



From Field to Faucet: Farm Conservation Plans and Source Water Protection

Lesson: 13

National Science
Education
Standards for
Grades 9-12

Content Standard E: Science and Technology: Understandings About Science and Technology

- *Technological designs have constraints. Some constraints are unavoidable, for example, properties of materials, or effects of weather and friction; other constraints limit choices in the design, for example, environmental protection, human safety and aesthetics.*

Content Standard F: Science in Personal and Social Perspectives: Science and Technology in Local, National, and Global Challenges

- *Humans have a major effect on other species. For example, the influence of humans on other organisms occurs through land use—which decreases space available to other species—and pollution—which changes the chemical composition of air, soil and water to society, as well as cause risks.*

Student Learning
Objectives

- 13.1 Describe the factors assessed in a farm conservation inventory for:
 - A. Public health and safety
 - B. Land treatment practices
 - C. Grazing and pasture land management
 - D. Nitrogen and phosphorus management
 - E. Manure and wastewater handling and storage
- 13.2 Compile and analyze data to describe part of a farm conservation plan.

**Teacher Info
Table Time**

Instruction time for this lesson: 45 minutes, or field trip, dependent on choice of activities

**Resources,
Tools, Equipment
and Supplies**

13.1 Describe the factors assessed in a farm conservation inventory

Resources

- Components of a Farm Inventory, Slide SW.13.1.AS
- NRCS Comprehensive Nutrient Management Planning (CNMP): Plan Development Resources and References, <http://www.wi.nrcs.usda.gov/technical/cnmp.html>

Homework:

- Common Manure Handling Systems, Ag 101, EPA: <http://www.epa.gov/agriculture/ag101/porkmanure.html>
 - Drainage, Ag 101, EPA: <http://www.epa.gov/oecaagct/ag101/cropdrainage.html>
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Key Terms

Biosecurity

Comprehensive nutrient management plan

Farm inventory

Septic system

Well casing

SUMMARY OF CONTENT AND TEACHING STRATEGIES (BACKGROUND FOR TEACHERS):

Farm Conservation Plans and Inventories

- What is a farm conservation plan?

A farm conservation plan is a comprehensive plan that farmers develop to help maximize productivity while protecting natural resources on the farm and in their communities. The plan helps farmers manage farm pollution to prevent contamination of drinking water sources.

Farmers may want to develop different types of management plans such as a risk management plan, an energy management, a land management plan or a grazing, feed, pest or nutrient management plan.

A Comprehensive nutrient management plan (CNMP) is one type of farm conservation plan. Here the term “nutrient” refers to excess nitrogen and phosphorus that needs managing. The Management Plan identifies management and conservation actions that will be followed to meet clearly defined soil and water conservation goals, including nutrient management on an animal feeding operation. A CNMP includes the following elements:

- Introduction
- General information
- Emergency plan
- Maps and site photos
- Manure and wastewater handling and storage
- Public health and safety
- Land treatment practices (conservation plan)
- Nutrient management plan
- Record keeping
- Feed management plan
- Pest management plan
- Prescribed grazing plan

- How is an inventory used to develop the conservation plan?¹

After completing the inventory, farmers evaluate and analyze the information, write up the plan and then begin to implement the plan.

- What is a farm inventory?²

A farm inventory is a process used to document practices and strategies adopted by farm operations to address natural resource concerns related to nutrient management, grazing practices, soil erosion, feed management and disposal of organic by-products such as livestock manure or waste water discharge from a milking barn. A surface and groundwater protection practice inventory, in addition to the above items, would also include evaluation of pesticide mixing practices, petroleum product handling, well and abandoned well management, and disposal of hazardous chemicals used in maintaining farm equipment or buildings. These practices can also affect the health of farm families and communities, which use the affected water as a drinking water source.

