

WINDBREAKS

These aren't your grandfather's shelterbelts

As we consider the role of windbreaks in today's agriculture we need to reflect on the roots of windbreak application in North America. The first thing we notice is that windbreaks were commonly called shelterbelts because they provided shelter from the wind. Protection for homes, livestock and soil drove the demand for shelterbelts. In this day of well-insulated homes, climate-controlled tractors and confined animal feeding operations the call for shelter isn't as apparent as it once was. Replacing the need for shelter are air and water quality, wildlife habitat, crop quality and additional income. Gone are the 10-15 row shelterbelts. Research on windbreak density tells us that depending on the need, sometimes only one, two or three rows are necessary. Take a look inside and see what windbreaks are doing for agriculture today. 🌱

Inside

3



PROTECTING ORGANIC CROPS

8



WINDBREAKS DESIGNED WITH POLLINATORS IN MIND

11



VARIED WEATHER CAUSING



A bumblebee foraging on a blueberry blossom. Photo by Nancy Adamson

Designed with pollinators in mind

Nancy Adamson

Pollinator Conservation Specialist
Xerces Society/NRCS-ENTSC

Thomas Ward

Forester, NRCS-ENTSC

Mace Vaughan

Pollinator Program Director

Historically, field windbreaks have been designed to increase crop quality and production, to reduce soil erosion and to protect and improve human habitats. However, while windbreaks are typically designed to reduce wind velocity, soil erosion or snow drifting, these designs also can be embellished to provide bees and other pollinators with habitat, food resources and protection from pesticide drift.

These additions include flowering trees and shrubs that provide pollen and/or nectar throughout the growing season to support bees, our major crop pollinators, and a greater use of taller trees and shrubs with denser growth to prevent pesticide spray drift.

Besides providing habitat and safety for pollinators, the additional agroforestry



A sweat bee gathers pollen on a nine-bark.
Photo by Mace Vaughan

benefits include wood production (maple, for example, is an excellent source of early spring pollen and hardwood timber) and income from fruit, berry and nut crops, as well as decorative florals and biofuels.

Windbreaks designed to prevent pesticide drift should emphasize greater use of evergreens, trees or shrubs with denser

growth habits and taller species.

Both approaches fit within the common types of windbreaks recommended by the USDA Natural Resources Conservation Service (NRCS): Field windbreaks, livestock windbreaks, farmstead windbreaks and living snow fences (see National Agroforestry Center, www.unl.edu/nac/windbreaks.htm for detailed criteria for effective windbreaks).

HABITAT ENHANCEMENT

Windbreaks designed as habitat for bees and other pollinators should provide a diversity of pollen- and nectar-rich flowers through the growing season (Table p. 9), that will provide a consistent food supply and, over time, support diverse bee populations. This is particularly important when nearby crops vary from year to year (i.e., when crop resources are inconsistent from year-to-year) and when floral resources in a crop field are abundant for only short periods of time, such as blueberries and apples.

Windbreaks also help bees conserve energy by protecting them from the wind.

see **Pollinators**, Page 10

Blooming dates for pollinator friendly trees and shrubs

Scientific Name	Common Name	Bloom Time ^b	Height Short (S), Medium (M), Tall (T)	Region West (W), Central (C), East (E)
<i>Acer</i> spp. ^c	maple	spring to early summer	T	WCE
<i>Amelanchier</i> spp. ^d	serviceberry	early spring to summer	SM	WCE
<i>Amorpha</i> spp.	leadplant, false indigo	spring to summer	S	WCE
<i>Aralia</i> spp.	devil's walkingstick, spikenard	summer	SM	WCE
<i>Arbutus</i> spp. ^e	madrone	early spring to summer	MT	WC
<i>Baccharis</i> spp.	groundsel bush, coyote brush	summer to fall	S	WCE
<i>Ceanothus</i> spp.	native lilac, NJ tea	early spring to summer	SM	WCE
<i>Cephalanthus occidentalis</i>	buttonbush	summer	SM	WCE
<i>Cercis</i> spp.	redbud	spring	M	WCE
<i>Clethra alnifolia</i>	sweet pepperbush	summer	S	CE
<i>Crataegus</i> spp.	hawthorn	spring	M	WCE
<i>Diospyros</i> spp. ^{c,d}	persimmon	spring	T	WCE
<i>Gaylussacia</i> spp. ^d	huckleberry	early spring	S	CE
<i>Gleditsia</i> spp. ^c	honey locust	spring	T	WCE
<i>Holodiscus</i> spp.	cliff spirea	summer	S	WC
<i>Ilex</i> spp. ^e	holly, inkberry	spring	SMT	WCE
<i>Liriodendron tulipifera</i> ^c	tulip tree	spring	T	CE
<i>Mahonia</i> spp.	Oregon grape	spring to early summer	S	WCE
<i>Nyssa</i> spp. ^c	blackgum	spring	MT	CE
<i>Oxydendrum arboreum</i>	sourwood	summer	T	E
<i>Parkinsonia</i> spp.	palo verde	spring	M	WCE
<i>Philadelphus</i> spp.	mock orange	spring	S	WCE
<i>Photinia</i> spp.	chokeberry	spring to summer	S	CE
<i>Physocarpus</i> spp.	ninebark	spring to summer	S	WCE
<i>Prunus</i> spp. ^{c,d}	cherry, plum, peach, apricot	spring	M	WCE
<i>Rhododendron</i> spp.	rhododendron, azalea	early spring	SM	WCE
<i>Rhus</i> spp.	sumac	spring to summer	M	WCE
<i>Robinia pseudoacacia</i>	black locust	spring	T	E
<i>Rosa</i> spp. ^d	rose	summer	S	WCE
<i>Rubus</i> spp. ^d	blackberry, raspberry, black raspberry	spring to fall	S	WCE
<i>Salix</i> spp. ^e	willow	early spring	MT	WCE
<i>Sambucus</i> spp. ^d	elderberry	spring to summer	S	WCE
<i>Sassafras albidum</i>	sassafras	spring	MT	CE
<i>Shepherdia</i> spp.	buffaloberry	spring	SM	WC
<i>Spiraea</i> spp.	spirea	summer	S	WCE
<i>Tilia</i> spp. ^c	basswood	spring to summer	T	CE
<i>Umbellularia californica</i>	California laurel	fall to spring	T	W
<i>Vaccinium</i> spp. ^{d,e}	blueberry, huckleberry	early spring	S	WCE

