USDA NATIONAL AGROFORESTRY CENTER

Forest Service Research, State & Private Forestry, and Natural Resources Conservation Service

Alley Cropping

Silvopasture

Forest Farming

Riparian Forest Buffers

Windbreaks

Agroforestry In-Service Workshop
LaFarge and Viola, Wis.
June 16, 2011

USDA National Agroforestry Center
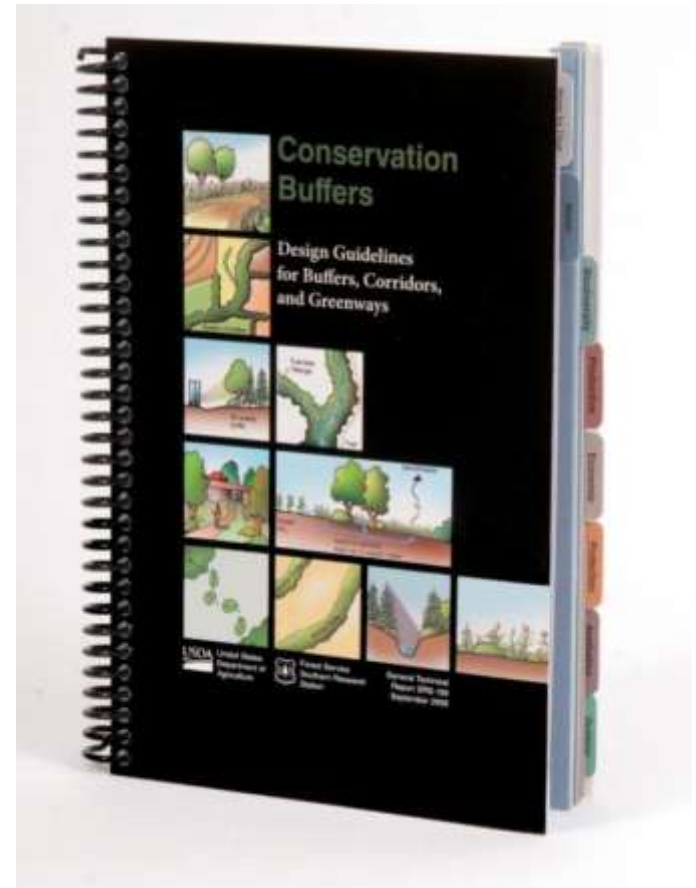
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NRCS

Conservation Buffer Guide

➢ **Based on over 1,400 research publications**

➢ **Developed with natural resource professionals**

  ➢ **Size**
  ➢ **Issues**
  ➢ **Images**
  ➢ **Tabs**
  ➢ **Paper type**

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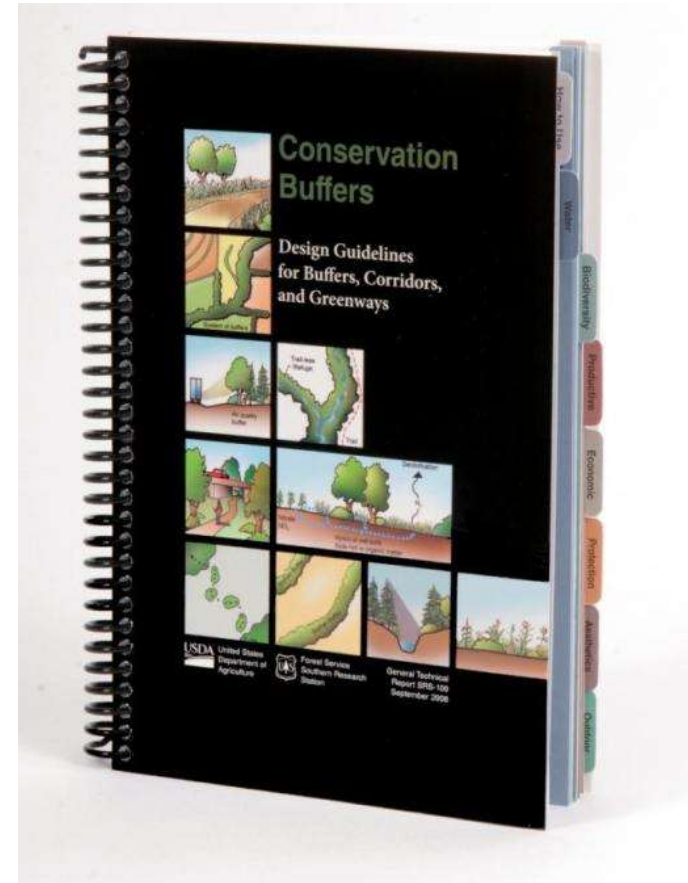
Conservation Buffer Guide

