Conservation Choices

Your guide to 30 conservation and environmental farming practices

U.S. Department of Agricutlure

NRCS Natural Resources Conservation Service

About this guide

This guide features 30 different conservation and environmental farming practices. It explains how each practice works and how it helps improve a farm, lists items to think about when considering each practice, gives some information on NRCS technical standards, and talks about maintenance needs.

Each practice will work most effectively in combination with others as part of a total resource management system.

Five symbols are used throughout the book to show the benefits of each practice featured in the guide. Explanations of the symbols are listed below.

Benefit symbols

This practice helps reduce soil erosion and sediment runoff, or may add organic matter to the soil

Help protect or improve water quality with this practice.

Use this practice to increase profits by reducing costs, increasing production or both.

You're thinking of wildlife by providing habitat or food sources with this practice.

This practice helps improve air quality by reducing odor and other problems.

Contact your local NRCS office for detailed information concerning your land.

About total resource

The key to a successful total resource management system is careful, complete planning.

Like the pieces of a jigsaw puzzle, each practice fits together with others to complete a picture. But anybody who has spent a rainy Sunday afternoon piecing together a jigsaw puzzle knows it takes patience, organization and teamwork.

When designing a total resource management plan you need to consider all the resources on your farm. Take an inventory; think about every field, pasture, pond, stream, and wooded area. Then consider which soil conservation, water quality, wildlife habitat and energy conservation practices would contribute to an environmentally and economically sound farm.

Some of the most profitable practices, like pest or nutrient management take little or no financial investment and may have the highest impact on water quality.

management

For example, scouting crops, selecting pest control alternatives and targeting control in problem areas can cut expenses and improve water quality.

The planning process may seem overwhelming, but that is where teamwork can help.

There are federal, state and local agencies available to help you plan, implement and maintain your total resource management system. You might also consider using a private crop consultant.

Make use of the technical experts to choose sound environmental, conservation and profitable practices for your farm.

Total resource management checklist: some basic questions

What are the natural resources on my farm?

What are the crops to be grown?

Have I minimized runoff?

Am I using crop rotations to reduce disease and pest problems?

What type of wildlife would I like on my farm?

Does any practice interfere with or cancel out another practice?

Can I use wetlands or filter strips to filter nutrients from runoff water?

Am I making the best use of animal manure as nutrients for plants?

Conservation Choices

The practices numbered below contribute to a well-rounded conservation and environmental farm. This photo shows many of the options available.

Use this booklet to identify the practices you might add to your farm. Then review each practice to see whether it could work with other practices to better protect your soil and water.

30 conservation and environmental choices

1. Woodland management
2. Planned grazing system
3. Manure storage
4. Farm pond
5. Wildlife upland habitat
6. Wildlife food plot
7. Filter strip
8. Grade control structure
9. Critical area planting
10. Contour stripcropping
11. Diversion
12. Grassed waterway
13. Contour buffer strip
14. Contour farming
15. Field border
16. Well protection
17. Windbreak
18. Pasture planting
19. Stream protection
20. Maure testing
21. Tree planting
22. Conservation tillage
23. Wetland enhancement
24. Crop rotation
25. Nutrient management
26. Wetland
27. Pest management
28. Water and sediment control basin
29. Terrace
30. Cover crop

1 Woodland management... improving the quality and quantity of woodland growing stock and maintaining ground cover and litter for soil and water conservation.

How it works

Existing woodland or other suitable land is dedicated to timber production. Livestock is excluded. Optimum tree populations are determined by the kinds of trees planted and their adaptability to your soils. Existing trees or newly planted trees are thinned, pruned and harvested to maintain desired production. Twigs, limbs and other debris are not removed, maintaining ground cover, reducing soil erosion and providing wildlife habitat. As trees mature they are harvested, and replacements are established.

How it helps

- Adds income to your farm.
- Adds beauty to your farm.
- Ground cover provides wildlife habitat, reduces soil erosion and improves water quality.

Planning ahead

- Do you need this land for livestock or crops?
- Are the trees you harvest going to be a marketable product?
- Can the soil support the type of trees and product you want?

Tech notes

- Plant trees that are suitable to your soils.
- Protect from grazing.
- Cut undesirable trees and shrubs that are competing with desired species for sunlight and moisture.
- Thin hardwood stands to a 12-foot spacing before trees are 5 inches in diameter at a 4 to 5 foot height.
- Thin conifer stands to a 10-foot spacing before trees are 5 inches in diameter at a 4 to 5 foot height.
- Do not cut vines unless they are interfering with trees with a high commercial value. Vines provide valuable cover for wildlife.

Maintenance

- Control weeds, brush and competing plants by mowing, spraying or cutting.
- Mow vegetative growth around new plantings until they are 3 to 4 feet high.
- Periodically check for rodent, insect or disease damage.

2 Planned grazing system... planting forage and using grazing rotations to maximize production and reduce sediment and nutrient runoff. Consider food, water and herd size.

How it works

Pasture is divided into two or more pastures or paddocks with fencing. Cattle are moved from paddock to paddock on a pre-arranged schedule based on forage availability and livestock nutrition needs.

How it helps

- Improves vegetative cover, reducing erosion and improving water quality.
- Increases harvest efficiency and helps ensure adequate forage throughout the grazing season.
- Increases forage quality and production which helps increase feed efficiency and can improve profits.
- Rotating also evenly distributes manure nutrient resources.

Planning ahead

- Is there enough water of good quality available in all pastures to meet the needs of your livestock?
- Is the mix of grass and legumes adequate for your herd and soil types?
- Will your pasture meet the nutrient needs of your cattle?
- Have you considered management alternatives for periods of low forage production?

Tech notes

- Plan your rotation so the same paddocks will not be grazed the same time year after year.
- Plan rest periods so each pasture (paddock) will have adequate time to recover during the growing season to promote plant growth.
- All livestock must be removed from pastures while they are being rested.

Maintenance

- Keep fencing secure.
- Some paddocks may need to be mowed or hayed during heavy growth periods.
- Remove pasture water systems during winter if necessary, and reinstall them in the spring.
- If herd size changes dramatically, update rotation schedule, paddock numbers and paddock size.
- Apply fertilizer and nutrients according to soil tests.

