

**“Vegetative Environmental Buffers”**

United States Department of Agriculture  
Natural Resources Conservation Service

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**INTRODUCTION**

The Delmarva Peninsula is home to one of the country’s highest concentrations of poultry farms. The 2007 National Agricultural Statistical Service placed poultry and egg production as the most valued commodity in Virginia (\$971 million). In Accomack County alone, there are 38 million broilers and other meat type chickens sold each year. Each farm houses approximately 25,000 birds per poultry house, and many farms have multiple houses. Poultry houses generate particulates (dust, bits of feathers, bedding, and manure), ammonia, and other odors that are expelled from the houses by the ventilation system. Particulates have been linked to respiratory effects in poultry workers, and can be a source of complaints from neighbors who live near poultry farms. Ammonia emitted from poultry houses has been linked to degradation of air and water quality in the Chesapeake Bay.

Trees, shrubs and grasses can be planted around poultry houses to provide shelter from winter winds; reduce particulates, ammonia, and other odors from ventilation fans; create visual screens; and provide shade to reduce extreme summer heat. Tall, stiff-stemmed warm-season grasses can be planted near

poultry house ventilation fans to help trap particulates, reduce the dispersal of ammonia and other odors, and also serve as visual screens. Warm-season grasses are more tolerant of heat and drying winds than tree/shrub barriers, and can be planted alone, or in front of trees and shrubs to provide an initial filter for fan emissions, slowing wind speed and providing shelter for the subsequent rows of shrubs and trees.

### **SITE PREPARATION**

Site conditions, including soil quality and the type and density of existing vegetation, will determine how much site preparation you will need to do before planting. Soil may be heavily compacted or contaminated with construction debris, gravel, and other fill material around buildings and other structures that can severely hinder plant rooting and survival. If existing grasses or weeds are tall, you should burn or mow the planting strips in late summer (August/September) then apply the appropriate rate of glyphosate after vegetation has approximately 4 to 6 inches of regrowth. Trees, shrubs and grasses that are planted into a competition controlled site are more likely to establish roots faster and survive than ones that are planted into a poorly prepared site with no competition control.

### **PLANTING DESIGN**

Every poultry house will differ as to the location of ventilation fans, access roads, drainage ditches, etc., so each planting design will need to accommodate these features. Always check for utility lines (gas, water, cable, electricity) before planting. Avoid planting on top of buried utility lines, or under low-hanging overhead lines. Where vehicle access is needed, locate the hedgerow a minimum of 50 feet from the sidewall and 80 feet from the end of the house. If the house does not have tunnel ventilation and has a south or west exposure, the minimum setback is 100 feet to provide for air movement. The length of the rows should extend an additional 20 feet from the beginning and end of the ventilation fans. For example, if the total width of multiple fans is 40 feet, then the total length of the warm-season grass rows would be 80 feet (20 + 40 + 20).

**Tree/Shrub:** For tree and shrub survival in fan impact areas, the nearest row of tree/shrub plantings must be set back from the fans by a distance that is at least 10 times the exhaust fan diameter. (For example, if the ventilation fan has a diameter of 4 feet, then the first line of plants needs to be planted at least 40 feet away.) In those cases where multiple fans are used in one location, this planting distance formula may be increased a minimum of 5 feet for each fan, depending on the number of fans that are likely to be running at the same time (e.g., bank of two 4-ft. diameter fans may need a 50-foot setback, four fans may need a 60-foot setback, etc.). Use at least two rows of trees and/or shrubs in the planting (see Table 1 for detailed spacing information) and select deciduous trees/shrubs or a waxy-leaf evergreen shrub, such as an evergreen holly (*Ilex* sp.) for the first row (closest to the fans). The second row of woody plants should be evergreen or deciduous trees that are tolerant of ammonia and particulates vented from ventilation fans. Container plants (1 to 2 gallon) are recommended because they generally have better survival rates in fan impact areas than seedlings or balled-and-burlapped plants. Containerized and balled-and-burlapped plants are usually available throughout the year. Use the plant spacing needed to accommodate mowing equipment for hedgerows that will be maintained with mowing. Consider using at least two rows of warm-season grasses in front of the tree/shrub planting to provide an initial filter for fan emissions, slowing wind speed and providing shelter for the subsequent rows of shrubs and trees.

