cover and often provide important travel corridors. Often times field borders are adjacent to riparian areas and are important for contributing clean water, and habitat areas nearby. Extending existing field borders not only enhances wildlife habitat but it increases the effectiveness of water quality protection if the border is next to a stream.

**Conditions Where Enhancement Applies**

This enhancement only applies to acres of existing field borders on crop or pasture land uses.

**Criteria**

1. Extend the existing field border for a total of 60 feet or more to enhance habitat and water quality functions.
2. The extended field borders must be composed of at least 5 species of non-noxious, wildlife friendly grasses, perennial forbs and /or shrubs best suited to site conditions. Include species that provide pollinator food and habitat where possible.
3. All site preparation and plant establishment shall be accomplished according to the appropriate NRCS conservation practice standard criteria and specifications.
4. Any use of the field border must not compromise its intended purpose. Vegetation from field borders can be harvested for bio-energy as long as the harvesting is done in accordance with a plan that does not compromise the water quality and wildlife benefits of the extended filter strip.
5. To the extent possible the field border areas and extended field border areas will be vegetated to increase overland flow interception and increase water quality values if they also border a stream or water body.



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6. The extension of field borders can incorporate other buffer types (filter strips, riparian herbaceous and riparian forest) where applicable to meet specific operator management goals.

### **Adoption Requirements**

This enhancement is considered adopted when the field border has a total width of 60 feet or more for the selected land use.

### **Documentation Requirements**

1. A map showing the location and size of enhanced field borders.
2. Documentation of the type and rates of vegetation planted in the new field borders.

### **References**

Clark, W.R. and K.F. Reeder. 2005. Continuous Conservation Reserve Program: Factors Influencing the Value of Agricultural Buffers to Wildlife Conservation. Pages 93-113 *in* Fish and wildlife benefits of Farm Bill conservation programs: 2000-2005 update. Haufler, J. B., editor. The Wildlife Society Technical Review 05-2.  
[http://www.nrcs.usda.gov/Internet/FSE\\_DOCUMENTS/nrcs143\\_012882.pdf](http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs143_012882.pdf)

USDA-NRCS. 2010. Grassland Bird Population Responses to Upland Habitat Buffer Establishment by L. Wes Burger, Jr., Philip J. Barbour, and Mark D. Smith. Wildlife Insight No. 86. Washington, DC.  
<http://www.fwrc.msstate.edu/pubs/NRCSWildlifeInsight86.pdf>

**Animal Enhancement Activity – ANM09 – Grazing management to improve wildlife habitat**



**Enhancement Description**

Implement a grazing management plan that will allow for rest periods to provide adequate residue for nesting and fawning cover and increase diversity of vegetation structure to benefit a variety of wildlife species.

**Land Use Applicability**

Pastureland, Rangeland, Forestland

**Benefits**

Wildlife habitat can be greatly improved through proper grazing management. Proper grazing management is essential to healthy wildlife populations because plants supply many species of birds and animals with food and cover for nesting, fawning, loafing, roosting, travel and escape from predators and adverse weather. These include song birds, quail, turkey, pheasants, deer, and rabbits to name just a few. Some species of ground nesting grassland birds are in decline and others have become uncommon. Healthy stands of forage can be managed to provide habitat for a wide array of wildlife.

**Conditions Where Enhancement Applies**

This enhancement applies to all pasture (including silvopasture), range or forest land use acres.

**Criteria**

1. Defer 33% of the grazing land on the land use from grazing during the nesting/fawning season each year.
2. Develop and implement a written grazing management plan that identifies the following:
  - a. wildlife management objectives for grazing land,
  - b. targeted wildlife species,
  - c. nesting or fawning dates,
  - d. the location and number of acres to be deferred each year,
  - e. a schedule for the year of deferment, and
  - f. stocking rates that will allow proper forage utilization while maintaining proper plant heights that provide food and shelter for wildlife and maintain plant health.

**Additional criteria for silvopasture**

1. Inventory the habitat condition of the silvopasture, the farm, and adjoining farms to determine habitat needs for the targeted wildlife.
2. Use one or more of the following methods to improve habitat for the targeted species.
  - a. Establish additional understory vegetation (e.g., native grass, forbs and shrubs) that will improve habitat conditions for the targeted species.



- b. Establish clusters of other tree species if needed as a food source (e.g., oaks for mast).
- c. Manage tree canopy to achieve the desired understory plant community.
- d. Leave some dead or dying trees as snags if cavity nesting wildlife is targeted.
- e. Remove trees or invasive plants that do not provide the desired habitat.
- f. Replace removed trees by planting new trees or shrubs that will provide the desired habitat.
- g. Thin less desirable trees to encourage the growth of trees that will provide the desired wildlife habitat.

### **Adoption Requirements**

This enhancement is considered adopted when a grazing management plan targeting selected wildlife species has been written and one-third of the grazing land is avoided during the nesting/fawning season each year as prescribed.

### **Documentation Requirements**

1. A schedule of when grazing activities occurred documenting that grazing activities were deferred on a minimum of 33% of the available acreage.
2. A map showing the acreage where these activities are applied.

### **References**

Holechek J. L., R. Valdez, S.D. Schemnitz, R.D. Pieper and C.A. Davis. 1982. Wildlife Society Bulletin Vol. 10, No. 3: 204-210.

Lyons, R.K. and B.D. Wright. 2003. Using Livestock to Manage Wildlife Habitat. Available electronically from <http://hdl.handle.net/1969.1/87188>

Nistler, C. M., J. Boren and D. Rollins. 2006. Proceedings – Symposia: Prescribed Livestock Grazing to Enhance Wildlife Habitat. 112 pages. Society for Range Management.

Undersander, D., S. Temple and J. Bartlet and L. Paine. 2000. Grassland Birds: Fostering Habitats using Rotational Grazing. University of Wisconsin-Extension Publication A3715.

USDA-NRCS. 2010. Conservation Practice Standard: Prescribed Grazing-Code 528.

**Animal Enhancement Activity – ANM10 – Harvest hay in a manner that allows wildlife to flush and escape**



**Enhancement Description**

Harvesting hay using conservation measures that allow wildlife to flush and escape. These measures include timing of haying to avoid periods when upland wildlife are nesting or fawning, idling hay land during the nesting or fawning period, and applying haying techniques that reduce mortality to wildlife.

**Land Use Applicability**

Cropland (hayland)

**Benefits**

Many species of birds and animals use pastures and hay lands as cover, to find food, nesting areas, and rearing their young. Examples include song birds, quail, turkey, pheasants, deer, and rabbits. Some species of ground nesting birds are in decline and others have become uncommon. Managing haying techniques can be beneficial to the survival of ground nesting birds and other wildlife species. Altering harvesting routes can provide escape routes for hens, hens with broods and hiding fawns. Delaying harvests or leaving portions of a field unharvested provide nesting habitat.

**Conditions Where Enhancement Applies**

This enhancement only applies to any annual planted or perennial hayland acres (a sub-component of the crop land use).

**Criteria**

Use one of the following techniques (A or B) to protect wildlife during haying activities.

- A. Defer haying. The producer *will apply and maintain at least two of the following* management actions specifically for improving or protecting grassland functions for the state identified targeted wildlife species.
  1. Do not cut hay on at least 1/3 of the hay acres each year. Idle strips or blocks must be at least 30 feet wide.
  2. For at least 1/3 of the hay acreage, hay cutting must be either before and/or after the primary nesting or fawning seasons based on state established dates for the targeted species.
  3. Increase forage heights after mowing to state specified minimum heights for the targeted species on all hayed acres.
- B. For all haying that will be conducted during the nesting/fawning season the producer will implement *at least two of the following* to flush wildlife from hay fields during the mowing operation:
  1. A flush bar attachment will be required on the mower



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2. All mowing will be done during daylight hours
3. Haying pattern will be either:
  - a. Begin on one end of the field and work back and forth across the field, or
  - b. Begin in the center of the field and work outward

### **Adoption Requirements**

This enhancement is considered adopted when either technique A or B from the criteria above has been implemented.

### **Documentation Requirements**

1. Map showing the fields that were treated
2. Option A – A picture showing residual heights of hay after mowing
3. Option B – A picture showing the flush bar attachment on tractor

### **References**

Greene, C. 2007. Reducing Mortality of Grassland Wildlife During Haying and Wheat-Harvesting Operations. Division of Agricultural Sciences and Natural Resources, Oklahoma State University, OSU Extension Wildlife and Forestry, NREM-5006. <http://www.okrangelandswest.okstate.edu/files/wildlife%20pdfs/NREM-5006.pdf>

USDA-NRCS. 2010. Management Considerations for Grassland Birds in Northeastern Haylands and Pasturelands by Noah Perlut, Allan Strong and Therese Donovan. Wildlife Insight No. 88. Washington, D.C. <http://directives.nrcs.usda.gov/OpenNonWebContent.aspx?content=27175.wba>

**Animal Enhancement Activity – ANM11 – Patch-burning to enhance wildlife habitat**



**Enhancement Description**

Use prescribed burning with livestock grazing to create patches of different vegetation structure and species composition for the benefit of wildlife.

**Land Use Applicability**

Pasture, Rangeland, Forestland

**Benefits**

Patch-burning is a management activity for landowners interested in improving habitat for wildlife while still maintaining forage production for livestock, primarily grasslands. This management activity helps create a mosaic of diverse vegetative structure and plant composition in the same pasture. Livestock also benefit as different plant species may be available, especially during mid-and late growing season vegetation slumps. Patches of different vegetation composition can extend and/or supplement livestock during the grazing season.

**Conditions Where Enhancement Applies**

This enhancement applies to all pasture, range or forest land use acres. This enhancement is not for the purpose of conducting wildfire reduction burns or forest stand improvement burns on forest land use acres.

**Criteria**

1. Burn at least 10% and not more than 40% of the grazing area in any year
  - a. Annual application by burning a different patch each year is acceptable and desirable for many wildlife species.
  - b. A minimum of two burn treatments should be applied during a 5 year period.
    - For vegetation types with a historic fire frequency greater than 10-15 years as determined by the NRCS State Office, minimum treatment should be two burns applied during a 10 year period.
2. Avoid burning during peak nesting season for targeted wildlife species.
3. Develop a written grazing management plan that identifies:
  - a. Wildlife management objectives describing how patch burning will accomplish those objectives.
  - b. Percentage of area planned to be burned by year
  - c. Locations, total acres, planned year and season of burns
  - d. The desired frequency of burning (example: burn same area once every 4 years) should be stated and based on the desired plant community’s adaptation and response to fire.
  - e. Stocking rates that will allow for proper forage utilization.



- f. Apply monitoring and adaptive management considerations to address potential multiple years overuse of burned areas, especially for those pastures not receiving some amount of annual burning.
  - g. Identify areas where fire is to be excluded for habitat considerations, such as desirable shrub stands, stream sides, etc.
4. Develop a written prescribed burn plan for each prescribed burn that identifies:
- a. Locations to receive burn treatment and level of patchiness desired
  - b. Time of burn
  - c. Firebreaks locations, if needed
  - d. Weather parameters for the burn (temperature, wind speed, relative humidity)
  - e. Burn plans must be conducted in accordance with all state laws.

### **Adoption Requirements**

This enhancement is considered adopted when all four of the criteria above have been implemented together in a one year period.

### **Documentation Requirements**

1. Written prescribed burn plan identifying pasture, range or forest acres and dates of prescribed burn.
2. A map showing where the activities are applied.

### **References**

Coppedge, B.R., S.D. Fuhlendorf, W.C. Harrell, and D.M. Engle. 2008. Avian Community Response to Vegetation and Structural Features in Grasslands Managed with Fire and Grazing. *Biological Conservation* 141:1196-1203.

Fuhlendorf, S.D., and D.M. Engle. 2001. Restoring Heterogeneity on Rangelands: Ecosystem Management based on Evolutionary Grazing Patterns. *BioScience* Vol. 51, no.8: 625-632.

Fuhlendorf, S.D., W.C. Harrell, D.M. Engle, R.G. Hamilton, C.A. Davis and D.M. Leslie, Jr. 2006. Should Heterogeneity be the Basis for Conservation? Grassland Bird Response to Fire and Grazing. *Ecological Applications* 16(5): 1706-1716.

USDA-NRCS. 2010. Conservation Practices Standards: Prescribe Burning-Code 338 and Prescribed Grazing-Code 528.

**Animal Enhancement Activity – ANM12 – Shallow water habitat**



**Enhancement Description**

Construct or renovate small, shallow sites to impound or hold water seasonally, typically from late winter through early summer (e.g., vernal pools).

**Land Use Applicability**

Cropland, Pastureland, Rangeland, Forestland

**Benefits**

Shallow water habitats are used by amphibians, reptiles, birds, mammals and other species in completing their life cycles. Most species of amphibians need shallow water areas to lay their egg masses. These seasonal pools of water do not provide year-round water habitat that would support fish that could prey on the egg masses.

**Conditions Where Enhancement Applies**

This enhancement applies to all crop, pasture, range or forest land use acres.

**Criteria**

This enhancement requires the construction or renovation of small, shallow sites to impound or hold water seasonally, typically from late winter through early summer (e.g., vernal pools).

1. **Soil & Site Considerations:** Shallow water habitat sites should be located where water can be impounded or regulated by diking, ditching, flooding, pumping, or excavation. Soils must have low permeability or seasonal high water tables to inhibit subsurface drainage and allow for maintenance of proper water levels. These aquatic habitats must be located adjacent to or within wildlife-friendly cover or natural habitats. This activity does not apply on existing wetlands.
2. **Size/Depth/Season/Composition:** There are no area limitations, although larger aquatic habitats provide greater ecological benefits.
  - a. The shallow water habitats must be arranged in groups of two or three with approximately ¼ to ⅓ mile between each pool. There will be 1 pool arrangement per each 20 acres of suitable land. Each pool must be between 0.1 and ½ acre in size. As a minimum there must be at least 0.2 acres of shallow water habitat per 20 acres of suitable land in a land use. If the suitable land use is less than 20 acres the amount of shallow water habitat required will be reduced according to the ratio: 0.2 acres per 20 acres.
  - b. Maximum depth shall not exceed 30 inches and the average depth should be between 6 and 18 inches.



- c. These aquatic habitats must be designed and managed to hold water at a minimum from late winter through early summer, however it should not hold water all year long.
- d. Irregular substrate surfaces are preferred over smooth substrate surfaces to create diverse plant communities and habitat structure.
- e. A combination of open water and natural vegetation, including moist soil and wetland plants, is desired within the wetted perimeter.
- f. A ratio of about 50% open water to 50% vegetation is ideal (acceptable range is 30-70%). Habitat complexity can be enhanced by the addition of logs or rocks that provide resting and basking sites.

Refer to Conservation Practice Standards, Shallow Water Development and Management (646) for additional management information and Dike (356), or Water and Sediment Control Basin (638) for additional information on water impoundment structures for this enhancement. Contact your local conservationist for assistance with Conservation Practice Standards.

#### Operation and Maintenance

The contributing watershed and/or water supply shall provide clean water free of harmful pollutants. Apply conservation treatments to the contributing watershed to ensure minimal erosion and sediment delivery. Buffer these aquatic habitats with wildlife-friendly perennial vegetation dense enough to retard erosion and trap sediments before entering the water.

Manage water levels by artificially raising or lowering in order to produce desired habitat conditions. Manage the areas to control reed canarygrass, purple loosestrife and other undesirable invasive plants. Manage dense vegetation such as cattails and prairie cordgrass so that 50-70% open water is maintained.

#### Adoption Requirements

This enhancement is considered adopted when vernal pools have been established that meet or exceed the above criteria and they have been functioning and maintained as described in the operation and maintenance section.

#### Documentation Requirements

1. Site description including a location map, a detailed map or sketch including surrounding land uses, with dimensions, water depth and estimate of area,
2. Description of management activities and dates completed,
3. Maintenance plan, and
4. Photos of established pools.

#### References

Balas C. J., N.H. Euliss Jr. and D.M. Mushet. 2012. Influence of Conservation Programs on Amphibians using Seasonal Wetlands in the Prairie Pothole Region. *Wetlands* 32:333-345.

Blackwell, M.S.A. and E.S. Pilgrim. 2011. Ecosystem services delivered by small-scale wetlands. *Hydrological Sciences Journal* 56(8): 1467-1484.



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Lehtinen, R.M., S.M. Galatowitsch and J.R. Tester. 1999. Consequences of habitat loss and fragmentation for wetland amphibian assemblages. *Wetlands* 19: 1–12.

USDA-NRCS and Wildlife Habitat Council. 2007. Temporarily flooded wetlands. Fish and Wildlife Habitat Management Leaflet No. 47. Washington, D.C.

<http://directives.nrcs.usda.gov/OpenNonWebContent.aspx?content=18529.wba>

USDA-NRCS and Wildlife Habitat Council. 2006. Amphibians and Reptiles. Fish and Wildlife Habitat Management Leaflet No. 35. Washington, D.C.

<http://directives.nrcs.usda.gov/OpenNonWebContent.aspx?content=18528.wba>

USDA-NRCS and Wildlife Habitat Council. 2006. Ecologically Isolated Wetlands. Fish and Wildlife Habitat Management Leaflet No. 38. Washington, D.C.

<http://directives.nrcs.usda.gov/OpenNonWebContent.aspx?content=18517.wba>

**Animal Enhancement Activity – ANM17 – Monitoring nutritional status of livestock using the NUTBAL PRO system**



**Enhancement Description**

Use the NUTBAL PRO software to determine if the current diet is sufficient to meet livestock nutritional needs. This requires the collection and laboratory analysis of forage or fecal samples to determine the nutritional value of grazing forages.

**Land Use Applicability**

Pastureland, Rangeland

**Benefits**

NUTBAL PRO is decision support software that assimilates information regarding animal attributes, environmental conditions, forage conditions, feeding program, and metabolic modifiers. NUTBAL PRO reports provide information to:

- Balance animal nutritional needs with contributions from grazing forage,
- Select the most cost efficient feed alternative, amount to be fed, and cost per day,
- Evaluate feed stuff values with regards to the animal's nutrient deficiency or desired gain,
- Monitor the quality of grazing forages throughout the year, and
- Better understand animal nutritional needs as they change throughout the year.

**Conditions Where Enhancement Applies**

This enhancement applies to all pasture or range land use acres.

**Criteria**

1. Forages (using either fecal samples or forage tissue sample) must be analyzed by an accredited laboratory,
2. Information is entered into the NUTBAL PRO decision support software,
3. A report must be generated and management decisions documented and completed within 14 days from receiving forage analysis, and
4. A minimum of 6 forage analysis and NUTBAL PRO reports must be completed each year.

**Adoption Requirements**

This enhancement is considered adopted when a minimum of 6 NUTBAL PRO reports have been generated per year and the results have been used to make management decisions.

**Documentation Requirements**

For each forage sample collected for analysis:

1. A copy of the forage analysis report.



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2. A copy of the NUTBAL PRO reports generated from the decision support software.
3. Written documentation of the management decisions made as a result of the analysis.

### **References**

CNRIT. 2011. Grazing Animal Nutrition Lab website. Texas AgriLife Research. Texas A&M University.  
<http://cnrit.tamu.edu/ganlab/index.php>

Walker, J., D. Tolleson, S. Byrns and P. Bengé. 2010. Shining Light on Manure Improves Livestock and Land Management. Texas AgriLife Research Technical Bulletin: SANG-2010-0250. Texas AgriLife Research and the Society for Range Management.

**Animal Enhancement Activity – ANM 21 – Prairie restoration for grazing and wildlife habitat**



**Enhancement Description**

This activity consists of restoring/renovating prairie habitat by establishing native vegetation and managing the restored plant community.

**Land Use Applicability**

Cropland, Pastureland, Rangeland

**Benefits**

Establishing and managing native prairie vegetation will provide food, cover, and nesting habitat for adapted species, especially grassland nesting birds.

**Conditions Where Enhancement Applies**

This enhancement applies to sites that have soils that indicate it was once a prairie or can sustain native prairie species.

NOTE: this enhancement can only be initiated in the 1<sup>st</sup> or 2<sup>nd</sup> year of the contract to ensure the activity has time to establish before the end of the contract.

**Criteria**

1. The resulting plant community will consist of at least 4 species of native perennial grasses and at least 4 species of native forbs adapted to the soils. In areas where seed availability and site adaptability is an issue, the NRCS State Office can modify the seeding combinations to meet local conditions.
2. Seeding must be done in a properly prepared seed bed as determined by the NRCS State Office.
3. Species appropriate fungal and microbial inoculants will be used during establishment where appropriate. Additional planting conditions may be specified if an ecological site description has been developed for the area.
4. During the establishment phase, weeds shall be controlled on the site.
5. After establishment:
  - a. The site will be protected from grazing and disturbance during the primary nesting and fawning season as defined by the NRCS State Office.
  - b. The site will be deferred from use for up to 3 years.
6. A grazing management plan will be developed and implemented.

**Adoption Requirements**

This enhancement is considered adopted when the applicant has successfully established the minimum number of native perennial grasses and forbs to the subject area.



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### **Documentation Requirements**

Following implementation of this activity, the participant must:

1. Document the list of the species planted,
2. Maintain the receipts for the seeds purchased,
3. Document the seeding dates,
4. Document the area (acres) restored by delineating the location of the restored prairie on a map or aerial photograph, and
5. Document the grazing management plan was implemented.

### **References**

Fuhlendorf, S.D., H. Zhang, T.R. Tunnell, D.M. Engle and A.F. Cross. 2002. Effects of Grazing on Restorations of Southern Mixed Prairie Soils. *Restoration Ecology* Vol. 10, Issue 2: 401-407.

Packard, S. 1997. *The Tallgrass Restoration Handbook: For Prairies, Savannas, and Woodlands*. Island Press.

Schramm, P. 1990. *Prairie Restoration: A Twenty Five year Perspective on Establishment and Management*. Proceeding of the Twelfth North American Prairie Conference.

USDA-NRCS. 2010. *Conservation Practice Standard: Prescribed Grazing-Code 528*.

**Animal Enhancement Activity – ANM 23 – Multi-species native perennials for biomass/wildlife habitat**



**Enhancement Description**

This enhancement consists of establishing native perennial vegetation for biomass production and wildlife habitat.

**Land Use Applicability**

Cropland, Pastureland, Rangeland

**Benefits**

Establishing multi-species native perennial vegetation and managing for both biomass and wildlife can provide natural resource and financial benefits.

**Conditions Where Enhancement Applies**

This enhancement applies to all crop, pasture, or range land use acres.

**Criteria**

1. Native perennial species shall be selected and planted based on site adaptability, value for biomass, and for wildlife benefits as determined by the state.
2. Biomass fields shall be managed for species of conservation concern as identified by the state and the State Wildlife Action Plans.
3. Develop a management plan, covering the length of the contract at a minimum, which minimizes impacts on wildlife species, especially grassland nesting birds for this enhancement activity. Management actions and their impact on affected wildlife species shall be addressed.
4. After establishment, the field shall be protected from grazing and disturbance during the primary nesting and fawning season as defined by the state. Further, harvesting of biomass must be in accordance with the written management plan. Partial removal in late summer/early fall to allow for re-growth for winter cover where winter conditions interfere with late season harvest should be addressed in the management plan.

**Adoption Requirements**

This enhancement is considered adopted when acres with established multi-species native perennials are being managed in accordance with the developed management plan for the species of concern.

**Documentation Requirements**

1. Copy of the management plan,



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2. Written description of the actions taken,
3. Receipts related to the a multi-species native perennial establishment,
4. Dates of establishment, and
5. A map or aerial photograph delineating the location of the established vegetation.

### **References**

USDA-NRCS. 2010. National Biology Handbook. Washington, DC.

<http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17723.wba>

USDA-NRCS. 2006. National Biology Manual. Title 190, Washington, DC.

<http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17895.wba>

**Animal Enhancement Activity – ANM25 – Stockpiling of forage to extend the grazing season**



**Enhancement Description**

Livestock are excluded from forages on specified acres during the growth season. The “stockpiled” forages are grazed at a later time using strip grazing to allow animals to utilize the forage within a strip for a specified period of time.

**Land Use Applicability**

Pastureland

**Benefits**

Managing grazing land to “stockpile” forages for later use extends the grazing season and promotes yearlong grazing. Stockpiling also provides long-term grass sustainability and improved forage health resulting in higher quality forage for livestock. Eliminating a minimum of one hay cutting reduces fuel use and labor. Water quality is improved since manure is evenly distributed throughout the pasture as livestock graze, and nutrient loading at hay feeding sites, if needed, is reduced.

**Conditions Where Enhancement Applies**

This enhancement applies to all pasture land use acres.

**Criteria**

Grazing on stockpiled forage must follow a grazing plan that includes:

1. Exclude grazing from specified acres for a state specified time period (at least three months minimum for cool season and two months for warm season),
2. Acreage needed will be calculated using a ratio of one acre per animal unit ,
3. Stockpiled acreage will be fertilized to achieve adequate forage growth,
4. Livestock must be rotated into a new stockpiled paddock every 1-3 days; use temporary fencing to adjust strip size to match forage availability,
5. Do not allow livestock to access previously grazed stockpiled areas when spring regrowth begins until adequate forage heights exist,
6. Follow NRCS Prescribed Grazing practice standard (528) each year this enhancement is in effect, including applying a prescribed grazing plan on the entire operation, and
7. Certification that practice requirements have been met after grazing of stockpiled forages begins each year.

**Adoption Requirements**

This enhancement is considered adopted when a prescribed grazing plan that specifies stockpiling acres has been developed and implemented.



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### **Documentation Requirements**

1. A copy of the operation's prescribed grazing plan,
2. Specified stockpiled acres designated on a map and in the prescribed grazing plan, and
3. Photographs showing stockpiled forage for each such pasture.

### **References**

Ball, D.M., E.N. Ballard, M.L. Kennedy, G.D. Lacefield and D.J. Undersander. 2008. Extending Grazing and Reducing Stored Feed Needs. Grazing Lands Conservation Initiative Publication 8-01, Bryan TX.

Curtis, L.E., R.L. Kallenbach and C.A. Roberts. 2008. Allocating Forage to Fall-calving Cow-calf Pairs Strip-grazing Stockpiled Tall Fescue. *Journal of Animal Science* (86): 780-789.

Hitz, A.C. and J.R. Russell. 1998. Potential of Stockpiled Perennial Forages in Winter Grazing Systems for Pregnant Beef Cows. *Journal of Animal Science* (76):404-415.

Rayburn, E.B. (editor). 2007. Forage Utilization for Pasture Based Livestock Production. NRAES – Book 173; Chapter 6 - Deferred Grazing to Extend the Grazing Season: p. 82-96. PALS Publishing, Ithaca, New York.

USDA-NRCS. 2010. Conservation Practice Standard: Prescribed Grazing-Code 528.

**Animal Enhancement Activity – ANM26 – Managing calving to coincide with forage availability**



**Enhancement Description**

This enhancement uses a controlled breeding season to match livestock nutrient requirements to available pasture forage and reduce supplemental feeding. This enhancement is applicable to all grazing livestock.

**Land Use Applicability**

Pastureland, Rangeland

**Benefits**

Managing calving to coincide with the production of palatable, high quality pasture matches forage availability to the peak nutrient needs of beef cows and allows nursing calves to use pasture for much of their growth. The result is improved animal health for lactation and reproduction, lower calf death losses and more efficient use of labor and resources. Matching livestock feed requirements to when forage is most abundant and of the highest quality reduces dependency on supplemental feed, and it saves energy associated with hay production and harvest.

**Conditions Where Enhancement Applies**

This enhancement applies to all pasture or range land use acres.

**Criteria**

Based on forage type and season of growth, use Land Grant University (LGU) and/or state developed recommendations for controlled breeding and calving seasons (single and/or split) to plan the start and end dates for calving that will match the operation’s herd requirements with forage availability. This enhancement recognizes that time is needed to adjust the controlled breeding and calving season for the operation. The desired start and end dates for calving are based on:

1. Calving (within a herd) taking place within a 90-day or less time period, and
2. Calving occurring four to six weeks prior to initial availability of good quality pasture.

Additionally,

1. Cow – calf pairs are on or are moved to pasture as soon as possible after birth (e.g., they are not left in dry lots or small calving pastures for extended time periods),
2. 50% of breeding females are transitioned by the third year of the contract, and
3. 75% of breeding females are transitioned by the end of the contract period.



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### **Adoption Requirements**

This enhancement is considered adopted when a participant's cattle breeding season coincides with the LGU and/or state developed recommended controlled breeding and calving seasons.

### **Documentation Requirements**

Document annually by herd the:

1. Percentage of breeding females with a projected calving date that falls within the established calving period,
2. Number of calf births occurring between the desired start and end dates,
3. Dominant forage type grazed, and
4. Acres of available pasture or range.

### **References**

Clark, T.C., D.C. Adams, G.P. Lardy and T.J. Klopfenstein. 1997. Matching Calving Dates with Forage Nutrients: Production and Economic Impacts. Range Beef Cow Symposium – Paper 166, 10 pages. Rapid City, SD.

Kruse, R.E., M.W. Tess, E.E. Grings, R.E. Short, R.K. Heitschmidt, W.A. Phillips and H.S. Mayeu. 2008. Evaluation of Beef Cattle Operations Utilizing Different Seasons of Calving, Weaning Strategies, Postweaning Management, and Retained Ownership. The Professional Animal Scientist Vol. 24, no. 4: 319-327.

Sprott, L.R., G.E. Selk and D.C. Adams. 2001. Review: Factors Affecting Decisions on when to Calve Beef Females. Professional Animal Scientist Vol. 17 no. 4: 238-246.

**Animal Enhancement Activity – ANM27 – Wildlife friendly fencing**



**Enhancement Description**

This enhancement involves the use of wildlife friendly fencing techniques that allow free passage of daily wildlife movement and seasonal migration; and/or increase visibility to prevent entanglement and mortality. Selection of this enhancement requires the activity to be planned concurrently on all eligible land use acres.

**Land Use Applicability:**

Cropland, Pastureland, Rangeland, Forestland

**Benefits**

Fencing used to define property boundaries and contain livestock creates barriers and traps to wildlife movement, fragments habitats and separate herds. Improper fence design results in injury and death through entanglement and collision. Wildlife friendly fencing techniques allow for safe passage and increase fence visibility improving wildlife habitat, granting access to food, shelter and water.

**Conditions Where Enhancement Applies**

This enhancement applies to cropland, pastureland, rangeland or forestland that has existing fencing in need of a retrofit.

**Criteria**

Wildlife friendly fence should improve passage through the fence by either jumping or crawling and be highly visible to prevent collision, entanglement and fatalities. Focus the use of wildlife friendly fencing along known wildlife travel corridors. For full implementation of this enhancement, 20% of **ALL** fencing on the land use must be made wildlife friendly.

1) Improve Passage

Retrofit Existing Fence- openings and crossing to allow wildlife access to food, water and shelter must be created in existing fence. Location and number of openings required will meet NRCS state standards. Methods used included but are not limited to:

1. Lay-down fence
2. Seasonal electric fence
3. Adjustable wire fence
4. Underpass fence with raised wire
5. Pole top fence



2) Improve Visibility

- a) Increase visibility of ALL fencing using flagging, vinyl markers, PVC pipe or other similar materials that will meet NRCS state standards for spacing, interval and size. A good example of improving visibility for prairie grouse (e.g. prairie chickens, sage grouse, etc.) in rangeland can be found at:  
[www.suttoncenter.org/pages/fence\\_marking\\_instructions](http://www.suttoncenter.org/pages/fence_marking_instructions)
- b) If no state criteria exist, follow criteria in the Montana Fish, Wildlife & Parks publication "[A Landowner's Guide to Wildlife Friendly Fences.](#)"

**Adoption Requirements**

This enhancement is considered adopted when 20% of the existing permanent fence on the operation has any combination of improved passage or improved visibility.

**Documentation Requirements**

1. Identify type (s) of wildlife friendly fencing used,
2. Location on a map showing where wildlife friendly fence is located, and
3. Photograph of each wildlife friendly fencing method used.

**References**

Paige, C. 2008. A Landowner's Guide to Wildlife Friendly Fences. Landowner/Wildlife Resource Program, Montana Fish, Wildlife and Parks, Helena, MT. pp 44. <http://fwpiis.mt.gov/content/getItem.aspx?id=34461>

**Animal Enhancement Activity – ANM29 – On-farm forage based grazing system**



**Enhancement Description**

A forage based grazing system that supplies all roughage (forage and supplemental hay) requirements for a livestock operation.

**Land Use Applicability**

Pastureland, Rangeland, Forestland

**Benefits**

Forage based grazing systems reduce the time that livestock are confined resulting in less manure to store and allows manure to become a fertilizer instead of a pollutant. Management of perennial grass and forbs ground cover improves nutrient and water cycling, soil structure and increases organic matter. Energy conservation is achieved by reducing annual cropping, transport of feed and less reliance on synthetic nitrogen.

**Conditions Where Enhancement Applies**

This enhancement applies to all pasture, range or forest land use acres.

**Criteria**

1. Develop a grazing management plan with a forage based grazing system that provides **ALL** livestock feed and nutrient needs for the duration the animals are on the participant’s land.
2. Livestock operations include those that produce cattle, sheep, goats, etc.
3. Manage pasture grazing and rest periods to follow NRCS Prescribed Grazing practice standard (528) criteria for recommended maximum (begin) and minimum (end) grazing heights by forage species or Ecological Site Description interpretations. Begin and end grazing heights are followed to maximize forage quality and palatability, as well as to promote rapid recovery and forage regrowth.
  - a. Maintain a livestock watering system that accommodates an appropriate grazing strategy through several different pastures or paddocks during the grazing season.
  - b. Follow NRCS practice standard criteria for Prescribed Grazing (528), Watering Facility (614), Pipeline (516), or other related standards for appropriate supply and travel distance to water.
  - c. Use fencing that is permanent, semi-permanent, and/or temporary to facilitate pasture rotation and/or livestock distribution improvement. Follow the NRCS Fence practice standard (382).

**Adoption Requirements**

This enhancement is considered adopted when no external forage or hay is utilized in the grazing operation.



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### **Documentation Requirements**

1. Provide a copy of the written grazing plan, and
2. Include time and timing of grazing, minimum and maximum grazing heights, season of use, grazing records and monitoring plan of pastures/paddocks in the grazing plan, as appropriate for the land use.

Note: NRCS Pasture Notes, grazers' notebooks, or other record keeping systems for pasture livestock operations can be used to facilitate record-keeping.

### **References**

Ball, D. M., E. N. Ballard, M. L. Kennedy, G. D. Lacefield, and D. J. Undersander. 2008. Extending Grazing and Reducing Stored Feed Needs. Grazing Lands Conservation Initiative Publication 8-01, Bryan TX.

Parish, J. A., J. D. Rivera, H. T. Boland, and R. Lemus. 2010. Beef Cattle Grazing Management. Mississippi State University Extension Service. Publication 2629.

Rayburn, E. B. (editor). 2007. Forage Utilization for Pasture Based Livestock Production. NRAES – Book 173. PALS Publishing, Ithaca, New York.

USDA-NRCS. 2011. Conservation Practice Standard: Livestock Pipeline-Code 516.

USDA-NRCS. 2010. Conservation Practice Standards: Fence-Code 382, Forage Harvest Management-Code 511, Prescribed Grazing-Code 528 and Watering Facility-Code 614.