3

Manure storage...

structure that protects water bodies from manure runoff by storing manure until conditions are appropriate for field application.

How it works

The type of manure storage structure you would use depends upon your livestock operation, animal waste management system and planned field application. Several options exist including an earthen storage pond, above or below ground tank, pit underneath a confinement facility or a sheltered concrete slab area. Manure can be pumped, scraped and hauled, pushed or flushed into your storage structure. The structure's purpose is to safely contain the manure and keep nutrient loss and pollution of downstream water bodies to a minimum by preventing runoff.

How it helps

- Protects water quality, by preventing runoff from feedlots.
- Cuts fertilizer costs and reduces nutrient losses.
- Allows for field application when conditions are right.

Planning ahead

- Is the structure planned for the proper location considering the landscape, potential odor problems, visibility, aesthetic value and compatibility with existing farm buildings?
- Will the structure store manure in a form you have the equipment to handle?
- Are there buffer zones of vegetation around the structure to filter any runoff and to improve appearance?
- Is the structure the right size to handle the amount of manure produced by your livestock during the planned storage period?

Tech notes

- Storage period should be determined by manure use schedule. Plan to empty at least twice a year.
- If manure is stored as a solid, it should be protected from precipitation.
- Runoff from land surrounding livestock facilities should be diverted from storage structures.
- Structures should be fenced for livestock and human safety.
- Ramps built for handling equipment should meet safety standards.

Maintenance

- Watch for any leaks or seepage and make repairs.
- Repair any damaged fences immediately.

4

Farm pond...a pool of water formed by a dam or pit, to supply water for livestock, recreation and wildlife, and to control gully erosion.

How it works

A typical farm pond is formed by building a dam across an existing gully or low lying area. Earth for the dam is dug out above the dam with heavy machinery to form a bowl. Generally the ponded area fills with water within a year. An overflow pipe is installed through the dam to control the water level and allow water to spill through the dam without causing erosion.

How it helps

- Prevents soil erosion and protects water quality by collecting and storing runoff water.
- Provides water for livestock, fish and wildlife, and recreational opportunities.
- Adds value and beauty to a farm or farmstead.
- Provides a water supply for emergencies.

Planning ahead

- Are adequate soil conservation measures installed near the proposed pond site to protect it from filling with sediment?
- Is there a dependable source of clean water to fill the pond?
- Will the pond store enough water for proposed uses—i.e. livestock, wildlife and recreation?
- Is the soil at the proposed site capable of holding water?

Tech notes

- Provide for a natural or constructed spillway.
- If the dam is for a fish pond, the pool should have at least ½ acre of surface area and be at least 8 feet deep.
- The landowner should secure necessary permits or easements.
- Divert runoff from feedlots, barnyards and septic tanks if the pond is used for drinking water, livestock, wildlife or recreation.
- Clear all trees and shrubs within at least 30 feet of the dam's spillway and embankment.
- Generally for every surface acre of pond there should be at least 10 acres of drainage area.

Maintenance

- Keep outlet free of debris.
- Keep burrowing animals, trees and shrubs off the dam.
- Maintain grass cover on the dam.

5 Wildlife upland habitat... creating, maintaining or improving food and cover for upland wildlife.

How it works

Planting trees, shrubs and other vegetation that provide cover and food will attract wildlife to an area. The type of habitat provided will determine the kind and numbers of wildlife attracted.

How it helps

- Ground cover helps reduce soil erosion, adds organic matter to the soil, filters runoff and increases infiltration.
- It can add value to your farmstead.
- Planned wildlife habitat provides food and cover for wildlife.

Planning ahead

- Will your planned habitat attract the type of wildlife you want?
- Is a particular piece of land better suited for upland habitat than for livestock or crops?
- Do you plan to allow hunting?
- Are there any endangered or threatened species in your area you could help protect?
- How close do you want the habitat area to your farmstead?

Tech notes

- Plant the wildlife area with a vegetative cover of grass, trees or shrubs.
- Exclude livestock.
- To attract a specific wildlife species, choose cover and habitat for that species.
- Create a diverse habitat to attract a wider variety of wildlife.
- Consult with anNRCS biologist or local DNR officer for the recommended wildlife populations for the upland habitat area planned for your farm.
- Include a food plot if possible.
- Encourage shrub growth between woodlands and grasslands.
- Include bird houses and feeding stations in habitat areas.
- Plant fruit and nut bearing trees or shrubs to the windward side of a woodland habitat area.

Maintenance

- Prescribed burning may be necessary to regenerate growth and eliminate undesirable species.
- Use weed management to maintain desirable plant and animal species.
- Replant vegetation and trees if habitat area is damaged by disease or poor weather.

6 Wildlife food plot... establishing a variety of plants that furnish food for wildlife.

How it works

Food plots may be established either within an existing crop field or in a separate location. You may simply leave four rows of corn standing after harvest to provide food for wildlife over the winter. Or you may plant a small plot elsewhere. These plots help wildlife through the winter when food supplies are in short supply.

How it helps

- Standing crops with unharvested grain give food to wildlife that may otherwise not be accessible after heavy snows or ice.
- A food plot helps maintain wildlife on your farm by providing food.

Planning ahead

- Will the crop you plan to plant or leave standing in the field attract the wildlife you want?
- Is there adequate cover and water near the food plot to support wildlife?
- Are you endangering wildlife by placing the food plot too close to high traffic areas?

Tech notes

- Planting dates range from March 1 to June 15 depending on the crop.
- Food plots should be planted on the least erosive areas of the selected field.
- Fall seedbed preparation is not allowed.
- Plots on slopes steeper than 5% must be planted on the contour.
- A plot can be planted on the same area each year as long as soil loss does not exceed acceptable limits.
- Accepted crops include: corn, sorghum, oats, barley, wheat, sunflower, buckwheat, millet, partridge pea and soybeans.
- Soybeans and sunflowers can not be used in Conservation Reserve Program food plots.
- Reduced till or no-till planting is encouraged.

Maintenance

- Exclude livestock.
- Don't control weeds with herbicides unless noxious weeds persist. If herbicides are needed, spot spray. Avoid using herbicides that would endanger adjacent seedings.