➢ **Improve air & water quality**

➢ **Protect soil**

➢ **Enhance habitat**

➢ **Enhance economic productivity**

➢ **Provide recreational opportunities**

➢ **Beautify the landscape**

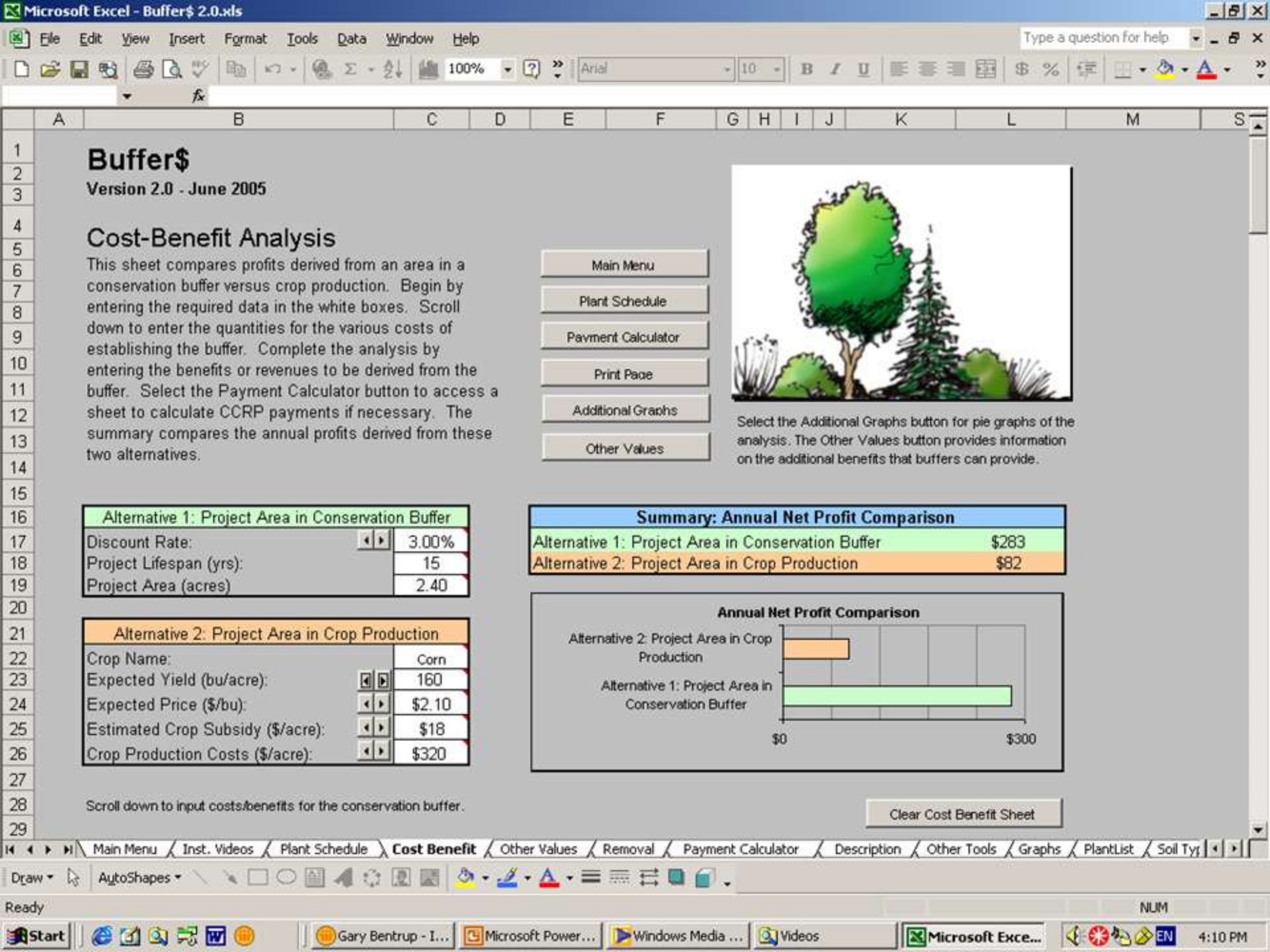USDA National Agroforestry Center

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Buffer Functions

Multi-Purpose Buffers

Issue and Objectives	Buffer Functions
Water Quality	
Reduce erosion and runoff of sediment, nutrients, and other potential pollutants	Slow water runoff and enhance infiltration
	Trap pollutants in surface runoff
	Trap pollutants in subsurface flow
Remove pollutants from water runoff and wind	Stabilize soil
	Reduce bank erosion
Biodiversity	
	Increase habitat area
	Protect sensitive habitats
Enhance terrestrial habitat	Restore connectivity
Enhance aquatic habitat	Increase access to resources
	Shade stream to maintain temperature
Productive Soils	
	Reduce water runoff energy
	Reduce wind energy
Reduce soil erosion	Stabilize soil
Increase soil productivity	Improve soil quality
	Remove soil pollutants
Economic Opportunities	
	Produce marketable products
Provide income sources	Reduce energy consumption
Increase economic diversity	Increase property values
Increase economic value	Provide alternative energy sources
	Provide ecosystem services
Protection and Safety	

Protection and Safety	
Protect from wind or snow	Reduce wind energy
Increase biological control of pests	Modify microclimate
Protect from flood waters	Enhance habitat for predators of pests
Create a safe enviroment	Reduce flood water levels and erosion
	Reduce hazards
Aesthetics and Visual Quality	
Enhance visual quality	Enhance visual interest
Control noise levels	Screen undesirable views
Control air pollutants and odor	Screen undesirable noise
	Filter air pollutants and odors
	Separate human activities
