

VEB TOOL-KIT

*A Guide to Vegetative Environmental Buffers for
Tunnel-Ventilated Poultry Houses*



Delmarva Poultry Industry, Inc.



ACKNOWLEDGEMENTS

This publication was written and prepared by James D. Scott, Jr. Technical assistance was provided by George W. “Bud” Malone, Extension Poultry Specialist, University of Delaware.

The guidance of the following VEB Committee members is gratefully acknowledged:

George W. “Bud” Malone (University of Delaware)
Roger Marino (Mountaire Farms)
Bill Massey (Mountaire Farms)
Dan Rider (Maryland Forest Service)
Austin Short (Delaware Forest Service)
Dr. Bob L. Tjaden (University of Maryland)
Jay Windsor (retired, University of Delaware)
Bill Satterfield (Delmarva Poultry Industry, Inc.)

This publication was funded in part by a grant from the USDA, Natural Resources Conservation Service.

*Published by Delmarva Poultry Industry, Inc.
Georgetown, Delaware
June 2007*

Contents

- Introduction..... 2
- 1. What is a VEB? 3
- 2. Designing Your Buffer..... 6
- 3. Plant Selection 12
- 4. Installing Your Buffer 17
- 5. Irrigation & Water Management..... 19
- 6. Weed Control 21
- 7. Buffer Care & Maintenance 23
- 8. Funding Your Buffer 25
- 9. Finding Help..... 29

APPENDIX

- A. Suitable Plants for Poultry Buffers 31
- B. Sources for Plant Stock..... 36
- C. Useful Contacts..... 39
- D. Further Information 42

Introduction

Welcome to the VEB TOOL-KIT. This publication is designed to help guide you through the process of planning, installing, and maintaining a Vegetative Environmental Buffer (VEB) for your tunnel-ventilated poultry operation.

Starting a buffer project can be quite overwhelming. It is hoped that this guide will clarify the fundamentals necessary to succeed. Please note that the information provided is only a starting point and may change as research on this subject evolves and is refined. As with any project, you are strongly advised to seek help in the planning stages for the best results.



The phrase “Vegetative Environmental Buffer” is used throughout this publication to describe a buffering system of trees, shrubs, and potentially other plant materials, installed to address environmental quality concerns. Some agencies refer to the same buffering system as a “windbreak” or “shelterbelt.”

What is a VEB?

The starting point in any undertaking is to define the goals and objectives. When considering a vegetative buffer for your poultry farm it is vital to understand the proper definition of a “Vegetative Environmental Buffer.”

A Vegetative Environmental Buffer, or VEB, is a multiple-row planting of suitable trees and shrubs around poultry houses and any related structures (e.g., manure/composting structures) that is installed and maintained to accomplish four objectives:

- (1) To foster good neighbor relations;
- (2) To maximize environmental stewardship;
- (3) To support biosecurity on the farm;
- (4) To enhance the aesthetic value of the property.

The four underlined parts are extremely important in defining the minimum expectation for a VEB. They must be understood before any planning process begins and are essential to an effective buffer.

First, an effective VEB should be a multiple-row planting, or buffer system of similar scale, consisting of different species of trees and/or shrubs. While a single row of trees may provide a satisfactory visual screen or windbreak, and in some cases may be the only option available, it presents some major limitations. A single row is generally not sufficient to accomplish the four objectives necessary for an effective buffer, especially at the tunnel fan end of a modern poultry house. It also has the drawback of not being able to absorb the loss of trees. In a single row, every lost tree represents a gap in the vegetative buffer. Even replanting with new stock cannot completely replace the lost plant. While not the worst case scenario, it can be an inconvenience and reduce the intended success of your buffer. A properly designed multiple-row planting, however, will meet the needed objectives and also minimize the impact of any tree losses. Yet, if only a single-row buffer can be planted, due to site limitations or other factors, then a single row of trees is better than no buffer at all.

Second, an effective VEB should be composed of suitable trees and shrubs. Not every plant is well-matched to the task of a vegetative buffer around poultry operations. Therefore, plantings must be carefully selected for the particular farm and its specific needs. Conditions around poultry houses, especially near the tunnel fans, are stressful for most trees. Research has shown that many plants popular with homeowners and foresters experience difficulty growing in the tunnel fan area. In addition, other factors such as soil type, drainage, and physical restrictions will impact the suitability of a particular tree or shrub. It is important therefore to select the best plants for the designated area. More information on selecting suitable plants is provided in following chapters.