7

Filter strip... a strip of grass, trees or shrubs that filters runoff and removes contaminants before they reach water bodies or water sources such as wells.

How it works

Strips of grass, trees and/or shrubs slow water flow and cause contaminants like sediment, chemicals and nutrients to collect in vegetation. Collected nutrients and chemicals are used by the vegetation, rather than entering water supplies. Filtered water then enters water bodies.

How it helps

- Grass, trees and shrubs provide cover for small birds and animals.
- Ground cover reduces soil erosion.
- The vegetative strip moves rowcrop operations farther from a stream.
- Vegetation prevents contaminants from entering water bodies, protecting water quality.

Planning ahead

- Are adequate soil conservation measures installed above filter strips?
- Are plants adapted to your soil types?
- Have you selected the correct species of vegetation for the control you need? For example, are you establishing the filter strip around a sinkhole, to control runoff from a feedlot or to filter runoff from cropland?

Tech notes

- Filter strips are most effective on slopes of 5% or less.
- Filter strips for cropland must be at least 15 feet wide. Steeper slopes require wider strips.

% Slope	Minimum width
0-10	15 feet
10-20	20 feet
20-30	25 feet

- A minimum 50 foot width is required for filter strips on forest land.
- Do not use a filter strip as a roadway.
- Filter strips will be less effective under snow or during frozen conditions.
- Avoid drift when applying herbicides on surrounding cropland.
- Controlled grazing may be allowed if filter strips are dry and firm.

Maintenance

- Repair rills and small channels that may have developed.
- Control grazing if livestock have access to filter strips.

8 Grade control structure... earthen, wooden, concrete or other structure built across a drainageway to prevent gully erosion.

How it works

A dam, embankment or other structure built across a grassed waterway or existing gully controls and reduces water flow. The structure drops water from one stabilized grade to another and prevents overfall gullies from advancing up a slope.

How it helps

- Grade control structures are often used at the outlet of a grassed waterway to stabilize the waterway outlet, preventing gully erosion.
- Grassed, non-eroding waterways made possible with a grade control structure give better water quality, can be crossed with equipment, and look better than non-stabilized gullies.
- If it is planned to store water, a grade control structure may provide a water source and habitat for wildlife.

Planning ahead

- Are adequate conservation practices installed above the structure to prevent sedimentation?
- Is the planned location in the proper place to achieve the level of control you want?

Tech notes

- Ask NRCS for design and construction specifications.
- Obtain any necessary easements or permits.
- Remove all trees and shrubs within 30 feet of the structure.
- Clear debris approximately 50 feet downstream from the spillway outlet.

Maintenance

- Keep burrowing animals off of earthen structures.
- Repair any cracks in concrete.
- Keep outlets free of debris.

9 Critical area planting... planting grass or other vegetation to protect a badly eroding area from soil erosion.

How it works

Grass, legumes, trees or shrubs are established in small, isolated areas of excessive erosion. The vegetation provides surface cover to stop the raindrop splash and slow water flow.

How it helps

- It reduces soil erosion.
- A vegetated area improves water quality by reducing the amount of sediment, nutrients and chemicals running off farmland.
- Protects areas such as dams, terrace backslopes or gullied areas when vegetation may be difficult to establish.
- Vegetation can be planted to provide small areas of nesting cover for birds and small animals.

Planning ahead

- Will protection provided by the critical area planting be adequate?
- Are proper soil conservation practices installed above the planting area?
- Will you want to provide wildlife cover?
- Can the area be stabilized with other conservation methods?

Tech notes

- Protect the area from erosion with annual grasses until permanent cover is established.
- Apply lime and fertilizer, if needed, in the top three inches of the soil before planting.
- Use proper rates and recommended seeding dates.
- Severely eroded areas may need a nurse crop like oats. Seed oats at a rate of 1 to 1½ bushels per acre. Mow oats before they head out if possible. Mow high to avoid clipping the permanent seeding.
- Areas disturbed during construction or barren slopes 4:1 or steeper should be mulched to provide temporary protection before seeding.
- Mulches include grass, hay, grain straw and shredded cornstalks.

Maintenance

- Allow no grazing the year after planting and prevent overgrazing after permanent cover is established. Fence if needed.
- Permanently exclude livestock from extremely steep slopes.
- Native or warm season grasses can benefit from periodic burning, which stimulates growth by reducing and removing competing plant growth.

10

Contour stripcropping... crop rotation and contouring combined in equal-width strips of corn or soybeans planted on the contour and alternated with strips of oats, grass or legumes.

How it works

Crops are arranged so that a strip of meadow or small grain is alternated with a strip of row crop. Not more than half a field can be planted to row crops. Meadow slows runoff, increases infiltration, traps sediment and provides surface cover. Ridges formed by contoured rows slow water flow which reduces erosion. Rotating the strips from corn to legumes allows nutrient-needy crops to benefit from the nitrogen added to the soil by legumes. This practice combines the beneficial effects of contouring and crop rotation.

How it helps

- Contour stripcropping reduces soil erosion and protects water quality.
- Contour stripcropping may help reduce fertilizer costs.

Planning ahead

- How many acres of row crops do you need?
- Does your crop rotation allow for alternating row crops with small grains and forages?
- Will herbicide carryover be a problem?

Tech notes

- Row crop strips need to be nearly the same width as small grains or meadow. A 10% variance is allowed.
- Plant grass or legume field borders instead of end rows and establish waterways as part of your stripcropping system.
- Key lines used for laying out strips should not exceed a 2% slope; except within 100 feet of an outlet, when the grade can be 3%.
- Strip widths may be adjusted downward to accommodate your equipment width for even rounds.
- Stripcropping is not as effective if crop strips become too wide, especially on steep slopes. Use the following table to plan maximum widths:

% Slope	Crop strip width
1 - 2	130 feet
3 - 8	100 feet
9 - 16	80 feet
17 - 20	60 feet
21 - 25	50 feet

Maintenance

- Keep strip widths consistent from year to year.
- If a meadow crop fails or is wintered killed, NRCS can help you make adjustments in your rotation schedule.