Outdoor Recreation	
Promote nature-based recreation	Increase natural area
	Protect natural areas
Use buffers as recreational trails	Protect soil and plant resources
	Provide a corridor for movement
	Enhance recreational experience

File Edit View Insert Format Tools Data Window Help

Type a question for help

Arial 10 B I U

100%

Buffer$

Version 2.0 - June 2005

Cost-Benefit Analysis

This sheet compares profits derived from an area in a conservation buffer versus crop production. Begin by entering the required data in the white boxes. Scroll down to enter the quantities for the various costs of establishing the buffer. Complete the analysis by entering the benefits or revenues to be derived from the buffer. Select the Payment Calculator button to access a sheet to calculate CCRP payments if necessary. The summary compares the annual profits derived from these two alternatives.

| Main Menu |
| Plant Schedule |
| Payment Calculator |
| Print Page |
| Additional Graphs |
| Other Values |

Select the Additional Graphs button for pie graphs of the analysis. The Other Values button provides information on the additional benefits that buffers can provide.

Alternative 1: Project Area in Conservation Buffer	
Discount Rate:	3.00%
Project Lifespan (yrs):	15
Project Area (acres)	2.40

Alternative 2: Project Area in Crop Production	
Crop Name:	Corn
Expected Yield (bu/acre):	160
Expected Price ($/bu):	$2.10
Estimated Crop Subsidy ($/acre):	$18
Crop Production Costs ($/acre):	$320

Summary: Annual Net Profit Comparison	
Alternative 1: Project Area in Conservation Buffer	$283
Alternative 2: Project Area in Crop Production	$82

Annual Net Profit Comparison

Alternative 2: Project Area in Crop Production

Alternative 1: Project Area in Conservation Buffer

$0 $300

Scroll down to input costs/benefits for the conservation buffer.