USDA-NRCS. 2006. Watering Systems for Serious Grazers. NRCS-Missouri Publication, Columbia, Mo.

USDA-NRCS. 2005. Electric Fencing for Serious Grazers. NRCS-Missouri Publication, Columbia, Mo.

## Animal Enhancement Activity – ANM31 – Drainage water management



### Enhancement Description

This enhancement consists of seasonal hydrology management during non-cropping periods for wildlife habitat on working lands.

### Land Use Applicability

Cropland

### Benefits

Maintaining flooded or saturated soil conditions during non-cropping periods can have multiple benefits. Flooded fields can provide important

habitat for migratory waterfowl and other species that benefit from temporarily flooded land. Flooded areas provide food, cover and resting areas for wildlife, especially waterfowl during their migration.

### Conditions Where Enhancement Applies

This enhancement applies to cropland that has been artificially drained (surface or subsurface) and which is flat enough that significant portions can be flooded or saturated by controlling outflow from the drainage system.

### Criteria

Refer to the criteria in Conservation Practice Standard, Drainage Water Management (554), Shallow Water Management for Wildlife (654), Upland Wildlife Habitat Management (645), Wetland Wildlife Habitat Management (644), and Structure for Water Control (587) for the requirements for drainage/water control structures, their management and vegetative management to be used with this enhancement. Contact your local conservationist for assistance with Conservation Practice Standards.

1. Develop a plan that:
  - a. Identifies the targeted species or suite of species (e.g., giant gartersnake, shorebirds, waterfowl, other waterbirds)
  - b. Provides for the installation, retrofitting of existing, or utilization of existing water-supply and water-control structures, including pumps and irrigation gates for precise water-level control such that seasonal shallow water is assured.
  - c. Establishes the optimum flooding or saturation including timing, frequency, depth, and duration of ponding and/or soil saturation that provides at least
    - i. Ponding of 1/3 of the surface area of the cropped field
    - ii. Ponding for 45-days during the target season
    - iii. Final drawdown is extended over at least a 2-week period
  - d. Provides wildlife food through the management of crop residues, or plantings of wildlife friendly cover-crops



### **Adoption Requirements**

This enhancement is considered adopted when drainage control structures are in place on all fields where the enhancement will be implemented and fields are flooded such that ponding or saturated conditions meet the target hydrologic conditions in the plan.

### **Documentation Requirements**

1. Plan developed for the target species,
2. List of fields where this enhancement was implemented,
3. The surface area of each field that is ponded,
4. List of equipment installed, retrofitted, or utilized for water level control and where it is located,
5. Dates when fields were ponded and when final drawdown began and when completed, and
6. Photographs of the impounded area(s). Photos must be dated and labeled with field number.

### **References**

Elphick, C.S., O. Taft and Pedro M. Lourenço. 2010. Management of Rice Fields for Birds during the Non-Growing Season. *Waterbirds* 33(sp1):181-192. <http://www.bioone.org/doi/pdf/10.1675/063.033.s114>

National Audubon Society, Monsanto and the Monsanto Fund. 2007. *Waterbirds on Working Lands: Recommended Practices for Rice Production*.

[http://web4.audubon.org/bird/waterbirds/pdf/recommended\\_practices\\_for\\_rice\\_production.pdf](http://web4.audubon.org/bird/waterbirds/pdf/recommended_practices_for_rice_production.pdf)

Taft, O.W. and C.S. Elphick. 2007. *Waterbirds on Working Lands: Literature Review Bibliography*. National Audubon Society. 46 pp. <http://web4.audubon.org/bird/waterbirds/downloads.html>

**Animal Enhancement Activity – ANM32 – Extend existing filter strips or riparian herbaceous cover for water quality protection and wildlife habitat**



**Enhancement Description**

Where existing filter strips or riparian herbaceous covers (i.e., buffers) are utilized, extend them to gain more efficiency in intercepting overland flow and reducing the transport of nutrients, pesticides and agro-chemicals, and for wildlife habitat.

**Land Use Applicability**

Cropland, Pastureland, Rangeland

**Benefits**

Widening existing buffers can provide food and cover for native and game species as well as enhancing aquatic habitat. Extended buffers offer more surface area to filter out sediments and agro-chemicals. Buffers can also mitigate pesticide drift during pesticide applications and pollen drift where the mixing of plant varieties is not desired.

Buffer habitats are important transition zones between terrestrial landscapes and aquatic zones. Wildlife species utilize these transition zones because they provide a unique combination of cover, access to water and often provide important travel corridors. Often buffers are adjacent to riparian areas or are important contributors to clean water, and habitat areas nearby. Extending existing buffers not only enhances wildlife habitat but it increases the effectiveness of water quality protection they provide to the streams.

**Conditions Where Enhancement Applies**

This enhancement only applies to acres of existing buffers on crop, pasture, or range land uses.

**Criteria**

1. Extend the existing buffer for a total of 60 feet or more to enhance habitat and water quality functions.
2. The extended buffers must be composed of at least 5 species of non-noxious, wildlife friendly grasses and/or perennial forbs best suited to site conditions. Include species that provide pollinator food and habitat where possible.
3. All site preparation and plant establishment shall be accomplished according to the appropriate NRCS conservation practice standard criteria and specifications.
4. Any use of the buffer must not compromise its intended purpose. Vegetation from buffers can be harvested for bio-energy as long as the harvesting is done in accordance with a plan that does not compromise the water quality and wildlife benefits of the extended buffer.
5. To the extent possible the buffer areas and extended buffer areas will be shaped and vegetated to increase overland flow interception and increase water quality values of the stream or water body.



6. The extension of buffers can incorporate other buffer types (riparian forest) where applicable to meet specific operator management goals.

#### Operation and Maintenance

1. Once established, buffers must not be mowed, disked, grazed, or otherwise disturbed during the primary wildlife ground nesting period.
2. Buffers will be regularly maintained for the intended purpose through the life of the contract. This includes any removal of vegetation, including grazing.
  - a. Grazing is not permitted unless a grazing management plan is in effect.
  - b. The grazing management plan must protect the integrity, diversity and function of the riparian area.
3. Buffers will have a wildlife management plan to maintain established plant communities through the life of the contract. The wildlife plan will maintain the plant community and its structural diversity and provide habitat for intended species, remove duff, and control woody vegetation.
4. The grazing management plan and the wildlife management plan shall complement each other.

#### Adoption Requirements

This enhancement is considered adopted when the buffer has a total width of 60 feet or more for the selected land use.

#### Documentation Requirements

1. A map showing the location and size of the existing and enhanced buffer.
2. Documentation of the type and rates of vegetation planted in the new buffer areas.

#### References

Al-Kaisi, M., M. Hanna and M. Licht. 2003. Conservation buffers and water quality. Iowa State University Extension Service Ames, IA. <https://store.extension.iastate.edu/ItemDetail.aspx?ProductID=5502>

Clark, W.R. and K.F. Reeder. 2005. Continuous Conservation Reserve Program: Factors Influencing the Value of Agricultural Buffers to Wildlife Conservation. Pages 93-113 *in* Fish and wildlife benefits of Farm Bill conservation programs: 2000-2005 update. Haufler, J. B., editor. The Wildlife Society Technical Review 05-2. [http://www.nrcs.usda.gov/Internet/FSE\\_DOCUMENTS/nrcs143\\_012882.pdf](http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs143_012882.pdf)

Davros, N. M. and W.L. Hohman. 2006. Breeding bird use of Minnesota Filter Strips in Relation to width, planting mixture, and surrounding land use. NRCS Technical Note. <http://directives.nrcs.usda.gov/OpenNonWebContent.aspx?content=18521.wba>

Reeder, K.F., D.M. Debinski, and B.J. Danielson. 2006. Factors affecting butterfly use of filter strips in southwestern Minnesota. NRCS Technical Note. <http://directives.nrcs.usda.gov/OpenNonWebContent.aspx?content=18503.wba>

USDA-NRCS. 2010. Grassland Bird Population Responses to Upland Habitat Buffer Establishment by L. Wes Burger, Jr., Philip J. Barbour, and Mark D. Smith. Wildlife Insight No. 86. Washington, DC. <http://www.fwrc.msstate.edu/pubs/NRCSWildlifeInsight86.pdf>

**Animal Enhancement Activity – ANM33- Riparian buffer, terrestrial and aquatic wildlife habitat**



**Enhancement Description**

This activity consists of managing riparian zones by utilizing select conservation measures (such as re-locating equipment operations, trails, or livestock; establishing diverse native vegetation and controlling invasive species; fencing; and extending the width of the riparian zone to enhance wildlife habitat adjacent to riparian zones of streams, ponds, lakes, or wetlands) to achieve stream side cover and vegetative diversity and structure to improve

terrestrial and aquatic wildlife habitat.

**Land Use Applicability**

Cropland, Pastureland, Rangeland, Forestland

**Benefits**

Intact riparian zones with a natural and diverse mix of herbaceous and/or woody vegetation of different ages are important landscape features for sustaining fish and wildlife populations. Maintaining vigorous native or natural riparian vegetation of diverse age classes and species will benefit riparian and aquatic fauna by providing: (a) thermal, nesting/fawning, and hiding cover in riparian zones, stream banks, and shorelines; (b) diverse food sources; (c) a steady source of leaves, brush, small woody material for aquatic food webs at and downstream of the site; (d) root systems to enhance bank stability, and (e) vegetative filters for surface water run-off.

**Conditions Where Enhancement Applies**

This enhancement only applies to existing acres of forested riparian zones on crop, pasture, range or forest land uses, *OR* existing acres of non-forested riparian zones on crop, pasture, or range land uses.

**Criteria**

For forested riparian zones:

1. The width of forested riparian zones must be wider than the NRCS State standard width for Riparian Forest Buffers to a maximum width of 150 feet.
2. Manage the riparian area to maintain a diversity of non-invasive tree, shrub, and herbaceous species by techniques such as selective thinning, controlled grazing, prescribed burning, selective use of herbicides, and/or the planting of native species.
3. Retain existing snags or create new snags by girdling live trees of at least one/acre.
4. Manage the riparian vegetation to provide tree canopy shade of the stream and good stream side cover.
5. Do not use heavy equipment such as bull dozers and tractors within the forested riparian zone to implement enhancement activities.



For non-forested riparian zones:

1. On streams, rivers, or floodplains adjacent to pastures, cropland, hayland, or rangeland:
  - a. Enhance and maintain a well-vegetated riparian zone that is 2.5 times the width of the stream channel or 35 feet, whichever is greater to a maximum width of 150 feet.
  - b. Improve the diversity of native or natural shrub and/or herbaceous plant species suitable for the site and appropriate for the riparian and aquatic species that inhabit the area by planting appropriate species.
  - c. Implement at least one of the management actions from #3 below.
2. On ponds, floodplain wetlands, or lakes adjacent to pastures, cropland, hayland or rangeland:
  - a. Enhance and maintain a well-vegetated riparian zone that is 35 feet wide or greater.
  - b. Improve the diversity of native or natural woody and/or herbaceous plant species suitable for the site and appropriate for the riparian and aquatic species that inhabit the area by planting appropriate species.
  - c. Implement at least one of the management actions from #3 below.
3. Additional management actions for enhancing non-wooded riparian zones:
  - a. Control invasive species through a grazing management plan or suitable pest management techniques.
  - b. Limit livestock use of riparian zone through a prescribed grazing management plan
  - c. Control access of people, machinery, and livestock to the riparian zone with fencing.
  - d. Provide off-site watering source(s) for livestock.

### **Adoption Requirements**

This enhancement is considered adopted when the riparian zone(s) is within the range of a 150 foot maximum and either the NRCS State standard width for Riparian Forest Buffers, or for non-forested riparian zones, 2.5 times the width of the stream channel or 35 feet, whichever is greater.

### **Documentation Requirements**

1. Delineations on a map or aerial photo indicating the stream channel length where the riparian zone has improved habitat.
2. Provide written documentation, on the delineation map, of all riparian zone activities implemented to meet the requirements of this enhancement.
3. List of maintenance activities carried out on riparian acres as prescribed under the practice used, and its specific fish and wildlife considerations.

### **References**

Clark, W.R. and K.F. Reeder. 2005. Continuous Conservation Reserve Program: Factors Influencing the Value of Agricultural Buffers to Wildlife Conservation. Pages 93-113 *in* Fish and wildlife benefits of Farm Bill conservation programs: 2000-2005 update. Haufler, J. B., editor. The Wildlife Society Technical Review 05-2.  
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Duehr, J., M. Siepker, C. Pierce and T.M. Isenhardt. 2007. Relation of riparian buffer strips to in-stream habitat, macroinvertebrates and fish in a small Iowa stream. *Journal of the Iowa Academy of Science* 113:49-55.  
[http://www.cfwruiastate.edu/unit\\_scientists/pierce/pierce2007\\_4.pdf](http://www.cfwruiastate.edu/unit_scientists/pierce/pierce2007_4.pdf)



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Fischer, J.R., Quist, M.C., Wigen, S.L., Schaefer, A.J., Stewart, T.W. and Isenhart, T.M. 2009. Assemblage and population-level responses of stream fish to riparian buffers at multiple spatial scales. *Transactions of the American Fisheries Society* 139:185-200. <http://www.tandfonline.com/doi/pdf/10.1577/T09-050.1>

**Animal Enhancement Activity – ANM34 - Leave standing grain crops un-harvested to benefit wildlife**



**Enhancement Description**

Implement a crop management plan that will allow a portion of grain crops to be left in fields un-harvested to provide food and cover for wildlife during winter months.

**Land Use Applicability**

Cropland

**Benefits**

Row crops such as corn and soybeans can be a very important food source for wildlife. Waste grain left

after harvest is used throughout the winter by many species, although under ice or snow cover, this grain may be unavailable to wildlife. One remedy is to leave a portion of the crop field un-harvested. Rows of these crops located on the edges of fields are often less productive from a crop production standpoint, but they can be very productive for wildlife. Corn is especially good for this purpose since it is held above winter snow and remains available all winter. Grain crops such as sorghums, sunflower, wheat, and oats also provide a food source for wildlife.

Not using herbicides on the crops that will be left un-harvested will provide additional food and cover benefits. This has the added benefit of reducing the amount of herbicides that are applied to fields. Allowing annual weeds such as foxtail, lamb’s quarter, smartweed, and common ragweed to grow among the rows of un-harvested crops will provide an additional food source as well as cover. Weeds in soybeans are particularly important as food and cover for wildlife. Since, compared to corn or small grains, soybeans provide relatively little cover.

**Conditions Where Enhancement Applies**

This enhancement applies only to cropland where grain crops such as corn, soybean, sorghum, or small grains are grown.

**Criteria**

1. Leave a minimum of ½ acre of un-harvested, standing grain crops for each 40 acres of cropland. The ½ acre plots shall be located in a single location on the 40 acre unit and additional ½ acre plots shall be located on different 40 acre units, respectively.
2. Locate the un-harvested crops adjacent to permanent cover such as brushy fencerows, field borders, forest land, or wetlands (this does not include newly established trees, windbreaks, or shelterbelts).
3. Leave un-harvested crops standing over winter until it is time to prepare the soil for planting the new crop.



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### **Adoption Requirements**

This enhancement is considered adopted when the ratio of un-harvested grain crop to standing crop in the criteria above is left in the selected area.

### **Documentation Requirements**

1. A map showing the location(s) where crops are left un-harvested,
2. The type(s) of crops grown and left un-harvested each year, and
3. The acreage of un-harvested crops.

### **References**

Pitts, D.E. and W.D. McGuire. 2000. Wildlife Management for Missouri Landowners. Missouri Department of Conservation. 3<sup>rd</sup> ed.

Krapu, G.L., D.A.Brant and R.R.Cox Jr. 2004. Less waste corn, more land in soybeans, and the switch to genetically modified crops: trends with important implications for wildlife management. Wildlife Society Bulletin, 32(1):127-136.

Ohio Division of Wildlife. 2012. Crop Field Management for Wildlife. Publication 391 (R402)

Zoller, C. and D. McMillen. 2004. Establishing Wildlife Food Plots. Ohio State University Extension Fact Sheet. W-19-2004. <http://ohioline.osu.edu/w-fact/pdf/0019.pdf>

Ohio Division of Wildlife. 2012. Food Plots for Wildlife. <http://www.ohiodnr.com/Portals/9/pdf/pub392.pdf>

**Animal Enhancement Activity – ANM35 – Enhance wildlife habitat on expired grass/legume covered CRP acres or acres with similar perennial vegetated cover managed as hayland**



**Enhancement Description**

Implement a focused habitat management plan for the benefit of selected wildlife species on expired CRP grass/legume covered acres that has CRP conservation cover or acres with similar perennial vegetated cover managed as hayland.

**Land Use Applicability**

Cropland (hayland)

**Benefits**

Acres of preexisting conservation cover from expired CRP contracts or acres of similarly vegetated perennial conservation cover implemented as a component of an operation’s conservation plan have utilitarian value when managed for both wildlife and forage production. Targeted management of wildlife species on working lands will maintain valuable cover on sensitive lands for continued reductions in soil erosion while providing habitat for recreational and economically important wildlife as well as species of broader conservation interest.

**Conditions Where Enhancement Applies**

This enhancement only applies to hayland acres in the crop land use where a predominance of perennial grass/legume conservation cover vegetation exists and a hayland management system can be demonstrated or documented.

**Criteria**

1. Identify the targeted species or suite of species (e.g., Lesser prairie chicken, Greater sage grouse, Bobwhite quail, etc.) described in need of action within the State Wildlife Action Plan or other reputable wildlife conservation plan(s).
2. Defer 66% of the enrolled land use acres from haying during the nesting/fawning season each year. The deferred acres shall rotate annually to ensure the same acreage is not deferred each year or deferred in back to back years.
3. Develop and implement a focused wildlife habitat management plan that identifies the following:
  - a) Targeted wildlife species and wildlife management objectives for the hay land,
  - b) Critical nesting and fawning period for targeted species,
  - c) The location and number of acres to be deferred each year,
  - d) A schedule for the year of deferment, and
  - e) Any unique management scenarios to promote diverse vegetation composition and structure for targeted wildlife while maintaining plant health.



4. Utilize both of the following techniques (A or B) to protect wildlife during haying activities.
  - a) Defer haying. The producer *will apply the following* management actions specifically for improving or protecting grassland functions for the state identified targeted wildlife species.
    - i. Do not cut hay on at least 2/3 of the hay acres each year. Uncut blocks must be at least 30 feet wide.
    - ii. Hay cutting must be either before and/or after the primary nesting or fawning seasons based on state established dates for the targeted species.
    - iii. Increase forage heights after mowing to state specified minimum heights for the targeted species on all hayed acres.
  - b) For all haying, the producer will implement *the following* mowing procedures:
    - i. A flush bar attachment will be required on the mower
    - ii. All mowing will be done during daylight hours
    - iii. Haying pattern will be either:
      - a. Begin on one end of the field and work back and forth across the field, or
      - b. Begin in the center of the field and work outward

### **Adoption Requirements**

The enhancement is considered adopted when each of the criteria above has been fully implemented on the enrolled land use acre.

### **Documentation Requirements**

1. A schedule of when haying activities occurred documenting that haying activities were deferred on a minimum of 60% of the available acreage.
2. A map showing the acreage where these activities are applied and the location of the deferred hay acreage.
3. Option A – A picture showing residual heights of hay after mowing
4. Option B – A picture showing the flush bar attachment on tractor

### **References**

Greene, C. 2007. Reducing Mortality of Grassland Wildlife during Haying and Wheat-Harvesting Operations. Division of Agricultural Sciences and Natural Resources, Oklahoma State University, OSU Extension Wildlife and Forestry, NREM-5006. <http://www.okrangelandswest.okstate.edu/files/wildlife%20pdfs/NREM-5006.pdf> .

Herkert, J. R., D. W. Sample, and R. E. Warner. 1996. Management of midwestern grassland landscapes for the conservation of migratory birds. Pages 89-116 in F. R. Thompson, III, ed. Management of midwestern landscapes for the conservation of neotropical migratory birds. U.S. For. Serv., Gen. Tech. Rep. NC-187. North Central For. Exp. Sta., St. Paul, MN. <http://nrs.fs.fed.us/pubs/gtr/other/gtr-nc187/index.html>

Sample, David W., and Michael J. Mossman. 1997. Managing habitat for grassland birds - a guide for Wisconsin. Wisconsin Department of Natural Resources, Madison, WI, PUBL-SS-925-97. 154 pp. Jamestown, ND: Northern Prairie Wildlife Research Center Online. <http://www.npwr.usgs.gov/resource/birds/wisbird/index.htm> (Version 03JUN2002)

USDA-NRCS. 2010. Management Considerations for Grassland Birds in Northeastern Haylands and Pasturelands by Noah Perlut, Allan Strong and Therese Donovan. Wildlife Insight No. 88. Washington, D.C. <http://directives.nrcs.usda.gov/OpenNonWebContent.aspx?content=27175.wba>

**Animal Enhancement Activity – ANM36 – Enhance wildlife habitat on expired tree covered CRP acres or acres with similar woody cover managed as forestland**



**Enhancement Description**

Implement a focused habitat management plan for the benefit of selected wildlife species on expired CRP tree covered acres that has CRP conservation cover or acres with similar woody cover managed as forestland.

**Land Use Applicability**

Forestland

**Benefits**

Acres of preexisting conservation cover from expired CRP contracts or acres of similarly vegetated woody conservation cover implemented as a component of an operation’s conservation plan have utilitarian value when managed for both wildlife and forest products (e.g., wood, food, fiber). Targeted management of wildlife species on working lands will maintain valuable cover on sensitive lands for continued reductions in soil erosion while providing habitat for recreationally and economically important wildlife as well as species of broader conservation interest.

**Conditions Where Enhancement Applies**

This enhancement only applies to forest land use acres where a predominance of tree conservation cover from expired CRP contract(s) exists or where woody cover implemented as a component of an operation’s conservation plan exists, and a management system can be demonstrated or documented.

**Criteria**

1. Identify species or suite of species (e.g., Bobwhite quail, New England cottontail, Golden-winged warbler, Gopher tortoise, wild turkey) described in need of action within State Wildlife Action Plans or other reputable wildlife conservation plans.
2. Fire tolerant sites
  - a) Develop and implement a focused wildlife habitat management plan that identifies the following:
    - i. As applicable, the critical nesting and fawning periods for targeted wildlife,
    - ii. The number of snags expected per acre (max 4) where the snags are in wood decay classes 2-5 (see Figure 1 below) and are 10 inches dbh (diameter at breast height) or greater, and

- iii. Method to increase tree species diversity and greater structural (vertical and horizontal) diversity.
- b) Develop and implement a prescribed burning plan written and carried out by a certified prescribed burner.
- c) Develop and implement a tree release plan with the following components:
  - i. The number of trees to be retained based upon site productivity and spacing guide developed within each state for the existing tree species as suited for the targeted wildlife species or suite of species,  
Note: If more than one tree species are present, base spacing upon the most abundant tree species.
  - ii. The landowner's objectives for the forest,
  - iii. Where possible, retain and promote a mixture of tree species to diversify the vertical and horizontal structure of the stand and reduce the potential of an epidemic event (e.g. insect outbreak) that may kill some/all trees,
  - iv. Impact of crowns touching the crop tree's crown on three or four sides,
  - v. Method for handling the marked trees (i.e., cut for harvest or killed using approved methods within in the state), and
  - vi. Where pockets of dead trees occur, ensure the Criteria # 2(a)(ii) is met.

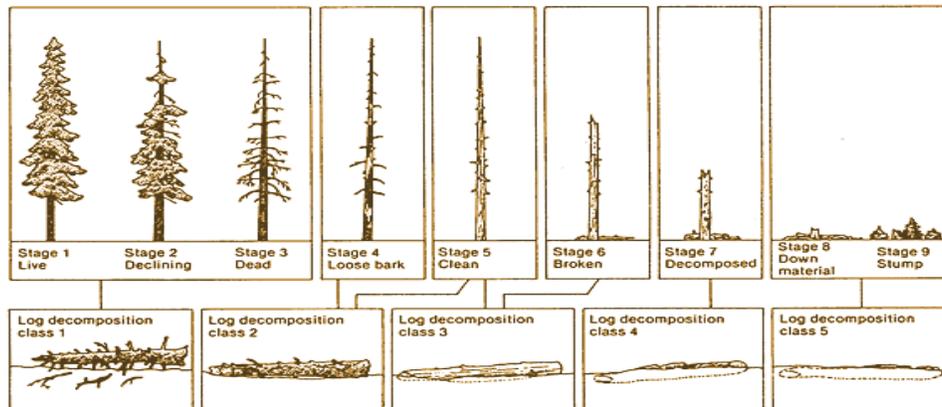


Figure 1. Snag and down wood decay classification system (Maser et al. 1979)

3. Non-Fire tolerant sites

- a) Develop and implement a focused wildlife habitat management plan that identifies the following:
  - i. As applicable, the critical nesting and fawning periods for targeted wildlife,
  - ii. The number of snags expected per acre (max 4) where the snags are in wood decay classes 2-5 (see Figure 1 above) and are 10 inches dbh (diameter at breast height) or greater, and
  - iii. Method to increase tree species diversity and greater structural (vertical and horizontal) diversity.
- b) Develop and implement a tree release plan with the following components:



- i. Identifies the number of trees to be retained (e.g., between 25-35 trees per acre) for the targeted wildlife species or suite of species,
- ii. Identifies targeted tree species as determined by NRCS state office (e.g. white and red oak or other species that have a high market value and provide wildlife benefits),
- iii. The landowner's objectives for the forest,
- iv. The impact of crowns touching the crop tree's crown on three or four sides,
- v. Method for handling the marked trees (i.e., cut for harvest or killed using approved methods within in the state), and

### **Adoption Requirements**

The enhancement is considered adopted when Criteria #1 plus either 2 or 3 above has been fully implemented.

### **Documentation Requirements**

1. The average number of snags per acre,
2. Delineations on a map or aerial photo of the treated (released and/or burned) areas,
3. Copy of the tree release plan,
4. Representative digital images/photos of the area showing before and after treatment conditions,
5. A copy of the written burn plan (if applicable), and
6. Description of post-burn conditions with representative digital images of the treated area

### **References**

Maser, C., R.G. Anderson, K. Cromack, Jr., J.T. Williams, and R.E. Martin. 1979. Dead and down woody material. In: Wildlife habitats in managed forests of the Blue Mountains of Oregon and Washington, USDA Handbook No. 553. pp 78-95.

Twedt, D.J. 2012. Wildlife Forestry, Global Perspectives on Sustainable Forest Management, Clement A. Okia (Ed.), ISBN: 978-953-51-0569-5, InTech, Available from: <http://www.intechopen.com/books/global-perspectives-on-sustainable-forest-management/wildlife-forestry>

**Animal Enhancement Activity – ANM37 – Prescriptive grazing management system for grazed lands (includes expired CRP grass/legume or tree covered acres converted to grazed lands)**



**Enhancement Description**

Implement a prescriptive grazing management system for all grazed lands and for all eligible land uses in the operation. This includes expired CRP grass/legume or tree covered acres that are now converted to a grazing system. Selection of this enhancement requires the activity to be planned concurrently on all eligible land use acres.

**Land Use Applicability**

Cropland, Pastureland, Rangeland, Forestland

**Benefits**

Utilizing a prescriptive grazing management system on all grazed acres regardless of the land use (including expired CRP grass/legume or tree conservation covered acres) will maintain sensitive lands in a valuable soil cover and provide needed wildlife habitat. With perpetual ground cover comes a continued reduction in soil erosion. Managing the forages on the entire operation will provide landscape level enhanced livestock production and critical wildlife habitat for species of interest.

**Conditions Where Enhancement Applies**

This enhancement applies to all grazed acres designed as crop, pasture, range or forest land use acres (including expired CRP grass/legume or tree covered acres that are now converted to a grazing system) on the entire operation.

**Criteria**

1. Develop and implement a grazing management plan for the acres where this enhancement applies that defers grazing on 20% of the eligible acres each year. The deferral period for introduced forage species is 90 days of the growing season while the deferral period for native forages is the full grazing season. In riparian buffer settings, flash grazing is allowed; however, the livestock must be excluded for the remainder of the time.
2. Incorporate into the written grazing management plan components that identify the following:
  - a. Wildlife management objectives for grazing land,
  - b. Identified targeted species or suite of species (e.g., Lesser prairie chicken, Greater sage grouse, Bobwhite quail, etc.) described in need of action within the State Wildlife Action Plan or other reputable wildlife conservation plan(s).



- c. Critical nesting and fawning period for targeted species,
  - d. Stocking rates that will allow proper forage utilization and plant health while maintaining proper plant heights for targeted wildlife species' food and shelter,
  - e. The recommended minimum grazing stop and start heights,
  - f. The location and number of acres to be deferred each year (Note: the location of the required amount of deferred acres shall be different each year), and
  - g. A schedule for the year of deferment.
3. Complete both sub-criteria list below on **ALL** open trough watering facilities on the acres where this enhancement applies. The escape structures must meet the following requirements:
- a. Wildlife escape structures for watering facilities must meet the following requirements:
    - i. Extend into the water and meet the inside wall of the watering facility,
    - ii. Reach to the bottom of the watering facility or to the depth of the lowest possible water level,
    - iii. Be firmly secured to the rim of the watering facility so as not to be displaced by livestock
    - iv. Be built of graspable, long-lasting materials, such as painted or coated metal grating, roughened fiberglass, concrete, rock and mortar, or high-strength plastic composites,
    - v. Have a slope no steeper than 45 degrees,
    - vi. Be located to cause minimal interference with livestock drinking, and
    - vii. One structure for every 30 linear feet of watering facility edge.
  - b. Obstruction removal above the watering facility's water surface.
    - i. Fencing material such as wire strands and boards shall not be within a 36" zone above the highest planned water surface (e.g., if a trough is bisected by fencing to provide water between two pastures, remove the lower strands of wires; or if wood bracing is present across the top of the trough, re-brace the tank to create an unobstructed space above the water's surface), or
    - ii. Rearrange the fence line to create an adjustable pivot point thereby removing any obstructions above the water surface while allowing full access to a single trough from two different grazing areas.
4. Modify 50% of **ALL** fencing on the acres where this enhancement applies to be wildlife friendly. The fence modification implemented shall be for the protection and/or benefit of the local species in the area and shall be focused along known wildlife travel corridors. The modified fence should improve passage by either jumping or crawling and be highly visible to prevent collision, entanglement and fatalities.
- a. Improve Passage  
Retrofit Existing Fence- openings and crossing to allow wildlife access to food, water and shelter must be created in existing fence. Location and number of openings required will meet NRCS state standards. Methods used included but are not limited to:
    - 1) Lay-down fence
    - 2) Seasonal electric fence
    - 3) Adjustable wire fence
    - 4) Underpass fence with raised wire
    - 5) Pole top fence



b. Improve Visibility

- 1) Increase visibility of ALL fencing using flagging, vinyl markers, PVC pipe or other similar materials that will meet NRCS state standards for spacing, interval and size. A good example of improving visibility for prairie grouse (e.g. prairie chickens, sage grouse, etc.) in rangeland can be found at:  
[www.suttoncenter.org/pages/fence\\_marking\\_instructions](http://www.suttoncenter.org/pages/fence_marking_instructions)
- 2) If no state criteria exist, follow criteria in the Montana Fish, Wildlife & Parks publication [“A Landowner’s Guide to Wildlife Friendly Fences.”](#) If a locally applicable publication exists, the local publication should be used.

Note: If no state criteria or local publications exist, the NRCS State Resource Conservation must agree to the proposed fence modification specifications offered.

**Additional criteria for silvopasture**

1. Inventory the habitat condition of the silvopasture, the operation, and adjoining farms to determine habitat needs for the identified targeted wildlife.
2. Use one or more of the following methods to improve habitat for the identified targeted species.
  - a. Establish additional understory vegetation (e.g., native grass, forbs and shrubs) that will improve habitat conditions for the identified targeted species. Note: introduced species such as Bahiagrass, hybrid Bermudagrass, fescue, etc. shall not be seeded for this purpose.
  - b. Establish clusters of other tree species if needed as a food source (e.g., oaks for mast).
  - c. Manage tree canopy to achieve the desired understory plant community.
  - d. Leave dead or dying trees as snags if cavity nesting wildlife is targeted. Trees left for this purpose must be 10 inch or greater dbh (diameter at breast height). In determining which snags to leave, consider fence maintenance and animal safety.
  - e. Remove trees or invasive plants that do not provide the desired habitat.
  - f. Thin less desirable trees to: 1) encourage the growth of trees, 2) establish additional understory vegetation, and 3) provide the desired wildlife habitat for the target species.

**Adoption Requirements**

The enhancement is considered adopted when the focused management plan has been fully implemented.

**Documentation Requirements**

1. A copy of the written grazing management plan.
2. The schedule of when grazing activities occurred documenting that grazing activities were deferred to meet the 20% requirement.
3. A map showing the acreage where these grazing activities were applied.
4. A photograph of each watering facility with a properly installed escape/access device.
5. A map showing where wildlife friendly fence is located with the type (s) of wildlife friendly fencing identified.
6. Photograph of each wildlife friendly fencing method used.



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## References

- Arizona Game and Fish Department. 2008. Wildlife Water Construction Standards. Arizona Game and Fish Department, Phoenix, Arizona.  
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- Holechek J. L., R. Valdez, S. D. Schemnitz, R. D. Pieper and C. A. Davis. 1982. Wildlife Society Bulletin Vol. 10, No. 3: 204-210.
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- Krausman, P., R. Rosenstock, S. Steven and James W. Cain III. 2006. Developed Waters for Wildlife: Science, Perception, Values, and Controversy. Water and Wildlife Special Section. The Wildlife Society Bulletin 34:563-569.
- Lyons, R. K., and Wright, B. D. 2003. Using Livestock to Manage Wildlife Habitat. Available electronically from <http://hdl.handle.net/1969.1/87188>
- Nistler, C. M., J. Boren, and D. Rollins. 2006. Proceedings – Symposia: Prescribed Livestock Grazing to Enhance Wildlife Habitat. 112 pages. Society for Range Management.
- Paige, C. 2008. A Landowner's Guide to Wildlife Friendly Fences. Landowner/Wildlife Resource Program, Montana Fish, Wildlife and Parks, Helena, MT. 44 pp. <http://fwpiis.mt.gov/content/getItem.aspx?id=34461>.
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- Undersander, D., S. Temple, and J. Bartlet, and L. Paine. 2000. Grassland Birds: Fostering Habitats using Rotational Grazing. University of Wisconsin-Extension Publication A3715.
- USDA-NRCS. 2010. Conservation Practice Standard: Prescribed Grazing-Code 528.

**Animal Enhancement Activity – ANM38 – Retrofit watering facility for wildlife escape and to enhance access for bats and bird species**



**Enhancement Description**

Retrofit all existing watering facilities (troughs, tanks, etc.) to allow for the escape of wildlife that become trapped while trying to drink and to remove obstructions above the watering facility such as boards and wires.

Selection of this enhancement requires the activity to be planned concurrently on all eligible land use acres.

