

# National Association of Conservation Districts New Landowner's Manual

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## References and Further Resources

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All material in this guide is a compilation of and originated from the following publications.

*Project Manager, Beth Mason, National Association of Conservation Districts*

**Small Pasture Management Guide (AG 508)**, Utah State University Cooperative Extension (2008), *Utah*

**Hood River County Rural Living Handbook**, Hood River Soil and Water Conservation District (2/2008), *Oregon*

**Wasco County Rural Living Handbook**, Wasco County Soil and Water Conservation District (9/2009), *Oregon*

**Deschutes County Rural Living Handbook**, Deschutes Soil and Water Conservation District, *Oregon*

**Jefferson County Rural Living Handbook**, Jefferson County Soil and Water Conservation District (1/2009), *Oregon*

**Managing Grazing for Sustainable Pastures**, USDA Natural Resources Conservation Service and Colorado State University Extension, *Colorado*

**Planning for a Sustainable Homestead**, USDA Natural Resources Conservation Service and Colorado State University Extension, *Colorado*

**Living on a Few Acres in Wyoming (MP-86)**, University of Wyoming Cooperative Extension Service, *Wyoming*

**Landowning Colorado Style**, USDA Natural Resources Conservation Service, *Colorado*

**Lake Superior Watershed Rural Property Guide**, Superior Watershed Partnership and the University of Wisconsin Extension (2008), *Wisconsin*

**Tips on Land and Water Management for Small Farms and Ranches in Montana**, Montana Department of Natural Resources and Conservation (1997), *Montana*

**Outdoors in Anoka County**, Anoka Conservation District and the University of Minnesota Extension Service, *Minnesota*

**Rural Lifestyles**, Clackamas County Soil and Water Conservation District (11/2009), *Oregon*

**Pocket Guide**, Clackamas County Soil and Water Conservation District (11/2009), *Oregon*

**Jackson County Rural Living Handbook**, Jackson Soil and Water Conservation District (10/2006), *Oregon*

**Marion County Rural Living Handbook**, Marion Soil and Water Conservation District (4/2011), *Oregon*

**Best Management Practices for Georgia Agriculture**, the Georgia Soil and Water Conservation Commission (3/2007), *Georgia*

**Land and Water Management Guide for Non-Urban Areas in Mississippi**, Mississippi Soil and Water Conservation Commission, *Mississippi*

**Rural Living**, South Dakota Association of Conservation Districts, South Dakota Association of RC&D Councils, South Dakota University/Cooperative Extension Service, and USDA Natural Resources Conservation Service (11/15/2004), *South Dakota*

**North Dakota Rural Living Handbook**, Grand Forks and Cass County Soil and Water Conservation Districts (2009), *North Dakota*

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## Introduction

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This New Landowner's Manual is a tool designed to assist current and prospective landowners and members of the community in understanding the value and responsibility of conserving the natural resources within the community as well as provide answers/solutions to the various land management issues they face.

The local Conservation District and the USDA Natural Resources Conservation Service (NRCS) are available to lend assistance in your quest for a healthy and productive property/homestead and should be considered a valuable resource in your land management plans. Either office is listed in the front of the phonebook in the government pages. The USDA Natural Resources Conservation Service will be listed under the federal government pages while your local Conservation District will be located in the local government pages, following the name of the county. You may also refer to either of these national websites for local contact information:

[www.nacdnet.org](http://www.nacdnet.org)

[www.nrcs.usda.gov](http://www.nrcs.usda.gov)

In some cases, your local Conservation District may have its own website as well.

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### A Few Examples of How Your Conservation District Can Assist Landowners

- A landowner wants to learn more about their land – its challenges and opportunities.
- A landowner notices a lot of mud/manure from her horse paddock running off into the stream and wants to know how to address the problem.
- There isn't much wildlife on the property, and the landowner wants to know how to increase the wildlife populations.
- An invasive or noxious weed is invading a landowner's property. He wants to know how to control these weeds in a way that won't harm the environment, and how to restore the original habitat.
- A landowner wants to prevent additional hillside erosion.
- A landowner wants to produce food for the fresh market.
- After just purchasing property, a landowner would like to review what conservation measures would be appropriate for the property.
- A landowner/operator would like to develop a conservation plan for the property so that the conservation measures could be installed systematically.
- A landowner wants to implement good conservation practices on their farm such as no-till farming and the use of conservation buffers.
- The farm has been in the family for years and the landowner would like to investigate any opportunities to preserve his farmland in agriculture.
- A small woodland owner wants to grow trees for the sustainable forest products market.
- In considering the purchase of new property, a land purchaser would like to have information on the soil, water, and other resources related to the property before a decision is made on the sale.
- A local city planner wants to use native plants and a water-conserving irrigation system for landscaping the new City Hall.

- A homeowner wants to reduce the cost of chemicals, fertilizer and water while maintaining a green lawn.
  - A homeowner wants to capture rainwater to use on their large garden.
  - A homeowner wants to know what type of trees would grow best on his property and how to care for them.
  - A scout group would like to assist in planting trees in the community.
  - A local educator wants to start teaching about soils in their classroom.
  - A local educator would like to start a science fair project using water as the theme.
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### **What is the Value of Conservation to Landowners?**

**Saves** money because your land is more productive over the long term

**Ensures** better water quality for you, your animals, and your neighbors

**Promotes** open spaces and wildlife habitat

**Produces** more grass for grazing

**Grows** healthier livestock and improves your property values

**Makes** your place more attractive, keeps your neighbors happier, and satisfies your responsibility to care for the land

**Assures** the health and safety of your family

## Planning for your Land

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### Buying Undeveloped Land

If your goal is to buy undeveloped land, there are important things to consider before you buy:

- Ensure that it is a legal parcel and it is buildable. Many times people have purchased acreage only to find out it isn't a legal parcel and therefore cannot be developed.
- Know the parcel zoning. Buildable parcel sizes vary depending upon the type of zone it is in. Visit with the local zoning office to learn about current and future zoning issues.
- Understand land use laws governing the zoning. Can the parcel be used for what you intend to use it for?
- What are the soil types? How will they impact your desired type of foundation, driveway, or agricultural operation?
- Is there water for a well? How deep are neighboring wells? What is the water quality (salt, iron, hardness, etc.)?
- Has it been approved for an onsite septic system? If not, you'll need to find out if it can be. The parcel must be approved for septic by the local Health Department. Costs of systems vary – determine the range of possible systems and costs.
- How far away is the nearest utility pole? The property owner is responsible for the poles needed to bring power to the dwelling.
- Has the property been surveyed? Fences are not necessarily an indication of property lines. Don't rely on them to be accurate.
- Is the property in the National Scenic Area or an historic area? If so you'll need to get familiar with the laws that govern property in the Scenic Area. They cover everything from tree height to the color of your house.
- Have any of the rights been sold or purchased? (e.g. development, grazing, water, oil, mineral, etc.)
- Is the land impacted by a homeowners association?

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### Why Develop a Management Plan?

- To design a way to meet your goals and objectives for your land
- To ensure environmental stewardship
- To create sustainability by considering all aspects (production goals, environmental goals, economic factors, and quality of life)
- To make management easier
- To save money and avoid problems
- To help you make decisions

Once you have inventoried the land and identified your goals, develop a management plan to accomplish your goals. You may find you have to modify some of your goals because they are not realistic for your property. The practice of preventive maintenance for both your home and land should be an integral part of your overall management plan. Even if you want to maintain things the way they are, you may need to do something to keep undesirable plants from invading and to protecting surface and ground water. Working with your neighbors to develop and implement resource management will improve your chances of success!

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## Benefits of a Plan

- Helps property owners comply with environmental regulations.
- Potentially improves land management efficiency and production.
- Identifies current and potential natural resource problems.
- Provides property owners with a better understanding of what is happening on the land.
- May increase property value.

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## Components of a Plan

Here is a list of common elements found in a conservation/management plan:

- Property owner's objectives and goals.
- Aerial photographs or diagrams of the property.
- Resource information: soil type (For more information, see [Soils and Buildings](#) in the section **Soil**), potential crop production types, possible stocking rate, and water resources.
- Description of land treatment decisions.
- A work plan with location of future and completed conservation practices.
- Plan of operation and maintenance of conservation practices and systems.

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## Develop the Plan

Identifying what you want to do with the land and where, will help you develop a comprehensive plan. Include your family from the beginning of the process to help you create a plan that will meet future expectations. Even if you currently like the way your land looks, you will need to do something to keep weeds out and the water clean. Property owners are encouraged to consult with a conservation planner from the Natural Resources Conservation Service (NRCS) or your local conservation district for assistance in developing a management plan.

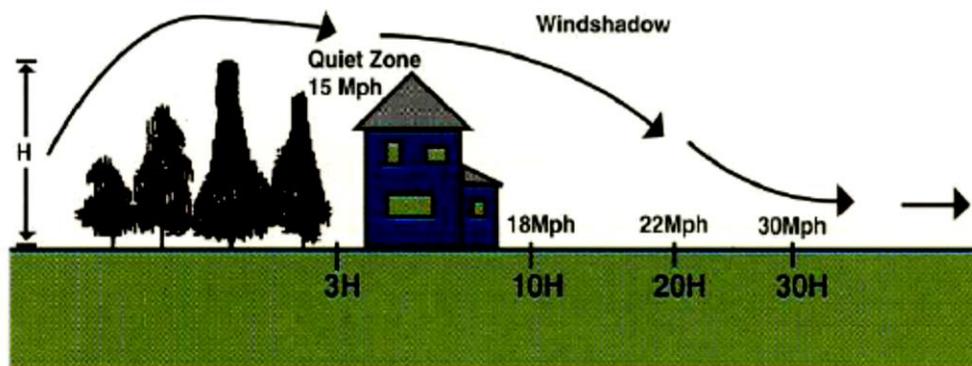
1. **Make a sketch** of the property, or if you have acreage, get a copy of an aerial photo from the USDA Farm Service Agency or NRCS. The photo will be small but can be enlarged on a copy machine. Also get a copy of the soils information for your property. Note unique features of your property such as views or sites of historical significance. Culturally significant sites may fall under historic preservation laws. Contact the State Historic Preservation Office before disturbing the site.
2. **Your plan should include:**
  - *Windbreaks or Shelterbelts*  
Unless trees are already present, you will want to establish a shelterbelt of trees to provide protection from the winds, especially in the winter. Plantings established to protect structures and livestock also provide wildlife habitat, improve aesthetics, reduce wind erosion, protect growing crops and forage, and manage snow.

Windbreaks are investments in the future value of your property. Properly designed windbreaks reduce wind speed and can lower heating costs by 25 percent. Shade trees can lower cooling

costs up to 50 percent. A successful planting depends on proper planning and maintenance. The height of the tallest row and overall density of foliage and branches influence the size of the area protected. A belt of six or seven rows should stop the snow from reaching the buildings. The ground should be prepared the year before the trees will be planted. The windbreak should be primarily of conifers with some shrubs on the north and south sides of the belt. If possible, the inside row should be no closer than 100 feet to the nearest building.

Time spent on the site preparation, weed control, and replanting will be repaid many times during the lifetime of the windbreak. While planning a windbreak, check with the local planning and zoning department regarding laws affecting tree plantings. Another important reminder when disturbing the earth is “Call Before You Dig.” Contact your local utility companies to find out where any utility lines may be buried on your property.

## Windbreak Function



- *Living Snow Fences*  
Living snow fences are rows of trees and shrubs planted to keep snow drifts off highways and access roads. A great deal of time and money is spent annually on snow removal to provide access and to keep transportation routes open. Tree plantings can protect roads from drifting snow and reduce snow removal costs.
- *Managing Runoff Water*  
Does the water drain from or pool on the property? While you may want to need or alter the drainage of water from your land, manmade alterations to the natural drainage may create adverse effects that were not intended. Drainage that affects a wetland could be a violation of the law (See [Wetlands](#) in the section **Streams, Wetlands and Water Quality Protection**). Altering the flow of water could also affect your downstream landowners from damages caused by upstream drainage activities. Check with NRCS to ensure that you are in compliance with Federal rules and with the County Planning and Zoning Office to determine whether a permit is required for your proposed activity. Also be aware if there are any Water Rights to be considered on your property (See [Water Rights](#) in the section **Streams, Wetlands and Water Quality Protection**)
- *Vegetation*  
Is the land protected by grass or other perennial plants or is there a need to establish ground cover?
- *Noxious Weed Control* (For more information, see the section [Weed Management](#))
- *Property Lines*

You may possess a map of your property, but unless the land has been surveyed and pins placed by a licensed surveyor, you should not assume that either the map or apparent boundary fences accurately reflect your property boundary. A survey of the land by a licensed surveyor is recommended before finalizing purchase of the property.

- **Buried Utility, Water, and Gas Line Locations**
  - Before digging, call your utility companies. Check to see if your area is covered by an entity that coordinates among all area utilities. To find contact information for such an entity in your state, you can visit the website [www.call811.com](http://www.call811.com).
  - Underground lines should be located and marked. Owner should maintain maps for future reference.
  - Placement of overhead utility lines should be planned for future tree plantings and safety.
  - Consider the suitability and stability of septic fields (For more information on [Septic Systems and Septic Fields](#), see the section **Streams, Wetlands, and Water Quality**.)
  - Locate drinking wells away from possible waste and flood contamination (For more information on [Wells and Water Quality](#), see the section **Streams, Wetlands, and Water Quality**.)
  - Plan for future, long-range improvements such as sheds, fencing, and water structures.
- **Water Source** (Review section [Streams, Wetlands, and Water Quality Protection](#))

Consideration must be given to water availability and water quality. Where will your domestic water be coming from: a well, surface water, or municipal water? Depending on where your water is derived from you may need to search the long-term availability and potential treatment of the water supply.

If municipal or rural water is not available, a well may need to be dug. The cost of installing a well varies with the depth to a dependable aquifer. Aquifer information is available from either the United States Geological Survey (USGS) (for most counties) or local well drilling contractors.

### **Get Assistance**

Assistance in developing and implementing your plan is available from local resource entities such as the NRCS, local conservation districts, or the Cooperative Extension Service.

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### **Know Your Responsibilities and Homesite Selection**

About to Build?

- Is the site in a floodplain or close to a stream?
- Could your access road cause slumping, scar the hillside, or cause sediment to enter a stream?
- Will your prospective homesite disturb wildlife habitat?
- Does your neighborhood lack covenants that will protect the land, water resources, and future aesthetics of the area?

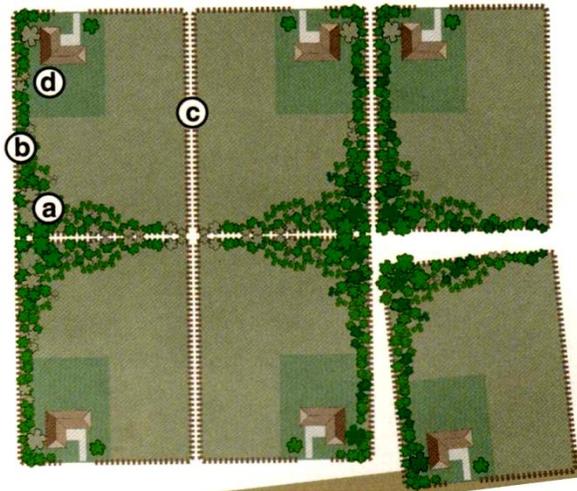
If you answered “yes” to these questions, WHOA – you have some planning to do.

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## Tips for Planning a Homesite

- Be alert for unintended consequences (for example, road construction may spread weeds and increase erosion; gardens may attract wildlife). Natural geology, topography, and vegetation can work for you.
- Plan for minimum impact on the land and the environment before building. Most sites require some excavation of earth. Because of the labor and expense involved, thorough planning is a must. The goal is to move as little earth as possible. Of the three methods of leveling – cut, fill and a combination of the two – the last is easiest and most economical.
- Check with your town or county to get background history or any studies (geologic and wildfire hazard) associated with your parcel of land. Check to see if your homesite is located in a floodplain.
- Avoid foundation and utilities excavations that remove large amounts of hard rock or cut tree roots.
- Check with your county about local zoning and building codes and obtain proper permits if required.
- Check with land trusts and conservation organizations about efforts to preserve open space in your area.
- Site homes and roads away from streams, on stable soils, and avoid steep slopes. Locate roads on stable soils away from streams. Avoid steep slopes and areas where drifting snow may accumulate.
- Maintain or plant native/suitable vegetation. Planting shrubs or grasses along streams and around corrals and pens provides a buffer to trap and absorb pollution-laden runoff before it reaches surface or groundwater. Planting native vegetation around your home's foundation requires less water and keeps the soil from eroding.
- Consider a conservation easement on your land to protect natural values.
- Construct homes and roads away from streams, in level areas, and on stable soils.
- Check carefully before buying to be sure the property is located a reasonable distance from livestock operations. Keep the direction of prevailing winds in mind.
- Locate your home so as to maximize the benefits of sunshine and shade, building for energy efficiency. Significant savings in heating can be realized by building on the east side of a rise or by locating the building site downwind of a stand of trees. A site that takes advantage of the low winter sun, even if the home is not designed for solar heating, can reap major long-term energy savings.
- Use appropriate materials and design choices (for example, non-flammable materials for roofs and siding).
- Create defensible space to mitigate wildfire hazards. (For more information on protecting your homesite from wildfires, see [Fire Prevention and Protecting Your Home from Wildfire](#) under the section **Forest Management**.)
- Avoid disturbing wildlife corridors, wetlands, and riparian areas. Locate buildings, lawn and any garden on your property so as to minimize wildlife disturbance and allow for future tree/windbreak plantings. Your property may already include high-quality habitat such as native grasses, shrubs, trees, wetlands or stream corridors. To preserve habitat, landowners should consider natural landscaping that minimizes water use and mowing. Ground cover in the form of native grasses provides habitat for many birds and mammals.
- Control your pets so they don't disturb or attract wildlife.

- Consider how your homesite will impact neighbors. By working together, you and your neighbors can help preserve and provide wildlife habitat, protect views, and minimize problems with noise and dust.
- As a neighborhood working together, you can provide the vegetation diversity that birds, butterflies, and small and large mammals need for food, cover and nesting:



- Plant small corner woodlots,
- Establish shelterbelts edged with shrubs along property boundaries,
- Connect with meadows of native grasses or pasture land,
- Locate house and lawn in a corner of your property to minimize wildlife disturbance.

#### Other considerations:

- *Dust and Pollen* – Tillage, harvesting, haying and other operations may create dust, especially during dry, windy weather. Dust easily invades homes and vehicles.

Depending on the types of crop that are being grown and the land management practices of neighbors, there can be times when air quality is low and pollen levels are extremely high, especially compared to urban areas. Farmers tilling their fields can create large clouds of dust that can travel long distances, depending on the weather conditions. Dust can also occur when fields are left bare and a wind storm occurs. High wind events are more frequent in rural areas because of the lack of natural windbreaks.

Pollen levels can also become extremely high in rural areas because of the concentration of pollen-producing crops grown in the county. Crops like grass seed, nursery plants and trees that are grown on a large scale will produce large volumes of pollen that can cause irritation or allergic reactions to individuals who are sensitive.

- *Smoke and Odors* – Fields or road ditches are occasionally burned to promote growth or control weeds. At certain times of year, smoke can be common in rural areas.

Smoke can also be caused by the burning of yard debris, cardboard and residual crop vegetation and is a common occurrence in rural areas. In some areas it is a legal and common practice for rural property owners to burn piles of vegetation that create large clouds of smoke, along with an odor that can travel for long distances.

Animal operations, more specifically AFO's and CAFO's (Animal Feeding Operations and Concentrated Animal Feeding Operations) can produce unacceptable odors and with the right

wind can be smelt from long distances away. Odors can also be derived from fields that have been recently amended with manure.

- *Noise* – Farmers sometimes work around the clock, and often that work involves the use of large farm machinery. Day and night-time hours can be disturbed by the noise and activity generated by common farm practices, especially during the spring and fall fieldwork seasons
- *Chemicals and Spray Drift* – Fertilizers, herbicides and pesticides are used in crop production. These products may affect land adjacent to treated fields.

There is a chance that rural property owners may be affected by spray drift coming from other properties. Farmers use chemical sprays to protect their plants from disease and pests, and can be vital to the success of their crop. Applicators are required to be licensed prior to spraying. Pesticides are normally applied from the spring to the fall, with the heaviest application occurring during the spring. Spray has the ability to travel by wind – drift or by volatilization that occurs when the spray turns into a gas and becomes airborne, where it can travel for very long distances. This is important to be aware of if you have concerns with inhaling pesticides or are growing crops that are highly sensitive to chemicals. Spray drift can be minimized by following the label and using best management practices.

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## Zoning

Zoning maintains compatibility between various land uses. Zoning in the county is based on a plan developed by the county to direct development in a manner which coordinates growth with the municipalities, preserves the rural quality of life, protects natural resources, and minimizes public expenditures.

The goal of zoning is to limit conflicts between adjacent property owners based on land use activities, conserve farm and forest lands and develop efficient public services and facilities.

Based on how your property is zoned, there may be restrictions on what uses are allowed. Be sure to check with the planning office, municipality or township before changing or use or beginning a new use such as a home business or residential development, as it may be zoned for agricultural use.

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## Subdividing

A subdivision can be defined as “a division of a lot, tract or parcel of land, creating one or more lots, tracts, or parcels for the purpose, either immediate or future of sale or of building development.” Growth plans and development rights in your county may prohibit the potential use of your property. Refer to local ordinances and contact your county planning office for more information.

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## Setbacks

Specific distances may be required between buildings or site features and property lines. Trees or shelterbelts, for example, may be prohibited within a set distance from a road. Setbacks are designed

for safety and to prevent future problems. Setbacks are designed for safety, to reduce fire hazards, to provide for future growth, and to prevent problems.

Rivers and streams are extremely dynamic and often require strict setback requirements due to flooding or riverbank slumping. The county planning office can provide information about setbacks that may be required. Rural subdivisions sometimes have more restrictive setbacks in their covenants or deed restrictions than do acreages. Counties cannot enforce these additional restrictions but your neighbors can. Check with your homeowners association or with the County Register of Deeds to determine if additional restrictions were filed for your property.

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## Easements

Easements may exist on property you are considering purchasing – most are noted in the property deed. An easement is a right to use, for a specific purpose, a particular piece of land owned by another. Easements can limit how property can be used and may require you to allow construction rights-of-way across your land. Roads, railroads, habitat protection, power lines, gas lines, water lines, and sewer lines are a few of the things for which easements can be established. Also be aware of easements on nearby parcels. Learn what the easement allows the easement owner to do in the way of access, maintenance and expansion, and check for limits the easement may impose on the use of your own property.

Before purchasing, it is a good idea to assess the land for any possible implied easements that may not be on the deed. Also talk with neighbors and the previous owner about possible implied easements. Easements are primarily used by the public sector for siting utility lines, pipes, or access. There are a variety of easement types with different legal implications, that if present on a property, should be understood. Check with a title company for the presence of any easements on a specific property. Easements are a matter of legal record.

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## Conservation Easement

Conservation Easements are voluntary easements that place additional restrictions on a property's development capabilities. It's a legal document between you and the easement holder that specifies what future uses will and will not be allowed on your property. These are used to protect property with important natural resources from being developed in the future. The property owner who implements the easements sets the restrictions. The easement is attached to the deed for your property and remains with the property forever. The easement holder is responsible for ensuring that the terms of the easement are met in the future. These easements are managed by either a land trust or a government agency to make sure the easement is upheld in perpetuity. Because some future development options are excluded, property taxes may be less. If interested in implementing a conservation easement on your property, contact your local conservation district or a local land trust.

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## Covenants

Many rural subdivisions have covenants that limit the use of the property. It is important to obtain a copy of the covenants (or confirm there are none) and make sure you can live with those rules.

Homeowners' associations may be established in some rural subdivisions and can provide information on common elements, private roads, open spaces, etc.

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### **Floodplains**

Flooding is a natural stream process. A floodplain is the land that is inundated with water during floods. Healthy floodplains reduce downstream flood impacts by spreading out and slowing flood waters. The process encourages aquifer recharge as water seeps into the soil. A flood plain is defined as that area which has a one-percent chance of flooding in any particular year (100-year flood plain). These areas are nutrient rich from accumulated sediment deposits.

Restrictions limit construction and activities within a floodplain to reduce potential damage during flood events. There may be restrictions in flood-prone areas regarding the type or amount of fill material (so floodwaters are not directed onto other property) or on the types of septic systems (to prevent potential water contamination). Your lending institution or insurance company may also require that you purchase Federal flood insurance if you live in a floodplain.

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### **Permits**

Building permits are required before starting any construction activity, and building inspections may be required at specific points during the construction process. The cost of a building permit is based on the value of the proposed construction. Check with the county Planning Office if building permits are required. In addition to a building permit, some construction activities may also need a storm water construction activities permit if:

- The area under construction disturbs soil
  - The construction activities are expected to contribute pollutants to surface or ground water
- 

### **Fences and Gates**

Fences and property lines are often a source of conflict between neighbors. Remember that fences do not always indicate property lines. Before purchasing your land, locate your property lines and confirm whether the existing fences are properly placed. Be sure to discuss any concerns with your neighbor and learn of past agreements. Decide if you can abide by the same agreements. Often, fence lines are shared between two neighbors and, in most cases, each landowner shares half the expense and labor to maintain or install a fence. Work with your neighbors to improve cooperation and build strong relationships.

People are often unaware of private-property boundaries. Fences often imply private property; however, private property is not required to be fenced. It is the responsibility of individuals to know whose land they are on, regardless of whether it is fenced. Always ask permission to be on someone's property.

Properly maintained fences are important for the protection of livestock and wildlife. Fences also allow for good pasture-rotation planning in managing livestock. When passing through another's gate, remember it is imperative that you leave the gate as you found it. If the gate was open, leave it open. If it was shut, close it after you pass through.

(For more information on [Fences](#), please see the section **Grazing Management and Livestock Health**.)

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### Advice on Being a Good Neighbor

- Recognize that being a good neighbor is a two-way street.
- Respect your neighbor's "Right to Farm." Refer to your own state's "Right to Farm" law for details. Visit the Farmland Information Center website to find the statute in your state, [http://www.farmlandinfo.org/search/type/law?search\\_api\\_views\\_fulltext=right%20to%20farm](http://www.farmlandinfo.org/search/type/law?search_api_views_fulltext=right%20to%20farm).
- Be aware of the types of activities that will be occurring on your neighbor's property throughout the year.
- Understand that livestock and farm machinery may need to use and/or share local roads or driveways. Be cautious, be patient, prepare for delay, and give them the space they need to maneuver.
- Pay attention to the wind when conducting certain land management activities to minimize drift or smell from burning.
- Know that actions on your property can have a negative effect on your neighbors.
- Work together to maintain fences and property boundaries so that pets, noxious weeds, runoff, or livestock are contained.
- Understand that some practices, such as burning along irrigation ditches and running machinery after dark are common farming practices and necessary at certain times of the year.
- Prevent noxious weeds from moving from your property to your neighbors' land via wind, water or other means.
- Do not let your trash accumulate as it may blow into your neighbor's field and damage the equipment used in farming.
- Coordinate use of irrigation water on shared systems.
- Proper irrigation prevents fields from turning into dusty/weedy patches and infecting neighboring fields.
- Remember that it is unlawful to use country roadways as parking areas during yard sales or family gatherings.
- Communicate: Get to know your neighbors and make an effort to understand more about their operation. With communication, many problems can be avoided. Don't assume anything.
- Respect private property and ask permission before entering. If you are granted permission to travel down private roads, be sure to leave gates as they are found (closed or open). Pay attention to "No Trespassing/Private Drive" signs.
- Educate young children about property boundaries and the importance of not trespassing.
- Privacy – Realize that while people who live in rural areas often value their privacy and their space, they also depend on their neighbors for help, advice and perhaps, a cup of sugar to finish their batch of cookies. Respect one another's privacy, but don't be afraid to extend some friendliness and courtesy.