| Clear Cost Benefit Sheet |

Main Menu / Inst. Videos / Plant Schedule / **Cost Benefit** / Other Values / Removal / Payment Calculator / Description / Other Tools / Graphs / PlantList / Soil Typ
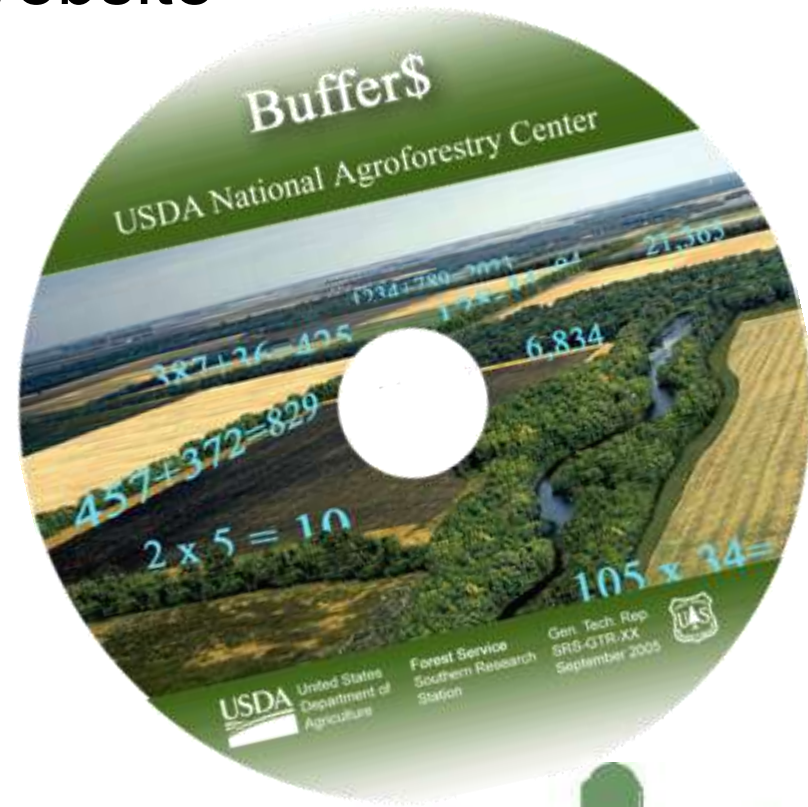
Draw AutoShapes

