United States Department of Agriculture
Soil Conservation Service
1220 SW Third Avenue
Room 1640
Portland, OR 97204-2822

Date: August 19, 1993

TECHNICAL NOTE
190-VI

SUBJECT: FORESTRY TECHNICAL NOTE NO. 29 WINDBREAKS FOR RURAL LIVING

Purpose. To transmit to all Oregon offices the above named Technical Notes.

Effective Date. Upon receipt.

Filing Instructions. File in correct numerical order in the Forestry section of your Technical Note binder. Replace page 1 of the Table of Contents with updated attachment.

Background. The attached Technical Note is one of a series being produced by the Soil Conservation Service in cooperation with the Cooperative Extension Service. Copies of the first four notes were already transmitted and should be in your Technical Note binder. The State Office still has a limited supply of each. Contact Russ Hatz, State Staff Forester for additional copies.

Dean Fisher

DEAN F. FISHER
Acting State Conservationist

Attachments

DIST: O

University of Nebraska Extension EC 91-1767-X

Windbreaks For Rural Living

By Bruce Wight, Soil Conservation Service, Teresa K. Boes and James R. Brandle, University of Nebraska

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

Ranch and farmstead 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 ranch and farmstead windbreaks in the United States is in the Western, North Central, and Great Plains regions. However, windbreak use for privacy screens, dust control, and noise reduction as well as wind protection are important throughout the country.

USDA-SCS

A well designed farmstead 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 can cut energy costs as much as 20 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 left vulnerable to winter's 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 winds are common and most homes are air-conditioned, a reduction of hot air infiltration into the home can reduce air conditioning demands and likewise energy consumption. Additionally, trees provide significant evaporative cooling and may 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 to 35 percent.

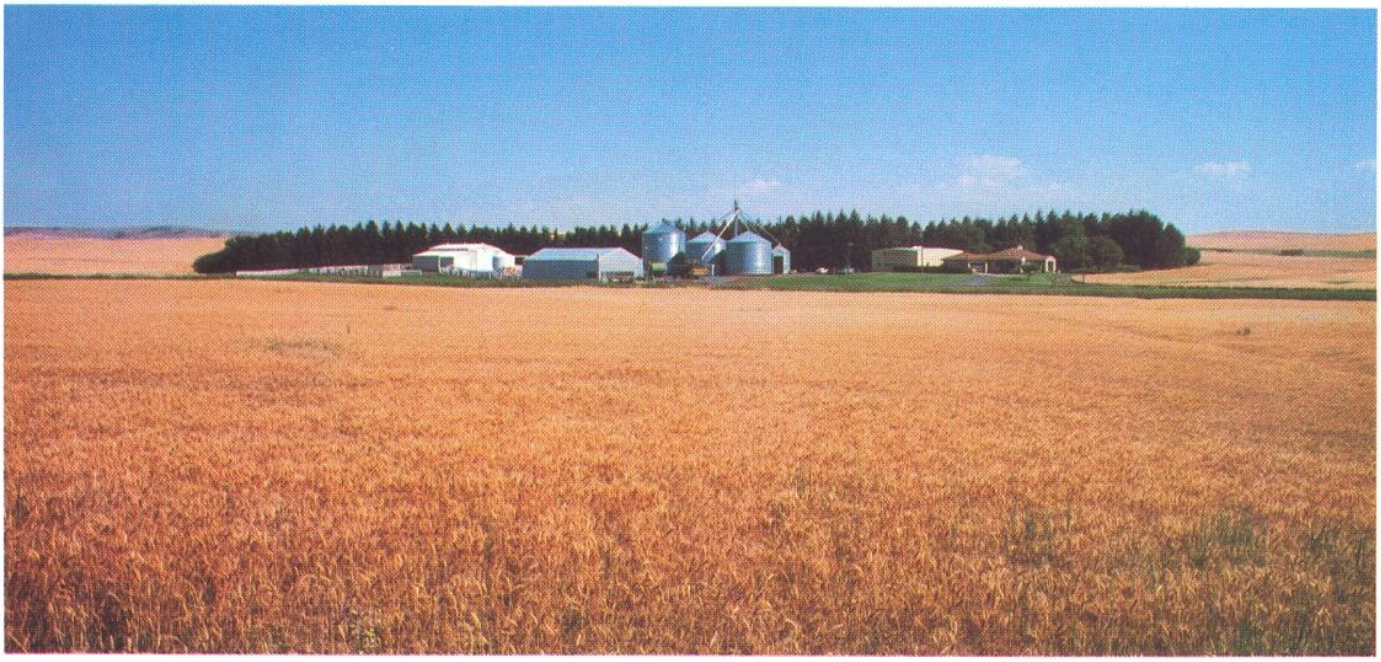
Snow control

Winter storms on open and unprotected land can render a farmstead snowbound. A properly placed windbreak can reduce or eliminate snow drifts on driveways, in service areas, and around buildings. Valuable time and energy can be spent on other activities instead of snow removal. For additional information see EC 91-1770 ***Windbreaks for Snow Management***.