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### Living Next to Agriculture

Homeowners should recognize that normal activities conducted as part of commercial agricultural operations are protected by the state's Right to Farm Law (refer to the Farmland Information Center for your state's Right-To-Farm statute,

[http://www.farmlandinfo.org/search/type/law?search\\_api\\_views\\_fulltext=right%20to%20farm](http://www.farmlandinfo.org/search/type/law?search_api_views_fulltext=right%20to%20farm)). These activities are an integral part of agricultural operation, and a necessary part of rural living

- Agricultural equipment can be noisy.
- Agricultural operations are sometimes conducted outside of normal business hours. Spray planes often fly early in the morning, while cutting and baling machinery often operates at night.
- Some pesticides emit an unpleasant odor. Pesticide use is strictly regulated by state and federal governments.
- Animal livestock manure often smells bad.
- Tillage operations can raise dust.
- Field burning creates smoke.
- Agricultural equipment operators have a right to use public roads.

## Outdoor Recreation and Public Lands

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The rural setting offers a variety of outdoor recreation. Hunting, fishing, bird watching, snowmobiling, all-terrain vehicles, hiking, and biking are a few examples. Some of these activities will occur in proximity to your property. You can control activities that occur on your property, but that right ends at the property line. You may need to establish some type of boundary to identify where your property ends or begins. Many individuals will establish a tree row, fence lines, or markers to indicate their property boundaries.

Even if you don't like hunting, you can't stop your neighbor from engaging in that activity on their own land. In North Dakota, there is a regulation preventing hunting within 440 yards of an occupied building without the owner's consent. This regulation only applies to land you directly own and control. If you have a two-acre lot you cannot stop the adjacent landowner from allowing hunting anywhere on his rural property, even if it is right up to the property line. So, when it comes to hunting and the discharging of firearms, be sure to know your specific state and local regulations.

Public land includes areas of land owned and/or managed by local, State or Federal government. These areas can include wildlife and waterfowl production areas, parks, Bureau of Land Management parcels, wetland management districts, and even historical sites. If your acreage is adjacent to public land, you will have recreational activities occurring next to you.

Being close to a recreational area can be a very attractive amenity to your household. Other citizens will also be utilizing the area and you will have increased traffic around your property. Placing a residence adjacent to a public use area will not preclude any activities that land is used for. For example, if you build your house next to a Wildlife Management Area that allows hunting, there will continue to be public hunting access on that parcel of land. An area designated for operational ATVs, snowmobiles, or other type of recreation will generate noise near your property.

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### Land Management Activities on Public Lands

If you have not lived in the western part of the country, you may not be aware of land-management activities that occur on neighboring public lands. These lands are actively managed to reduce the risk of wildfire, restore healthy ecosystems, protect rare plant and animal species and produce natural resource commodities such as timber and forage to promote economic stability within local communities and industries.

- Prescribed burning (i.e. controlled fires) is often used to reduce hazardous fuels that can carry wildfire and to restore historic plant communities and habitats. Controlled burns are usually conducted in the fall after the wildfire season. The Forest Service posts signs along roads when it is conducting a burn in the area.
- Thinning and commercial timber/firewood/biomass harvest helps reduce risk of wildfire, restore historic vegetation, enhance wildlife habitat and promote natural functions and processes.
- Seeding native plant species helps restore natural ecosystems and reduce weeds.
- Controlling invasive plants through spraying or pulling.
- Managing livestock grazing through allotment management plans.

- Developing recreational facilities and opportunities including campgrounds, trails, and boating facilities. Some popular trails require permits even for day hikes. Some also require that dogs be leashed.

***Be Informed and Get Involved***

Find out what is happening on the public lands in your area. Ask to be included on mailing lists for land management activities. Attend public meetings, scoping sessions and other forums to participate in the management of your public lands.

# Soil

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## Soil Basics

Soil is a vital resource in the production of food, fiber, and many other necessities of life. Property owners who understand the basic facts about soil should be better prepared to identify and address issues on their property.

Soils develop over geological time. Climate, water, temperature and parent materials all contribute to soil creation. Parent material is the underlying geological material (generally bedrock or a drift deposit) in which soil horizons form. Soils typically inherit a great deal of structure and minerals from their parent material, and, such as, are often classified based upon their contents of mineral material that has undergone some degree of physical or chemical weathering. Parent material can include bedrock, volcanic ash and glacial outwash.

It can take 500 years for natural processes to create an inch of top soil. Soils are also fragile. They are susceptible to erosion when not adequately protected. Without productive soils we would not be able to grow plants which provide us with food, medicine, industrial products and wildlife habitat.

Soils have different textures including silts, sands and clays. The combination of these textures determines the characteristics of your soils. The depth of the soil to bedrock or the water table is often a factor which determines land use. Steepness of slope or position on the landscape can affect soil stability and sustainability.

The characteristics and how they affect the potential of a soil are outlined in a document called a soil survey. (For more information on a soil survey, please see the section [“Types – Know Your Soil.”](#))

## Five Essential Functions of Soil

- **Regulates water** – soil helps control where water goes. Water and dissolved particles flow over the land, into and through the soil
- **Sustains plant and animal life** – the diversity and productivity of living things depends on soil.
- **Filters pollutants** – the minerals and microbes in soil are responsible for filtering, buffering, degrading, immobilizing, and detoxifying organic and inorganic materials, including industrial and municipal by-products and atmospheric deposits.
- **Cycles nutrients** – carbon, nitrogen, phosphorus, and many other nutrients are stored, transformed, and cycled through soil.
- **Supports structures** – Buildings need stable soils for support, and archeological treasures associated with human habitation are protected in soils.

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## Soil Health

Soil is more than just dirt. Everyone is dependent on soil. Plants use minerals in soil to grow. These plants give us food, shelter, fiber, and oxygen. Topsoil is the most productive layer. It has varying amounts of organic matter, minerals, and nutrients. Five tons of topsoil spread over an acre is as thick as a dime. It can take up to 500 years to form one inch of topsoil through the natural process. Understanding limitations of the soil on your property is very important. The types of soils on your land

will greatly affect what you can build and grow. Soils can vary widely even over a distance of just a few feet. They differ in chemical makeup and physical properties based on:

- Parent material (the kinds of rocks your soil has been formed from)
- Climate
- Temperature
- Biological factors (native vegetation)
- Topography
- Time (how young your soil is. e.g. “young” soil in geologic time means thin topsoils and lower fertility)

The Web Soil Survey (WSS) provides soil data and information and is produced by the National Cooperative Soil Survey. It is operated by the USDA Natural Resources Conservation Service (NRCS) and provides access to the largest natural resource information system in the world. For more information and to access the survey, visit their website at <http://websoilsurvey.nrcs.usda.gov/app/> and stop by your local USDA Service Center or see your local NRCS Soil Scientist for assistance.

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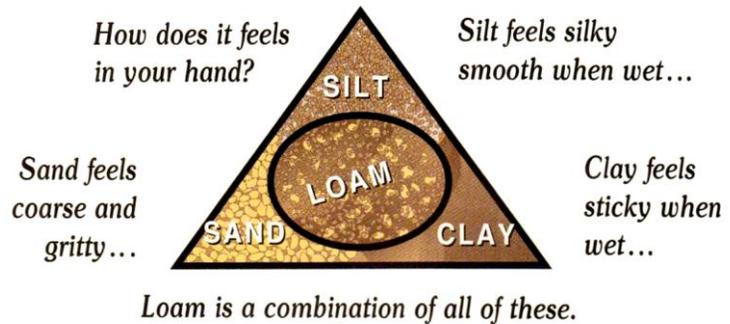
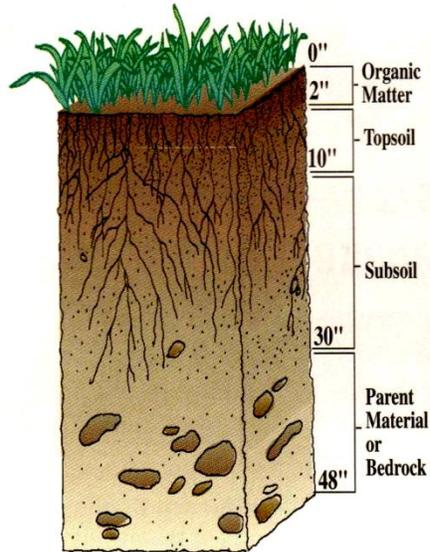
### Types – Know Your Soil

Soils vary widely, even across your backyard. The type of soil you have will influence:

- What type and how much grass, flowers, trees and crops your land can produce
- How quickly water moves through the soil, or the ability of the soil to hold water
- How well a septic system will function: will the soil filter human and animal wastes before they reach groundwater?
- How often you need to irrigate
- How much fertilizer is needed, if any
- Construction of foundations or basements for buildings. Are there possible problems with building foundations?
- Whether the area is a wetland
- What type of trees will survive or thrive
- Water table depths, shrink/swell, flooding

To obtain information about your soil types or a copy of your local soil survey, visit your local NRCS and Soil and Water Conservation District office. The soil survey is a detailed inventory and evaluation of the most basic resource of the survey area – the soil. It is useful in adjusting land use, including urbanization, to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in uses of the land. Fall is the best time to test your soil’s pH and for the availability of nutrients. Your soil test will give you very important information that you need to understand such as pH, extractable nutrient levels, cation exchange capacity, percent organic matter, lime recommendation, and plant nutrient needs. All of these items are needed and work together for healthy for a healthy plant growth. If you have any questions after reviewing your results, contact your local conservation district office or Extension service office.

## A Soil Profile:



Knowing the type of soil(s) is very important when making decisions about your property. Soils can vary greatly – even across a small acreage.

In general, there are three major soil textures:

**Medium textured soils** (loams, silt loams, sandy loams) are the best soils for all around use. Water goes in at an average rate, and is held with medium strength.

**Heavy textured soils** (clays, shale) have a slow infiltration rate and high shrink-swell. Water goes in slowly but is held tightly. They can be difficult to build on and have some construction limitations. They often limit the effectiveness of septic tank drain fields.

**Light sandy soils/Coarse Textured soils** (Sands, loamy sands) have a rapid rate of infiltration; tend to be droughty and are poor for gardens and plants unless large amounts of organic matter are added. They are, however, good soils to build on. Water goes in quickly and is held loosely/poorly. Septic tank drain fields do not function well in these soils and risk polluting groundwater. Most county planning and zoning offices will be able to give information on septic installation.

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## Soil Fertility and Soil Biology

Soil is alive and, like us, works best when it's healthy. Soil biology is one aspect of soil that is commonly overlooked but is important to the soil's fertility. Diverse and balanced soil biology creates a high-quality soil. Soil is an ecosystem where thousands of different creatures interact and contribute to the overall health of the soil. One simple indicator of healthy soil biology is the presence of earthworms and nematodes (roundworms), the more the merrier. Soils that have a healthy biology are much more resilient to extreme environmental conditions and severe disturbances. Those soils can also produce healthier plants that are more resistant to disease. Many land management choices, like spraying and tilling, if done improperly, will disturb and damage the soil's biology.

### ***Soil Test***

A soil test lets you know what nutrients your soil needs to produce healthy plants. The cost of soil testing is minor compared to the cost of dealing with the problem after planting.

Soil analysis gives you chemical and physical information about your soil which can be used to optimize plant growth or assist in solving soil related problems. Soil test results will guide you in the decision whether or not to fertilize, resulting in environmental and economic benefits.

- Test your soil for excess salts, pH, soil texture, adverse nutrient levels, etc.
- Apply recommended fertilizer and lime (more is not better)
- Avoid compaction – stay off wet soil so as not to pack soil and push out the air which will reduce water infiltration.
- Add organic matter (e.g. compost) – which is a mixture of dead plants, roots and leaves. If the soil is clayey, adding compost will help the soil drain water; if it is a sandy soil, compost will help to hold water.

There are several ways you can test your soil to determine the physical properties and nutrient levels. These include: “Do it yourself” home tests, home commercial soil testing kits, and professional soil testing laboratories. The home commercial test can be purchased at a local gardening store for a relatively low cost given the money one can save from fully understanding the irrigation and amendment needs of their soil.

The “do-it-yourself” methods can provide fairly good results if done correctly; soil type, compaction, pH and biological health are the four characteristics of a soil that can be tested with these methods.

However, soil tests from a laboratory at a university in your area, are more reliable and detailed than home test kits. In addition to the test results, the soil lab will send you a summary report that will state if your soil needs amendments such as nitrogen or phosphorus, and recommended application dates. Apply according to the recommendations. The NRCS and your local Extension office can assist property owners with collecting a soil sample and locating a testing lab.

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### **Soil Management and Having a Soil Management Plan**

Practicing good soil management can help limit the amount of soil that leaves a piece of property and increase the soil’s biology. Property owners can reduce the amount of sediment that leaves their property through consistent land monitoring and implementing conservation practices. Soil nutrient depletion, loss of healthy soil characteristics, reduced soil productivity and water pollution are just some of the consequences of improper soil management.

Conducting a visual site analysis and documenting problem areas and changes to the land over time could greatly benefit any grower.

### ***The Plan***

- Base Map of the property with a soil inventory and other natural resource data. Provide a means for recordkeeping on the map.
- Inventory of soil opportunities and issues on the property.
- Land management practices that can resolve the soil issues or enhance existing resources.
- Goals that the property owner wants to accomplish.

- A list of resources.
- 

### Soils and Buildings

No matter where you live, you need to work with the geology and soils of the land – not against them. A few questions to ask:

1. Are soils around a building or on a building site prone to the “shrink swell” syndrome – expanding when they’re wet and contracting when they’re dry?  
*If the answer is yes: Maintain low-water plantings around existing buildings to minimize damage to foundations. If you’re building: Consult with a geotechnical engineer and make sure proper design and construction procedures are followed.*
  2. Is radon gas present in the soil and bedrock?  
*If the answer is yes: Place radon test kit in your basement. (In new construction, place in basement after space is enclosed but before construction is finished.) If readings are high, install proper ventilation.*
  3. Is your building site on a slope of more than 7 to 10 percent?  
*If the answer is yes: Consult a geotechnical engineer for a slope-stability study before you build.*
  4. Is your building site on or near abandoned coal mine workings or in a historic metal mining area?  
*If your site is on or near an abandoned coal mine, a geotechnical engineer should conduct a subsidence investigation. If you are building in a historic metal mining district, you should have an environmental audit done to evaluate mine waste material on your site and the extent of underground mine workings. If you have a hazardous mine opening on your land, contact the division within your state government which specializes in Geology and Mining issues.*
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### Soil Erosion

(Also, review the section [Erosion Control](#))

Soil erosion and its impacts are some of the most important but poorly understood environmental concerns we face. Soil erosion can be caused by:

- Water
- Wind
- Tillage Practices
- Development Practices
- Agricultural Practices

Soil erosion is a consequence of over-grazing or leaving land exposed, combined with damaging rains and winds. Stream banks are highly susceptible to soil erosion when left bare because of the constant force of the waterway. Removal of riparian plants can cause large amounts of land to be washed away. Maintaining vegetation or residue on the land year-round is the best strategy against excessive soil erosion. “No-till” is another land management strategy that can greatly reduce the amount of soil that leaves your land. (For more information on [No-Till farming](#), please see the section **Sustainable Agriculture**.)

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## Soil Compaction

Soil Compaction is a change in the soil structure and not just an increase in soil density. This causes the soil to have smaller pores, limiting its ability to absorb water, decreasing crop yields, and increasing runoff.

Compaction is primarily caused by wheel and animal traffic. The size, weight, and frequency of traffic directly relates to the speed and level of compaction that is occurring.

There are different types of compaction, each with different causes and treatments. The types are:

- Surface Crusting
- Surface Compaction
- Deep Compaction
- Plow Pan

Wet soil is the most susceptible to soil compaction, so limiting heavy machinery operations during these times is ideal but can also be a tough decision. If soil compaction is causing you problems, contact the NRCS or an agronomist.

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## Practices to Improve Soil Performance

(Also review the section on [Sustainable Agriculture](#))

### **Add organic material**

Regularly adding organic material helps enhance soil quality, soil structure, water and nutrient holding capacity, and helps protect the soil from erosion and compaction.

### **Avoid excessive tillage practices**

Tillage is necessary practice for preparing fields, but unfortunately it makes soil more susceptible to erosion, causes compaction, and can alter the productivity of the soil. By reducing tillage practices you can minimize these problems, diminish the loss of organic material and increase the amount of residue on the land.

### **Cover the soil**

Bare soil is much more susceptible to erosion than land that has crop or residue cover. Many farmers leave the residue on their land between growing seasons for the purpose of reducing erosion. In addition, cover crops, once decomposed, can add important nutrients and organic material to the soil. Ground cover needs to be managed for diseases, pests, and phosphorus build-up.

### **Reduce Chemical Use**

The use of fertilizers and chemicals for pest management can greatly impair a soil's health biology. Chemicals can harm naturally-occurring organisms crucial to its fertility and structure. Utilizing primarily non-chemical approaches to land management and only applying chemicals as a last resort can help increase the natural biology of the soil.

### **Increase Crop Diversity**

Different crops provide unique beneficial factors to the soil. These factors help control pests and weeds naturally due to the diversity of organisms in the soil. By rotating vegetation or crops and increasing the diversity, you can increase the types of insects, microorganisms, and wildlife that are present on your land.

### **Soil Monitoring**

Day-to-day observation and the development of a soil management plan will assist property owners in identifying changes to their soil and its productivity. Periodic soil tests can assist with identifying necessary soil amendments.

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### **Nutrient Management**

Nutrient Management is used to manage the amount, source, placement, form and timing of plant nutrients and soil amendments. The goal is to optimize crop yields and minimize non-point source pollution while maintaining or improving soil conditions. The most common soil nutrient amendments are: nitrogen (N), phosphorous (P), and potassium (K).

*Nutrient Application* should be done in response to a plant's uptake characteristics, while considering weather and climate conditions to minimize runoff.

- No direct nutrient application in established buffer areas
- Don't apply to frozen, snow-covered or saturated soils
- Don't apply dry manure when there is potential for wind-driven loss
- Delay application if precipitation is forecasted within 24 hours of the time of application
- Avoid applying upwind of occupied structures

For more information, contact your local Extension office or the local NRCS office.

## Weed Management

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Light, water, and nutrients are the essential components for plant growth and development. Weeds and brush compete with forages for these valuable components. Unfortunately, weeds and brush are often the successful survivors. Every pound of weeds means fewer pounds of forage. Grass in weed-free pastures form thicker stands, that livestock tend to graze more uniformly. Controlling weeds and brush in pastures will increase forage production, carrying capacity and profits. If not managed properly, your property could be a source of weeds causing problems for you and your neighbors. As part of your plan for your land, consider Weed Management/Control.

The best practice to prevent weeds from establishing or spreading is to establish long-term perennial grasses where bare soil is present. Once perennial grasses are established, weeds either spread more slowly or grass competition prevents them from establishing from seed. Careful use of pasture is the key to managing good grass stands. If continuous grazing of livestock occurs on small acreages bare soil will result, making an excellent area to establish. (For more information on grazing, please see the section [Grazing Management](#))

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### What is a weed?

A weed is often defined as a plant growing in a place it is not wanted. Almost any plant could be classified as a weed if it spreads out of control. The most problematic weeds are invasive, persistent, and difficult to control. Some plants are also poisonous to animals and humans. The most common terms for classifying weeds are noxious and invasive.

**Noxious weeds** can cause harm to the natural environment, humans, and animals. Noxious weeds spread rapidly and are difficult to eradicate. They often start in soil disturbed by construction, recreation and other human activities, and are then spread by wildlife, livestock, machinery and vehicles, people, wind and water. Noxious weeds are capable of spreading by underground plant parts as well as by seed dispersal, and require special cultural or chemical practices for control.

Because noxious weeds are not native to the United States, they grow unchecked by natural enemies such as insects or diseases. All noxious weeds are aggressive and competitive, stealing moisture, nutrients, and sunlight from other plants. Their biology allows them to spread rapidly and invade neighboring land covered by native plant communities.

**Invasive weeds** proliferate, crowding out desired vegetation and creating mono-cultures leading to declines in habitat diversity.

Weeds left unchecked can reduce the enjoyment, beauty and value of a piece of property or severely harm the natural environment.

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### Weed Control

Weeds and brush can be controlled in a number of different ways. Competition from the forage is one of the most underused methods of weed control. The pasture must be managed for maximum

production to make the forage competitive with weeds. Soil pH and fertility must be monitored and maintained according to soil test recommendations. Most forages will not produce maximum yield in acidic (low pH) soils. Remember, a soil test is an inexpensive management tool that can enable the forage producer to harvest high quality hay, if the recommendations are followed. Fertilize soils according to soil test recommendations to maintain readily available quantities of phosphorus, potassium and other elements essential for forage growth. Add nitrogen as needed but with caution not to apply excess. Excess nitrogen may predispose the forage to attack by insects and diseases. Areas attacked by these pests may be killed or weakened, which will create ideal sites for weed invasion. Also, remember not to apply fertilizers or pesticides when rainfall is imminent because excess nutrients and chemicals may flow into waterways contaminating the water. (For more information on testing your soil's nutrients, please see the section on [Soil Fertility and Soil Biology](#).)

Weeds spread fast so regularly look for new weed patches on your property and act immediately to treat them by using one or more weed control practices mentioned in the following section. Weed management never stops. Weeds that appear to be suppressed may re-emerge. Team up with neighbors to improve effectiveness. Remember, weed control by itself is not enough. It is also necessary to modify the practices that caused weeds to become established in the first place! Responding quickly to weed infestations when it is just a plant or two is crucial to keeping weeds under control.

Reducing soil disturbance is key to controlling weeds, along with regular monitoring and weed removal.

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### Weed Management Strategies

It is encouraged for property owners to work with neighbors on weed management because of the transient nature of weeds. Be aware that certain weeds require different management strategies to control. Identifying weed threats on your property is the first step to early detection and rapid response. Here are some other strategies for managing weeds:

**Prevention:** Prevention is the most effective and least costly form of weed control. Weed seeds are spread onto new lands by wind, water, animals, and man. Some weeds spread by plant or root parts. Proper land management will help keep desirable vegetation healthy which prevents weed seedlings from establishing a foothold. Buy only weed-seed-free hay, plant only certified grass and legume seed, wash your vehicle after being in a weed-infested area, monitor your property, avoid over grazing, and respond quickly to any new weed infestations. Reseed soil that has been disturbed with a seed mix that will work at your site and provide desirable grasses to guard against weed invasion. This may work best when you cooperate and collaborate with your neighbors to keep the soil covered with desirable, productive plants.

The best way to combat weeds is to provide strong competition from desirable plants. Having healthy, vigorous perennial plants that provide competition for the space, moisture and nutrients is the best way to keep weeds away. Use native or naturalized vegetation to out-compete noxious weeds. Annually cropped fields and gardens are difficult to manage because they do not maintain a stable population of plants to compete with weeds.

**Biological:** Biological control attempts to find something in nature that can weaken or eventually kill a weed plant. Successful bioagents include certain fungi and insects from a weed's country of origin that weaken weeds by attacking seed heads and other plant parts.

**Mechanical:** Techniques like mowing, tilling, hand-pulling, or burning can physically disrupt plant growth. Mow weeds annually before they go to seed. Pull small weed patches and weeds near streams by hand. Use caution with tilling, which can help spread some weeds.

**Livestock Grazing:** As a practical method of weed management, graze non-poisonous weeds before they go to seed using sheep, goats, or cattle. Because livestock and wildlife can easily carry and spread weed seed on their coats or in their feces, avoid moving livestock from a weedy area to a weed-free area. Brushing horses and cleaning equipment after riding or traveling through weed infested areas before returning home will prevent the transport and introduction of weed seeds. Some weed species, if eaten, will make livestock sick. Pastures that are not overgrazed maintain a healthy and diverse grass cover and do not have bare ground patches which are prone to grow weeds. Livestock owners should purchase weed-free hay and feed.

**Chemical Herbicides:** The use of herbicides to control weeds should be the last resort. This is only a short term solution before the development of a longer term means of management. Herbicides may be expensive, but are effective when applied in the proper amounts and at the proper time of year. Read the label instructions carefully and follow directions. Use chemicals away from water to prevent adverse health effects to you and your animals and to prevent pollution of streams and groundwater. Utilize weather tools, buffers or other practices to minimize any transport to water by runoff or drift. Only licensed users can use restricted herbicides. Call a local farm supply store to find out about hiring custom chemical applicators to spray your weeds. Be sure herbicide will not reach and kill desirable trees and shrubs. Properly dispose of leftover chemicals.

Herbicide formulations can be target-specific, such as a broadleaf formulation that will not harm grasses, or they can be a "kill-all" which kills everything it's sprayed on. There are formulations that kill the target weed yet become inert when in contact with the soil. There are some, which, when sprinkled on the ground, prevents seed germination for a period of time. There are some that can remain active for a month or even years, thus preventing new weed growth.

Formulations with longer effects are considered residuals and have the potential to weaken trees and shrubs over time. A tree's root zone is considered to extend out along the ground to the edge of the leafy canopy above, though the roots can actually extend well beyond that. Weed and feed products have been known to cause damage to trees planted in lawns. The effects are slow and by the time the damage is noted, the tree is usually on its deathbed. There are formulations for broadleaves that can be used safely around trees without great adversity.

Some formulations can become volatile when used above a particular temperature. This means that after spraying, high temperatures can cause the components of the liquid mixture to turn into an invisible gaseous state that can travel along the ground and damage non-targeted plants.

Mulches, cultivation and other cultural methods of management are usually lower cost and often more effective than the use of chemicals. Whenever you have a disturbed site, seed desirable plants before weeds take over. Never leave bare soil.

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## Transportation of Weeds

Weeds travel by many means – people, animals, wind, water, machinery. Here are some practices that will help limit the spread of invasive and noxious weeds on your property.

- After working with or walking through weeds or invasives, wash your clothing, boots or machinery to remove any remaining residue or plant seeds before moving to another area.
- Use only native or naturalized species when planting new vegetation. Invasives are commonly used unknowingly as ornamentals.
- Dump fish tanks/aquariums down the drain or into the trash. Many aquarium plants and animals are aquatic invasives.
- Buy fire wood locally. Weeds and pests can be transported in wood.
- Clean boats of all vegetation and aquatic life after each use. CLEAN, DRAIN, and DRY.

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## Know Your Weeds and the Harm They Can Do

Know your weeds before they...

- Choke out desirable forage for livestock and wildlife
- Reduce the productivity of your pasture and land
- Cause water pollution and soil erosion because they're less effective at holding the soil
- Spread RAPIDLY!

To view federal and state noxious weed lists, an invasive plant list, or an introduced plant list, visit the USDA NRCS website at <http://plants.usda.gov/java/noxiousDriver>.

Below are pictures of some of the many weeds found across the country.



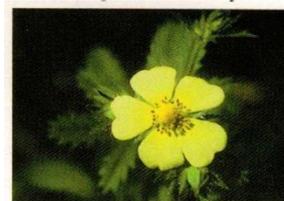
Knapweed (Spotted, Russian, and Diffuse)



Leafy Spurge



Whitetop



Sulfur Cinquefoil

*To distinguish from other native cinquefoils, note that sulfur cinquefoil has many stem leaves, few basal leaves, and long, right-angled hairs along stems.*



Dalmatian Toadflax



Canada Thistle



Purple Loosestrife



Hoary Cress



Downy Brome



Musk Thistle



Dyers Woad



Burdock



Cocklebur



Curly Dock



Teasel



Foxtail Barley

## Examples of Noxious Weeds



### **Yellow Flag Iris**

Grows with roots in water. Prefers partial shade. Resin can irritate the skin. Must remove all parts of the plant.