**Table 1: Recommended Spacing of Trees and Shrubs within and between Rows <sup>1</sup>**

Plant Type	Spacing (feet) Within Rows:		Spacing (feet) Between Rows
	Single Row	Multiple Rows	
Small Shrubs (4 – 12 feet tall)	2 - 4	4 - 6	10 - 15
Large Shrubs and Small Deciduous Trees (12 – 30 feet tall)	6 - 8	8 - 10	10 - 20
Large Deciduous Trees (more than 30 feet tall)	10 - 12	12 - 14	15 - 20
Evergreen Trees (columnar form)	6 - 8	8 - 10	10 - 20
Evergreen Trees (conical and broad forms)	8 - 10	10 - 14	15 - 20

**Note:**

<sup>1</sup> Select tree spacing at or near the lower end of the range to create a dense barrier in a shorter period of time. Spacing between rows shall be at least four feet wider than the mechanized maintenance equipment used, and may be increased beyond what is shown in this table to accommodate the equipment.

**Table 2. Recommended Trees and Shrubs for Odor Control and Screening around Poultry Houses**

Plant Names	Height at 20 Years	Growth Rate <sup>1</sup>	Density <sup>2</sup> - Summer	Density - Winter	Remarks
<b>DECIDUOUS TREES</b>					
CYPRESS, BALD <i>Taxodium distichum</i>	30 ft.	Fast	Medium to High	Low	Naturally occurring on streambanks and in swamps.
HAZELNUT <i>Corylus americana</i>	20 ft.	Moderate	Low to Medium	Low	Native shrub/small tree. Resistant to most diseases and pests. Monoecious flowers (needs male and female plants to produce nuts).
HONEYLOCUST <i>Gleditsia triacanthos</i> var. <i>inermis</i>	40 ft.	Fast	Low to Medium	Very Low	Proven effective for odor control (passive ammonia absorption). Can be planted near poultry house ventilation fans.
POPLAR, HYBRID <i>Populus deltoides x nigra</i> (var. 'Spike')	40 ft.	Fast	Medium	Low	Sterile hybrid. Proven effective for odor control (passive ammonia absorption). Can be planted near poultry house ventilation fans.
WILLOW, 'AUSTREE' HYBRID <i>Salix matsudana x alba</i>	60 ft.	Very Fast	Medium to High	Low	Sterile hybrid. Due to its extremely fast growth (>3 ft/yr), can provide visual screen in 1 – 2 years. Proven effective for odor control (passive ammonia absorption). Can be planted near poultry house ventilation fans.
WILLOW, PURPLEOSIER 'STREAMCO' <i>Salix purpurea</i>	20 ft.	Fast	Medium to High	Low	Non-invasive shrub/small tree. 'Streamco' is a male clone, does not root sucker, and does not spread readily beyond the planting site. Proven effective for odor control (passive ammonia absorption). Can be planted near poultry house ventilation fans.