Managing Nonpoint Source Pollution on the Farm

A. How different land uses affect runoff

1. Forest land – high infiltration

- a. Most rain soaks into the soil (infiltrates), where it eventually is used by growing plants or percolates to groundwater
- b. Groundwater flows slowly into streams, usually over a period of months (depending on soil types)
- c. Groundwater also provides steady base flow (flow in streams in times without rainfall) that fish and other aquatic life need
- d. The more forest cover in a watershed the lower the treatment costs for drinking water (2002 study of 27 water suppliers conducted by the Trust for Public Land and the American Water Works Association, (<http://www.tpl.org/research/land-water/making-the-case/the-cost-of-not-protecting.html>))

2. Commercial and residential use – low infiltration

- a. Most rain runs off immediately
- b. Drains into storm sewers that transport it to a ditch, stream or river

3. Agricultural land – intermediate infiltration

- a. Some rainfall runs off, while some infiltrates into the ground
- b. Infiltrated water can be used by plants, recharge groundwater, or provide base flow for streams and rivers

¹ NRCS Comprehensive Nutrient Management Planning (CNMP): Plan Development Resources and References, <http://www.wi.nrcs.usda.gov/technical/cnmp.html>

² Farm*A*Syst program resources, <http://www.uwex.edu/farmasyst>

B. Crop production methods and protecting drinking water sources.

1. Nutrient Management:

- a. Rates: Apply only the amount of nutrients needed to grow crop based on realistic yield goals and soil tests
- b. Timing: Apply nutrient as close as possible to the period of rapid crop uptake
- c. Method: Incorporate nutrients into the soil while disturbing as little soil as possible
- d. Form or type of fertilizer: Choose nitrogen sources that are more likely to be held in the soil
- e. Weather

C. Types of Conservation Practices

1. Nutrient management – appropriate application rate, timing of application, method of application, and form of nutrient.

a. Fertilizer application considerations:

i. Methods

- 1. Rates: Applying only the amount of nutrients needed to grow crop based on realistic yield goals.
- 2. Timing: Applying fertilizer at the best time for plant uptake and therefore reduced runoff or leaching to water.

ii. Form or type of fertilizer

iii. Weather

2. Conservation Tillage - a method of soil cultivation that leaves the previous year's crop residue (such as corn stalks or wheat stubble) on fields before and after planting the next crop, to reduce soil erosion and runoff.

3. Integrated Pest Management (IPM) - Management of pest damage by the most economical means, and with the least possible hazard to people, property, and the environment.

4. Buffers - A strip of land, trees, or other vegetation used to “buffer” or filter out chemicals before they reach the water source. Areas of vegetation, such as grasses and trees, between a field and a water source. These zones allow pollutants to be filtered naturally before getting into water source.

5. Irrigation - operate irrigation systems so that the timing and amount of irrigation water applied match crop water needs.

6. Drainage water management: Minimize nutrients leaving tile drains or ditches through controlled drainage such as two-stage ditches or other practices such as constructed wetlands.

7. Stream fencing and alternative water source - placing a fence near a stream or around a pond to keep out livestock.
8. Proper grazing - planting the correct type of vegetation for livestock as well as managing the livestock use of the pasture.
9. Recycle water for reuse - Collect rainwater in barrels for watering plants and gardens.

INTEREST APPROACH:

Students will explore the components of a farm inventory and identify those that relate to water quality in this lesson.

A suggestion for starting Lesson 13:

For a quick warm-up on compiling and evaluating inventories, ask students to take a sheet of scratch paper out and list as many components of your classroom as they can in three to five minutes. At the end of the recording time, ask for call-out answers—

- What have you got for furniture?
- Electronics?
- How about plans for safety? (fire escape, lockdown procedures)
- Classroom rules?

Query students for reasons a classroom inventory could be useful and to whom.

OBJECTIVE BY OBJECTIVE:

Activity Outline and Teacher Support Information:

13.1. Describe the factors assessed in a farm conservation inventory for:

- A. Public health and safety
- B. Land treatment practices
- C. Grazing and pasture land management
- D. Nitrogen and phosphorus management
- E. Others (local concerns)

Have students work in small groups to review the Components of a Farm Inventory Worksheet (SW.13.1.AS). Ask students to identify and list components in the inventory that may have source water quality or drinking water quantity implications. Ask each group to share two examples and explain why they chose those examples.