**Land Use Applicability**

Cropland, Pastureland, Rangeland, Forestland

**Benefits**

This activity provides wildlife with a definitive means of escape while utilizing a livestock water facility as a water source. Concurrently, livestock performance is improved by supplying a cleaner water supply. Dead wildlife in water facilities impair the water quality which results in decreased water consumption by livestock and reduced rates of weight gain. In addition, obstructions (e.g., boards and wires) located above the watering facility reduces the availability of water to wildlife that need open sources of water in order for them to swoop and drink while in flight. Removal of these obstructions will make many previously unavailable water sources available while reducing the injury or death potential to bats and birds as they fly in to scoop water from the watering facility. This enhancement will eliminate this threat.

**Conditions Where Enhancement Applies**

This enhancement applies to **all** open watering facilities in the crop, pasture, range, or forest land use area. This enhancement does not apply to earth stock ponds, ball type, energy-free waters or similar.

**Criteria**

This enhancement applies to ALL watering facilities located in the land use acres. Both criteria, A and B below must be met.

- A. Wildlife escape structures for watering facilities must meet the following requirements:
1. Extend into the water and meet the inside wall of the watering facility,
  2. Reach to the bottom of the watering facility or to the depth of the lowest possible water level,
  3. Be firmly secured to the rim of the watering facility so as not to be displaced by livestock
  4. Be built of graspable, long-lasting materials, such as painted or coated metal grating, roughened fiberglass, concrete, rock and mortar, or high-strength plastic composites,
  5. Have a slope no steeper than 45 degrees,
  6. Be located to cause minimal interference with livestock drinking, and
  7. One structure for every 30 linear feet of watering facility edge.



**B. Obstruction removal above the watering facility's water surface.**

1. Fencing material such as wire strands and boards shall not be within a 36" zone above the highest planned water surface (e.g., if a trough is bisected by fencing to provide water between two pastures, remove the lower strands of wires; or if wood bracing is present across the top of the trough, re-brace the tank to create an unobstructed space above the water's surface), or
2. Rearrange the fence line to create an adjustable pivot point thereby removing any obstructions above the water surface while allowing full access to a single trough from two different grazing areas.

**Adoption Requirements**

This enhancement is considered adopted when the watering facility has the wildlife escape structure installed and obstructions above the water surface, if present, meet either Criteria B(1) or B(2).

**Documentation Requirements**

Photograph showing a properly installed escape device for each watering facility. The photograph must also show that there are no obstructions suspended within 36" above the watering facility's water surface.

**References**

Arizona Game and Fish Department. 2008. Wildlife Water Construction Standards. Arizona Game and Fish Department, Phoenix, Arizona. [http://www.azgfd.gov/w\\_c/WaterDevelopments.shtml](http://www.azgfd.gov/w_c/WaterDevelopments.shtml)

Kie, J.G., V.C. Bleich, A.L. Medina, J.D. Yoakum, and J.W. Thomas. 1994. Managing rangelands for wildlife. Pages 663-688 *in* Research and management techniques for wildlife and habitats, 5th Edition (T.A. Bookhout, ed.). The Wildlife Society, Bethesda, MD. 740pp.

Kiryuchuk, B. 2000. Effect of Water Quality on Cattle Weight Gain. Canada-Saskatchewan Agri-Food Innovation Fund. AFIF Coagulation File: 6672-1-12-1-4.

Krausman, P., R. Rosenstock, S. Steven and James W. Cain III. 2006. Developed Waters for Wildlife: Science, Perception, Values, and Controversy. Water and Wildlife Special Section. The Wildlife Society Bulletin 34:563-569.

McCullum, T. 2010. Some points to consider about cattle water. AgriLIFE Extension. Texas A&M. Amarillo, TX. <http://amarillo.tamu.edu/files/2010/10/Some-points-to-consider-about-cattle-water.pdf>

Taylor, D.A.R. and M.D. Tuttle 2012. Water for Wildlife: A handbook for ranchers and ranch managers. Bat Conservation International, Austin, TX. <http://www.batcon.org/pdfs/water/bciwaterforwildlife.pdf>

Tuttle, S.R., C.L. Chambers and T.C. Theimer. 2006. Potential effects of livestock, water trough modifications on bats in northern Arizona. Wildlife Society Bulletin 34:602-608.

**Supplemental payment activity –CCR99–Resource Conserving Crop Rotation (RCCR)**



**Enhancement Description**

Resource-conserving crop rotation means a crop rotation that:

1. Includes at least one resource conserving crop as determined by the State Conservationist;
2. Reduces erosion;
3. Improves soil fertility and tilth;
4. Interrupts pest cycles; and
5. In applicable areas, reduces depletion of soil moisture or otherwise reduces the need for irrigation.

Resource-conserving crop means a crop that is one of the following:

1. A perennial grass;
2. A legume grown for use as forage, seed for planting, or green manure;
3. A legume-grass mixture;
4. A small grain grown in combination with a green manure crop consisting of a grass, legume, forbs, or grass-forbs mixture, whether interseeded or planted in rotation.

**Land Use Applicability**

Cropland

**Benefits**

Resource-conserving crop rotations provide:

- Substantial aboveground residue and extensive root systems resulting in controlled erosion, improved soil tilth and carbon sequestration into soil organic matter.
- Improved soil condition and deep root channels resulting in enhanced water infiltration and soil moisture holding capacity; all of which reduce runoff losses as well as the frequency and amount of irrigation required.
- Improved soil biological activity for enhanced soil health via green manures and rhizodeposition (i.e., root exudates; fine root sloughing).
- Biological N fixation by legumes for soil fertility building and reduced energy consumption.
- Disrupted pest and weed life cycles by varying plant families and timing of field management activities

**Conditions Where Enhancement Applies**

This enhancement applies to all annually planted crop land use acres. The enhancement does not apply to permanent hayland, orchards, or vineyards.



**Criteria**

Design the crop rotation with sufficient diversity in plant family and species as well as timing and type of field operations to reduce the weed and pest populations. The rotation plan should reduce anticipated needs for pesticides, cultivation, or other pest/weed control measures.

The resource conserving crop rotation shall include at least one of the following resource conserving crops:

1. With at least one other crop in the rotation, include a perennial grass grown at least 2 years from time of planting;
2. With at least one other crop in the rotation, include a legume that is grown at least 2 years from time of planting;
3. With at least one other crop in the rotation, include a legume-grass mixture that is grown at least 2 years from time of planting;
4. With at least one other crop in the rotation, include a grass-forbs or legume-grass-forbs mixture, in which at least the grass component of the mixture is grown at least 2 years from time of planting, or
5. With at least two other crops in the rotation, include a small grain grown in combination with a grass, legume, forbs or any grass-forbs mixture that is used as a green manure, whether interseeded or planted after small grain harvest. Neither the small grain residue nor the cover crop shall be harvested or grazed.

**Contract Criteria**

1. The rotation shall cover at least 3 fiscal years of the CSP contract.
2. The resource conserving crop must be adopted by the third fiscal year of the contract and established or planted on all planned acres prior to the final annual payment.

**Adoption Requirements**

This enhancement is considered adopted when the resource conserving crop rotation is planted on at least 1/3 of the rotation acres.

**Documentation Requirements**

Planned Resource-Conserving Crop Rotation(s):

List crop rotation(s), resource conserving crops, and cover crops that will follow the specific crops as applicable for each rotation to receive supplemental payment:

Rotation#1: \_\_\_\_\_ Fields: \_\_\_\_\_ Years \_\_\_\_\_  
Resource Conserving Crop(s) to be used: \_\_\_\_\_

Rotation#2: \_\_\_\_\_ Fields: \_\_\_\_\_ Years \_\_\_\_\_  
Resource Conserving Crop(s) to be used: \_\_\_\_\_



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Rotation#3: \_\_\_\_\_ Fields: \_\_\_\_\_ Years \_\_\_\_\_  
Resource Conserving Crop(s) to be used: \_\_\_\_\_

Records:

- a. Crop rotation records by field
- b. Cover crops planted
- c. Photographs of representative fields showing different phases of the rotation
- d. Seed tags and receipts

**Energy Enhancement Activity – ENR01 – Fuel use reduction for field operations**



**Enhancement Description**

This enhancement is for fuel savings of 20% or more achieved by a reduction in field operations when compared to existing management system.

**Land Use Applicability**

Cropland

**Benefits**

In addition to saving money the advantages of fossil fuel conservation include reducing air pollutants such as greenhouse gas emissions, and decreasing reliance on foreign oil.

**Conditions Where Enhancement Applies**

This enhancement applies to all crop land use acres.

**Criteria**

1. Implementation of this enhancement requires that the participant reduce their field operations to achieve fuel savings of 20% or greater over their present baseline use.
2. Reduced trips across the field, and reduced tillage intensity are documented by using RUSLE2 to compare the planned tillage operations with present baseline tillage operations. The RUSLE2 user must ensure the energy data in RUSLE2 is current.

**Adoption Requirements**

This enhancement is considered adopted when the present baseline fuel consumption for all field operations is calculated using RUSLE2, at the time of application, and the comparison of the baseline to the planned reduced field operations, also calculated with RUSLE2, is  $\geq 20\%$ .

**Documentation Requirements**

Documentation of the fields where field operations have changed

**References**

Klein, R.N. and R.K. Wilson. 2012. Crop Budgets Nebraska – 2012. Extension University of Nebraska. Lincoln, NE. EC872 (Revised January 2012). <http://www.ianrpubs.unl.edu/epublic/live/ec872/build/ec872.pdf>

Brown, E., R.N. Elliot and S. Nadel. 2005. Energy Efficiency Programs in Agriculture: Design, Success, and Lessons Learned. American Council for an Energy-Efficient Economy. Report Number IE051.

**Energy Enhancement Activity – ENR09 - Variable frequency drive electric motors**



**Enhancement Description**

This enhancement activity is for upgrading of existing single speed electric motors through the addition of variable frequency electric drives. A motor replacement may also be included in some cases. The primary use of this enhancement is for irrigation water pumping. This enhancement is not intended for farmstead or animal housing applications.

**Land Use Applicability**

Cropland, Pastureland

**Benefits**

Motor-drive systems are matched to the pump or other machinery which performs the work that needs to be done. Each motor-drive system must be sized to meet the maximum expected load even if that maximum load only occurs infrequently. This maximum output condition is rarely the most efficient operating point of the motor-drive system. A variable frequency drive improves the system’s energy efficiency under most operating conditions by matching the motor speed to the load. In contrast, the output of a single speed motor-drive system will rarely match the actual demand and is controlled in some way that often wastes a large part of the power it produces. Single speed electric motor-drive systems use more electricity during startup and as operating requirements vary during the run cycle. A variable frequency drive can start a motor slowly and ramp up to full speed reducing wear and tear on the motor.

Variable frequency drives achieve higher energy savings in applications with long annual run-times and when the system operates outside its best efficiency point for long periods of time. Equipment which operates with frequent on/off cycles or uses some kind of mechanical throttling (dampers on air systems or valves in liquid systems) are typically good candidates for a variable speed drive.

Motor-drive systems which generally operate under steady load conditions are not good candidates for variable speed drives.

**Conditions Where Enhancement Applies**

This enhancement applies to only the number of single speed electric motors without variable speed drives within the selected land use. This enhancement does not apply to single speed electric motors for farmstead or animal housing applications.

**Criteria**



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1. Determine current and anticipated requirements in terms of peak and typical load conditions (as the load varies daily and by season, crop, or other appropriate activity).
2. Retrofit single speed electric motors with a variable frequency drives or replace single speed electric motors with an efficient motor and variable speed drive.

### **Adoption Requirements**

This enhancement is considered adopted when the selected single speed motor has been retrofitted or replaced with a variable speed drive.

### **Documentation Requirements**

Receipts and pictures of the installed variable frequency drive(s).

### **References**

US-DOE. 2001. GREENING FEDERAL FACILITIES: An Energy, Environmental, and Economic Resource Guide for Federal Facility Managers and Designers. 2<sup>nd</sup> ed. Part V Energy Using Systems. 5.7.2 Variable-Frequency Drives. <http://www1.eere.energy.gov/femp/pdfs/29267-0.pdf>

**Energy Enhancement Activity – ENR10 – Using nitrogen provided by legumes, animal manure and compost to supply 90 to 100% of the nitrogen needs**



**Enhancement Description**

This enhancement involves using nitrogen (N) produced by legumes and/or available animal manure and compost to supply 90 to 100% of N nutrient needs for crops, hay and/or forages produced on the farm.

**Land Use Applicability**

Cropland, Pastureland

**Benefits**

Annually 12 million tons of N fertilizers are used to produce crops on over 90 million acres. It requires 35,000 to 40,000 cu. ft. of natural gas to produce one ton of N fertilizer accounting for 1/3 of the energy input to crop production. Managing legumes, manures and compost properly can replace the need for additional N fertilizer and reduce the energy footprint of the farming operation.

**Conditions Where Enhancement Applies**

This enhancement applies to all crop or pasture land use acres.

**Criteria**

1. Follow a nutrient management system that utilizes N from legumes, animal manures, composts and the mineralization of N from soil organic matter decomposition to supply 90 to 100% of the N needs for production.
2. Follow recommendations from the Land Grant University (LGU) for legume N production when estimating available N for crop production. Note: For a more accurate estimate, utilize the guidance in “Northeast Cover Crop Handbook” chapter 2.
3. Utilize manure and compost nutrient analysis conducted by a LGU laboratory or a private commercial lab recognized by the state when estimating available nutrients for crop production.
4. Manure must be applied according NRCS Nutrient Management Conservation Practice Standard (590). Contact your local conservationist for assistance with Conservation Practice Standards.
5. Utilize cover crops to trap N where appropriate (e.g., following manure application on soils with low residue levels, on soils that have been tilled, or where the fall manure applications were made for a spring planted crop).
6. Manure from off farm sources can be used. The total amount of phosphorus applied shall not exceed the rate recommended by the LGU based on soil testing and established yield goals.



7. This enhancement does not include the removal of crops that require nitrogen from the rotation (e.g., eliminating corn to avoid use of nitrogen fertilizer). However, diversifying the crop rotation to alternate N-requiring with N-fixing crops to reduce the frequency of N-requiring crops in the rotation is acceptable.

### **Adoption Requirements**

This enhancement is considered adopted when 90 to 100% of the nutrient N needs for the crops, hay or forages produced on the farm are from organic sources.

### **Documentation Requirements**

Crop production records that include:

1. Source of organic nitrogen (e.g., cover crop, manure, and compost)
2. An estimate of available nitrogen and methods used to estimate N including:
  - a. Lab analysis
  - b. Biomass calculation
3. Soil test results for each treatment area
4. Amount of manure and/or compost applied per acre
5. Manure and compost nutrient analysis (if applicable)
6. List of fields where enhancement was applied each year
7. Estimate of legume biomass produce each year (if applicable)

### **References**

Clark A. (editor). 2007. Managing cover crops profitably. 3<sup>rd</sup> Ed. Sustainable Agriculture Network Handbook Series; bk 9.

Magdoff, F. and H. van Es. Cover Crops. 2000. p. 87-96 *In* Building soils for better crops. 2nd Ed. Sustainable Agriculture Network Handbook Series; bk 4. National Agriculture Library. Beltsville, MD.

**Energy Enhancement Activity - ENR11 – Improving energy feedstock production using alley cropping systems with short rotation woody crops**



**Enhancement Description**

This enhancement involves the use of short rotation woody plants that produce energy feedstock planted in multiple rows with crops or forages produced in the alleyways between the woody rows.

**Land Use Applicability**

Cropland, Pastureland

**Benefits**

The strategic integration of woody biomass species within agricultural landscapes will assist in meeting society’s and on-farm energy demands while improving agro-ecosystem health and function. Woody feedstock can be harvested year round (with proper planning and design) and the resulting solid chips can be handled, stored and converted to energy. See Alley Cropping (311) conservation practice standard for further guidance.

**Conditions Where Enhancement Applies**

This enhancement applies to all acres of the selected land use.

**Criteria**

1. Identify short rotation woody crops to be planted. (Lists of woody plants suitable for energy feedstock production will be developed by NRCS at the state level.)
2. Account for potential local energy markets and personal needs when selecting species. Use native species wherever possible.
3. Plant woody species in multi-row (minimum of two-rows/set) sets.
4. The alleyway distance between woody row sets will be determined by the following:
  - a. Tree or shrub management objectives
  - b. Type (s) of woody plant used
  - c. Light requirements and growth period of the crops or forages in the alleyways
  - d. Erosion control needs
  - e. Machinery widths and turning areas
5. Maximum distance of the alleyways between woody row sets will be determined by states.

**Adoption Requirements**

This enhancement is considered adopted once the short rotation woody crops have been planted.

**Documentation Requirements**

1. List of short rotation woody crops planted.
2. Type of woody feedstock material (e.g. chips, pellets, rounds)



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3. Brief written description of the activities (criteria) completed with dates of application and receipts for planting stock, herbicides, etc.
4. Acreage of the enhancement activity.
5. Delineations on a map or aerial photo of alley cropping layout and placement.

### **References**

Garrett, H.E. (editor). 2009. Alley Cropping Practices – Chapter 7. *In* North American Agroforestry: An Integrated Science and Practice. American Society of Agronomy, Inc.

State University of New York College of Environmental Science and Forestry. 2010. Short Rotation Woody Crops in a Renewable Energy Future: Challenges and Opportunities. 8th Biennial Short Rotation Woody Crops Operations Working Group Conference. Syracuse, NY.

USDA National Agroforestry Center. 1999. Alley Cropping: An Agroforestry Practice.. Agroforestry Notes – AF Note 12. Lincoln, NE.

USDA National Agroforestry Center. 1998. Opportunities for Growing Short-Rotation Woody Crops in Agroforestry Practices. Agroforestry Notes – AF Note 10. Lincoln, NE.

**Energy Enhancement Activity – ENR12 – Use of legume cover crops as a nitrogen source**



**Enhancement Description**

This enhancement is for the use of legume cover crops as a primary source of nitrogen in a cropping system. Use of legume cover crops is applicable to conventional, specialty and organic crop production systems.

**Land Use Applicability**

Cropland

**Benefits**

Approximately 35,000 cu ft of natural gas is required to produce one ton of nitrogen fertilizer; or on average, 20,000 BTU’s are required to produce one pound of synthetic nitrogen; or approximately 140 BTU’s are required to produce one gallon of diesel fuel. Legume

cover crops can provide 50 to 100 lbs of plant available nitrogen per acre to reduce synthetic nitrogen use and fossil fuel use.

**Conditions Where Enhancement Applies**

This enhancement applies to all crop land use acres.

**Criteria**

1. On all acreage where this enhancement will be applied, plant and manage legume cover crops prior to all field or specialty crops raised that require the use of commercial nitrogen.
2. Estimate nitrogen credits from the leguminous crop.
3. The legume cover crop must be selected and managed to supply a **minimum of 40 lbs N/acre credit** for the following crop.
4. Nitrogen credit estimate should consider:
  - a. The amount of biomass produced (plant height and maturity)
  - b. The nutrient composition of the cover crop (for example, clover vs. vetch)
  - c. The decomposition rate of the cover crop during the cash crop growing season based on incorporation of the residue or being left on the soil surface after planting. Note: An example procedure is outlined in “*Managing Cover Crops Profitably, 3rd Edition*” (Sarrantonio, 1998)
5. Seeding rates for the selected cover crop species shall be based on NRCS practice standards or the respective state Land Grant Universities recommendation.
6. Base additional nitrogen application rates for crops following the cover crop on guidelines from the state Land Grant University. Reduce nitrogen application rates by at least the amount credited in #3 above to account for the nitrogen available from the legume cover crop.



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### **Adoption Requirements**

This enhancement is considered adopted when the land use acreage has been planted to a leguminous cover crop that meets or exceeds the minimum nitrogen credit from the criteria above.

### **Documentation Requirements**

Written documentation for each year of this enhancement describing the following items is required:

1. A map showing where the enhancement is applied
2. Type of legume cover crop planted
3. Calculations for estimating available nitrogen
4. Application rates of additional nitrogen by field
5. Realistic yield goals for field or specialty crop grown

### **References**

Clark, A.(editor.). 2007. Managing cover crops profitably. 3<sup>rd</sup> ed. Sustainable Agriculture Network Handbook Series.

Magdoff, F. and H. van Es. Cover Crops. 2000. *In* Building soils for better crops. 2nd ed. Sustainable Agriculture Network Handbook Series. pp87-96. National Agriculture Library. Beltsville, MD.

Liebman, M., Graef, R., Nettleton, D., Cambardella, C.A. 2011. Use of legume manures as nitrogen sources for corn production. Renewable Agriculture and Food Systems. p. 1-12. Available:  
<http://dx.doi.org/10.1017/S1742170511000299>

## Plant Enhancement Activity – PLT02 – Monitoring key grazing areas to improve grazing management



### Enhancement Description

Adjust grazing management based on monitoring data. Monitor key grazing areas to determine if current grazing management is meeting management goals and objectives. A key grazing area is a small area of a grazed field that is identified as being representative of the entire field.

### Land Use Applicability

Pastureland, Rangeland, Forestland

### Benefits

Proper grazing management will maintain and improve vegetation and soil conditions, improve water quality, and enhance wildlife habitat. Monitoring can be utilized to determine if current grazing management actions are having the desired effect on natural resources. Monitoring enables managers to make decisions and adjust management strategies as needed.

### Conditions Where Enhancement Applies

This enhancement applies to all acres in the operation for the selected land use.

### Criteria

1. Key grazing areas will be established for each grazed field
2. Each key grazing area will be monitored based on the frequency of grazing once established (i.e., more than annually if grazed multiple time per year)
3. Monitoring will include a photo for each pasture of key grazing area and use of one or more of the following techniques:
  - a. Plant productivity determinations
  - b. Measurements of key forage plant heights (before and after grazing) at least once per period
  - c. Locally applicable methods such as those described in “Monitoring for Grasslands, Shrublands and Savanna Ecosystems” available at <http://jornada.nmsu.edu/monitor-assess/manuals/monitoring>.
4. Each grazed field will follow a written grazing plan which meets NRCS requirements

### Adoption Requirements

This enhancement is considered adopted when there is documentation that monitoring data has been collected and used to adjust the objectives in a grazing management plan.



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### **Documentation Requirements**

1. A written grazing plan which meets NRCS requirements,
2. A map showing the location of each key grazing area,
3. Photographs from the fixed photo location points for each monitoring time,
4. Written documentation of the monitoring data collected, and
5. Written documentation of how monitoring data was used to adjust grazing management plans including modifications and objectives.

### **References**

BLM Technical Reference 1734-3. 1999. Utilization Studies and Residual Measurements. Interagency Technical Reference.

BLM Technical Reference 1734-4. 1999. Sampling Vegetation Attributes. Interagency Technical Reference.

Herrick, J. E., J.W. Van Zee, K.M. Havstad, L.M. Burkett and W.G. Whitford. 2005. Monitoring Manual for Grassland, Shrubland, and Savanna Ecosystems, Vol II. 2005. USDA-ARS Jornada Experimental Range. [http://usda-ars.nmsu.edu/monit\\_assess/monitoring.php](http://usda-ars.nmsu.edu/monit_assess/monitoring.php)

Rayburn, E. B. (editor). 2007. Forage Utilization for Pasture Based Livestock Production. NRAES – Book 173; Chapter 1 – Assessing Species Composition and Forage Quality, Chapter 2 – Assessing Forage Mass and Forage Budgeting. PALS Publishing, Ithaca, New York.

**Plant Enhancement Activity – PLT05 - Multi-story cropping, sustainable management of nontimber forest plants**



**Enhancement Description**

This activity involves the manipulation of forest species composition, structure, and canopy cover to achieve or maintain a desired native plant community to facilitate the sustainable management of native non-timber forest plant(s) (e.g., goldenseal, ramps, mushrooms, ginseng, ferns, “sugarbush”, etc.).

**Land Use Applicability**

Cropland, Forestland

**Conditions Where Enhancement Applies**

This enhancement applies to forestland and cropland (sugar bush) where the forest is managed for harvestable non-timber plants in addition or instead of timber.

**Benefits**

Implementation of this enhancement activity can result in increased plant health and vigor, decreased intensity of pest outbreaks, decreased spread of diseases, decreased use of pesticides and improved water quality.

**Criteria**

Multi-Story Cropping can cover a wide variety and types of plants and products. Multi-Story Cropping requires the development and implementation of a plan for the manipulation of forest growth through management of the competition for light, nutrients, moisture and control of allelopathic (toxic) effects to promote the production of a nontimber forest plant complex while maintaining a healthy forest ecosystem. The plan will include the following components as a minimum:

1. The objectives of the multi-story cropping enhancement.
2. Maps, images and/or descriptions of the proposed multi-story area.
3. An inventory appropriate to the targeted species of the area to identify trees and understory species necessary to achieve the desired purposes.
4. Listing of management activities that will be used to complete the multi-story cropping such as, but are not limited to, pruning, selective thinning and the introduction of new species to achieve plant diversity or to re-establish native plants.
5. Identification of specific canopy and plant densities in the overstory and understory to achieve the intended purpose(s)



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6. The plant community will be diverse to avoid species-specific pests and to enhance wildlife food and habitat.

### **Adoption Criteria**

This enhancement is considered adopted when the developed plan for forest growth manipulation has been implemented according to plan's criteria.

### **Documentation Requirements**

1. Brief written description of the actions taken to enhance the multi-story cropping,
2. Delineations on a map or aerial photo of the areas being treated with multi-story cropping, and
3. Representative digital pictures of the overstory and understory plant community following multi-story cropping management activities.

### **References**

Association for Temperate Agroforestry. 2012. Forest Farming Creates Profit Niches, Conserves Endangered Plants. University of Missouri. Columbia, MO. [http://www.aftaweb.org/forest\\_farming.php](http://www.aftaweb.org/forest_farming.php)

USDA National Agroforestry Center. 1997. Forest Farming: An Agroforestry Practice. Lincoln, NE. <http://nac.unl.edu/agroforestrynotes/an07ff01.pdf>

USDA National Agroforestry Center. 2012. Working Trees Info-What is Forest Farming. Lincoln, NE. <http://nac.unl.edu/Working%20Trees%20Info%20Sheets/WT%20Info%20forest%20farming.pdf>

Virginia Polytechnic Institute and State University. 2009. Non-Timber Forest Products. Blacksburg, VA. <http://www.sfp.forprod.vt.edu/>

**Plant Enhancement Activity – PLT06 – Renovation of a windbreak, shelterbelt or hedgerow for wildlife habitat**



**Enhancement Description**

This enhancement is for the renovation of existing sites that are declining in vigor, need additional woody plants (trees or shrubs) or otherwise no longer provide wildlife habitat benefits. Existing rows of woody plants may be thinned, removed or replaced with new plantings. Existing woody plants may be pruned, either branches or roots or both, to improve windbreak function, health and vigor.

**Land Use Applicability**

Cropland, Pastureland, Rangeland

**Benefits**

Renovation restores the function of existing windbreaks, shelterbelts or hedgerows to provide wildlife habitat benefits as well as other benefits such as reduced wind erosion, pesticide drift, mitigation of odor and noise and controlled snow deposition. Species composition may be upgraded by adding trees or shrubs that produce wildlife food and shelter as well as wood products and visual quality, such as spring blossoms or fall colors. Woody species threatened by pests such as emerald ash borer can be replaced with more resilient species that provide wildlife habitat benefits.

**Conditions Where Enhancement Applies**

This enhancement applies only to the acres of existing windbreaks or shelterbelts in the crop or pasture land use.

**Criteria**

1. Identify wildlife species to be benefited by the renovation,
2. Develop a plan for new trees and/or shrubs that will provide the desired habitat and windbreak or shelter belt functions,
3. Remove dead or dying trees that do not provide the desired habitat unless habitat for cavity nesting wildlife is desired,
4. Remove other trees or invasives that do not provide the desired habitat,
5. Replace removed trees by planting new trees or shrubs that will provide the desired habitat while serving the required windbreak or shelter belt function, and
6. Prune or thin less desirable trees to encourage the growth of trees that will provide wildlife habitat and windbreak or shelter belt functions.

**Adoption Requirements**

This enhancement is considered adopted when all six criteria above have been implemented.



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### **Documentation Requirements**

1. Brief written description of the tasks completed with dates and any receipts for planting stock, herbicides, etc.,
2. Delineations on a map or aerial photo of renovated windbreak, and
3. Photos of before and after renovation.

### **References**

USDA-NRCS and Xerces Society. 2008. Using Farm Bill Programs for Pollinator Conservation. Technical Note No. 78. Washington, D.C. <http://directives.nrcs.usda.gov/OpenNonWebContent.aspx?content=24993.wba>

**Plant Enhancement Activity – PLT15 – Establish pollinator and/or beneficial insect habitat**



**Enhancement Description**

Seed or plug nectar and pollen producing plants in non-cropped areas such as field borders, vegetative barriers, contour buffer strips, grassed waterways, shelterbelts, hedgerows, windbreaks, conservation cover, and riparian forest and herbaceous buffers.

**Land Use Applicability**

Cropland, Pastureland, Rangeland, Forestland

**Benefits**

Increased habitat for pollinators will improve fruit set, size and quality, productivity per acre, biodiversity, beneficial insect populations, and the food base for many

wildlife species. The increased plant diversity of pollinator habitat will enhance wildlife habitat and may increase populations of other beneficial insects, reducing the need for pesticides.

**Conditions Where Enhancement Applies**

This enhancement applies to all crop, pasture, range or forest land use acres.

Habitat areas must be at least 0.5 acres for each 40 acres of the selected land use. Where the selected land use is less than 40 acres, the required amount of habitat will be reduced according to the ratio of 0.5 acres to 40 acres. Where the selected land use is greater than 40 acres, the 0.5 acre habitat area(s) may be a single site or interspersed sites in the larger land use area as agreed to by the NRCS State Biologist.

**Criteria**

Establish habitat for pollinators (A) and beneficial insects (B) as described below:

**A. Pollinators**

1. Lists of plants suitable for pollinator habitat will be developed by NRCS at the state level. The lists must emphasize as many native species as practical.
2. The habitat planting will include (as a minimum) three early, three mid, and three late flowering species from the NRCS state list including forbs, legumes, vines, shrubs, and/or trees. Plants that produce toxic nectar will not be planted.
3. Any other use of the pollinator habitat area must not compromise its intended purpose.

**B. Beneficial insects**

1. Identify pest species and associated beneficial insects targeted for control.
2. Inventory existing conditions on the farm to determine habitat needs of selected beneficial insects, including:
  - a. Permanent insectary sites,



- b. Augmentation of existing hedgerows, field borders or other odd areas adjacent to fields, and/or
    - c. Trap crop areas .
  3. Plant selection should be matched to attract identified beneficial insects.
  4. Beneficial insect habitat may include either annual or perennial cover. If annual cover is used, the cover must be replanted each year during the life of the contract.
  5. Lists of plants suitable for beneficial insect habitat will be developed by NRCS at the state level. The lists must emphasize as many native species as practical.
- C. Planting Criteria for both pollinators and beneficial insects
  1. Site selection should consider existing weed pressures and available methods of control, delay planting if high weed pressure requires aggressive treatment.
  2. Site preparation and plant establishment shall be accomplished according to the appropriate NRCS conservation practice and specifications.
  3. Successful establishment is when the planting is providing at least 80% soil cover, visually estimated, and that the resultant cover consists primarily of the early, mid, and late blooming species planted for pollinators and/or other beneficial insects.
  4. Insecticides should not be used in the habitat planting area.
  5. Herbicides are allowed during site preparation (prior to planting) when it is necessary to eliminate competing weeds from a planting area in order for nectar and pollen producing plants to establish.
  6. After a pollinator enhancement has been planted, herbicides may be spot-sprayed to remove broad-leaf weeds, or grass-selective herbicides may be applied to larger areas to eliminate persistent weedy grasses. Similarly, the entire site may be mowed in the first year post-planting to reduce annual or biennial weeds that persist (site should be mowed just before dominant annual weeds flower).
- D. Operation and Maintenance for both pollinators and beneficial insects
  1. Management and/or maintenance activities such as mowing, haying, burning, or grazing must be conducted outside of the growing season or bloom period. Maintenance should be done on less than 1/3 of the acreage during any given year, except during the first year post-planting.
  2. Insecticides should not be used in the habitat planting area. Even non-synthetic botanical insecticides can harm beneficial insects. If adjacent crop areas are treated with insecticides use one or more of the following actions to limit insecticides in the pollinator habitat area:
    - a. Create insecticide free buffers in the first 25 feet of crop area,
    - b. Use application methods that minimize drift to the adjacent habitat,
    - c. Apply active ingredients in the evening when most insect pollinators are not active.
  3. The planted habitat areas must be regularly inspected for invasive and/or noxious plants or other plants that may compromise the purpose of this enhancement. Undesirable species should be controlled using the method least damaging method, for example, spot-spraying with herbicide or physical removal.
  4. If habitat is part of an organic farming operation, only materials allowed according to the USDA National Organic Program's National List of Allowed and Prohibited Substances may be used.



### **Adoption Requirements**

This enhancement is considered adopted when pollinator or beneficial habitat has been established that meet or exceed the above criteria, respectively, and the established habitat is maintained and functioning as intended.

### **Documentation Requirements**

1. A map showing the location and dimension of the habitat areas
2. A list of pollinator or beneficial species planted
3. List of maintenance activities carried out to manage the habitat areas

### **References**

Mader, E., M.D. Shepherd, M.Vaughan, S.H. Black and G. LeBuhn. 2011. Attracting Native Pollinators: Protecting North America's Bees and Butterflies. Storey Publishing. North Adams, MA. pp 372.

Winston, M. 1987. The Biology of the Honey Bee. Harvard University Press. Cambridge, MA. pp 281.

Spivak, M., E. Mader, M. Vaughan, N.H. Euliss Jr. 2010. The plight of bees. Feature Article. Environmental Science & Technology. 10.1021/es101468w

Mader, E, M. Vaughan, M. Shepherd and S. Hoffman-Black. 2010. Alternative Pollinators: Native Bees. ATTRA. IP126.

Delaplane, K.S. and D.F. Mayer. 2000. Crop Pollination By Bees. CABI Publishing. New York, NY. 344 pp.

Reidl, H., E. Johansen, L. Brewer and J. Barbour. 2006. How to Reduce Bee Poisoning from Pesticides. Pacific Northwest Extension Publication 591. Oregon State University. Corvallis, OR. pp 28.  
<http://extension.oregonstate.edu/catalog/pdf/pnw/pnw591.pdf>

National Research Council – Committee on Status of Pollinators in North America. 2007. Status of Pollinators in North America. Washington, D.C.: The National Academies Press. pp 307.

Society for Range Management. 2011. Pollinators in Rangelands. Special Issue. Rangelands. Society for Range Management. Volume 33. Number 3 (June).

Mader, E., M. Spivak and E. Evans. 2010. Managing Alternative Pollinators: A guide for growers, beekeepers, and conservationists. Sustainable Agriculture Research and Education. Handbook 11. Beltsville, MD.

USDA-NRCS Plant Materials Program. Plants for Pollinators.  
[http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/plantsanimals/pollinate/?cid=nrcs143\\_022326](http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/plantsanimals/pollinate/?cid=nrcs143_022326)

Xerces Society Pollinator Conservation Program. Pollinator Conservation Resource Center.  
<http://www.xerces.org/pollinator-resource-center/>

**Plant Enhancement Activity – PLT16 – Intensive management of rotational grazing**



**Enhancement Description**

This enhancement is for the harvest efficiency of grazing livestock to increase forage harvest, and to improve forage quality and livestock health. The grazing system is managed to produce high quality, nutritious forage and maintain plants with sufficient energy reserves to recover quickly when adequate soil moisture is available for regrowth. Generally, livestock are rotated through pastures in the grazing system based on the physiological growth and nutritional stage of the forage plants and the daily dry matter intake and nutritional

requirements of the animal. This enhancement is for: rotational grazing systems with increased numbers of pastures or paddocks, the accompanying required infrastructure, shorter grazing periods, and increased stock density. Selection of this enhancement requires the activity to be planned concurrently on all eligible land use acres.