Keep in mind that every farm will be different. You are reminded to seek help, especially in the initial planning stages.

Third, an effective VEB should be properly installed and maintained. Establishing a vegetative buffer on your farm involves more than merely “planting trees.” Your buffer must be designed carefully, installed competently, and maintained consistently. A vegetative buffer that is correctly planted and well cared for, especially in the first few years, will result in a positive return on your investment. If you are thinking about installing a buffer yourself, you are urged to consider carefully your ability to complete the task in a satisfactory manner. While establishing a buffer is not exactly rocket science, it does require a base of technical knowledge and practical skill to ensure the best long-term results. Most people tend to overestimate their ability or underestimate the commitment required to sufficiently meet the objectives of an effective buffer, both of which lead to less than satisfactory results. Be realistic in your self-assessment. Likewise, the importance of proper maintenance, such as weed control and irrigation, cannot be minimized. Even a perfectly-selected, well-installed buffer is a wasted expense if it dies in a few years. Your VEB is a long-term investment that must be planned and nurtured to avoid disappointment or frustration.

Lastly, an effective VEB should accomplish four objectives. Any planting that does not meet these criteria in some way cannot properly be called a “Vegetative Environmental Buffer.” While many opinions and expectations exist, research and practical experience has shown that buffers which are designed to meet these criteria provide the best outcome. Observing the advice given in this guide should result in a buffer that helps improve water quality, remove carbon from the atmosphere, and mitigate dust, feather, and ammonia emissions. Biosecurity will be supported by providing a physical barrier to capture particulate matter which may carry disease and to control unauthorized traffic around your poultry houses. The added benefits of potential energy savings, increased property value, and a general improvement to the overall appearance of your farm further

encourage proper buffer design. Moreover, as environmental concerns continue to be a priority issue and neighbor pressures increase, a well planned buffer will be a firm foundation from which to address future issues.



A properly planned vegetative buffer is not the “end-all” solution for neighbor and environmental issues. However, it is a piece of the puzzle that will yield tangible benefits over time and will supplement other proactive steps.

Designing Your Buffer

The most critical part of any buffer planting is the planning stage. If a problem exists with this foundational aspect the whole project is in jeopardy. For this reason it cannot be stressed too often that guidance be sought during the initial development of your plan.

As noted earlier, the situation of every poultry operation will be different. No two farms will have the same needs or situation, and thus no two farms can have the same VEB plan. However, there are a few general rules that will help frame the planning process.

To begin, a full assessment of your farm is essential. Some questions which you should consider include:

- ***What specific purposes must my buffer satisfy?*** Beyond the generic functions of a VEB, you must tailor your buffer to serve the particular needs of your farm. In other words, are there any special concerns, such as neighbors in close proximity, unique biosecurity risks, or the presence of environmentally sensitive areas nearby, which should be factored into your buffer design? Both existing and potential problems must be accounted for as you plan.
- ***How are my poultry houses oriented on my property?*** The location of tunnel fans, feed bins, fuel tanks, and the distance from property lines impact the design and flexibility of your buffer plan. The best time to plan a buffer is *before* any poultry house is built. This eliminates the compromises that are required when attempting to fit a VEB onto an existing farm. However, if this is not possible, you must take into account any aspects of orientation that may limit or require adjustment to the design of your buffer.
- ***What are the prevailing winds?*** Prevailing winds affect the transmission of dust, feathers, and odor. These winds are also seasonal in nature and

influence house heating and cooling. On Delmarva, winter prevailing winds are primarily from the north; summer prevailing winds from the south. Your design can compensate for wind effect by adjusting row density and varying plant selection. The buffer side most exposed to winter prevailing winds should be planted more densely. Plants should be able to endure the harsh, often strong, winds of winter and capable of forming a reliable windbreak. The side exposed to summer prevailing winds should be planted more loosely to allow air circulation in the summer months. A combination of deciduous trees planted sparsely may provide the best alternative for this area.

- ***Are there any boundary concerns, company restrictions, or utility issues that might impact or limit my buffer planting?*** In addition to the obvious limitation of property boundaries, other factors such as county setback requirements, public rights-of-way, or tax ditch rules may impose limitations on where a buffer could be installed. Your poultry company also has setback requirements for load-out areas, feed bin access, and along side-walls. Access to fuel tanks will need to be considered as well. Finally, be sure to allow for any utility lines that may interfere with a buffer planting. Aerial lines impose height restrictions on the plants selected, while buried cable or gas lines must be avoided altogether.



