



# Windbreaks For Rural Living

By James R. Brandle, University of Nebraska–Lincoln  
Bruce Wight, Natural Resources Conservation Service

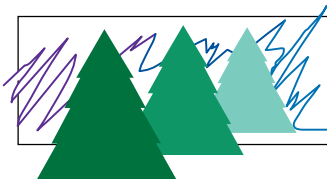
In many parts of the United States, the constant force of wind exaggerates daily weather conditions and can make living in these areas seem unbearable. A well-designed windbreak around the home, acreage, ranch or farmstead slows the wind and improves the overall environment. Windbreaks around homes conserve energy, provide snow control, improve working and recreational conditions, enhance wildlife populations, provide visual screening and dust control, protect livestock, and increase the production of various crop and food

products. Windbreaks provide the greatest benefits in areas with high winds, large amounts of snow, extreme temperature fluctuations, or minimal natural forest cover. Traditionally, the most extensive use of windbreaks has been to protect rural homes in the northern regions of the United States. However, windbreaks used for privacy screens, dust control and noise reduction as well as wind protection are important throughout the country including urban areas.



USDA-NRCS

*A well-designed windbreak can add value to your home and provide an enhanced living environment for you and your family.*



## Benefits of Farmstead Windbreaks

### Energy conservation

Well-designed windbreaks reduce the amount of energy needed to heat and cool your home, reducing energy costs as much as 20 percent to 40 percent. Individual savings depend on local site and climatic conditions, the construction quality of your home, your living habits and the design and condition of your windbreak.

Local wind conditions affect the amount of energy needed to keep a home comfortable during cold winter months. Unprotected buildings, buildings with poorly fitted doors and windows or frequently opened doors, and buildings in areas with high average wind speeds coupled with low average temperatures are vulnerable to winter weather extremes. Windbreaks reduce the force of the wind on the exterior surfaces of buildings and thus the amount of cold air that enters the home.

In the summer, the inside and outside temperatures of a home may be very similar. Usually, this means that the reduction of hot air entering the home provides only minimal savings in home cooling costs. However, in areas where hot windy conditions are common and most homes are air-conditioned, a reduction of hot air entering the home can reduce air conditioning demands and likewise energy consumption. Additionally, trees provide significant evaporative cooling and can lower the local air temperature several degrees. Well placed landscape plants, such as shade trees or foundation plantings can provide summer energy savings of 15 percent to 35 percent.

### Snow control

Winter storms on open and unprotected land can render a homeowner snowbound. A well-designed windbreak system can reduce or eliminate snow drifts on driveways, in service areas and around buildings. Controlling drifting snow and providing areas for snow drifts away from outdoor work areas will save valuable time and energy. (See EC-1770 **Windbreaks for Snow Management**)

### Improved living and working environments

Struggling against the wind makes hard work seem even harder. Protecting working areas around the home or ranch with windbreaks makes tasks such as cutting firewood, working on equipment or feeding livestock safer and more comfortable.

When winter winds are combined with low temperatures, the resulting wind chill may create dangerous conditions. For example, the cooling effect of a 15 mph wind combined with a temperature of 10°F affects your body warmth as if the temperature were minus 7°F. More seriously, a temperature of minus 20°F with a wind speed of 20 mph equals a wind chill of minus 48°F, cold enough to cause frostbite in 10 minutes or less. A moderately-dense windbreak will reduce the 20 mph wind to approximately 5 mph out to a distance of 5H (H = height of the windbreak), still very cold but not nearly as dangerous (*Table 1*).



J. Brandt

A large, well-managed windbreak often is the only woodland area providing wildlife habitat among large expanses of agricultural crops.