**Land Use Applicability**

Pastureland, Rangeland, Forestland

**Benefits**

The main benefits of Intensive Management of Rotational Grazing are efficient resource use with increased forage utilization, improved manure distribution, and nutrient cycling throughout the grazing acreage, and increased carbon sequestration resulting from greater forage harvest. Optimal environmental conditions are achieved by maintaining healthy, actively growing forage plants that improve the quantity and quality of cover available for wildlife and protect the soil surface from erosion, thereby reducing risks to ground or surface water quality.

**Conditions Where Enhancement Applies**

This enhancement applies to all grazed acres designed as pasture, range or forest land use acres on the entire operation.

Note: the grazing acres of the operation must have a defined rotation before selecting this enhancement. A single grazed field/pasture does not constitute a rotation. The minimum number of grazed fields/pastures shall be determined by each state.

**Criteria**

A prescribed grazing plan is developed that increases harvest efficiency by utilizing a 75% increase in the number of pastures/paddocks per movement group (herd). See the attached “Supplement” for specifics on harvest efficiency.



### **Adoption Requirements**

This enhancement is considered adopted when a prescribed grazing plan is complete, and implementation of the plan has begun, that incorporates a 75% increase in the number of pastures/paddocks, including the necessary infrastructure (fences/water/etc.)

### **Documentation Requirements**

1. Copy of signed “National Supplement to Plant Enhancement Activity – PLT 16 – Intensive management of rotational grazing” certifying that a grazing plan has been implemented with a 75% increase in the number of paddocks/pastures for the herd (movement group) increasing the harvest efficiency resulting from greater stock density and reduced grazing time per pasture/paddock .
2. A map or aerial photo showing the pastures/paddocks making up the rotational grazing system. The layout of the pastures/paddocks both before implementation and after implementation shall be delineated on the map or photo.

### **References**

Bertelsen, B.S., D.B. Faulkner, D. . Buskirk and J.W. Castree. 1993. Beef Cattle Performance and Forage Characteristics of Continuous, 6-paddock, and 11-paddock Grazing Systems. *Journal of Animal Science* 71:1381-1389.

Jacobo, E.J., A.M. Rodríguez, N. Bartoloni and V.A. Deregibus. 2006. Rotational Grazing Effects on Rangeland Vegetation at a Farm Scale. *Rangeland Ecology & Management* 59( 3): 249-257.

McKown, C.D., J.W. Walker, J.W. Stuth and R.K. Heitschmidt. 1991. Nutrient intake of Cattle on Rotational and Continuous Grazing Treatments. *Journal of Range Management* 44(6).

Rayburn, E.B. (editor). 2007. Forage Utilization for Pasture Based Livestock Production. NRAES – Book 173. PALS Publishing, Ithaca, New York.

Smart, A.J., J.D. Derner, J.R. Hendrickson, R.L. Gillen, B.H. Dunn, E.M. Mousel, P.S. Johnson, R.N. Gates, K.K. Sedivec, K.R. Harmony, J.D. Volesky and K.C. Olson. 2010. Effects of Grazing Pressure on Efficiency of Grazing on North American Great Plains Rangelands. *Rangeland Ecology and Management* 63(4): 397-406.

Teague, W.R. and S.L. Dowhower. 2003. Patch Dynamics under Rotational and Continuous Grazing Management in Large, Heterogeneous Paddocks. *Journal of Arid Ecology* 55: 211-229.

USDA-NRCS. 2010. Conservation Practice Standard: Prescribed Grazing-Code 528.



**National Supplement to Plant Enhancement Activity – PLT 16 – Intensive management of rotational grazing**

**State:** \_\_\_\_\_

**Participant:** \_\_\_\_\_

**Increase harvest efficiency resulting from greater stock density and reduced grazing time per pasture/paddock**

Change the current grazing system to allow for an increased number of pastures or paddocks, including the necessary infrastructure (fences/water/etc.), shorter grazing periods, and increased stock density. The grazing plan should document the planned length of grazing periods in pastures and length of time between grazing periods for an overall reduction in total grazing activity per pasture and an increased harvest efficiency resulting from greater stock density and reduced grazing time per pasture/paddock because of the 75% increase in the number of paddocks/pastures for the herd (movement group).

**Criteria:** Use the following formula for documentation, and attach a plan map showing the location of the grazing system design. The following example is provided.

EXAMPLE:

- A. Current # of Pastures/Paddocks      6
- B. Planned # of Pastures/Paddocks      11
- C. % Increase= ((B/A)-1)100%      ((11/6)-1)100 = ((1.83)-1)100 = (.83)100% = **83%**

Grazing Plan:

- A. Current # of Pastures/Paddocks      \_\_\_\_\_
- B. Planned # of Pasture/Paddocks      \_\_\_\_\_
- C. % Increase= ((B/A)-1)100      \_\_\_\_\_

**Operation and Maintenance:**

**Operation:** Livestock grazing plans should accommodate increased rest of grazing units, particularly during the active growing season of desirable rangeland and pasture species. Planned grazing use should not exceed 60% of annual production. Additional practices and inputs such as cross fences and water facility development may be required to facilitate adequate rest periods and increased harvest efficiency.

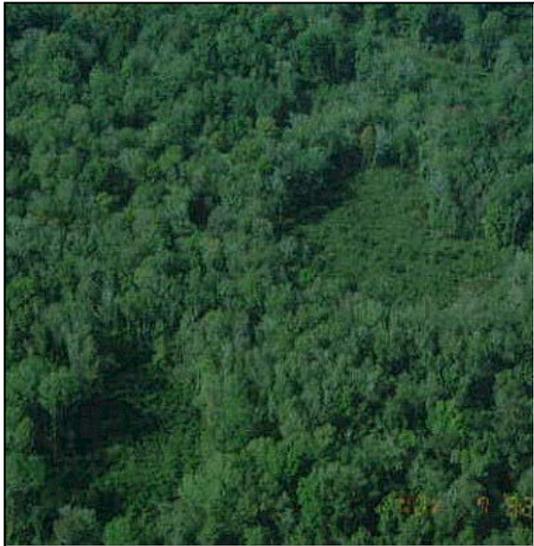
**Maintenance:** Grazing unit rotation of livestock should be accomplished annually, alternating the planned rotation sequence of grazing units each subsequent year, or specifically providing growing-season rest periods based on individual pasture condition.

**Certification:**

I certify that I have applied the grazing management system as explained in the narrative in the field(s) and listed in the table above.

Name: \_\_\_\_\_ Date: \_\_\_\_\_

**Plant Enhancement Activity – PLT17 – Creating forest openings to improve hardwood stands**



**Enhancement Description**

Creating forest openings or patches is a silvicultural practice used to naturally regenerate over-mature and/or degraded hardwood stands while providing added cover and browse for several game and non-game species of wildlife.

**Land Use Applicability**

Forestland

**Benefits**

Years of harvesting high quality hardwood trees have left many forested acres with degraded, low quality trees. Creating a forest opening promotes the regeneration of a new, younger stand of desirable tree species by removing all standing trees in selected

areas (patches) within the forest. Patch areas are chosen based on their lack of acceptable growing stock (AGS), presence of desirable trees to regenerate the stand and presence of advanced regeneration. Wildlife habitat is increased by the amount of edge, cover and diversity of the tract created during the clearing.

**Conditions Where Enhancement Applies**

This enhancement applies to forest land use acres with conifers, hardwoods or mixed stands that have a forest management plan that recommends thinning within the next 3 years.

**Criteria**

1. Forested acres planned for this enhancement must be cleared during the contract period.
2. Forested acres that meet the “Conditions Where Enhancement Applies” must have an “acceptable growing stock” level below 50 sq. ft. of basal area per acre.
3. Site condition must be of medium or higher quality.
4. Forested acres targeted for patch development must contain species for regeneration from the NRCS state list. Species on this list were selected based on their abilities to regenerate from seed, sprouts or other natural regeneration sources.
5. For oaks, advance regeneration must be present or developed prior to the timber removal in order to be competitive with other faster growing species.
6. Size of patches to be treated can vary from 1 to 10 acres, be distributed throughout the forest and cannot total more than 50% of the acres meeting Criteria 2.
7. Trees removed during patch development having marketable quality can be sold.
8. Slash and cull trees must be managed to allow for natural regeneration to occur. This can be accomplished by:



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- a. Windrowing
  - b. Wildlife piles
  - c. Chipping
  - d. Cutting for firewood
9. Burning of slash is prohibited.

This enhancement is not for normal thinning or other forest stand improvement activities conducted on non-degraded sites.

### **Adoption Requirements**

This enhancement is considered adopted when forest openings have been created that meet the nine above criteria.

### **Documentation Requirements**

1. Site suitability and acceptable growing stock evaluation for each patch,
2. Identify the desired species to be regenerated and evidence they are present,
3. Map show where patches are located, and
4. Documentation that patch cut activities were completed, e.g. photo's, sale receipt.

### **References**

Healy, W. 2011. Central Hardwood Notes - Wildlife Openings. U.S. Forest Service. North Central Forest Experiment Station. Amherst, MA. [http://www.ncrs.fs.fed.us/pubs/ch/ch\\_9\\_11.pdf](http://www.ncrs.fs.fed.us/pubs/ch/ch_9_11.pdf)

Leak, W.B., 2003. Regeneration of Patch Harvests in Even-Aged Northern Hardwoods in New England. Northern Journal of Applied Forestry. 20(4):188-189.  
[http://www.fs.fed.us/ne/newtown\\_square/publications/other\\_publishers/OCR/ne\\_2003\\_leak001.pdf](http://www.fs.fed.us/ne/newtown_square/publications/other_publishers/OCR/ne_2003_leak001.pdf)

Tubbs, C.H., L.J. Verme and R.M. Godman. 2001. Northern Hardwood Notes -Making Wildlife Openings. U.S. Forest Service. North Central Forest Experiment Station. [http://www.ncrs.fs.fed.us/pubs/nh/nh\\_8\\_01.pdf](http://www.ncrs.fs.fed.us/pubs/nh/nh_8_01.pdf)

**Plant Enhancement Activity - PLT18 – Increasing on-farm food production with edible woody buffer landscapes**



**Enhancement Description**

This enhancement is for the enhancing of windbreaks, alley cropping, silvopasture, or riparian forest buffer systems with trees and shrubs that produce edible products for human or wildlife consumption.

**Land Use Applicability**

Cropland, Pastureland

**Benefits**

An edible landscape is special in that it is planted with trees and shrubs that produce foods that we can eat/sell or that are beneficial

for wildlife. Trees and shrubs can be used to provide shade, to improve microenvironments or to protect crops, or to mitigate challenging environmental issues. In an edible landscape they provide more than just a protective structure, they become sources of food that produce home grown and nutritious fruits and nuts, increase household food security, and create sites that provide critical habitat for pollinators and wildlife.

**Conditions Where Enhancement Applies**

This enhancement applies to all crop or pasture land use acres.

**Criteria**

1. Follow appropriate standard for basic agroforestry practice design.
2. Plant tree, shrub and bramble species that produce food and/or culinary items to create an edible landscape. Lists of suitable woody plants will be available at your local NRCS field office.
3. Maximize planting space by creating vertical structure with varying plant heights and plant sizes.
4. Use all of the following methods to improve edible food production:
  - a. Add at least one edible food producing row to existing agroforestry practices or incorporate at least one edible food producing row into new planting designs.
  - b. Adding planting masses in scattered clusters is encouraged.
  - c. Plant a variety of tree, shrub and bramble species (3 or more; use native species whenever possible) with varying flowering times to favor pollinator species and to add a longer harvest time frame. Choosing several fruit bearing cultivars can provide an extended period of seasonal production.



- d. Minimize herbicide use. Use spot weed treatments and avoid spraying when flowers are present.

### **Adoption Requirements**

This enhancement is considered adopted when each selected acre has been planted to the desired tree, shrub and bramble species that produce food or culinary item.

### **Documentation requirements**

1. List of edible food producing trees, shrubs and brambles.
2. Brief written description of the activities (criteria) completed with dates of application and receipts for planting stock, herbicides, etc.
3. Acreage of the enhancement activity.
4. Delineations on a map or aerial photo of landscape layout and placement.

### **References**

Dana, M.N. 2001. Fruits and Nuts for Edible Landscaping. Purdue University Cooperative Extension Service. Landscape Horticulture, HO-190-W. <http://www.hort.purdue.edu/ext/HO-190.pdf>

Josiah, S.J. and J. Lackey. 2001. Edible Woody Landscapes for People and Wildlife. University of Nebraska Cooperative Extension. Lincoln, NE. <http://www.unl.edu/nac/brochures/sfp/sfp3.pdf>

USDA-NAC. 2008. Working Trees for Agriculture. USDA National Agroforestry Center, Lincoln, NE. <http://www.unl.edu/nac/workingtrees/wta.pdf>

USDA-NAC. 2006. Agroforestry: Sustaining Native Bee habitat for Crop Production. Agroforestry Notes – AF Note 32. USDA National Agroforestry Center. Lincoln, NE. [http://plants.usda.gov/pollinators/Agroforestry\\_Sustaining\\_Native\\_Bee\\_Habitat\\_for\\_Crop\\_Pollination.pdf](http://plants.usda.gov/pollinators/Agroforestry_Sustaining_Native_Bee_Habitat_for_Crop_Pollination.pdf)

USDA-NAC. 2006. Improving Forage for native Bee Crop Pollinators. Agroforestry Notes – AF Note 33. USDA National Agroforestry Center. Lincoln, NE. [http://plants.usda.gov/pollinators/Improving\\_Forage\\_for\\_Native\\_Bee\\_Crop\\_Pollinators.pdf](http://plants.usda.gov/pollinators/Improving_Forage_for_Native_Bee_Crop_Pollinators.pdf)

**Plant Enhancement Activity – PLT19 –Herbicide resistant weed management**



**Enhancement Description**

Adoption of multiple agronomic principles to manage herbicide resistant weeds in annually planted crop fields.

**Land Use Applicability**

Cropland

**Benefits**

The number of weed species becoming herbicide resistant is increasing at an alarming rate and other weed species are evolving to possibly become resistant. Without a comprehensive management strategy to control the weeds that have already become herbicide resistant and to mitigate the evolution of potentially resistant weeds, many acres of conservation tilled land may be converted back to conventional tillage. This conversion will reverse the gains achieved over the years by conservation tillage leading to diminished soil health and greater erosion rates. By implementing this enhancement, the identified resource concerns (i.e., soil quality, soil erosion, plants and water quality) will be improved and sustained at a high level by the recommended management system.

**Conditions Where Enhancement Applies**

This enhancement applies to all acres of annually planted cropland. These acres can be organic, transitioning to organic, or non-organic.

**Criteria**

1. Develop a crop rotation for each enrolled acre that prevents back to back growing seasons of the same or similar crops on the enrolled acre, or crops grown back to back that utilized the same herbicide chemistry for weed control. If the current crop rotation only contains two crops, an additional crop different from the original two must be added. Exceptions to the crops grown back to back limitation: crops grown using flooded conditions for weed control (i.e., rice, lotus or taro) or new crop rotations developed as a result of this enhancement that utilize a sod base rotation.
2. The crop rotation developed as a result of Criteria #1 must be grown in a manner to maintain a Soil Tillage Intensity Rating (STIR) as determined by RUSLE2 that is lower than the previous rotation/system.
3. Develop a herbicide rotation for each enrolled acre that avoids repeated use of herbicides with the same mode of action (MOA). The same herbicide used independently shall not be used in more than two consecutive applications (i.e., two split applications in a growing season, or two consecutive single applications in two years). An herbicide with the same MOA may be used in tank mixed, prepackaged, or sequential mixtures that include multiple MOAs with substantial control of the potentially resistant weed(s).



4. When herbicides are used for weed control, a pre-plant residual shall be used with any pre-plant burn down herbicide used. Residuals shall be also be used with post-plant burn downs, early post-emerge applications and lay-by applications.
5. Scout the enrolled acreage to facilitate early weed identification, weed mapping of the problems areas, and a more timely response to weed pressures.
6. In the event of herbicide resistant weed escapes on the enrolled acres pre-harvest but after lay-by treatments, hand weed or hoe the escaped weeds prior to flowering.
7. For organic or transitioning to organic systems where a plant ecotype becomes resistant to a NOP approved herbicide, hand weeding or hoeing of the enrolled acres at least 3 times during the growing season shall be accomplished before the weeds reach maturity (i.e., flowering).
8. Post-harvest, where fields will be temporarily fallow and adequate growing conditions exist for weed growth (i.e., pre-frost), the fields shall be mechanically (this does not include tillage) or chemically treated to prevent adding seed to the weed seed bank and weed spread.

Note: If the use of a high residue cover crop or mixtures of high residue cover crops is desired as an additional management option for weed management, refer to “PLT20-High Residue Cover Crop or Mixtures of High Residue Cover Crops for Weed Suppression and Soil Health.” This enhancement and PLT20 are complementary.

### **Adoption Requirements**

This enhancement is considered adopted when all of the criteria have been met on the land use acre.

### **Documentation Requirements**

Written documentation for each year of this enhancement describing the following items:

1. Crop rotation
2. Crop planting system used to manage residue
3. Scouting reports
4. Herbicides used- their MOA and date of application
5. Dates of hand weeding or hoeing, if applicable
6. Dates of post-harvest chemical or mechanical treatment, if applicable

### **References**

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Price, A.J., K.S. Balkcom, L.M. Duzy and J.A. Keltron. 2012. Herbicide and Cover Crop Residue Integration for *Amaranthus* Control in Conservation Agriculture Cotton and Implications for Resistance Management. Weed Technology. In press.



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Sustainable Agriculture Research and Education (SARE). 2010. Managing Cover Crops Profitably. 3<sup>rd</sup> ed. Handbook #9. College Park, MD.

Whitaker, J.R., A.C. York, D.L. Jordan, A.S. Culpepper, and L.M. Sosnoskie. 2011. Residual Herbicides for Palmer Amaranth Control. The Journal of Cotton Science. 15:89-99.

**Plant Enhancement Activity – PLT20 –High residue cover crop or mixtures of high residue cover crops for weed suppression and soil health**



**Enhancement Description**

Utilize biomass from a cover crop or cover crop mixture as a living or killed mulch to suppress weed seed germination and to add carbon to the terrestrial carbon pool.

**Land Use Applicability**

Cropland

**Benefits**

Cover crop or cover crop mixtures when managed properly can physically and/or chemically control weeds. Physically, a live cover crop competes with weeds for water, nutrients and sunlight. A killed cover crop physically prevents the germination of weed seed by changing the micro environment around the weed seed (temperature and light). Chemically, certain legume, cereal or brassica cover crops suppress weed seed germination and seedling development via plant-produced natural herbicides upon decomposition (i.e., allelopathy). By implementing this enhancement, the major resource concerns of soil quality, soil erosion, plants and water quality will be improved and maintained to a high level.

**Conditions Where Enhancement Applies**

This enhancement applies to all acres of annually planted cropland. These acres can be organic, transitioning to organic, or non-organic.

**Criteria**

1. Between each crop in the rotation, except double cropped situations, seed a high residue cover crop or mixture of high residue cover crops. Each cover crop or mixture shall meet the following requirements:
  - a. Seed a cover crop or cover crop mixture at a rate and within a planting date range as determined or agreed to by the NRCS State Agronomist.
  - b. Cereal grain cover crops or mixtures shall be top dressed with nitrogen at rates determined or agreed to by the NRCS State Agronomist.
  - c. The cover crop or mixture shall reach a maturity level (i.e., growth stage) to ensure 100% soil coverage in the row middles for 3 months of the growing season. For example, cereal rye shall reach the soft dough stage before termination. The NRCS State Agronomist can determine a specified maturity level or desired residue quantity (dry matter basis) for the selected cover crop cultivar.
  - d. Termination of all cover crops shall be accomplished by chemical methods, non-chemical methods (such as flail mowing or roller crimper), or a combination of both.



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2. The crop rotation must be grown in a manner to maintain a minimum Soil Tillage Intensity Rating (STIR)  $\leq 10$  as determined by RUSLE2.

### **Adoption Requirements**

This enhancement is considered adopted when all of the criteria have been met on the land use acre.

### **Documentation Requirements**

Written documentation for each year of this enhancement describing the following items:

1. Cover crop or mixture used
2. Cover crop or mixture seeding rate and seeding date
3. If applicable, nitrogen top dress rate and date for the cover crop or mixture
4. Cover crop or mixture termination stage
5. Method used to terminate cover crop or mixture and date of termination

### **References**

Price, A.J., K.S. Balkcom, L.M. Duzy and J.A. Keltron. 2012. Herbicide and Cover Crop Residue Integration for *Amaranthus* Control in Conservation Agriculture Cotton and Implications for Resistance Management. Weed Technology. In press.

Price, A.J., K.S. Balkcom, R.L. Raper, C.D. Monks, R.M. Barentine, and K.V. Iversen. 2008. Controlling Glyphosate-Resistant Pigweed in Conservation Tillage Cotton Systems. Conservation Systems Research. Special Publication No. 09. USDA-ARS-NSDL, Auburn, AL.

Sustainable Agriculture Research and Education (SARE). 2010. Managing Cover Crops Profitably. 3<sup>rd</sup> ed. Handbook #9. College Park, MD.

**Plant Enhancement Activity – PLT21 – Forest stand improvement pre-treating vegetation and fuels preceding a prescribed fire**



**Enhancement Description**

This enhancement is to manage the vegetation and fuels in a forested area with mechanical or manual methods in advance of a prescribed fire **AND** to complete one or more treatments with prescribed fire during the contract period to restore native forest conditions.

**Land Use Applicability**

Forestland

Credit: John D. Hodges, Mississippi State University, Bugwood.org

**Benefits**

Prescribed burning is a useful tool in the restoration and maintenance of native forest plant communities. However, certain sites preclude the application of prescribed fire due to unsafe conditions caused by excessive amounts and types of fuel present on the site. The implementation of this enhancement will make it possible to safely conduct a controlled burn by mechanically or manually treating this condition prior to a planned burn followed by a prescribed fire to allow regeneration of native forest plants. Other benefits include reduced wildfire risk, improved access, improved wildlife habitat, and enhanced visual quality.

**Conditions Where Enhancement Applies**

This enhancement applies to forest land use acres with conifers or mixed stands that have a forest management plan that recommends a prescribed burn within the next 3 years.

**Criteria**

Develop and implement a prescribed burning plan written and carried out by a certified prescribed burner.

1. The plan must include a thorough assessment of both the existing fuel load and the desired fuel load. See the “References” section for guidance to make these determinations.
2. This enhancement also requires implementation of one or more of the following measures:
  - a. Excessive volatile live vegetation pretreatment –When volatile, live grasses and shrubs are present in the area where this enhancement applies in excess of that needed to safely conduct a prescribed burn, reduction of these fuels may be accomplished by shredding, cutting, chipping, mulching, crushing, scattering, removing from the site or any combination of these methods. If this vegetation represents the primary fuel needed to carry a controlled burn in the area, the timing of this measure will be important. Depending on the vegetation, time the reduction to allow for adequate re-growth to supply the amount and continuity needed. If invasive plants are present, utilize methods and timing that will prevent or control their spread.



- b. Excessive debris and dead fuels –When excessive amounts of debris and dead fuel exist in the area where this enhancement applies, remove the material from the area by chipping, crushing, shredding, scattering or any combination of these methods.
- c. Closed canopy – When the trees within the area where this enhancement applies form a continuous, closed canopy, thin the stand to allow for heat escape and control of prescribed burns. Conduct thinning to space crowns at least 10 – 15 feet apart. Prune flammable limbs to a height of at least 10 feet. Remove slash from the area, scatter or reduce in size by crushing or chipping.
- d. Ladder fuels – When ladder fuels form connections between the ground and the higher levels of the canopy in the area where this enhancement applies that make it possible for a fire to spread into the upper canopy, break the continuity of fuel between the ground and the upper canopy position by cutting or snagging. Complete removal is not required as long as the continuity is broken. If excessive amounts of slash are created, remove it from the area, scatter or reduce in size by crushing or chipping.

### **Adoption Requirements**

The enhancement is considered adopted when at least one prescribed fire has been implemented on the forest land use acre.

### **Documentation Requirements**

1. Brief written documentation detailing the pre-treatment conditions and the post-treatment conditions.
2. Representative digital images of the area showing before and after photos.

### **References**

Barrett, S., D. Havlina, J. Jones, W. Hann, C. Frame, D. Hamilton, K. Schon, T. Demeo, L. Hutter and J. Menakis. 2010. Interagency Fire Regime Condition Class Guidebook. Version 3.0. <http://www.frcc.gov/>

Global Learning and Observations to Benefit the Environment (GLOBE). [www.globe.gov](http://www.globe.gov).

Fire Fuel Protocol: [http://www.globe.gov/documents/355050/355099/land\\_prot\\_firefuel.pdf](http://www.globe.gov/documents/355050/355099/land_prot_firefuel.pdf) ;

Transect Measurements Field Guide: [http://www.globe.gov/documents/355050/355097/lc\\_fg\\_firetransect.pdf](http://www.globe.gov/documents/355050/355097/lc_fg_firetransect.pdf) ;

Transect Measurements Data Sheet: [http://www.globe.gov/documents/355050/355096/lc\\_ds\\_firetransect.pdf](http://www.globe.gov/documents/355050/355096/lc_ds_firetransect.pdf)

Napper, C. 2010. Useful Tools for Identifying Surface Fuels and Biomass. 1019 1802P. San Dimas, CA: U.S. Department of Agriculture, Forest Service, San Dimas Technology and Development Center. pp 28. <http://www.fs.fed.us/t-d/pubs/pdf/10191802.pdf>

Outcalt, K.W., and D.D. Wade. 2004. Fuels Management Reduces Tree Mortality from Wildfires in Southeastern United States. Journal of Applied Forestry 28(1): 28-34. [http://www.srs.fs.usda.gov/pubs/ja/uncaptured/ja\\_outcalt008.pdf](http://www.srs.fs.usda.gov/pubs/ja/uncaptured/ja_outcalt008.pdf)

**Soil Erosion Enhancement Activity – SOE05 – Intensive no-till (ORGANIC or Non-organic systems)**



**Enhancement Description**

This enhancement is for using an intensive no-till, strip till, or direct seeding method of planting throughout the planned rotation. A C:N ratio that builds soil health is maintained by including high residue and low residue crops in the rotation, and/or by using cover crops where needed. Termination of all cover crops is accomplished using chemical methods or non-chemical methods, such as flail mowing, roller crimper, and frost kill; not tillage.

**Land Use Applicability**

Cropland

**Benefits**

Use of intensive no-till, strip till, or direct seeding leaves high levels of crop residue that can improve soil health and reduce erosion by wind and water up to 100%. The result is increased soil organic matter and added weed control as compared to heavily tilled soils with no surface residue. This will in turn, enhance and protect water quality and biotic communities that depend on clean water. Mechanically terminating cover crops using a flail mower or roller crimper can eliminate the use of herbicides, thereby reducing potential offsite water quality problems while leaving the soil undisturbed.

**Conditions Where Enhancement Applies**

This enhancement applies to all acres of annually planted cropland. The acres can be organic, transitioning to organic or non-organic.

**Criteria**

Implementation of this enhancement **requires** the use of no-till, strip till, or direct seeding of all crops in the planned rotation. The no-till, strip till, or direct seeding system must include the following activities:

1. For each crop in the planned rotation, calculate an estimated post harvest residue amount.
2. Compare the estimated post harvest residue amount to a state and locally defined critical residue amount, as determined by the NRCS State Agronomist, to determine high and low residue-producing crops.

Note: The “defined critical residue amount” is based on maintaining a positive Soil Conditioning Index (SCI).

3. For crops in the rotation where the difference between the estimated and critical residue amount are positive:



- a. No cover crop is required if a Soil Tillage Intensity Rating (STIR)  $\leq 10$  is maintained for the rotation.
  - b. Otherwise, cover crops should be:
    - i. A single grass species or a multiple species mixture that includes at least 50% grass or legume adapted for the local area, and
    - ii. Must be planted using a no-till system.
  - c. Residue removal is prohibited (Exception: residue removal is allowed for optimal crop production where SCI can be maintained greater than zero and the criterion of 5(c) is still met).
4. For crops in the rotation where the difference between the estimated and critical residue amount are neutral or negative:
- a. Cover crops must be used
  - b. Plant cover crops using a no-till system
  - c. Cover crops can be a single grass species or a multiple species mixture that includes at least 50% grass or legume adapted for local use.
  - d. Maintain a minimum Soil Tillage Intensity Rating (STIR)  $\leq 10$  for each crop in the planned rotation
  - e. Residue removal is prohibited
5. Additional Criteria
- a. All residues must be uniformly distributed over the entire field
  - b. No full-width tillage is permitted regardless of the depth of the tillage operation
  - c. Field(s) must have a soil loss at or below the soil tolerance (T) level for wind and/or water erosion for the crop rotation and a Soil Tillage Intensity Rating (STIR) of  $\leq 10$  for each crop in the planned rotation
  - d. If applicable, only herbicides approved for organic production systems are allowable for weed control
  - e. If applicable, termination of all cover crops is accomplished using non-chemical methods, such as flail mowing, roller crimper and frost kill.

### **Adoption Requirements**

This enhancement is considered adopted when the STIR criteria, residue and/or cover crops listed above have been implemented on the land use acreage.

### **Documentation Requirements**

Documentation for each field where this enhancement is applied:

1. Planned crop rotation showing cover crops that will be used after low residue crops,
2. Planting method used for each crop in the rotation (no-till, strip till, direct seeding),
3. List of all other potential ground disturbing farming operations,
4. Method of cover crop termination, e.g. chemical, flail mowing, roller crimper, or combination,
5. Dates for farming operations,
6. Map showing fields and acreage, and
7. Photographs of planted crops.



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## References

- Bolton, R. 2003. Impact of the surface residue layer on decomposition, soil water properties and nitrogen dynamics. M.S. thesis. Univ. of Saskatchewan, Saskatoon, Saskatchewan, CA.
- Mutch, D. and T. Martin. 2010. Website: Roller/Crimper Research. Michigan State University. <http://www.covercrops.msu.edu/crimper/works.html>
- Reicosky, D.C., M.J. Lindstrom, T.E. Schumacher, D.E. Lobb and D.D. Malo. 2005. Tillage-induced CO<sub>2</sub> loss across an eroded landscape. *Soil Tillage Res.* 81:183-194.
- Reicosky, D.C. 2004. Tillage-induced soil properties and chamber mixing effects on gas exchange. Proc. 16<sup>th</sup> Triennial Conf., Int. Soil Till. Org. (ISTRO).
- Renard, K.G., G.R. Foster, G.A. Weesies, D.K. McCool, and D.C. Yoder, coordinators. 1997. Predicting soil erosion by water: A guide to conservation planning with the Revised Universal Soil Loss Equation (RUSLE). U.S. Department of Agriculture, Agriculture Handbook No. 703.
- Shaffer, M.J., and W.E. Larson (ed.). 1987. Tillage and surface-residue sensitive potential evaporation submodel. *In* NTRM, a soil-crop simulation model for nitrogen, tillage and crop residue management. USDA Conserv. Res. Rep. 34-1. USDA-ARS.
- Skidmore, E.L. and N.P. Woodruff. 1968. Wind erosion forces in the United States and their use in predicting soil loss. U.S. Department of Agriculture. Agriculture Handbook No. 346.
- USDA-NRCS. 2011. National Agronomy Manual. 190-V. 4<sup>th</sup> ed.

## Soil Quality Enhancement Activity – SQL01 – Controlled traffic system



### Enhancement Description

Controlled traffic confines heavy traffic from tractor drive wheels/tracks, combine wheels, fertilizer or manure spreaders and grain carts to specific lanes in crop fields year after year.

### Land Use Applicability

Cropland

### Benefits

Controlled traffic systems will reduce soil compaction, increase infiltration, and improve crop yields. Additional benefits include reductions in erosion, runoff and sedimentation as well as energy savings as the need for sub-soiling decreases and firm traffic tracks form for better traction.

### Conditions Where Enhancement Applies

This enhancement applies to all annually planted crop land use acres.

### Criteria

Implementation of this enhancement **requires** the use of a *controlled traffic system* on annually planted cropland that includes the following:

1. Limit wheel/track traffic to no more 50 percent of the row middles or a maximum of 50 percent of the area of the field.
2. Wheel/track traffic is in the same lanes for all passes, all equipment and years.
3. No tire or rubber track that is greater than 26 inches wide (for 30-inch rows). For 20-inch or 15-inch rows, use skip rows to provide space for primary tracks (36-inch maximum width tires/tracks for a 40-inch space).

The minimum components required to maintain the controlled traffic system enhancement activity are:

1. All equipment must cover the same width or multiples of that width (See Figure 1),
2. Number of traffic lanes are minimized (See Table 1),
3. For full width tillage Geographic Positioning System (GPS) is required to maintain the designated traffic lanes,
4. For narrow width or drilled crops, a skip row system or GPS is required, and
5. Do not deep till (> 4 inches) the controlled traffic paths.

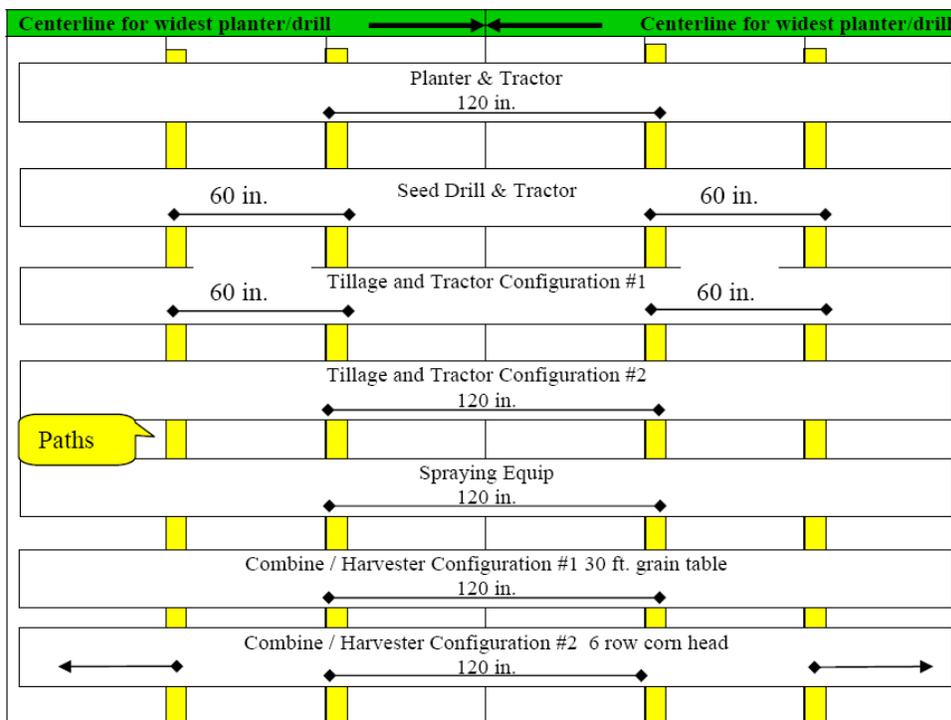
### Adoption Requirements

This enhancement is considered adopted when all three of the criteria above have been implemented on the land use acre.

