Windbreaks and Living Fences in Agroforestry

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Definition

A barrier placed on the land surface that obstructs the wind flow and alters flow patterns both up-wind (windward) and downwind (leeward) of the barrier.

Plantings of single or multiple rows of vegetation (trees, shrubs, grass) that are established for one or more environmental and economic purposes.

How do Windbreaks Provide These Benefits?

- The change in wind flow affects the exchange rates between the surface of an object and the air above that object.
- The vertical motion of air parcels is brought about by turbulent transfer.
- As these parcels move up they carry with them the various "properties".

How do Windbreaks Provide These Benefits?

Almost any measurable property of interest in the atmosphere is moved from levels of high concentration to levels of low concentration.

Properties such as:

- Water vapor Pollen -Heat
- Carbon dioxide Ozone Dust



How do Windbreaks Provide These Benefits?

- Lower wind velocity causes particulate matter to be deposited
- Windbreak vegetation physically traps particulate matter

Windbreak vegetation may absorb some of the chemicals attached to particulate matter

Even changes in atmospheric pressure















Odor Control

















Organic Buffer







Structure Protection



Industrial Wind Barriers





Conservation Practice Windbreak Establishment -380

- Standards define the practice and where it applies
- Specifications are detailed requirements for installing the practice

FOTG does not address production and harvesting

One Size Does Not Fit All

One design cannot serve all these purposes

- Producers may have more than one purpose for their windbreak
- The soil will significantly influence choice of trees and shrubs
- The local conditions may limit options

Design Elements



Windbreak function depends upon six key windbreak elements:

- Height
- Density
- Orientation
- Length
- Width
- Continuity

Criteria for elements vary by purpose

What is H? At What Age ?



H = Height of the Windbreak

Windbreak Height



The leeward distance of wind protection is directly proportional to the height of the windbreak.

Note: 4H is about the mid-point of maximum wind reduction

Windbreak Density



Windbreak density is the percentage of the solid portion of the barrier to the total area of the barrier.

Illustrations of Windbreak Density by Species and Number of Rows

65% Porosity





Air Flow Differences



VS

3-D barrier (top view)



Air Flow Through Buffers



Windbreak Orientation



• Orient windbreaks perpendicular to troublesome winds

• Plan multiple windbreaks for whole field protection

Working With Variable Wind Direction





Windbreak Continuity





Gaps in the windbreak can result in damage downwind

Can Windbreaks Do More?













In a world filled with Smart Phones,

why do we design single purpose conservation practices?

Use Crop Producing Trees & Shrubs

- Like What ?
- **Food**
- Decorative
- Herbal / Medicinal
- Craft Materials / Specialty Wood Products









RESOURCES

NRCS Windbreak Standard and supporting documents

Wind Erosion Prediction System <u>https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/</u> technical/tools/weps/

UNL Windbreak Research Bibliography <u>http://trees.unl.edu/research/windbreakbiblio.asp</u>

Wind Rose Data

https://www.wcc.nrcs.usda.gov/climate/windrose.html

National Agroforestry Center <u>https://www.fs.usda.gov/nac/practices/windbreaks.php</u>



One is good

But more is better





LEGEND

Associated practice or activity

#. Created by practice



LEGEND