# Wind Chill Chart



		Temperature (°F)																		
		Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
Wind (mph)	5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63	
	10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72	
	15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77	
	20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81	
	25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84	
	30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87	
	35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89	
	40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91	
	45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93	
	50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95	
	55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97	
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98		

Frostbite Times  30 minutes  10 minutes  5 minutes

**Wind Chill (°F) = 35.74 + 0.6215T - 35.75(V<sup>0.16</sup>) + 0.4275T(V<sup>0.16</sup>)**  
 Where, T= Air Temperature (°F) V= Wind Speed (mph) Effective 11/01/01

Table 1: The wind chill index is a measure of how cold it feels under different combinations of temperature and wind speed. As wind speeds increase, your body loses heat more rapidly. Under extreme conditions, frostbite becomes more likely and wind protection more valuable. (NOAA-NWS)

A well-designed windbreak can improve living conditions by screening undesirable sights, sounds, smells and dust. A dense, multi-row windbreak in the right location will increase mixing of the air, dispersing and diluting odors. Trees and shrubs in the windbreak act as a natural filter, catching dust particles that carry odor. In addition, some odors will be absorbed by plants while others may be masked by more desirable smells from aromatic leaves or flowering shrubs. Finally, a well-landscaped facility is visually pleasing and more acceptable to neighbors.

Windbreaks reduce traffic noise from nearby roads and highways by deflecting sound off of large branches and tree trunks and by absorbing sound with leaves, needles, twigs and smaller branches. In addition, trees and shrubs can mask undesirable noises by creating more desirable sounds such as the rustling of leaves or the singing of birds attracted to the windbreak.

### Garden and recreational environments

A home garden not only provides healthy, home-grown produce but saves money and brings pleasure to its caretaker. Locating the family garden within the sheltered zone of a windbreak improves the yield and quality of fruits and vegetables. Lower wind speeds reduce damage to tomatoes, peppers, leaf lettuce, peas, beans and other garden vegetables. Bee activity is increased, resulting in more complete pollination and fruit formation. The moderation of the microclimate by the windbreak results in early maturity of many crops such as asparagus, tomatoes, sweet corn, cucumbers and melons. Landscape plants and flower gardens also

benefit from protection against hot, dry, summer winds. (See EC-1779 **Windbreaks for Fruit and Vegetable Crops**)

Recreation is an essential part of family life. Popular activities such as a picnic or backyard barbecue, playing ball with children or working in the garden, are far more enjoyable behind the shelter of trees. The very presence of various trees and shrubs attracts native wildlife, and in turn, can promote a greater awareness and understanding of nature by the entire family. Windbreak protection enriches the comfort and enjoyment of outdoor activities.

### Wildlife habitat

Multi-row windbreaks provide essential nesting, feeding, singing and breeding habitat for many birds and animals. Additionally, windbreaks provide a safe, linear travel corridor for wildlife between feeding, watering, and resting sites. By varying tree and shrub species you can create a smorgasbord of seeds, nuts and fruits. More diverse food types and habitat in your windbreak will attract a greater variety of birds and animals to your backyard. By selecting species that will provide cover and food resources in early spring and late fall, you provide a rest area for many migrating birds. Adding food plots downwind of a windbreak will increase its use by wildlife especially in the winter. (See EC-1771 **Windbreaks and Wildlife**)

## Products from the windbreak

In addition to providing wind protection, large multiple row windbreaks can provide posts, poles, rough lumber, firewood, nuts, fruits and decorative/craft materials.

In some situations, and on sites with deep, well-drained and fertile soils, high quality timber may be incorporated into the windbreak design. Species such as walnut, oak and pecan can be grown in many areas. Harvesting wood products from the windbreak requires careful management and you should seek technical assistance from a forester. Remember, it is the overall structure of your windbreak that provides protection against the wind and it must be maintained in order to gain the protection benefits from your windbreak.

Planting fruit and nut trees or decorative woody florals on the downwind side of a windbreak provides another opportunity for harvesting products from the windbreak. Typically these products are used by the homeowner but may be sold at local farmer's markets. A windbreak creates an excellent environment for a honey bee operation, which in turn provides pollinators for vegetables and fruit trees and honey for home use or sale.