Components of a Farm Inventory

1. Facility site sketch. Include all buildings, manure storage and management, wells, streams, lakes, ponds, wetlands, drains/drainage ditches, fuel tanks, roads, fences, property lines, fertilizer storage, pesticide mixing.
2. Emergency response plan.
3. Maps and site photos. Include a soil map and a topographic map.
4. Manure and wastewater handling and storage.
5. Wells. Include distance to septic, barnyard or other potential contaminants, type of well, depth of well and condition of casing, well location, gradient from potential contaminant sources, well testing results and concerns, abandoned wells.
6. Mortality disposal procedures (dead livestock).
7. Medical waste disposal procedures.
8. Disposal of plastic and other solid waste material.
9. Storage and disposal of hazardous products (excluding herbicides and pesticides). Include type of product, type of storage, quantity, precautions to minimize risk, distance to nearby wells and potential for runoff to surface waters such as streams or ponds.

Components of a Farm Inventory *(continued)*

10. Petroleum storage. Include type, storage structure, max capacity for storage structure, spill containment procedures.
11. Pesticide storage and mixing. Include type of product, type of storage, quantity, precautions to minimize risk, distance to nearby wells and potential for runoff to surface waters such as streams or ponds.
12. Biosecurity (disease concerns).
13. Neighbors. Include proximity of neighbors; problems arising from facility management such as noise, dust, or smells; use of screens to enhance appearance from outside the farm.
14. Conservation plan. Does it address: soil loss potential, nutrient management techniques for crops and cropland and waterway descriptions.

If the following plans have already been developed, they would also be included in the inventory:

15. Nutrient management plan. Address what they included in the plan and whether it has been implemented.
16. Feed management. Address what is included in the plan and whether it has been implemented.
17. Pest management: Address what is included in the plan and whether it has been implemented.
18. Grazing and pasture land management: Address what is included in the plan and whether it has been implemented.

13.2. Compile and analyze data to describe part of a farm conservation plan.

13.2.a. Field trip to an Animal Feeding Operation (preferred activity):

In advance of the trip, contact a county extension agriculture educator or natural resource conservation service staff to choose a location and identify a certified comprehensive nutrient management plan (CNMP) expert to accompany the group. Ask the extension educator to meet with students in advance of the trip to provide an overview of the farm operation they will view, to walk through some of the questions that an expert would ask when developing a comprehensive nutrient management plan, and to demonstrate an example of data collection processes or techniques that might be applied in the inventory process. This is a good opportunity to review soil testing procedures and interpretation investigated in Lesson 5, for example. Students will use their practice farm inventory (worksheet

SW.13.1.AS) to guide their discussion with the extension educator. In preparing for the trip, ask the CNMP expert to identify two or three elements of the inventory, including nutrient management, as a focus for the trip, and to conduct a “walkover” taking students through any farm management areas relevant to that focus. If possible, share data previously collected for making a comprehensive plan for that farm, and ask the CNMP expert to engage the students in analyzing the data. Discuss with the farmer, extension educator, or other agriculture professional how that data might be used to inform the development of best practices.

OR

13.2.b. Students go on a virtual field trip:

Ask a county extension agriculture educator for help in identifying a nearby operation for a local agriculture enterprise (such as a beef, dairy, crop or tree farm), where farm inventory data has been gathered and incorporated into a comprehensive plan. Ask the farmer, the extension educator, or other agricultural professional to present sample segments of the data to the class, using as many visuals and examples of data as time allows. Ask the guest speaker to engage the students in analyzing the data and making recommendations for potential new practices and opportunities.

Current CAFO Regulations - Animal Thresholds

Animal Type	Large CAFO	Medium CAFO
Dairy Cows	700	200 - 699
Veal Calves	1,000	300 - 999
Beef Cattle	1,000	300 - 999
Swine	2,500 (55 lbs or more) 10,000 (under 55 lbs)	750 - 2,499 (55 lbs or more) 3,000 - 9,999 (under 55 lbs)
Horses	500	150 - 499
Sheep or Lambs	10,000	3,000 - 9,999
Turkeys	55,000	16,500 - 54,999
Chickens, liquid manure	30,000	9,000 - 29,999
Chickens, other than a liquid manure system	125,000 (not laying hens) 82,000 (laying hens)	37,500 -124,999 (not laying hens) 25,000 - 81,999 (laying hens)
Ducks	30,000 (except liquid manure system) 5,000 (liquid manure system)	10,000 – 29,999 (except liquid manure system) 1,500 – 4,999 (liquid manure system)

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REVIEW / SUMMARY:

Respond to the following questions in your journal:

1. What is one aspect of a farm inventory which could have an impact on drinking water quality that you find most interesting?
2. How does this element of a farm operation make a difference in the quality of drinking water?
3. How does the farm that you toured or learned about deal with this operation and what is the result to surrounding surface and groundwater?