^aNames in bold include some or all evergreen species.

^bFlowering times depend on species, location, and environmental conditions, varying from year to year. Consult with local native plant experts to plan for overlapping bloom times.

^cAdded value as timber.

^dAdded value of fruit crop.

^eAdded value of decorative cut twigs for floral industry.

^fSouthern distribution only.

^gThis species is invasive in some parts of the country and should not be planted in those regions.

When protected from wind, bees conserve energy (like livestock and plants), and are more likely to have greater energy to visit adjacent crops for longer periods of time. The sheltering effect of windbreaks also creates slightly warmer conditions, enough to expand the time period bees forage. By supporting diverse bee populations throughout the growing season, successful pollination is ensured even when there is a decline in one or more bee species.

Since 30 percent of native bees are cavity nesters, including woody plants and cane-producing shrubs within windbreaks is an important consideration. The bees' offspring complete their life cycle in beetle tunnels and the centers of pithy stems, so leaving dead wood on-site is beneficial, as is increasing young woody sprouts of plants such as boxelder, sumac, caneberry and elderberry by cutting them back every few years. These practices can greatly increase nesting habitat for native bees.

Trees and shrubs that are especially attractive to bees vary regionally and seasonally and should be chosen based on local conditions. Several studies have shown that native species are more attractive and provide more resources for native and honey bees alike. In general, native species are encouraged over introduced species. Adding wildflower species to a windbreak also greatly benefits pollinators by providing additional forage, and native warm season bunch grasses can provide nesting sites for bumble bees. Likewise, renovating established windbreaks with smaller shrubs can be added as part of a habitat plan (see USDA practice standard for Windbreak Renovation #650).

For more detailed information about pollinator habitat, visit www.xerces.org/pollinator-resource-center

Windbreaks designed to support pollinators also are beneficial to other insects and wildlife. Though farmers may worry that this habitat could harbor pest species, greater numbers of predator species, such as spiders, wasps, hover flies and lady beetles, more than compensate. In fragmented landscapes, windbreaks can be important habitat corridors for a variety of wildlife, including game birds, migratory songbirds and insects.

PESTICIDE DRIFT PREVENTION

When designing windbreaks to prevent pesticide drift, trees and shrubs known to be exceptionally effective at capturing spray drift should be used while staying away from using plants that provide forage for bees or other pollinators. Using this design, a windbreak can capture the maximum amount of pesticide drift with the least harm done to the pollinators.

Research has shown that, because of their three-dimensional porosity, vegetative windbreaks are more effective in controlling drift than artificial windbreaks made of wood, cloth, or other materials. One note of caution: overly dense windbreaks (greater than 60 percent), may lead to wall effects, forcing wind up and creating eddies on their leeward side that could bring drifting material back down to the surface (known as downwash).

The best pesticide drift protection comes from multiple rows of vegetation that include small-needled evergreens. These trees are two to four times as effective as broadleaf plants in capturing spray droplets and provide year-round protection. A porosity of 40-50 percent in several rows is optimum for capturing spray

drift, which can be achieved in a windbreak of several rows. Two rows of evergreens can provide a 60-percent density (40-percent porosity). Spruce, juniper, fir and arborvitae are recommended over pines since pines generally are less dense and their growth form opens with age. While multiple rows of low porosity vegetation are better than a single row of dense vegetation, even a single row can substantially reduce drift.