## Designing your windbreak

Understanding windbreak benefits and how they are derived can help you in designing one to meet your particular needs. The primary effect of a windbreak is the reduction in wind speed in adjacent areas. Within these areas the reduction in wind speed creates zones of protection where the microclimate is improved. For multiple-row windbreaks the zone of maximum protection lies approximately 2 to 7H to the leeward side of the windbreak (H equals the height of the windbreak). Additional protection is found from 1 to 3H to the windward or upwind side. The goal in designing windbreaks is to take advantage of these zones of protection to achieve your objectives.

A windbreak designed to protect the rural home needs to provide maximum protection to the major buildings and the living and working areas. Ideally, the windbreak row with the tallest tree species should be approximately 2 to 5H upwind from all primary objects or areas needing wind protection. In regions needing wind and snow protection, the most windward row must be 100 to 200 feet from the areas needing protection in order to provide room for snow drifts. Areas

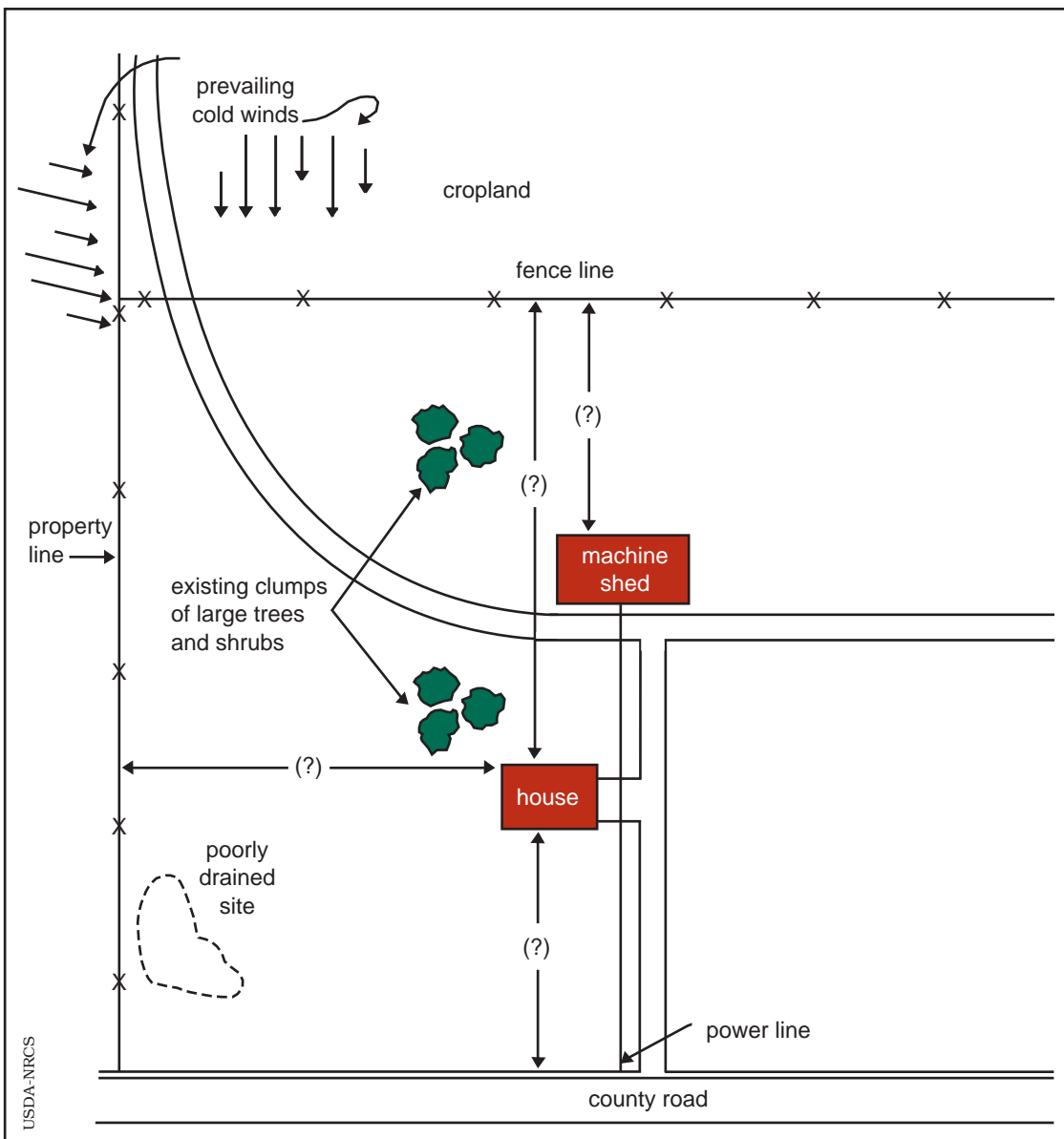


Figure 1. A windbreak is a long-term investment and careful planning can improve benefits and help avoid future problems. A sketch of the area helps in planning. Begin by identifying prevailing or troublesome winds. Locate existing buildings, property lines, roads and driveways, existing landscaping and utilities. Add distances to your sketch. Consider having utility lines buried to allow more flexibility in design. Question marks represent dimensions you must be aware of as you design your windbreak.