### **Butterfly Bush**

Commonly escapes yards and takes over riparian habitats.



### **Meadow Knapweed**

Found in disturbed areas, roadsides, waste areas, and pastures. Remove roots and place flowers in a bag for disposal.



### **Purple Loosestrife**

Square stem and can get up to 10' tall. Mature plant can produce 2.7 million seeds. Found mostly in moist or marshy areas.



### **Tansy Ragwort**

Produces yellow flowers. Found in pastures, roadsides and other disturbed areas. Mowing is ineffective.



### **Knotweeds**

Multiple strains: Giant, Japanese, Himalayan & Bohemian. Red bamboo-like stem. Grows along roadsides, trails and rivers.



**Lesser Celandine**

Ground cover with bulbous roots. Mechanical control ineffective, spreads it. Bag all parts.



**Diffuse Knapweed**

Found in gravel pits, roadside, vacant lots, and heavily grazed pastures. Mowing or cutting can increase infestation.



**False Brome**

Bunch grass that has broad flat leaves with hairs along the edge. Mow or pull before it seeds.



**Thistles**

Found along roadsides, ditches, fences and disturbed areas. Mowing may increase population.



**Spotted Knapweed**



**Water Hemlock**



**Orange Hawkweed**



**Puncturevine**



**Hairy Nightshade**



**Black Nightshade**

### Weed Classification

Life cycle type serves to classify weeds, and often control measures. Below are just some of the different weeds in their classifications.

<b>Perennial</b> <i>(back every year)</i>	<b>Biennial</b> <i>(2 year life)</i>	<b>Annual</b> <i>(1 year life)</i>	<b>Poison</b>
Canada Thistle Leafy Spurge Dalmation Toadflax Hoary Cress Knapweed Others	Houndstongue Scotch Thistles Others	Downy Brome Mustards Others	Larkspur Death Camas Hemlock

## Pasture Management

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A pasture is a grazing area for animals enclosed by a fence. These grazing areas are a very important resource. They provide the forage that is the heart of the beef, dairy, goat and horse operations. Whether you farm full-time or part-time, have numerous livestock or a few, good pasture management can improve your bottom line. It also helps protect natural resources, improves water quality and enhances the environment. Good pasture management includes forages, water, fences, fertility, weed management, and grazing systems.

Maintaining a pasture to its maximum potential requires management that does not allow animals to over-graze, trample or compact the soil. Putting too many animals on the land will put increased stress on the pasture and can quickly turn the pasture into a muddy, weedy field. Improving or protecting the health of your pasture can help increase the property's value while reducing the amount of polluted runoff that leaves the land. A healthy pasture will also support animal health by providing nutritious forage that will better their chances of staying disease-free.

Choosing and managing forages for your operation is a top priority. You will want forages that meet the nutritional needs of your livestock and that are suited for your soils. Consider a mix of cool-season and warm season grass pastures, as well as grass-legume mixtures. Plan for the year around forage needs to ensure high quality forage when livestock nutritional requirements are high.

Clean water is essential for producing healthy livestock. As you begin to divide your acreage into several pastures, how you supply water to livestock in the field will become more of a challenge. Both natural and man-made water sources can be used effectively in grazing systems. Always strive to keep livestock out of water sources to protect water quality and prevent contamination. Options for livestock water development include ponds or stock tanks. Stock tanks can be supplied by a pressure system, animal-powered nose pumps or ram type pumps. (For more information on [Water Requirements of Animals](#), see the section **Grazing Management and Livestock Health**.)

Like cropland, pastures also need the right mix of nutrients to be productive. Soil fertilization can help you improve forage quality, yield and diversity. Fertilizing and liming promote a vigorous, healthy stand. Soil testing is critical for effective pasture fertility management and should be done every three to five years. This will help you assess available nutrients for the forage crop and determine how much fertilizer and lime to apply to each pasture. Nitrogen (N) is associated with lush vegetative growth; adequate Phosphorus (P) is required for flowering and fruiting, and Potassium (K) is necessary for durability and disease. Lime is often needed in pastures to neutralize acidic soil and improve pasture productivity. Plants, especially legumes, are unable to use nutrients in soil too acidic. Remember to follow your soil test recommendations when applying fertilizer and lime. (For more information on [Soil Testing](#), see the section **Soil**.)

Applying manure to fields and pastures may help with the soil's tilth, water holding capabilities, resistance to erosion and production of beneficial organisms. Crop nutrient needs should be the regulator for how much manure is applied. The goal is to maximize nutrient use with minimal environmental hazard. Nutrients in manure vary between animals, so conduct soil tests and then choose the proper animal manure accordingly.

## Pasture Crops

Decisions crucial to grazing management should be made based on plant growth. Pasture crops vary in the time of season when they are most productive, so choose accordingly. Proper irrigation, soil management and lime application can help improve a pasture's productivity.

When choosing a pasture crop it is recommended to choose a mixture of ONE GRASS and ONE LEGUME. Many of the commercial seed mixtures will consist of a large variety of grasses and legumes, which can be hard to manage because of their different growing season and livestock appeal. Ultimately, you want to choose a mixture that is best suited for the animals that will be foraging.

Depending on the condition of your pasture, you may need to reseed with new forage crops. Understand that the state of a pasture is a sign of the current management practices; reseeding without changing management practices can be an expensive and ineffective decision. But if a pasture does not improve with better management then reseeding is the next step.

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## Pasture Establishment

Before replanting a run-down pasture, consider invigorating it with improved irrigation, fertilization, weed control and grazing management. If poor management practices have created a run-down pasture, the management approach needs to change before investing a lot of resources into improving or replanting it.

**Seed bed preparation** – Best results come with a clean, firm seed bed. An herbicide application (broad-spectrum type such as Roundup) may be necessary prior to tillage for effective control of perennial weeds. To prepare the soil, cultivate with a plow or disk and use a cultipacker or roller to firm the seedbed so that your footprint leaves only a ¼ depression. A firm seedbed helps control planting depth.

**Species selection** – Access to irrigation is the primary concern in determining which grass species to plant. Drought tolerant species are not as palatable or productive but are the only realistic option when sufficient irrigation water is not available. Another factor to consider is tolerance to salinity and standing water. If the site is free of these constraints, consider palatability and yield. Legumes such as alfalfa or clover are often included in pasture mixes. These broadleaf plants may be killed by herbicides if a broadleaf weed treatment is needed after establishment.

**Planting considerations** – Pasture planting is most successful when completed in the spring months of March and April or early fall months of August and September. The seeding rate for most species is 15 to 20 lbs/acre. Planting depth should be ¼ inch. Seed planted deeper than ½ inch will have difficulty emerging. Either drill or broadcast spreader can be used to distribute the seed. Rolling after planting assures good contact between the seed and the soil which aids in germination.

**Non-irrigated pastures** are generally planted in November and December. This is called dormant seeding, and increases the likelihood of proper moisture for early spring germination.

**Grasses** – A mixture of grass species is often desirable. However, mixtures that contain a large number of varieties tend to lose their more palatable species, because animals preferentially graze them. Many of these pastures end up being dominated by the least palatable species.

**Legumes** – a legume such as alfalfa or clover can be added to the mix at a rate of 1 to 2 lbs of seed per acre to increase forage protein and provide organic nitrogen.

**Grazing** – New seedlings should be protected from grazing and trampling until plants are sufficiently established so that they will resist being uprooted by grazing animals. This can be accomplished by taking one cutting of hay before allowing animals to graze. Non-irrigated pastures may require two summers without grazing.

### What is Your Annual Pasture and Hay Production?

	Fertile Soil		Poor Soil	
	Feed (Hay) Tons/Acre	Forage AUMs/Acre	Feed (Hay) Tons/Acre	Forage AUMs/Acre
Irrigated	2-4	3-4	Less than 2	1-2
Non-irrigated	1-2	1-2	.5 or less	.5
Rangeland/woodland	1	.5	.5 or less	.25

These figures are averages and may vary up or down, depending on management. "AUM" stands for "animal unit month." (For more information, see the section [Grazing Management and Livestock Health](#))

### Increasing Your Pasture Production

A pasture is grazing area for animals enclosed by a fence. Pastures are often planted to non-native plant species to increase their production. These pastures may need fertilizing, irrigating, and periodic replanting.

- Develop irrigation, which may require a water right, depending on your state. Practice irrigation water management. Under-irrigating will shorten the life of your pasture; over-irrigating wastes energy, water, and your time.
- Fertilize according to NRCS and soil test recommendations. Believe the soil test! Over-fertilizing is not better and can damage water quality.
- Mow pastures to a uniform 3" height. After grazing to stimulate equal growth of all plants.
- Drag or harrow to spread nutrient-rich manure.
- Control weeds.
- Reseed. Contact your local NRCS office to determine the most productive seed mixture for your purpose and location.

### Consider Custom Farming as a Way to Improve Your Pasture

Many landowners find it too expensive to own their own farm equipment for preparing the soil, seeding, harvesting, or baling. Ask your neighbors whether they know of any custom farmers or ranchers in the area who will follow your instructions for improving your pasture.

Signs of GOOD Pasture Management	Signs of BAD Pasture Management
<ul style="list-style-type: none"> <li>• Sacrifice area used when pasture is wet.</li> <li>• Large pasture subdivided into smaller pastures</li> <li>• Animals fenced out of streams</li> <li>• Water provided in each pasture</li> <li>• Presence of a vegetation buffer between streams and pastures</li> <li>• Forage is never less than 3" in height</li> </ul>	<ul style="list-style-type: none"> <li>• Bare ground filled with weeds</li> <li>• High browse lines on trees and shrubs</li> <li>• Trampled stream bank</li> <li>• Animals grazing through the fence</li> <li>• Grazing happening on wet soil</li> <li>• Animals sunk in the mud/manure ankle deep</li> </ul>



**Poor Pasture Management**



**Good Pasture Management**

## Mud Management

### Mud Production

Mud can be caused by a number of activities and conditions, including increased surface water, high traffic areas, highly organic soil, and the lack of ground cover. If not managed properly, mud can be hazardous to animal health, causing sickness and parasites. In addition, runoff from a muddy property will have high levels of sediment that contribute to water pollution.

### 6 Techniques for Reducing Mud

Reducing the amount of rain and water that runs through a pasture and animal yard will greatly reduce mud production. Ideally you want to divert water to a wetland, stream, ditch, bioswale or other safe outlet before it passes through animal areas. Here is a list of additional techniques for reducing mud production on a property.

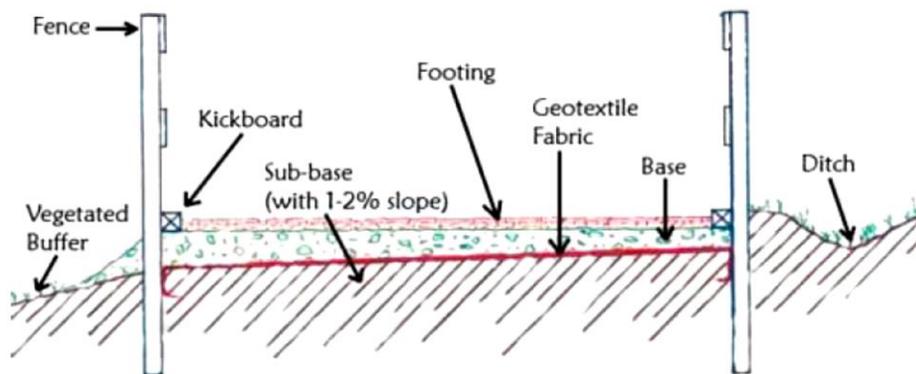
- Establishing a sacrifice area for animals.
- Pick up manure regularly.

- Use appropriate footing for paddocks, sacrifice areas and high traffic areas.
- Install gutters and downspouts to roofs.
- Use vegetation as a mud manager.
- Rotate water trough placement areas to avoid mud and manure buildup.

### Sacrifice Area

A sacrifice area is an alternative animal housing area used to keep animals off the pasture during the wet months. This area can also be used to care for sick or injured animals. Locate the sacrifice area away from water resources and plant a vegetation buffer around the area to reduce the chance of contaminating the water. The appropriate size depends on the type and quantity of animals that will be held.

#### Diagram of a Sacrifice Area: Longitudinal Section



**There are multiple types of bases and footing materials available for a sacrifice area: sand, hog fuels and gravel. Talk with a professional on the best choice for your property.**

*Courtesy of Fairfax County, Virginia*

## Irrigation Water Management

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The type and amount of irrigation required on your land is dependent on many factors, including crop, soil type, acreage and land use. Some crops have higher water requirements than others or need more water at different times of the growing season. Fertile soils generally make more efficient use of water. Lack of water frequency and availability can be a limiting factor for productivity.

Agricultural soil erosion and pollution are controlled by applying irrigation water uniformly and efficiently. Irrigation water is applied to crops at rates consistent with soil characteristics and in accordance with crop needs. Irrigation scheduling techniques include knowing climate data for your location or observing soil moisture in the field at several locations.

Recommended irrigation water management techniques include:

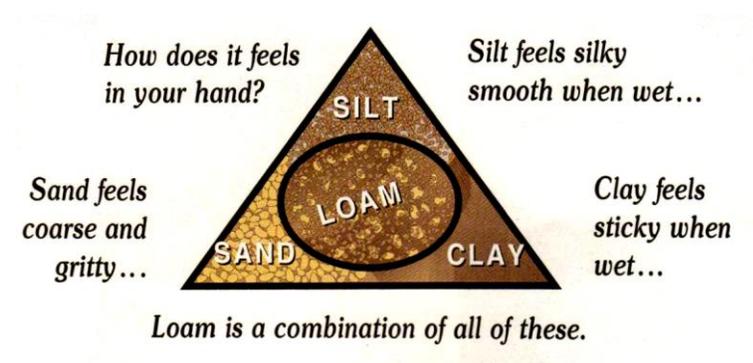
- Schedule irrigation based on crop needs, soil type, climate, topography, infiltration rates
- Improve irrigation efficiency
- Piping or lining irrigation mainline and delivery systems
- Minimize irrigation return flows through the use of cover crops, straw mulch, grass filter strips
- Install backflow devices
- Grade and slope property to retain runoff whenever possible
- Confirm nozzle sizes and water pressure throughout the system

Irrigation water management will:

- Prevent excessive use of water for irrigation
- Prevent soil erosion
- Reduce labor
- Minimize pumping costs
- Maintain or improve quality of ground water and downstream surface water
- Increase crop biomass yield and product quality

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### Discovering your Soil Texture for Irrigation



## Irrigation: How Much and How Often?

Soil Texture	Moisture to be replaced in the 3-foot rooting zone when soil is at 50% of its water-holding capacity	Average peak season (July/August) Irrigation frequency
Loaming sand	1.4"	6 days
Sandy loam	2.3"	9 days
Loam	3.1"	12 days
Clay loam	3.2"	13 days
Clay	3.1"	12 days

\* These moisture replacement estimates are for an alfalfa/grass hay crop. Amounts may vary for other crops. Irrigation is most important for alfalfa during the seedling stage and immediately after cutting. If your soil depth is less than 3', you'll need to irrigate more often and apply less water.

### *Q: When do I need to irrigate?*

A: Irrigate when the soil moisture drops to about 50 percent of its water-holding capacity in the top 3 feet of soil. Check your soil moisture by squeezing several handfuls of soil taken at 6", 12", and 18" depths in your field. Irrigate before the soil at the 18" depth begins to crumble in your hand, since most of the plants' roots are above 18".

If there is a staining on your fingers from squeezing the soil, wait a couple days and test the soil again. If the soil feels only slightly moist, forms a slightly crumbly ball when squeezed in your hand, and there is no staining, then it is time to irrigate.

### *Q: How long should I irrigate?*

A: In general, irrigate sandy soils for short periods (2-3 hours) and clay soils for longer periods (9-12 hours). Ask your farm supply store or local NRCS office to recommend the correct size spray nozzle for your soil type and your irrigation system. When it rains, see if the rain has gone deeper than the soil surface before considering it a source of water for your crop. To determine exactly how long to run your system, first place several pans at various locations under your sprinkler system. Run the system for one hour. Average the depth of the water in the pans. This is your hourly application rate. Next, divide the inches of water to replace by the hourly application rate.

### **EXAMPLE:**

Loam needs 3.1" of water replaced in the top 3 feet when it is at 50 percent of its water-holding capacity (see irrigation table). If your irrigation system's application rate is 0.3"/hour, you will need to run your irrigation system for ten and a half hours to deliver 3.1" to the soil, since 3.1" divided by 0.3"/hour = 10.5 hours.

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## **Irrigation Systems: Advantages and Disadvantages**

**Sprinkler Irrigation** (includes moveable hand lines, moveable wheel line, and center pivot) uses the least amount of water, requires labor to move the irrigation pipe, requires some maintenance, and requires an initial investment. Some operational costs are possible.

**Flood Irrigation** requires lots of water, doesn't spread water evenly across the pasture, requires labor to turn water on or off a pasture, is low maintenance, and is the least expensive (assuming irrigation ditches are already in place).

**"Big gun" sprinkler irrigation** requires high power costs, applies excess water, and doesn't work well on clay-type soils. Water distribution is only fair and cost is moderate. Minimum labor and some maintenance are required.

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### **Tips on Water Management/Irrigation**

- Water needs vary with weather (temperature and precipitation).
- Watch for drying (discoloration, wilting, and footprints).
- Shallow root plants require small frequent watering.
- Deep root plants require large infrequent watering.
- Some trees/shrubs require water during cold periods.
- When mowing, leave 2/3 of the plant height and mulch.
- If clay or loam soils crumble in hand at 12", irrigate.
- Plants near curbs or slopes will show drying first.
- Water in early morning, evening watering may cause plant disease, mid-day watering wastes water with high evapo-transpiration rates.
- Check with Cooperative Extension Service, USDA, Natural Resource Conservation Service, or others for more background information.

# Grazing Management and Livestock Health

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## Livestock and Pets

For many people, raising livestock is one of the key reasons for relocating to the rural setting. With that desire comes some major responsibilities. If you are one of the many people who dream of moving to the country and raising a few head of livestock, make sure that you have enough land to accommodate the number and type of animals you plan to raise.

## Stocking Rate

The stocking rate determines how many animals your land can support. It is this management practice that can have the greatest affect on the long-term condition of a site and the profitability of a livestock operation. Many individuals make the mistake of acquiring more animals than the pasture has forage. Local Extension Educators, conservation districts, and NRCS staff can provide guidance on how much land is needed to support different types of livestock. Establishing the stocking rate, the amount of forage a particular animal needs, and how much forage is available, is key to maximizing profits while sustaining current land conditions. The stocking rate equation has been standardized for all animals based on weight. If the land is not able to support the number of animals an individual has, supplemental feeding of hay or other feed must be part of the management plan.

Livestock require a balanced diet, shelter from extreme weather, water, fencing, veterinary services, and protection from predators. Owners need to be aware of the time commitment necessary to ensure the welfare of their animals.

Zoning ordinances may require permits if you plan to exceed certain numbers of livestock or operate various types of facilities such as a boarding kennel or a stable. Some zoning ordinances may not allow for livestock ownership. Be sure to also check with your county to see if they have licensing and/or leash laws for pets.

In addition to traditional livestock, new and diverse species are increasing. Llamas, emus, ostrich, alpaca, meat goat, and other species are being produced with various degrees of success. These animals are well adapted to small acreage farms. Animals have varying housing requirements (e.g. individual stalls vs. open areas). Bedding materials may also be needed on a regular basis. The storage of feed and bedding should be considered when grazing is not available.

Square Feet of Shed Space Recommended per Head	
Cows	30
Calves	15
Horses	80
Sheep	8
Ewe w/ Lamb	12
Goats	10
Llama	12-20

### ***Owning Livestock***

Before buying livestock, apply for a registered brand to assist in legally proving livestock ownership. If livestock stray, or become missing, it is easier to track branded cattle. Owners also have some protection and assurance that missing cattle may be returned. The brand laws apply to the entire state, however, ownership inspection is only required west of the Missouri River.

### ***Buying Animals***

Conducting research prior to buying animals is always a good practice. There are many different breeds of each animal to choose from; be sure to choose the right breed for your land and what you are trying to accomplish.

Buy animals from a trusted seller and try to avoid barn sales of culled animals. When buying animals, ask the seller about problems with the herd and vaccination information to make sure there are no red flags. Be aware of the diseases and issues related to your particular animal and consult with the local veterinarian when problems occur.

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### ***Animal Feeding Operations (AFO's) and Confined-AFO's (CAFO's)***

CAFO's and AFO's are defined by the EPA as "a place where animals are kept in a confined space for at least 45 days in a 12 month period, without any grass or vegetation being present during the normal growing season." The difference between confined and other feeding operations is based in part by the number of animals that are involved. These operations congregate animals, feed, manure, urine, dead animals, and a production facility on a small area of land. Feed is brought to the animals rather than allowing them to graze or feed in pastures or fields.

Due to large concentrations of manure and lack of ground vegetation, these operations can cause great harm to the natural environment because of the risk of pollution during rain events. Implementing vegetation buffers along with a manure management strategy can help reduce the risk of polluted run-off or leachates.

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### ***Grazing and Livestock Management***

The plant communities that make up pasture and rangeland are living ecosystems. Land managers need to have a basic understanding of plant growth, soils and nutrient cycling in order to keep their grazing land productive and healthy. Work with your local natural resources professionals to develop a grazing plan that includes determining available forage, water or supplemental water requirements, soil fertility and nutrient availability on your property.

#### ***Why Manage Grazing?***

- Improve grass health and productivity
- Increase grazing capacity
- Improve use of forage supply throughout the year
- Help control weeds
- Land stewardship
- Reduce soil erosion
- Improve water quality
- Improve range or pasture condition

### ***Are Your Grazing Animals Properly Managed?***

- Do you have so little grass in your pastures that your animals consume dirt while trying to graze?
- Are your animals browsing on trees, shrubs, fences, or barns?
- Are your animals losing weight, or are they overweight?
- Do your animals have scruffy coats?
- Are your animals prone to colic or respiratory problems?

If you answered “yes” to any of these questions, you need a new grazing program that will provide more grass and healthier animals...and save you money in lower feed costs and lower veterinarian expenses!

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### **Grazing as a Pasture Management Tool**

Grazing is one of the best tools available for improvement and maintenance of healthy, productive pastures. Increased infiltration rate, water quality, organic matter, rooting structure, plant health, animal production, and decreased weed invasion, soil erosion, and pesticide use are benefits of proper grazing management.

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### **Grazing Methods**

Timing, intensity, and duration of livestock grazing can have a dramatic impact on individual plant vigor and overall pasture production and rotational grazing. There are two primary styles of grazing available to property owners: continuous and rotational. Providing quality forage throughout the year helps save farmers a considerable amount of money on feed costs.

Ideally, animals should graze before pasture crops mature and produce a seed head. After a plant seeds, it will stop growing and is less palatable and nutritious to animals. Pasture crops should reach a height of 6 – 8” before allowing animals to graze. Only 50 percent (3 – 4”) of the crop height should be grazed; otherwise, it will affect the plant’s ability to rejuvenate.

#### **Continuous Grazing**

Continuous grazing typically employs a fixed number of animals grazing a certain number of acres for a given length of time. Continuous grazing, although less labor intensive creates pastures that can be overgrazed and depleted. This is a result of cattle being able to selectively graze the more desirable, nutritious, and palatable plant species first until eventually they have exhausted the good forage species – similar to letting a child choose between ice cream and brussel sprouts. This method of grazing can result in a patchwork of grass, weeds and mud because of the animals’ selectivity.

#### **Rotational Grazing**

Rotational grazing requires more intensive management. This strategy requires property owners to have a base knowledge of their forage crops and an understanding of the animal-pasture interaction to be successful. Forages vary in their optimal grazing heights. Livestock typically are allowed to start grazing in a paddock when the forage (grass or grass/clover mix) is from 8 – 10 inches tall. After the forage is eaten down to approximately 4 inches, livestock are removed and the plants are allowed to rest. This leaves adequate plant leaf area, which enhances the photosynthetic capability of the plant. The more energy the plant receives from the sun the less energy it needs to extract from root reserves. Quicker re-growth occurs from photosynthetic activity and translates into more vigorous plants with

increased production. Rotational grazing also results in more uniform grazing of all plant species to a desirable stubble height (length of leaf blade) increasing per-acre production. Rotational grazing allows for more efficient harvesting of sun light. Rotation frequency depends on the amount of forage available, crop type and the number and type of animals foraging.

### ***Basic Management Techniques***

- Determine goals and objectives in a management plan.
- Divide pastures into small units (paddocks) utilizing electric fence and making sure that livestock are trained to the electric fence prior to grazing.
- Move grazing animals between paddocks to allow recovery time for forage species.
- Drag pastures to break up and evenly distribute manure, following grazing.
- Irrigate paddocks following grazing rather than prior to grazing.
- Take soil samples and fertilize based on the results of the soil test.
- Have water, salt, and minerals constantly available and dispersed at varying distances will distribute livestock evenly across pasture while keeping them healthy.
- Adjust animal numbers and management based on pasture production and re-growth.

Producers should not allow livestock continuous access to the entire pasture. Grazing on saturated soils or too early in the spring should be avoided. Soil compaction and plant damage can result from grazing livestock in the late fall, winter or early spring. Horses only need 2 – 3 hours of grazing per day allowing for partial intake of their daily nutrient requirement and for exercise.

Good grazing management should produce more pounds of product per acre. It will reduce overgrazing and the need to seek feed from other sources. Livestock are healthier and will maintain weight on well-managed pasture. Pastures will be productive and be uniformly covered with desired forage species. There will also be a reduction of invasive weedy species. Irrigation will be more efficient with less overland flow of water. Pasture rotation and good grazing management produces more grass, fewer weeds, and no bare ground.

Continuous grazing allows weeds to grow where grass roots have been weakened. A less dense leaf canopy allows sunlight to reach invading weeds.

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### **Unhealthy Pastures Result in Unhealthy Livestock**

Some of the livestock issues that can result from grazing on unhealthy pastures are:

- Colic and respiratory problems from eating dirt
- Weight loss
- Parasites
- Poor coat

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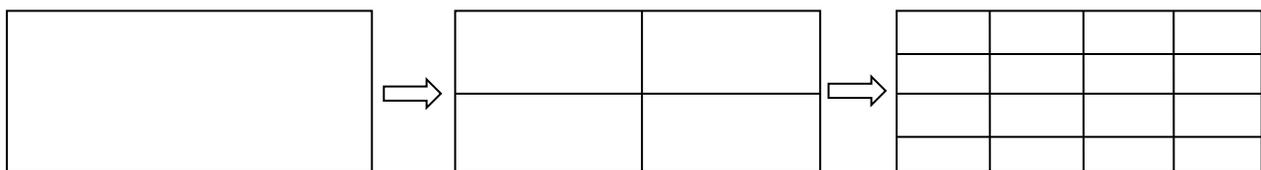
### **Tips for a Successful Grazing Program**

- Eliminate continuous season-long grazing by subdividing larger pastures into smaller ones and developing a rotation system – or by finding alternative pasture.
- Continue year-round rotation to distribute manure, food wastes, and trampling evenly across your pastures or hold animals in a corral.