11 Diversion... earthen embankment similar to a terrace that directs runoff water from a specific area.

How it works

A diversion is much like a terrace, but its purpose is to direct or divert runoff water from an area. A diversion is often built at the base of a slope to divert runoff away from bottom lands. A diversion may also be used to divert runoff flows away from a feedlot, or to collect and direct water to a pond.

How it helps

- Reduces soil erosion on lowlands by catching runoff water and preventing it from reaching farmland below.
- Vegetation in the diversion channel filters runoff water, improving water quality.
- Vegetation provides cover for small birds and animals.
- Allows better crop growth on bottomland soils.

Planning ahead

- Are there proper soil conservation measures installed to prevent the diversion from filling with sediment?
- Is the outlet planned in a location which will not cause erosion?
- Is the diversion and outlet large enough to handle the runoff amount for that location?

Tech notes

- Diversions cannot substitute for terraces used for erosion control.
- Diversions must be built to carry at least the peak amount of runoff generated by a 10-year, 24-hour storm.
- Minimum top width for a diversion ridge is four feet.
- Each diversion must have an outlet. A grassed waterway, grade stabilization structure, or underground outlet is acceptable.
- Establish vegetative outlets before a diversion is constructed.
- Diversions should not be built in high sediment producing areas unless other conservation measures are installed too.

Maintenance

- Keep outlet clear of debris.
- Keep burrowing animals out of the diversion.
- Maintain vegetative cover on the diversion ridge.
- Install filter strips above the diversion channel to trap sediment and protect the diversion, if needed.
- Fertilize as needed.

12 Grassed waterway... shaping and establishing grass in a natural drainageway to prevent gullies from forming.

How it works

A natural drainageway is graded and shaped to form a smooth, bowl-shaped channel. This area is seeded to sod-forming grasses. Runoff water that flows down the drainageway flows across the grass rather than tearing away soil and forming a larger gully. An outlet is often installed at the base of the drainageway to stabilize the waterway and prevent a new gully from forming.

How it helps

- Grass cover protects the drainage-way from gully erosion.
- Vegetation may act as a filter, absorbing some of the chemicals and nutrients in runoff water.
- Vegetation provides cover for small birds and animals.

Planning ahead

- Is major land reshaping needed?
- Is there a proper outlet for surface runoff at the bottom of the water-way?
- Are soil conservation measures installed to prevent siltation?
- Will tile drainage be necessary to establish vegetation in the water-way?

Tech notes

- A waterway should be deep enough and wide enough to carry the peak runoff from a 10-year frequency, 24-hour storm. Check NRCS design charts.
- Plant seed at recommended time and rates. Place seed about ¼ to ½ inch deep. Plant across the area or in a figure 8 pattern to reduce erosion.
- A nurse crop, temporary cover or mulching may be necessary until permanent cover is established.

Maintenance

- Lift implements out of the ground and shut off spray equipment when crossing.
- Don't use the waterway as a road-way.
- Fertilize as needed.
- Mow periodically, but wait until August 1 so young birds have a chance to leave the nest.
- Maintain the width of the grass area when tilling surrounding fields.
- Avoid planting end rows along the waterway. This prevents a new gully forming on the outside edges of the waterway.

13 Contour buffer strip... strips of grass or legumes in a contoured field, which help trap sediment and nutrients. Similar to stripcropping, but with narrower grass or legume strips.

How it works

A series of grass strips are placed across the slope on a contour. The alternating strips of grass or other permanent vegetation slow runoff flow, trap sediment from the crop strips above, and increase water infiltration. Because the buffer strip is established on the contour, runoff flows evenly across the entire surface of the grass strip, reducing sheet and rill erosion.

How it helps

- Vegetation provides cover and habitat for small birds and animals.
- The strips reduce erosion by slowing water flow and increasing water infiltration.
- By reducing siltation and filtering nutrients and chemicals from runoff, grass strips improve water quality.

Planning ahead

- Have you decided whether you want parallel crop strips or parallel buffer strips?
- Are other conservation measures such as crop residue management installed or planned to help reduce siltation of grass strips?
- Will planned acres in row crops meet your production objectives?

Tech notes

- Buffer strips must be at least 15 feet wide.
- Either crop strips or grass strips may be parallel. Parallel crop strips are easier to farm with no point rows, but that results in less of the slope in row crops.
- Grass buffer strips commonly make up 20% to 30% of the slope.

Maintenance

- Control weeds and brush in grass filter strips.
- Delay mowing until August 1 to help ground-nesting birds.
- Keep vegetation tall in spring and early summer to help slow runoff flow.
- Fertilize as needed.
- The buffer strip may be moved up or down the slope to help re-establish vegetation or for other maintenance needs.

14 Contour farming... farming with row patterns nearly level around the hill—not up and down hill.

How it works

Crop row ridges built by tilling and planting on the contour create hundreds of small dams. These ridges or dams slow water flow and increase infiltration which reduces erosion.

How it helps

- Contouring can reduce soil erosion by as much as 50% from up and down hill farming.
- By reducing sediment and runoff, and increasing water infiltration, contouring promotes better water quality.

Planning ahead

- Will more than one key contour line be needed because of steep or irregular slopes?
- Are terraces or stripcropping needed for steeper slopes?
- Are field borders needed to replace end rows in the contouring system to control sheet and rill erosion?

Tech notes

- Establish a key line around the hill by using a hand level or contour gauge.
- Contour key line grade should not exceed 2% except within 100 feet of an outlet. In that case, the grade can be a 3% slope.
- Perform all tillage and planting operations parallel to the key contour line.
- Contouring is less effective in preventing soil erosion on steeper or longer slopes.
- Replace end rows with field borders to reduce erosion.

Maintenance

- Use grassed waterways in areas where runoff is concentrated to prevent gully erosion.
- Contoured rows should enter the grassed area of waterways on the level, but should direct water into the grass.
- To avoid having to lay out new key contour lines every year, establish a narrow permanent strip of grass along each key contour line.

15 Field border... a strip of grass or legumes at the edge of a field used in place of end rows.

How it works

Strips of perennial vegetation are established at the outside edges of a field where excessive sheet and rill erosion is occurring. The grass or legume strips replace crop end rows, which would be planted up and down hill and be highly erosive. Field borders are sometimes referred to as picture frames of grass, and are used with contour farming, terrace, buffer strip and contour stripcropping systems.