### Documentation Requirements

A description of the controlled traffic system that includes:

1. List of fields with controlled traffic system,
2. Crops rotation for the fields,
3. Equipment used,
4. Row spacing and number of planter units,
5. Planting width for drills,
6. Wheel/track spacing and operational width for tractors, combines, grain carts, harvesters, sprayers, manure spreaders, etc. Tires on planters and drill can be ignored, and
7. Sketch of the traffic paths and wheel/track spacing.



**Figure 1. Example of Wheel/Track Spacing and Paths Using Multiples of the Basic Width** (units are in inches or number of rows):

Situation: 12 row planters with 30 inch rows for corn, 15 foot grain drill, and 6 row corn head on combine, 30 foot grain table on combine, 15 foot tillage tools.

1. If 2 or more tillage operations have the same width and tractor tire configuration the operations are only entered once.
2. If 2 or more combine/harvesting operations have the same width and tire configuration the operation is only entered once.

**Note:** The 6 row corn head begins by taking the center 6 rows of the 12 row configuration, then harvesting the three outside rows along with 3 outside rows from the adjacent planter pass. This reduces the number of row middles receiving wheel traffic (down to 33% in this example). This applies for any system where the combine is one-half the planter width.



**Table 1. Examples of traffic patterns for controlled traffic systems.**

Number of rows	Tractor (in)	Combine (in)	Number of paths	% Trafficked Assumes 20" tires
-----30" row spacing-----				
6	60	120	4	44
6	120	120	2	22
8	120	120	2	17
8	60 & 120	120 & 180	6	50
12	60 & 120	120 (6-row)	4	22
16	60 & 120	120 & 180 (8-row)	8	33
24	60 & 120	120& 180 (12-row)	12	33
-----36" row spacing-----				
6	72	144	4	37
8	72	144	4	28
12	72	144	4	18

**Note:** In the first scenario (line 1), the tractor tire spacing is 60 inches and the combine tire spacing is 120 inches. Each set of six rows has four tire paths. By increasing the tractor tire spacing to match the combine tire spacing, (lines 2 and 3) the number of paths and area trafficked are cut in half.

**References**

Reeder, R.C. 2002. Controlled traffic. Encyclopedia of Soil Science. Marcell Dekker, Inc. pp233-236.

Reeder, R.C. and J.M. Smith. 2000. Controlled Traffic. In: Conservation Tillage Systems and Management, MWPS-45. Midwest Plan Service, Ames, IA. pp 77-82.

**Soil Quality Enhancement Activity – SQL04 – Use of cover crop mixes**



**Enhancement Description**

This enhancement is for the use of cover crop mixes that contain two (2) or more different species of cover crops or cultivars of a single species.

**Land Use Applicability**

Cropland

**Benefits**

The use of a cover crop mixture that contains two (2) or more species is often more effective than a planting of single species cover crop. Cover crop mixtures adapt to variation in soils, increase biomass production, provide broader spectrum of weed control, have better winter survival and ground cover and attract a range of beneficial insects. Nutrients can be trapped or produced depending on existing soil conditions and plants used. Mixes can be a grass/legume, multiple cultivars of a single species, or a mix containing plants with different growth patterns, e.g. fast and slow, tall and short

**Conditions Where Enhancement Applies**

This enhancement applies to all crop land use acres (excluding permanent hayland).

**Criteria**

1. Cover crop mixes must contain a minimum of two (2) different plant species or two (2) different cultivars of a single species with differing maturity dates.
2. Cover crop species will be selected from state specific lists. The list of approved cover crops is available at the local NRCS Field Office.
3. Crops planted following cover crop must be no-tilled.
4. Nutrient applications for crops following cover crop should consider nitrogen fixation from leguminous cover crops.

**Adoption Requirements**

This enhancement is considered adopted when two different plant species or cultivars of a single species are being grown on the land use acre.

**Documentation Requirements**

1. Written documentation for each year describing, in detail, the following items:
  - a. Cover crop species used and dated planted,
  - b. Date and amount of fertilizer applied,
  - c. Method to kill cover crop and date completed, and
  - d. Crop planted after cover crop and method used.
2. A map showing fields where the enhancement is applied.
3. Photographs of a representative number of fields showing cover crop mix.



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### **References**

Sainju, U.M., W.F. Whitehead and B.P. Singh. 2005. Biculture Legume–Cereal Cover Crops for Enhanced Biomass Yield and Carbon and Nitrogen. *Agron. J.* 97:1403–1412.

## Soil Quality Enhancement Activity – SQL05 – Use of deep rooted crops to break up soil compaction



### Enhancement Description

This enhancement is for the use of deep rooted crops to break up compacted soils and improve soil quality. Deep rooted crops can be perennial plants like alfalfa or annual plants like forage radish.

### Land Use Applicability

Cropland

### Benefits

Soils can have naturally occurring compacted layers (hard pans) or those that have been created through tillage or other farming activities. Deep rooted crops with large taproots can alleviate the effects of soil compaction by penetrating the compacted layer, creating pore space that allows air, water and crop roots to penetrate deeper in the soil profile. Eliminating soil compaction through the use of deep rooted crops increases infiltration, reduces surface

runoff, improves soil tilth and overall soil quality. It also eliminates the need for sub-soiling with a plow, thus saving fuel, reducing erosion and enhancing water quality.

### Conditions Where Enhancement Applies

This enhancement applies to all crop land use acres.

### Criteria

1. The selected crop must be one that has been identified as having the capability of alleviating soil compaction. State specific lists are available at your local NRCS Field Office.
2. If perennial plants are used and once established, they must be maintained annually by proper fertilization and mowing/harvesting.
3. Annual crops should be seeded early enough in the fall to allow for adequate growth to occur prior to winter. Follow specifications provide by your local NRCS Field Office.
4. No deep tillage is allowed to remove compacted layer.

### Adoption Requirements

This enhancement is considered adopted when the selected deep rooted cover crop has been grown in a given rotation on the land use acre.

### Documentation Requirements

1. Written documentation for each year describing the following items:
  - a. Deep rooted crop(s) used and dated planted.



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- b. Cash crop planted and method used.
2. A map showing fields where the enhancement is applied.
3. Photographs of a representative number of fields showing deep rooted crops.

### **References**

A. Clark (ed.). 2007. Managing cover crops profitably. 3<sup>rd</sup> ed. Sustainable Agriculture Network Handbook Series; bk 9.

Magdoff, F. and H. van Es. Cover Crops. 2000. *In* Building soils for better crops. 2nd ed. Sustainable Agriculture Network Handbook Series. National Agriculture Library. Beltsville, MD. pp 87-96.

Sainju, U.M., W.F. Whitehead and B.P. Singh. 2005. Biculture Legume–Cereal Cover Crops for Enhanced Biomass Yield and Carbon and Nitrogen. *Agron. J.* 97:1403–1412.

**Soil Quality Enhancement Activity – SQL08 – Intercropping to improve soil quality and increase biodiversity**



**Enhancement Description**

This enhancement involves the use of intercropping principles (i.e., growing two or more crops in close proximity to each other during part or all of their life cycles) to promote interactions that improve soil and water quality via increased biodiversity and contribute to pest management.

**Land Use Applicability**

Cropland

**Benefits**

Incorporating intercropping principles into an agricultural operation increases diversity and interaction between plants, arthropods, mammals, birds and microorganisms resulting in a more stable crop-ecosystem and a more efficient use of space, water, sunlight and nutrients. Furthermore, soil health is benefited by increasing ground coverage with living vegetation which reduces erosion and by increasing the quantity and diversity of root exudates which enhances soil fauna. This collaborative type of crop management mimics nature and is subject to fewer pest outbreaks, improved nutrient cycling and crop nutrient uptake, and increased water infiltration and moisture retention. Soil quality, water quality and wildlife habitat all benefit.

**Conditions Where Enhancement Applies**

This enhancement applies to all crop land use acres (excluding permanent hayland).

**Criteria**

One or more of the following intercropping systems shall be used. Systems can be mixed during the contract period allowing for within year diversity on the same field.

1. Relay intercropping – grow two or more crops on the same field with the planting of the second crop after the first one (e.g., over seeding of a clover cover crop into cotton during defoliation; planting of clover at lay by time in corn).
2. Row intercropping – grow two or more crops simultaneously in the same field with at least one crop planted in rows (e.g., planting corn in the rows and interseeding sorghum between the rows, harvesting all as silage; plant vegetables, cereal grains, perennial covers or annual covers between orchard tree rows).
3. Strip intercropping – grow crops in alternate strips wide enough to permit separate crop production machinery, but close enough for crops to interact (e.g., planting alternating strips of corn and soybeans 6 rows each or alternating strips of corn and Sudan grass). Generally, the maximum width of individual strips for effective interaction of crop pests and their



natural enemies is about 30 ft. Note: this criterion is not the same as NRCS Conservation Practice *Stripcropping Code 585*.

Considerations for system design:

1. Adjustments in plant density to avoid overcrowding.
2. Maturity dates and/or development periods to maximize use of nutrients, water and other resources.
3. Combining deep and shallow rooted crops to optimize use of soil moisture and nutrients
4. Utilizing complementary plant structures and crop heights to:
  - a. provide support for others to grow (e.g., corn supporting climbing beans),
  - b. provide partial shade and a cooler micro-climate for the other (e.g., lettuce and other greens between rows of taller crops),
  - c. low-growing living mulch between rows of taller crops to control erosion, reduce soil displacement onto fruit, or suppress weeds.
5. Intercropping a legume with a nitrogen requiring crop to reduce fertilizer N requirements of the system,
6. Adjustments in nutrient application rates to account for nutrients being supplied (e.g., sequestered N from legume sources), recycled or consumed by the components of the intercropping system used,
7. Companion crops that provide food or habitat for natural enemies of key pests of the production crop(s), and
8. Companion crops that serve as alternate hosts of pests of production crops.

### **Adoption Requirements**

This enhancement is considered adopted when one or more of the three listed intercropping systems in the criteria above have been implemented on the crop land use acre where this enhancement applies.

### **Documentation Requirements**

1. Written documentation for each year describing by field:
  - a. Intercropping system(s) used
  - b. Crops planted
2. A map showing fields where enhancement was applied
3. Photographs of one or more representative number of fields showing the intercropping system(s) used.

### **References**

Zhang, F. and L. Long. 2003. Using competitive and facilitative interactions in intercropping systems enhances crop productivity and nutrient-use efficiency. *Plant and Soil*. 248, pp 305–312.

## Soil Quality Enhancement Activity – SQL09 – Conversion of cropped land to grass-based agriculture



### Enhancement Description

Conversion of cropped land to grass-based agriculture is the establishment of mixtures of perennial grasses, forbs and legume species on cropland where annually-seeded cash crops have been grown in monocultures. Select perennial species based on species compatibility, forage quality potential, improvements to soil quality, beneficial effects for wildlife and/or production of biomass.

### Landuse Applicability

Cropland

### Benefits

Perennial plants maintain a living root system throughout the year that provides habitat and organic exudates (food) for soil biota responsible for decomposition and nutrient cycling. Perennials provide soil cover for most of the year and are managed with little or no physical disturbance of the soil. High plant biomass production contributes to increased soil organic matter accumulation. Plant mixtures provide diversity in plant structure, soil cover that moderates soil temperature extremes, rooting depths that improve soil structure and residue quality that stimulates microbial activity. The combination of these factors results in improved soil quality, reduced runoff and erosion and improved water quality.

Many species of birds and animals, including song birds, quail, turkey, pheasants, deer and rabbits, use grasslands as cover and nesting areas, to find food and to rear their young. Managing grassland harvesting techniques can be beneficial to the survival of ground nesting birds and other wildlife species. Altering harvesting patterns can provide escape routes for hens, hens with broods, and hiding fawns. Delaying harvest or leaving portions of a field unharvested can provide nesting habitat. When grassland management and harvesting schedules are planned to alleviate man-made pressures on wildlife, high biomass producing, perennial species can provide desirable habitat for wildlife populations.

### Conditions Where Enhancement Applies

This enhancement applies to cropland that is currently in annual crop production. It does not apply to cropland that is currently in a permanent perennial crop such as permanent hay, orchards or vineyards.

### Criteria

1. Establish perennial grassland species (e.g., switchgrass, big bluestem, indiangrass, eastern gamagrass, etc.) on cropland according to the NRCS Pasture and Hay Planting (512) conservation practice standard.



2. Minimize soil erosion and disturbance when establishing perennials by using techniques such as no-till planting, use of nurse crops that germinate quickly and/or the use of suitable erosion control practices.
3. Use seeding mixtures of at least three perennial grasses, perennial forbs and/or legumes.
4. Use plant density observations from multiple areas in the field(s) to confirm successful establishment two years from the planting date; compare the actual to the recommended plant density for the seeding mix and region (e.g., at least 10 plants of the seeded mixture per square yard).
5. If the field will be grazed, a grazing management plan that meets CSP eligibility requirements must be developed and followed.

### **Adoption Requirements**

This enhancement is considered adopted on each acre when the annually planted cropland acre has been successfully established to the chosen perennial grass species mix.

### **Documentation Requirements**

1. Provide a map showing the location of the field(s) that were converted from cropland to grassland,
2. List the species that were included in the planting mix for each field,
3. Provide a record of plant density by species (seeded and volunteer; number of plants/sq yd for each species present) for multiple areas in the field(s) prior to harvest each year, and
4. Grazing management plan (as applicable).

### **References**

Jokela, B. and M. Russelle. 2010. Perennial Forages Benefit Soils, Other Crops, & Water Quality. Forage Focus. USDA-ARS. <http://www.midwestforage.org/pdf/452.pdf.pdf>

Magdoff, F. and H. van Es. Cover Crops. 2000. *In* Building soils for better crops. 2nd ed. Sustainable Agriculture Network Handbook Series. National Agriculture Library. Beltsville, MD. pp 87-96.

Wright, D., J. Marois, M. Vargas and P. Wiatrak. 2003. Perennial Grasses, Soil Organic Matter, And Crop Yield. Proc. of Sod Based Cropping Systems Conference. North Florida Research and Education Center-University of Florida. Quincy, FL.

**Soil Quality Enhancement Activity – SQL10 – Crop management system where crop land acres were recently converted from CRP grass/legume cover or similar perennial vegetation**



**Enhancement Description**

Implement a prescriptive crop management system on crop land acres that have been recently converted from CRP grass/legume conservation cover or similar perennial vegetated cover to a rotation of annually planted crops. Note: this enhancement is limited to acres where the conversion event took place not more than 2 years prior (not including hayland).

**Land Use Applicability**

Cropland (excluding Hayland)

**Benefits**

CRP grass/legume covered acres or acres with similar perennial vegetated cover that have been recently converted to annually planted crop systems have the potential to lose some or all of the soil health improvements generated from the years of CRP conservation cover. Depending on the new management system being used, the recalcitrant carbon pool in the system could be stable or declining, especially if a form of full width or deep tillage is being used in the new management system. In order to prevent further degradation of the accumulated carbon pool, there is a necessity to implement a crop management system to stabilize or increase these sites as carbon sinks. Utilizing a crop management system on working lands that integrates residue management systems with high residue cover crops will create systems with net carbon inputs and greater conservation benefits than lands that are absent of some degree of residue management.

**Conditions Where Enhancement Applies**

This enhancement only applies to crop land use acres (excluding hayland) that have been converted from CRP grass/legume conservation cover or acres with similar perennial vegetated cover to a rotation of annually planted crops. Note: this enhancement is limited to acres where the conversion event took place not more than 2 years prior.

**Criteria**

Develop a crop rotation on the acres where this enhancement applies that implements each of the following components:

1. Sites where burning of any plant materials have occurred during the last year of the CRP contract or since the termination of the CRP contract, are NOT eligible for this enhancement.
2. For each crop rotation, the average annual Soil Tillage Intensity Rating (STIR) as determined by RUSLE2 must be  $\leq 10$ ,
3. All residues must be uniformly distributed over the entire field,



4. No full-width tillage is permitted regardless of the depth of the tillage operation,
5. Field(s) must have a soil loss at or below the one-half soil tolerance (0.5T) level as determined by approved tools for wind and/or water erosion for the crop rotation, and
6. Between each crop in the rotation, except double cropped situations, seed a high residue cover crop or mixture of high residue cover crops. Each cover crop or mixture shall meet the following requirements:
  - a. Seed a cover crop or cover crop mixture at a rate and within a planting date range as determined or agreed to by the NRCS State Agronomist.
  - b. Cereal grain cover crops or mixtures shall be top dressed with nitrogen at rates determined or agreed to by the NRCS State Agronomist.
  - c. The cover crop or mixture shall reach a maturity level (i.e., growth stage) to ensure 100% soil coverage in the row middles for 3 months of the growing season. For example, cereal rye shall reach the soft dough stage before termination. The NRCS State Agronomist can determine a specified maturity level or desired residue quantity (dry matter basis) for the selected cover crop cultivar.
  - d. Termination of all cover crops shall be accomplished by chemical methods, non-chemical methods (such as flail mowing or roller crimper), or a combination of both.

### **Adoption Requirements**

The enhancement is considered adopted when all the criteria above has been fully implemented.

### **Documentation Requirements**

Documentation for each field where this enhancement is applied:

1. Planned crop rotation showing cover crops that will be used after low residue crops,
2. Planting method used for each crop in the rotation (no-till, strip till, direct seeding),
3. List of all other potential ground disturbing farming operations,
4. Method of cover crop termination, e.g. chemical, flail mowing, roller crimper, or combination,
5. Dates for farming operations,
6. Map showing fields and acreage, and
7. Photographs of planted crops.

### **References**

Bolton, R. 2003. Impact of the surface residue layer on decomposition, soil water properties and nitrogen dynamics. M.S. thesis. Univ. of Saskatchewan, Saskatoon, Saskatchewan, CA.

Price, A.J., K.S. Balkcom, L.M. Duzy and J.A. Keltron. 2012. Herbicide and Cover Crop Residue Integration for *Amaranthus* Control in Conservation Agriculture Cotton and Implications for Resistance Management. Weed Technology. In press.

Price, A.J., K.S. Balkcom, R.L. Raper, C.D. Monks, R.M. Barentine, and K.V. Iversen. 2008. Controlling Glyphosate-Resistant Pigweed in Conservation Tillage Cotton Systems. Conservation Systems Research. Special Publication No. 09. USDA-ARS-NSDL, Auburn, AL.

Reicosky, D.C. 2004. Tillage-induced soil properties and chamber mixing effects on gas exchange. Proc. 16<sup>th</sup> Triennial Conf., Int. Soil Till. Org. (ISTRO).



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Reicosky, D.C., M.J. Lindstrom, T.E. Schumacher, D.E. Lobb and D.D. Malo. 2005. Tillage-induced CO<sub>2</sub> loss across an eroded landscape. *Soil Tillage Res.* 81:183-194.

Renard, K.G., G.R. Foster, G.A. Weesies, D.K. McCool, and D.C. Yoder, coordinators. 1997. Predicting soil erosion by water: A guide to conservation planning with the Revised Universal Soil Loss Equation (RUSLE). US Department of Agriculture, Agriculture Handbook No. 703.

Shaffer, M.J., and W.E. Larson (ed.). 1987. Tillage and surface-residue sensitive potential evaporation submodel. *In* NTRM, a soil-crop simulation model for nitrogen, tillage and crop residue management. USDA Conserv. Res. Rep. 34-1. USDA-ARS.

Skidmore, E.L. and N.P. Woodruff. 1968. Wind erosion forces in the United States and their use in predicting soil loss. USDA Agriculture Handbook No. 346.

Sustainable Agriculture Research and Education (SARE). 2010. *Managing Cover Crops Profitably*. 3<sup>rd</sup> ed. Handbook #9. College Park, MD.

USDA-NRCS. 2011. *National Agronomy Manual*. 190-V. 4<sup>th</sup> ed.

**Soil Quality Enhancement Activity – SQL11 –Cover cropping in orchards, vineyards and other woody perennial horticultural crops**



**Enhancement Description**

Grow perennial or annual cover crop mixtures of grass, legumes, native flowering plants and/or other forbs year round to provide soil coverage, organic mulch, beneficial insect habitat, and other conservation benefits in orchards, vineyards or other perennial horticultural crops. Cover crops, once planted, are replanted annually or maintained year after year.

**Land Use Applicability**

Cropland

**Benefits**

Maintaining orchard and vineyard floors or row middles of perennial horticultural crops with continuous cover protects the soil resource from erosion, enhances soil quality, reduces compaction and rutting from field operations, and suppresses weeds. Cover crops provide habitat for pollinators and natural enemies of crop pests, fix nitrogen (legumes), and conserve moisture via organic mulch and suppress weeds.

**Conditions Where Enhancement Applies**

This enhancement only applies to acres of orchards, vineyards, and other woody perennial cropping systems.

**Criteria**

1. Plant cover crops in the inter-row spaces to be compatible with optimum yield and quality of the fruit crop. Grow cover crops on a minimum of 60% of the field area year annually. When annual cover crops are used, plant each succeeding cover crop within as soon as possible after termination of the preceding cover. Residue from the previous cover crop must be left on the soil surface until immediately before the next cover crop is planted.
2. Areas near crop rows or young, establishing trees that must be kept free from competing vegetations shall be maintained with organic mulch to control erosion, conserve soil moisture, and sustain soil quality. Select mulching material, application rate, and placement compatible with needs of the production crop. Total soil coverage (living cover + mulch) shall be maintained at a minimum of 85% of the field area. Replenish mulch as needed. Exception: In lieu of using mulch to meet the 85% minimum requirement, the area beyond the 60% minimum shall be seeded to a cover crop for systems where the mulching material would hinder harvest operations.
3. Select and seed cover crop mixtures at rates and within planting date ranges as determined or agreed to by the NRCS State Agronomist. Perennial mixtures must consist of at least two



species from different plant families. Annual cover crops must include at least three species from a minimum of two different plant families.

4. Select a mixtures and sequence of cover crop species to accomplish two or more of the following objectives:
  - a. High biomass and root mass to build soil organic matter. Expect at least 2 tons/ac of aboveground biomass annually.
  - b. Biologically fixed nitrogen for the production crop. Choose a mixture that will provide sufficient but not excessive amounts of N to the crop. Schedule mowing or termination of the cover to optimize rate and timing of N release for crop needs. Leave clippings near crop rows for desired N delivery.
  - c. Mulch generation. Plant mixtures which can be cut periodically to generate mulch material for application to crop rows or areas not protected by living cover.
  - d. Weed suppression. Select covers that establish rapidly form a heavy canopy and suppress weeds without competing excessively with the production crop. Schedule mowing of perennial covers to optimize weed control and prevent weed propagation.
  - e. Habitat for beneficial insects. Select a mixture of flowering plants based on the habitat needs of key predators or parasitoids to control the most economically important pests of the crop to be protected.
  - f. Pollinator habitat. Select a mixture of flowering plants to provide food and habitat for desired pollinators. Time mowing and other management operations to minimize competition for pollinators while the fruit crop is blooming.

### **Adoption Requirements**

This enhancement is considered adopted when cover crop mixture are established and total ground coverage (living cover + organic mulch) reaches 85% of the field area.

### **Documentation Requirements**

1. Cover crop species mix, planting dates, mowing dates and (for annual species) termination dates and methods.
2. Pattern and layout of production and cover crops plus mulch used to document how soil coverage criteria were reached.
3. The accomplished items from “Criteria #4.”
4. Photographs of representative fields showing cover crops added to the rotation, timing and method of cover crop establishment, and cover crop management.
5. Seed and legume inoculant tags and receipts.

### **References**

Ames, G. K., G. Kuepper, and A. Baier. 2004. Tree Fruits: Organic Production Overview. National Sustainable Agriculture Information Service. <http://attra.ncat.org>.

Dufour, R. 2006. Grapes: Organic Production. National Sustainable Agriculture Information Service. pp 44. <http://attra.ncat.org>

Hinman, T., and G. Ames. 2001. Apples: Organic Production Guide. National Sustainable Agriculture Information Service. pp 40. <http://attra.ncat.org>



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Kuepper, G.L., H. Born, and J. Bachman. 2003. Organic Culture of Bramble Fruits. National Sustainable Agriculture Information Service. pp 20. <http://attra.ncat.org>

USDA Sustainable Agriculture Research and Education (SARE) Handbook Series Book 9. Managing Cover Crops Profitably, 3<sup>rd</sup> Ed. <http://www.sare.org>.

**Soil Quality Enhancement Activity – SQL12 – Intensive cover cropping in annual crops**



**Enhancement Description**

Grow and manage *seasonal* cover crops of grasses, legumes or forbs to maintain soil coverage and other conservation benefits during all the non-crop production periods in an annual crop rotation. Intensive cover cropping is applicable to conventional, specialty and organic crop production systems.

**Landuse Applicability**

Cropland

**Benefits**

Using seasonal cover crops during all non-production periods between annually produced crops reduces wind and water erosion. When managed appropriately for local conditions, cover crops can restore and maintain soil productivity and soil quality over a wide range of climates and crop species. Cover crops restore and maintain soil properties by increasing organic matter, relieving compaction, improving soil tilth and fertility, fixing nitrogen (legumes), recycling nutrients in the soil profile, breaking pest cycles and providing habitat for soil biota, such as beneficial bacteria, mycorrhizal fungi and earthworms.

**Conditions Where Enhancement Applies**

This enhancement applies to all acres of annually planted cropland. These acres can be organic, transitioning to organic, or non-organic.

**Criteria**

Implementation of this enhancement requires the use of cover crops to provide soil coverage during the non-crop production periods of the rotation. To minimize periods of soil exposure, plant cover crops as soon as practical after harvest of each production crop. Use cover crop species appropriate to the season and seeding as well as seeding rates and methods that will yield a uniform stand and rapid ground coverage. Cover crops may be seeded into standing production crops provided seeding rates and methods, soil moisture levels and other environmental conditions are adequate to yield a satisfactory cover crop stand.

For the purposes of this enhancement, the cover crop shall not be harvested or grazed.

Each cover crop in the rotation shall meet the criteria for a least one of the following purposes. Over the duration of the crop rotation, cover crops shall be utilized to meet two or more of the criteria.

1. High bio-mass cover crops for erosion control and increased soil organic matter improvement.



- a. Plant a cover crop with a growth potential to produce a minimum of 3,000 lbs/acre (dry weight) above ground bio-mass when terminated by seasonal temperature changes (frost or heat), mechanical action (mowing, tillage, crimping, etc.) and/or herbicides in preparation for the following crop. Use seeding rates and row spacing (for drilled cover crop) that will provide rapid canopy closure and adequate ground coverage to prevent erosion between production crops, with a minimum of 90% cover by the time of cover crop termination.
- b. Leave the entire biomass in the field (i.e., do not harvest or graze the cover crop)
- c. Growth potential lists and recommended seeding rates and methods for selected cover crops are available in “Managing Cover Crops Profitably, 3<sup>rd</sup> Edition” (Clark, 2007).
2. Legume cover crops for biological nitrogen fixation.
  - a. Plant a leguminous cover crop between two primary crops in the rotation. This option does not apply to legumes that are normally part of the crop rotation. The legume shall be seeded at a rate recommended by the NRCS Field Office Technical Guide. Estimate nitrogen credits from the leguminous crop and base any additional N applications according to the guidelines of the Land Grant University, as approved by the NRCS State Agronomist.
  - b. Manage legume N to minimize N loss. In climates and soils where rapid N mineralization and/or leaching are likely, plant a legume-grass mixture to increase the biomass C: N ratio. This will decrease the N release rate.
3. Non-leguminous cover crops to capture and recycle residual nitrogen.
  - a. Plant a cover crop with a growth rate and rooting depth sufficient to scavenge excess/unused nitrogen remaining in the upper soil profile. Select cover crops, planting dates and seeding rates as determined or agreed to by the NRCS State Agronomist.
  - b. Consider reducing the N recommendation for the following crop by an estimated amount based on the site conditions both before and during the cover crop’s growing period, the cover crop species, and the termination phase of the cover crop.

*Note: This option does not apply to the same acres on which a leguminous cover crop is applied.*
4. Cover crops for weed suppression.
  - a. Plant a cover crop with the chemical and physical characteristics necessary to suppress or compete with the identified target weed species. Leave cover crop residues on the soil surface to maximize the allelopathic (chemical) and mulching (physical) effects. Select cover crops, planting dates and seeding rates as determined or agreed to by the NRCS State Agronomist.
5. Biodiversity improvement with cover crops.
  - a. Plant cover crop species with the characteristics to attract beneficial insects such as pollinators and/or predator insects, serve as trap crops for damaging insects, and/or provide natural bio-fumigation for soil dwelling pests. Select cover crops, planting dates and seeding rates as determined or agreed to by the NRCS State Agronomist.

### **Adoption Requirements**

This enhancement is considered adopted when two or more of the criteria are met on land use acreage.



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### **Documentation Requirements**

1. Crop rotation records, including rotation length in years, crops and cover crops planted,
2. Sequence and description of operations for each crop and cover crop including harvest, tillage, nutrient placement and planting/seeding,
3. Photographs of representative fields showing cover crops added to the rotation, timing and method of cover crop establishment, and extent of cover crop growth just before termination, and
4. Seed and legume inoculant tags and receipts.

### **References**

A. Clark (ed.). 2007. Managing cover crops profitably. 3<sup>rd</sup> ed. Sustainable Agriculture Network Handbook Series; bk 9.

Magdoff, F. and H. van Es. Cover Crops. 2000. *In* Building soils for better crops. 2nd ed. Sustainable Agriculture Network Handbook Series. National Agriculture Library. Beltsville, MD. pp 87-96.

**Water Quality Enhancement Activity – WQL01 – Biological suppression and other non-chemical techniques to manage brush, herbaceous weeds and invasive species**



**Enhancement Description**

This enhancement is for the reduction of woody brush, herbaceous weeds and invasive plants using non-chemical methods. Physical methods include pulling, hoeing, mowing, mulching or other similar techniques. Biological methods include use of natural enemies either introduced or augmented. Use of chemicals is prohibited with this enhancement.

**Land Use Applicability**

Pastureland, Rangeland, Forestland

**Benefits**

Environmental benefits will be site specific. Benefits may include but are not limited to improved water quality achieved through eliminating the use of synthetic pesticides resulting in no chemicals in surface runoff or leaching into the soil profile. Air quality will see similar impacts by eliminating chemical drift and volatilization. Controlling invasive species, brush and weeds will allow native plant communities to return and improve wildlife habitat.

**Conditions Where Enhancement Applies**

This enhancement applies to all pasture, range or forest land use acres.

**Criteria**

1. Develop a plan for managing invasive plants, brush and/or weeds that includes:
  - a. Assessment of existing conditions,
  - b. Identify strategies for control,
  - c. Control methods selected,
  - d. Monitoring and evaluation process, and
  - e. Operation and maintenance follow up activities.
2. Implementation of this enhancement requires the use of biological and/or physical pest suppression techniques instead of pesticides. These techniques, used individually or in combination, can include activities such as:
  - a. Grazing animals (primarily through the use of goats) to target undesirable vegetation.
  - b. Introduction of beneficial insects to attack undesirable vegetation.
  - c. Introduction of beneficial micro-organisms to attack undesirable vegetation.
  - d. Prescribed burning
  - e. Hand removal or cultivation



- f. Mowing or cutting
- g. Use of heavy equipment in areas with well established, dense brush cover
- 3. Biological suppression techniques should be based on techniques recommended by the local Land Grant University.
- 4. Biological suppression must be preceded by an analysis to ensure the proposed biological agent is compatible with the agronomic, ecological and social objectives of the operation.
- 5. Operation and maintenance activities must be followed to ensure regrowth or resprouting is controlled. Additional treatment of individual plants or areas needing retreatment should be completed as required to effectively controlling the targeted species.

### **Adoption Requirements**

This enhancement is considered adopted when invasives are being managed via biological or physical methods described above and no pesticides were used.

### **Documentation Requirements**

Written documentation for each treatment area and year of this enhancement including:

- 1. A full description of all biological and/or physical suppression techniques utilized include:
  - a. Method (s) of control used
  - b. Area (s) on farm control methods were applied
  - c. Number of animals or insect colonies distributed and the planned time frame of the treatment.
  - d. Photograph (s) of treatment applied
- 2. A map showing where the activities were applied including treatment acreage

### **References**

- Bellows, T.S., and T.W. Fisher. 1999. Handbook of Biological Control. Academic Press.
- Bond, W. and A.C. Grundy. 2001. Non-chemical Weed Management in Organic Farming Systems. Weed Research 41: 383-405.
- DiTomaso, J.M., M.L. Brooks, E.B. Allen, R. Minnich, P.M. Rice, and G.B. Kyser. 2006. Control of Invasive Weeds with Prescribed Burning. Weed Technology 20(2):535-548.
- Peischel, A. and D.D. Henry, Jr. 2006. Targeted Grazing: a Natural Approach to Vegetation Management and Landscape Enhancement. American Sheep Industry.
- Popay, I., and R. Field, 1996. Grazing Animals as Weed Control Agents. Weed Technology 10(1):217-231.
- Upadhyaya, M.K., and R.E. Blackshaw. 2007. Non-Chemical Weed Management : Principals, Concepts and Technology. Cabi.
- USDA-NRCS. 2010. Conservation Practice Standards: Herbaceous Weed Control-Code 315, Integrated Pest Management-Code 595, and Prescribed Burning-Code338.
- USDA-NRCS. 2009. Conservation Practice Standard: Brush Management-Code 314.
- Valentine, J.R., 1989. Range Developments and Improvements, 3<sup>rd</sup> ed. Academic Press, MA.

**Water Quality Enhancement Activity – WQL03 – Rotation of supplement and feeding areas**



**Enhancement Description**

The proper location and regular movement of livestock concentration areas such as feeding areas and mineral blocks in a manner that will improve livestock distribution, reduce localized areas of disturbances and reduce impacts on water bodies.

**Land Use Applicability**

Pastureland, Rangeland, Forestland

**Benefits**

The benefits of proper location and rotation of supplement and feeding areas are:

1. Aid in livestock distribution and utilization of forage
2. Reduce compaction of the soil and excess trampling of vegetation
3. Reduce high concentrations of nutrients around water sources for improved nutrient distribution in the grazed area.
4. Improve animal health (concentrated areas of parasites etc.)
5. Reduced energy consumption (where heavy use area will be decommissioned)

**Conditions Where Enhancement Applies**

This enhancement applies to all grazing acres in the operation for the selected land use.

**Criteria**

1. Move all supplement sources (i.e., salt or mineral block, tub or station) locations between grazing periods or every 30 days during a grazing period.
2. Move all feeding locations (including creep feeders) every 30 days or less.
3. Locate supplement sources at least ¼ mile (1,320 ft) from surface water and watering facilities. In those situations where pasture size limits supplement source placement or multiple water sources preclude meeting the minimum distance requirement, move supplement areas twice as frequent as described in criteria 1 or 2 to prevent nutrient buildup and to maintain good ground cover.
4. Follow a written grazing plan that meets NRCS requirements.