- Check your animals frequently to limit amount grazed. Do not leave animals on too long.
- Avoid overgrazing. Overgrazing occurs when more than 50 percent of the grass plant is removed all at once. Overgrazing stops root growth and reduces grass production. Corral livestock and feed them hay until your pasture grasses are 6" to 8" high. Move livestock when 50 percent of the grass plant has been eaten (3" to 4" height remains). Do not re-graze until grasses are at least 6" high (will take 1 – 3 months).
- Seasonal instructions: Do not graze too early in the spring, do not graze heavily in fall before dormancy, and during winter months, continue your pasture rotation to distribute manure and feed wastes evenly across your pastures or hold animals in a corral.
- Allow long rest periods or use a high-intensity, short-duration grazing system to rejuvenate poor condition pasture. Let your grass re-grow.
- Provide a water source for each pasture.
- Develop irrigation – if you have water rights – and practice proper irrigation water management. Insufficient irrigation may shorten the life of plants (especially alfalfa), and excess irrigation can drown plants, increase salt problems, promote weed growth, and waste water – and your time. Over-irrigation also can leach nutrients from your soil and cause erosion and fertilizer and pesticide run-off.
- Irrigate each pasture (if you have irrigation) immediately after grazing to get plants growing again. Do not graze on wet soils due to potential soil compaction and erosion.
- Horses do not need 24-hour access to feed or forage. Their nutrition needs can be met with only a few hours of grazing on good pasture each day. Corral animals for the remainder of the day to prevent overgrazing of plants and extend the forage available in your pastures.
- On a limited acreage, you may have only enough pasture to exercise your animals and will need to feed year-round.
- Practice controlled agricultural burning. Burning of irrigation ditches and pasture should be done with caution. Notify the local fire department before you start – and after you complete – a burn.
- Fertilize irrigated pastures according to soil test recommendations. Fertilizing normally is not recommended on non-irrigation pastures.
- Drag or harrow to spread nutrient-rich livestock manure.
- Control weeds.
- Reseed, if necessary, following recommendations from the NRCS or your Extension office.

### What Can I Do to Maintain Sufficient Resting Periods?

1. **Subdivide your existing pastures.** By subdividing fields we can maintain or increase the resting period while maintaining or shortening the grazing period. For example, if we have eight pastures and need a 50-day resting period per pasture, our grazing periods will be seven days long. If we divide each of those pastures in half to create 16 pastures, we can rest each pasture for 60 days with only four-day grazing periods.



2. **Create a sacrifice area** – a fenced in area, with little or no vegetations, for animals to stay in while your grass is re-growing.

### Do You Have Enough Feed and Forage for Your Livestock?

**Forage** is what your animals consume by grazing or what can be harvested for feed. Forage production is generally measured in animal unit months (AUMs). One AUM is equivalent to the amount of forage consumed by a 1,000-pound animal in one month.

An animal unit equivalency (AU) for a 1,000-pound cow is the standard used to compare all forage animals. One AU is equal to forage demand of 790 pounds of air-dried forage per month. A horse is equal to 1.25 AU requiring 988 pounds of air-dried forage per month.

**Feed** is the hay or grain that you provide an animal as a supplement or when forage is not available. Hay production is generally measured in tons per acre, and feed is measured in pounds.

**Q: How much feed and forage do your animals need each year?**

A: Average requirements are listed below, but may vary with season, level of use, and the age and size of the animal.

	Feed (Hay) Tons/Month	Forage AUMs of Grazing/Month
1 cow	.4	1.2
1 horse	.5	1.25
1 sheep	.1	.2
1 llama	.15	.3
1 goat	.1	.2

**Q: How much feed and forage can your land produce?**

A: Refer to the following table.

	Fertile Soil		Poor Soil	
	Feed (Hay) Tons/Acre	Forage AUMs/Acre	Feed (Hay) Tons/Acre	Forage AUMs/Acre
Irrigated	2-4	3-4	Less than 2	1-2
Non-irrigated	1-2	1-2	.5 or less	.5
Rangeland/woodland	1	.5	.5 or less	.25

These figures are averages and may vary up or down, depending on management. "AUM" stands for "animal unit month."

***Q: Do your feed and forage requirements balance with your land?***

A: To find out, do your own calculations following these examples:

Feed Requirements: 3 horses x 0.5 tons per month x 6 months = 9 tons hay

Feed Production: 10 acres (fertile non-irrigated soil) x 1 ton per acre = 10 tons hay

Forage Requirement: 3 horses x 1.25 AUMs per month x 6 months = 22.5 AUMs

Forage Production: 10 acres (fertile non-irrigated soil) x 1 AUM per acre = 10 AUMs

In this example, your land will produce enough hay to feed your animals for 6 months. However, you do not have enough forage (grazing) to meet your animals' needs. To avoid overgrazing your pastures each year:

- Buy additional feed or rent pasture
- Increase your pasture production
- Improve your grazing management
- Reduce your number of animals
- Seek assistance

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**Winter Care of Livestock**

Most livestock can handle wind chills above 20 degrees F without much stress. However, when possible it is best to have a dry place for livestock to escape from cold rains, wet snow and wind. Weather stress can have a detrimental effect on the animal's health.

While natural protection and windbreaks may be adequate, three-sided sheds opening away from prevailing winds are desirable. Allow enough room for livestock to safely lie down without being trampled or smothered. Good clean dry bedding provides insulation from the cold ground.

**Feed** – it is often thought that providing extra grain in cold conditions is the thing to do. However, in reality, livestock produce body heat through the fermentation of fiber, which creates heat while releasing energy. Therefore, good quality grass hay or alfalfa is actually the best source of total digestible nutrients (TDN) for cold weather.

The rule of thumb is to plan on feeding 2-3% of an animal's body weight in dry matter per day. If poor quality forage is fed the volume of hay will need to be increased. Hay contains about 10% water, so if you need to feed 100 lbs of dry you would have to feed 111lbs of hay. Also, weights shown in the table are for actual consumption in dry matter, so include at least 10% more to account for waste.

**Hay** – Rely on your nose, eyes, and hands when purchasing hay. Good hay is usually very green. Green hay has plenty of Vitamin A and the protein is usually of good quality. Brown or bleached out hay will be deficient in Vitamin A and protein denatured. Good hay will smell fresh and grassy, not moldy, musty, damp or dusty.

Good hay is tender to the touch with thin, small stems, not coarse with thick stems. The best hay has plenty of protein-rich leaves and relatively few stems. It doesn't have debris such as weeds, manure, or other foreign materials.

Check the maturity. Grass hays should not be fully headed-out; optimally it should contain about 10% heads. Alfalfa should be harvested at about 10-13% bloom. If it's full of blooms then it is lower in

nutrient values. This should really apply to all the feed you buy. Knowing what you are buying will help you in getting the best feed for your dollar.

If you are going to buy grass seed straw, you need to make sure the straw has been tested for or is known to be free of toxins caused by endophytes. Endophytes are fungi that produce toxins which are harmful to livestock at high concentrations.

One last thing of note: hay can contain noxious and toxic weed seeds. Ensure your hay is purchased from a reputable source as weeds can quickly become a problem for you and your neighbors if allowed to spread.

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### Water Requirements of Animals

*Note: These are just estimates*

The following values show the daily minimums for a water system. Hot weather can more than double water requirements and combining this with less succulent forage can increase consumptions four fold. The system may be prohibitive. Be sure to have a back-up plan for hot weather situations.

You'll need to know livestock water needs to design the system and determine if your water source is adequate. If large mobs of livestock run together, the large amount of water required will not only tax the delivery system, but also might be greater than your well, spring or pond recharge capacity.

Animal	Gallons Water/Day	Range
Dairy Cow	20	15-25
Beef Cow Pair	15	12-20
Yearling	10	6-14
Horse	10	8-14
Chickens (per 100)	5 ½	5-9
Sheep	2	2-3
Goat	2 ½	2-3

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### Stockwater Development

Clean, accessible, fresh water is essential for good animal health.

**Options for stockwater include:**

1. A stock tank (keep from freezing)
2. Water gaps on a stream or pond
3. Wind and solar pumps
4. Pipelines from wells and springs

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### How Grass Grows

To maintain healthy grass pastures and livestock, a general rule of thumb is to manage grass height so that it ranges between three to eight inches high. These management heights vary by grass species.

Graze the pasture when eight inches tall. Rotate the animals to the next pasture when the grass is three inches tall.

- Grass plants must have adequate leaf area (solar panels) to photosynthesize optimally.
- Photosynthesis is the process of converting the sun’s energy into plant biomass.
- Plants with fewer leaves have fewer roots, making it more difficult to absorb necessary nutrients and water from the soil.
- Grass roots are actively growing in the spring and the fall; the roots are “shedding” in the summer and winter.
- Grass plants store most of their food reserves in the crown area (bottom two to four inches) of the plant. These stored food reserves consist of sugars and nonstructural carbohydrates. Grasses utilize food reserves for re-growth and to survive periods of dormancy. (Legumes store most of their food reserves in the root.)

Growth rates of grasses vary seasonally. The more green leaves, the quicker the plants will re-grow to provide forage for animals. If grass is grazed short when the roots are actively growing (spring and fall), then the summer slump and winter dormancy will negatively affect grass growth even more the following year. Fall is the worst time to graze grass very short.

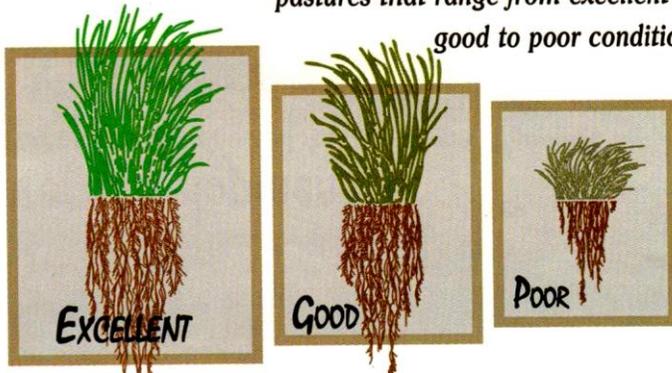
Legumes, like alfalfa and clover, grow better than cool-season grasses in hot weather. Clover can take over an overgrazed pasture in the summer because of its heat tolerance and comparative leaf-area advantage.

### How Grazing Affects Root Growth

Overgrazing occurs when more than 50 percent of the grass plant is removed all at once. Overgrazing stops root growth and reduces grass production. Look what happens when you try to sneak in another 10 percent “harvest” – 50 percent of the roots stop growing!

Percent Grass Plant Removed	Percent Root Growth Stopped
10%	0%
20%	0%
30%	0%
40%	0%
50%	2-4%
60%	50%
70%	78%
80%	100%
90%	100%

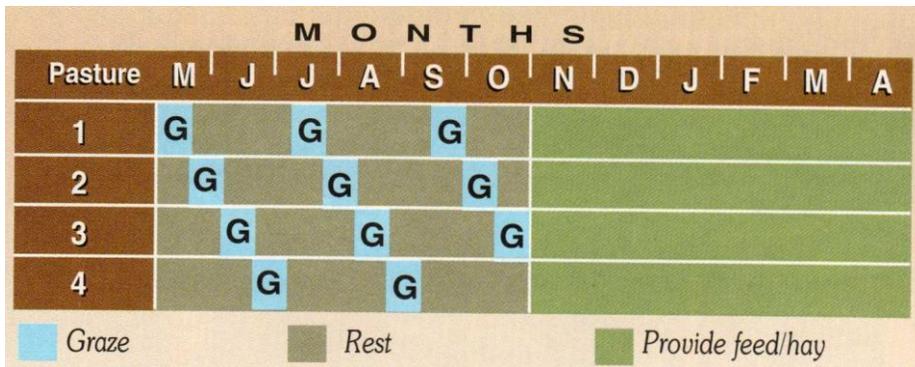
Notice how the root mass of these grasses decreases in pastures that range from excellent to good to poor condition.



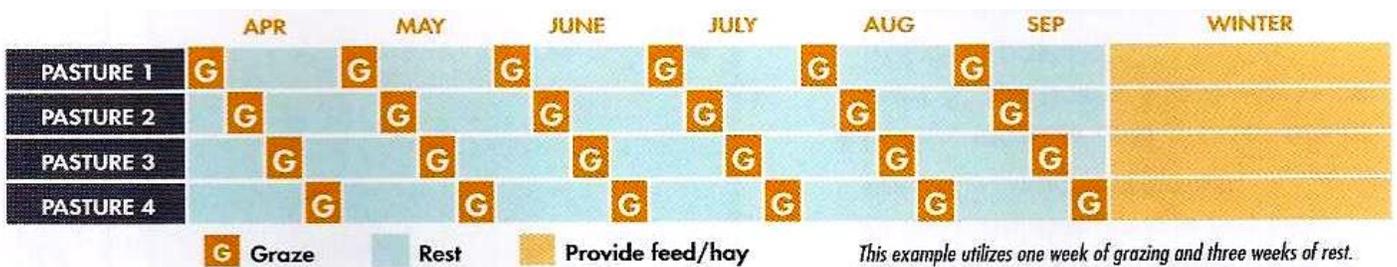
### Grazing Schedule for a One Herd Multiple-Pasture System – Samples

Begin grazing when plants are 6” to 8” in height. Move livestock after 50 percent has been eaten (3” – 4” remains). A minimum of 30 days is needed between grazing periods on irrigated pasture and up to 3 months for non-irrigated pasture. You may need to corral livestock and feed them hay until the pasture re-grows.

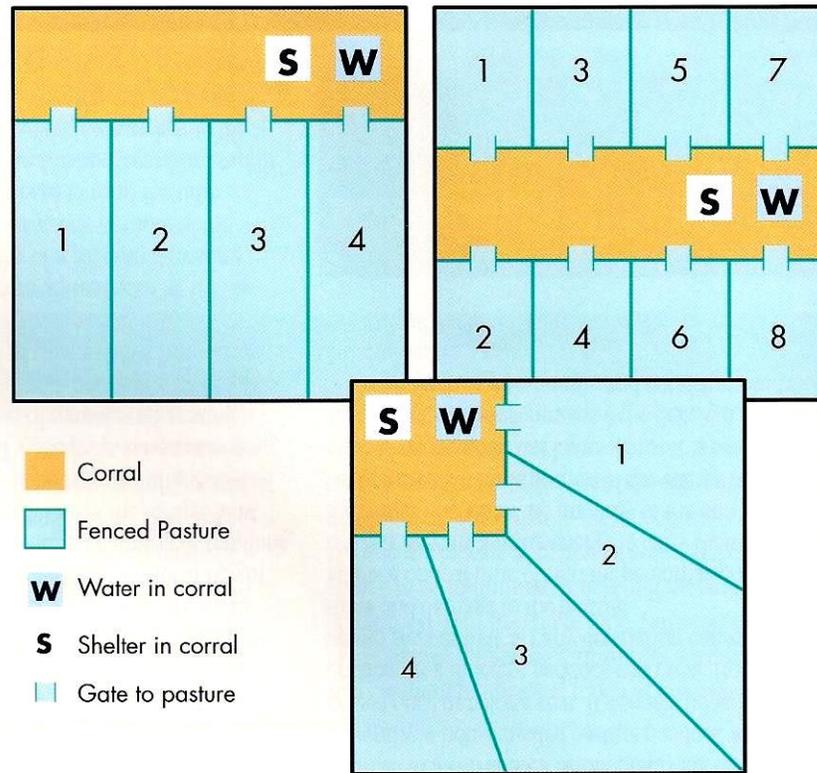
#### Sample of a Grazing Schedule in Montana



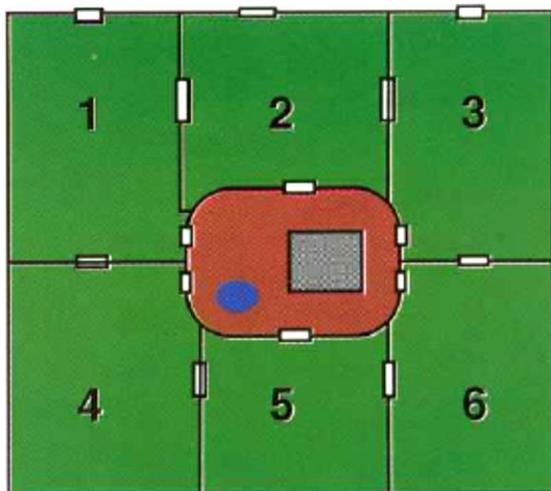
#### Sample of a Grazing Schedule in Utah



## SAMPLE DESIGNS FOR A ROTATIONAL GRAZING SYSTEM



- Corral
- Fenced Pasture
- W** Water in corral
- S** Shelter in corral
- Gate to pasture



- Corral
- Water
- Shelter
- Pasture
- Gate
- Fence

### What Should You Record?

**Grazing order of your pastures:** It is best to rotate the pasture grazing order each year. For example, if you have five pastures, the first pasture grazed in year one may be pasture 1; the following year you should rotate which pasture is grazed first (2, 3, 4, or 5, but NOT pasture 1). Similarly, you should rotate which pasture is grazed last in the grazing season. Remember that grazing early in the growing season

and grazing late in the growing season is hardest on pasture plants. If you rotate this “stress” among pastures, it will protect your overall forage quality.

**Start grazing and stop grazing dates for each pasture:** Noting the start and finish dates of grazing a particular pasture will enable you to get a better handle on your actual forage availability. The decision to start and stop grazing is not based on a calendar; it is based on the grass height and observations of pasture growth and grazing patterns. Remember that in the early spring, when grasses are growing fast, animals may actually start grazing the regrowth before they utilize all the plant species in your pasture. Be observant!

**Number of animals on the pasture:** This will help you determine if you are under or overloading your pastures.

**General health and productivity of the pasture:** Does your pasture appear healthy? Are the plants growing vigorously? Do you observe any weed infestations or any worn or damaged pasture areas? Again, you are recording observations and trying to improve your pasture quality and productivity.

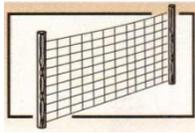
**Seasonal variations and weather:** Storms, dry weather, late freezes, etc. all affect plant growth and hence affect your pasture’s productivity. Recordkeeping of this type of data may help with productivity predictions in the future.

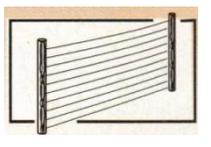
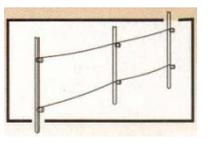
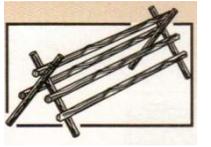
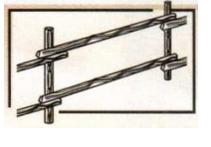
## Fencing: A Grazing Management Tool

### Choosing the Right Fence

There are many types of fences. Each has advantages and disadvantages. No single factor determines the best type of fence to use. When selecting a fence, consider:

- Purpose (type of animal you’re keeping in or out)
- Type of soil material (rocky or deep loam)
- Terrain
- Material and labor costs for construction
- Availability of power
- Maintenance requirements
- Weather
- Visual impact

Types of Fencing	Advantages	Disadvantages
	<p><b>4-Strand Barbed Wire</b> Good control of cattle. Skill and design for construction readily available.</p>	<p>Barbed wire may be injurious to horses and llamas. Labor and material costs high. Periodic maintenance required. May be damaged by big game</p>
	<p><b>Woven Wire</b> Skill and design for construction readily available. Good control of sheep. Add 2 upper strands of barbed wire for cattle.</p>	<p>Labor and material costs high. Some maintenance necessary.</p>

Types of Fencing	Advantages	Disadvantages
	<p><b>4- to 10-Strand Smooth Wire</b> 4- to 5-strand good for horses. 8- to 10-strand will contain large, exotic animals or keep big game out. Durable.</p>	<p>Labor and material costs high. Periodic maintenance required.</p>
	<p><b>Electric</b> Good for establishing pasture rotation program on small acreages. Lightweight, portable, easy to set up or dismantle before and after irrigation. Less expensive.</p>	<p>Weathers poorly. Don't use in lengths over 1,000 feet. Requires regular maintenance. Needs solar or electric power source.</p>
	<p><b>Jackleg</b> Aesthetically appealing. Very durable. Withstands heavy snow. Good in areas where it is hard to dig or drive posts. Can be adapted for marshy, wet areas. Low maintenance.</p>	<p>High labor and material costs during construction.</p>
	<p><b>Post and Pole (Rail Fence)</b> Durable. Withstands heavy snowfall. Low maintenance.</p>	<p>High labor and materials costs.</p>
	<p><b>Hog Panels</b> Can be formed into a small, portable pen. Wheels may be attached to make moving easier. Good for establishing rotation grazing for a couple animals on small acreage. Inexpensive and easy to construct.</p>	<p>Appropriate for only a few sheep or other small animals. Should be moved once or twice each day.</p>

### Fence Lines

Fences and property lines have the potential of causing conflict between neighbors while also providing an opportunity to develop a relationship by working together. It should be the responsibility of each property owner sharing a fence to maintain part of the existing fence and/or share in the cost for constructing a new fence, if necessary. (For more information on [Fences](#), please see the section **Planning for Your Land.**)

### Concerns, General Welfare and Safety Tips for Livestock

- Allow animals to adjust to their new environment.
- Don't overcrowd animals – understand their behavior and space requirements.
- Children are attracted to animals, be aware of this attraction for safety reasons.
- When planning a vacation, don't forget to make arrangements for someone to care for your livestock.
- Provide shelter for animals if possible for improved health and reduced feeding costs.

- Monitor animal water consumption, keep water open.

**Pasture Management** – Animals on pasture should have access to a windbreak or other shelter to protect them from cold winter winds, hot summer sun, and wet, rainy weather. When introducing livestock, especially horses, to pasture in the spring it is wise to limit access for a few days to decrease the likelihood of colic, founder or other digestive disorders due to an abrupt change in diet. Animals that are moving from the corral to pasture for the first time should be filled with their normal feed to reduce excess hunger. Begin by turning animals out the first day for twenty minutes. Increase this gradually over a week or two. After this adjustment period, it should be safe for them to remain in the pasture full-time.

The young growing calf, hard-working horse, or pregnant mare may have higher nutritional requirements than pasture alone can provide and may necessitate the addition of a grain mixture. All animals should have access to free choice minerals and salt, and access to adequate quantities of fresh water. The average horse will consume 10 – 12 gallons of water each day.

**Parasite control** – This is a vital part of every health care program. Manure is the primary means through which parasites spread. Manure often contaminates the feed, water supplies, pastures, paddocks, and stalls. Proper manure disposal helps prevent this contamination. Manure should be composted or spread on unoccupied pastures to sun cure. Harrowing or dragging pastures during hot, dry weather helps disperse manure deposits and kills parasite larva by exposing them to the sun. Dragging should not be done where animals are grazing because it distributes the larvae across the grass making it more accessible initially.

**Bloating** – Bloating is a concern for four-stomached animals (ruminants) such as cattle and sheep. Pastures that contain a large percentage of alfalfa or clover pose an increased risk for bloating. Make sure animals are not hungry when they enter these fields and watch them closely. It is recommended that they be filled with dry hay before turn-out, and the time allowed in the legume pasture be restricted initially. Providing bloat reducing supplements decreases the danger of bloat.

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### Windbreaks and Livestock

Windbreaks are important for reducing feed and maintenance energy costs for livestock because they reduce wind velocity and, therefore, reduce the effect of wind-chill. This will result in better animal health, lower feed costs and greater financial gain.

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### A Good Health Program is Important

Your program should include:

- Regular de-worming
- Regular hoof and teeth care
- A balanced feed ration
- Shelter
- Mineral supplements
- Fresh water and feed

The most important factor in a proper health program comes from getting to know your local veterinarian, farrier and other animal health care provider.

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### **Proper Waste Management and Pest Control**

Proper disposal of waste is important in maintaining the health of your livestock. Be aware of the following when planning your management program.

- How much waste an animal produces per day
- The odor from waste can attract flies, which may pose health risks
- Zoning laws may specify waste management programs
- To dispose of waste, spread the manure, compost or give it away

Reducing the manure level decreases flies, parasites and their associated health risks. (See information on [Manure Management](#) in the section under **Streams, Wetlands, and Water Quality Protection**) When spraying for pests, be careful not to contaminate the water and feed sources. It is wise to check with local authorities before beginning a pest control system. (See information on [Integrated Pest Management](#) in the section under **Predators and Pest Control**)

## Forest Management

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Forest Management is a challenge because it involves more than just trees. Good management requires the consideration of every aspect of the forest habitat – including shrubs, herbs, grasses, fungi, insects and wildlife. Active woodland management can help protect your home from wildfires and the forest from unwanted pests and diseases.

Your forest acreage may be managed for both timber production and wildlife. Optimum tree populations are determined by the kind 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 left on the surface to help maintain ground cover, reduce soil erosion and provide wildlife habitat. As trees mature and are harvested, establish new plantings.

As you plan ahead for well-managed forest acreage that adds beauty and income to your farm, consider the following tips:

- Know your timber markets.
- Plant trees that are suitable to your soils.
- Cut undesirable trees and shrubs that are competing with desired species for sunlight and moisture.
- Thin stands to maintain growth and vigor.
- Maintain diversity.

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### Developing a Forest Management Plan

If you plan on engaging in forestry, you should first develop a management plan. A current forest management plan can help you qualify for grants and conservation programs within your state. Your state department of forestry can provide assistance in developing a plan. Private forestry consultants can help you conduct inventories, set up timber sales and help you achieve your forest management goals. Some consultants have multi-resource specialists on staff. They are usually well-versed in federal and state cost-share programs, laws and regulations. Professional assistance can help save you money and minimize mistakes.

The USDA Natural Resources Conservation Service and local conservation districts can provide assistance in developing a forest land plan. They can also provide technical and financial assistance through federal programs along with the Farm Services Agency.

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### Hiring a Forester

When having work done on your property it is very important to know who you are hiring before they come onto your property with a chain saw. Landowners should ask for credentials and references from the logger, and ask to see some past work prior to having any work done. There are many forestry operations that can cause damage and expose you to liability.

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## A Succession Plan

Developing a property succession plan will aid in the process of passing woodland property to the next generation. Without a plan, the new landowner will be obligated to pay the federal inheritance tax that is roughly 50 percent of the appraised property value. This can put great pressure on the family to sell the land to a developer or harvest the wood resource to pay the tax. "Ties to the Land" is an organization that works to educate families on planning for property succession

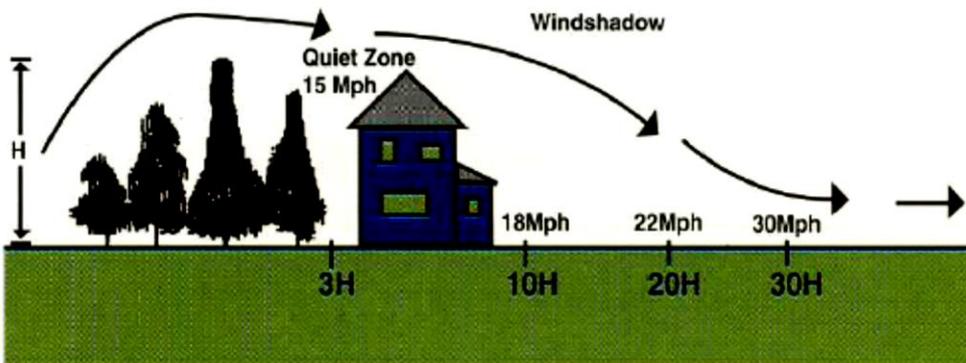
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## Agroforestry – Working with Trees for Rural Living

The force of the wind exaggerates daily weather conditions. A well-designed windbreak around your home, ranch, or farmstead slows the wind and improves the surrounding environment.

- Energy costs may be cut as much as 20 – 40 percent by planting trees to create living, working windbreaks
- Chores such as firewood cutting, working on equipment, and feeding livestock are safer and more comfortable in areas protected from cold winds.
- A properly placed windbreak can reduce or eliminate snowdrifts on driveways, in work areas, around buildings, access roads, and highways. These windbreaks are referred to as "Living Snow Fences." A great deal of money is spent annually on snow removal to provide access and to keep transportation routes open. Tree plantings can protect roads from drifting snow and reduce snow removal costs.
- Strategically placed trees and shrubs can improve living conditions by screening undesirable sights, sounds, smells, and dust.
- Well-placed shade trees provide summer energy savings of 15 to 35 percent. Shaded areas protected from wind by windbreaks provide a private park-like atmosphere for family enjoyment.
- Plantings for wildlife habitat provide food, shelter, nesting, and breeding areas for many birds and animals.
- Firewood, fence posts, fruit, and wild game are potential products from the forest you create when you plant working trees for rural living.