The grass or legume in the strip protects steep field edges from soil erosion, and provides turning and travel lanes around the field.

How it helps

- Vegetative cover reduces sheet and rill erosion by slowing water flow.
- Vegetation filters runoff to improve water quality.
- Grass and legume strips may be harvested in some cases and are easier to turn on than end rows.
- Vegetation provides cover and habitat for small birds and animals.

Planning ahead

- Will the width be wide enough to turn your equipment?
- Can that land qualify for set aside?

Tech notes

- Borders must be at least 16 feet wide, or wide enough for your equipment.
- Borders need to be seeded or left in place when a meadow field is plowed.
- Seed with perennial grasses, legumes or a mixture of the two.
- Seed cool season grasses between March 1 and May 15 or during late summer seeding period, August 1 to September 15. Plant warm season grasses between April 1 and June 1.

Maintenance

- Delay mowing field borders until August 1 to allow time for young nesting birds to leave their nests.
- Reseed as necessary to maintain desired cover.
- Shut off farm chemical sprayers when turning on a field border, and insist custom chemical applicators do the same.
- Maintain nutrient levels. If vegetative cover declines, apply 30 lbs. nitrogen, 20 lbs. phosphate and 20 lbs. potash per acre.

16

Well protection... changing farming practices which occur on or near the farmstead in order to reduce the risk of contamination of water sources—mainly the well.

How it works

The way you handle materials that could contaminate a water supply, and the distance of possible contaminants from a well or other water source, can have a dramatic effect on the quality of drinking water on the farm. For instance if you typically mix pesticides near the well, your chances of drinking water contamination from pesticides escalates. To protect your well, take an inventory of farming practices like pesticide mixing and container washing and disposal. Then assess the risk of contamination and make necessary changes.

How it helps

- Modifications in farming operations may improve your efficiency and reduce operation or production costs.
- Soil conservation practices may be necessary to divert runoff from the well area.

Planning ahead

- Are necessary soil erosion practices in place?
- Have you taken an inventory of the operations you complete at or near the farmstead well?
- Have you properly closed and sealed all abandoned wells near the farmstead?
- Where is your well in relation to any feedlots and pesticide and herbicide spraying, storage and mixing?

Tech notes

- Mix farm chemicals and rinse containers a minimum of 100 feet from the well.
- Apply pesticides on days with minimal wind to prevent chemical drift into farmsteads.
- Use a device in the hose when filling a sprayer tank to be sure chemicals will not siphon back to the well.

Maintenance

- Keep an emergency chemical spill kit handy.
- Maintain any filter strips surrounding the farmstead or wellhead.
- Repair wellhead casing as needed.
- Repair any cracks in concrete pads used for chemical mixing, loading or container washing.

17

Windbreak... rows of trees and shrubs that protect areas from wind and provide food and cover for wildlife.

How it works

Multiple rows of coniferous trees or a combination of coniferous and deciduous trees are planted to protect a farmstead or feedlot from wind and snow. One or two rows of shrubs are also often planted. The established windbreak slows wind on the downwind side of the windbreak for a distance of 10 times the height of the trees. The tree rows also act like a snow fence, trapping snow within the windbreak. Field windbreaks can also be planted to reduce wind speed in open fields.

How it helps

- A windbreak reduces wind erosion, conserves energy, reduces heating bills and beautifies a farmstead.
- Trees serve as a sound barrier and muffle road noise.
- Trees and shrubs provide food and cover for wildlife.
- Improved livestock weight gains can be expected when livestock are protected from winter winds and snow.

Planning ahead

- Have you planned enough space for summer air circulation, travel lanes or gardens?
- Will the mature windbreak cast a shadow over the driveway or nearby road, prolonging icy conditions?
- Will trees in the windbreak attract the desired wildlife species?
- Will the position of the mature windbreak cause a visibility hazard for drivers or dump snow where it's not wanted?

Tech notes

- Preferred planting time is after winter thaw and before May 15.
- Plant on at least the north and west sides of the area to be protected; extend rows 50 feet beyond that area.
- Don't plant trees on the south or east side of a road. At mature height the trees will cast a shadow and prolong icy road conditions.
- Keep plantings 20 to 30 feet away from phone or utility lines.
- Plant trees according to spacing recommendations for the species.

Maintenance

- Control competing vegetation with tillage or herbicides before planting and for the first three years after planting.
- Fence livestock out.
- Inspect regularly to help control damage.

18 Pasture planting... planting grass and legumes to reduce soil erosion and improve production.

How it works

Drill or broadcast adapted grass or legumes into a low-producing pasture or a steep, eroding cropland field.

How it helps

- Heavy grass cover slows water flow, reducing soil erosion.
- Good pastures protect water quality by filtering runoff water and increasing infiltration.
- Lush pastures give cover and habitat for wildlife.
- As plants recycle and roots die, organic matter in the soil is improved.

Planning ahead

- Are selected species suited to your soil types?
- Have you chosen species that will help you reduce the use of pesticides and herbicides?
- Have you chosen species that will meet the needs of your livestock?

Tech notes

- Do not mix warm and cool season grasses in the same pasture.
- Selected grass and legumes should be compatible with the planned management.
- When only two grass species are selected, they should make up equal proportions of the seeding mixture.
- Add legumes to improve forage quality and extend the grazing season.
- Drill seed uniformly to a depth of ¼ to ½ inch.
- Leave residues and till on the contour.
- If erosion is a problem, leave at least 30% residue cover after planting.
- Plant a nurse crop on steeper slopes or where weeds are a problem to get a good stand. NRCS recommends seeding oats at 1 to 1½ bu/acre as a nurse crop.
- Graze or closely chop pastures before reseeding. Apply a burndown herbicide.

Maintenance

- Wait until pasture is well established to graze.
- Mow weeds when they reach a height of 6-8 inches. Control persistent weeds with herbicides.
- Fertilize as needed.

19 Stream protection... protecting a stream by excluding livestock and by establishing buffer zones of vegetation to filter runoff.