Plant Names	Height at 20 Years	Growth Rate <sup>1</sup>	Density <sup>2</sup> - Summer	Density - Winter	Remarks
<b>EVERGREEN TREES</b>					
ARBORVITAE <i>Thuja occidentalis</i>	25 ft.	Slow	Very High	Very High	Frequently planted statewide as an ornamental. Prefers moist, well-drained soil, but tolerates a wide range of conditions. Prone to bagworms. Can be planted near poultry house ventilation fans.
ARBORVITAE, 'GREEN GIANT' <i>Thuja plicata x standishii</i>	40 ft.	Fast	Very High	Very High	Prefers well-drained soil, but tolerates a wide range of conditions. No serious pest or disease problems. Proven effective for odor control (passive ammonia absorption). Can be planted near poultry house ventilation fans.
CEDAR, EASTERN RED <i>Juniperus virginiana</i>	20 ft.	Moderate	Very High	Very High	Should not be planted near apple orchards; alternate host of cedar-apple rust. Proven effective for odor control (passive ammonia absorption). Can be planted near poultry house ventilation fans.
CYPRESS, LEYLAND <i>X Cupressocyparis leylandii</i>	40 ft.	Very Fast	Very High	Very High	This is a hybrid of <i>Cupressus macrocarpa</i> and <i>Chamaecyparis nootkatensis</i> . Adaptable to adverse sites; growth is best on good sites. Prone to bagworms, canker, and windthrow. Use in multiple-row plantings to minimize windthrow. Proven effective for odor control (passive ammonia absorption). Can be planted near poultry house ventilation fans. 'Green Giant' arborvitae is the preferred alternative to Leyland cypress.
HOLLY, AMERICAN <i>Ilex opaca</i>	20 ft.	Slow	High	High	Need male and female plants for fruit production. Shade tolerant. Can be planted near poultry house ventilation fans, but is very slow-growing. May be suitable for use in Row 1 to reduce wind velocity from fans, but should be backed by a fine-leaved evergreen to trap particulates. Proven effective for odor control (passive ammonia absorption).
JUNIPER, CHINESE <i>Juniperus chinensis</i>	30 ft.	Slow	High	High	Height varies with cultivar. Cultivars with similar shapes and heights include Hetzii, Hetzii columnaris, Pyramidalis, Fairview, Keteleen, Mountbatten, Spartan, Torulosa, (Hollywood juniper) and Robusta Green. In cool, wet springs, Chinese juniper is susceptible to blights that can cause severe damage.,
SPRUCE, NORWAY <i>Picea abies</i>	35 ft.	Fast	High	High	Fast growth rate when young, slows down with age. Prefers moderately moist, well-drained soil. Proven effective for odor control (passive ammonia absorption). Can be planted near poultry house ventilation fans.
<b>SHRUBS</b>					
ABELIA, GLOSSY <i>Abelia x grandiflora</i>	6 ft.	Fast	High	Moderate	Semi-evergreen foliage. No serious pests or diseases. Stems may be killed to the ground in cold winters.
BAYBERRY, NORTHERN <i>Morella pensylvanica</i> (formerly <i>Myrica pensylvanica</i> )	10 ft.	Moderate	Medium	Low	Need male and female plants for fruit production. Salt tolerant (0-20 ppt.) Suckers to form colonies. Can be planted near poultry house ventilation fans.
EUONYMUS, MANHATTAN <i>Euonymus kiautschovicus</i>	6 ft.	Moderate	High	Medium	Semi-evergreen foliage that may be damaged in cold winters. Not as susceptible to scale as other Euonymus.

Plant Names	Height at 20 Years	Growth Rate <sup>1</sup>	Density <sup>2</sup> - Summer	Density - Winter	Remarks
HOLLY, JAPANESE <i>Ilex crenata</i> (var. 'Steeds')	8 ft.	Fast	High	High	Evergreen. Need male and female plants for fruit production. Tolerates partial shade. Excellent for high pollutant areas; can be planted near poultry house ventilation fans. Proven effective for odor control (passive ammonia absorption).
HOLLY, 'NELLIE STEVENS' <i>Ilex cornuta x aquifolium</i> (var. 'Nellie Stevens')	15 ft.	Fast	High	High	Evergreen. Need male and female plants for fruit production. Tolerates partial shade. Can be planted near poultry house ventilation fans. Proven effective for odor control (passive ammonia absorption).
WAXMYRTLE, SOUTHERN <i>Myrica cerifera</i>	10 ft.	Moderate	Medium	Medium	Evergreen. Need male and female plants for fruit production. Salt tolerant (0-10 ppt). Can be planted near poultry house ventilation fans.

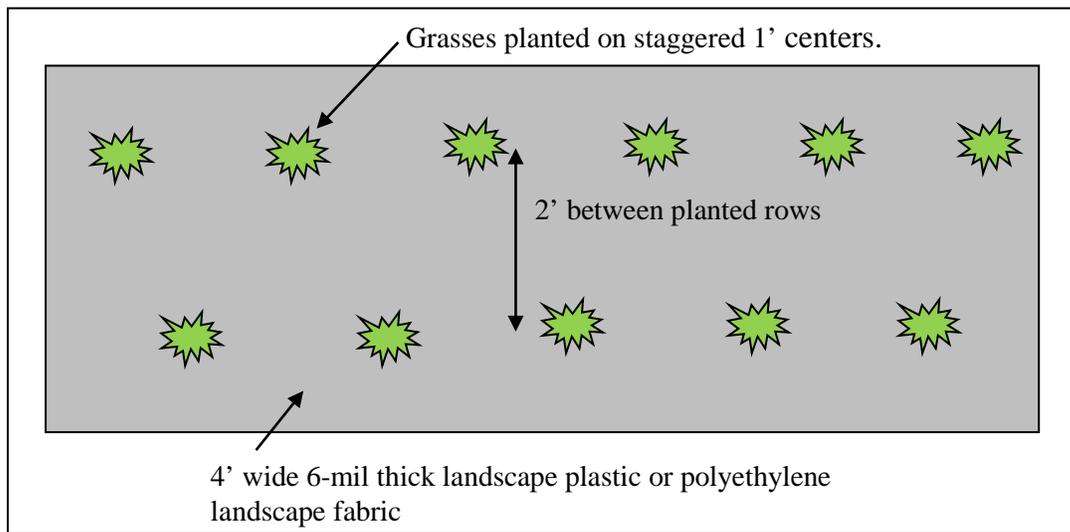
**Notes:**

<sup>1</sup> **Growth Rate:** Slow = less than 1 ft/year; Moderate = 1–2 ft/year; Fast = 2-3 ft/year; Very Fast = more than 3 ft/year.