Always know the location of utility lines before attempting any installation project. Before digging, be sure to call Miss Utility for your area:

Delaware: 1-800-282-8555

Maryland: 1-800-441-8355

Virginia: 1-800-552-7001

Failure to call could result in service disruption, legal liability, or physical harm.

- ***What are the soil conditions in the planting area?*** Soil texture, soil history, and overall soil quality influence the selection of plants and are critical in determining the overall success of any buffer planting. Most soils around poultry houses are often severely disturbed and may contain extremes between wet and dry conditions. Visual observation is often sufficient to assess the general soil condition, but a proper soil test might be advisable to identify the precise condition of soils in the proposed planting area.

- ***Are there any drainage issues or areas that tend to flood in the projected planting area?*** Some plants thrive in wet conditions, while others cannot tolerate “wet feet.” You should take into consideration the soil-water relationships that exist on your farm. Areas of poor drainage, with frequent standing water or subject to regular flooding, must be identified and planned accordingly.
- ***What plans exist for expanding my poultry operation?*** Since your buffer is a long-term investment, you are well advised to give consideration to future structures which may be built on your farm. It is far better to make allowances for expansion that never comes than to remove previously planted buffer rows to make room for expansion. Likewise, some cost-share programs may impose limits on the removal of buffer plantings during a set time period.
- ***Are there any existing trees or other features that can be incorporated into my plan?*** The landscape around your farm may have existing windrows, forested areas, or physical structures that may be incorporated into your buffer plan. Do not be afraid to use them.
- ***What personal access must be maintained?*** It may seem obvious, but something as simple as your personal access needs might be overlooked in the planning process. Your buffer should be designed with your personal traffic patterns in mind. Efficient access to home, fields, barns, and other structures should be considered. Allowances for equipment width and movement of field implements may also apply.



The best time to plan for a VEB is before construction begins on a poultry house. This allows arrangement of the buffer plantings for maximum benefit, making it an integrated part of the farm and not an afterthought.

Once you have given consideration to these questions, you can turn to the actual design of your buffer. Fundamentally, an effective design should be broken down into two zones. The first zone is the area of direct impact from tunnel fans and adjacent areas affected due to prevailing winds. This is the most critical area for planning since odor, ammonia, dust, and feather loads predominate here. Similarly, the harsh growing

conditions caused by these issues, and the drying effect of forced air, make it an area of special attention for plant selection.

The second zone is the area in the buffer planting other than the tunnel fan area. This zone allows greater flexibility in design and plant selection since there are fewer environmental or plant viability concerns. The presence of sidewall fans may require special consideration, but in most cases a simple windbreak is sufficient to address any concerns, while providing an adequate visual screening effect.

Taking into account the character of these two zones, your buffer plan should incorporate some basic standards. These are given as a guide to help frame your plan. Please be aware that various circumstances may require significant adjustment to fit your farm needs, such as the location of neighboring properties, boundary constraints, and prevailing winds. You must plan for the conditions on EACH exposed side of the poultry houses to be buffered.

Model standards for an effective VEB, allowing for farm-specific modifications, would be as follows:

GENERAL ::

- Minimum 50 feet from the sidewall of poultry house
- Minimum 80 feet for load-out areas

*** As a general rule, the first row of plantings should be no closer than 10x the width of the tunnel fans in feet. This usually corresponds to a minimum of 50 feet. Planting closer than this will drastically reduce the livability of any plant.*



***Be sure to allow for the mature size of your trees.
Always plan with the full diameter in mind.***

ZONE 1 ::

[Fan Impact Area]

- Recommended minimum of three rows, staggered
- Preferred arrangement (from nearest to the fans outward):

Row A = waxy-leaf shrub or deciduous tree/shrub
Row B = deciduous tree (for ammonia and carbon)
Row C = evergreen tree (year-around visual screen)

*** If space is a limiting factor, two rows may be used. The combination of a deciduous tree row closest to the fans and an evergreen tree row on the outside is recommended.*

ZONE 2 ::
[Screen Areas]