Shape, structure and width affect droplet capture effectiveness. Species without lower vegetation branches or foliage should be avoided or supplemented with low-growing species. Wind velocity reduction is proportional to windbreak height and density. While some crops benefit by being sheltered from wind, maturing more quickly, others may not thrive with less light, so structural design needs to balance wind reduction goals with consideration of shade effects.

Windbreak design will depend on site conditions and available space. Generally, windbreaks are aligned to intercept prevailing winds with one to five rows, starting with a shrub row and including an evergreen row. For pesticide drift prevention, they also may need to be placed on the leeward side of crop fields to prevent movement of chemicals off-site.

Spacing between rows should be 12-20 feet, guided by the mature width of plants and maintenance practices (four feet wider than equipment used between rows). Where possible, spacing should be closest on the windward (shrub row) and leeward (evergreen row) sides, and farthest between the innermost rows (deciduous or evergreen trees). Designs with a mixture of shrubs, trees, and perennials or fewer rows, can be planted a little more densely. In drift prevention windbreaks, avoid nectar-producing perennials that might attract pollinators. If grasses are used, planting density should be very low to prevent competition with shrub and tree growth (until the shrubs and trees mature). Minimum height at maturity should be one and one half times the spray release height (twice the spray height if porosity is expected to be less than 40 percent).

Buffer zones — unsprayed areas around the edge of the crop field — are an alternative and complementary drift management technique. To protect pollinators, buffer zones can be mowed just prior to spray time if pollen or nectar producing plants are flowering within them.

While windbreaks for pollinators are designed to intercept pesticides, potential susceptibility of plants to herbicide drift should be considered where herbicides are regularly used. Windbreaks make up only one component of best management practices to minimize agro-chemical drift. Timing (avoiding active times of pollinators and choosing times with lower wind velocities), nozzle adjustments (smaller droplets travel farther and are less easily captured by vegetation) and other spray systems/techniques can reduce potential drift impacts on pollinators and their habitats.

Windbreaks provide a unique opportunity to address conservation threats to pollinators and, at the same time, address a wide variety of other resource concerns, from crop production and reduced soil erosion to wildlife habitat. Therefore, they continue to be a flexible and useful tool for conservation on agricultural lands and an important component of a sustainable farm. 🌱

USDA National Agroforestry Center
East Campus—UNL
Lincoln, NE 68583-0822

Official Business
Penalty for Private Use, \$300

Address Service Requested

PRSRT STD
POSTAGE & FEES
PAID
USDA — FS
PERMIT NO G-40

Upcoming Events

Jan. 26-27, 2012

Kansas Natural
Resources Conference
Wichita, KS.

"Wetlands: The Jewels of Kansas"

More information at:

www.kansasnrc.org/

Feb. 23-24, 2012

Agricultural Outlook Forum 2012
Arlington, VA.

"Agriculture: Visions of the Future."

For more information go to:

www.usda.gov/oce/forum

July 22-25, 2012

The Northern Nut Growers
Association's 103rd Annual meeting
Lexington, KY.

More information at:

www.nutgrowing.org/

For more upcoming events, visit
our website calendar:

www.unl.edu/nac/calendar.htm

Has Your Address Changed?

If you've had a change of address or personnel, we'd like to know. Please fill out a change of address form on our website:
www.unl.edu/nac/changeofaddress.htm



Mission

The USDA National Agroforestry Center (NAC) is a partnership of the Forest Service (Research & Development and State & Private Forestry) and the Natural Resources Conservation Service. NAC's staff are located at the University of Nebraska, Lincoln, NE and in Blacksburg, VA. NAC's purpose is to accelerate the development and application of agroforestry technologies to attain more economically, environmentally, and socially sustainable land use systems by working with a national network of partners and cooperators to conduct research, develop technologies and tools, establish demonstrations, and provide useful information to natural resource professionals.

Policy

Opinions expressed in "Inside Agroforestry" are those of the author and do not necessarily represent the policy of the USDA Forest Service and the USDA Natural Resources Conservation Service. The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or part of an individual's income is derived from any public assistance. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at 202-720-2600 (voice and TDD). To file a complaint of discrimination, write USDA, Director, Office of Civil Rights, 1400 Independence Avenue, SW, Washington, DC 20250-9410 or call toll free 866-632-9992 (voice). TDD users can contact USDA through local relay or the Federal relay at 800-877-8339 (TDD) or 866-377-8642 (relay voice). USDA is an equal opportunity provider and employer.

"Inside Agroforestry" is published by the USDA
National Agroforestry Center.

Phone: 402-437-5178; Fax: 402-437-5712.

- Andy Mason, NAC Director (202-205-1694)
- Michele Schoeneberger, FS Research Lead (ext. 4021)
- Richard Straight, FS Lead Agroforester (ext 4024)
- Vacant position, NRCS Lead Agroforester

www.unl.edu/nac