<sup>2</sup> **Density:** For an individual plant species, defined as the amount of space that is occupied by foliage, twigs, and branches, and can be estimated by the amount of light that can be seen through the plant. Low density – 25-35% of space occupied by plant material (with 65-75% open space through which air can travel); Medium density – 40-60% of space occupied by plant material; High density - 60-80% of space occupied by plant material; Very High – more than 80% of space occupied by plant material. The overall density of a hedgerow is affected by the species selected, number of rows, and spacing between plants.

**Grasses:** Native warm season grasses can be used in combination with trees/shrubs or alone to effectively trap particulates and absorb ammonia. They should be planted as close as possible to the ventilation fans, but no closer than 20 feet. Due to the typically small size of the “Vegetative Environmental Buffers”, native warm season grass plugs that have well-developed root systems can be used (1-quart containerized stock can be substituted where available). Plants of this size will be able to survive better in the harsh conditions near the ventilation fans than smaller seedlings. Use a minimum of two rows of grasses (if planted alone), or where space allows, use one or more rows of grasses in front of one or more rows of shrubs/trees. Plant the grass plugs 1’ foot apart (2’ feet apart if using containerized stock) on center within rows and 2’ between rows, with a staggered planting arrangement between rows (see Figure 1). It also is advisable to use more than one species or variety of grass so that a single insect or plant pathogen won’t devastate the entire planting. Native warm season grass plugs/containerized stock are usually available throughout the year, but may be in short supply after summer.

**Figure 1. Recommended Warm Season Grass plug spacing**



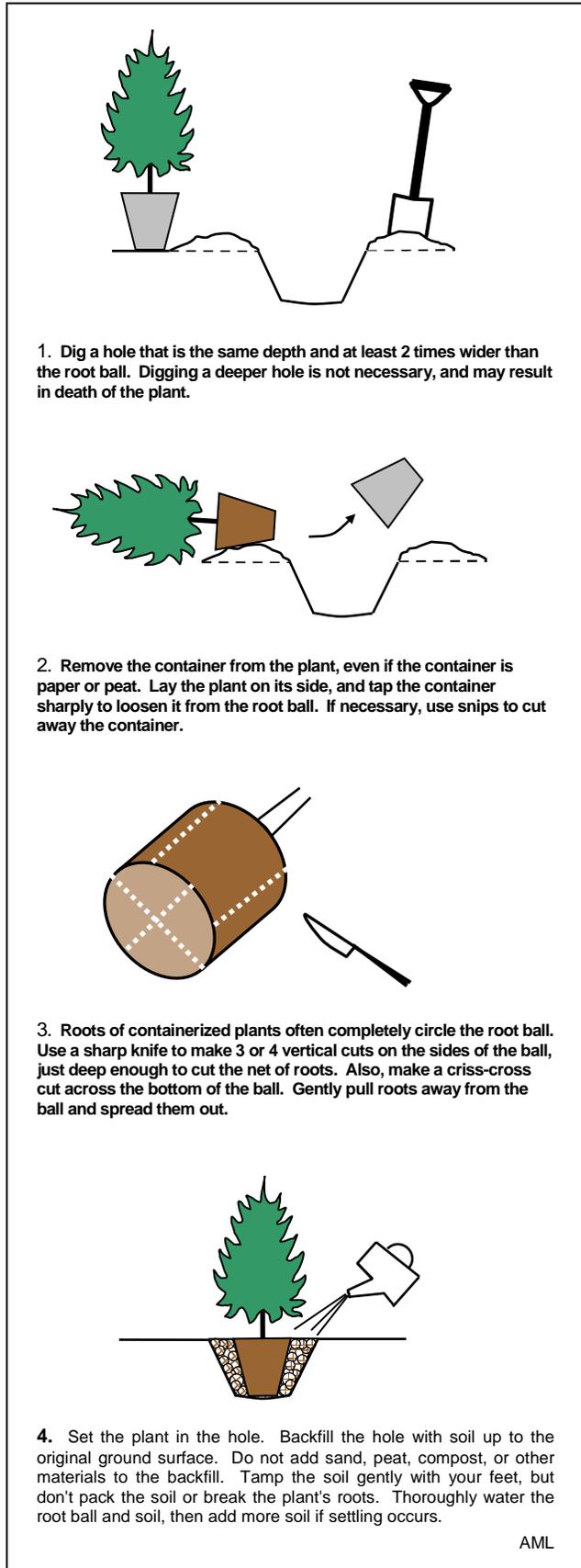
**Table 2. Recommended Warm Season Grasses for Planting near Poultry House Ventilation Fans**