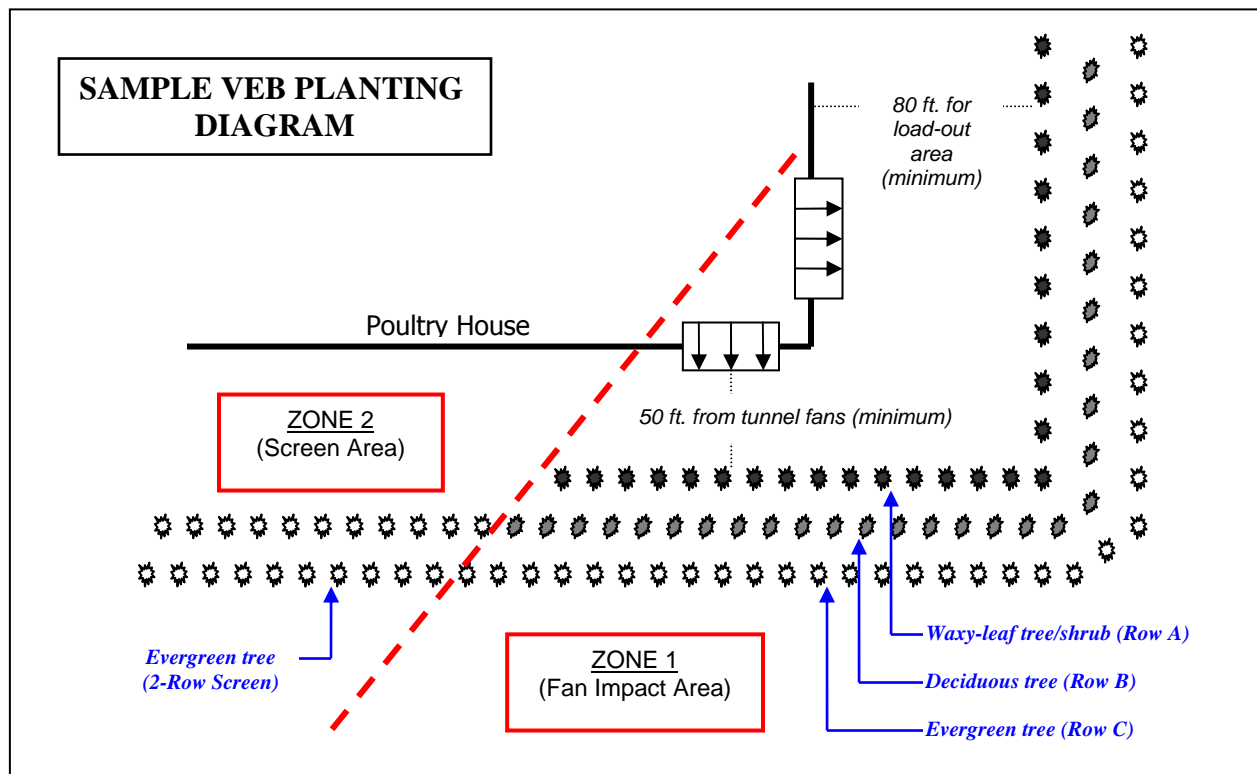
- Recommended minimum of two rows, staggered planting
- Evergreen trees; or combination of windbreak-type trees

*** If a single row is used, an evergreen should be used to provide an adequate visual screen and windbreak.*

- Density of planting should correspond to prevailing winds

N-NW = Tighter density (windbreak for winter)

S-SW/SE = Looser density; or combination planting
(air circulation in summer)



Spacing in and between your rows depends on a number of factors. The particular species of trees or shrubs will dictate the minimum allowable spacing. However, factors such as prevailing winds and the need to move equipment between rows (for mowing, spraying, etc.) may require a greater distance. It should be noted that wider between-row


spacing allows for more surface area to collect and capture particulate matter. A general recommendation for in-row and between-row spacing would be as follows:

Evergreens – Pine/Spruce	8-14 ft. in row*	10-20 ft. Row Width
Evergreens – All Others	6-10 ft. in row*	
Shrubs – Suckering	3-6 ft. in row	
Shrubs – Non Suckering	3-4 ft. in row	
Deciduous Trees – Small (including hybrid willows)	5-8 ft. in row	
Deciduous Trees – Large	8-14 ft. in row	

**Use wider plantings for double, staggered rows; narrower plantings for high-density single rows*

Beyond these basic recommendations, there is a tremendous opportunity for originality. Simply put, there is no single, “best” approach. As long as your buffer meets or exceeds the minimum environmental and technical objectives outlined earlier, it is a legitimate design.