Improved living and working environments

Struggling against the wind makes hard work seem even harder. Protecting working areas around the farmstead 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 windchill may create dangerous working conditions. For example, the cooling effect of a 15 mph wind combined with a temperature of 10 degrees affects your body warmth as much as a temperature of 18 degrees below zero. More seriously, a temperature of minus 20 degrees with a wind speed of 20 mph equals a windchill of -67 degrees, cold enough to freeze exposed flesh in less than a minute. A moderately-dense windbreak will reduce the 20 mph wind to approximately 5 mph out to a distance of 5H (H = effective height of the windbreak), still very cold but not nearly as dangerous (Table 1).



J. Brandle

A farmstead windbreak is often a woodland island among large expanses of agricultural crops.

Wind Speed (Miles per Hour)	AIR TEMPERATURE (°F)																
	35	30	25	20	15	10	5	0	−5	−10	−15	−20	−25	−30	−35	−40	−45
	Wind Chill Equivalent Temperature																
4	35	30	25	20	15	10	5	0	−5	−10	−15	−20	−25	−30	−35	−40	−45
5	32	27	22	16	11	6	0	−5	−10	−15	−21	−26	−31	−36	−42	−47	−52
	COLD																
10	22	16	10	3	−3	−9	−15	−22	−27	−34	−40	−46	−52	−58	−64	−71	−77
	VERY COLD																
15	16	9	2	−5	−11	−18	−25	−31	−38	−45	−51	−58	−65	−72	−78	−85	−92
	BITTER COLD																
20	12	4	−3	−10	−17	−24	−31	−39	−46	−53	−60	−67	−74	−81	−88	−95	−103
25	8	1	−7	−15	−22	−29	−36	−44	−51	−59	−66	−74	−81	−88	−96	−103	−110
	EXTREME COLD																
30	6	−2	−10	−18	−25	−33	−41	−49	−56	−64	−71	−79	−86	−93	−101	−109	−116
35	4	−4	−12	−20	−27	−35	−43	−52	−58	−67	−74	−82	−89	−97	−105	−113	−120
40	3	−5	−13	−21	−29	−37	−45	−53	−60	−69	−76	−84	−92	−100	−107	−115	−123
45	2	−6	−14	−22	−30	−38	−46	−54	−62	−70	−78	−85	−93	−102	−109	−117	−125
	Wind speeds greater than 40 MPH have little additional chilling effect.																

Table 1. The wind chill index was developed to help indicate how much heat a person would lose under different combinations of temperature and wind speed. As wind speeds increase, the evaporation rate from the skin surface increases and the body experiences dramatic and often very dangerous cooling.

A farmstead windbreak can improve living conditions by screening undesirable sights, sounds, smells, and dust. Reduced wind speed on the leeward side of a windbreak helps reduce the odors and dust carried from upwind livestock corrals, feedlots, fields, and roads. Some odors are absorbed by the plants within the windbreak while others may be masked by the more desirable smells of aromatic leaves or flowering shrubs.

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, homegrown 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 its contents. 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.

Recreation is an essential part of family life. Popular activities such as a picnic or barbecue in the backyard, 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 on a ranch or farmstead 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

Farmstead windbreaks provide sites for nesting, feeding, singing, and breeding for many birds and animals. Additionally, windbreaks furnish a safe, linear corridor for wildlife movement between feeding, watering, and resting sites. Using varied tree and shrub species you can create a smorgasbord of seeds, nuts and fruits. By including a greater diversity of food types and habitat in your windbreak you will attract a greater variety of birds and animals to your backyard. By selecting species that will provide benefits in early spring and late fall, you provide a rest area for many migrating birds. See ***Windbreaks and Wildlife*** (EC 91-1771) for additional details on enhancing wildlife with windbreaks.

Products from the windbreak

In addition to providing protection from the wind, ranch and farmstead windbreaks can provide posts,

poles, rough lumber, and firewood. These products may be useful on the ranch or farm, or may be sold for additional economic benefits.

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 benefits from your windbreak.