Common Name	Scientific Name	Cultivar	Mature Size (width x height)	Remarks
Coastal Panicgrass	<i>Panicum amarum</i> var. <i>amarulum</i>	'Atlantic' or 'Dewey Blue'	3' x 6'	Quickest to establish, but not as stiff-stemmed as others on this list. 'Dewey Blue' has especially attractive bluish leaves.
Switchgrass	<i>Panicum virgatum</i>	'Kanlow'	5' x 6'	Vigorous lowland switchgrass, typically used for biofuel production. Especially good for moist soils.
Switchgrass	<i>Panicum virgatum</i>	'Northwind'	2' x 6'	Does not spread as much as other cultivars. Useful for planting closest to the ventilation fans if space is limited.
Switchgrass	<i>Panicum virgatum</i>	'Thundercloud'	4' x 8'	Tallest cultivar on this list. If using multiple rows, can be planted downwind of shorter plants. Also can be placed at greater distances from ventilation fans due to taller height.



### **PLANTING DATES AND TECHNIQUES**

**Trees/Shrubs:** The preferred planting time for trees and shrubs are in the fall or early spring. Do not plant during the summer months when high temperatures and lack of rainfall will make survival very difficult or in the winter if the ground is frozen. Containerized and balled-and-burlapped stock can be stored for extended periods if they are protected. Store the plants in partial to full shade and water as needed to keep moist. Lift and carry the plant by the container or rootball, never by the branches or trunk. These tree/shrub plant materials can be planted either by hand or by machine, depending on site conditions and available equipment. Larger stock is typically used when it is not feasible to wait for smaller plants to reach a desired size (such as for landscaping, visual screens, or particulate barriers). Because larger stock is more difficult for most people to handle, installation by a professional landscaping contractor is recommended. See Figure 2 for instructions on hand planting smaller containerized stock.



**Figure 2. Hand planting containerized trees**

Instructions for hand planting balled-and-burlapped plants are essentially the same as for planting containerized stock. Prepare a planting hole, and gently set the plant in the hole. Cut away any wire or twine from around the trunk. If the root ball is contained in a wire basket, some nurseries and arborists recommend leaving it on, while others say it should be removed. Most experts recommend cutting and removing as much of the wire basket as possible, provided you can do so without breaking up the root ball. Avoid buying plants that have a plastic liner, because the liner must be removed and you will probably have to remove the basket to reach it. For very large trees, it is best to leave the basket in place if there is no liner. Just remove any wire from around the trunk. Improper removal of a wire basket can result in serious damage to the root system that may outweigh any benefits derived from removal of the basket. For burlap-wrapped plants, remove natural burlap and fasteners from at least the top half of the root ball, again being careful not to damage the roots. Avoid purchasing plants wrapped in plastic or synthetic fabrics. These must be completely removed because they can severely restrict the roots if left in place. Trees may need to be staked if they have dense crowns, are more than 5 feet tall, have slender stems or will be planted in windy locations. Use guy lines that won't damage the bark. Leave some slack in the lines so that trees will have slight amount of flex and remove all stakes and guying materials after one year.

On well-drained loamy soils, new plantings usually need at least 1 inch of water per week from rainfall or irrigation in summer and fall. On sandy soils, plants may need at least 2 inches of water per week, preferably in two separate 1 inch waterings. On heavier soils or wet sites, plants may need less water. Watering should be sufficient to moisten the soil to the depth of the root ball — usually 1 to 2 feet deep. If irrigation is desired, use ½-inch polypropylene with ½-gallon per hour emitters placed every 12 – 18 inches between rows of grasses. Be careful where you tap into your water system. Many integrators meter the water consumption for each poultry house.