While a multi-row VEB system affords the most straight-forward, proven design, other options exist. For some farms a more ecological approach, such as naturalized plantings rather than delineated rows, or the intentional incorporation of wildlife habitat on adjacent acreage, may have more practical value. Another possibility in the near future might be buffers that integrate sources of biomass which can be harvested for energy production, such as larger-scale plantings of hybrid poplar and willows or switchgrass. In other words, do not be afraid to think out of the box!



Remember to seek help during the planning process to obtain the best possible results.

Plant Selection

Plant selection boils down to choosing “the right plant, for the right place, and the right job.” It involves working with existing site conditions and any specific limitations or necessities identified in the initial planning assessment. Again, the aim is identifying appropriate plants for your buffer needs.

Numerous plant characteristics will play a role in determining which are suitable for your buffer. Growth habit (height, width, branching pattern, etc.), pest resistance, longevity, shade tolerance, invasiveness potential, maintenance requirements, and, ultimately, the ability to “do the job” are among the matters that influence choice of plant materials. Additionally, soil conditions and specific environmental capacity (ammonia tolerance, dust tolerance, etc.) must be factored in the selection process.

In general, certain plant qualities are better able to improve the efficiency and survivability of a buffer. These include:

- ***Maximum vegetative density, especially in the lower canopy.*** The density of the leaf canopy governs the filtering ability of a tree or shrub. Most critical is the density at lower levels, near the ground. Plants with a loose branch arrangement or have a tendency toward a higher crown are less preferred as buffer plants. If used, they must be combined with other plants that offset these deficiencies.
- ***Ability to retain lower branches.*** Some trees, such as loblolly pine, tend to “self-prune” and drop their lower branches as they age. Since an effective filter and visual screen relies on vegetation near ground-level, the capacity to maintain lower branches is an important feature. Trees lacking this ability could be selected, but under-story shrubs will likely be needed to supply lower vegetation as the trees mature.
- ***Complex leaf structure, with waxy or “hairy” surfaces.*** The greater surface area offered by complex leaf structures amplifies a plant’s ability to collect and filter poultry house emissions. Waxy leaves, such as those

found on various hollies, ease the burden of damaging dust build-up on the leaves by allowing the rain to wash off any captured particulates.

- **Stable rooting system.** Some trees are noted for weak root systems and may tilt or topple under wind force. Deep-rooting trees, or trees with a large taproot, are preferred in areas where winds are a significant concern.
- **Wind tolerance.** In addition to tilting and toppling, some trees are prone to breakage. Others cannot endure the drying effect of winds during the first few years after planting. These factors may make a particular tree unsuitable for your situation, or might require relocation of particular plants within your buffer.



Careful consideration should always be given to the potential of any tree or shrub for causing storm-related damage. Trees in particular should be selected so as to avoid the danger of falling on your poultry house. Shallow-rooting trees and trees with greater susceptibility to wind breakage should be avoided on sides where strong winds, including hurricane force winds, are possible. By selecting trees whose mature height is less than their planting distance from your poultry house will help prevent storm-related damage.

- **Low maintenance.** Trees and shrubs should be strong and require minimal care. Plants that are overly sensitive or prone to disease and pest problems are best to be avoided.
- **Medium to fast growth rate.** Plants must also be selected to create an effective buffer in a reasonable period of time. While slower growing plants have a place, they must be balanced with faster growing plants to diminish the delay in forming a functional screen.

On the other hand, you may wish to avoid shrubs or trees with fruit that might attract wild birds. Some species have non-fruiting varieties or separate male plants which may be used instead. Plants with high invasive potential should also be avoided.

It is important to research any potential plant for use in your buffer. Various sources of information can help identify potential benefits and limitations of a particular species. For your convenience, a list of suggested trees and shrubs is given in the Appendix. Even so, many other possibilities exist.

In addition to the species of tree or shrub, you may need to decide what type of planting stock is best for your buffer. If your buffer is installed professionally, either by a landscaper or similar contractor, their preference, company policy, or availability of plant material may determine the type of stock used. If you elect to install plants yourself, then you must decide based on your immediate goals (e.g., how quickly do I need the buffer to reach maturity?), technical ability, financial resources, and availability of plant materials.

There are three types of stock available: bare-root seedlings, containerized plants, and balled-and-burlapped plants. Each has distinct benefits and disadvantages.

