Working Trees for Carbon:
Windbreaks in the U.S.

Windbreaks are used throughtout the U.S. to accomplish a multitude of objectives. Among these are the reduction of water stress to improve crop yield and quality, reduction of soil erosion, snow management, livestock protection and odor control, provision of wildlife habitat, and energy conservation around farmsteads.

If society is looking for places to store carbon, windbreaks are an obvious choice. Since a large number of landowners already appreciate the value of a windbreak for the many benefits listed above, many would be interested in discussing ways to get financial assistance for planting and maintaining a windbreak that was also designed to optimize carbon storage. The fact that many landowners have been motivated to establish windbreaks for their own purposes, suggests that these plantings would remain in place on the ground for a long time. While windbreaks are used for various purposes throughout the U.S., the following scenarios describe the potential for carbon storage in windbreaks in the North Central reigon. Due to the extensive agricultural land base in the North Central region, large amounts of carbon can be stored by integrating more windbreak plantings into the agricultural landscape.

The following scenarios describe the potential for carbon storage in tree stems and branches over a 20-year period. Roots are not included, but would likely add from 15 to 25 percent to the totals. In addition, windbreaks typically function effectively for 50 to 70 years and would continue to accumulate carbon over the life of the planting.

Field Windbreaks

Field windbreaks reduce evaporation and plant transpiration rates such that per field crop yields are typically improved, even though a portion of the field has been converted to windbreaks. Research has estimated the optimal tree planting levels at between three and six percent of the cropped field area. There are 210 million acres of cropland unprotected by windbreaks in the North Central U.S. and of this 30 million acres are subjected to wind erosion in excess of the soil loss tolerance rate. Each million acres of planted windbreak would represent 200 million trees storing 21.2 million metric tons of carbon dioxide (CO_2) at age 20.

In addition to carbon stored in windbreak trees, the protection provided by the windbreak

Within 20 years field windbreak
storage could exceed
215 million metric tons of CO_2

results in energy savings from reduced fuel use. In the case of field windbreaks, land removed from agricultural production results in less fuel use. Based on an average of five gallons of diesel fuel per acre for most crops, planting 60,000 acres to windbreaks would reduce fuel consumption by 300,000 gallons annually.

Protecting the 210 million acres of exposed cropland in the North Central U.S. by planting five percent of the field area to windbreaks would sequester over 215 million metric tons of CO_2 in the first 20 years.

Farmstead Windbreaks

Of the more than 800,000 farms in the region, over 300,000 have no wind protection. For farmsteads located in cold climates, windbreaks have been shown to reduce home heating requirements by 10 to 20 percent. Assuming an average home uses 2350 gallons of propane per heating season, a 15 percent savings would reduce annual demand by 10.6 million gallons. While this benefit would not begin until the windbreak reached an effective height (about 10 years) it would continue throughout the remaining life of the windbreak, typically 40 to 50 years. Over this period fuel savings in excess of 290 million gallons could be expected.

Planting windbreaks around these 300,000 unprotected farms would result in 120 million trees (approximately 400 trees per home) storing 13 million metric tons of CO_2 within 20 years.

Living Snowfences

In North and South Dakota, Nebraska, Minnesota, and Iowa there are over 460,000 miles of roadway. Many of these would benefit from protection with a living snowfence. Properly designed living snowfences can dramatically reduce the need to plow and re-plow roadways. Assuming a one third reduction in snow removal costs, fuel usage for every 1,000 miles of protected roads could be reduced by 320,000 gallons annually. In addition, several states have documented reductions in both the frequency and severity of winter accidents due to living snowfences.

For each 1,000 miles of roads protected by windbreaks two million conifers could be planted to store 175,000 metric tons of CO_2 within 20 years.

References

Adapted from "Opportunities to Increase Tree Planting in Shelterbelts and the Potential Impacts on Carbon Storage and Conservation," Brandle, James; Wardle, Tom; and Bratton, Gerald. Chapter 9, Forests and Global Change, Vol. 1. Edited by Sampson, R. Neil; and Hair, Dwight; American Forests, 1992.

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