**Grasses:** The preferred planting times for native warm season grass plugs and containerized stock are in April and May, but the grasses can also be planted during the summer months **IF** irrigation will be used. Planting during the dormant period (winter and early spring) is also an option if plants are available and the ground is not frozen. Native warm season grass plugs should be planted as soon as possible after receiving the plants and are usually planted by hand. Containerized stock can be stored in partial to full shade for extended periods if the plants are protected from harsh conditions and watered as needed to keep moist. Installation of a trickle or emitter irrigation system is highly recommended for all summer plantings. The feasibility of watering will depend on the size and location of the planting, availability of a water source, watering equipment, etc. On well-drained loamy soils, new plantings usually need at least ½-inch of water per week from rainfall or irrigation in late spring and summer. On sandy soils, plants may need at least 1 inch of water per week, preferably in two separate ½-inch waterings. On heavier soils or wet sites, plants may need less water. Watering should be sufficient to moisten the soil to the depth of the roots – at least 1 foot deep. (Note: Roots will be much deeper once plants are established.) If irrigation is desired, use ½-inch polypropylene with ½-gallon per hour emitters placed every 12 – 18 inches between rows of grasses. Warm-season grasses are more tolerant of drought and harsh conditions than cool-season grasses or most trees/shrubs, but sufficient moisture during the establishment period is important for plant survival, growth, and overall plant health. New plantings will become established more quickly when watered as needed.

## **SUPPLEMENTAL PRACTICES**

Weed control is extremely important to the establishment and longevity of all plantings. Control weeds around plants using power tools, hand pulling or treating with an appropriate herbicide. Pre- and post-emergent herbicides may also be used if weeds are abundant. Herbicides can be spot-sprayed around plantings or applied to the planting strip. Do not apply herbicides when ventilation fans are active or on windy days because spray drift can damage nearby plantings. The use of plastic landscape fabric or black polyethylene (6 mil) is highly recommended to provide an effective, long-lasting weed barrier. Black polyethylene is generally cheaper than landscape fabric and works well **IF** trickle or emitter irrigation is also implemented. If no irrigation is planned, select the plastic landscape fabric. Mulch can also be used around the plants, but will not provide long-term weed control unless more mulch is periodically added. If using mulch, spread a layer of well-aged bark mulch (shredded, chipped, or nuggets) 2 to 3 inches thick around new plantings. A minimum 3-foot diameter circle of mulch is recommended around each plant. Adding sand, peat, compost, or other materials to a planting hole is generally not recommended unless the soil is excessively compacted or otherwise has very poor quality.

Newly planted trees, shrubs and native grasses should not be limed and fertilized, unless soil tests show that pH and nutrients are extremely low. For most sites, it's best to allow the root systems of new plantings to become established before applying lime and fertilizer. The warm-season grasses recommended are tolerant of poor soil conditions and can usually be planted in natural soil without soil amendments. If soil amendments are needed, the best approach is to rip or deep-till a wide planting strip and add the materials to the entire strip. If this is not feasible, then dig a wide planting hole (at least 2 or 3 times the diameter of the root ball), and mix the excavated material with the soil amendments.

## **BUFFER MAINTENANCE**

Continue to water plants, as needed. It can take up to 5 years before a tree or shrub develops a root system extensive enough to sustain itself, especially in harsh conditions. Sufficient moisture during this period is important for plant survival and overall plant health. Weed control is extremely important to the establishment and longevity of hedgerows. Always avoid damaging the plantings during weeding and herbicide application. If using mulch around plants, do not exceed a total thickness of 3 inches (new mulch, plus any remaining old mulch). Replace any dead plants until the barrier is functional. Maintenance mowing should be done with extreme caution to avoid damaging the stems or bark of plantings. By the third year, the warm season grasses and trees/shrubs should be well-established. If weed mat is used for weed control, the openings will need to be enlarged as the grasses grow so that the mat does not constrict growth. The weed mat should be removed after 3 growing seasons. After the grasses have gone dormant, as early as October and as late as mid-April, cut or mow stalks to about 6 inches from ground level. Some farmers have used the cut stalks of the grasses for duck blinds, and there is great potential for use of the stalks for biofuels.

For hedgerows that are planted to reduce particulates from ventilation fans, a build-up of particulates on leaves may threaten to smother and kill the plants. If feasible, periodically remove the accumulated particulate matter from the leaves by hosing the plants with water. Excessive accumulation of particulates may require installation of additional barriers such as fencing or netting to protect the plants. Unlike dust, particulates from chick down and feathers do not wash off easily, so the planting distance and type of plant materials opposite fans is critical.

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