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### **Adoption Requirements**

This enhancement is considered adopted when supplement source locations and feeding areas are being moved at intervals less than or equal to this job sheet's criteria and the locations are at distances from surface water greater than or equal to the suggested criteria of this job sheet.

### **Documentation Requirements**

1. A map showing the location of supplement sources and feeding areas in each pasture, and
2. The schedule for moving the supplement source and feeding area locations.

### **References**

Alberta Cattle Commission. 2005. Cattle Wintering Sites – Managing for Good Stewardship. Prairie Farm Rehabilitation Administration, Alberta Agriculture, Food and Rural Development, and the Alberta Environmentally Sustainable Agriculture Program. E-publication, Government of Alberta.

Ball, D.M., C.S. Hoveland and G.D. Lacefield. 2007. Southern Forages – Chapter 25, 4<sup>th</sup> ed. International Plant Nutrition Institute, Norcross, GA.

Holechek, J. L., R. D. Pieper and C. H. Herbel. 2000. Range Management Principals and Practices – Chapter 10. 5<sup>th</sup> ed. Prentice Hall, NJ

USDA-NRCS. 2010. Conservation Practice Standard: Prescribed Grazing-Code 528.

**Water Quality Enhancement Activity – WQL04 – Plant tissue tests and analysis to improve nitrogen management**



**Enhancement Description**

Use plant tissue tests to adjust nitrogen application rates.

**Land Use Applicability**

Cropland

**Benefits**

The use of either plant tissue testing or leaf tissue testing is an adaptive nitrogen management technique used to adjust nitrogen application rates in-season (leaf tissue test) or for the following crop year (stalk test). Test such as

these help provide a thorough analysis of how nitrogen is being used by the current crop, giving a basis for adjustments to nitrogen rates. The end result is a more complete utilization of the nitrogen applied and less nitrogen remaining in the soil to be lost to the environment through nitrate leaching or soil emissions of nitrous oxide.

**Conditions Where Enhancement Applies**

This enhancement applies to all crop land use acres.

**Criteria**

This enhancement requires the use of an analysis of appropriate plant tissue to monitor the uptake of nitrogen and other nutrients during the growing season or for the following year and to make necessary adjustments in nutrient applications.

**In-season tissue testing and analysis**

1. This enhancement is limited to crops and state’s with one or more of the following:
  - a. A Land Grant University (LGU) that provide tissue analyses,
  - b. That recognize private commercial laboratory analyses,
  - c. Where chlorophyll tissue testing is a recognized methodology, or
  - d. Where aerial imagery (infrared) technology is a recognized methodology.
2. Participant must have a current soil test (no more than 3 years old).
3. Nutrient application rates are within the LGU recommendations based on soil testing and established yield goals and considering all nutrient sources.
4. Follow guidelines from the laboratory and local LGU for interpretation of the results and appropriate adjustments in the application of N and other nutrients.

**Plant tissue testing and analysis for the following year**

Corn stalk testing and analysis - The nitrogen status of the corn crop can be determined by measuring the nitrate concentrations in the lower portions of cornstalks at the end of the growing season. This involves taking an 8” sample of the cornstalk after black layer



development in corn. The stalk is analyzed for nitrate to determine if the corn received insufficient, sufficient, or excessive levels of nitrogen. Since this test is conducted after the current corn crop is mature, the results are used to “fine-tune” nitrogen recommendations in the next corn crop. Follow your LGU guidelines for the use of this type of test.

### **Adoption Requirements**

This enhancement is considered adopted when the results from plant tissue testing have been used to make nutrient application adjustments, either in-season or for the next crop year.

### **Documentation Requirements**

Each year, documentation for each treatment area (field) shall describe the following essential items:

1. A map showing where the activities are applied,
2. Test used (stalk, leaf, chlorophyll, infrared, or other plant tissue),
3. Dates of test(s),
4. Acres for each treatment area,
5. Soil test results for each treatment area,
6. Manure analysis results (if applicable),
7. Crop yields (both yield goals and measured yield, if available),
8. Amounts of all nutrients applied in each treatment area,
9. Plant tissue test results (including reference strips), and
10. Change in annual N applied due to adaptive management change per treatment area.

Note: In lieu of documenting each individual item listed in the Documentation Requirements, a Certified Crop Advisor plan that contains each of the items may be substituted.

### **References**

Blackmer, A.M. and A.P. Mallarino. 1996. Cornstalk Testing to Evaluate Nitrogen Management (PM-1584). Iowa State Univ. Extension.

Brouder, S. and D. Mengel. 2003. The Pre-sidedress Soil Nitrate Test for Improving N Management in Corn (AY-314-W). Purdue Univ. Extension.

International Plant Nutrition Institute (IPNI). 2012. 4R Plant Nutrition – A Manual for Improving the Management of Plant Nutrition (North American Version). IPNI, Norcross, GA.

**Water Quality Enhancement Activity – WQL05 – Apply nutrients no more than 30 days prior to planned planting date**



**Enhancement Description**

This enhancement is for applying nutrients from fertilizer, manures and/or compost no more than 30 days prior to the planned planting date of the crop.

**Land Use Applicability**

Cropland

**Benefits**

Nutrient application timing is critical in order for nutrients to be available during critical crop growth stages and to meet crop yield goals.

Nutrients that are land applied in excess of 30 days prior to the planned crop planting date are potentially lost to the environment causing water quality concerns and potential soil emissions of nitrous oxide, a potent greenhouse gas.

**Conditions Where Enhancement Applies**

This enhancement applies to only annually planted crop land use acres.

**Criteria**

Implementation of this enhancement requires:

1. Fertilizer, manure or any other organic by-products, regardless of form or application method must be applied no more than 30 days prior to the planned crop planting date, or after crop planting.
  - a. Utilized incorporation or injection where recommended by the Land Grant University (LGU)
2. The producer must have a current soil test (no more than 3 years old).
3. Nutrient application rates must be within the LGU recommendations based on soil testing and established yield goals and considering all nutrient sources.
4. Soil surface disturbance must be minimized by nutrient applications to stay within the site’s residue management goals.

**Adoption Requirements**

This enhancement is considered adopted when all four criteria above have been met on the land use acre.

**Documentation Requirements**

For each year of this enhancement, provide documentation of the following:

1. A map showing the treated acres,



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2. Target (planned) crop,
3. Planned planting date,
4. Actual planting date and crop planted,
5. Soil test results,
6. Manure analysis results (where appropriate),
7. Crop yields (both yield goals and measured yield), and
8. Nutrient application rates/amounts and application dates for each treatment area.

Note: In lieu of documenting each individual item listed in the Documentation Requirements, a Certified Crop Advisor plan that contains each of the items may be substituted.

### **References**

Follett, R.F. 2001. Nitrogen Transformation and Transport Processes. pp. 17-44, In R.F. Follett and J. Hatfield. (eds.). 2001. Nitrogen in the Environment; Sources, Problems, and Solutions. Elsevier Science Publishers. The Netherlands. 520 pp.

Stevenson, F.J. (ed.) 1982. Nitrogen in Agricultural Soils. Agron. Series 22. ASA, CSSA, and SSSA, Madison, WI.

**Water Quality Enhancement Activity – WQL07 – Split nitrogen applications, 50% after crop emergence or pasture green up**



**Enhancement Description**

Apply no more than 50% of total crop nitrogen needs within 30 days prior to planting or in the case of pasture or hay after green up of the dormant grasses. Apply the remaining 50% or more of the total nitrogen needs after crop emergence or pasture green up.

**Land Use Applicability**

Cropland, Pastureland

**Benefits**

Timing of nitrogen application can be used to ensure adequate amounts of N are available during critical growth stages. Application rates can also be adjusted based on crop forage conditions to refine yield goals. Split application of 50% or more of the total N needs allows for more efficient nutrient utilization resulting in a reduced potential for N loss through leaching and/or greenhouse gases to the environment (e.g. nitrous oxide).

**Conditions Where Enhancement Applies**

This enhancement applies to all crop or pasture land use acres.

**Criteria**

Implementation of this enhancement requires:

1. Regardless of form or application method (fertilizer, manure or any other organic byproducts), apply no more than 50% of crop N needs within 30 days prior to planting and 50% or more of the N needs after crop emergence or in the case of pasture or hay after green up of the dormant grasses.
2. Post emergence N application rates can be reduced based on crop scouting reports that would suggest lower yield potential. Scouting reports shall be provided.
3. Participant must have annual manure analysis (if organic nutrient sources are used)
4. Nutrient application rates must be within the “Land Grant University (LGU) recommendations based on soil testing and established yield goals and considering all nutrient sources.
5. Minimize soil surface disturbance to stay within the site’s residue management goals.

**Adoption Requirements**

This enhancement is considered adopted when all of the relevant criteria above have been implemented on the land use acre.



### **Documentation Requirements**

1. Written documentation for each treatment area (field) and year of this enhancement describing these items:
  - a. Acres,
  - b. Planned crop,
  - c. Planting date and crop planted,
  - d. Dates of crop emergence,
  - e. Annual manure analysis results (if organic nutrient sources are used),
  - f. Crop yields (both yield goals and measured yield),
  - g. Nutrient application rates/amounts and application dates for each treatment area, and
  - h. Scouting reports.
2. A map showing where the activities are applied.

Note: In lieu of documenting each individual item listed in the Documentation Requirements, a Certified Crop Advisor plan that contains each of the items may be substituted.

### **References**

Follett, R.F. 2001. Nitrogen transformation and transport processes. *In* Nitrogen in the environment; sources, problems, and solutions, (eds.) R.F. Follett and J. Hatfield, pp. 17-44.

International Plant Nutrition Institute (IPNI). 2012. 4R Plant Nutrition – A Manual for Improving the Management of Plant Nutrition (North American Version). IPNI, Norcross, GA.

Randall, G., J.A. Delgado, J.S. Schepers. 2008. Nitrogen management to protect water resources. p. 911-945. In Schepers and Raun (eds) Nitrogen in Agricultural Systems. SSSA Monograph. 49. Madison, WI.

**Water Quality Enhancement Activity – WQL09 – Apply phosphorus fertilizer below the soil surface**



**Enhancement Description**

This enhancement is for the application of all phosphorus fertilizer at least 3 inches deep, including manure, or as a 2X2 row starter. Note: the use of this enhancement may require a revised Highly Erodible Land Conservation (HELIC) plan.

**Land Use Applicability**

Cropland

**Benefits**

Nutrient management encompasses managing the amount, source, placement, form, and timing of the application of plant nutrients and soil amendments. Nutrient management effectively utilizes available nutrient resources to supply crops with nutrients required to efficiently produce food, forage, fiber, and cover while minimizing environmental degradation. Nutrient management enhancement activities help agricultural production and the environment.

Increased management activities will protect and enhance water quality and the biotic community that depends upon clean lakes and rivers. Nutrient application placement is critical in order for nutrients to be available during critical crop growth stages and to meet crop yield goals. By applying phosphorus either 3 inches deep or as a 2x2 row starter, it is less vulnerable to loss in surface runoff, both in solution and attached to soil particles, therefore reducing the potential loss of nutrients to the environment.

**Conditions Where Enhancement Applies**

This enhancement applies to all annually planted crop land use acres.

**Criteria**

Implementation of this enhancement requires:

1. All phosphorus fertilizer, regardless of form, will be injected at least 3 inches deep below the soil surface, and/or phosphorus applied as a starter fertilizer during the planting operation will be placed in a band 2 inches to the side and 2 inches below the crop seed (commonly referred to as "2x2" placement).
2. Producer must have a current soil test (no more than 3 years old)
3. The amount of phosphorus fertilizer applied as a starter in the 2x2 placement shall not exceed the rate recommended by the Land Grant University (LGU).
4. The total amount of phosphorus applied shall not exceed the rate recommended by the "Land Grant University" (LGU) based on soil testing and established yield goals.
5. Soil surface disturbance must be minimized during phosphorus injection.



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### **Adoption Requirements**

This enhancement is considered adopted when all phosphorus is subsurface applied as either a 2X2 starter application or  $\geq 3$  inches below the soil surface.

### **Documentation Requirements**

1. Documentation for each treatment area (field) and year of this enhancement describing the following:
  - a. Treatment acres,
  - b. Target (planned) crop,
  - c. Soil test results,
  - d. Crop yields (both yield goals and measured yield),
  - e. Phosphorus application rates/amounts and application dates for each treatment area, and
  - f. Method used to inject or incorporate phosphorus.
2. A map showing where the activities are applied.

Note: In lieu of documenting each individual item listed in the Documentation Requirements, a Certified Crop Advisor plan that contains each of the items may be substituted.

### **References**

Sims, J.T. (ed.) 2005. Phosphorus: Agriculture and the Environment. Agronomy Monograph 46. ASA, CSSA, and SSSA, Madison, WI.

**Water Quality Enhancement Activity – WQL10 - Plant a cover crop that will scavenge residual nitrogen**



**Enhancement Description**

Plant a cover crop that will scavenge nitrogen remaining in the soil after the harvest of a previous crop. Suitable cover crops include those with at least a “Very Good” rating for scavenging nitrogen as documented in *“Managing Cover Crops Profitably, 3rd Edition”* (Sarrantonio, 1998), Chart 2 Performance & Roles, pg 67. Examples include cereal rye, barley, forage radish and sorghum sudan.

**Land Use Applicability**

Cropland

**Benefits**

Planting an annual cover crop to scavenge residual nutrients from cropland after the harvest of a previous crop effectively utilizes residual nutrient resources to supply following crops with nutrients required to efficiently produce food, forage, fiber, and cover while minimizing environmental degradation.

**Conditions Where Enhancement Applies**

This enhancement applies to only annually planted crop land use acres.

**Criteria**

Implementation of this enhancement requires:

1. The cover crop selected shall have the growth rate and rooting depth required to effectively scavenge residual nitrogen from the root zone of the previous crop. Suitable cover crops include those with at least a “Very Good” rating for scavenging nitrogen as documented in *Managing Cover Crops Profitably, 3rd Edition, Chart 2 Performance & Roles, pg 67*. Examples include cereal rye, barley, forage radish and sorghum sudan.
2. Timing of planting and seeding rates for cover crops shall follow the recommendations as available in the local NRCS Field Office.
3. The participant must have a current soil test (no more than 3 years old).
4. Nitrogen application rates for the crop following the cover crop must be reduced by the “Land Grant University (LGU) recommendations to account for the recycling of N by the cover crop.

**Adoption Requirements**

This enhancement is considered adopted when all of the above criteria have been implemented on the land use acre.



### **Documentation Requirements**

Documentation for each treatment area (field) and year of this enhancement describing these items:

1. A map showing where the activities are applied,
2. Cover crop species planted,
3. Cover crop planting date,
4. Cover crop seeding rate (bu/ac),
5. Annual crop planted,
6. Nitrogen application rates/amounts for the annual crop:
  - a. If N application rates increased, technical justification shall be provided for the increase,
  - b. If N application rates were decreased in excess of the default residual value recommended by the LGU, technical justification shall be provided for the decrease, and
7. Treatment acres.

### **References**

Jokela, B. and M. Russelle. 2010. Perennial Forages Benefit Soils, Other Crops, & Water Quality. Forage Focus. USDA-ARS. <http://www.midwestforage.org/pdf/452.pdf.pdf>

Magdoff, F. and H. van Es. Cover Crops. 2000. *In* Building soils for better crops. 2nd ed. Sustainable Agriculture Network Handbook Series. National Agriculture Library. Beltsville, MD. pp 87-96.

Shiple, P.R., J.J. Meisinger and A.M. Decker. 1992. Conserving Residual Corn Fertilizer Nitrogen with Winter Cover Crops. *Agron. J.* 84S69-876.

**Water Quality Enhancement Activity – WQL11 – Precision application technology to apply nutrients**



**Enhancement Description**

The use of precision agriculture technologies to apply nutrients to fit variations in site-specific conditions found within fields.

**Land Use Applicability**

Cropland, Pastureland

**Benefits**

Precision agriculture methods are used to collect information needed to more precisely evaluate production input factors, accurately record crop yields, and precisely apply

variable rates of nutrients. The primary benefit of precision agriculture techniques is the use of detailed information about within field variability to maximize nutrient use efficiency. Done properly this helps to protect surface and ground water resources.

**Conditions Where Enhancement Applies**

This enhancement applies to crop or pasture land use acres where:

- Crop or forage yields can be monitored and correlated to positions in the field in order to produce a geographically accurate yield map.
- Nutrients can be applied according to geographically defined management zone(s) (DMZ).

**Criteria**

Implementation of this enhancement requires the use of precision agriculture technologies for nutrient management. This enhancement requires the following activities:

- a. Variable rate technologies (VRT) for nutrient application. This means computer-controlled equipment that adjusts fertilizer applications based on DMZ.
- b. The use of yield monitoring systems. Measure yields in the field using combine-mounted sensors, volume meters or other suitable technologies. Use a GPS receiver with the equipment to correlate field location with yield to create a yield map.
- c. Sample soils for nutrient analysis shall be based on DMZs.
- d. As a minimum, use yield monitoring data and soils data to create DMZs maps. Apply all nutrients according to the requirements of the DMZ based on yield expectations from yield monitoring.
- e. Soil tests for P and K must be no more than 3 years old. If soil or plant tissue tests are used for variable rate nitrogen application, the tests shall be current.
- f. All nutrient application rates must not exceed the “Land Grant University (LGU) recommendations for the target yield expectation.



Exception: In lieu of yield monitor data for crops that are not harvested using a geospatial component measurement system; work with your NRCS State Agronomist to use a method similar to the following procedure in order to implement this enhancement:

- a. Identify a realistic yield expectation (RYE) goal for the entire field-typically a 3 yr average.
- b. Define the DMZs in the field and a RYE goal for the DMZ.
  - i. This is accomplished by identifying a measured yield determining factor per DMZ (i.e., specific factor from a soil test result that correlates to yield).
- c. Using the DMZ RYE, calculate a weighted average yield goal for the field.
- d. As a check, the weighted average field RYE cannot be greater than the RYE goal for the entire field. But a single DMZ RYE can exceed the field RYE.
- e. The DMZ RYE becomes the replacement for yield monitor data.

### **Adoption Requirements**

This enhancement is considered adopted when the system as described in the criteria above have been implemented on the land use acreage. This includes the development of DMZs and the application of nutrients according to the requirements of the DMZ.

### **Documentation Requirements**

Documentation for each field where this enhancement is applied:

1. A map showing the fields where the enhancement is applied,
2. Crops grown in each field and maps with yield monitoring results,
3. Soil sampling protocol,
4. Soil test results,
5. Map(s) showing management zones for each field,
6. Calibration of fertilizer application equipment, and
7. Nutrient application rates/amounts and application dates for each DMZ.

Note: In lieu of documenting each individual item listed in the Documentation Requirements, a Certified Crop Advisor plan that contains each of the items may be substituted.

### **References**

International Plant Nutrition Institute (IPNI). 2012. 4R Plant Nutrition – A Manual for Improving the Management of Plant Nutrition (North American Version). IPNI, Norcross, GA.

Randall, G., J.A. Delgado and J.S. Schepers. 2008. Nitrogen management to protect water resources. In Schepers and Raun (eds) Nitrogen in Agricultural Systems. SSSA Monograph. 49. Madison, WI. pp 911-945.

USDA-NRCS. 2010. Precision Nutrient Management Planning. Agronomy Technical Note. (TN) 190-AGR-3. Washington, DC.

**Water Quality Enhancement Activity – WQL13 – High level integrated pest management to reduce pesticide environmental risk**



**Enhancement Description**

Utilize advanced Integrated Pest Management (IPM) prevention, avoidance, monitoring, and suppression techniques, and only apply the lowest risk pesticides available (or if higher risk pesticides are used appropriate mitigation techniques are used to ameliorate the risk) in an environmentally sound manner when monitoring indicates that an economic pest threshold has been exceeded. Pesticide applications must follow all label requirements.

**Land Use Applicability**

Cropland, Pastureland, Rangeland, Forestland

**Benefits**

This enhancement will improve water and air quality by reducing toxic pesticide runoff, leaching, drift and volatilization, and also reduce pesticide impacts on pollinators and other beneficial insects.

**Conditions Where Enhancement Applies**

This enhancement applies to all land uses where pesticide environmental risks are present that need mitigation options to meet or exceed the criteria detailed below.

**Criteria**

IPM is a sustainable approach to pest control that combines the use of prevention, avoidance, monitoring and suppression strategies, to maintain pest populations below economically damaging levels, to minimize pest resistance, and to minimize harmful effects of pest control on human health and environmental resources. High level IPM suppression systems include effective agro-chemicals and cost effective biological and cultural controls as well as the lowest risk pesticides available that can sustain the cropping system.

High level IPM requires:

1. A written IPM plan and implementation of activities that include:
  - a. Prevention techniques such as cleaning equipment and gear when leaving an infested area, using pest-free seeds and transplants, irrigation scheduling to avoid situations conducive to disease development, etc.
  - b. Avoidance techniques such as maintaining healthy and diverse plant communities, using pest resistant varieties, crop rotation, refuge management, etc.
  - c. Monitoring techniques such as pest scouting, degree-day modeling, weather forecasting, etc. to help target suppression strategies and avoid routine preventative treatments.



- d. Suppression techniques such as cultural, biological and low risk chemical control methods, used judiciously to reduce or eliminate a pest population or its impacts while minimizing risks to non-target organisms.
2. A minimum mitigation index score of  $\geq 45$  for the identified environmental risk but not less than specified by NRCS Agronomy Technical Note #5.
3. Mitigation index scores are quantified using NRCS Agronomy Technical Note #5, [Pest Management in the Conservation Planning Process](#).

### **Adoption Requirements**

This enhancement is considered adopted when a management system has been implemented on the land use acreage that meets or exceed the minimum mitigation index criteria.

### **Documentation Requirements**

1. A description of the high level IPM system that is utilized on all of the offered acres. This description should include each of the following items:
  - a. Pest prevention techniques,
  - b. Pest avoidance techniques,
  - c. Pest monitoring (scouting) techniques,
  - d. Economic pest thresholds,
  - e. Pesticide environmental risk analysis tool that was utilized (e.g., the NRCS Windows Pesticide Screening Tool - WIN-PST), and
  - f. Pesticide application records with the specific management techniques that were utilized to reduce pesticide environmental risk (i.e., spot treatment, banding, pheromone traps, pesticide incorporation, etc.).
2. If formal IPM Guidelines with a numeric scoring system have been developed and approved by Extension, a completed set of those guidelines can be substituted for the documentation requirements in number 1 above.

### **References**

Ignazi, J.C. 1991. Prevention of Water Pollution by Agriculture and Related Activities. Proceedings of the FAO Expert Consultation – Water Report 1, pp 247-261.

USDA-NRCS. 2010. Conservation Practice Standard: Integrated Pest Management-Code 595

USDA-NRCS. 2011. Agronomy Technical Note No. 5 – Pest Management in the Conservation Planning Process.

**Water Quality Enhancement Activity – WQL14 – Land application of treated manure**



**Enhancement Description**

This enhancement is for the use of manure that has been treated to reduce **both** odors and pathogens prior to land application. Acceptable practices include controlled temperature anaerobic digestion (mesophilic or thermophilic), composting and chemical treatment. Waste treatment lagoons and injection of manure alone do not qualify as acceptable practices.

**Land Use Applicability**

Cropland, Pastureland

**Benefits**

Utilizing manure for land application not only benefits crop production and soil quality, it also reduces air and water quality concerns if properly treated. Odors have been shown to be significantly reduced when manure is treated before land application. Benefits include reduced odors in the airshed. This lessens the impacts on neighboring properties along with potentially increasing the time and areas available for land application. Working conditions for employees can also be improved by the reduction in odors. An additional benefit for treating manure prior to land application is the reduction in pathogens. Human and animal health concerns are diminished due to lower pathogen counts from properly treated animal manure. Reduced or eliminated pathogens from land applied manure also decrease the likelihood water quality contamination from pathogens.

**Conditions Where Enhancement Applies**

This enhancement applies to crop land use acres, not including orchards and vineyards, and all pasture land use acres.

**Criteria**

1. Animal manure must be treated with a practice which will reduce both odors and pathogens prior to the manure being land applied. Acceptable treatment practices include:
  - a. Controlled temperature anaerobic digestion (mesophilic or thermophilic)
  - b. Composting
  - c. Chemical treatments (as recommended by the Land Grant University)
2. Animal manure is land applied according to a nutrient management plan.

**Adoption Requirements**

This enhancement is considered adopted when manure has been treated via controlled temperature anaerobic digestion (mesophilic or thermophilic), composting or chemical methods



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to reduce odors and pathogens, and the manure has been land applied according to a nutrient management plan.

### **Documentation Requirements**

1. Documentation of the manure treatment practice(s) used prior to land application to obtain both odor and pathogen reduction.
2. Documentation of the land application of manure that includes:
  - a. Fields where manure is applied,
  - b. Manure application rate per field,
  - c. Nutrients applied to each field, and
  - d. Crops grown in each field.

### **References**

International Plant Nutrition Institute (IPNI). 2012. 4R Plant Nutrition – A Manual for Improving the Management of Plant Nutrition (North American Version). IPNI, Norcross, GA.

USDA-NRCS. 2000. National Engineering Handbook, Part 637, Chapter 2, Composting, Washington, D.C.

USDA-NRCS. 1992. National Engineering Handbook, Part 651, Agricultural Waste Management Field Handbook. Washington, D.C.

**Water Quality Enhancement Activity – WQL17 – Use of non-chemical methods to kill cover crops**



**Enhancement Description**

This enhancement is for the use of non-chemical methods to kill cover crops prior to planting. These methods include mowing, rolling, undercutting and weather kill.

**Land Use Applicability**

Cropland

**Benefits**

The use of non-chemical methods to kill cover crops provides a dense bio-mass that controls erosion, increases soil organic matter, reduces soil water evaporation, suppresses weeds along with other improvements in soil and water quality while eliminating potential water quality problems or other concerns from the use of herbicides.

**Conditions Where Enhancement Applies**

This enhancement applies to all crop land use acres, not including hayland.

**Criteria**

**General**

1. Use different methods within the cropping rotation.
2. Cash crops must be no-tilled or strip-tilled after cover crop is terminated.
3. Use of herbicides is prohibited to terminate cover crop.
4. All crops shall be killed using one of the methods described below:
  - a. **Mowing**
    - i. Mowing must be done using a “Flail” or “Sickle Bar” mower
    - ii. Time mowing to ensure plant re-growth is minimized, e.g. after flowering in rye or midbloom or later in hairy vetch
  - b. **Roller Crimping**
    - i. Delay crimping until after early milk stage in cereal grain cover crops to ensure successful termination
    - ii. Manage cover crops for high bio-mass production through proper selection of seed, fertilizer application and timing of planting in the fall
    - iii. Cover crop must be crimped not cut
  - c. **Undercutting**
    - i. Use “V” blade cultivators that are run just under the surface of the soil (<2’)
    - ii. Most suitable for bed production
  - d. **Weather Kill**
    - i. Select cover crop based on those that are most reliably killed by temperature shifts



- ii. Use both summer or winter kill cover crops based on crop rotation

### **Adoption Requirements**

This enhancement is considered adopted when one of the cover crop termination methods described above has been implemented on the land use acre.

### **Documentation Requirements**

1. Written documentation for each year of this enhancement describing the following items:
  - a. Cover crop used and date planted,
  - b. Date and amount of fertilizer applied (if used),
  - c. Date on which cover crop was terminated, and
  - d. Cash crop planted and method used,
2. A map showing fields where the enhancement is applied.
3. Photographs of a representative number of fields showing roller crimping of cover crop.

### **References**

Creamer, N.G. and S.M. Dabney. 2002. Killing cover crops mechanically: Review of recent literature and assessment of new research results. *Amer. J. Alt. Ag.* 17:32-40.

Hulugalle, N.R., L.A. Finlay and T.B. Weaver. 2011. An integrated mechanical and chemical method for managing prostrate cover crops on permanent beds. NSW Department of Primary Industries. Australian Cotton Research Institute. Australia.

**Water Quality Enhancement Activity – WQL18 - Non-chemical pest management for livestock**



**Enhancement Description**

The use of management, monitoring, and prevention techniques to manage external livestock pests without the use of pesticides.

**Land Use Applicability**

Pastureland, Rangeland, Forestland

**Benefits**

Environmental benefits will be operation specific.

Benefits may include, but are not limited to improved animal health, reduced risk to humans and improved water quality. Pests and parasites can have a significant impact on the economic viability of livestock operations by affecting the performance and health of animals. The improper use of chemical control methods can pose risks to animal and human health as well as water quality. Nonchemical pest management strategies will require increased monitoring and management of livestock which should result in a higher overall level of management efficiency.

**Conditions Where Enhancement Applies**

This enhancement applies to all pasture, range or forest land use acres.

**Criteria**

1. Have a technical expert prepare a written plan addressing basic management considerations, including:
  - a. Pests/parasites of concern, including correct species identification
  - b. Monitoring process (jug traps, baited cards, on-livestock counts, fecal egg counts, FAMANCHA<sup>®</sup>, etc) to determine when control is needed and to monitor control effectiveness
  - c. Sanitation, cleaning feed/hay sites, and manure removal to reduce breeding sites
  - d. Rotational grazing and how it will be used to disrupt pest life cycles, minimum residual forage height to reduce parasite ingestion.
2. Incorporate two or more of the following applications into the plan as appropriate:
  - a. Provide non-invasive plants with secondary compounds such as tannins and terpenes that can reduce internal parasites when grazed by livestock.
  - b. Provide for multi-species grazing to disrupt life cycles of host specific parasites.
  - c. Monitor dung beetle populations and enhance by eliminating or significantly reducing use of detrimental injectable, pour-on, and especially bolus type pesticides.
  - d. If dung beetle populations are essentially non-existent, harrow or otherwise mechanically treat manure piles to speed up drying and decomposition.



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- e. Incorporate pastured poultry, such as portable poultry wagons, into pasture rotations to eat fly larvae, 2-3 days after livestock leave pasture.
- f. Enhance populations of martins, swallows, and bats by providing roosts, nesting, and breeding sites as appropriate.

### **Adoption Requirements**

This enhancement is considered adopted when a management plan has been developed, the management plan contains two or more of the sub-criteria to # 2 above, and the selected sub-criteria have been implemented.

### **Documentation Requirements**

1. Copy of the written plan that includes:
  - a. Basic management considerations,
  - b. Specific selected prevention and monitoring techniques performed,
  - c. Dates techniques performed,
  - d. Effectiveness of applications, and
  - e. Other monitoring results.
2. Schedule of when grazing occurred on pastures and residual vegetation heights both at start and end of each grazing period.

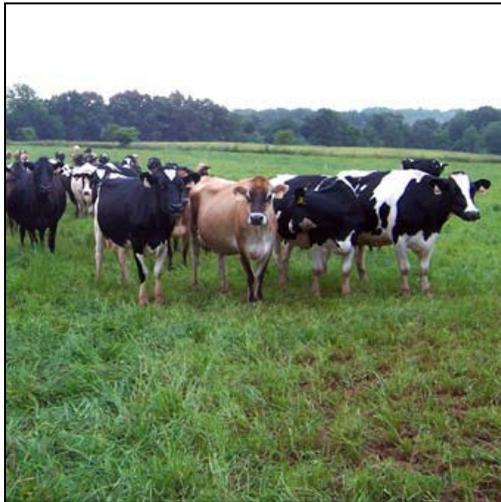
### **References**

Dufour, Rex. 2001. Biointensive Integrated Pest Management. National Center for the Appropriate Technology (NCAT). <https://attra.ncat.org/attra-pub/summaries/summary.php?pub=146>.

National Center for the Appropriate Technology (NCAT). 2004. Organic Livestock Workbook – A Guide to Sustainable and Allowed Practices. <http://www.co.marin.ca.us/depts/AG/Main/PDFsForOrganicAgAndMOCA/livestockworkbook.pdf>.

USDA-AMS. 2012. National Organic Program Final Rule – Access to Pasture [www.ams.usda.gov/NOP](http://www.ams.usda.gov/NOP)

**Water Quality Enhancement Activity – WQL19 – Transition to ORGANIC grazing systems**



**Enhancement Description**

“Transition to Organic Grazing Systems” supports the conversion of a conventional to an organic livestock grazing system. Key to the enhancement activity is following ecological and pasture-based grazing requirements, applying materials according to the National List of Allowed Synthetic and Prohibited Natural Substances, and managing livestock according to National Organic Program (NOP) rules (Subpart C – Organic Production and Handling Requirements) for organic certification. This enhancement activity facilitates compliance with NOP rules for organic certification.

**Land Use Applicability**

Pastureland, Rangeland, Forestland

**Benefits**

Environmental benefits will be operation specific. Benefits may include, but are not limited to improved forage, soil, and animal health, and improved water quality.

Managing for recommended time and timing of grazing, minimum and maximum grazing heights, pasture/paddock rotation, and rest periods improve plant health, diversity, and productivity. Sufficient pasture/paddock rest or pasture/paddock avoidance that minimizes livestock contact with viable internal parasite populations can break parasite cycles, reduce ingestion of parasites and the need for treatment, and improve animal health. Soil organisms and soil quality are benefitted by the reduction or elimination of natural or synthetic pesticides typically used on forage and/or livestock. Rotating livestock through several pastures/paddocks minimizes the development of loafing areas and improves the distribution of manure nutrients for plant uptake. Nutrients are more uniformly available to forage crops and the potential for polluted runoff from high traffic areas is reduced.

**Conditions Where Enhancement Applies**

This enhancement applies to only pasture, range or forest land use acres in the process of transitioning to an organic production system.

**Criteria**

1. Manage pasture grazing and rest periods to follow NRCS Prescribed Grazing practice standard (528) criteria for recommended maximum (begin) and minimum (end) grazing



heights by forage species or Ecological Site Description interpretations. Beginning and ending grazing heights are followed to maximize forage quality and palatability and to promote rapid recovery and forage regrowth.

- a. Maintain a livestock watering system that accommodates a high frequency of livestock rotation through several different pastures or paddocks during the grazing season. Follow NRCS practice standard criteria for Prescribed Grazing (528), Watering Facility (614), Pipeline (516), or other related standards for appropriate supply and travel distance to water.
- b. Use fencing that is permanent, semi-permanent, and/or temporary to facilitate pasture rotation. Follow the NRCS Fence practice standard (382). Additionally, follow NOP rules for allowable fence materials.

Note: Contact your local conservationist for assistance with Conservation Practice Standards.

2. Apply all materials, including plant nutrients and pesticides for forage production and animal health, in accordance with the National List of Allowed Synthetic and Prohibited Natural Substances.
3. Comply with all NOP rules for livestock management (NOP § 205.236 - .239 for livestock origin, feed, healthcare, living conditions)
4. Complete organic transition within three (3) years as verified by obtaining an approved Organic System Plan from a valid certifying agency.
5. Follow a written grazing plan that meets the CSP eligibility requirements.

### **Adoption Requirements**

This enhancement is considered adopted when the land use acre is certified via an Organic System Plan.

### **Documentation Requirements**

1. Provide a written grazing plan following the 'Plans and Specifications' guidelines in the Prescribed Grazing standard. Include time and timing of grazing, minimum and maximum grazing heights, and date rotated in and date off of pastures/paddocks in the grazing plan, as appropriate for the land use.
2. Provide a record of the application of inputs according to the NOP rules, e.g., type, date, rate, and amount of allowed nutrients and pesticides for forage and livestock.
3. Provide a copy of the Organic System Plan when approved by the certifying agent.