Ready

NUM

Buffer$ - Current Status

- NRCS Economic Tools Website
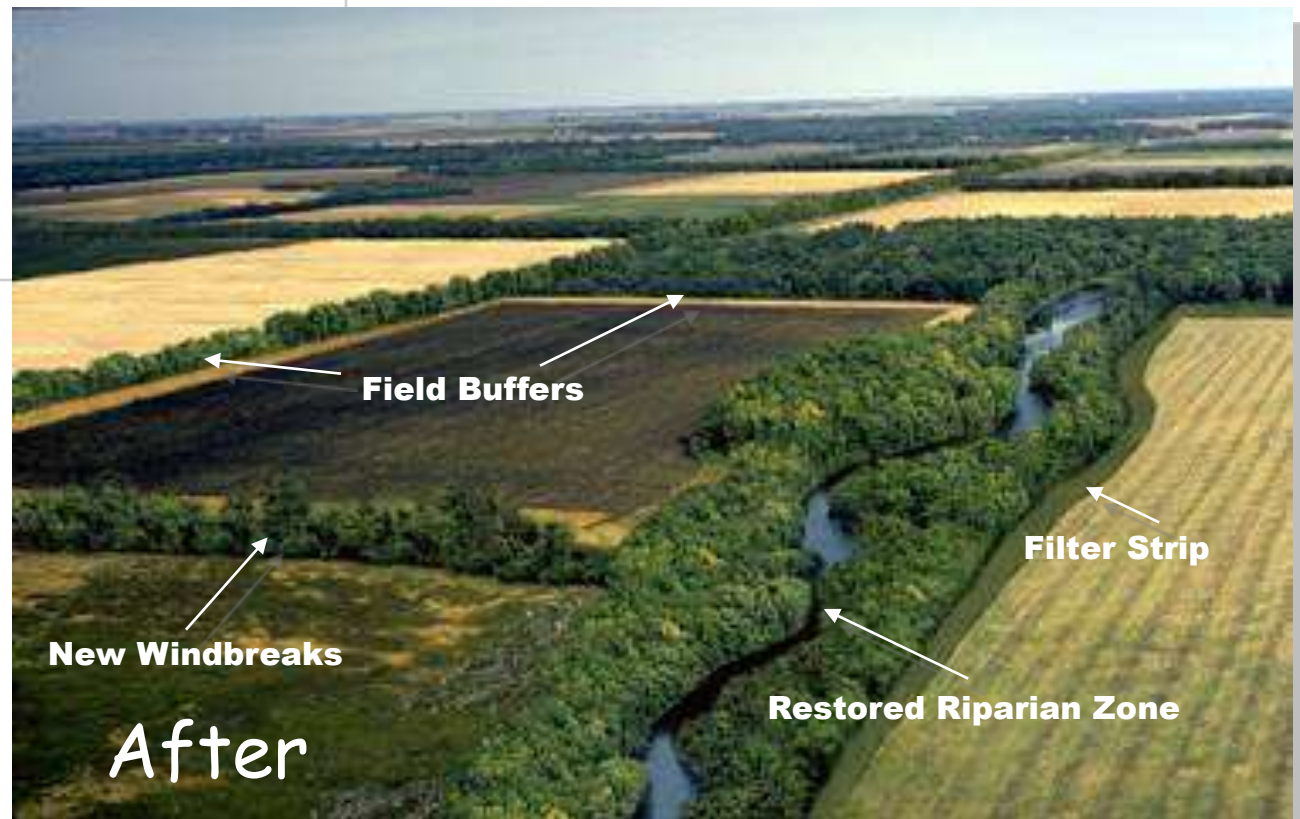
- EPA Manual

- Over 30 states

- *En Español* ?

Buffer$ allows me to quickly calculate an economic return, saving me valuable time with landowners.

Don Ulrich
District Conservationist

Visual Simulations

CanVis~

Field Buffers

Filter Strip

New Windbreaks

Restored Riparian Zone

After

CanVis Visual Simulations

Existing conditions

With new conservation practices

Existing condition

With constructed stormwater wetland

Before

Bioengineering - 1 year Growth

Windbreak Design Clipboard

1. Determine landowner primary and secondary windbreak objectives

- Reduce soil erosion from wind
- Provide noise screens
- Protect plants from wind-related damage
- Provide visual screens
- Alter microenvironment for enhancing plant growth

- Improve air quality by reducing and intercepting airborne particulate matter, chemicals and odors
- Manage snow deposition
- Delineate property and field boundaries
- Improve irrigation efficiency

- Provide shelter for structures, livestock, and people
- Enhance aesthetics
- Enhance wildlife habitat by providing travel corridors
- Increase carbon storage in biomass and soils

2. Consider the applicable density to meet windbreak objective(s)

- Crop & soil protection – 40-60%
- Snow distribution – 25-50%
- Snow accumulation – at least 50%
- Protection of structures, livestock and people – at least 65%
- Air quality – at least 50% on the windward side of the source area and, for windbreaks on the downwind side of the source area, at least 65%
- Density for other purposes is generally no less than 50%
- Noise screens – at least 65%

25–50% density
- 1-row – deciduous shrub
- 2-row – deciduous tree and deciduous shrub

50–65% density
- Twin-row – deciduous shrub
- 1-row – small evergreen tree
- 2-row – evergreen tree and deciduous tree
- 3-row – combination of deciduous trees and deciduous shrubs

65+% density
- Twin-row – small evergreen tree
- 3 or more row – combination of evergreen trees, deciduous trees, and shrubs

3. Determine troublesome wind direction

Refer to local weather records for monthly wind rose data. See
http://www.wcc.nrcs.usda.gov/climate/windrose.html

January   May
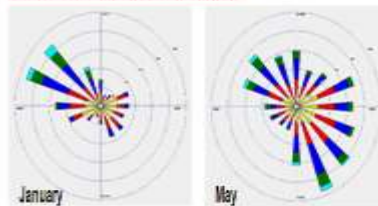
Position the windbreak as close to perpendicular to the most troublesome wind direction