Planting fruit and nut trees on the leeward side of a windbreak provides another opportunity for harvesting produce from the windbreak. These products are suitable for home use and possibly for sale. A windbreak creates an excellent environment for a 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, farmstead windbreaks the zone of maximum protection lies approximately 2 to 7H to the leeward side of the windbreak (H equals the mature height of the windbreak). Additional protection is found from 1 to 3H to the windward side. The goal in designing windbreaks is to take advantage of these zones of protection to achieve your objectives.

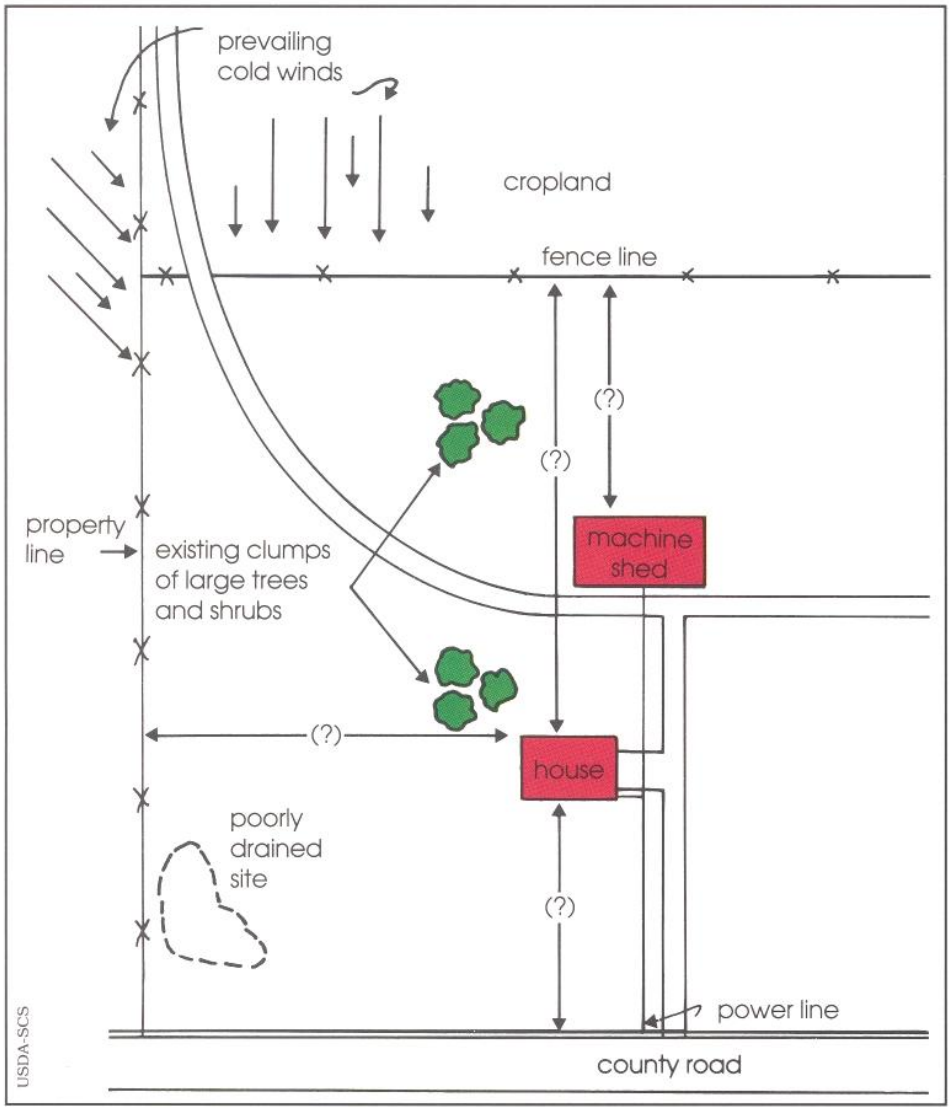


Figure 1. A windbreak is a long-term investment, and careful planning can improve benefits and help avoid future problems. A sketch of the area helps in planning. Begin by identifying prevailing or troublesome winds. Locate existing buildings, property lines, existing trees, soil problems, roads, and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

A ranch or farmstead windbreak needs to provide maximum protection to the major buildings and the living and working areas of your farm or ranch. Ideally, the windbreak row with the tallest tree species should be approximately 2-5H from all primary objects or areas needing wind protection. In regions needing both wind and snow protection, the most windward row needs to be 100 to 200 feet from the areas needing protection in order to provide room for snow drifts. Areas 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. For the best windbreak, choose trees and shrubs suitable for your soil and climate conditions. Species native to your area are usually the best choice. 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