- (1) ***Bare-root seedlings*** – This is the most inexpensive option for plant stock; however, it is also more vulnerable to mortality loss. Seedlings can be obtained from many sources, including state forestry nurseries, and are sold with the roots exposed. Great care must be taken in handling the seedlings to avoid drying the roots. Even brief exposure to sunlight or dry, warm air can threaten the seedling. In addition, seedlings are especially vulnerable to weed competition and animal damage. A sound weed control program must be followed, and other precautions may be needed, to prevent less than desired results. Furthermore, since these seedlings are younger than containerized or balled-and-burlapped stock, they will require a longer period of care to ensure proper establishment and a longer growing period before providing an adequate buffering effect.
- (2) ***Containerized plants*** – While more expensive than seedlings, these plants are usually easier to establish and maintain. Excellent survivability is possible with reasonable care. Containerized stock is available through many professional landscapers, larger retail stores, and local private nurseries. Some larger commercial nursery suppliers will also ship containerized plants. Major disadvantages of containerized stock can be cost and availability. This is primarily due to competition with the landscaping market. Plants are commonly sold in 1-gallon or 3-gallon containers—the larger the container, the older and, as you might guess, the larger the plant. While there may be some obvious advantages to selecting the 3-gallon stock, the 1-gallon container is less expensive and often experiences less stress during establishment.



Before purchasing, take time to research the plant. Tips on selecting the best stock can be obtained from your local cooperative extension office or from staff at local nurseries.

- (3) ***Balled-and-burlapped plants*** – Balled-and-burlapped plants, also known as “balled-in-burlap” stock or simply “B & B,” are sold with the roots of the tree and surrounding soil intact. As the name suggests, the soil ball is bound in burlap. This option is normally limited to larger trees and shrubs. While utilizing balled-and-burlapped stock provides the advantage of larger plants from the start, it does come at a higher price. Additionally, larger plants experience a period of shock after transplanting. Depending on the situation, a well maintained planting of containerized stock may be just as effective and neutralize any advantage of using balled-and-burlapped plants.



Be aware that some funding agencies may specify a particular type of stock or plant material as a part of their program requirements. Please clarify any requirements before purchasing plant materials.

Time of the year affects plant selection as well. Certain plants are only available during specific seasons. Similarly, the type of stock will dictate when they can be planted. A typical schedule would be summarized as follows:

Bare-root seedlings Early to mid spring (March-April)
***Seedlings can sometimes be successfully planted in the fall, but it is generally not recommended due to loss potential from a severe winter*

Containerized stock Anytime, except frozen ground
***Containerized stock planted in the summer must be irrigated*

Balled-and-burlapped Best results if planted early to mid-spring

By taking into consideration the seasonal nature of plant availability and installation, you can avoid unnecessary delays or less than satisfactory experience. In the end, preparation is the key.

Finally, you should note that plant selection is more of an art than a science. This is especially true when selecting plants for use around poultry houses. Help in choosing the best plants for your farm and the proper type of stock can be provided through Delmarva Poultry Industry, Inc. (DPI) or your local cooperative extension office. If you are unsure about anything, do not hesitate to seek help.

Installing Your Buffer

Once the design of your buffer has been settled and the plants to be included have been chosen, you can begin focusing on the actual installation process. At this point you must decide on the best method to install the buffer. Once more, each has advantages and disadvantages.

Installation options include:

- (1) ***Self-installation*** – Installing the buffer yourself is an inexpensive approach that can yield great success. However, it could produce less than desired results as well. If you choose this method, the responsibility for acquiring the plant materials and planting them correctly will be yours. Before considering this option, you must realistically consider your ability and willingness to complete the job in a satisfactory manner. Be sure you know what you are doing and that you can set aside the necessary time and effort to complete the job properly.
- (2) ***Professional installation*** – The use of a landscape contractor to install your buffer costs more, but it will eliminate the hassle of doing the work yourself. In the long-run this route may be the best choice since the plants will be given the “expert” treatment they need to thrive. Professional landscapers have the equipment, experience, and employee resources to properly install your buffer in a timely manner. Additionally, some contractors may provide a guarantee for their work and make arrangements for replacing any mortality loss. For most poultry growers, this will be the best method for installation.
- (3) ***Forestry installation*** – Your state forestry office might be able to help acquire trees and identify larger-scale planting options. These generally will be bare-root seedlings and routinely involve native plants. If you anticipate larger-scale plantings, or buffer systems that incorporate certain types of wildlife conservation funding, this may be a feasible alternative. Please

contact your local forestry office for further information or to discuss available options.