4. Locating the windbreak
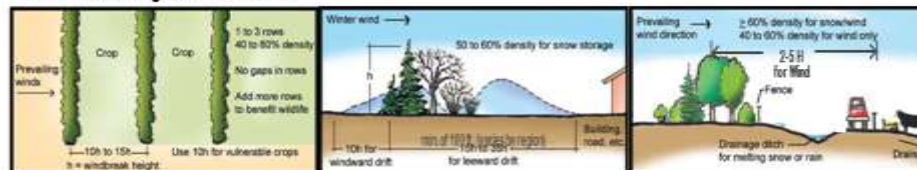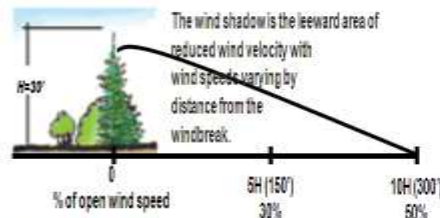
5 Additional site considerations

- Inventory the soils paying close attention to inclusions of difficult soils such as high/low pH or restrictive layers.
- Begin a starter list of species adapted to the soils
- Locate property lines and overhead/underground utilities
- Will access roads/lanes cross the windbreak?
- Determine water drainage pattern into or away from windbreak

6 Consider windbreak length

- The windbreak length needs to be at least ten times the 20 year height of the windbreak
- The windbreak should extend at least 100 feet beyond the desired area of protection
- A "two-leg" (or more) windbreak is needed when troublesome winds deviate throughout the windy season
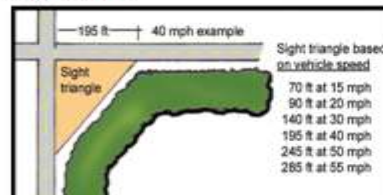

Wind Direction

Single Leg or **Multiple Leg Windbreak**

7 Consider windbreak height

The wind shadow is the leeward area of reduced wind velocity with wind speeds varying by distance from the windbreak.

H=30'

% of open wind speed

0
5H (150')
30%
10H (300')
50%

Windbreak height is referred to as 'H'. The area protected is a direct proportion to the height.
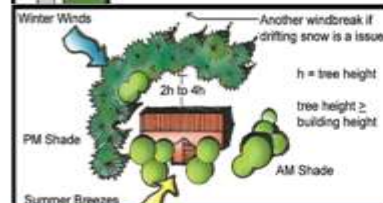
Buffer vegetation height ≥ 2h

Windbreak needs to be twice as tall as the crop or structure being protected.
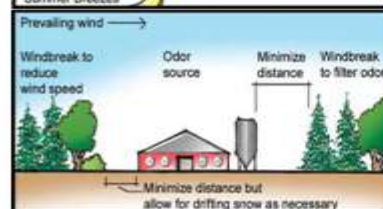
8 Special situations

Check local ordinances for specific setback distances

195 ft — 40 mph example

Sight triangle

Sight triangle based on vehicle speed

70 ft at 15 mph
90 ft at 20 mph
140 ft at 30 mph
195 ft at 40 mph
245 ft at 50 mph
285 ft at 55 mph