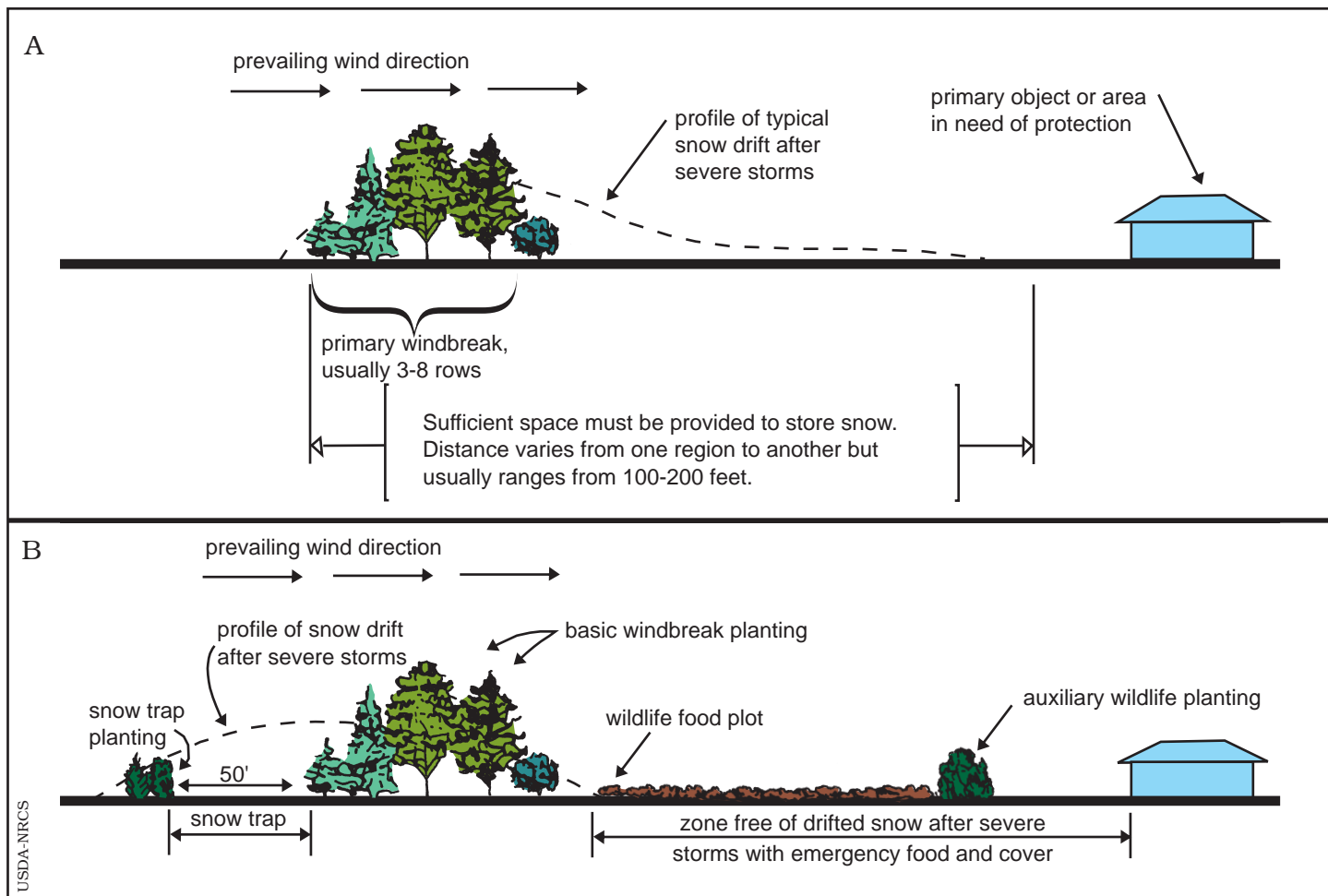


Figure 2. A. A basic home windbreak consists of three to eight rows of both conifers and deciduous trees. Conifer species should be located on the windward side with the tall deciduous species in the center. A row of shrubs on the interior or leeward side completes the design. Spacing between rows is typically 12 to 16 feet but can be increased to accommodate larger equipment. Spacing within the rows is typically 3 to 6 feet for shrubs, 6 to 15 feet for deciduous trees, and 6 to 20 feet for conifers. B. In areas with frequent heavy snows consider adding a row or two of shrubs 50 feet to the windward side to help control snow before it gets to the main windbreak. Adding food plots or landscape plantings on the interior will provide additional benefits to wildlife and enhance the aesthetics of the outdoor living spaces.

and objects more than 10H from the windbreak will receive little protection from the wind.

Once the site of the windbreak is determined, the soils need to be examined. Choose trees and shrubs suitable for your soil and climate conditions. Species native to your area are usually the best choice. Avoid species with known insect or disease problems. Include a variety of species and at least one or two tall tree species to provide maximum wind protection for the site. By using a mixture of deciduous trees, conifers and shrubs, the windbreak will provide better protection all year and will lessen the chance of insects or diseases damaging the entire windbreak.