## Windbreak Function



## Re-Planting

After trees have been harvested from a site, the landowner is required to replant within two years. Once the trees are planted it is up to the landowner to maintain those trees for the next four years. After four years a tree is considered “free to grow” on its own. When buying property that appears to have been harvested without any new planting, check with your state department of forestry for the current status of the site.

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## Tree Diversity

By maintaining a diversity of trees appropriate to the site, you will encourage the overall health of the forest. Tree species should be selected based on soil and climatic conditions. Soil information can be found on the Web Soil Survey (<http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm>). (For more information, see the section [Soil](#).)

New trees require protection from competing vegetation to help improve their survival rate. In addition to species diversity, forests should also have trees of various ages.

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## Choosing the Right Trees for the Site

The following must be considered when designing tree and shrub plantings.

- **Soils** – Select species that are appropriate for the soil at the planting site.
- **Orientation** – Best protection occurs when windbreaks are perpendicular to the troublesome wind.
- **Width and Density** – Generally, wider windbreaks’ provide more protection and wildlife benefits. If space is limited, choose plants that provide dense foliage for snow control and height for downwind protection. Placing dense shrubs on the windward side keeps more of the snow off the protected area. (Also, see information on a [Living Snow Fence](#) in the section **Planning for Your Land**.)
- **Species** – Select a diversity of adapted species to reduce disease and increase effectiveness.
- **Setback and Easement Restrictions** – Before beginning design, determine setback and easement restrictions that may affect location and species that can be planted. (For more information on [Setbacks and Easements](#), see the section **Planning for Your Land**.)
- **Utilities** – Check with all utility companies with lines or pipes on or near your property that could affect location or species in the planting.
- **Septic Drain Fields** – Keep plantings at least 50 feet from septic leach fields, or potential leach field locations. (For more information on [Septic Systems and Septic Drain Fields](#), see the section **Streams, Wetlands, and Water Quality Protection**.)

If planning for wildlife, consider species that produce fruit, nuts, or edible browse. In particular, favor species that retain food late into the winter.

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## Cleaning Up the Woods

What’s frequently called “cleaning up the woods” usually involves removing the forest understory – especially small trees, shrubs, and deadwood – to create a more open forest. The term suggests it’s beneficial, but it often backfires.

Understory clearing can harm the woods by removing:

- Young replacement trees
- Deadfalls: an important part of habitat
- Vertical wildlife habitat structure
- Desirable species that are quickly replaced by “weed” or invasive tree species

Efforts to “clean up the woods” should be focused on invasive species, especially exotic species. Some are so aggressive that they replace the natural ecosystem. They can form dense thickets, making the forest less usable.

Usually local foresters and conservationists will have more locally specific technical guidance for such activities as woodland or invasive species management.

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### Thinning

Thinning is the process of removing trees to improve your forest’s growth, health and vigor. Thinning creates more light, water and nutrients for the remaining trees. It reduces the loss of trees due to pathogens, increases resistance to wildfire, drought, and insect infestation. Thinning also offers an opportunity to encourage species diversity.

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### Weed Control

Tree plantings should be weed-free around each plant during the three years of establishment and aggressive sods like smooth brome, blue grass, and canary grass should be controlled for the life of the planting. If tillage is performed, it should be no deeper than 2 – 3” and should stay away from the stem 8 – 12” to avoid damage to root collars, roots and trunks. If using herbicides, apply according to label instructions, and be alert to potential damage to the trees and shrubs and nearby plants. Mulches can be effective but must not be placed too deeply near the trunk of the tree (3 – 4”). Synthetic weed fabric will need annual inspection and the openings enlarged and edges refastened as necessary. Additionally, weeds, soil and grass clippings should be removed from atop the fabric as this material becomes a medium for weed germination. Seeding non-aggressive grasses between fabric strips (tree rows) is an effective way to ease maintenance, reduce erosion and potential damage to tree roots. (For more information, see the section [Weed Management](#).)

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### Pruning

Pruning trees and shrubs is done to:

- Improve growth form
- Correct hazardous situations
- Remove dead or dying branches

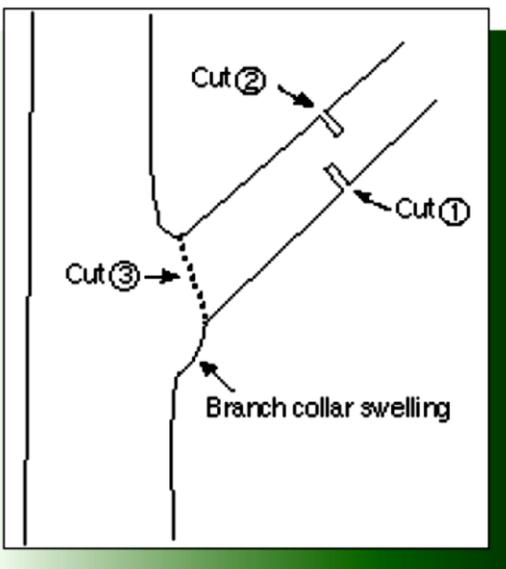
Proper pruning can improve the form and function of trees and reduce the risk of disease and insect damage. In particular, prune double leaders when trees are young to encourage a straight strong trunk. Ideally, pruning should be done when trees are dormant, after leaf drop. Storm damage and dead limbs

should be pruned as soon as noticed. Diseased limbs should be pruned when trees are dormant and pruning tools should be sterilized between each cut. Rubbing limbs should be removed. Improper pruning can damage trees, making them more prone to disease, insects, and loss of function.

### *Pruning Rules of Thumb:*

- Don't "top" the tree (cut the branches to a stub). This will lead to a gnarly appearance and tree health problems
- Cut where the branch joins a trunk or major branch. Cut at the branch collar, not flush against the trunk. To shorten a small branch, cut just above a bud.
- For larger branches, first make a shallow cut on the underside of the branch, and then cut from the top. This will prevent tearing of bark on the underside as the branch falls.
- Never prune oaks in April, May, or June when risk of oak wilt is highest. The risk is less in other summer months and zero in the dormant season.
- Prune so that no one will be able to tell that you pruned – that's the mark of a good job

Information on pruning techniques is available at local Extension offices, your state Forest Service, or online.



*Diagram source: UMN Extension*

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### **Is Your Forest Healthy?**

A Healthy Forest is characterized by vigorous trees that are resistant to disease, insect infestation, and animal damage. They are spaced far enough apart to allow sunlight to reach plants on the ground and are comprised of a diversity of species. Woody material on the ground is scattered rather than piled.

- Are your trees free of problem insects, diseases or animal damage?
- Are your trees spaced far enough apart to allow some sunlight to reach the plants growing on the ground?
- Is there more than one age or size of tree present (e.g., seedling, pole, mature)?
- Is there more than one tree species present?

- Do you have scattered, rather than piles of, down woody material?

If you had all “yes” answers, your woodlot is looking good.

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### Tips for a Healthy Forest

- Maintain diverse species and ages of trees suited to your site.
- Reduce losses of trees to problem insects and diseases by removing infected trees and slash as soon as possible.
- Thin trees to improve growth, health, and vigor. While reducing the loss of trees due to pathogens, thinning will allow more light, water and nutrients for the remaining trees. Thinning will also increase forage for livestock and wildlife. Leave the largest and healthiest trees.
- Avoid season-long livestock grazing that can compact soils and damage trees from browsing or rubbing.
- Locate access roads away from streams; construct adequate drainage. Seed cut slopes promptly to reduce erosion and water pollution.
- Dispose of heavy accumulations of down woody material to reduce fire hazard. Leave snags (standing dead) and larger downed logs for wildlife and forest nutrient cycling.
- When controlling weeds with chemicals, take special precautions not to kill trees.
- Avoid activities that damage roots or lower trunks of trees. This is especially critical during construction.
- When planting trees, select species adapted to your soil, climate, and particular site. Care for new trees by watering regularly and removing competing vegetation in a 1-foot diameter around trunk. The use of fencing around new trees will also increase their survival rate by preventing livestock and wildlife from browsing and foraging.
- Seek help when planning a timber sale to get top dollar, handle the various permits needed and see that the remaining stand is in good shape when the harvest is over.

Remember – what you do in “your forest” affects your neighbors, other forest residents (including wildlife), and those downstream from your land.

Cost-share funding may be available for some of these practices. Contact your local office of the State Forest Service.

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### Tree Health Monitoring

Tree and shrub plantings should be inspected annually for the following:

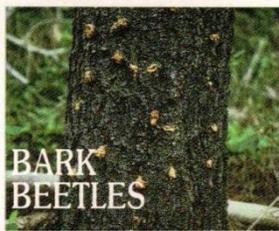
- Dead and storm damaged limbs – These should be pruned out as soon as noticed.
- Missing plants – Gaps should be replanted at the next available planting season. If replants still do not survive, re-evaluate soils at that location.
- Diseased limbs should be pruned at the next dormant season with tool sanitation between each cut.
- Check each spring for the development of double leaders on tall tree species. Pruning one of the limbs when small produces a strong wind-hardy tree that will function for many years.
- Brown needles or missing or dead leaves during the growing season – Determine if it’s a result of disease, windbreak or weather extremes. If deciduous or coniferous trees do not re-leaf next

season, replant the gap. Note that larch are deciduous conifers and naturally lose their needles each fall.

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### Diseases and Pests

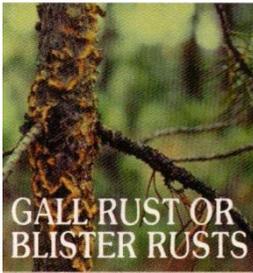
Depending on the health of your forest, it could be susceptible to disease and pests. Being able to identify problems in the forest is important for treatment because most problems require different treatments. Root disease, beetles (such as the emerald ash borer) and sudden oak death are some of the most common issues that can spread to neighboring trees and destroy a stand. If you think that your forest is diseased, contact a local forester or your state department of forestry for assistance in identifying the problem and taking the proper actions for eradication



#### **Bark Beetles**

Vulnerable Trees: Grand fir, subalpine fir, species of pine >6" diameter; spruce or Douglas-fir > 14" diameter – all conifers, fruit trees, and elms.

Problem: Pitch tubes or masses of sap/pitch on bark surface or mounds of red-orange boring dust on bark at the base of the tree.



#### **Gall Rust or Blister Rusts**

Vulnerable Trees: Lodgepole, ponderosa pine, and white pine

Problem: Gall rust forms large swellings on branches and trunks. Blister rust cracks bark open in spring, exposing yellow or orange powdery spores.



#### **Budworms**

Vulnerable Trees: Douglas-fir, white and subalpine fir, blue and Englemann spruce, and ponderosa pine

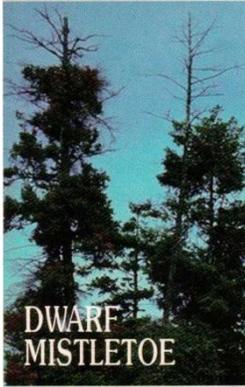
Problem/symptoms: silky webbing in new needles, followed by chewed needles turning brown at branch tips.



#### **Western Spruce Budworm**

Vulnerable Trees: Grand fir, subalpine fir, and Douglas-fir

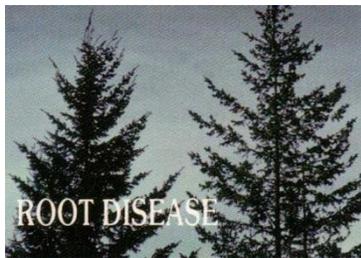
Problem: Initially, silky webbing in needles; followed by chewed needles turning brown at tips of branches



**Dwarf Mistletoe**

Vulnerable Trees: Douglas-fir and white fir; ponderosa, lodgepole, limber, and piñon pine; Rocky Mountain juniper; and larch

Problem: Witches-brooms form on infected branches and/or small orange or yellowish-green plants growing from swollen portions of branches.



**Root Disease**

Vulnerable Trees: All sizes and ages of Douglas-fir, grand fir, and subalpine fir are most susceptible

Problem: Individual trees are dying in the stand, tree crowns thinning; rare east of Continental Divide



**Scale**

Vulnerable Trees: Green Ash, Pines

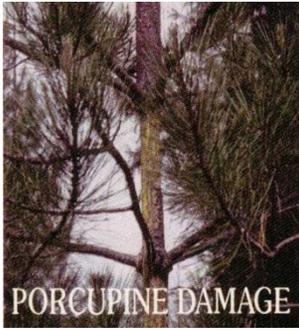
Problem/symptoms: White to brown tear drop shape, found on needles of pines, branches of ash.



**Mites**

Vulnerable Trees: Juniper, Spruce

Problem/symptoms: Fine webbing, minute red to brown mites, needles lighten in color



### **Porcupine Damage and Other Physical Damage**

Vulnerable Trees: All sizes, ages, and species of trees

Problems/symptoms: outer bark removed, exposing inner layers of wood; broken or split trunks and branches; patterns of chewing, grooved with parallel teeth marks or drilling.

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## **Fire Prevention and Protecting Your Home from Wildfire**

Research has shown that reducing fuel sources around a structure can greatly increase the chance of it surviving a wildfire. Fire needs three elements to occur; fuel, oxygen, and heat. Remove anyone of them and the fire will die out. Fuel is defined as anything that can burn. Landowners should systematically arrange trees and shrubs in a way that makes it difficult for fire to spread on your property. Many fires start from a single ember which lands on a fire fuel source. Fires should be covered and never left unattended.

A firebreak is a gap in vegetation or other combustible material that works to stop or slow the progress of a brush or wildfire. Rivers, lakes, canyons, roads or gravel trails are examples of both natural and man-made fire breaks. A firebreak around your home and along your driveway can be one of the most effective ways to protect your property. Initially this can be a major undertaking, so start small and do a little at a time. Once it's complete, annual maintenance is much less demanding. Since protecting your home is the primary concern, start there and work outward. Fire burns 16 times faster uphill so start on the downhill side of your home. Firebreaks do not have to sacrifice the scenic beauty or natural setting of your land.

Developing a yearly schedule can help speed up implementing and maintaining fire prevention measures on your property.

- Typically, a defensible space around your home, on flat ground, extends a minimum of 70 to 75 feet around your home. This distance is extended if the structure is located on a slope.
- To create a firebreak, remove combustible vegetation from 30 feet around the house, a 100-foot buffer is ideal. Maintain a short green lawn (less than 6 inches tall) or fire-resistant plants within this buffer.
- Prune low tree branches to at least 12 feet above the ground, removing "ladder fuels" that can cause a ground fire to become a more destructive and harder-to-control crown fire.
- Protect large trees by removing fuels under them.
- Keep limbs at least 15 feet away from the roof and chimney.
- Trim branches along driveway at least 14 feet tall and wide.
- Dispose of all slash and debris left from thinning by either chipping, hauling away or piling and burning. Contact your local fire department or State Forest Service office for burning restrictions and/or assistance.

- Clear roofs and gutters of pine needles, leaves and other debris. This will eliminate an ignition source for firebrands, especially during hot, dry weather.
- Have water, a shovel, rake, axe, saw, bucket, roof ladder and hose available and ready for use – especially during the fire season.
- Replace flammable building materials like wood shakes for roofing and vegetation with more fire-resistant ones.
- Screen vents and areas under decks with metal mesh.
- Stack firewood and wood piles at least 30 feet from any structure. Make sure these piles are uphill or on the same level as structures. Clear away flammable vegetation from within 10 feet of these woodpiles.
- Maintain good access to your home and ensure that your address is visible and easy to read. Your address should be clearly posted at each rural intersection or road fork with an arrow under your address.
- Place liquefied petroleum gas (LPG) containers at least 30 feet from structures. Clear flammable vegetation from within 10 feet of all such tanks.

### *Construction Design and Materials*

Your house may be vulnerable to a wildfire because of its design, construction, and/or location. When preparing to build, buy or remodel, the following tips can reduce the chance of your home catching fire or resist further damage if it does catch fire.

#### **Location:**

- Choose a site away from heavily vegetated areas.
- Build on the most level portion of the property
- Avoid ridge tops, canyons, and areas between high points on a ridge.
- Set your structure a minimum of 30 feet back from ridges or cliffs; increase the distance if your home will be more than one story.

#### **Building Materials:**

- Use Class A or B roofing materials such as asphalt shingles, slate or clay tile, or metal. Avoid wooden shake-shingle roofing.
- Fire resistive or noncombustible construction materials are essential for siding and walls. Use a minimum of Class III flame/spread-rated siding material – stone, brick, and stucco are best.
- Limit the length of roof eaves so that they do not extend beyond exterior walls. If the eaves are longer, enclose them with fire-resistive materials.
- Foundations may come in contact with a spreading wildfire before other areas of the structure. Enclose foundations with concrete block, cement walls, or other fire-resistive materials.
- Minimize the size and number of windows on the downhill side of the house or the side most likely to be exposed to wildfire. Both size and materials used are crucial in windows and sliding-glass doors. Multi-paned glass or tempered glass is recommended.
- Cover exterior attic, soffit, and under-floor vents with metal wire mesh (openings no larger than one-eighth of an inch) to prevent sparks from entering structures through vents. Install eave and soffit vents closer to the roof line than to the walls.
- Do not locate decks at the top of a hill; a fire's spread is generally uphill. Enclose the undersides of balconies and decks with fire-resistive materials so that burning embers cannot accumulate.
- Cover chimneys and stove pipes with a nonflammable screen (mesh openings no larger than one-half inch).

<b>Recommended Defensible Space based on Steepness of Slope</b>			
Slope %	0 – 20%	21 – 40%	41% +
Grass	30'	100'	100'
Shrubs	100'	200'	200'
Trees	30'	100'	200'

<b>Distance between shrubs is based upon canopy “fullness” at maturity. Distance between tree canopies are in feet.</b>			
Slope %	0 – 20%	21 – 40%	41% +
Shrub Distances	2x	4x	6x
Tree Distances	10'	20'	30'

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### **Importance of Fire**

Fire is mostly seen as a destructive undesirable occurrence, but it is actually a necessary part of a healthy forest’s ecosystem. Fire helps remove unwanted invasive species, parasites, diseases and insects, while the remaining ash provides needed nutrients to the soil. Fire also helps reduce the amount of fuel in the forest resulting in smaller, less severe wildfires. Some trees require the high temperature of fire to open their cones for seed dispersal and reproduction.

## Streams, Wetlands, and Water Quality Protection

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### Watersheds – Everyone Lives in a Watershed

Watersheds and their hydrological features provide key functions to natural ecosystems. Destroying or altering these features in any way can have a huge impact upon the natural environment. A watershed is defined as an area of land where all of the water that falls upon it, is under it, or drains off of it, converges into specific lakes, rivers, streams, wetlands, or oceans. Watersheds are bounded by topographical high points known as divides, such as ridges, hills, or mountaintops. Watersheds come in different shapes and sizes, with the larger being divided into smaller sub-basins. Our actions on the land directly affect the water quality and quantity for all communities living downstream.

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### Water Rights

Because water is less abundant in the western U.S., this part of the country has developed the appropriation of water and water sources through water laws and the issue of “Water Rights” – the right to make use of the water from a particular stream, lake, or irrigation canal. Water Rights are assigned to the land. When the land changes ownership, the Water Rights stay with the land and transfer to the new owner. Before doing anything with an accessible water source on your property, be sure you are aware of who owns the water rights.

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### How Safe Is Your Drinking Water?

- Do you have a drainfield or livestock corral less than 100 feet from your drinking well or stream?
- Is your well downhill from contamination sources (such as septic system, pesticides, fertilizer, animal manure, petroleum storage, or other pollutants)?
- Are your streambanks bare of vegetation, eroding, or falling into the stream?
- Has it been more than a year since you tested your drinking water supply?
- Do your well tests show fecal or nitrate contamination above the safe drinking water standards?
- Do you own a dug or driven well rather than a drilled well?
- Is your well more than 20 years old?
- Is your well casing (well pipe) less than 12 inches above ground and/or 19 feet below ground?
- Is there an earth depression around your well casing or does the casing have cracks or holes?
- Do you have any abandoned wells on your property?
- Is your drinking water well shallow (less than 50 feet deep)?

If you answered “yes” to any of these questions, you will want to take immediate action to correct the problem. Get help!

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### Agricultural Water Quality Concerns

#### *Low Stream Flows*

Low flows cause increased water temperature and changes in pH and dissolved oxygen. Increased stream flows, especially during summer months, can help to reduce or eliminate these problems. Conserve water by irrigating efficiently.

### ***Soil Erosion***

Excess soil in streams can silt in fish habitat and clog irrigation pumps. Soil most likely enters streams through eroding streambanks, soil-laden irrigation runoff from fields, eroding rangelands, and poorly designed and maintained roads and culverts. You must prevent soil from eroding into streams. You may also need to prevent excess soil from entering irrigation ditches, depending on where the water is going.

### ***Nutrients***

Nutrients are elements like nitrogen and phosphorus that are found in manure and fertilizer. They help plants grow, but in excess they can cause algae blooms that remove the oxygen needed by fish and water critters for survival. Excess nitrogen can also pollute drinking water from wells. You must prevent your valuable manure or fertilizers from entering creeks and irrigation ditches.

### ***Pesticides***

Improper application of pesticides can harm people, livestock, fish, and wildlife. Pesticides must be applied as indicated on the label.

### ***Bacteria***

The bacteria known as E. Coli can harm humans. You should prevent manure from entering groundwater, creeks, and irrigation ditches to protect yourself and your neighbors. If you have a large number of animals confined in a dirt lot or stable, you may need a Confined Animal Feeding Operation (CAFO) permit.

### ***Streamside Vegetation***

Plants help stabilize streambanks, filter potential pollutants out of water flowing over the ground, and shade the water. Agricultural activities must allow plants to provide these functions.

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## **Non-Agricultural Water Quality Concerns**

Leaking septic systems, improper pesticide applications on lawns and gardens, inappropriate off-road vehicle use, and suburban runoff can contribute to water quality concerns.

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## **Tips to Prevent Water Pollution**

- Establish and maintain shrubs and grasses along streams and around animal confinement areas to trap and absorb pollution-laden runoff before it reaches streams or groundwater.
- Locate corrals and other livestock confinement areas away from streams. Use water gaps or off-stream stockwater tanks to minimize livestock trampling of streambanks.
- Avoid over-irrigation that can cause valuable topsoil, fertilizer, and pesticide runoff.
- Properly dispose of manure, feed, and bedding wastes by spreading on your cropland. Be sure soil is not too wet or frozen to absorb wastes. This will reduce your need for expensive commercial fertilizers.
- Locate corrals, septic systems, and fuel storage tanks downslope of your drinking water well – at least 100 feet away. (Check with your local permitting on exact requirements.) Factors such as location of your well to surface drainage courses and direction of groundwater flow also are important.

- Use farming practices that reduce soil erosion and increase water infiltration, such as minimum tillage, contour farming, filter strips, and grassed waterways.
- Do not mix, apply, or dispose of weed control chemicals, used motor oil, or other toxic substances near streams or where they can leak into groundwater. Contact your county health department for the best method of disposal in your area.
- Keep soil covered with vegetation to prevent erosion
- Maintain septic systems
- Practice Integrated Pest Management (IPM) (See information on [Integrated Pest Management](#) in the section **Predators and Pest Control.**)
- Avoid over-fertilizing

### Improving Water Quality with Best Management Practices (BMP's)

**Terraces:** When terraces are installed, erosion is controlled by slowing water runoff on the surface and moving it to a vegetated or pipe outlet. Topsoil is maintained in the field and gullies are prevented.



**Grassed Waterway:** This practice reduces erosion in areas where water concentrates. It should be vegetated with an adaptable grass or grass-legume mixture. Proper construction of waterways and maintenance of vegetation provide an adequate erosion free outlet in sloping fields.



**Conservation Tillage:** This practice is part of a cropping system that retains protective amounts of crop residues on the soil surface throughout most of the year. This system combines reducing and delaying tillage with winter cover such as crop residues or winter annuals. Besides reducing soil loss 50% - 90%, this practice lowers costs, reduces soil compaction, improves soil tilth, conserves soil moisture and retards the loss of nutrients and pesticides.



**Filter Strips:** Filter strips are permanently vegetated sections of land established downslope of agricultural operations to control erosion and slow, reduce, or eliminate pollutants from entering an adjacent waterbody.



**Waste Utilization:** Waste Utilization is the use of animal wastes on land in an environmentally acceptable manner while maintaining or improving soil and plant resources. This practice safely uses wastes to provide fertility for crop, forage, or fiber production; to improve or maintain soil structure; to prevent erosion; and safeguard water resources.



**Sediment Basin:** Sediment basins are short earth embankments constructed across the slope and minor watercourses used to trap sediment, reduce erosion and improve water quality. They can be used on fields where concentrated runoff is causing erosion that cannot be controlled by vegetation or residue alone.



**Slotted Board Riser:** When installed in a drainage system, these structures can be used to hold water on fields long enough for sediment to settle out. These structures also can be used to control the discharge rate of water leaving the field to create wildlife habitat.



**Cover Crop:** Cover Crops are close growing legumes, or small grains grown primarily to control erosion during periods when the major crops do not furnish adequate cover; add organic material to the soil; and improve infiltration, aeration and tilth.



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### Landscaping for Water Quality

You don't need to own shoreline to have an effect on water quality. Rain water from every property goes to a stream or a lake, or to groundwater. On the way it picks up contaminants from roofs, driveways, and yards. Runoff affects fish, your drinking water, and contributes to flooding. There are several ways to reduce stormwater runoff or improve water quality.

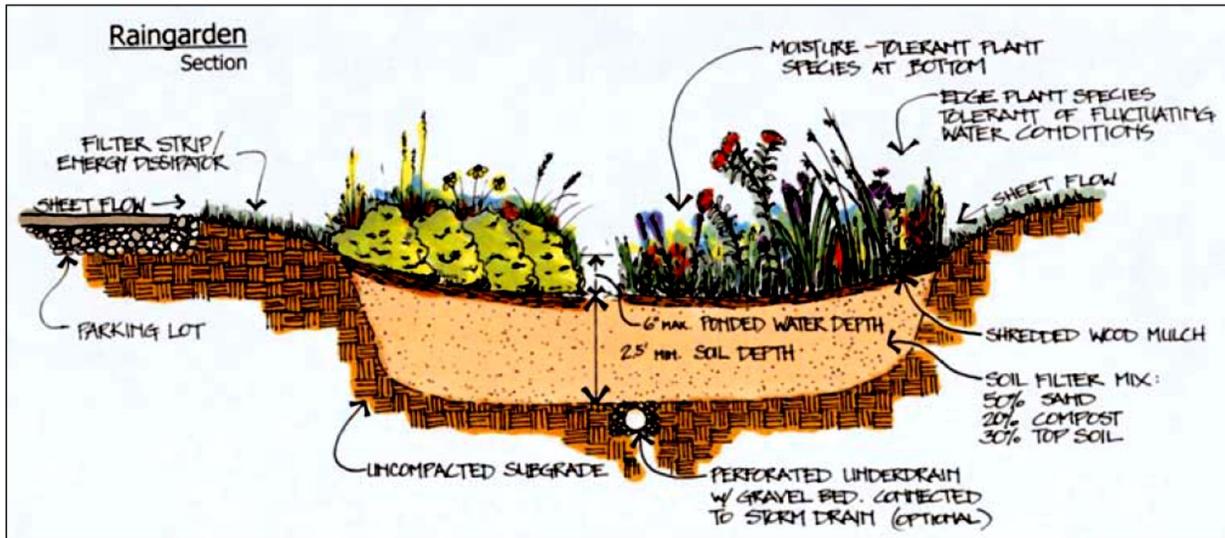
#### *Ways to reduce and/or treat storm water:*

**Rain Barrels** capture rain from your roof's gutter system. The barrel has a spigot so the water can be used later for watering plants. Each barrel acts as a filter to keep debris and mosquitoes out and built-in overflow for large rains. A 50-gallon rain barrel will fill quickly – a one-inch rainfall on a 1,000 square foot roof (small house or garage) yields 617 gallons of water.