NRCS Pasture Notes, grazer's notebook, or other record keeping systems for pasture livestock operations can be used to facilitate record-keeping.

### **References**

Murphy, Bill. 1995. Pasture Management to Sustain Agriculture. Agroecology: The Science of Sustainable Agriculture, 2<sup>nd</sup> ed, edited by Miguel A. Altieri. Westview Press. Boulder, CO. pp. 321-347.



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Bezdicsek, David. 1984. Organic Farming: Current Technology and Its Role in a Sustainable Agriculture. ASA Special Publication No. 46. ASA, CSSA, and SSSA, Madison, WI. 192 P.

USDA-AMS. 2012. National Organic Program Final Rule – Access to Pasture  
[www.ams.usda.gov/NOP](http://www.ams.usda.gov/NOP)

**Water Quality Enhancement Activity –WQL20 – Transition to ORGANIC cropping systems**



**Enhancement Description**

“Transition to Organic Cropping Systems” supports the conversion of a conventional to an organic cropping system. Key to the enhancement is the inclusion of management activities that improve water and soil quality in an “Organic System Plan (OSP)” that adheres to the National Organic Program (NOP) 205.201 criteria. Included in the plan are specifics on how producers will manage pests, weeds, diseases, and plant nutrients by following a crop rotation that incorporates cover crops

and by using other cultural, biological and physical methods. The OSP also covers uses of manure and compost, measures to prevent exposure of organic crops and soils to NOP-prohibited substances, and seed sources.

**Land Use Applicability**

Cropland

**Benefits**

Environmental benefits are operation specific. Benefits may include, but are not limited to, improved soil quality through reduced erosion, increased organic matter, and balanced plant nutrients; reduced energy consumption due to the use of inputs with lower energy embodiment; wildlife habitat protection; and reduced impact on water quality. Organic transition reduces the impact of the farming operation on water quality by managing pests, weeds, and diseases through biological, mechanical, and cultural practices that eliminate the need for synthetic pesticides and by using slower-release organic and natural mineral nutrient sources that reduce nutrient losses via leaching and runoff.

**Conditions Where Enhancement Applies**

This enhancement only applies to crop land use acres in the process of transitioning to an organic production system.

**Criteria**

1. Implement a crop rotation that improves soil quality using a sod-based rotation, inclusion of high residue crops, addition of cover crops during non crop periods, reduced tillage, and/or other soil improving practices. Work with you local NRCS Field Office to calculate RUSLE2 STIR values in order to document the soil quality improvement.
2. Manage plant nutrients using agronomic practices such as:
  - a. Cover crops to provide or trap nutrients,
  - b. Crop rotations that mix high and low nutrient feeding crops,
  - c. Deep rooted crops followed by shallow-rooted crops, and/or
  - d. Soil testing to determine nutrient values for application rates of compost and other nutrient sources.



3. Incorporate manure when applied within the time limit specified in the NOP 205.203c1.
4. Follow NOP 205.203c2 before land application of composted manure and plant materials for plant nutrient use
5. Follow criteria in NOP 205.203d & e to apply additional plant nutrient supplements in such a way that they do not contribute to contamination of crops, soil, or water.
6. Manage pests through strategies that incorporate:
  - a. Prevention management practices (e.g., crop rotation, sanitation measures, providing habitat for natural enemies, and selection of pest-resistant crop varieties),
  - b. Scouting and monitoring of pests and beneficial insects,
  - c. Suppression by using biological, mechanical, or physical practices (e.g. introduction of predators or parasites of the pest species, row covers and other barriers, cultivation or flame weeding, mulching), and
  - d. Suppression by using biological, mineral or botanical materials allowed under NOP regulations, only when the above measures prove insufficient.
7. Apply all materials, including plant nutrients and pesticides for crop production in accordance with the National List of Allowed Synthetic and Prohibited Natural Substances.
8. Apply no prohibited substances, as listed in NOP §205.105 to the land for a period of 3 years immediately preceding harvest of the first crop to be marketed as USDA certified organic.
9. Establish distinct, defined boundaries and buffer zones between fields and adjacent lands 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.

### **Adoption Requirements**

This enhancement is considered adopted when the crop land use acre has received USDA Organic Certification.

### **Documentation Requirements**

1. Written narrative of practices used during the transition to:
  - a. Protect water resources from contamination by sediment, nutrients or pest-control materials,
  - b. Improve soil quality including crop rotation, cover crops and other associated practices,
  - c. Provide and manage plant nutrients, and
  - d. Manage pests in the cropping system.
2. Map showing field boundaries and buffer zones.
3. RUSLE2 documents displaying STIR before and after.
4. A record of the application of inputs according to the NOP rules (e.g., type, date, rate, and amount of allowed nutrients and pesticides).
5. Documentation of practices applied and steps taken to receive organic certification based on consultation with an accredited organic certifier.
6. Copy of the Organic System Plan when approved by certifying agent and the valid USDA Organic Certificate when issued.

### **References**

Lockeretz, W., G. Shearer, and D. Kohl. 1981. Organic farming in the Corn Belt. *Science*. Vol. 211, Issue 4482. pp. 540-547.



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Mohler, C.L. and S.E. Johnson, editors. 2009. Crop Rotation on Organic Farms: A Planning Manual. Natural Resource, Agriculture, and Engineering Service. Cooperative Extension. IV. Series: NRAES (Series); 177.

USDA-AMS. 2011. Organic Production and Handling Standards. National Organic Program  
<http://www.ams.usda.gov/AMsv1.0/getfile?dDocName=STELDEV3004445>

USEPA. 2011. Water Quality Criteria for Nitrogen and Phosphorus Pollution.  
<http://water.epa.gov/scitech/swguidance/waterquality/standards/criteria/aqlife/pollutants/nutrient/index.cfm>

USDA-Study Team on Organic Farming. 1980. Report and Recommendations on Organic Farming. US Government Printing. Office 1980-0-310-944/96. Beltsville, MD.

**Water Quality Enhancement Activity – WQL21 – Integrated pest management for ORGANIC farming**



**Enhancement Description**

Managing pests on an organic farm, including farms transitioning to organic, with an Integrated Pest Management (IPM) system that relies on high level prevention, avoidance, monitoring, and suppression techniques that are based on an understanding of pest ecology. Organic IPM relies primarily on ecologically-based cultural and biological practices that result in healthy soil and habitat for beneficial organisms. Appropriate mitigation techniques are utilized to improve environmental risks from selected suppression techniques.

**Land Use Applicability**

Cropland, Pastureland, Rangeland

**Benefits**

Environmental benefits will be operation specific. Benefits may include but are not limited to improved water and air quality achieved through minimizing suppression risk to natural resources. This will include reducing pesticide risks in runoff, leaching, drift and volatilization, as well as impacts on pollinators, beneficial insects and wildlife. It may also include reduced soil erosion and sediment loss from tillage for weed control. Implementing IPM increases biodiversity on the farm while improving soil quality, resulting in a more stable farming system that helps to prevent pests from overwhelming the system.

**Conditions Where Enhancement Applies**

This enhancement applies to all crop, pasture, or range land uses in an organic system where pesticide environmental risks are present that need mitigation options to meet or exceed the criteria detailed below.

**Criteria**

IPM is a sustainable approach to pest management that combines the use of prevention, avoidance, monitoring and suppression strategies, to maintain pest populations below economically damaging levels, to minimize pest resistance, and to minimize harmful effects of pest control on human health and environmental resources. If available, Land Grant University guidance should be followed for acceptable prevention, avoidance, monitoring and suppression techniques. Components of a high level Organic IPM include proactive cultural and biological controls.



High level IPM requires:

1. A written IPM plan and implementation of activities that include:
  - a. Prevention techniques such as cleaning equipment and gear when leaving an infested area, using pest-free seeds and transplants, irrigation scheduling to avoid situations conducive to disease development, etc.
  - b. Avoidance techniques such as maintaining healthy and diverse plant communities, using pest resistant varieties, crop rotation, refuge management, etc.
  - c. Monitoring techniques such as pest scouting, degree-day modeling, weather forecasting, etc. to help target suppression strategies and avoid routine preventative treatments.
  - d. Suppression techniques such as cultural, biological and low risk chemical control methods, used judiciously to reduce or eliminate a pest population or its impacts while minimizing risks to non-target organisms.
2. Only those substances listed in the National Organic Program regulations §205.601 and §205.603 may be used in the IPM program.
3. Acreage must be certified organic or in the transition to organic process.
4. A minimum mitigation index score of  $\geq 35$  for the identified environmental risk but not less than specified by NRCS Agronomy Technical Note #5.
5. Mitigation index scores are quantified using NRCS Agronomy Technical Note #5, [Pest Management in the Conservation Planning Process](#).

### **Adoption Requirements**

This enhancement is considered adopted when a management system has been implemented on the land use acreage that meets or exceed the minimum mitigation index criteria.

### **Documentation Requirements**

1. A written organic IPM system plan for all of the offered acres. This plan should include each of the following items:
  - a. Pest prevention techniques,
  - b. Pest avoidance techniques,
  - c. Pest monitoring (scouting) techniques,
  - d. Economic pest thresholds,
  - e. Pesticide environmental risk analysis tool that was used for pesticides selected from the NOP Prohibited and Allowed Substance list (e.g., the NRCS Windows Pesticide Screening Tool - WIN-PST),
  - f. Approved pesticide application records with the specific management techniques that were utilized to reduce pesticide environmental risk (i.e., spot treatment, banding, pheromone traps, pesticide incorporation, etc.),
  - g. Map showing location of fields, acreage, beneficial insect habitat, etc., and
  - h. Environmental assessment of non-chemical suppression methods, e.g. cultivation, burning.
2. Copies of scouting reports and other IPM records used to monitor and evaluate the plans effectiveness
3. If formal IPM Guidelines with a numeric scoring system have been developed and approved by Extension, a completed set of those guidelines can be substituted for the documentation requirements in number 1 above.



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### **References**

Ignazi, J.C. 1991. Prevention of Water Pollution by Agriculture and Related Activities. Proceedings of the FAO Expert Consultation – Water Report 1, pp 247-261.

Mohler, C.L. and S.E. Johnson, editors. 2009. Crop Rotation on Organic Farms: A Planning Manual. Natural Resource, Agriculture, and Engineering Service. Cooperative Extension. IV. Series: NRAES (Series); 177.

USDA-AMS. 2011. Organic Production and Handling Standards. National Organic Program  
<http://www.ams.usda.gov/AMsv1.0/getfile?dDocName=STELDEV3004445>

USDA-NRCS. 2010. Conservation Practice Standard: Integrated Pest Management-Code 595

USDA-NRCS. 2011. Agronomy Technical Note No. 5 – Pest Management in the Conservation Planning Process.

**Water Quality Enhancement Activity – WQL22 – On-farm composting of farm organic waste**



**Enhancement Description**

This enhancement consists of composting organic waste generated from the agricultural operation(s) on-farm. This includes animal manures, livestock mortality (where state or local laws allow), and waste from on-farm processing of agricultural products (e.g., slaughter by-products or vegetable culls removed from the field during harvest). It does not include any hazardous household waste, any general hazardous waste products or bio-hazard waste products. Yard waste such as grass clippings and leaves can be included but are not

required. Composted products must be used in compliance with all federal, state and local laws, rules and regulations.

**Land Use Applicability**

Cropland, Pastureland

**Benefits**

Composting is a resource management process that promotes an ecological farming system with focused nutrient and organic carbon cycling within an agricultural operation. Composting reduces the volume of waste, kills pathogens and reduces odors. The reuse of the compost products on the farm where they were produced improves soil quality and reduces the need to bring in additional nutrients from off-farm sources. On farms with a net import of nutrients (e.g., feed grain nutrient content exceeds nutrient content of farm products sold), the export of surplus nutrients in the form of compost turns a potential water quality concern into a beneficial product available to a wider area. The use of surplus compost by other growers has the potential to improve soil quality on their farm.

**Conditions Where Enhancement Applies**

This enhancement applies to farms that produce livestock manure, vegetable waste and/or other organic waste from on-farm processing facilities.

**Criteria**

1. **All** waste products produced on the farm that are suitable for composting may be composted. The composted products must include 75% of the animal manures produced from confinement areas, if applicable, and may also include:
  - a. Livestock mortality (where state or local laws allow)
  - b. Slaughter by-products



- c. Vegetable culls
- d. Waste from on farm processing of agricultural products
- e. Spoiled hay or forages

Note: where liquid animal manure systems are used, the 75% requirement applies to the materials from a solid/liquid separation system.

The following materials shall not be included in the composting operation and plan:

- a. Poultry litter recycled to be used again as poultry litter,
  - b. Composted bedded packs used for housing livestock,
  - c. Hazardous household waste,
  - d. General hazardous waste products,
  - e. Bio-hazard waste products, and
  - f. Crop residues not intended for harvest.
2. Follow a composting plan that includes:
    - a. Identification of the intended use of the compost and of the required level of pathogen destruction for that use.
    - b. Mixing/turning, compost time and temperature requirements to achieve pathogen destruction consistent with the intended use of the compost.
    - c. Monitoring and management of composting temperatures and compost moisture levels
    - d. Balancing Carbon/Nitrogen (C:N) ratio of compost feedstock, based on materials being composted
    - e. Compliance with all federal, state and local laws, rules and regulations
    - f. Time and temperature requirements of green waste to achieve egg destruction of any invasive pest species (ex.Coqui Frog eggs).
  3. Compost site and environmental considerations
    - a. Size the composting area according to the organic material being generated
    - b. Divert runoff away from the composting pad
    - c. Runoff from compost pad must be directed through a grass filter strip or other means to prevent water quality impairment
    - d. Select a method of aerobic composting (i.e., bin, windrow or forced air composting) that is compatible with the waste product.
    - e. Runoff management from the raw materials storage area, composting area and compost storage area must comply with all federal, state and local laws, rules and regulations.
  4. Compost facility operation must be in accordance with NRCS Conservation Practice Standards *Composting Facility Code 317* and *Animal Mortality Facility Code 316*, as appropriate.
  5. Follow Conservation Practice Standard *Nutrient Management Code 590* for land application of composts as well as all federal, state and local laws, rules and regulations.

### **Adoption Requirements**

This enhancement is considered adopted when the participant has established composting facilities with sufficient capacity for their composting needs and finished compost has been produced.



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### **Documentation Requirements**

1. An inventory of waste products produced on the farm,
2. An estimate of the annual quantities of compost to be produced,
3. Nutrient analysis of finished compost (by batch),
4. A location map showing the location of the composting facility(s),
5. A nutrient management plan for the land application of the compost,
6. A composting plan that identified the quantities needed, the intended use of the compost, and the composting process consistent with the intended use,
7. Farm nutrient flows and balances (including nutrients imported, nutrients exported, and nutrients recycled), and
8. Photographs of the composting facility.

### **References**

International Plant Nutrition Institute (IPNI). 2012. 4R Plant Nutrition – A Manual for Improving the Management of Plant Nutrition (North American Version). IPNI, Norcross, GA.

NRAES-54. 1992. On-Farm Composting Handbook, Ithaca, NY.

USDA-NRCS. 1992. National Engineering Handbook, Part 651, Agricultural Waste Management Field Handbook. Washington, D.C.

USDA-NRCS. 2000. National Engineering Handbook, Part 637, Chapter 2, Composting, Washington, D.C.

**Water Quality Enhancement Activity – WQL24 – Apply enhanced efficiency fertilizer products**



**Enhancement Description**

At least 50% of the pre-emergent and early post emergent nitrogen fertilizer and/or phosphorus fertilizers used for crop production must include enhanced efficiency formulations.

**Land Use Applicability**

Cropland, Pastureland

**Benefits**

Nutrient management encompasses managing the amount, source, placement, and timing of the application of plant nutrients and soil amendments.

Nutrient management effectively utilizes available nutrient resources to supply crops with nutrients required to efficiently produce food, forage, fiber, and cover while minimizing environmental degradation.

The use of enhanced efficiency fertilizer products can make nitrogen or phosphorus available to plants over a longer portion of the growing season to match the plant uptake needs. This limits the loss of nitrogen to leaching and denitrification, and can help control soil emissions of the greenhouse gas nitrous oxide. Increased phosphorus availability improves phosphorus use efficiency and reduces the potential for loss by leaching (soluble P) and erosion (P bound to detached soil particles).

**Conditions Where Enhancement Applies**

This enhancement applies to all crop or pasture land use acres.

**Criteria**

Implementation of this enhancement requires:

1. Enhanced efficiency fertilizers, used in the State must be defined by the Association of American Plant Food Control Officials (AAPFCO) and be accepted for use by the State fertilizer control official, or similar authority, with responsibility for verification of product guarantees, ingredients (by AAPFCO definition) and label claims.
2. The use of one or more nitrogen or phosphorus fertilizer products defined as enhanced efficiency fertilizers that are recommended by the state Land Grant University (LGU) and concurred with by NRCS on all treatment acres to supply at least 50% of the LGU recommended nitrogen or phosphorus requirement for the crop(s) grown.
3. Application of nutrients within the LGU recommendations based on soil testing and established yield goals and considering all nutrient sources.
4. Minimize soil surface disturbance during fertilizer placement.



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### **Adoption Requirements**

This enhancement is considered adopted when the enhanced efficiency product, for nitrogen or phosphorus enhancement, has been utilized as a fertilizer or fertilizer additive and applied to the land use acre.

### **Documentation Requirements**

1. A map showing where the activities are applied,
2. Enhanced efficiency product used,
3. Treatment acres,
4. Soil test results,
5. Crops grown and yields (both yield goals and measured yield),
6. Calibration of fertilizer application equipment, and
7. Nutrient application rates/amounts and application dates for each treatment area.

Note: In lieu of documenting each individual item listed in the Documentation Requirements, a Certified Crop Advisor plan that contains each of the items may be substituted.

### **References**

AAPFCO. 2011. Association of American Plant Food Control Officials, Official Publication No. 64. AAPFCO Inc., Little Rock, Arkansas.

**Water Quality and Air Quality Enhancement Activity – WQL25 – Split applications of nitrogen based on a PSNT**



**Enhancement Description**

Use pre-sidedress soil nitrate test (PSNT) to determine the need and/or amount of additional nitrogen to be applied during a sidedress/topdress N application.

**Land Use Applicability**

Cropland

**Benefits**

Efficient use of nitrogen (N) fertilizer is important for economical crop production as well as water and air quality enhancement. Split sidedress or topdress applications of fertilizer N improve the efficiency of nutrient uptake and protect water and air resources. Pre-plant soil test nitrogen analysis (not to be confused with PSNT) can be poorly correlated with growing season soil N availability and often does not provide sufficient insight upon which to base sidedress or topdress N applications. Additionally, sidedress or topdress applications of N based on a PSNT may lower the total amount of fertilizer applied, including ammonia fertilizer, minimizing ozone damage and greenhouse gases. Nitrate, while required by plants as a nutrient, is unstable in soil and can move with water through the soil into surface and ground water. Using split applications of N based on a PSNT will minimize nitrate contamination of surface and ground water, improve N use efficiency, and reduce harmful N emissions, improving the overall greenhouse gas footprint.

**Conditions Where Enhancement Applies**

This enhancement applies to all annually planted crop land use acres in states where a Land Grant University approves the methodology.

**Criteria**

Conduct a **PSNT** on the selected crop (e.g. corn) to test if additional N fertilizer is needed (sidedress application) on fields with a history of manure application, sewage sludge, or other residual organic products or where a legume crop or a legume cover crop has been grown.

The PSNT attempts to:

1. Gauge the pool of potentially mineralizable organic N in the top foot of soil, and
2. Link that pool with a likelihood of a yield response from additional N fertilizer at sidedressing time.

**Adoption Requirements**

This enhancement is considered adopted when a PSNT has been conducted on the land use acre.



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### **Documentation Requirements**

Written documentation for each year of this enhancement describing the following items:

1. A map showing where the enhancement is applied,
2. Recommendations from the test,
3. Dates of split nutrient applications,
4. Type(s) of nutrients (fertilizer and organic) applied including rate, form and timing,
5. Treatment area(s),
6. Soil test results,
7. Crops grown and yields (both yield goals and measured yield), and
8. Calibration of application equipment.

Note: In lieu of documenting each individual item listed in the Documentation Requirements, a Certified Crop Advisor plan that contains each of the items may be substituted.

### **References**

Follett, R.F. 2001. Nitrogen transformation and transport processes. *In* Nitrogen in the environment; sources, problems, and solutions, (eds.) R.F. Follett and J. Hatfield, pp. 17-44. Elsevier Science Publishers. The Netherlands. pp 520.

International Plant Nutrition Institute (IPNI). 2012. 4R Plant Nutrition – A Manual for Improving the Management of Plant Nutrition (North American Version). IPNI, Norcross, GA.

Randall, G., J.A. Delgado and J.S. Schepers. 2008. Nitrogen management to protect water resources. *In* Schepers and Raun (eds) Nitrogen in Agricultural Systems. SSSA Monograph. 49. Madison, WI. pp. 911-945.

Schepers, J.S. and W.R. Ruan(eds.). 2008. Nitrogen in agricultural systems. Agron. Monogr. no. 49, American Society of Agronomy (ASA). Crop Science Society of America (CSSA). Soil Science Society of America (SSSA). Madison, WI.

**Water Quality Enhancement Activity – WQL26 – Reduce the concentration of nutrients imported on farm**



**Enhancement Description**

Grow at least 75% of feed for livestock on the farm and use manure from the livestock to supplement up to 50% of N, 90% of P and 90% K for crops grown on the farm.

**Land Use Applicability**

Cropland, Pastureland

**Benefits**

On livestock farms, when feed for livestock is imported on the farm and manure from the livestock is spread on the

farm, over time this can result in a buildup of nutrients on the farm.

This problem is made worse if the nutrient value of the manure is not accounted and additional fertilizer is applied to crops. By growing the majority of feed for livestock on the farm and properly accounting for the nutrients in the manure when applying it to crop land, better nutrient cycling is achieved. Nutrients are not concentrated on the farm and a more sustainable operation is possible.

**Conditions Where Enhancement Applies**

This enhancement applies to all crop or pasture land use acres.

**Criteria**

1. At least 75% of feed for livestock must be grown on the farm.
2. For crops grown on the farm, manure from the livestock must be used to supplement up to:
  - a. 50% of N
  - b. 90% of P
  - c. 90% of K

**Adoption Requirements**

This enhancement is considered adopted when both criteria above have been met.

**Documentation Requirements**

1. Total feed requirements for livestock,
2. Feed purchases from off farm,
3. Nutrient requirements for crops, and
4. Off farm nutrient purchases.



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### **References**

International Plant Nutrition Institute (IPNI). 2012. 4R Plant Nutrition – A Manual for Improving the Management of Plant Nutrition (North American Version). IPNI, Norcross, GA.

USDA-NRCS. 2000. National Engineering Handbook. Part 637, Chapter 2, Composting. Washington, D.C.

USDA-NRCS. 1992. National Engineering Handbook. Part 651, Agricultural Waste Management Field Handbook. Washington, D.C.

**Soil Quality Enhancement Activity – WQL27 – Drainage water management for nutrient, pathogen, or pesticide reduction**



**Enhancement Description**

This enhancement consists of managing soil and/or surface water levels during the non-cropping season in order to reduce the loss of nutrients, pathogens, or/and pesticides from a crop field through drainage systems and into downstream receiving waters. This enhancement may also be utilized to reduce the oxidation of organic matter in the soil and/or reduce wind erosion or particulate matter (dust) emissions.

**Land Use Applicability**

Cropland

**Benefits**

This enhancement holds nutrients in the soil, reduces pathogens leaving the field, and/or reduces pesticides leaving the field when crops are not actively growing. Additional benefits may include reduction of the oxidation of organic matter and/or reduced wind erosion or particulate matter (dust) emissions.

**Conditions Where Enhancement Applies**

This enhancement applies to cropland that has been artificially drained (surface or subsurface) and which is flat enough that significant portions can be flooded or saturated by controlling outflow from the drainage system.

**Criteria**

1. Implementation of this enhancement requires compliance with the requirements of the Conservation Practice Standard, Drainage Water Management (554) and the associated plan;
2. Operate water control structures/devices to hold water surface elevations no more than 6 inches **below** the ground surface on the affected area for a minimum of 90 days per year;
3. This enhancement only applies to the areas of cropland where water levels can be effectively maintained at the desired elevations.

**Adoption Requirements**

This enhancement is considered adopted when a drainage water management plan that meets NRCS Conservation Practice Standard, Drainage Water Management, Code 554 has been implemented (check with your local NRCS Field Office for a copy of the practice standard) and fields are flooded such that ponding or saturated conditions meet the target hydrologic conditions in the above criteria.



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### **Documentation Requirements**

1. List of fields where this enhancement was utilized, the field size, and the equipment installed/used,
2. Dates when fields were flooded and water removed from fields, and
3. Photo documentation of saturated soil areas. Photos must be dated and labeled with field number.

### **References**

Drury, C.F., C.S. Tan, J.D. Gaynor, T.O. Oloya and T.W. Welacky. 1996. Influence of controlled Drainage-Subirrigation on Surface and Tile Drainage Nitrate Loss. Journal Environmental Quality. Vol 25. pp 317-324. <https://www.soils.org/publications/jeq/abstracts/25/2/JEQ0250020317>

Fouss, J.L. and M. Sullivan. 2009. Agricultural Drainage Management Systems Task Force (ADMSTF). <http://hostedweb.cfaes.ohio-state.edu/usdasdru/ADMS/411-ASCE%20EWRI%20Congress%202009%20-%20JLF%20&%20MCS.pdf>

**Water Quantity Enhancement Activity – WQT01 – Irrigation system automation**



**Enhancement Description**

This enhancement entails using GPS guided variable rate irrigation or other innovative technologies that allow irrigation water application based on variable site conditions within a field.

**Land Use Applicability**

Cropland, Pastureland

**Benefits**

The advantages of using variable rate irrigation or other innovative technologies to reduce water use and runoff from irrigation include conservation of water resources and energy conservation.

**Conditions Where Enhancement Applies**

This enhancement applies to only the irrigated acres in the crop or pasture land use.

**Criteria**

1. Implementation of this enhancement requires compliance with the requirements of the Conservation Practice Standard, Irrigation Water Management, Code 449 (check with your local NRCS Field Office for a copy of the practice standard).
2. Development and utilization of an irrigation prescription based on soil characteristics, topography, or crops.
  - a. Use of a GPS guidance and control system which will provide for the variable application of irrigation water based on variations of soils, topography, or crops; *or*
  - b. Use of an automated control system based on technologies other than GPS which will provide for variable application of irrigation water based on variations of soils, topography, or crops.

**Adoption Requirements**

This enhancement is considered adopted when GPS guided variable rate irrigation or other innovative technologies have been installed on the irrigated acres in the selected land use.

**Documentation Requirements**

1. Documentation showing the operation of a variable rate irrigation system and how it accounted for variations of soils, topography, or crops, and
2. Copy of the irrigation prescription and irrigation logs.



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### **References**

Evans, R., J. LaRue, K. Stone, B. King. 2012. Adoption of site-specific variable rate sprinkler irrigation systems. [http://www.ars.usda.gov/research/publications/publications.htm?SEQ\\_NO\\_115=279907](http://www.ars.usda.gov/research/publications/publications.htm?SEQ_NO_115=279907)

King, B. A. and D.C. Kincaid. 2004. Variable Flow Rate Sprinkler for Site-Specific Irrigation Management. <http://eprints.nwisrl.ars.usda.gov/6/1/1144.pdf>

Sadler, E.J., C.R. Camp, D.E. Evans, L.J. Usrey. 1996. A Site Specific Center Pivot Irrigation System for Highly-Variable Coastal Plain Soils. <http://naldc.nal.usda.gov/catalog/17999>

**Water Quantity Enhancement Activity – WQT03 – Irrigation pumping plant evaluation**



**Enhancement Description**

This enhancement consists of the evaluation of the irrigation pumping plant performance and efficiency using the Nebraska Irrigation Pumping Plant Performance Criteria.

**Land Use Applicability**

Cropland, Pastureland

**Benefits**

A pumping plant performance test can determine the energy efficiency of an irrigation pumping plant and provide information on adjustments or modifications needed to improve the energy efficiency. Efficiency improvements come in the form of reduced energy consumption, reduced water use and better management techniques. A pumping plant test may be performed regardless of the age of the system.

**Conditions Where Enhancement Applies**

This enhancement applies to all irrigation pumping plants in the crop or pasture land use.

**Criteria**

An irrigation pumping plant performance test must be performed by a qualified service provider with appropriate testing equipment. A full and complete report must be completed by the service provider. This should include:

1. Age and condition of the components of the irrigation system and pumping plant
2. Water levels during pumping, a pressure / discharge curve
3. Pump and engine speed (rpm)
4. Actual Pump Plant Performance versus the Nebraska Performance Criteria
5. Actual pump efficiency versus the Manufacturers Published efficiency
6. Recommendations for improvements to the overall system efficiency
7. Estimate of energy savings if improvements are implemented

Note: Below is the “Nebraska Performance Standards for Irrigation Pumping Plants” table.

**Adoption Requirements**

This enhancement is considered adopted when a full and complete report with the seven criteria above has been developed by a trained service provider.

**Documentation Requirements**

A completed pumping plant evaluation report including the items identified in the above criteria.



**References**

Fischbach, P.E. and M.A. Schroeder. 1982. Irrigation Pumping Plant Performance Handbook. 4<sup>th</sup> Ed.  
 USDA-NRCS. 1997. National Engineering Handbook. Part 652. Irrigation Guide. Chapter 12. Energy Use and Conservation. Section 2.

**Nebraska Performance Standards for Irrigation Pumping Plants**

<b>Energy Source</b>	<b>Energy Unit</b>	<b>Hp-hr<sup>(1)</sup> Per Unit of Energy</b>	<b>Water Hp-hr<sup>(2)</sup> Per Unit of Energy<sup>(3)</sup></b>
Diesel	Gallon	16.7	12.5
Gasoline	Gallon	11.5 <sup>(4)</sup>	8.66
Propane	Gallon	9.2 <sup>(4)</sup>	6.89
Natural Gas	1,000 cu ft	88.9 <sup>(5)</sup>	66.7
Electricity	kWh	1.18 <sup>(6)</sup>	0.885 <sup>(7)</sup>

- (1) Horsepower-hours are the work being accomplished by the power unit with losses considered.
- (2) Water horsepower-hours are the work being accomplished by the pumping plant, engine or motor and pump, at the Nebraska Performance Criteria.
- (3) Based on 75 percent pump efficiency.
- (4) Taken from Test D of Nebraska Tractor Test Reports. Drive losses are accounted for in the data. (Assumes no cooling fan)
- (5) Manufacturers' data corrected for 5 percent gear-head drive loss and no cooling fan. Assumes natural gas energy content of 1,000 Btu per cubic foot
- (6) Assumes 88 percent electric motor efficiency.
- (7) Direction connection, assumes no drive loss.

**Water Quantity Enhancement Activity – WQT05 – Remote monitoring and notification of irrigation pumping plant operation**



**Enhancement Description**

A system for monitoring the status of an irrigation pumping plant and notifying the operator by a wireless connection of a change in the operating status of the irrigation system.

**Land Use Applicability**

Cropland, Pastureland

**Benefits**

Irrigation water usage and energy costs associated with pumping irrigation water are a critical resource concerns. Even the most careful managers cannot manage the water on all of their fields on a continuous basis without increasing the potential for some runoff. Real time information on the status of their irrigation systems helps to prioritize field visits to observe the system and make necessary adjustments for proper functioning. New technology monitors the status of the watering system and notifies the operator when there is a change, such as, the pump turning on or off.

**Conditions Where Enhancement Applies**

This enhancement applies to all the irrigation pumping plants in the crop or pasture land use.

**Criteria**

The pumping plant monitoring system must include:

1. Installation of necessary sensors to monitor the operation of the pumping plant and irrigation system.
2. A communication system at the pump with an automated recording and wireless communication system to automatically notify the operator of a status in the watering system.
3. The irrigation water management plan must reflect usage of the data from the system and include necessary operation and maintenance to keep the system functional.

**Adoption Requirements**

This enhancement is considered adopted when a monitoring system has been installed at the remote well location(s) and the subject well has a functioning automated remote notification system.

**Documentation Requirements**

A map delineating the locations where the monitoring systems are installed.



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### **References**

Kranz, W. 2011. Monitoring irrigation water application with computerized controllers. Proceedings of the 23rd Annual Central Plains Irrigation Conference. Burlington, CO. February 22-23, 2011.

<http://www.ksre.ksu.edu/irrigate/OOW/P11/Kranz11b.pdf>

Piao, X. and L. Burt. 2001. Remote monitoring and control – system set-up.

<http://www.itrc.org/reports/remote/remote.pdf>

**Water Quantity Enhancement Activity – WQT07 – Regional weather networks for irrigation scheduling**



**Enhancement Description**

Crop evapotranspiration (crop ET) information from a regional weather network is utilized as a part of the irrigation water management plan for irrigation scheduling. Water use is planned and adjustments in application rates and timing are made using the regional weather network data.

**Land Use Applicability**

Cropland, Pastureland

**Benefits**

The use of data from regional weather networks can improve a farmer’s estimate of evapotranspiration from irrigated crops. This information combined with local rainfall data and monitoring of soil moisture can significantly improve the accuracy of irrigation timing and application rates. Benefits include reduced aquifer depletion, and reduced runoff and deep percolation, both of which reduce movement of agrichemicals from farm fields to aquifers, lakes, and streams.

**Conditions Where Enhancement Applies**

This enhancement applies to irrigated cropland or pastureland where regional weather data is not currently used to schedule irrigation events.

**Criteria**

This enhancement requires:

1. A subscription to a regional weather network that supplies crop ET values for irrigation scheduling.
2. The crop ET information from the network must be used as part of the irrigation water management plan to match water application rates and timing to the needs of the crops and soils.

**Adoption Requirements**

This enhancement is considered adopted when the applicant has a valid subscription to a regional weather service, has developed an irrigation water management plan based on the ET data from the regional weather network and has a record of irrigation events based on the ET data from the regional weather network.

**Documentation Requirements**

1. Documentation of subscription to a regional weather network.



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2. An irrigation water management plan showing the use of the crop ET data from a weather network in irrigation scheduling.
3. A record of actual irrigation events based on the ET data from the weather network.

### **References**

Elliott, R.L., K.G. Hubbard, M.D. Brusberg, M.J. Hattendorff, T.A. Howell, T.H. Marek, R.L. Snyder. 2000. The Role of Automated Weather Networks in Providing Evapotranspiration Estimates. Proceedings of the 4<sup>th</sup> Decennial National Irrigation Symposium. November 2000. pp 243-250.

<http://www.cprl.ars.usda.gov/wmru/pdfs/The%20role%20of%20automated%20weather%20networks%20in%20providing%20evapotr.pdf>

Pierce, F.J. and T.V. Elliott. 2008. Regional and on-farm wireless sensor networks for agricultural systems in Eastern Washington. <http://www.sciencedirect.com/science/article/pii/S0168169907001664>

**Water Quantity Enhancement Activity – WQT08 – Decrease irrigation water quantity or conversion to non-irrigated crop production**



**Enhancement Description**

This enhancement consists of reducing the total quantity of irrigation water used to produce crops and forages or the conversion of land to non-irrigated production.

