AGROFORESTRY NOTES
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Using agroforestry to buffer noise

Introduction

Excessive noise is considered a form of environmental pollution and can have detrimental effects for individuals and their quality of life. Unwanted noise can cause anxiety, tension, and in some cases even illness. Prolonged exposure to high levels of noise can also cause hearing loss. Outdoor noise invades our recreational areas, parks, playgrounds, schools, and even our backyards.

Obviously the most effective way to reduce noise pollution is to reduce the noise level or to completely enclose it. Quieter running lawn equipment, different road surface materials, and slower traffic speeds are all ways to lower noise levels. When noise generation cannot be reduced, creating noise barriers or buffers between the source of the noise and the recipient is another option. The amount of noise acceptable varies depending on the individual and the circumstances surrounding the situation.

Traffic noise on high speed roads is a common complaint. Noise can be partially deflected and absorbed with a combination of structural and vegetative practices.

USDA National Agroforestry Center file photo.

Measuring noise levels is not a simple matter. High and low frequency sounds travel differently and sound waves bend over and around objects and barriers. Noise can be reflected and it diminishes with distance. The volume of sound is commonly measured in decibels. Noise volume is most commonly measured using an A-weighted decibel scale (dBA), which approximates what the human ear can hear. Decibels are measured using a logarithmic scale. Consequently a 10 dBA reduction equates to a halving of the apparent noise level. Somewhere around 66 dBA is considered an acceptable noise level for daytime outdoor environments and about 50 dBA is desirable during evening hours.

Types of noise buffers

Wood, masonry, or other solid barriers that are often erected for visual screening have proved useful as outdoor noise buffers. These barriers are often seen along high-speed roads within residential areas of cities.

Constructed earth berms are another type of solid barrier that is utilized to reflect and diffract road noise. Berms or linear mounds do require more space than walls and fences. Plant materials, such as trees, shrubs, and vines have often been considered by homeowners as effective noise buffers. But unless they are properly designed, possibly along with a solid barrier, most landscape vegetation will accomplish little more than “out of sight, out of mind” reduction in noise.

Noise buffer basics

There are some fundamental principles that apply universally regardless of the type of buffer used.

- First, the buffer density must result in completely blocking the view between the recipient and the noise source.
- Second, sound is refracted over and around buffers, bending toward the buffer or toward the recipient.

Consequently both the height and length of the buffer are very important. Noise buffers and barriers are most effective when they are located either near the source or the recipient. Buffers located midway between the source and recipient are relatively ineffective. Each of these factors will be discussed in more detail.

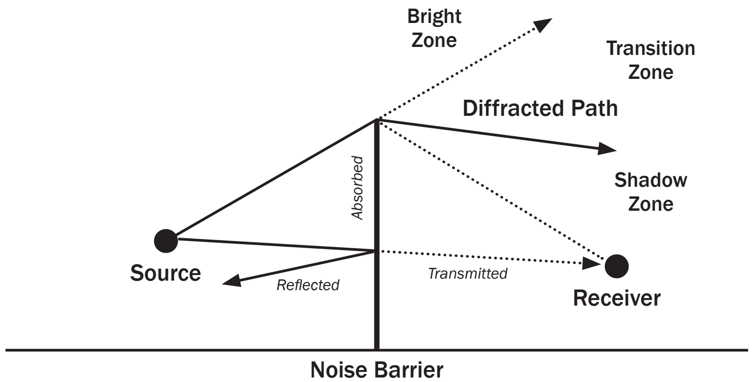

Figure adapted from the Federal Highway Administration's Highway Noise Barrier Design Handbook

Buffer location

The most effective location for a buffer is near the source of the noise; the next best location is near the recipient. The closer the buffer is located to the noise source the better. The buffer should be preferably within 50 feet in each case. Buffers located near the recipient are minimally effective when they are greater than 200 feet from the source.

Buffer density

The noise buffer must completely block the line of sight. If any light can be seen through the buffer, it is providing no appreciable noise reduction. When only trees and shrubs are used for the buffer, this means the planting must be at least 100 feet wide with evergreen species for year around reduction. Even with wide and dense vegetative buffers noise reduction above 3 to 5 dBA is not likely.

To achieve a 10 dBA reduction (one half the noise level) either a very wide dense tree planting or including a solid barrier is necessary. Solid barriers can be either an earthen berm or a solid wall or fence. If a berm is utilized trees and shrubs should be planted on top and near the recipient. Planting on top of the berm creates a relative increase in height of the trees with respect to the recipient. Solid barriers also reflect sound back toward the source. If this is an issue, a row of shrubs can be planted near the solid barrier on the source side. If a solid wall is constructed the least effective location is within the tree planting and the most effective location is near the source.