**Permeable Pavers** are an alternative to concrete. They let water soak through and can be used for sidewalks, patios, and driveways.

**Buffers** of native grasses and wildflowers around ponds, lakes, streams, and wetlands will help filter runoff before it enters the waterbody. They have the added benefit of vastly improving the waterbody's value to wildlife. A recommended starting width for buffers is 50 feet to have both wildlife and water quality benefits but any buffer is an asset. Your local conservation district can help you with buffer designs and cost share grants for stream or lakeshore properties.

**Rain Gardens** look great but they also have a hidden function. These gardens are planted in small depressions and use specially structured soils that allow large amounts of storm water to soak in. Rain water from house gutters and driveways are directed into the garden. It is planted with native plants that can tolerate flooding, but thrive when it is dry too. These plants have deep root systems that help the water soak in quickly. Pollutants are filtered out of the water by the roots and soils. Mosquitoes can't breed in a rain garden because it only holds water for a few hours. Assistance designing and installing a rain garden is available from your local conservation district. Cost share grants are also occasionally available.



## Protecting Water Quality

### *Rural Water Systems:*

These systems ensure a clean, reliable source for drinking water. Homes not connected to rural water may submit requests to the rural water system for connection. If approved, connection costs, including pipeline establishment and permitting may be the sole responsibility of the homeowner.

### *Wells:*

Groundwater accumulates from precipitation and is stored beneath the surface of the earth. It fills cracks, pores and crevices of underground materials. Many rural homes and businesses rely completely on groundwater for their source of potable water.

As a water supply, groundwater is actually preferable to surface water from rivers, lakes or streams. Groundwater requires minimum treatment and quality and temperature is usually uniform. When properly managed, groundwater is a dependable source of supply that is accessed by drilling wells.

Yearly maintenance and upkeep of a well is good practice for prolonging its life and keeping drinking water safe. Yearly water tests will provide the needed information for identifying possible health concerns related to water quality. Homeowners with private wells are responsible for monitoring the quality of their drinking water.

All ground water contains some gases and minerals; accept ability and desirability of these materials is a matter of personal preference. Be aware that some problems invisible to the naked eye such as hardness or high bacterial counts, do require treatment while other issues that are more obvious may not be detrimental to one's health and do not need to be treated.

There are three main types of wells. Each type has its advantages and disadvantages.

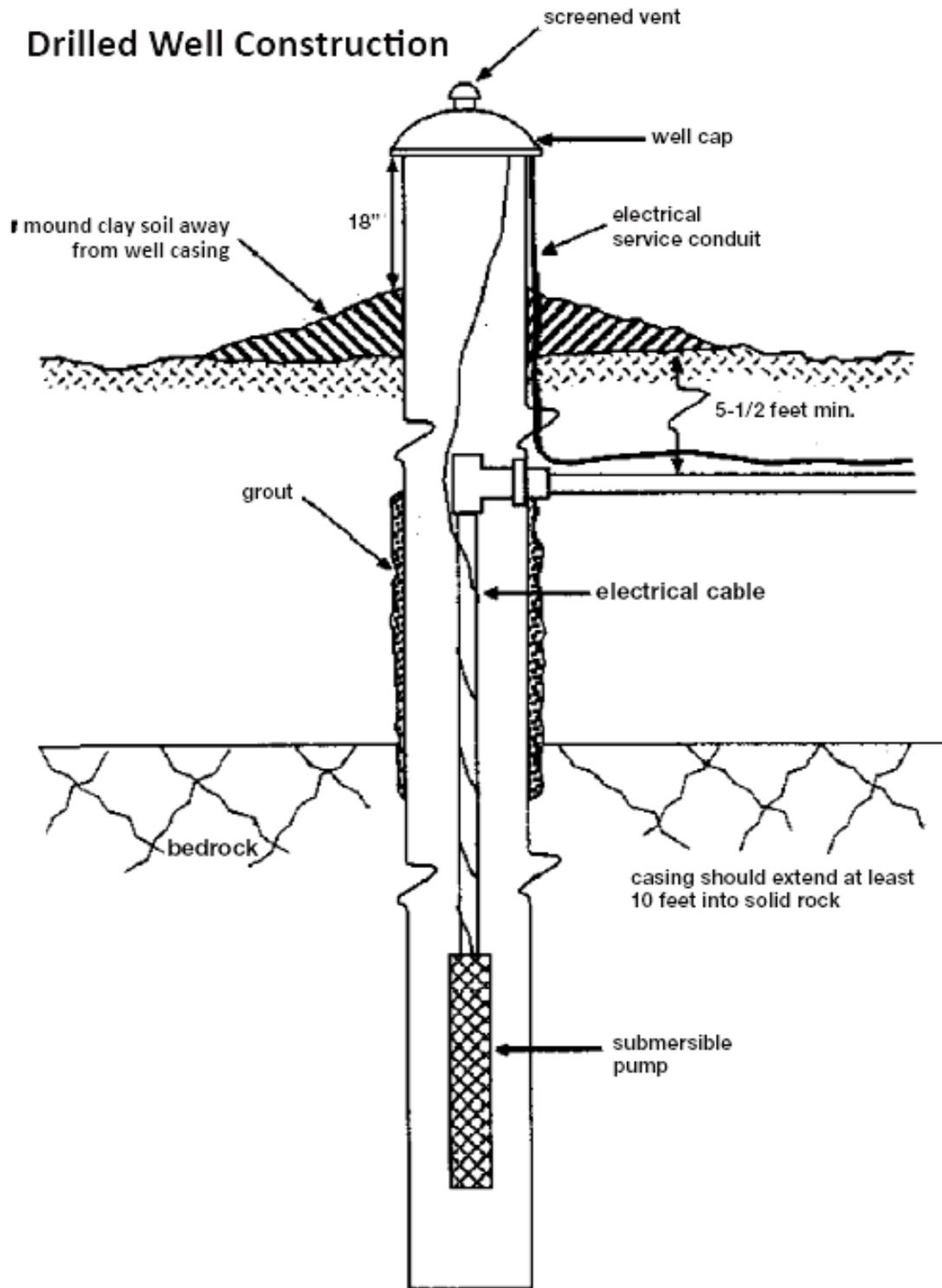
- **Drilled wells** can reach deeper aquifers and can be drilled through bedrock. These wells are also less susceptible to contamination. Some deep, drilled wells do have a tendency to produce poor water quality however, due to salt, sulfur and other minerals.
- **Dug or Bored wells** are usually shallow, typically in the 20 – 30 foot (6 – 9 meter) range. They are easy and inexpensive to construct. On the other hand, water shortages are possible with these shallow wells during dry periods and they are quite vulnerable to contamination from debris or bacteria found in surface water (as opposed to groundwater) which may infiltrate these wells. Dug wells often pose a safety hazard and a threat to groundwater quality.
- **Sand point wells** are generally simple and inexpensive to install but they are limited to installation in permeable materials like sand, have limited yield, are susceptible to shortages in dry periods and are quite vulnerable to contamination from surface water and materials.

A well should be properly located in order to minimize the risk of contamination. Wells must also have watertight casings to a minimum depth. If not, wells must have increased separation distance to potential sources of contamination. Potential sources of contamination include animal pens and barns, homes, buildings and downspouts (which can flush large quantities of debris locked up in surface water into a well which is not properly sealed) and septic fields.

Wells must also be properly maintained. This includes the following actions:

- Regular testing for bacteria and other contaminants
- Inspection for cracks and leaks which admit surface water
- Inspection for staining on the well interior which may indicate that, over time, surface water is seeping into the well
- Removal of debris which may be floating in the well
- Ensuring ground directly around the well is mounded up to promote drainage away from the well
- Maintenance of a buffer around the well

# Wells



## Concerns and Actions for Well Protection

Concern	Action
1. Natural or human-induced pollutants may have already contaminated the well.	<ul style="list-style-type: none"> <li>Collect a sample from the drinking water tap and have it analyzed by the county health department every 1 to 2 years.</li> </ul>
2. A dug or driven well (rather than a drilled well) or a well more than 20 years old may lack adequate protective measures to prevent contamination	<ul style="list-style-type: none"> <li>Have a licensed well installer or professional engineer inspect the well and develop a well head protection plan.</li> </ul>
3. Improper well casing allows runoff-borne contaminants into the aquifer.	<ul style="list-style-type: none"> <li>Make sure that wells are cased, that the casing is properly grouted, and that the casing (pipe) extends a minimum of 12 inches above and 19 feet below the ground surface.</li> <li>Repair or replace any casing that has cracks or holes.</li> </ul>
4. A well downhill from a contaminant source is vulnerable	<ul style="list-style-type: none"> <li>Locate new wells uphill from contaminant sources such as fuel or fertilizer storage areas, animal pens, or septic systems.</li> <li>Locate new wells 50 feet or more from a septic tank or chemical storage sites and 100 feet or more from a septic leach field</li> <li>Grade your land to divert flow away from existing wells in vulnerable sites and to prevent ponding of runoff around the well.</li> </ul>
5. Improperly abandoned wells create a high risk for aquifer contamination	<ul style="list-style-type: none"> <li>Have a licensed well installer or professional engineer inspect the abandoned well and develop a well decommissioning plan.</li> </ul>

### *Abandoned Wells:*

A well is a direct channel from the surface to the aquifer below and can be a safety hazard. Properly sealing abandoned wells prevents aquifer contamination and life threatening accidents. With an approved design, the abandoned well can be sealed by the owner, however, for safety, it is strongly recommended that a licensed well driller perform the work.

### *Non-point Source (NPS) Pollution:*

Contaminants that are delivered to surface waters by way of runoff or leached downward into groundwater are NPS pollution. It causes streams to be muddy, lakes to be choked with weeds, fewer fish in your favorite fishing hole, and rivers to flood more frequently. Nutrients contribute to the over enrichment of streams and lakes with cause an increase in undesirable weed and algae growth. This excessive plant growth makes it difficult for fish and other aquatic life to live and discourages recreational use. Some of these nutrients come from city streets, cropland, pastureland, lawns, gardens, and improperly maintained septic systems. Recognizing potential pollution sources can help avoid accidental contamination of drinking water.

### **Non-Point Pollution Sources**

- Erosion and runoff from roadsides and construction sites
- Contaminated runoff from both agricultural operations and development.

- Sediment from eroding agricultural and forestry lands.

You can help prevent nonpoint source pollution by using a wide variety of soil and water conservation practices such as no-till or minimum till farming. Plant trees and shrubs along streams and other water bodies to control erosion and to filter pollutants. Apply chemicals at the proper rate and not when rainfall is imminent. Use proper logging and erosion control practices on your forest lands by ensuring proper construction, maintenance and closure of logging roads. Retain trees and shrubs on the edges of drainage channels, streams and rivers.

By contrast, *Point Source* is defined by the EPA as any recognizable transporting agent in which pollutants are or may be discharged; pipe, ditch, channel, tunnel, conduit, well, etc. (section 502(14) of the Clean Water Act)

### ***Animal Manure Management (Pets and Livestock):***

Man's best friend may be water quality's enemy if contaminants from pet feces and urine run off into water bodies. Overuse of pastures and paddocks may result in erosion and stream-choking sediment being carried offsite. Livestock manure can be transported by rain, runoff, or floodwaters. Pet runs and livestock pens should be located as far away from riparian areas, streams, drainages, and wetlands as possible and downslope from wells; maintain a vegetated buffer between them and the water course or well. Keep livestock out of streams where their wastes can pollute the water and their movements can cause erosion. You can do this by designating a special area along the stream as a buffer which will improve and enhance any grazing system.

Develop a regular routine for collecting feces; store it where runoff won't carry it away until it can be disposed of. Recycle livestock manure and bedding for use as fertilizer on gardens or cropland, either directly or after composting. Locate manure piles away from drainage areas, cover them, and divert clean water away from them. Maintain vegetation in pasture areas through proper grazing techniques.

An animal feeding operation (AFO) is defined as a facility where livestock (cattle, hogs, sheep, poultry, and horses) are confined more than 45 days per year in an area without permanent vegetation. Due to large concentrations of manure and lack of ground vegetation, these operations can cause great harm to the natural environment because of the risk of pollution during rain events. Implementing vegetation buffers along with a manure management strategy can help reduce the risk of polluted run-off or leachates.

Be sure to restrict livestock from riparian areas. This will allow trees and low growing vegetation to thrive. (For more information on [Manure Management/Composting](#), please read further in this section **Steams, Wetlands and Water Quality Protection.**)

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### **Clean Water Act**

The federal Clean Water Act makes it unlawful to discharge any pollutant from a point source into navigable waters without a permit. It also sets water quality standards for all contaminants in surface water.

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## Septic Systems

Most rural homeowners are responsible for the treatment of their own wastewater. An individual home sewage treatment system, also known as a septic system, treats and disposes of household wastewater. A properly designed, installed, and maintained septic system will provide long-term, effective treatment of wastewater.

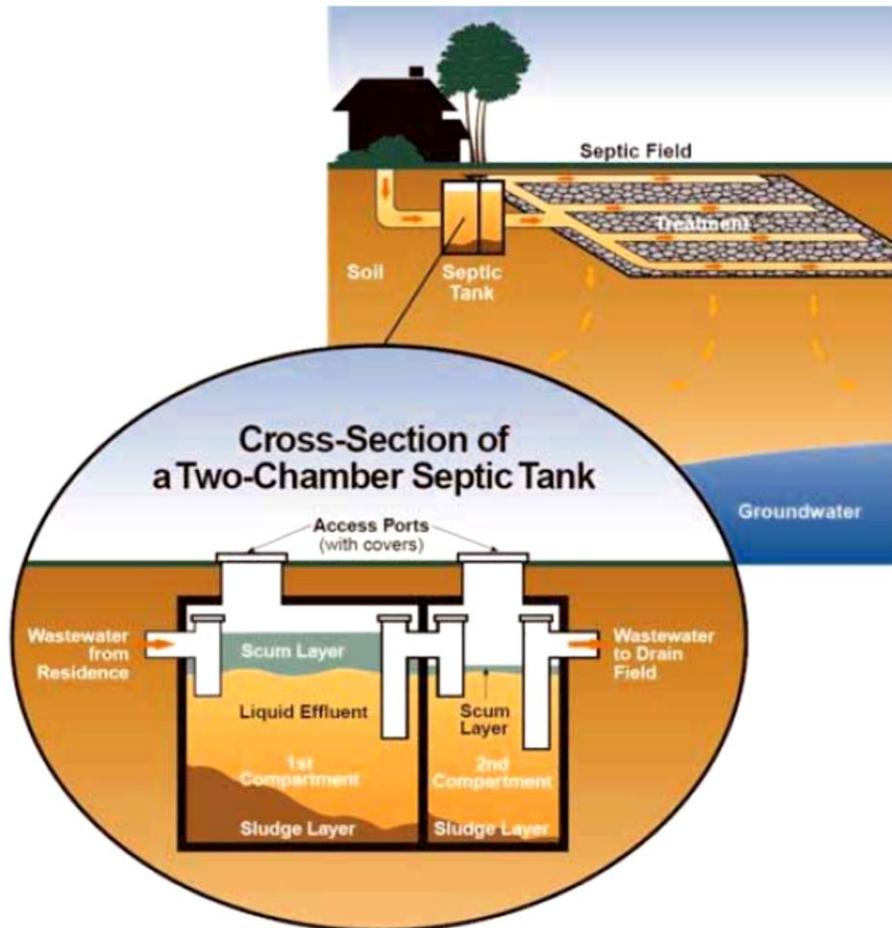
Septic systems are designed to discharge contaminants below ground. A poorly designed system or one in need of maintenance makes your water supply susceptible to contamination. Locate your septic system to provide the maximum possible separation between it and surface or ground water sources. Septic system designs must satisfy county regulations and should be installed by an experienced contractor.

A septic system has two main pieces, a septic tank and a drain field.

### **Primary Treatment: Septic Tank**

Wastewater enters the septic tank through a pipe from the house. Septic tanks are buried, water-tight containers where liquids and solids will separate. Three distinct layers separate out within the tank: a layer of floating scum, a middle liquid zone, and a bottom layer of sludge. Given time, naturally occurring bacteria will decompose most of the solids in the waste and what doesn't decompose will settle to the bottom as sludge or float on the surface as a scum layer. Baffles within the tank are designed to allow water, but not solids out to the drain field for secondary treatment. Solids in the tank must be periodically pumped out.

*Image courtesy of the city of Winnipeg*



### **Secondary Treatment: Drain Field**

Wastewater that exits the septic tank will enter the drain field through a system of connected perforated pipes or bottomless chambers. The drain field provides additional bacteria treatment as the material passes through perforated pipes, into a gravel bed and then into the soil. A thick layer of fine solids, dead bacteria, and soil bacteria called the “biomat” forms where sewage meets the soil. Water is treated by bacteria and plants as it percolates into the soil. As the water passes through the biomat, bacteria destroy pathogens and consume nutrients and other wastes. The water then infiltrates into the soil below.

The size of a drain field depends on the type of soil and number of bedrooms located within the home. The lower the absorption rate of the soil, the bigger the drain field needs to be. If the drain field is overloaded with water, the septic tank will fill up and sewage can back up into the house plumbing. Overuse of the system, even for a short period of time, can cause water to be released into the drain field without being properly separated into the septic tank. This can contaminate ground water and damage the system by clogging the pipes.

All household wastewater must go to the septic tank. Wastewater cannot be discharged onto the ground surface because it can be a source of dangerous water-borne diseases and offensive odors. It is also important to limit the amount of solids disposed through this system. Items such as cat litter,

cigarette butts, and coffee grounds may clog your septic system. Other types of waste could kill the beneficial bacteria in the tank and drain field. Do not dispose of oil based paints, solvents, and toxic cleaners through the septic system.

Proper maintenance will extend the life of a septic system. It should be inspected every couple of years by a professional. The sludge that settles out in the tank will need to be pumped out every two to three years as a general rule. The frequency of pumping will depend on the number of people living in the house, the quantity of water used, the amount of solids put into the system, and the size of the septic tank. In some sites, septic drain fields will plug after 20 – 30 years, and become less effective even with proper maintenance. A new drain field may be needed.

State and local laws set standards for septic systems, including requiring inspection of your system during home sale or property transfer.

In some areas (such as portions of the Lake Superior Basin), drain fields are not practical, so holding tanks are authorized under state codes.

### *Maintaining a Septic System*

#### **Importance of Maintenance:**

- Cost – Septic systems are expensive to repair or replace, but easy to maintain. Lack of maintenance is a primary reason for early failure.
- Health and Safety – A failed septic system can release inadequately treated solid waste into natural water sources (streams, lakes and groundwater) creating a risk to public health.
- Property Value – A failed system can lower property value. In addition, occupational permits might not be approved because of a failed system.

#### **Tips for maintaining a properly functioning septic system:**

Monitoring the functionality of the septic system and conducting maintenance accordingly is your best bet for maintaining a healthy septic system. Following these rules will help prolong the life of your septic system.

- Schedule an annual inspection.
- Develop a septic tank pumping schedule for your tank. Your tank must be professionally pumped periodically to remove solids, sludge, and scum. If this is not done, these materials overflow into the drain field. Pumping frequency depends on the size of the tank, household water use and the volume of solids. Most tanks are designed for three- or more-year pumping cycle.
- Plant only grass over your septic system. Roots from trees or shrubs could clog or damage the drain field pipes.
- Do not drive or build over the drain field. Compaction of the soil will reduce the effectiveness of the percolation within the soil.
- Direct rain runoff from roofs and driveways, away from the drain field. Doing so will minimize the chance of overloading the drain field with water.
- Conserve water to avoid overloading the septic system. Repair leaky faucets and toilets and install low-flow fixtures. Space out tasks like laundry that use a lot of water. For example, do laundry throughout the week rather than all on one day.
- Consider alternative options to garbage disposal systems such as composting.

**Causing Harm to the System:**

Some actions can cause serious damage to the septic system and can reduce the life expectancy of the system. Properly managing the site of the septic system will also help prolong the system's life.

Following these simple guidelines will help keep your system safe.

- Flush only easily digested organics and water down the drain. Refrain from flushing items that could be placed in the trash; napkins, cigarette butts, dental floss, feminine products, pharmaceuticals or condoms.
- Minimize your use of household soaps and chemicals. They can destroy helpful bacteria that assist in the breaking down of solid waste in the system. Small amounts of drain cleaner can kill the needed bacteria and disrupt the system. Consider alternatives such as the use of boiling water instead.
- Use liquid laundry detergent rather than powder.
- Water softener backwash into your septic tank may harm the system.
- Experts believe that septic tank additives are unnecessary and provide little to no benefit for a properly managed system.
- Avoid allowing animals to graze on the drain field.

**Maintain pumps and filters properly**

- All pumps and motors should be routinely checked for proper operation
- Replace weak or faulty pumps and motors
- Install and clean lint filters on laundry equipment
- Clean or replace effluent filters regularly
- Attend to alarms on pumps and filters immediately

**Tank Additives**

Starters and feeders are either unnecessary or harmful.

The installation of a septic system may require a permit from your city or county. Professional installers may be found in the phone book or from your local public health unit. If you suspect a problem with your existing system, contact a local septic system professional or the public health department.

Additional Resources:

National Environmental Service Center: Septic Systems

EPA: Septic Systems

## Concerns and Actions for Preventing Septic System Problems

Concern	Actions
1. System location creates potential to contaminate adjacent water sources.	Locate system properly: <ul style="list-style-type: none"> <li>• 50 feet from septic tank to well.</li> <li>• 100 feet between leach field or lagoon and well.</li> <li>• 100 feet away from a surface water body</li> <li>• Avoid areas with shallow (&lt;10 feet) groundwater tables.</li> </ul>
2. Failure due to overload from excessive water use.	<ul style="list-style-type: none"> <li>• Practice water conservation to lessen the work the septic system must perform.</li> </ul>
3. Poor quality effluent due to inadequate microbial treatment.	<ul style="list-style-type: none"> <li>• Dispose of hazardous household chemicals at an approved hazardous waste collection center.</li> <li>• Use bleach, disinfectants, drain and toilet bowl cleaners, and other “poisons” sparingly and in accordance with product labels.</li> <li>• DON’T use commercial septic tank additives – these products rarely help, and some may even hurt your system.</li> </ul>
4. Failure due to accumulation of solids in the septic tank.	<ul style="list-style-type: none"> <li>• DON’T use your toilet as a trash can by dumping non-degradable items down your toilet or drains. Keep grease, diapers, plastics, etc., out of your septic system.</li> <li>• Have your tank pumped out and your system inspected every 3 – 5 years (1 – 2 years if a garbage disposal is used) and keep records.</li> </ul>
5. Failure of the soil absorption field (leach field).	<ul style="list-style-type: none"> <li>• Construct two fields so one may rest while the other is in use. Alternate use every year.</li> <li>• Divert surface water from gutters, driveways and hillsides away from the septic system.</li> <li>• DO NOT drive or park over any part of the system. The area over the drain field should be left undisturbed with only a mowed grass cover.</li> <li>• Don’t plant trees or wood shrubs near the system; roots may clog and damage drain lines.</li> </ul>

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### Solid Waste Disposal & Recycling Options

Rural residents should consider their impact on natural resources surrounding their private property. Proper disposal of solid waste, hazardous materials, and recyclables will help maintain the quality of surface and groundwater, including lakes, streams, rivers, and aquifers.

## **Reduce and Reuse**

Source reduction prevents waste from being created. It reduces the amount of toxicity, of waste at the source. Because source reduction actually prevents the generation of waste in the first place, it is the most preferable method of waste management. Source reduction includes purchasing durable, long-lasting goods and making them last longer by repairing them when necessary, reusing products and packaging, and reducing the amount of packaging that is discarded. It is also seeking products and packaging that are as free of toxics as possible.

Reusing items by repairing them, donating them to charity and community groups or selling them also reduces waste. Reusing when possible is preferable to recycling because the item does not need to be reprocessed before it can be used again.

## **Solid Waste**

Rural areas may not have a commercial solid waste service. You are responsible for properly disposing of solid waste. In some cases, your only option may be to haul trash to the landfill yourself. Check with your county office to see what options are available to you.

## **Recycling**

Items such as corrugated cardboard, newspapers, magazines, aluminum cans, used motor oil and steel cans can be recycled. Many landfills will compost lawn clippings and other organic material. Recycling reduces consumption of natural resources and extends the lifespan of landfill sites. However, buying products that are recyclable and actually recycling them is only part of the recycling process. Consider also buying products made from recycled materials.

Recycling may be more difficult for rural homeowners. Pick-up of recycled materials may not be available and few rural areas have recycling centers. Check with your county to see what services are available.

## **Hazardous Materials and Contaminants**

Household hazardous waste includes items labeled danger, toxic, poisonous, corrosive, or flammable. Chemicals used in and around our homes can be a risk to water quality when used or disposed of improperly. If spilled or disposed of on the ground, it can wash into streams or leach through soils into wells. If your driveway or sidewalk de-icers are necessary, use organic-based products that pose minimal risk if washed into an adjacent creek or wetland. Minimize fertilizers and pesticides, don't exceed the recommended application rates or frequency on the product label, and leave an untreated area as a buffer between the treated areas and riparian zones. Store trash in areas where wind or floods can't carry it away and recycle or dispose of chemical containers in accordance with the manufacturer's recommendations and applicable laws and regulations.

*Examples of hazardous materials/contaminants include:*

- Pesticide containers
- Paints
- Thinners
- Stains
- Varnishes
- Drain and oven cleaners
- Poisons

- Automotive fluids
- Weed and insect killers
- Fluorescent light bulbs and ballasts

Household hazardous waste needs to be properly reused, recycled, or disposed of. Once a year your community may have a hazardous waste collection week. If you want to drop off your waste, contact hazardous waste sites.

### Backyard Burning

Backyard burning of garbage is unnecessary, dangerous and often illegal in many places. Even rural households have alternatives to burning trash. In addition, burning garbage may be a liability since open burning can start fires (for example, 36% of Wisconsin wildfires are from careless debris burning). Backyard burning is also a source of toxic chemicals because trash burning creates toxic pollution. Trash burned in a burn barrel creates two thousand times more dioxin (a highly toxic known carcinogen) than if that same trash was burned at a modern municipal incinerator. For some people, pollutants created by garbage burning can cause respiratory and other health problems and it's an un-neighborly practice since the unpleasant odor wafts into other properties.

### Manure Management /Composting

**Manure** contains both valuable nutrients and potential pollutants, and if not properly managed, can leach into ground and surface water causing pollution. Animals produce a lot of manure and without regular management it can become overwhelming quickly. Ideally manure should be collected every one to three days to reduce polluted run-off, fly breeding sites, and muddy areas. Using certain types of footing material can make cleaning sacrifice areas easier with minimal material loss. Manure should be kept away from streams and ditches, regardless of the type of livestock.

An “all-weather paddock” is a key part of most well-managed horse properties and is useful for other livestock. You keep your horses here to allow pasture grass to re-grow, protect saturated ground, and manage the amount of grass they are eating. Think of it as the horse’s “living room,” with the pasture as the “dining room.”

To reduce mud and dust, use wood chips, sand or some other surface to provide adequate drainage. Regularly clean the paddock. Horses shouldn't stand in their own waste! A well-managed paddock will have little or no contaminated runoff or nutrient leaching to shallow groundwater, ditches, or canals. Direct runoff to a vegetative buffer or filter strip. Divert rainwater and snowmelt around the paddock with gutters and downspouts on the buildings.