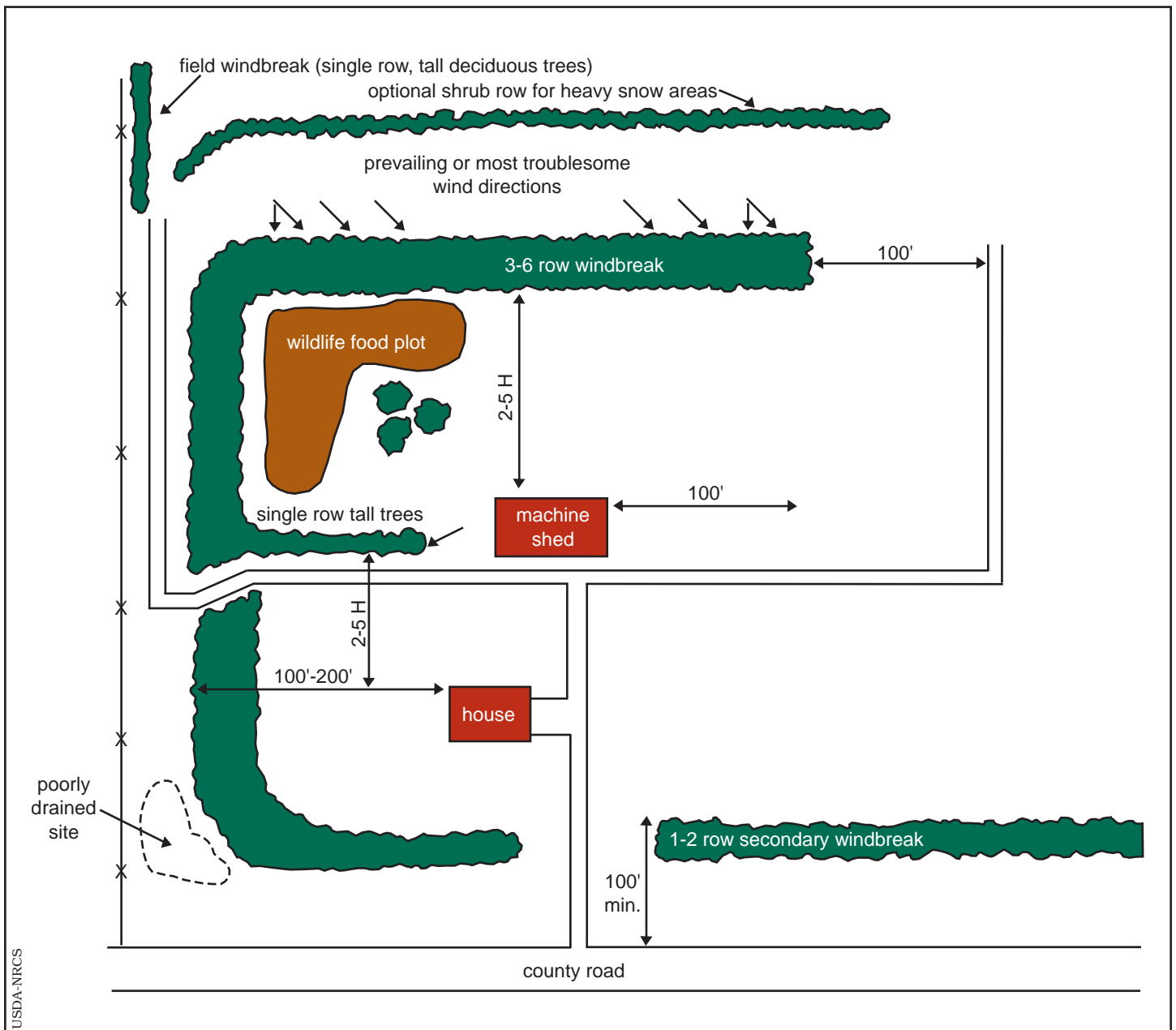
A basic windbreak will reduce wind speed, but a personalized, multiple-use windbreak designed to consider wildlife enhancement, fruit, nut, wood or other type of production will provide additional rewards. The unique attributes of some species provide accents in windbreaks that are especially pleasing when visible from your window or patio. Consider what you want your outdoor living area to look like and add species that have flowering, fruiting, form, color or texture characteristics which appeal to you. Enhanced aesthetic quality and a more natural look can be achieved by using

curved rows or adding clumps of trees or shrubs to the planting.

Throughout the United States, strong winds can make living in rural or suburban areas difficult. Strategically planted trees and shrubs will provide protection against the wind and will diminish both its direct and indirect effects upon people, plants, property and animals. Windbreaks reduce energy use by the home, enhance the quality of outdoor living spaces and add value to your property.

A windbreak providing only wind protection is fairly simple to design, but the complexity increases when including additional benefits such as snow control or enhanced wildlife habitat. Your objectives will always determine the parameters of the best windbreak design. Clearly defining these objectives will help ensure a successful windbreak planting.

For additional information, see other guides in this series or contact your local extension office, the Natural Resources Conservation Service or state forestry agency.



USDA-NRCS

Figure 3. The windbreak should be oriented perpendicular to the prevailing or most troublesome wind directions. Lanes or access roads that must go through the windbreak should be at an angle to the prevailing winds so they will not funnel winds into the protected homestead area. Because of wind turbulence around the end of the windbreak, the windbreak should extend 100 to 200 feet beyond the area needing protection.



Extension is a Division of the Institute of Agriculture and Natural Resources at the University of Nebraska–Lincoln cooperating with the Counties and the United States Department of Agriculture.

University of Nebraska–Lincoln Extension educational programs abide with the nondiscrimination policies of the University of Nebraska–Lincoln and the United States Department of Agriculture.

© 2007, The Board of Regents of the University of Nebraska on behalf of the University of Nebraska–Lincoln Extension. All rights reserved.

This series of windbreak publications is jointly sponsored by the University of Nebraska, USDA Natural Resources Conservation Service, USDA Forest Service and USDA National Agroforestry Center.