How it works

Grass, riprap and gabions are installed along the edges of a stream to buffer the banks from heavy stream flow and reduce erosion. Fencing prevents cattle from trampling banks, destroying vegetation and stirring up sediment in the streambed. A buffer zone of vegetation along the streambank filters runoff and may also absorb excess nutrients and chemicals.

How it helps

- Streambanks are covered with rocks, grass, trees or other cover to reduce erosion.
- Better water quality results from reducing amounts of nutrients, chemicals, animal waste and sediment entering the stream.
- Buffer zones provide cover and habitat for birds and small animals.

Planning ahead

- Have you planned to install an off-stream water system for livestock or limited livestock access to the stream?
- Are proper soil conservation measures installed in the stream watershed to prevent siltation of buffer zones and streambed?
- Will a stream crossing be needed for livestock?

Tech notes

- Fence livestock out of the stream.
- Smooth streambanks to provide an adequate seedbed for vegetation.
- The vegetation area along streambanks should be between 15 and 25 feet wide.
- Remove fallen trees, stumps and debris that might cause turbulence in the stream.
- Remove trees and brush that adversely affect the growth of desirable bank vegetation.

Maintenance

- Keep fences repaired.
- Avoid damaging buffer zones with herbicides from surrounding cropland.
- Remove off-stream watering systems in the winter if necessary, and reinstall the spring.

20

Manure testing... sampling and testing manure to determine nutrient cntent. This promotes proper nutrient application to fields.

How it works

Taking a representative sample from stored manure and sending it to an approved lab for analysis to determine nutrient content is the first step in a manure management system. This data is used to match application rates to plant nutrient needs and soil test data.

How it helps

- Manure testing and proper application to the land can reduce crop input costs.
- Preventing over-application of manure to crop fields results in improved water quality.

Planning ahead

- What form of manure do you plan to apply?
- Have you calibrated your spreader to apply the volume of manure called for according to plant needs and nutrient value of manure?
- Have you reduced commercial fertilizer use after accounting for nutrients supplied by manure?
- Will you hire someone or take manure samples yourself?
- Do you plan to take soil samples to help determine how manure can be used most effectively?
- Have you allowed sufficient time for the laboratory to process your manure sample and return the results to you?

Tech notes

- Take a representative sample from your storage structure.
- Apply manure as soon as possible after receiving analysis data.

Maintenance

- Retest manure storage every time storage structure is emptied or after making major changes in livestock feed or bedding methods.

21 Tree planting... establishing trees in areas adapted to woodlands.

How it works

A variety of desired tree species, either seedlings or seeds, are planted mechanically or by hand in understocked woodlands or open fields. Tree species are matched with soil types and selected to prevent soil erosion, increase income, or boost productivity of existing woodland.

How it helps

- Improving stands of woodlands can increase profits.
- Ground cover created by trees and associated debris protects soil from rill and sheet erosion.
- Ground cover also protects water quality by filtering excess nutrients and chemicals from surface runoff and increasing infiltration rates.
- Healthy, well-managed woodlands provide long-term wildlife habitat.

Planning ahead

- Is the soil suitable for producing wood crops?
- Is the soil suitable for the tree species you have selected?
- Is there a market for the species you want to plant?
- Do you need this land for crops or livestock?

Tech notes

- Remove brush and till the strips of pasture or sod where trees will be planted the fall before planting.
- Complete spring planting by May 15. Fall planting should begin between September 1-15.
- Standard forest planting spacings are 6' x 6', at a rate of 1,210 trees per acre; 6' x 7', 1,037 trees per acre; 6' x 8', 908 trees per acre.
- Tree seedlings should be planted within seven days of their arrival.
- Keep roots moist during planting.
- Place the root crown at ground surface or one inch below.
- Remove all air pockets when planting seedlings.
- The hole prepared for the seedling should have enough room for the roots to spread completely out.

Maintenance

- Mow vegetative growth around trees until the trees are 3 to 4 feet high.
- Use herbicides to control competing vegetation.
- Check periodically for rodent, disease or insect damage.
- Replant, if necessary, to achieve a desired stand.

22

Conservation tillage... leaving last year's crop residue on the soil surface by limiting tillage. Includes no-till, mulch till and ridge till.

How it works

Leaving last year's crop residue on the surface before and during planting operations provides cover for the soil at a critical time of the year. The residue is left on the surface by reducing tillage operations and turning the soil less. Pieces of crop residue shield soil particles from rain and wind until plants can produce a protective canopy.

How it helps

- Ground cover prevents soil erosion and protects water quality.
- Residue improves soil tilth and adds organic matter to the soil as it decomposes.
- Fewer trips and less tillage reduces soil compaction.
- Time, energy and labor savings are possible with fewer tillage trips.

Planning ahead

- Will your crop produce enough residue?
- Is crop residue management part of a planned system of conservation measures?
- Do you have the needed equipment?

Tech notes

- Planning for residue cover begins at harvest. Ensure ample residues are spread evenly over the field by the combine.
- Reduce the number of unnecessary tillage passes. Every tillage pass buries more crop residue.
- Use straight points and sweeps on chisel plows instead of twisted points. Twisted points can bury 20% more residue.
- Set tillage tools to work at shallower levels.

Measuring crop residues

You can estimate residue levels by using a line that has 50 or 100 equally divided marks. Stretch the line diagonally across crop rows. Count the number of marks that have residue under the leading edge when looking from directly above the mark. Walk the entire length of the rope. The total number of marks with residue under them is the percent residue cover. If the line has only 50 marks, multiply your count by two. Repeat this three to five times in a representative area of the field.

23 Wetland enhancement... installing practices such as dikes in existing wetlands to manage water levels and improve habitat.

How it works

Most wetland enhancement work includes small structures built to add water or regulate water levels in an existing wetland. Subsurface and surface drains and tiles are plugged. Concrete and earthen structures—usually dikes or embankments— are built to trap water. These practices maintain a predetermined water level in an existing wetland. Adjustable outlets allow the landowner to fluctuate the water level during different seasons. Enhancement also includes planting native wetland vegetation if plant populations need to be supplemented.