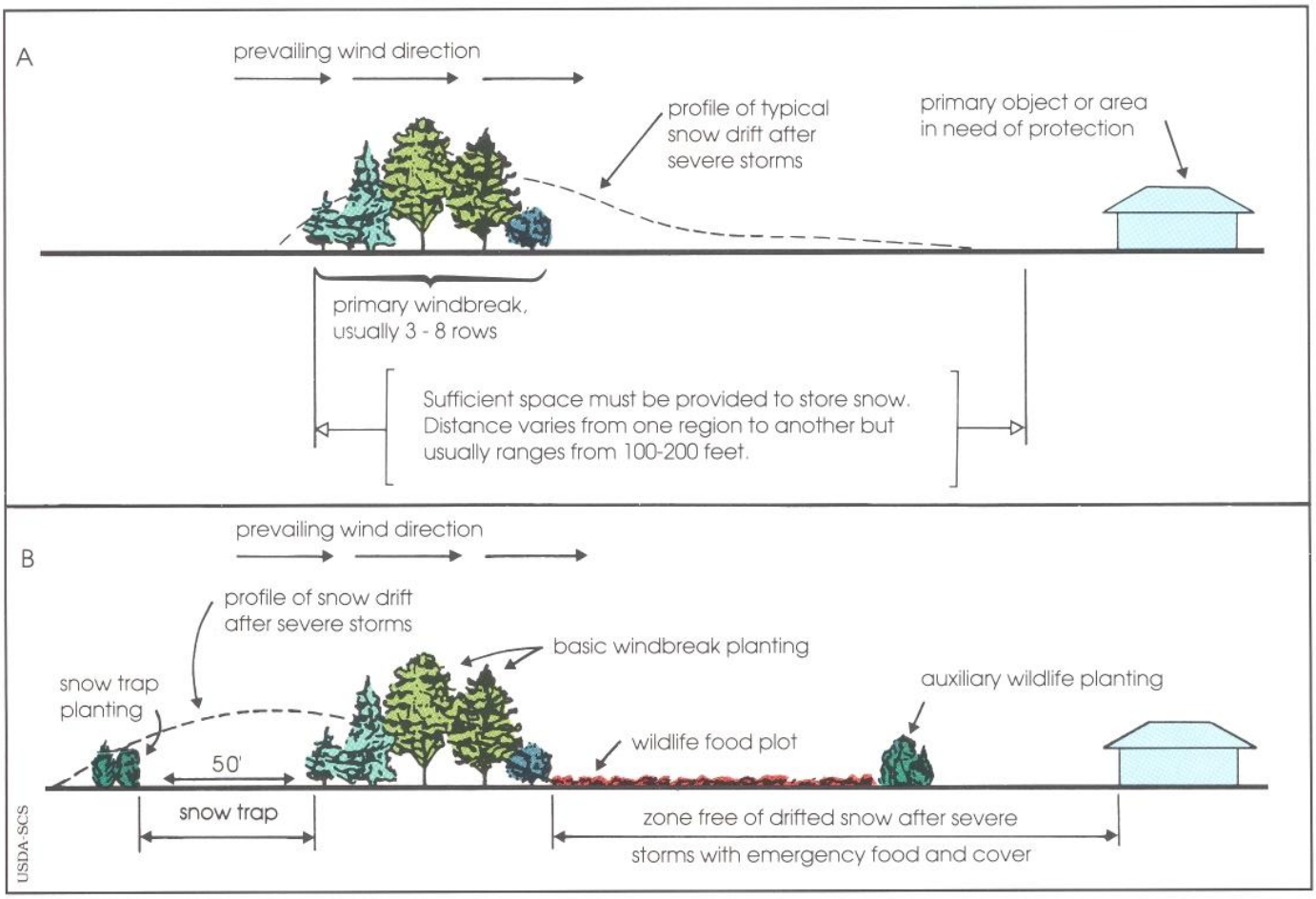


Figure 2. A) A basic farmstead windbreak consists of three to eight rows of both conifers and deciduous trees. Conifers or shrubs should be located on the windward side with the tall deciduous species in the center. A row of shrubs on the interior or leeward side completes the design. Spacing between the rows is typically 12 to 16 feet but can be increased to accommodate larger tillage 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 trip snow before it reaches the main windbreak.

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, and/or fruit, nut, and wood production will provide additional rewards. The unique attributes of some species provide accents in windbreaks that are especially pleasing when visible to the landowner. 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 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 enhance the quality of life on ranches and farms and add to the value of the 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. The requirements and objectives of the ranch or farm owner will always determine the parameters of the best windbreak design to use.

For additional information, see other guides in this series or contact your local Cooperative Extension office, the Soil Conservation Service, or State Forestry agency.