As mentioned earlier, time of installation will vary depending on the plant species and the type of planting stock (bare-root, containerized, or balled-and-burlapped). In addition, weather conditions, the availability of plant materials, the schedule of the installer, and access to funding may impact the time frame for installation of your buffer. Please plan for these circumstances.

When arranging for the installation of your buffer, it may be helpful to remember that the entire plan does not need to be completed at one time. It may be more feasible (practically and financially) to break the plan into phases or stages that can be completed on a more manageable scale. Of course, the danger lies in not completing the entire project. Whether done in phases, or all at once, your commitment must be to see the plan through to completion.

Irrigation & Water Management

Young trees and shrubs need a regular supply of water, especially during the first couple of years after planting. An interruption of water supply during this period can severely impair the establishment of your buffer and lead to plant mortality. In short, you run the risk of losing your entire investment. Once established, however, most plants can tolerate some water deficiency.

Since drought conditions are a reality on Delmarva, some form of irrigation is highly recommended. Certainly it is possible to establish a buffer without supplemental watering; however, experience has shown that more effective results are obtained with some form of reliable irrigation. In fact some trees can double in size during early establishment if irrigated on a regular basis. Thus, you should plan for some sort of irrigation during the first year at an absolute minimum, and for 2 to 3 years ideally.

Irrigating your buffer can be accomplished in various ways. Driplines with emitters provide the most efficient form of irrigation. While minimally adding to the cost of installation, driplines ensure a consistent, measured supply of water to each plant. An automatic timer may also be a wise investment. It allows for a “hands-off” approach that eliminates the need for you to have the added burden of managing the irrigation.

Of course, manual watering works when faithfully applied. Be realistic, however. Watering an entire buffer requires consistency and a considerable time commitment. Once a scheduled watering is missed, trying to compensate by adding more water later will not help. It will likely compound the problem.



The use of a drip irrigation system is strongly encouraged for best results.

A specific irrigation management plan is essential for your buffer. The exact details will depend upon the plants selected and existing soil conditions. An experienced landscape professional or your local cooperative extension office can assist with your particular situation.

Weed Control

After drought, the greatest threat to a successful buffer planting is weed competition. Weeds are undesired plants that compete for light, water, and nutrients. Until a tree or shrub is established it is highly susceptible to weed pressure. Therefore, attention must be given to managing weeds around plantings and in between rows.

An effective weed management strategy begins with site preparation. This may be as simple as thoroughly tilling the soil or using an appropriate broad-spectrum herbicide prior to planting. If your buffer will be installed professionally, the installer should take care of the site preparation. Otherwise, be sure to seek advice on the best method for your particular situation.

A strategy for long-term weed control must also be a part of your buffer plan. Three alternatives are available for weed control:

- ***Chemical control*** – The use of various herbicides to control weeds around trees is an effective management tool, provided that the proper herbicide is selected and all label instructions are followed. Still, it is important to note that just because a chemical is effective in killing weeds, does not mean that it is appropriate for every circumstance. Not all herbicides can be used with buffer plantings, and some cannot be used in mixed plantings (i.e., for both deciduous and evergreen trees/shrubs). Contact with the leaves or green, immature bark could result in severe damage or even cause premature death with the use of certain herbicides. Always seek advice on which herbicide and application procedure are best suited to your needs



Before attempting to apply any chemical herbicide, please be sure that you are in compliance with all state pesticide licensing requirements and have completely read the pesticide label.

- ***Mechanical control*** – Cutting weeds with a rotary blade mower or string trimmer is probably the most common method of mechanical weed control. Admittedly, it is a cost-effective approach that avoids the environmental concerns posed by using herbicides. However, and this is a big HOWEVER, mowing is also a major cause of tree loss in buffer plantings. Small seedlings are especially vulnerable to being cut off, while larger plants may be “whipped” to death by a string trimmer. Extreme care must be taken when mowing around trees or shrubs. For this reason, it is *not* recommended for most farms that mowing be the primary weed control strategy within buffers rows.



Mowers and buffer plantings do not mix very well. Please use extreme caution when attempting to mow around buffer plantings!