Animal	Manure Lbs per Day
Dairy Cow	120-150
Heifer	50
Beef Cow	75
Horse	50-55
Ewe w/Lamb	12
Goats	10
Llama	12-20

**Composting** is the process of turning plant remains and other once-living material into fertilizer and organic matter that is ideal as a natural soil amendment. There are multiple containers and methods for composting, all of which share primarily the same process. The main difference is in the amount of time it takes for the material to fully compost. Composting helps reduce household trash production while providing a valuable resource that can help increase crop yields. If you want to start composting at home, there is no better time to start. There are many online and local resources available to landowners.

Composting Facilities utilize animal manure or other waste products (not including animal carcasses) in a sanitary method that results in a product that can be used on farms to improve soil organic matter. A well-managed compost pile will cause naturally occurring chemical compounds in the manure to stabilize and reduce the potential for adverse environmental impact. Additionally, besides turning livestock waste into garden gold, the volume of the material will be reduced to about one-third of its original mass.

There are some things to take into consideration when choosing a composting site, including distance from a water body, property lines, residence, wells, or other environmentally sensitive areas. A good location is very helpful for a successful compost pile. Sun is important to help heat, yet it can also cause excessive drying out. Additional requirements include: good availability of water to keep the pile moist, protection from winds which can dry and cool the pile, and good drainage so standing water doesn't impeded the decomposition process. Compost piles should be situated away from buildings, wood, or trees which can be affected by the decomposition process.

Heating of the pile is a vital part of the composting process. The right amount will kill pathogens and weed seeds, too much will kill off the microbes.

The temperature is expected to increase in a compost pile due to the breakdown of organic material by microorganisms. The pile will start out at the outside temperature when it is first mixed and can reach 150 degrees in less than 2 days. The maximum composting rate occurs when the temperature is between 110 and 150 degrees F. It has been shown that a temperature of 131 degrees for 3 days will kill all parasites, weed seeds, and disease-causing organisms. It is important to turn the piles frequently to ensure that all parts of the pile are exposed to these temperatures.

#### *Water Quality Benefits*

Composting provides a soil amendment that:

- Physically protects soil from rain and wind and reduces sediment transport in runoff
- Increases plant growth and soil cover
- Improves soil structure, organic content, water infiltration and water holding capacity
- Provides an alternative use for poultry litter and other animal by-products as part of a nutrient management plan.

#### *When to Use*

Composting facilities provide an alternative use for manure and other waste products from agricultural operations and can improve air quality and odors.

In order to maintain water quality benefits, composting facilities should not be located within 25 feet of an intermittent or perennial stream, unless there are no other feasible locations.

These facilities can be designed to handle animal mortality.

#### *How to Establish*

Whatever method of manure storage being used, the pile should be covered during wet periods and set on an impervious surface to limit leaching and runoff. If you plan on using a front loader to turn or move the pile make sure the roof of the structure is tall enough.

When possible, composting facilities should be located outside of floodplains and above seasonal high water tables. Permeable soil is ideal to reduce surface water contamination. Be sure to divert runoff away from composting facilities.

Facilities need to be large enough to handle the type and amount of composting materials being used.

pH levels should be neutral or slightly lower to reduce nitrogen losses. Once established, moisture content should remain between 40-60%. The minimum composting period for stability is 21-28 days; for higher quality compost, piles may need up to 60 days.

#### Good



*Courtesy of Alayne Blickle*

#### Better (needs cover)



*Courtesy of the Sequim Gazette*

#### Best



#### *Considerations and costs*

Inspect composting facilities frequently to ensure proper function. This includes temperature, odor, moisture and oxygen.

Initially, use a composting mix of 30:1 to reduce odors. Chemical agents and carbonaceous materials may be needed to maintain proper function.

To obtain maximum solar warming, piles should be aligned north to south with moderate side slopes.

Composting facilities can be high in cost depending on materials, size and construction.

#### *Effectiveness*

Composting by-products reduced erosion by 86% in studies. On slopes up to 15%, composted materials reduced runoff by 70% in studies.

By using composting by-products sediment transport was reduced up to 99% compared to silt fences and 38% compared to hydroseeding in studies.

## Crop Nutrient or Animal Waste Management Problems

You must prevent your valuable manure or fertilizers from leaving your property. Small acreage landowners are especially vulnerable to this rule. Stored waste from barn cleanings or feedings areas can leave the property if water runs through it, either from rain or runoff or if stored in a flood plain. Paying attention to where you site your manure pile, covering it, and diverting clean water away from it are all easy ways to stay in compliance with this rule. The best way however is to use it right on your property or share some with your neighbor. Just don't send it to him by way of your stream!

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## Wetlands

A wetland is an area with saturated soils that will host water-loving vegetation. Because wetlands store floodwater, trap nutrients and sediment, help recharge ground water, and provide habitat for wildlife, they are vital to a healthy environment.

Wetlands and their adjacent ecological transition zones are important features of a watershed. The flow of water, the cycling of nutrients and the energy of the sun meet to produce a unique ecosystem characterized by its hydrology, soils, and vegetation. Wetlands can be classified into four general categories: marshes, swamps, bogs and fens.

Wetlands have two primary characteristics: (1) hydric (water logged) soils and (2) water-tolerant plants. Even when water isn't visible these indicators will still be present.

Wetlands are home to thousands of species and provide important breeding areas. Wetlands' natural systems are critical to maintaining the ecological balance of a region. They help reduce flooding by storing water, and help reduce water pollution through their filtering and cleansing abilities.

Wetlands aren't always wet. In fact, depressions that are only wet for a little while each year are an especially valuable type of wetland for many kinds of wildlife, such as frogs and salamanders. In short, just because it's dry doesn't mean it's not an important wetland.

The areas around wetlands are important too. Ducks, for example must have dry natural areas around a wetland for nesting. Frogs lay eggs in the water but spend much of the year foraging in woods and grasslands around their wetland.

Whether an area is a wetland or not is determined by specific soil, vegetation and hydrologic conditions. Wetlands are protected under federal law from land management activities that would destroy them or change their function. Become familiar with regulations before you consider draining, filling or otherwise altering a wetland. In some cases, a drainage permit may also be required by the county.

Voluntary programs are available to help landowners protect, restore, and preserve wetlands by providing financial incentives. A good first step is to contact your local NRCS or conservation district office for assistance. Other State, Federal and local agencies can also provide information regarding these programs and the regulations that help preserve these valuable resources.

Contact the Natural Resources Conservation Service (NRCS) to determine whether your area is a wetland.

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## Wetland Creation, Enhancement and Restoration

### *Water Quality Benefits:*

- Reduces nutrient loadings
- Provides and protects native species habitats
- Can improve water quality associated with degraded wetlands
- Can reduce chemical contaminants

### *When to Use:*

Creating a wetland is ideal in areas where wetland conditions can be established and maintained by modifying drainage.

Enhancing existing wetlands can improve overall habitat and water quality, and may improve the many functions of a wetland. Restoring a wetland can provide habitats for wildlife.

Large wetland restoration projects can generate income when used to mitigate wetland losses elsewhere.

Prior to any wetlands project, contact the U.S. Army Corps of Engineers for additional requirements.

### *How to Establish:*

All federal, state and local regulations should be followed. Landowners must obtain all required permits before beginning a restorative process.

Except where seasonal, wetlands require a permanent water source. Examine natural wetlands in the area as a guide for restoring a wetland. Vegetation established in wetlands should be adapted to the area as well as to wet conditions.

Permits are the responsibility of the owner to obtain.

### *Considerations and Costs:*

Consider any impacts of changes in the volume and rate of runoff, infiltration, evaporation, and transpiration on the water budget that may result from these practices. Producers should also consider any impacts on downstream flows and wildlife habitats prior to creating or modifying a wetland.

Costs associated with wetland creation include planning and design, site preparation, seed/plant materials, and other costs that result from altering water flows and establishing vegetative buffers.

Costs associated with enhancing and restoring wetlands may include drainage modification, additional plant materials, soil improvement costs, expansion costs, etc.

Contact your local conservation agent prior to beginning a wetlands project in order to fully understand maintenance requirements.

Wetland creation is moderately high to high in cost. Wetland enhancement is low in cost. Wetland restoration is moderate in cost.

*Effectiveness:*

Restored wetland buffers with an up slope grass strip and down slope planted pines and hardwoods retained or removed 59% of nitrogen and 66% of phosphorus entering from adjacent manure application sites in studies.

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### **Wetland Invasive Plants**

Invasive plants can be a problem in wetlands, and managing them requires special techniques. Methods like mowing or burning are difficult in wet areas. The herbicides we rely upon in forests and grasslands are toxic to fish and other aquatic life in even tiny amounts, so special aquatic formulations must be used. For example, glyphosate herbicides should not be used around water. Instead look for aquatic formulations.

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### **Wetlands and Surface Pollutants**

Wetlands often have very close connections with the groundwater system. Some wetlands, in higher ground, may serve as important groundwater recharge areas. Others, especially those in low-lying areas, may be the receptors for significant amounts of groundwater discharge. Therefore, if the underlying groundwater is contaminated, detrimental consequences will be felt by the wildlife and all other resources users dependent on that wetland.

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### **Regulations and Working in Waters and Wetlands**

The Food Security Act of 1985 protects all wetlands from being harmed or removed without a permit, and Section 404 of the Federal Clean Water Act regulates filling, draining and excavations in wetlands, and is administered by the U.S. Army Corp of Engineers. When working in or adjacent to a stream or wetland, there is a good chance that you may first need to acquire a permit. Placement of fill, excavation, alteration of stream banks or stream course, ditching, stump removal, and plowing or discing wetlands not previously farmed, are all activities that require a permit and are regulated by the Department of State Lands and Army Corps of Engineers. All work done at or below the high water mark is subject to these regulations. A rule of thumb for identifying a high water mark is by a change in the type of vegetation present on the bank. You should always contact your local authorities before doing work in or near a waterway.

If you are considering a project that might impact a wetland, contact your local conservation district. Do not ignore the laws – penalties often include restoring the wetland to its original condition, which can be very expensive.

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### **Riparian Areas**

Riparian areas are defined by the Natural Resources Conservation Service (NRCS) as ecosystems that occur along waterways and water bodies such as streams, lakes and wetlands. Riparian areas act as the transition between the wet (aquatic) lands and the dry (terrestrial) land. A healthy riparian area will be highly vegetated with ideal riparian vegetation, good shade, and an abundance of woody and organic debris. Plant roots provide the bank with increased stability while minimizing sediment runoff. Riparian

buffers should be between 25 – 100 feet wide depending on surrounding land uses. They are comprised of water-loving plants such as alder, willow, cottonwood, and sedges.

These areas make up less than 5 percent of the landscape, they represent critical habitat for a diverse range of living creatures, containing 75 percent of our plant and animal diversity: turtles, beaver, muskrat, wood duck, songbirds, frogs, insects, aquatic organisms, orchids, lilies, and more. Just about everything you like about these areas depends on leaving them in their natural state.

Properly managed riparian areas provide property owners and the environment with numerous benefits. Riparian areas are vital to the natural ecosystem, thus property owners are highly discouraged from altering or removing riparian vegetation.

*Ecological Benefits:*

- Reduces water pollution
- Reduces flooding
- Reduces erosion
- Protects fish habitat
- Provides nutrients
- Provides wildlife habitat

Many riparian areas have lost their natural diverse vegetation, allowing invasive plants or other weeds to take over the area. Without proper management, invasive plants can totally overtake otherwise healthy riparian areas.

Continuous season-long grazing often removes important riparian vegetation and may cause streambank erosion and water quality degradation.

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## **A Healthy Riparian Area**

A Healthy Riparian Area is the key to a healthy stream system through its lush and diverse vegetation along the water's edge. Vegetation reduces water pollution by filtering out sediments, chemicals and extra nutrients from runoff. Water is retained in the soil for longer periods of time and is slowly released. This process enhances longer stream flows and groundwater recharge. Water running through the area is slow in order to reduce erosion and property loss. Although these areas may comprise only a small portion of the landscape, they will provide food and cover for a diverse range of living creatures, including deer, beaver, muskrat, wood ducks, songbirds, frogs, insects, and a variety of aquatic organisms. Lush riparian and wetland vegetation along the water's edge will:

**Slow** flood flows and reduce erosion and property loss

**Secure** food and cover for fish, birds and other wildlife

**Keep** water cooler in the summer and prevent ice damage in winter

**Reduce** water pollution by filtering out sediment, chemicals, and nutrient runoff

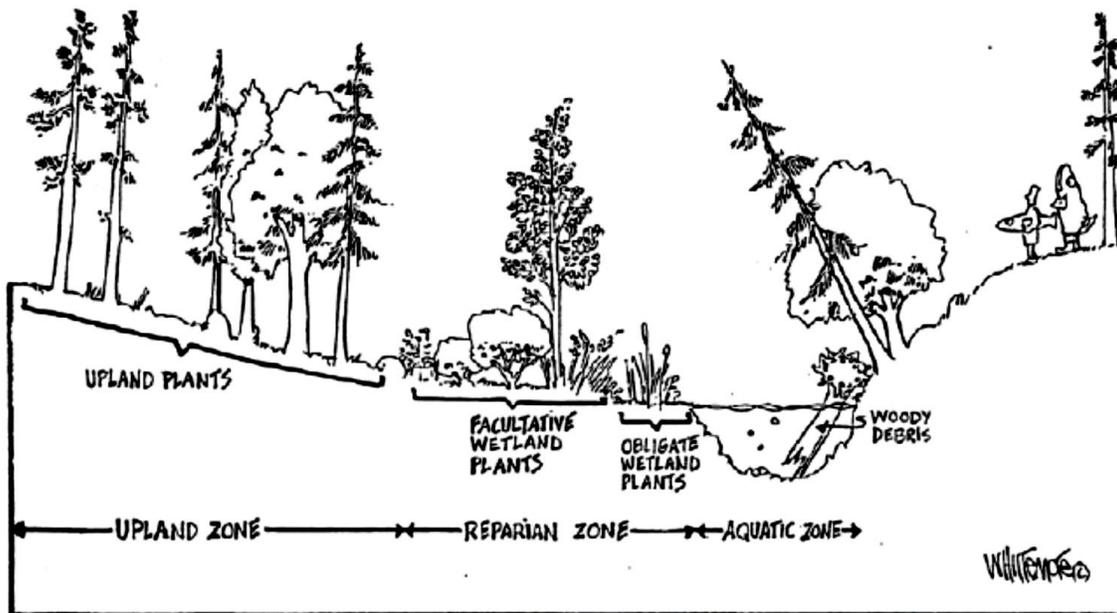
**Provide** important breeding habitat for birds

**Shelter** animals during calving, lambing, or fawning

**Hold** more water in the soil, slowly releasing it for longer season stream flows and groundwater recharge

**Stabilize** the riverbank with riparian vegetation such as trees and deep-rooted sedges.

**Provide** excellent area for recreation and education activities.



**Figure 2 - Healthy Riparian Area**  
*Courtesy of Adopt a Stream Foundation*

### Practices to Enhance Riparian Areas and Preserve Good Water Quality

- Increase buffer (vegetation) width around open water. Studies show that widths of 50 feet trap sediment, 100 feet filter pollutants, and 200 – 300 feet provide wildlife corridors.
- Fence livestock away from riparian areas or develop riparian pastures that exclude livestock from entering wetlands and streams, providing watering sites away from the wetlands. Animals break down stream banks causing erosion and stream widening as well as adding pollutants to the waterway.
- Remove noxious weeds with mechanical means rather than chemical means. Replace them with native plants.
- Avoid mowing except as needed to maintain a healthy vegetated area.
- Delay mowing riparian areas until late July after birds are done nesting.
- Keep new buildings as far away from creeks as possible. This will help reduce erosion and flooding problems.
- Do not install rock, rip-rap, or gabions along your stream bank. While these features may give your streamside a more landscaped appearance, these features can reduce the water quality in your stream and damage your downstream neighbor's property. If you have erosion issues, try planting native riparian plants. Their roots will hold the soil in place much better than any rock structure.
- Preserve the natural features of the creek. Fallen logs and meanders in the stream are essential physical structures that maintain food and habitat for fish and wildlife. There is no need to clean up this natural debris unless it is threatening you or your property. If so, be sure to consult the county before going to work.

- Do not divert a spring or creek to build a pond (even for irrigation use) without a permit. Ponds raise water temperatures and promote algal growth. Impounding water without a permit is illegal.
- Avoid filling ravines or slopes above creeks with dirt, grass clippings or other debris. Storms will carry this debris down slopes and into the waterways.
- Remember, water flows downstream. How you treat the section of stream on your property affects water quality on your neighbor's property downstream, just as the actions of your neighbors upstream affect you and your property.

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## Riparian Forest Buffers

Use trees or shrubs to reduce sediment, organic matter, nutrients and pesticides in surface runoff alongside watercourses.

### *Water Quality Benefits:*

- Reduces soil erosion
- Reduces sediment transport into water sources
- Reduces nutrient loadings in water sources
- Provides shade and lowers aquatic temperature

### *When to Use:*

Use forest buffers on areas adjacent to permanent or intermittent streams, lakes, ponds, wetlands and in areas with groundwater recharge capable of supporting woody vegetation.

These areas can be used for very limited livestock grazing and hay harvesting.

### *How to Establish:*

Prepare site to support the type of forest buffer zone that will be established. Use native trees and shrubs that are non-invasive. Plants and trees need time to establish and should be planted when growth will be promoted. Fertilizer may be needed. In addition, livestock and equipment should be kept out of forest buffers until plants and trees are established.

### *Considerations and Costs:*

(See the following Illustration for location of Zones)

Use Zone 2 buffers on sites that receive nutrient, sediment and animal waste applications where additional protection is needed to reduce soil erosion and water contamination.

Use Zone 3 buffers on sites adjacent to cropland and highly erodible areas to filter sediment, address concentrated flow erosion, and maintain sheet flow. For Zone 3 buffers, follow standards and specifications for filter strips.

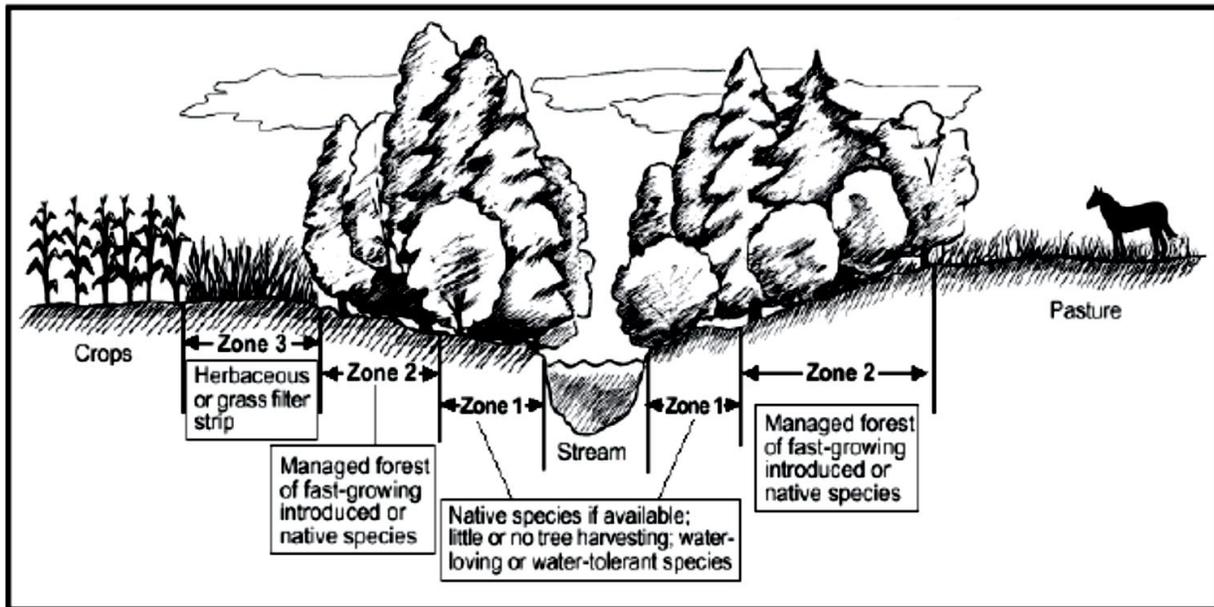
Maintenance and labor costs may include sediment build-up removal and periodic inspections to ensure proper function.

Forest buffers are moderate in cost depending on the type of vegetation established.

*Effectiveness:*

Riparian forest buffers removed 25 – 85% of nitrogen, 50 – 75% of phosphorus and 50 – 75% of sediment in runoff in addition to the acreage converted to forests in studies.

Restored Zone 3 buffers removed 60% of nitrogen and 65% of phosphorus entering from manure application sites to an adjacent water source in one Georgia research study. Grass buffers alone removed 45% of the nitrogen and 20% of the phosphorus from the same sites.



**Zone 1 is the area closest to the water body course. Zone 2 is adjacent to and up-gradient from Zone 1 (a minimum of 15 feet). Zone 2 plantings intercept sediment, nutrients, pesticides, and other pollutants in surface and subsurface water flows (a minimum of 20 feet). Zone 3 is established if periodic and excessive water flows, erosion, and sediment from upslope fields or tracts are anticipated. Zone 3 is generally of herbaceous plants or grass and a diversion or terrace if needed.**

*Source: NRCS Conservation Practice Job Sheet 391*

### Riparian Herbaceous Cover

Uses grasses, grass-like plants and forbs to protect water quality, provide wildlife habitats and to stabilize streambanks and channels.

*Water Quality Benefits:*

- Reduces soil erosion
- Reduces sediment transport into water sources
- Reduces nutrient loadings in water sources

*When to Use:*

Riparian herbaceous cover is ideal where runoff can be a problem from pastures and cropland. Riparian cover is used between areas of agricultural land and water bodies.

Riparian Herbaceous Cover areas are not filter strips.

*How to Establish:*

The size of riparian areas varies according to use. Use native plant species whenever possible. Avoid harvesting or grazing these areas until plants are established. Then harvest or graze on a carefully monitored rotational schedule. Normal maintenance is required to ensure the function of the riparian herbaceous cover area. Herbaceous cover works best to provide soil stability when used in conjunction with planting shrubs and trees.

*Considerations and Costs:*

Costs associated with riparian herbaceous cover areas include site preparation, seed and plant materials and maintenance.

Herbaceous cover is low to moderate in cost depending on the type of vegetation established.

*Effectiveness:*

Riparian Herbaceous cover can potentially reduce nitrogen by 17 – 58%, phosphorus by 50 – 75%, and sediment by 50 – 75%. Riparian herbaceous cover effectiveness depends on maintaining sheet flow across the buffer and increasing infiltration and subsurface flow.

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## **Riparian Enhancement Programs**

Check with local agencies for local, state, and federal riparian enhancement programs that may help you with your particular project.

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## **Streambank and Shoreline Protection**

In order to reduce erosion and water quality degradation, streams are stabilized and protected by constructed channels and shorelines.

*Water Quality Benefits:*

- Reduces erosion and loss of land
- Protects and maintains water flow and storage capacity
- Can be used to protect and improve stream corridors for wildlife and aquatic species
- Lowers total sediment and nutrient loads entering water bodies
- Provides shade and lowers aquatic temperature

*When to Use:*

This practice can be applied to the streambanks of natural or constructed channels or shorelines that are susceptible to erosion. This type of practice is NOT applicable to ocean fronts or associated areas.

Prior to initiating work in any waterbody, including wetlands, contact the U.S. Army Corps of Engineers for additional requirements.

*How to Establish:*

All federal, state and local regulations should be followed in the installation process.

Permits are the responsibility of the owner to obtain.

Prior to installation, an assessment of the project area should be performed to identify unstable and erosive areas.

Install protective measures to protect streams from up-gradient runoff. The channel grade should be stable and based on prior field assessment when permanent measures are installed.

Limit the removal of obstructions whenever possible as they provide ideal aquatic habitats. It may be necessary to clear channels when obstructions and/or debris (stumps, fallen trees, etc.) cause erosion or interrupt channel flow and function.

Use materials that cause minimal visual impacts, and maintain or complement the existing landscape. Protective measures should have a minimal impact on the existing wildlife and habitat.

Disturbed areas should be re-vegetated as soon as possible with plant species that are native or adapted to the local ecosystem. Livestock should be excluded until plants are established and then use appropriate grazing practices.

*Considerations and Costs:*

Additional protection may be necessary to protect surrounding habitats. Consider implementing other conservation practices to further protect water quality and reduce erosion.

Costs associated with this practice may include site preparation, materials, installation, maintenance, and the re-vegetation of surrounding areas.

Contact your local conservation district prior to beginning a streambank or shoreline protection project in order to fully understand maintenance requirements.

Streambank and shoreline protection is moderate to high in cost depending on the size and length of the protection area.

*Effectiveness:*

Streambank and shoreline protection can significantly reduce erosion and sediment entering water.

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## **Floodplains**

Flooding is a natural stream process. A floodplain is the land that is inundated with water during floods. Healthy floodplains reduce downstream flood impacts by spreading out and slowing flood waters. The process encourages aquifer recharge as water seeps into the soil. A flood plain is defined as that area

which has a one-percent chance of flooding in any particular year (100-year flood plain). These areas are nutrient rich from accumulated sediment deposits.

Restrictions limit construction and activities within a floodplain to reduce potential damage during flood events. There may be restrictions in flood-prone areas regarding the type or amount of fill material (so floodwaters are not directed onto other property) or on the types of septic systems (to prevent potential water contamination). Your lending institution or insurance company may also require that you purchase Federal flood insurance if you live in a floodplain.

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## Ponds

Ponds come in many sizes and types – from the vernal pool that dries up in the summer to the beaver pond that backs up a stream to that “golden pond” of our memories. Ponds provide critical habitat for numerous species of plants and animals, as well as recreational, agricultural and aesthetic benefits to landowners.

But what a beaver builds instinctively is not so easy to replicate by man.

For starters, you must have a permit to construct a reservoir or pond of any size to store water. This can include a Water Rights permit among others.

Wild ponds provide important habitat for turtles, frogs and other animals, they can impair water quality and aquatic life downstream. Unless the pond is disconnected from a waterway (and few are in nature), the water in the pond will warm and grow algae before flowing downstream.

A poorly-designed or constructed pond can be breached during a storm event. Ponds can also be attractive nuisances to children, pets and other animals. As such, ponds are a liability to the landowner. Check your insurance coverage to assess if the benefits outweigh the risks.

If you want to enjoy the aesthetics of a pond without the hassles of permits and liability, you might want to build a water feature. A water feature differs from a pond in size and source of water. It might be a fountain, a man-made babbling brook or a birdbath, but a water feature would be filled with domestic water, not irrigation water or water from a stream.

## Erosion Control

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Soils are precious and without them life as we know it would be impossible. Our country's top soils, combined with intensive technological management, are the most productive soils on earth. Soil provides a foundation for life, and erosion is its enemy. Erosion reduces soil productivity and is the largest source of stream and waterway pollution. Although erosion is a natural process, some activities greatly increase erosion rates by leaving the ground unprotected. Road and building construction and some farming practices can lead to excessive erosion if proper management practices and precautions are not taken. Over grazing pastures can lead to erosion by leaving the vegetation too weak to protect the soil – stream banks are particularly susceptible.

Without deep, healthy topsoil we would find ourselves in a wasteland of desert-like conditions. Eroded soils are not able to support desirable plant roots. Without the intricate network of plant roots and life forms below the surface, water and snow would not penetrate and percolate throughout the watershed. Stormwater would flush through the system, removing more soil particles with each storm event. Try planting your garden in subsoil or bedrock!