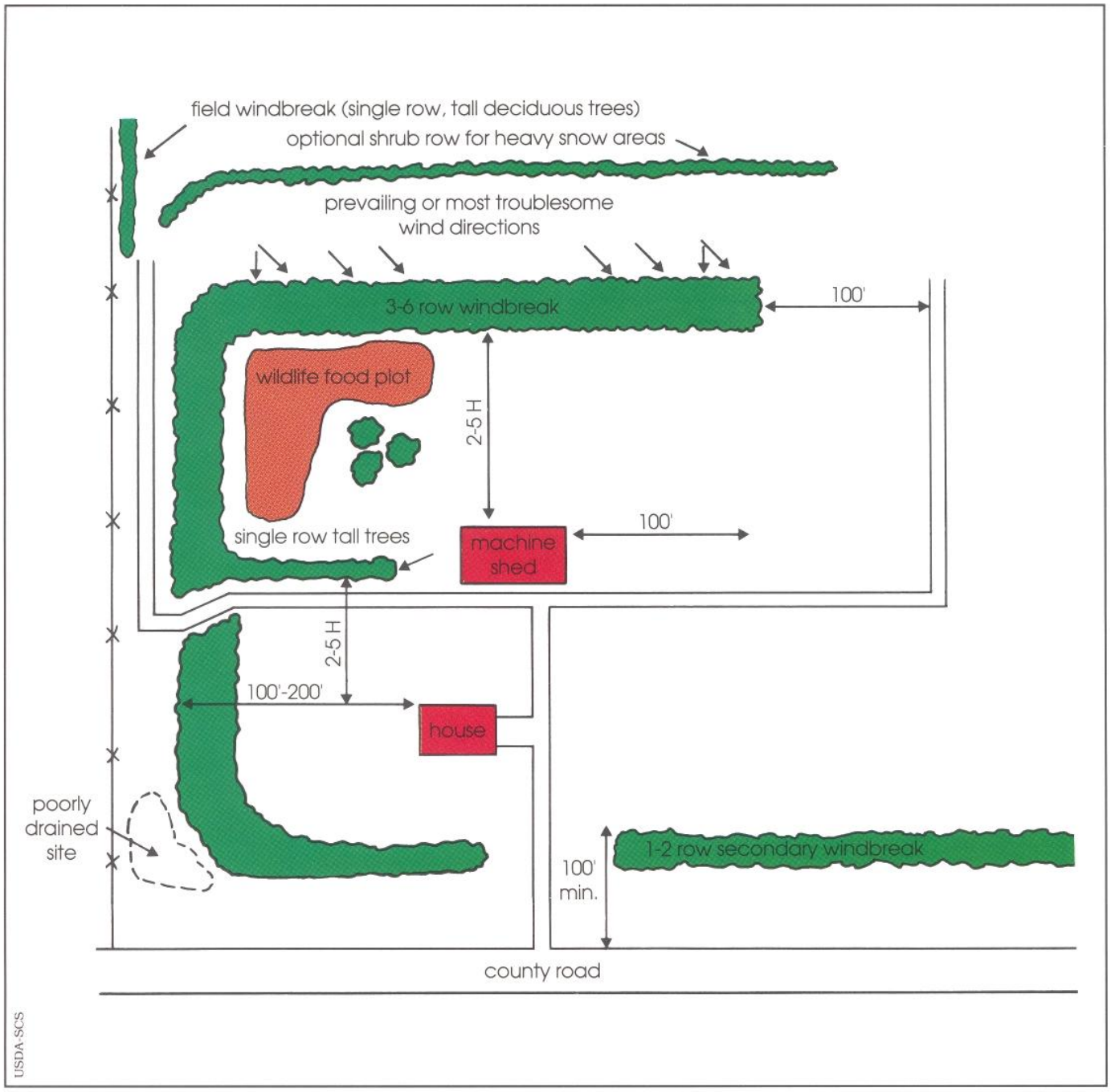


Figure 3. The windbreak should be oriented perpendicular to the prevailing or most troublesome wind directions. Lanes or access roads that go through a windbreak, should be at an angle to prevailing winds so they will not funnel winds into the farmstead. Because of wind turbulence around the end of a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

Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Kenneth R. Bolen, Director of Cooperative Extension, University of Nebraska, Institute of Agriculture and Natural Resources.
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This series of windbreak publications is jointly sponsored by the University of Nebraska, the USDA Soil Conservation Service, North Dakota State University, and the Forest Stewardship Program of The Nebraska Forest Service. Its goal is to encourage the proper management of all our woodland resources.