How it helps

- Wetlands filter nutrients, chemicals and sediment before water infiltrates into ground water supplies.
- Wetlands provide habitat for waterfowl and many other species of wildlife.
- Wetlands add beauty and value to a farm.

Planning ahead

- Will soil hold water?
- Is there an adequate water supply?
- Is there adequate upland wildlife habitat available?
- What wildlife do you want to attract?
- Will plugging drains or breaking tile lines to enhance the wetland have adverse effects on other parts of your farm, or a neighboring farm?

Tech notes

- Remove trees and brush from embankments and the vegetative spillway area.
- Protective vegetative cover should be established on exposed surfaces of embankments and spillways.
- Obtain any necessary permits.
- Keep livestock from the area, unless it is included in a planned grazing management plan.
- Dikes and levees should meet NRCS or US Army Corps of Engineers standards.

Maintenance

- You may need to replant some wetland vegetation until a good stand is established.
- Keep burrowing animals out of earthen structures. Control beavers and muskrats.
- Keep intakes clean and outlet free of debris.
- Inspect pipe structures and repair any damages.

24 Crop rotation... changing the crops grown in a field, usually year by year.

How it works

Crops are changed year by year in a planned sequence. Crop rotation is a common practice on sloping soils because of its potential for soil saving. Rotation also reduces fertilizer needs, because alfalfa and other legumes replace some of the nitrogen corn and other grain crops remove.

How it helps

- Pesticide costs may be reduced by naturally breaking the cycles of weeds, insects and diseases.
- Grass and legumes in a rotation protect water quality by preventing excess nutrients or chemicals from entering water supplies.
- Meadow or small grains cut soil erosion dramatically.
- Crop rotations add diversity to an operation.

Planning ahead

- Will rotations meet crop base needs for set aside?
- Do you have use for other crops?

Tech notes

- Crops must be suited to your soils.
- Design crop rotations to meet the residue needs of your crop residue management plans.
- Rotations that include small grains or meadow provide better erosion control.
- Small grains and meadow can always be used to replace any row crop or low residue crop to gain better erosion control.
- Corn (grains) can always be used to replace soybeans or any other low residue crop in the rotation to gain better erosion control.
- For crop rotations which include hay (meadow) the rotation can be lengthened by maintaining the existing hay stand for additional years.

Maintenance

- Switch crops to maintain perennials in the rotation, if necessary.
- Consider herbicide carry over to avoid crop failures.

25 Nutrient management... applying the correct amount and form of plant nutrients for optimum yield and minimum impact on water quality.

How it works

After taking a soil test, setting realistic yield goals, and taking credit for contributions from previous years' crops and manure applications, crop nutrient needs are determined. Nutrients are then applied at the proper time by the proper application method. Nutrient sources include animal manure, sludge, and commercial fertilizers. These steps reduce the potential for nutrients to go unused and wash or infiltrate into water supplies.

How it helps

- Sound nutrient management reduces input costs and protects water quality, by preventing over-application of commercial fertilizers and animal manure.
- Correct manure and sludge application on all fields can improve soil tilth and organic matter.

Planning ahead

- Have you tested your soil and livestock manure for their nutrient levels?
- Are organic wastes or sludge available for you to use?
- Have you determined realistic yield goals?
- Are proper soil conservation measures installed?
- Have you accounted for nitrogen credits produced by legume crops?

Tech notes

- Choose best application method. Use broadcast, starter, surface band or injection.
- Use the late spring nitrogen test when appropriate when corn plants are between 6 to 12 inches tall.
- Refrain from applying commercial nitrogen in the fall except if N is associated with P application.
- Avoid applying manure on frozen or snow-covered ground if possible.

Maintenance

- Test soils once every three years according to Extension recommendations.
- Analyze manure and other organic waste for nutrient content before field application.
- Establish a winter cover crop if there's a possibility of nitrogen leaching because of poor crop yield.

26

Wetland... marsh-type area with saturated soils and water-loving plants. Wetlands provide wildlife habitat and serve as natural filters for agricultural runoff.

How it works

Natural wetlands— swamps, bogs, sloughs, potholes and marshes— occur in every state in the Nation and vary widely in size, shape and type. Sloughs, potholes and marshes in low-lying areas are most common in Iowa. A wetland may have standing water year-round or may hold surface water for only part of the year.

How it helps

The many values of wetlands are only recently being fully understood and appreciated. Among the benefits of wetlands are:

- Wetlands can provide natural pollution control. They remove nutrients, pesticides and bacteria from surface waters and can act as efficient, low cost sewage and animal waste treatment practices.
- Wetlands filter and collect sediment from runoff water.
- Because wetlands slow overland flow and store runoff water, they reduce both soil erosion and flooding downstream.
- Many wetlands release water slowly into the ground which recharges groundwater supplies.
- All of America's ducks and geese depend on wetlands for breeding, nesting, and feeding habitat. More than 5,000 plant species, 190 species of amphibians, and one-third of all native bird species are supported by wetlands.
- The ecological diversity of wetlands can offer one of the most beautiful and aesthetically pleasing features of a farm.

Planning ahead

- Goose nests, wood duck boxes, and other protection for water fowl and habitat for adjoining uplands may be added to enhance the wildlife and recreational value of a wetland.

Maintenance

- Mostly it's best to leave wetlands alone. They can be enhanced, however, by adding plants or water to a relatively dry wetland.

27

Pest management...

evaluating and using a tailored pest management system to reduce crop and environmental damages. Scouting is done to identify insects, weeds and diseases.

How it works

Crops are scouted to determine type of pests—insects, weeds and diseases—and the stage of development. The potential damage of the pest is then weighed against the cost of control. Finally, if pest control is economical, all alternatives are evaluated based on cost, results, and environmental impact. Precaution is taken to keep any chemicals from leaving the field by leaching, runoff or drift.

How it helps

- Scouting and spot treatment for only those pests that are threatening can save money.
- Using fewer chemicals improves water quality.
- Specific treatments for specific pests on specific areas of a field prevents over-treatment of pests.

Planning ahead

- Which soils on your farm are likely to leach pesticides?
- Did you establish filter strips along streams?
- Did you consider pest control alternatives?
- Did you use records of crops and pest control for reference?
- Did you rotate crops to reduce the chance of pest problems?