Energy conservation design considerations

Winter Winds

Another windbreak if drifting snow is a issue

h = tree height

tree height ≥ building height

2h to 4h

PM Shade

AM Shade

Summer Breezes

Design considerations for odor concerns

Prevailing wind →

Windbreak to reduce wind speed

Odor source

Minimize distance

Windbreak to filter odor

Minimize distance but allow for drifting snow as necessary
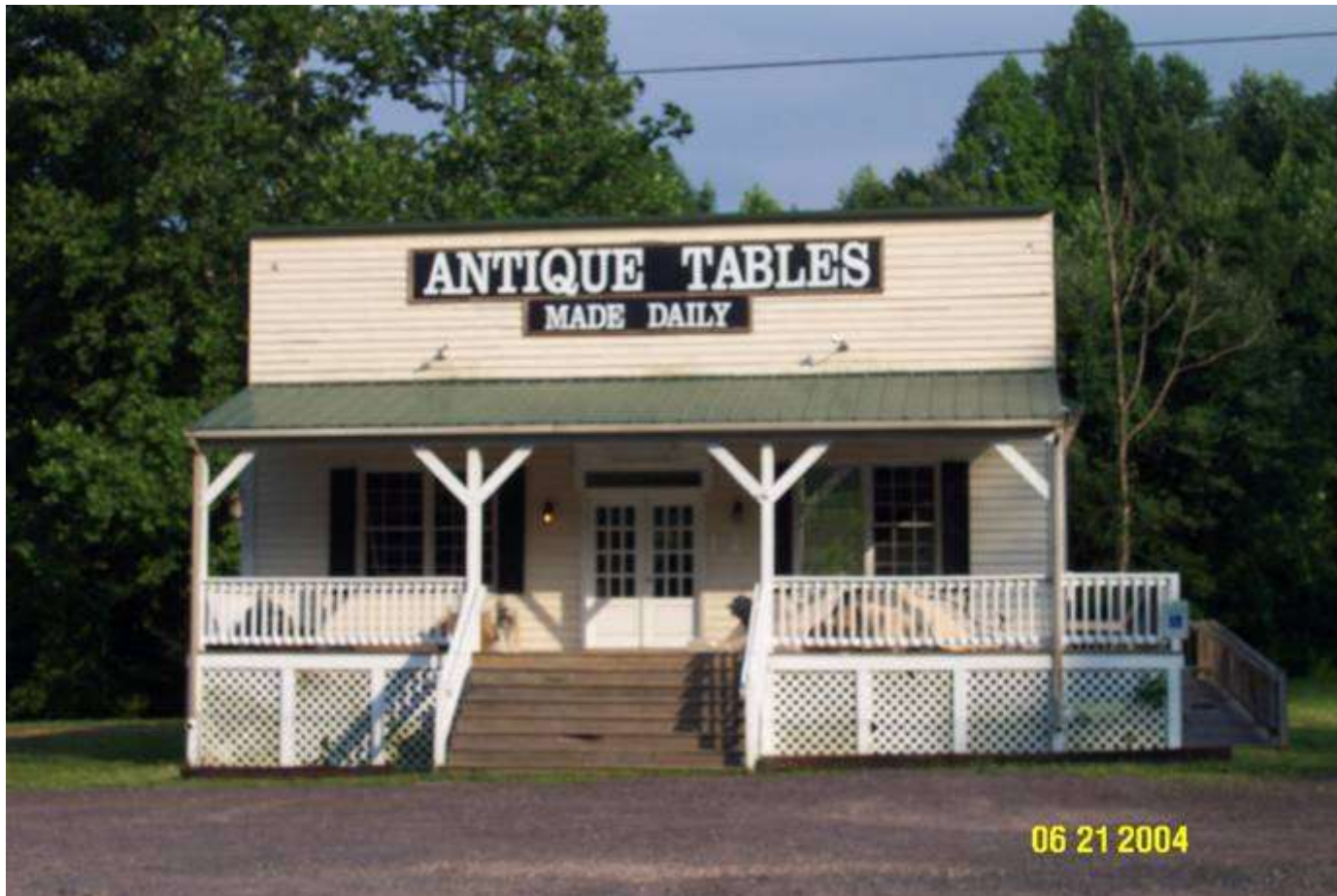
9 Tree & shrub species selection & spacing

- Adapted to soils
- Use approved species determined by NRCS or State Forestry Agency
- At least one species provides optimal height for the site
- Favorable for wildlife food and cover
- Diverse mix of species
- Consider seasonal variation of foliage
- Adjacent species should have similar growth form
- Choose within/between-row spacing suited to species growth and vigor
- Row spacing needs to accommodate maintenance equipment

10 Operation & maintenance

- Weed control
- Watering/irrigation
- Protection from pests
- Maintain required fencing
- Replacement of dead plants

O&M is important!

Viewing Our Jobs Differently

www.unl.edu/nac

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