Installing erosion control and conservation practices helps maintain soil productivity and reduces fertilizer costs while reducing silt, chemicals and excessive nutrients that enter our waterways and lakes. These practices also reduce costs for road maintenance, waterway dredging, and the maintenance of recreation areas. We can maintain our natural resource base by using sustainable management practices. One simple way to prevent erosion is to simply cover your soil with vegetation. Vegetation will protect the soil from erosion by rain, runoff and wind. It also increases the uptake of water and holds soils in place on slopes and along streams.

Franklin Roosevelt said, "The history of every nation is eventually written in the way in which it cares for its soil."

(For more information, see the section on [Soil](#).)

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### Soil Saving Tips

- Keep all soils on your property well covered with vegetation.
- Cover crops, sod-forming grasses, native plants and ground covers are excellent soil protectors.
- Reseed immediately with weed-free grass seed after any earth disturbing activity.
- Grade and reshape roads and building sites to direct water to safe outlets and prevent standing water on soils

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**Tree and Shrub Establishment** can be utilized for long-term erosion control by slowing runoff and allowing more time for nutrient absorption. (For more information on erosion control through tree, shrub, and grasses, see [Riparian Areas](#) in the section **Steams, Wetlands, and Water Quality Protection**.)

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## Access Roads

Reduce erosion by providing a fixed entry point into fields and pastures for year-round access.

### *Water Quality Benefits:*

- Reduces soil erosion
- Reduces sediment and runoff entering fields
- Protects downstream water quality

### *When to Use:*

Access roads are ideal as permanent or temporary structures in heavy traffic areas. Access roads should be avoided in wetlands and riparian areas.

### *How to Establish:*

Plan roads to follow natural contours and slopes. The minimum width for one-way traffic is 14 feet and 20 feet for two-way traffic with an additional 2 feet for shoulder construction. Ditches may be needed to divert water.

Once construction is complete, re-vegetate as soon as possible. Vegetation will slow water traveling on surfaces and reduce soil erosion. Filter strips and buffers can protect nearby water sources.

### *Considerations and Costs:*

Before installing an access road, consider potential negative impacts. Improperly managed access roads can negatively impact downstream flows, increase sedimentation in water, and impair water quality.

Access road maintenance can be substantial if soil erosion is a problem or if roads are poorly planned and constructed. Costs associated with this practice may include filter strip and buffer plantings, surface cover costs, silt fences and general maintenance. It may also be necessary to periodically re-cover surfaces to maintain road integrity.

Access roads are moderate to high in cost depending on materials, size and construction.

### *Effectiveness:*

Forest access road reconstruction can potentially reduce sediment yield by 70% using slope reduction, vegetated and brush barriers, broad-based dips, hay bales and silt fences.

## Sustainable Agriculture

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### **Sustainable Practices: Farming with Nature**

Sustainable agriculture is a means of producing food without depleting the earth's resources or polluting the environment. It works to mimic nature's self-sustaining processes by promoting biodiversity, recycling plant nutrients, protecting soil from erosion, conserving and protecting water, and integrating livestock with crop production. Farms that rely on sustainable practices tend to be of smaller scale and can be labeled by many different names; natural, organic, low input, perma-culture, holistic, and biological farms. The difference between them is in the practices they follow, yet they all share the same goal of producing food while protecting and improving ecological health.

### **Conservation Buffers**

Conservation buffers are vegetation strips that, when properly done, can provide a variety of natural services; they reduce erosion and polluted runoff, provide areas for habitat, increase soil productivity, protect areas from winds and flooding, and enhance the visual aesthetic of a property. These practices can be ineffective without an understanding of the natural process that is being addressed. The size, shape and structure of the buffer will determine how effectively it will perform. If interested in implementing a conservation buffer, contact your local conservation district or the Natural Resources Conservation Service (NRCS) for assistance in implementing conservation buffers.

### **No-Till**

No-Till is an emergent agricultural technique that does not disturb the soil to the extent of conventional tillage practices. No-till helps keep the soil intact, reducing soil erosion while helping the soil hold more water. No-till leaves residue cover on the field that would normally be tilled into the soil prior to seeding. The residue helps with reducing soil erosion, but requires regular monitoring for the presence of slugs and other pests. No-till does require more management throughout the year because of the increased monitoring and treatments needed to keep land pest free. No-till can be done with any seeded crop. (For more information on [Conservation Tillage](#), see the section on **Improving Water Quality with Best Management Practices (BMP's)**)

Preparation: first you should understand the soil's current condition. Does the soil need any amendment, or are there pest problems, like slugs or cutworms? Pest problems should be treated prior to the beginning no-till. In most cases, if pests are present you should wait at least a year after exterminating pests to start no-till. Expect to have a slight loss in crop yield for the first couple of years while the soil is rebuilding itself. No-till farming should be done for multiple consecutive years to experience the full benefits of the practice.

### **Cover Crops**

Cover crops are essential to preserving and maintaining healthy soils in the county. Cover crops help protect the soil from erosion, reduce soil nutrient leaching and provide additional nutrients to the soil by green manuring. Cover crops can be placed between crop rows, under fruit and other trees and on un-vegetated land. Choose a cover crop that won't shade out cash crops, won't wrap around trees, grows well in the shade, and will crowd out weeds. Contact your local Extension office for information regarding cover crops that can help meet your farm goals. (For more information on [Cover Crops](#), please see the section **Improving Water Quality with Best Management Practices (BMP's)**)

### ***Crop Rotation***

Establishing a crop rotation may help with erosion, plant disease, and other problems that a monoculture might intensify. Rotating crops can leave built-up bug populations without food or habitat; rotation disrupts their life cycle and reduces the need for chemical control. For vegetable production, it is recommended to wait three years before repeating a crop in the same plot. Crop rotation can be done for all scales of agriculture production. Take into consideration soil types, climate, and available water when deciding on a rotation crop. Implementing a crop rotation along with cover crops takes good planning and management.

### ***Integrated Pest Management (IPM)***

Integrated Pest Management is a strategy for pest management that utilizes both natural and chemical-based practices, though pesticides should be used only when natural management is ineffective. IPM utilizes the most effective and environmentally conscious practices for controlling pests on a farm. IPM uses information about the life cycle of pests and their interaction with the environment to develop a management strategy that is economical and least hazardous to the health of people, the land, animals, and the environment. These techniques can be used for non-agricultural uses as well. (For more information, see the section [Predators and Pest Control](#))

There are currently a variety of online tools available to property owners for using local pest infestation forecasting. One of the best tools is the “IPM Pest and Plant Disease Models and Forecasting” website (<http://uspest.org/wea/>). Property owners can monitor possible pest infestations related to specific crops for scheduling pest management. Most farmers already implement a form of IPM; they can move farther along the continuum to more ecologically friendly pest management practices regionally through the use of advanced warning and scouting tools.

## Improving Wildlife Habitat

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### Is Your Property Attractive to Wildlife?

- Is there a variety of vegetative types, such as small grains, tall grasses, shrubs, and trees for food? For cover?
- Is there a pond, stream or stockwater tank available to wildlife?
- Can wildlife avoid predation from domestic animals, such as cats and dogs?

The more “yes” responses you had, the more likely you will enjoy the company of birds, small mammals, and maybe even deer or elk.

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### Wildlife Habitat = Food+Water+Cover

Wildlife habitat is being lost as more land is subdivided, bringing houses, people, livestock, dogs, cats, and other intrusions. Landowners can help offset this loss of wildlife habitat by growing a diversity of vegetation that provides food and cover for wildlife.

#### *Habitat Elements*

Wildlife needs three basic elements for a supportive habitat.

- **FOOD** requirements will naturally vary by wildlife species, from the seeds and berries required by birds, to the grasses, forbs, and shrubs preferred by deer and elk. Trees and shrubs that hold their fruit into winter are very beneficial. Wildflowers are eaten by insects, which are important food for frogs, birds, and other animals. Use native plants because they have adapted to local conditions, and local wildlife have adapted to using them. Commercial bird seed should be microwaved prior to distribution to greatly reduce the chances of it producing weeds. Avoid feeding wildlife processed foods – dependency and unbalanced diets can result.
- **WATER** on or near your property in the form of a pond, stream, or developed stockwater will increase the variety of wildlife you can attract. Drinking water sources are essential for wildlife. Even though most wildlife can find the water they need, including clean flowing water, bird baths, and garden ponds features will help draw wildlife to your property. Have a flower garden around mini-ponds. Do not mow to the edge of natural ponds. Most frogs need ponds to breed, but spend the vast majority of the year in surrounding woods and grasses. Ducks and other wetland birds need wetlands surrounded by grasses in order to raise their young.
- **COVER** is needed for hiding from predators, travel corridors, nesting, and shelter. Wildlife need cover and protection both on your property and when traveling between properties. Bird/bat/bee boxes, hedgerows, shrubs, and trees can provide wildlife with a place to rest and hide from predators and a covered path for travel. Crossing large, open areas like mowed lawns is dangerous and scary for most animals, and many won't do it. Copy the woodlands, fields, and wetlands in your area by adding trees, shrubs, tall grasses, and wildflowers. Work around the edges of your yard so you can keep a large central area as lawn for active use. Place bird feeders and bird houses close to trees and shrubs that can be used for cover or perching.

While planning for wildlife habitat you must also consider space – the size (space) of your yard will determine the size of projects that can be tackled. Diversity is very important in plantings for two reasons: it allows a wider range of wildlife shelter and food and if disease or stress-related mortality occurs in a certain plant species, the entire yard will not be affected. Consider native plantings to

provide both shelter and food. Native plantings have the advantage of being hardy for our temperatures, rainfall amounts, and soil types. In addition, resident wildlife has evolved around native grasses, forbs, trees, and shrubs. Coupled with a natural or artificial water source, you will enjoy a variety of animals.

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### Tips for Creating Successful Backyard Wildlife Habitats

Whether you live on a small place or a large ranch, you can help increase the amount of wildlife habitat by making a few simple changes to your backyard environment.

- Planning and research are important beginning steps to creating productive backyard wildlife habitat.
- Collaborate with neighbors. Their actions will directly affect the outcomes on your property. More cooperation should lead to greater success.
- Reduce the use of chemical sprays and refrain from unnecessary spraying on natural areas.
- Plant a diversity of vegetation types and heights. Developing and maintaining appropriate vegetation at the three different vertical areas (canopy, understory, and floor) of the natural environment will help provide a variety of habitats on your land. Consider planting native plant species first. Wildlife prefers them to non-native species.
- Minimize mowing. Ground cover in the form of native grasses provides habitat for many birds and mammals.
- When locating a house, roads, or other improvements, avoid higher-quality habitats.
- Control noxious weeds that can destroy habitat value.
- Avoid overgrazing by livestock; consider fencing livestock out of sensitive areas like streambanks and riparian habitats.
- Plant shelterbelts and fence rows with evergreens as well as plants that flower and bear fruit at different times of the year.
- Leave snags and some downed, woody material for perching, hiding and nesting unless they pose a safety hazard. Many people are not aware of the value of dead, dying and hollow trees, as well as logs for wildlife. Dead trees provide homes to many species of birds, mammals, reptiles, and amphibians. Fish, plant and fungi also benefit from dead and dying trees. If you do not have any snags or dead trees on your property, you can girdle unneeded trees to create snags. Piling woody debris near the forest edge can provide wildlife with places to hide. In dry areas, fire risk must be taken into consideration.
- Plant small grains or large-seeded grasses for wildlife food.
- Use water efficiently and maintain natural water features, along with the vegetation that surrounds those features. Develop ponds, stockwater tanks or other watering facilities.
- Bat boxes and bird houses can encourage these species that often feed on insects.

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### Fencing for Wildlife

The fencing you choose can make a big difference to wildlife, and fencing that accommodates both livestock and wildlife doesn't have to cost more. Spacing fence wires at 16, 22, 28, and 40 inches from the ground will allow antelope, deer, and elk to get through with reduced fence damage. Leaving that 12-inch gap between the highest wires also will help keep animals from getting tangled in the wires. (For more information on [Fences](#), please see the section **Grazing Management and Livestock Health**.)

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## Attracting Specific Wildlife and Providing for their Needs

### *Pollinators*

Pollinators are important to our environment and facilitate the reproduction of at least 80 percent of the world's flowering plants. In addition, they help produce a healthy affordable food supply; yet many of us eradicate their habitats by using pesticides and herbicides and by removing vegetation.

Hummingbirds, bats, small mammals, beetles, bees, ants, wasps, butterflies, and moths are all pollinators. Providing nectar-bearing flowers and blossoming bushes as sources of nectar and pollen year-around will help increase your pollinator population. Farmers are able to increase pollinators on their farm by diversifying crops and planting pollinator plots, field borders, or hedgerows.

### *Upland Game Birds*

#### **Provide food.**

Areas of tall grass, thickets of shrubs and plots of wheat, barley, and other small grains provide food and habitat diversity for pheasants and other upland birds. When harvesting crops, begin cutting from the center of the field outward to flush birds away. Don't worry about water. These birds get moisture from dew and the food they eat.

#### **Provide nesting areas and cover.**

Plant tall grass along roadsides and ditchbanks and shrubs along fencelines or as part of a windbreak to provide nesting and cover. Since these birds nest on the ground in the spring, avoid mowing, burning, or using weed control chemicals on your tall grass until birds are out of the next in mid-June. (Some weeds should be sprayed prior to June 15 to control their spread effectively, so weigh your priorities.)

### *Song Birds*

#### **Provide food and water.**

Trees and shrubs can provide seeds, fruits, and berries that birds like. Streams, ponds, or stock tanks can provide water. Place a floating board in stock tanks to prevent birds from drowning while watering.

#### **Provide nesting areas and cover.**

Song birds require a diversity of vegetation heights (tall grass, shrubs, and trees) and a variety of foliage densities (evergreen and deciduous trees) for nesting and safety from predators. Perches of different heights, such as old snags, fences, and telephone poles, are used by many birds (from bluebirds to hawks) for resting and searching for food.

### *Waterfowl*

#### **Provide food.**

Waterfowl like aquatic plants, small insects, snails, and crustaceans. They also feed on grains and forage.

#### **Provide water.**

Ponds are a natural for attracting ducks, geese, and other waterfowl. Ponds should have shallow and deep areas and well-vegetated banks. Vegetated islands are the safest and preferred for nesting.

**Provide nesting areas and cover.**

Large 40- to 50-acre areas of tall, dense, undisturbed vegetation near open water are needed for successful nesting. A tangle of dead plants from last year's growth will hide nesting hens from predators. This dense, vegetation also creates better temperature and moisture conditions for egg hatching.

***Trout and Other Fish*****Provide food and cover.**

In small streams, the majority of "fish food" comes from the insects and leaves that fall into the stream from overhanging vegetation. Overhanging shrubs, sedges, and grasses also help to keep water temperatures cool in summer and reduce icing in the winter.

**Provide habitat.**

Fish need riffles and deep pools to meet all of their food and cover needs at different stages in their lives. The rocks found in riffle areas churn up the water, which adds oxygen and carries insects to the fish hiding behind rocks or under overhanging banks. Deep pools provide the coldest, most oxygenated water in summer and are least likely to freeze in winter, killing fish.

***Deer and Elk***

Remember, attracting large wildlife may also mean damage to gardens and ornamental plants. More deer and elk around your home may also attract predators like mountain lions (depending on where you live).

**Provide food.**

Deer and elk are primarily grazers, but also browse on trees and shrubs. Creating openings in the forest will increase grass and shrub growth for big game. In winter, deer and elk look for windblown areas where grasses are exposed – that may be *your* pasture! After feeding, elk and deer look for thickets of shrubs or stands of trees to rest and stay warm.

**Provide cover.**

When deer and elk feed in the open, they like being no more than 600 feet from trees and brush for hiding. Consider maintaining large areas of dense shrubs or trees on your property for hiding and shelter, especially near pastures. Areas of dense timber are cooler in the summer and warmer in winter than open areas. If you want to accommodate deer and elk and need a fence, build a low one with a smooth top wire. This is easier for them to cross.

***Big Game***

**Pronghorn antelope** are browsers preferring various species of sagebrush, but also select succulent grasses and forbs (broadleaf plants) in the spring and summer. Antelope prefer flat terrain with short vegetation to evade predators. Fences should be constructed with a smooth bottom wire approximately 16 inches above the ground to allow easier travel.

**Mule and White-tailed deer** are browsers as well, preferring shrubs such as mountain mahogany, chokecherry, bitterbrush, and sagebrush. Forbs and grasses are also consumed in varying amounts depending on their availability and succulence. Deer prefer mixture of open range and forest to inhabit. Deciduous and coniferous trees provide important thermal and hiding cover.

**Elk** are grazers, selecting succulent grasses whenever possible. Forbs are an important food source in spring and early summer. Shrubs and tree species are necessary in fall and winter due to their accessibility during times of heavy snow accumulations and for their high protein content.

**Moose** are browsers, preferring willow species for a forage source virtually year round. Aquatic vegetation, grasses and sagebrush are all utilized to some extent as well. Habitat requirements for moose include riparian areas for foraging and dense forest cover.

### *For Help*

To develop a plan for improving wildlife habitat on your property, contact your local Natural Resources Conservation office, conservation district office or visit your library or local bookstores.

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### **How Well Do You Get Along with Your “Neighbors?” (Wildlife)**

1. Does your land offer a wide range of native vegetation that wildlife can use for food and cover?
2. Is water from a pond, stream, or wetland available to wildlife?
3. Do you keep pets under control at all times?
4. Do you keep trash, pet food, etc., in “wild-proof” containers?
5. Can wildlife get through your fences?

The more “yes” responses you have, the more “wildlife-friendly” your property is.

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### **Leave the Animals Wild**

Country dwellers share space with wild animals and encounters with those animals can occur frequently. Some animals that commonly inhabit or visit rural developments or acreages are deer, raccoons, skunks, opossum, rabbits, fox, coyotes, and many types of birds and snakes. Help them to remain wild by giving them space and not touching them. Doing so will reduce the possibility of harm to the animal or to you. Some animals may frequent trash piles, garbage bins or gardens. You can minimize or eliminate this problem by covering or fencing these areas while keeping them clean.

### *Feeding*

Plant species that will provide wildlife food year round to help reduce or eliminate the need for supplemental feeding. Supplemental feeding congregates wildlife, posing a threat of disease transmission. Animals spread disease in the same manner as humans. Nose-to-nose contact in a feed pile increases the chance of disease transmission. Feeding animals food they are not used to eating can be fatal. Acidosis can occur in ruminants (deer, sheep, cows, etc.) when an animal switches to a diet of highly fermentable food such as corn, grain, apples, or sugar beets. For ruminants to digest a food source, it must be introduced gradually for lactate-consuming bacteria to multiply in the stomach. When feeding in agricultural fields, this gradual introduction occurs. In an artificial feeding pile, the feed is too available and over consumption and acidosis can occur. Well-intentioned people have killed wildlife by artificially feeding them in the winter. Animals also lose some of their natural fear of man from this situation. Last, but not least, winter is part of natural selection. By feeding animals, you are altering “survival of the fittest” and allowing inferior animals to survive and multiply.

### ***Wildlife Young***

Although you may encounter baby wild animals, you should understand that wild babies are rarely abandoned. Many wild animals leave their young unattended for short periods of time. It is common for baby birds to fall out of nests before they are ready to fly. The parents will continue to feed the young on the ground. If you need to move a baby wild animal, the parents will still care for it even though it was handled. This is true of all birds and mammals. Parent animals can be very protective of their young and may attack if they feel threatened – for the protection of both you and the animals, keep a safe distance. Enjoy them with your eyes, not your hands! When humans take young animals out of the wild, the ability for that animal to survive in the wild once released is greatly reduced.

### ***Undesirable Results of Wildlife Habitats***

There are downsides to backyard animal visitors. If your acreage is attracting deer and rabbits, you are going to have a hard time growing a garden. Flowers, young trees, and shrubs will also be browsed severely. Great wildlife habitat will also attract nuisance animals such as skunks, rodents, and raccoons. Your tolerance of this type of animal activity should be considered when you develop and implement your backyard wildlife plan.

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### ***Avoiding Conflicts with Wildlife***

Some tips for avoiding unpleasant interactions with your wild neighbors:

- Don't feed deer, elk, or other wildlife. Putting out food for deer and elk also will lure predators that may prey on the wildlife – and livestock and pets. Also it can cause nutritional problems and even disease in wildlife. Instead, concentrate on planting natural foods for wild creatures.
- Store garbage in plastic and metal containers with tight-fitting lids; keep the containers in a closed shed or garage and put them out only on trash-collection days. Clean trash cans periodically with hot water and chlorine bleach to control odors.
- Feed pets indoors and store pet food inside.

*If you live in bear country, take special precautions:*

- Use specially designed bear-proof trash containers. (The Division of Wildlife can provide designs.)
  - Clean grease from your barbecue grill and store the grease inside.
  - Hang bird seed, suet, and hummingbird feeders on a wire between trees or on your porch or deck – and bring them in at night.
  - Do not put fruit, melon rinds, and other tasty items in mulch or compost piles.
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### ***Your Pets and Wildlife***

Uncontrolled pets are one of the biggest threats to wildlife. Domestic cats kill many thousands of small mammals and birds every year. Cats should be prevented from preying on birds by “belling” them to alert birds. Dogs on the loose can harass and kill wildlife and livestock. Law enforcement officers are authorized to destroy dogs seen chasing livestock or wildlife – and fine the pet owner. Free-roaming pets are also easy source of food for predators. Pets should be under control at all times – leashed, kenneled or kept indoors. Pets should have collars and identification tags. Responsible owners should have their pets spayed or neutered.

## Predators and Pest Control

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### *Predators*

Predators, including coyotes, fox, mink, hawks, and owls, can prey on farm animals, pets, and native animals. These predators are often attracted by high populations of small mammals like mice and ground squirrels. These small mammals can also cause problems such as eating plant roots, chewing on small trees, and creating unwanted burrows. If you move into the country, you need to be prepared to live with or deal with these problems.

It is important to keep in mind that many species have “territory” that you are moving onto. While most wild animals will avoid humans, their natural instinct is to kill easy prey, which often includes livestock and pets. Precautions can be taken to avoid or minimize conflict.

### *Livestock*

While larger animals are rarely attacked, smaller animals are more vulnerable. All animals need shelter from the elements with smaller animals needing protection at night when most predators are active. A solid barn or other sturdy enclosure that can't be entered by predators will be needed to protect your animals. Keep in mind that if you have chickens, skunks and other small predators can enter through even small spaces.

### *Pets*

Pets should be monitored when they are outside for both their own safety and the safety of the wildlife that may be living on your property. Avoid attracting predators and pests by not leaving pet food outdoors. Also, keep pets in at night or put them within a shelter for their safety. In some areas, housecats and small dogs can fall prey to predators even during the day. It is best to keep cats indoors (also for the sake of declining bird populations) and keep pets from roaming. Many birds will nest in low-lying trees and brush which makes them easy prey for cats. Larger dogs can sometimes become predators, especially if roaming in packs, and can be legally shot.

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### **Dealing with Pests**

The wonderful wildlife that people move out to the country to be near can turn into a nuisance. If your acreage is attractive to deer and rabbits, you may have a hard time growing a garden. Flowers, young trees, and shrubs could be browsed severely. Wildlife habitat could attract wildlife such as skunks, rodents, and raccoons that can be bothersome.

If you are having problems with protected animals such as deer, netting can be draped over roses and ornamentals as a deterrent, but you can also select landscaping varieties that deer do not prefer to dine on. The best strategy, however, is to fence your vegetable garden or trees to protect them. There are also products available to discourage wildlife from eating your plants and trees. Check with your local conservation district office, Extension office, or a garden center to learn about available products.

Ground squirrels and other small animals can also pose a problem. It is not recommended that poison be used to eliminate them since non-target species and pets can die from eating the poisoned animal. Poison is also considered an inhumane method of pest control as it causes a very slow and painful death. The use of poisons can be a short term solution with long term consequences. They can poison pets.

They can also be absorbed into plants and leach into water supplies. Live traps can usually be rented for capturing and relocating small animals.

Note that many animals are protected by law and need to be dealt with following strict guidelines.

By working with wildlife rather than against it, unintended consequences can be avoided.

For tips on how to deal with nuisance animals and avoid wildlife conflicts, consult the book *Wild Neighbors: the Humane Approach to Living with Wildlife*, by John Hadidian.

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### Discouraging Pests

During the rural living experience you probably will encounter what is commonly referred to as “Pests.” For the sake of clarity, we are considering pests as any unwanted animal, insect, plant or microorganism. Pests range from rats, rabbits and other critters to weeds and certain damaging insects and nematodes (many kinds are good). How to successfully manage these pests can make your enterprise more successful and your life much happier.

One of the best methods of pest management is actually a number of methods combined into one plan. It’s called **Integrated Pest Management (IPM)** and is regarded as the most successful way to manage pests.

To be successful at pest management you have to out-think the competition. The following points focus on the basics of IPM:

- Learn about the kinds of pests that attack your crop or livestock before you plant or purchase. For instance, where you locate a crop will determine how well it will be able to resist certain soil pests.
  - Use biological control or natural enemies to control pests. There are many naturally occurring enemies of pests and some can be added to your arsenal. For instance, lady bugs help control aphids. Study this process carefully.
  - Rotate crops – planting one crop on a site for long periods of time enables pests that like that crop to build up and eventually cause damage. Rotating the crop can hinder the establishment of the pest.
  - Plant crops that are resistant to certain diseases.
  - Plant trap crops that attract pests and keep them away from desirable crops.
  - Keep your land, equipment, tools, and buildings clean and trash-free.
  - Pesticides are substances that are used to control pests. They include insecticides, herbicides, defoliants, nematicides and rodenticides. Many pesticides are highly toxic and may be dangerous to people, pets and water life if used incorrectly. Many others are common household products.
  - Keep your soil healthy. (For more information, see [Soil Health](#) in the section **Soil**.)
  - Pay attention to your plants – they will tell you how they feel – keep them from stressing out and becoming ill.
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## Mosquito Control

Taking the time to learn a little bit about mosquitoes can make for an enjoyable pest-free summer. Mosquitoes can transmit West Nile Virus and other diseases, especially to livestock. Mosquito larvae live in stagnant water. Larvae can be killed in stock tanks with goldfish or *Bacillus thuringensis*.

Municipal mosquito control programs can do a good job controlling mosquitoes in urban areas. This is in part because they have a larger population of people to share the cost of funding the program. Unfortunately, to achieve the same results in rural areas, the cost per household would be too expensive. However, by taking a few simple steps, you can control mosquitoes in your own backyard.

Eliminate breeding habitat as mosquitoes can reproduce anywhere water collects and remains for as little as one week.

- Dispose old tires, buckets, and other refuse that can hold water
- Cover or overturn containers that hold water when not in use (garbage cans, wheel barrows, flower pot bottoms, etc.)
- Clean debris from rain gutters and downspouts
- Repair leaky faucets
- Change water in bird baths at least once a week
- If you have an ornamental pond, make sure it is aerated and consider stocking it with mosquito eating fish
- Maintain proper drainage around your buildings
- Avoid excess landscape watering that creates runoff and ponding in low areas
- Reduce or eliminate vegetation and debris in ditches, ponds, etc.
- Eliminate standing water in low spots, ditches, gutters, and similar areas.
- Control seepage and fix leaks in pet and livestock waterers and irrigation systems.

A good time to begin inspecting your property for mosquito breeding areas is in the spring after snow melt and before mosquitoes are active. Develop a checklist and get your children and grandchildren involved in weekly inspections. They'll love it and they will learn responsible stewardship of the property.

Most mosquitoes are active during twilight hours, and this is when most bites occur. During the day, mosquitoes look for cool, moist shady areas to rest. Tall grass, weeds, shrubbery and trees with large canopies provide ideal resting places.

- Keep shrubs and hedges trimmed
- Keep lawns mowed and eliminate weedy areas on your property, especially areas that your family uses regularly.

# Community Resources

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