A single row of trees will not provide noticeable noise reduction. At best they will provide a visual screen between residents and the noise source.

USDA National Agroforestry Center file photo.

A newly planted noise and visual barrier consisting of multiple rows of evergreen trees and close to the source of the undesirable road noise. Also note the slower speed limit that also reduces noise creation.

USDA National Agroforestry Center file photo.

Buffer length

Since sound refracts around the ends of a barrier or buffer the overall length is very important. The necessary length is best described with respect to the distance between the recipient, or the area for which the noise reduction is desired, and the buffer. The buffer should extend in either direction at least four times the distance between the recipient and the buffer. For example, if a 60-foot-wide house is located 75 feet from the buffer, the recommend buffer length is 660 feet ([4 feet × 75 feet left] + [4 feet × 75 feet right] + [60 feet house width] = 660 feet). If space does not allow for the recommended buffer length, some additional advantage can be gained by curving the ends of the buffer inward.

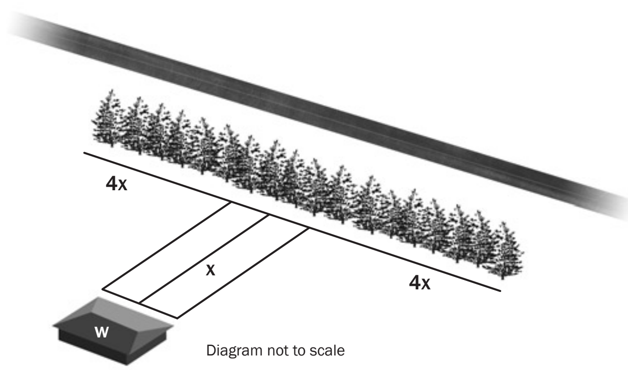

Diagram not to scale

Buffer height

Keep in mind, the relative height of the recipient location to the noise source will impact the buffer design. If noise reduction is desired for a two-story house, then the buffer must completely block the line of sight from the house roof to the noise source, commonly the street or highway.

Considerations

- *Cost and availability of materials:* The cost of trees and shrubs must be balanced against the cost of constructing an alternative structural barrier such as a wall or earthen mound.
- *Urgency of the situation:* Man-made landforms can be constructed rather quickly, whereas the time required to develop a tree and shrub buffer, capable of providing substantial noise protection, may take several years.
- *Aesthetics:* Certain situations are not compatible with a sterile-looking fence. Combining trees and shrubs with the structure will improve overall aesthetics and provide a softer profile increasing noise protection for the long term.
- *Safety and conflict:* Avoid planting under or over utilities, on rights-of-ways, and too close to sidewalks. Think safety to maintain visibility for pedestrians and traffic.
- *Traffic noise:* Traffic noise is a combination of the volume, speed, and number of trucks in the flow of traffic. Generally speaking 2,000 vehicles per hour is twice as loud as 200 vehicles per hour; 65 mph traffic is twice as loud as 30 mph traffic; one truck at 55 mph is twice as loud as ten cars at 55 mph.

Additional benefits and uses

Noise buffers can be designed for multiple uses and to produce a variety of products. For example, a noise buffer oriented properly may also serve as a windbreak. When the design includes a diverse mixture of native plants and physical structure, a noise buffer can also provide food, cover, and travel corridors for wildlife. Finally, individual plant species can also be incorporated for other products like fruits, nuts, or decorative florals.

Conclusion

Where noise is a problem and where a natural environment is sought, trees, shrubs, and other vegetation can offer more than just a psychological advantage gained by screening the view of the noise source. Anticipating a noise problem and employing vegetative noise buffers is an opportunity to act, rather than react.

Additional information

Suburban Noise Control with Plant Materials and Solid Barriers, David I. Cook and David F. Van Haverbeke, USDA Forest Service, Rocky Mountain Research Station, Research Bulletin EM100, 1977

Tree-Covered Land-Forms for Noise Control, David I. Cook and David F. Van Haverbeke, USDA Forest Service, Rocky Mountain Research Station, Research Bulletin 263, 1974

FHWA Highway Noise Barrier Design Handbook, U.S. Department of Transportation, Research and Special Programs Administration, John A. Volpe National Transportation Systems Center (Volpe Center), Acoustics Facility, in support of the Federal Highway Administration (FHWA), Office of Natural Environment, *wwwcf.fhwa.dot.gov/environment/noise/table.htm*

Keeping the Noise Down-Highway Traffic Noise Barriers, Federal Highway Administration Washington, DC 20590, *www.fhwa.dot.gov/environment/keepdown.htm*

This Quiet House-Noise Control for the Home, James P. Cowan, *www.nonoise.org/library/qz7/HomeNoiseControl.pdf*

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