APPLICATION:

Homework preparation for Lesson 14: Students should read the following resources for background information:

Common Manure Handling Systems, Ag 101, EPA: <http://www.epa.gov/agriculture/ag101/porkmanure.html>

Drainage, Ag 101, EPA: <http://www.epa.gov/oecaagct/ag101/cropdrainage.html>

EVALUATION AND ANSWERS:

SW.13.ASSESS

A farm inventory consists of multiple components of the physical structures and the plans and procedures of operation. Mark **T** for true next to components you would expect to find in a Farm Inventory. Mark **F** for false next to components that are not part of a Farm Inventory.

- | | |
|--|--|
| _____ Feed management | _____ Disposal of plastic and other solid waste material |
| _____ Emergency response plan | _____ Groundwater model |
| _____ Public service announcement | _____ Facility site sketch |
| _____ Soil map | _____ Petroleum storage |
| _____ Grazing management | _____ Pesticide storage and mixing |
| _____ Manure and wastewater handling and storage | _____ Safe Drinking Water Act |
| _____ Well testing results | _____ Dust and smell from neighboring farms |
| _____ Distance between septic and well | _____ Regional groundwater flow |
| _____ Mortality disposal procedures | _____ Nutrient management plan. |
| _____ Municipal sanitary waste treatment system | _____ Pest management |

Answers to SW.13.ASSESS

<u> T </u>	Feed management	<u> T </u>	Disposal of plastic and other solid waste material
<u> T </u>	Emergency response plan	<u> F </u>	Groundwater model
<u> F </u>	Public service announcement	<u> T </u>	Facility site sketch
<u> T </u>	Soil map	<u> T </u>	Petroleum storage
<u> T </u>	Grazing management	<u> T </u>	Pesticide storage and mixing
<u> T </u>	Manure and wastewater handling and storage	<u> F </u>	Safe Drinking Water Act
<u> T </u>	Well testing results	<u> T </u>	Dust and smell from neighboring farms
<u> T </u>	Distance between septic and well	<u> F </u>	Regional groundwater flow
<u> T </u>	Mortality disposal procedures	<u> T </u>	Nutrient management plan.
<u> F </u>	Municipal sanitary waste treatment system	<u> T </u>	Pest management

ACTIVITY WORKSHEET(S) – AS NEEDED:

SW.13.1.AS

Components of a Farm Inventory:

1. Facility site sketch. Include all buildings, manure storage and management, wells, streams, lakes, ponds, wetlands, fuel tanks, roads, fences, property lines, fertilizer storage, pesticide mixing.
2. Emergency response plan.
3. Maps and site photos. Include a soil map and a topographic map.
4. Manure and wastewater handling and storage.
5. Wells. Include distance to septic, barnyard or other potential contaminants, type of well, depth of well and condition of casing, well location, well testing results and concerns.
6. Mortality disposal procedures (dead livestock).
7. Medical waste disposal procedures.
8. Disposal of plastic and other solid waste material.
9. Storage and disposal of hazardous products (excluding herbicides and pesticides). Include type of product, type of storage, quantity, precautions to minimize risk, distance to nearby wells and potential for runoff to surface waters such as streams or ponds.
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14. Conservation plan. Does it address: soil loss potential, nutrient management techniques for crops, cropland and waterway descriptions.
15. Nutrient management plan: Address what is included and whether it has been implemented.

SW.13.1.AS *(continued)*

16. Feed management: Address what is included and whether it has been implemented.
17. Pest management: Address what is included and whether it has been implemented.
18. Grazing and pasture land management: Address what is included and whether it has been implemented.