Tech notes

Following are guidelines to follow for applying and mixing pesticides:

- Complete a pesticide risk assessment of potential environmental damage from leaching or runoff. Consider this information when selecting a pesticide.
- Wear protective clothing when applying pesticides.
- Mix and load pesticides in an area that won't contaminate water supplies; and prevent back siphoning.
- Triple rinse containers before disposal. Burn paper bags.
- Apply pesticides during periods of minimal potential for drift or runoff.
- Use the lowest application rate practical and rotate pesticides.
- Use spot treatment or banding when possible in areas of concentrated pest populations.
- Use proper erosion control.

Maintenance

- Continue scouting to best identify pests and control methods.
- Keep records to track costs and chemical application.
- Calibrate spray equipment.

28 Water and sediment control basin... a short earthen dam built across a drainageway where a terrace is impractical; usually part of a terrace system.

How it works

An embankment is built across a depressional area of concentrated water runoff to act similar to a terrace. It traps sediment and water running off farmland above the structure, preventing it from reaching farmland below.

How it helps

- Basins improve water quality by trapping sediment on uplands and preventing it from reaching water bodies.
- Structures reduce gully erosion by controlling water flow within a drainage area.
- Grass cover may provide habitat for wildlife.

Planning ahead

- Will basins be part of an existing terrace system?
- Is the site too steep for the basin to work properly or be economically feasible?
- Can adequate outlets be provided?

Tech notes

- The uncontrolled area draining into the basin must not exceed 50 acres.
- Build the basin large enough to control the runoff from a 10-year storm without overtopping.
- Install a tile or infiltration outlet.
- Use fill material free of sod, roots, frozen materials and stones larger than 6 inches in diameter. It should also have correct moisture content for adequate compaction.
- Spacing for water and sediment control basins depends on the land slope, tillage and management system. Consult NRCS for recommended spacing.

Maintenance

- Reseed and fertilize as needed to maintain vegetative cover.
- Check the basin after each large storm, and make any needed repairs.

29 Terrace... an earthen embankment around a hillside that stops water flow and stores it or guides it safely off a field.

How it works

Terraces break long slopes into shorter ones. They usually follow the contour. As water makes its way down a hill, terraces serve as small dams to intercept water and guide it to an outlet.

There are two basic types of terraces—storage terraces and gradient terraces. Storage terraces collect water and store it until it can infiltrate into the ground or be released through a stable outlet.

Gradient terraces are designed as a channel to slow runoff water and carry it to a stable outlet like a grassed waterway.

How it helps

- Both water quality and soil quality are improved.
- Terraces with grass on front or backslopes can provide nesting habitat.

Planning ahead

- Will other conservation practices be used in conjunction with terraces to prevent sedimentation?

Tech notes

- Chisel the parts of the terrace that will be farmed to loosen compacted soil.
- Fertilize and seed according to NRCS recommendations.
- Grassed backslope terraces have a farmable frontslope with a 2:1 backslope (2 foot horizontal to every 1 foot of vertical drop.)
- Narrow base terraces have 2:1 slopes on both the frontslope and backslope.
- Broadbase terraces should not be built on slopes greater than 8%. Farmable slopes should not be steeper than 5:1.
- Terraces are designed to control runoff from a 10-year storm.

Maintenance

- Avoid farming too close to intakes.
- Remove sediment build-up in the channel to maintain the required water-holding capacity.
- Repair sections of embankment which have eroded or have excessive settlement.
- Fill settled or eroded areas in the tile trench.
- Repair or replace damaged intakes.
- Remove sediment build-up and trash from around the intake.
- Control rodents or burrowing animals, weeds, brush and trees.
- Reseed and fertilize as needed to maintain good vegetation.

30 Cover crop... a close-growing crop that temporarily protects the soil when crop residues are not adequate.

How it works

Crops including cereal rye, oats and winter wheat are planted to temporarily protect the ground from wind and water erosion during times when cropland isn't adequately protected against soil erosion.

How it helps

- Cover crops keep ground covered, add organic matter to the soil, trap nutrients, improve soil tilth and reduce weed competition.

Planning ahead

- Do you have a seeding method that won't harm standing crops?
- Are adequate soil conservation measures installed?

Tech notes

- Cover crops are most often recommended when low residue producing crops such as soybeans or corn silage are grown on erodible land.
- Cover crops need 30-40 days of good growth before the first hard frost. Seeding after harvest will normally not allow cover crops to grow large enough to survive the winter.
- Seed from the end of August until mid-September.
- Cover crops may be air seeded prior to harvesting soybeans and other crops, or seeded conventionally after silage harvest.
- Many crops can be used for cover crops. Cereal rye is common.
- Kill cover crops in the spring. Mowing or herbicide application is acceptable. Tillage is not recommended because it will bury residue. Early kill is important to reduce the risk of depleting moisture needed for the grain crop.
- Follow the NRCS recommended seeding rates for the cover crop you select:

Crop	lb./ac.
Oats	70
Cereal rye	90
Winter wheat	90
Alfalfa	12
Sweet clover	12
Red clover	10
Crownvetch	5
Sudan grass	25
Hairy vetch	30

- Legume cover crops add nitrogen to the soil, providing a low-cost fertilizer for grain crops.

Maintenance

- Cover crops are a short term practice and are not expected to last after initial establishment.
- Restrict grazing if necessary.

Conservation practices blanket the landscape.

Challenges Ahead

Farmers are applying conservation and environmental practices to their land at record rates.

They are protecting water resources by scouting fields for pests, establishing buffer zones of vegetation along streams and creeks and storing animal manure until conditions are right for field application.

They are saving soil by leaving more residues on crop fields, building terraces, and farming on the contour.

Farmers have accepted the challenge of protecting our natural resources and continue to educate themselves about new technologies and techniques as they are developed.

Consider this book as another tool to help you meet the conservation and environmental challenges ahead. Select practices which will help you balance the needs of the environment with your own economic needs and the needs of the hundreds of people you help feed every year.

Use the human resources available to you as well. Technical staff from several federal and state agencies as well as agribusiness specialists and private crop consultants, will help you protect your land and water.