**Land Use Applicability**

Cropland, Pastureland

**Benefits**

In areas where ground water or surface water supplies are limited, the reduction of irrigation water used or the conversion of irrigated cropland or pasture to non-irrigated (dry) cropland, non-irrigated pasture or range land, has the immediate benefit of conserving a scarce resource. Where irrigation water is pumped, elimination of pumping will also reduce energy usage and improve air quality if internal combustion engines were used for pumping on the farm.

**Conditions Where Enhancement Applies**

This enhancement only applies to crop or pasture land uses where there is acreage that has been irrigated a minimum of 2 years out of the last 5 years.

**Criteria**

1. The water that would have been used for irrigating land where this enhancement is implemented cannot be used to irrigate other acreage on the farm or the water rights sold to another landowner.
2. The land must:
  - a. Receive a reduced quantity of irrigation water due to rotational adjustments, and/or
  - b. Be converted to growing crops, pasture species or other vegetation that can be expected to survive under the normally expected rainfall regime.
3. Regardless of the type of vegetation grown on the land after removal of irrigation or reduction of water application, invasive species must be managed.
4. Conversion to dryland production or the reduction of irrigation application must include the necessary changes in management of the land to improve the success of the change, such as, changes to drought tolerant crops or cultivars, changed crop rotations and installation of moisture capturing practices (i.e., mulch tillage, no-till, reduced tillage, chemical weed control versus conventional tillage, herbaceous wind barriers, trap strips, strip cropping, etc.), and practices to maintain erosion at or below soil loss tolerance (T).
5. A flow meter must be installed to measure quantities of water used. Open channel systems may utilize irrigation district measurements to determine quantities of water used.  
 Note: Ditch riders meet the intent of this criterion.
6. The total cumulative quantity of irrigation water must be reduced by 25% and maintained at



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25% or more over the rotation (i.e., from the initiation of the reduction to the end of the agreement with NRCS).

### **Adoption Requirements**

This enhancement has been adopted when the cumulative irrigation water quantity has been decreased by 25% as compared to the previous 5 years.

### **Documentation Requirements**

1. A map showing areas of quantity reduction or conversion to non-irrigated land,
2. Documentation of the amount of water used for irrigation in the previous 2 to 5 years (use the maximum number of years possible),
3. Flow meter measurements for each crop for the entire rotation,
4. Record of crop rotation and species (cultivars) planted,
5. Records that show cumulative reduction in irrigation water application for rotation,
6. Documentation recording implementation of required management practices, and
7. Documentation that water saved was not used on other part of the operation or sold to another landowner.

### **References**

Amosson, S.H., L.K. Almas, F. Bretz, D. Gaskins, B. Guerrero, D. Jones, T. Marek, L. New and N. Simpson. 2006. Water Management Strategies for Reducing Irrigation Demands in Region. Prepared for Agricultural Sub-Committee, Panhandle Water Planning Group.

[http://www.twdb.state.tx.us/rwpg/2006\\_RWP/RegionA/Appendices/Appendix%20Q.pdf](http://www.twdb.state.tx.us/rwpg/2006_RWP/RegionA/Appendices/Appendix%20Q.pdf)

Cropping Options for Limited Water Supplies in Northeast Colorado, 2003

**FPP02 - On-Farm Pilot Project**



**Enhancement Description**

On-Farm Pilots showcase conservation activities that have proven environmental benefits, but have not been widely adopted in the local farm community. Participants select and agree to install, monitor and promote conservation activities (practices, components or management techniques) that have been identified by the NRCS State Conservationist as addressing specific resource needs.

**Land Use Applicability**

Each approved pilot project will have a land use designated, e.g. Cropland, Pastureland, Rangeland and/or Forest land.

**Benefits**

Conservation activities can show promise in research but until they are proven in actual field use farmers may be reluctant to adopt them. Pilot projects will provide a mechanism to prove that a new conservation activity is viable in the project area. Publicizing the implementation of the conservation activity can help other farmers learn about new conservation techniques by observing their peers.

**Conditions Where Enhancement Applies**

This enhancement applies to all crop, pasture, range or forest land use acres.

**Criteria**

1. Producers will select from a pre-approved list of pilot projects (if available).
2. Pilots include practices, components, or management techniques that have shown environmental benefits but have not been adopted by farmers in the project area.
3. The pilots must be implemented and monitored according protocols developed specifically for the project.
4. Protocols include:
  - a. Specifics of the practice, component or management technique being piloted
  - b. Acreage required to adequately conduct the pilot
  - c. How many years the pilot is to be conducted
  - d. What the participant is required to provide (materials, labor, maintenance etc.)
  - e. Type(s) of publicized events that will be used (field days, signage, winter meetings, etc.) to meet the minimum number of three (3) events. This activity will be schedule once per year that an educational event takes place.



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5. Data on the costs and performance must be collected for the demonstration project as specified for each individual pilot project. The data collection needs are available in a separate document.

### **Adoption Requirements**

This enhancement is considered adopted when the pre-approved pilot project has been implemented and monitored according protocols developed specifically for the project and events to publicize the project have been held.

### **Documentation Requirements**

1. Documentation of the events held to publicize the project.
2. Data collected for the project will include as directed by the individual states:
  - a. Practice cost, field operations conducted, etc.
  - b. Frequency of collection
  - c. Data collection forms



## **Conservation Stewardship Program On-Farm Pilot Project Requirements**

### **Overview**

The Conservation Stewardship Program (CSP) encourages participants to address resource concerns in a comprehensive manner by undertaking additional conservation activities, and improving, maintaining, and managing existing conservation activities. This enhancement is eligible for cropland, pastureland, rangeland, and non-industrial private forestland. CSP enhancements means a type of activity installed and adopted to treat natural resources and improve conservation performance. Many of the CSP enhancements are related to existing NRCS conservation practice standards, but at a management intensity level that exceeds minimum practice standards.

On-Farm Pilots showcase conservation activities that have proven environmental benefits, but have not been widely adopted in the local farm community. Participants select and agree to install, monitor and promote conservation activities (practices, components or management techniques) that have been identified by the NRCS State Conservationist as addressing specific resource needs. Using field days, signage and/or other innovative publicity methods, conservation activities that have shown promise in research plots can be promoted on a larger scale, thus removing farmers' reluctance to adopt them. Participants in On-Farm Pilots learn about new conservation activities first hand, becoming advocates for how these new conservation techniques can be applied. On-Farm Pilots are not intended to pay for the cost of setting up or administering a pilot. CSP applicants that choose this activity will be awarded conservation performance points that increase their ranking score and payment level for participation in the program.

### **Pilot Project Requirements**

Each year NRCS will identify broad national technology focus areas for which new and innovative conservation activities are needed. States will select specific pilot projects to emphasize and will develop a list of acceptable projects, guidelines for implementation and publicity requirements. This should be done in consultation with the State Technical Committee. Conservation partners are encouraged to help promote and organize On-Farm Pilots, but the activity is not intended to provide any financial assistance for doing so. Individual or groups of farmers are also encouraged to submit project proposal following the criteria listed below. Ideas for On-Farm Pilots should be submitted to the State Conservationist along with supporting documentation as to how the idea relates to a focus area and selected conservation activities (practices, components and/or management techniques).



**Criteria for On-Farm Pilot Conservation Activities (Practices, Components and/or Management Techniques)**

- Practices, components or management techniques:
  - Should have been demonstrated to provide environmental benefits either through research or practical field experience
  - Should not have been widely adopted in a given geographic area
  - Could be an activity that has been proven in another state or geographic area within the state and shows promise in addressing the resource needs in the targeted area
  - Address one of the State identified focus areas:
    - Air
    - Animal
    - Energy
    - Plant
    - Soil Erosion
    - Soil Quality
    - Water Quality
    - Water Quantity
- States will develop a pilot project protocol that includes:
  - Specifics of the practice, component or management technique being piloted
  - Acreage required to adequately conduct the pilot
  - How many years the pilot is to be conducted
  - What the participant is required to provide (materials, labor, maintenance etc.)
  - Type(s) of publicized events that will be used (field days, signage, winter meetings, etc.) to meet the minimum number of three (3) events. This activity will be schedule once per year that an educational event takes place.
  - This information can be presented to interested participants as a fact sheet that outlines their involvement.
- States will develop data collection criteria that includes:
  - Type of data collected (practice cost, field operations, etc.)
  - Frequency of collection
  - Data collection forms

**FRD01 – On Farm Research and Demonstration**



**Enhancement Description**

On farm research and demonstration consists of the implementation of applied research projects on working farms to gather information and demonstrate the efficacy of the activity. The projects must fit within identified state priority topic areas.

The farmer will need to conduct one of the following types of research: 1) randomized and replicated experiment, paired comparison, or multiple activity comparison on the farm where data is collected and assessed to determine

which activities might best enhance conservation or resource condition on their farming operation and others in their region, or 2) intense record keeping and analysis where data is collected on implementation, efficacy, and/or outcomes of one or more conservation practices or enhancements over a period of time and used for better decision-making concerning the farmer’s activities addressing conservation concerns on working lands.

**Land Use Applicability**

Cropland, Pastureland, Rangeland and/or Forest land, each approved project will have a land use designated.

**Benefits**

On-farm research, documentation, and evaluation of alternative conservation techniques can help farmers and NRCS personnel develop more effective approaches to protecting resources and improving resource condition. Dissemination of findings through on farm field days, written summaries, and other means promotes adoption of the most effective current and new conservation practices and enhancements.

Farmers often need willing researchers to help them design research and demonstration projects they initiate. It is also true that researchers often need willing farmers to help them carryout out research projects on working farms. Regardless of who takes the lead in initiating the project, participating in such projects can help farmers learn about new technologies while helping researchers determine the results of new technologies. The results of the research can help NRCS identify new and innovative techniques to address on farm conservation problems.

**Conditions Where Enhancement Applies**

This enhancement applies to all crop, pasture, range or forest land use acres.



### **Criteria**

On-Farm Research and Demonstration projects consists of implementing applied research on working land to gather information and demonstrate the effectiveness of new and innovative conservation activities. The research projects must be conducted by an individual or entity that seeks to determine the value of a conservation practice, component, treatment, or process. The individual or entity must have the means and expertise to conduct the research, analyze the findings and develop conclusions from the findings that are relevant to NRCS. Projects are preapproved by the NRCS State Conservationist in each state.

This is not intended to require farmers to initiate on farm research and demonstrations but rather to encourage them to participate in new or ongoing research projects sponsored by other responsible parties such as universities or other research oriented entities. However, if farmers have the necessary capability to conduct scientific research, they can initiate their own projects within the topic areas identified by their state and the criteria of this activity.

The farmer may chose to work independently, or to collaborate with other farmers, a non-governmental organization, extension, university, NRCS, and/or other entities to help with trial design and protocol, and the conduct of the study or data collection. The farmer is not required to work with an outside group. However, if working independently, the participant must be able to demonstrate the ability to manage and lead an applied research project.

When field trials or other research on a particular practice, enhancement, or conservation topic are conducted on multiple farms, each farm is eligible for this enhancement. However, enrollment in the CSP is not a requirement for all farms participating in a multiform research project under this enhancement.

Participants will need to follow criteria as outlined for each project that include:

- Goals of the research and demonstration
- A schedule showing completion of the project during the contract period
- A chronological list or plan of activities expected to take place during the project
- Planned end products or outcomes from the project
- Acreage needed
- Years research is to be conducted
- Farm inputs, equipment needs, etc.
- Expected assistance with data collection

### **Adoption Requirements**

This enhancement is considered adopted when the pre-approved applied research project has been implemented and monitored according protocols developed specifically for the project and events to publicize the project have been held.

### **Documentation Requirements**

- Research plan, including objectives, resource concerns addressed, experimental design, and data to be gathered.



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- Results or conclusions from the research and demonstration
- Plan for disseminating project outcomes
- The farmer is committed to sharing research plans, data summary, and project outcomes in writing with NRCS and with other farmers and the general public through written summaries, on-farm events, or oral presentations.
- Farmers are encouraged but not required to work with their NRCS and/or extension agents to have at least one field day/open house where the experimental practices can be reviewed and discussed with the public.
- Documentation of the CSP participant's participation in the research project including:
  - A schedule of activities undertaken by the participant
  - Fields or other areas of the farm involved in the research



## **Conservation Stewardship Program On-Farm Research and Demonstration Projects and Research Entity Requirements**

### **Overview**

The Conservation Stewardship Program (CSP) encourages participants to address resource concerns in a comprehensive manner by undertaking additional conservation activities, and improving, maintaining, and managing existing conservation activities. This enhancement is eligible for cropland, pastureland, rangeland, and non-industrial private forestland. CSP enhancements means a type of activity installed and adopted to treat natural resources and improve conservation performance. Many of the CSP enhancements are related to existing NRCS conservation practice standards, but at a management intensity level that exceeds minimum practice standards.

On-Farm Research and Demonstration projects consists of implementing applied research on working land to gather information and demonstrate the effectiveness of new and innovative conservation activities. The research projects must be conducted by an entity that seeks to determine the value of a conservation practice, component, treatment, or process. These projects are designed to encourage applicants to participate in new or ongoing research where participation is needed from working land. Interested researchers gain access to farmers that are willing to follow research protocols on their farm across a broad landscape. Farmers participating in such projects learn about new technology first hand, helping to determine how new technology will be applied.

NRCS invites interested researchers to submit their projects for inclusion as eligible On-Farm Research and Demonstrations. The purpose of this activity is not to provide primary funding for a research project, but to expand the area and acreage from which research data is collected. CSP applicants that choose to participate in On-Farm Research and Demonstrations are awarded conservation performance points that improve their CSP ranking and increase annual payment levels.

### **Project Criteria:**

#### **Eligible Entities**

#### **Research Entity Requirements**

Entities must be able to demonstrate their means and expertise to conduct on-farm research, analyze findings, and develop conclusions that are relevant to NRCS. Eligible research institutions include land grant universities and others, who have ongoing research or the potential for research in the focus areas. Individual farmers are encouraged to participate in identified on-farm projects. However, if they have the necessary capability to conduct scientific research they can initiate their own proposal for consideration.

#### **Research Project Requirements**

Projects must address one of the resource concerns identified by NRCS as a national technology focus area and be conducted by a creditable research entity. States will identify specific projects within the national focus areas that they want to offer to CSP applicants in their states. Research projects should follow scientific methods that include project goals, hypotheses, data collection methods, results, summary, etc.



### **Project Documentation**

Creditable research entities must submit a copy of their research project documentation for a State to use in selecting those projects that will be offered to applicants. The document should include:

- a. Title of Research Project
- b. Research Director/Manager work affiliation and contact information (phone, email, etc.)
- c. Name and brief description of the research entity submitting the proposal, along with similar information for other collaborating researchers, if applicable
- d. General description and/or summary of research to be conducted, specifying the national focus that is being addressed:
  - Air
  - Animal
  - Energy
  - Plant
  - Soil Erosion
  - Soil Quality
  - Water Quality
  - Water Quantity
- e. The geographic location (e.g. state, county) or farm enterprise (peach growers, cattle producers) targeted by the research
- f. Researcher expectation of participants, explaining what the participants will need to provide as part of the project. This should include acreage, number of years research is to be conducted, farm inputs, equipment needs, and/or assistance with data collection.
- g. Total number of on-farm research sites needed
- h. Copy of research projects final report for NRCS use

### **Evaluation Criteria**

States should select research projects that will be offered to applicants based on the following or similar evaluation criteria:

- a. Research purpose and goals as related to the resource focus area
- b. Potential for success and adoption on a broad scale
- c. Number of participants the research can appropriately involve
- d. Demonstration of new and innovative approach to conservation
- e. Design and implementation of research based on sound methodology and/or demonstrated technology
- f. Capability of the entity to conduct scientific research
- g. Potential to transfer the approach or technology nationally or to other geographic or socio-economic areas
- h. Development or improvement of NRCS technical or related materials that will help foster expanded adoption of the innovative technology or approach

This information can be presented to interested participants as a fact sheet that outlines their involvement. Enhancement Job Sheet must be provided for additional information. States will notify the Field of the selected projects and associated entities that will be offered and available to applicants.

**Cropland Enhancement Bundle – BCR06 (Improves nutrient and pesticide application techniques and widens buffers)**



**Enhancement Description**

This bundle of enhancement activities includes: AIR04- Use drift reducing nozzles, low pressures, lower boom height, and adjuvants to reduce pesticide drift; AIR07- GPS, targeted spray application (SmartSprayer), or other chemical application electronic control technology; WQL11-Precision application technology to apply nutrients; WQL13-High level IPM to reduce pesticide environmental risk; and one of the buffer widening enhancements ANM05, ANM07 or ANM32.

**Land Use Applicability**

Cropland

**Benefits**

This bundle of enhancements is focused on applying nutrients and pesticides using technologies that will limit their impact on the environment. The inclusion of one of the buffer widening enhancements will provide further protection of off-site areas from the impact of agricultural operations. By implementing these activities together a synergy is achieved that should result in more conservation benefits than might be expected from the individual activities. Applicants that choose to implement this bundle of activities will receive an increase in ranking and activity points.

**Conditions Where Enhancement Applies**

This enhancement applies to all crop land use acres.

**Criteria**

Bundle rules

1. All of the activities in the bundle must be implemented. However, if an applicant is already implementing 1 or 2 of the activities, they are still eligible for the bundle and only need to implement the remaining 3 or 4 activities.
2. Applicants will be required to install all enhancements in the bundle wherever they are needed on the applied area.
3. Other enhancements cannot be substituted for those in the bundles.
4. Applicants choose the acres of their operation where they want to implement the bundle. If the applicant chooses to implement the activity on only a portion of their operation, their ranking and performance points will be reduced proportionally.
5. The amount of the bundle that can be scheduled cannot exceed the most limiting individual “system” enhancement scheduled.



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Follow the criteria in the respective enhancement activity sheets to implement each enhancement in the bundle.

For this bundle, implement AIR04, AIR07, WQL11 and WQL13 according to their respective criteria on all of the area selected for bundle application. Implement the buffer widening enhancements ANM05, ANM07 or ANM32 where needed according to the criteria for the respective enhancements. If a buffer is needed to address a resource concern but does not exist, the requirements of this bundle can be met by installing a new buffer to the minimum width required by these enhancements.

### **Adoption Requirements**

This enhancement is considered adopted when rules # 1 and 2 from “Rules for Enhancement Activity Bundles” above have been fulfilled.

### **Documentation Requirements**

Follow the documentation requirements in the respective enhancement activity sheets to document the implementation of each enhancement in the bundle.

In addition, document the actual amount, fields and when each enhancement in the bundle is applied:

<b>Enhancement Activity</b>	<b>Amount (unit)</b>	<b>Field(s) Number or Name</b>	<b>Year Applied</b>
<b>AIR04</b>			
<b>AIR07</b>			
<b>WQL11</b>			
<b>WQL13</b>			
<b>ANM05, 07 or 32</b>			

**Cropland Enhancement Bundle – BCR09 (Addresses orchard and vineyard resource concerns)**



**Enhancement Description**

This bundle of enhancement activities includes: AIR03-Replace burning of pruning, removals and other crop residues with non-burning alternatives; AIR04-Use of drift reducing nozzles, low pressures, lower boom height, and adjuvants to reduce pesticide drift; PLT15-Establish pollinator and/or beneficial insect habitat; SQL11-Cover cropping in orchards, vineyards and other woody perennial horticultural crops; and WQL13-High level IPM to reduce pesticide environmental risk.

**Land Use Applicability**

Cropland

**Benefits**

This bundle of enhancements is focused on activities that address air, water and soil resource concern in orchards and vineyards. Implementing these activities together creates a synergy that should result in more conservation benefits than might be expected from the individual activities. Applicants that choose to implement this bundle of activities will receive an increase in ranking and activity points.

**Conditions Where Enhancement Applies**

This enhancement applies only to acres of orchards and vineyards in the crop land use.

**Criteria**

Bundle rules

1. All of the activities in the bundle must be implemented. However, if an applicant is already implementing 1 or 2 of the activities, they are still eligible for the bundle and only need to implement the remaining 3 or 4 activities.
2. Applicants will be required to install all enhancements in the bundle wherever they are needed on the applied area.
3. Other enhancements cannot be substituted for those in the bundles.
4. Applicants choose the acres of their operation where they want to implement the bundle. If the applicant chooses to implement the activity on only a portion of their operation, their ranking and performance points will be reduced proportionally.
5. The amount of the bundle that can be scheduled cannot exceed the most limiting individual “system” enhancement scheduled.



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For this bundle implement AIR03, AIR04, PLT15, SQL11 and WQL13 according to their respective criteria on all of the area selected for bundle application.

If the orchard or vineyard can benefit from any of the criteria listed in SQL11 a state can require that it be implemented, otherwise if existing cover is adequate to meet the resource needs, SQL11 does not have to be implemented.

**Adoption Requirements**

This enhancement is considered adopted when rules # 1 and 2 from “Rules for Enhancement Activity Bundles” above have been fulfilled.

**Documentation Requirements**

Follow the documentation requirements in the respective enhancement activity sheets to document the implementation of each enhancement.

In addition, document the actual amount, fields and when each enhancement in the bundle is applied:

<b>Enhancement Activity</b>	<b>Amount (unit)</b>	<b>Field(s) Number or Name</b>	<b>Year Applied</b>
<b>AIR03</b>			
<b>AIR04</b>			
<b>PLT15</b>			
<b>SQL11</b>			
<b>WQL13</b>			

**Forest Enhancement Bundle –BFO07 (Improves wildlife habitat in conifer or mixed forests)**



**Enhancement Description**

This bundle of enhancement activities includes: ANM12-Shallow water habitat; PLT15-Establish pollinator and/or beneficial insect habitat; PLT21-Forest stand improvement pre-treating vegetation and fuels preceding a prescribed fire; WQL01-Biological suppression and other non-chemical techniques to manage brush, weeds and invasive species; and WQL13-High level IPM to reduce pesticide environmental risk.

**Land Use Applicability**

Forestland

**Benefits**

This bundle of enhancements is focused on activities that will improve wildlife habitat and soil quality. Implementing these activities together creates a synergy that should result in more conservation benefits than might be expected from the individual activities. Applicants that choose to implement this bundle of activities will receive an increase in ranking and activity points.

**Conditions Where Enhancement Applies**

This enhancement applies to all forest land use acres.

**Criteria**

**Bundle rules**

1. All of the activities in the bundle must be implemented. However, if an applicant is already implementing 1 or 2 of the activities, they are still eligible for the bundle and only need to implement the remaining 3 or 4 activities.
2. Applicants will be required to install all enhancements in the bundle wherever they are needed on the applied area.
3. Other enhancements cannot be substituted for those in the bundles.
4. Applicants choose the acres of their operation where they want to implement the bundle. If the applicant chooses to implement the activity on only a portion of their operation, their ranking and performance points will be reduced proportionally.
5. The amount of the bundle that can be scheduled cannot exceed the most limiting individual “system” enhancement scheduled.



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Follow the criteria in the respective enhancement activity sheets to implement each enhancement.

For this bundle implement ANM12, PLT15, PLT21, WQL01, and WQL13 according to their respective criteria on all of the area selected for bundle application.

**Adoption Requirements**

This enhancement is considered adopted when rules # 1 and 2 from “Rules for Enhancement Activity Bundles” above have been fulfilled.

**Documentation Requirements**

Follow the documentation requirements in the respective enhancement activity sheets to document the implementation of each enhancement.

In addition, document the actual amount, fields and when each enhancement in the bundle is implemented:

<b>Enhancement Activity</b>	<b>Amount (unit)</b>	<b>Field(s) Number or Name</b>	<b>Year Applied</b>
<b>ANM12</b>			
<b>PLT15</b>			
<b>PLT21</b>			
<b>WQL01</b>			
<b>WQL13</b>			

**Forest Enhancement Bundle –BFO08 (Improves wildlife habitat in hardwood or mixed forests)**



**Enhancement Description**

This bundle of enhancement activities includes: ANM12-Shallow water habitat; PLT15-Establish pollinator and/or beneficial insect habitat; PLT17-Create forest openings to improve hardwood stands; WQL01-Biological suppression and other non-chemical techniques to manage brush, weeds and invasive species; and WQL13-High level IPM to reduce pesticide environmental risk.

**Land Use Applicability**

Forestland

**Benefits**

This bundle of enhancements is focused on activities that will improve wildlife habitat and soil quality. Implementing these activities together creates a synergy that should result in more conservation benefits than might be expected from the individual activities. Applicants that choose to implement this bundle of activities will receive an increase in ranking and activity points.

**Conditions Where Enhancement Applies**

This enhancement applies to all forest land use acres.

**Criteria**

**Bundle rules**

1. All of the activities in the bundle must be implemented. However, if an applicant is already implementing 1 or 2 of the activities, they are still eligible for the bundle and only need to implement the remaining 3 or 4 activities.
2. Applicants will be required to install all enhancements in the bundle wherever they are needed on the applied area.
3. Other enhancements cannot be substituted for those in the bundles.
4. Applicants choose the acres of their operation where they want to implement the bundle. If the applicant chooses to implement the activity on only a portion of their operation, their ranking and performance points will be reduced proportionally.
5. The amount of the bundle that can be scheduled cannot exceed the most limiting individual “system” enhancement scheduled.

Follow the criteria in the respective enhancement activity sheets to implement each enhancement.



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For this bundle implement ANM12, PLT15, PLT17, WQL01, and WQL13 according to their respective criteria on all of the area selected for bundle application.

**Adoption Requirements**

This enhancement is considered adopted when rules # 1 and 2 from “Rules for Enhancement Activity Bundles” above have been fulfilled.

**Documentation Requirements**

Follow the documentation requirements in the respective enhancement activity sheets to document the implementation of each enhancement.

In addition, document the actual amount, fields and when each enhancement in the bundle is implemented:

<b>Enhancement Activity</b>	<b>Amount (unit)</b>	<b>Field(s) Number or Name</b>	<b>Year Applied</b>
<b>ANM12</b>			
<b>PLT15</b>			
<b>PLT17</b>			
<b>WQL01</b>			
<b>WQL13</b>			

**Pasture Enhancement Bundle –BPA07 (Improves forage utilization)**



**Enhancement Description**

This bundle of enhancement activities includes: ANM25-Stockpiling of forages to extend the grazing season; ANM26- Managing calving to coincide with forage availability; ANM29-On-farm forage based grazing system; PLT16-Intensive rotational grazing; and WQL07-Split nitrogen applications 50% after the crops/pasture emerge/green-up.

**Land Use Applicability**

Pastureland

**Benefits**

This bundle of enhancements is focused on activities that improve forage utilization for a longer period of the growing season while saving energy, protecting water quality and improving soil. Implementing these activities together creates a synergy that should result in more conservation benefits than might be expected from the individual activities. Applicants that choose to implement this bundle of activities will receive an increase in ranking and activity points.

**Conditions Where Enhancement Applies**

This enhancement applies to all pasture land use acres.

**Criteria**

Bundle rules

1. All of the activities in the bundle must be implemented. However, if an applicant is already implementing 1 or 2 of the activities, they are still eligible for the bundle and only need to implement the remaining 3 or 4 activities.
2. Applicants will be required to install all enhancements in the bundle wherever they are needed on the applied area.
3. Other enhancements cannot be substituted for those in the bundles.
4. Applicants choose the acres of their operation where they want to implement the bundle. If the applicant chooses to implement the activity on only a portion of their operation, their ranking and performance points will be reduced proportionally.
5. The amount of the bundle that can be scheduled cannot exceed the most limiting individual “system” enhancement scheduled.



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Follow the criteria in the respective enhancement activity sheets to implement each enhancement.

For this bundle implement ANM25, ANM26, ANM29, PLT16, and WQL07 according to their respective criteria on all of the area selected for bundle application.

**Adoption Requirements**

This enhancement is considered adopted when rules # 1 and 2 from “Rules for Enhancement Activity Bundles” above have been fulfilled.

**Documentation Requirements**

Follow the documentation requirements in the respective enhancement activity sheets to document the implementation of each enhancement.

In addition, document the actual amount, fields and when each enhancement in the bundle is implemented:

<b>Enhancement Activity</b>	<b>Amount (unit)</b>	<b>Field(s) Number or Name</b>	<b>Year Applied</b>
<b>ANM25</b>			
<b>ANM26</b>			
<b>ANM29</b>			
<b>PLT16</b>			
<b>WQL07</b>			

**Pasture Enhancement Bundle –BPA09 (Addresses multiple resource concerns)**



**Enhancement Description**

This bundle of enhancement activities includes: AIR04-Use drift reducing nozzles, low pressures, lower boom height, and adjuvants to reduce pesticide drift; ANM03-Incorporate native grasses and/or legumes into 15% or more of herbage dry matter productivity; ANM27-Wildlife friendly fencing; PLT16-Intensive rotational grazing, and WQL07-Split nitrogen applications 50% after the crops/pasture emerge/green-up.

**Land Use Applicability**

Pastureland

**Benefits**

This bundle of enhancements is focused on activities that address all aspects of pasture management: pests, nutrients and forage quality while improving wildlife access to water. Implementing these activities together creates a synergy that should result in more conservation benefits than might be expected from the individual activities. Applicants that choose to implement this bundle of activities will receive an increase in ranking and activity points.

**Conditions Where Enhancement Applies**

This enhancement applies to all pastureland use acres.

**Criteria**

Bundle rules

1. All of the activities in the bundle must be implemented. However, if an applicant is already implementing 1 or 2 of the activities, they are still eligible for the bundle and only need to implement the remaining 3 or 4 activities.
2. Applicants will be required to install all enhancements in the bundle wherever they are needed on the applied area.
3. Other enhancements cannot be substituted for those in the bundles.
4. Applicants choose the acres of their operation where they want to implement the bundle. If the applicant chooses to implement the activity on only a portion of their operation, their ranking and performance points will be reduced proportionally.
5. The amount of the bundle that can be scheduled cannot exceed the most limiting individual “system” enhancement scheduled.



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Follow the criteria in the respective enhancement activity sheets to implement each enhancement.

For this bundle implement AIR04, ANM03, ANM27, PLT16, and WQL07 according to their respective criteria on all of the area selected for bundle application.

**Adoption Requirements**

This enhancement is considered adopted when rules # 1 and 2 from “Rules for Enhancement Activity Bundles” above have been fulfilled.

**Documentation Requirements**

Follow the documentation requirements in the respective enhancement activity sheets to document the implementation of each enhancement.

In addition, document the actual amount, fields and when each enhancement in the bundle is implemented:

<b>Enhancement Activity</b>	<b>Amount (unit)</b>	<b>Field(s) Number or Name</b>	<b>Year Applied</b>
<b>AIR04</b>			
<b>ANM03</b>			
<b>ANM27</b>			
<b>PLT16</b>			
<b>WQL07</b>			

**Range Enhancement Bundle –BRA08 (Addresses multiple resource concerns)**



**Enhancement Description**

This bundle of enhancement activities includes: ANM09-Grazing management to improve wildlife habitat; ANM26-Managing calving to coincide with forage availability; PLT02-Monitor key grazing areas to improve grazing management; WQL03-Rotation of supplement and feeding areas; and WQL13-High level IPM to reduce pesticide environmental risk.

**Land Use Applicability**

Rangeland

**Benefits**

This bundle of enhancements is focused on activities that increase wildlife habitat, improve forage utilization and mitigate environmental risk associated with pesticide use. Implementing these activities together creates a synergy that should result in more conservation benefits than might be expected from the individual activities. Applicants that choose to implement this bundle of activities will receive an increase in ranking and activity points.

**Conditions Where Enhancement Applies**

This enhancement applies to all rangeland use acres.

**Criteria**

Bundle rules

1. All of the activities in the bundle must be implemented. However, if an applicant is already implementing 1 or 2 of the activities, they are still eligible for the bundle and only need to implement the remaining 3 or 4 activities.
2. Applicants will be required to install all enhancements in the bundle wherever they are needed on the applied area.
3. Other enhancements cannot be substituted for those in the bundles.
4. Applicants choose the acres of their operation where they want to implement the bundle. If the applicant chooses to implement the activity on only a portion of their operation, their ranking and performance points will be reduced proportionally.
5. The amount of the bundle that can be scheduled cannot exceed the most limiting individual “system” enhancement scheduled.

Follow the criteria in the respective enhancement activity sheets to implement each enhancement.



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For this bundle implement ANM09, ANM26, PLT02, WQL03 and WQL13 according to their respective criteria on all of the area selected for bundle application.

**Adoption Requirements**

This enhancement is considered adopted when rules # 1 and 2 from “Rules for Enhancement Activity Bundles” above have been fulfilled.

**Documentation Requirements**

Follow the documentation requirements in the respective enhancement activity sheets to document the implementation of each enhancement.

In addition, document the actual amount, fields and when each enhancement in the bundle is implemented:

<b>Enhancement Activity</b>	<b>Amount (unit)</b>	<b>Field(s) Number or Name</b>	<b>Year Applied</b>
<b>ANM09</b>			
<b>ANM26</b>			
<b>PLT02</b>			
<b>WQL03</b>			
<b>WQL13</b>			

**Range Enhancement Bundle –BRA09 (Addresses multiple resource concerns)**



**Enhancement Description**

This bundle of enhancement activities includes: ANM09-Grazing management to improve wildlife habitat; ANM11-Patch-burning to enhance wildlife habitat; ANM26-Managing calving to coincide with forage availability, ANM27-Wildlife friendly fencing, and WQL13-High level IPM to reduce pesticide environmental risk.

**Land Use Applicability**

Rangeland

**Benefits**

This bundle of enhancements is focused on activities that increase wildlife habitat, improve forage utilization and mitigate environmental risk associated with pesticide use. Implementing these activities together creates a synergy that should result in more conservation benefits than might be expected from the individual activities. Applicants that choose to implement this bundle of activities will receive an increase in ranking and activity points.

**Conditions Where Enhancement Applies**

This enhancement applies to all rangeland use acres.

**Criteria**

**Bundle rules**

1. All of the activities in the bundle must be implemented. However, if an applicant is already implementing 1 or 2 of the activities, they are still eligible for the bundle and only need to implement the remaining 3 or 4 activities.
2. Applicants will be required to install all enhancements in the bundle wherever they are needed on the applied area.
3. Other enhancements cannot be substituted for those in the bundles.
4. Applicants choose the acres of their operation where they want to implement the bundle. If the applicant chooses to implement the activity on only a portion of their operation, their ranking and performance points will be reduced proportionally.
5. The amount of the bundle that can be scheduled cannot exceed the most limiting individual “system” enhancement scheduled.

Follow the criteria in the respective enhancement activity sheets to implement each enhancement.

For this bundle implement ANM09, ANM11, ANM26, ANM27 and WQL13 according to their respective criteria on all of the area selected for bundle application.



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**Adoption Requirements**

This enhancement is considered adopted when rules # 1 and 2 from “Rules for Enhancement Activity Bundles” above have been fulfilled.

**Documentation Requirements**

Follow the documentation requirements in the respective enhancement activity sheets to document the implementation of each enhancement.

In addition, document the actual amount, fields and when each enhancement in the bundle is implemented:

<b>Enhancement Activity</b>	<b>Amount (unit)</b>	<b>Field(s) Number or Name</b>	<b>Year Applied</b>
<b>ANM09</b>			
<b>ANM11</b>			
<b>ANM26</b>			
<b>ANM27</b>			
<b>WQL13</b>			