- ***Mulch*** – Including some sort of mulch around your plants offers a no-hassle, environmentally-friendly means of weed management, and is strongly recommended. Mulches can consist of natural materials (wood chips, shredded bark, etc.), specially designed weed-suppressing fabrics, or some form of black plastic (polyethylene, polypropylene, etc.). From a practical standpoint mulch should cover an area of 2-3 feet from the base of each plant. A minimum 48-inch (4 Ft.) wide roll of black plastic or landscape fabric run the entire length of the row provides an exceptional, easily-maintained weed barrier. An additional benefit of using black plastic or landscape fabric is the improvement of plant growth by helping moderate soil temperatures and conserving water loss. During the establishment phase, trees can experience significant growth advantage when compared with trees planted without plastic mulch.

Buffer Care & Maintenance

Since your vegetative buffer is a long-term investment, you must be willing to accept some responsibility for its long-term care. For the most part the actual maintenance needs will be fairly routine and require minimal day-to-day attention. This is especially true if suitable plants are selected.

Here are a few things that you can do to keep your VEB in top form...

- ***Inspect your buffer regularly.*** Something as simple as occasionally walking down your buffer rows and visually examining the plants can help identify problems before they become too difficult, or expensive, to manage. Signs of problems may include leaf die-back, stunting, unexpected changes in color, or indication of pests. If you see anything out of the ordinary, it may be a clue that something is wrong.
- ***Manage problems aggressively.*** When signs or symptoms of a pest or disease are detected, steps need to be taken to address the problem. The longer a problem is allowed to linger, the more drastic, and likely less effective, any response will be. If you see something wrong with your buffer plants, please seek guidance on obtaining a diagnosis and treatment.



Some plants tend to have chronic problems with pests and diseases. For most growers the best bet is to avoid these problems by selecting plants which are more pest and disease resistant.

- ***Prune sparingly.*** Pruning may be desirable in certain situations to increase the density of lower branches or to address specific plant problems. However, you should not attempt to prune buffer plants without seeking advice from our cooperative extension agent, state forestry office, or a trained tree professional. As a general rule, you should only prune buffer plants when absolutely necessary.
- ***Use caution when staking.*** Staking is not generally necessary when healthy, high quality plants are used in your buffer. This is especially true of containerized and balled-in-burlap stock, unless they are subject to especially strong winds. Bareroot trees, however, will likely require minimal staking during the first year. Since staking can cause serious problems if undertaken needlessly or improperly, you are advised to seek assistance before attempting to stake any young plant.
- ***Seek help immediately.*** Help is available if you have a concern or question about your buffer plants. Since time can be of the essence, do not hesitate to use the resources available to you. A list of important contacts is provided in the Appendix for your convenience.

Funding Your Buffer

At this point you are probably wondering how much your buffer will cost and what help there might be to fund the project. These are very important questions.

The cost of installing and establishing your buffer will depend on the type of plants selected, who installs them, planting density, irrigation method, and the weed management strategy, among other things. Since prices do fluctuate and can vary widely, only a rough estimate of cost can be given here.

A base-line cost calculation for a professionally installed buffer can be expected as follows:

Plant materials:

\$2.00 – \$5.00+ per row ft.

[Cost will vary relative to species, plant size, row density, etc.]

Plants only: \$5.00 – \$10.00 (1 gal. container stock)
\$12.00 – \$20.00 (3 gal container stock)

Irrigation:

Drip-line with emitters \$0.20 – \$0.50 per row ft.

[Irrigation controller and additional piping to water supply will be extra]

Plastic Mulch:

(a) Black poly sheeting \$0.10 - \$0.20 per row ft.
(b) Landscape fabric \$0.30 - \$0.50 per row ft.

Please remember that these are only approximate figures. It may be possible to install a buffer for slightly less or significantly more depending on who installs the buffer, manual labor requirements, and general overhead. For a current, and more accurate, cost estimate, you are strongly advised to contact plant suppliers or an installer who can discuss your particular site needs.

For some growers funding the entire project out of pocket may be an option. This has obvious benefits; namely, no paperwork. However, most growers will not have that luxury. So then, what other funding possibilities exist?

Sources for funding for a buffer project might include any or all of the following sources:

EQIP – The Environmental Quality Incentives Program (EQIP) offers cost-share funding for buffers, which the Natural Resources Conservation Service (NRCS) calls “windbreaks.” Cost-share assistance may be available to cover up to 75% for approved vegetative buffers (up to 90% for new farmers). Since each state determines its own cost-share policies and funding priorities, the current cost-share rates in your area may be different. Sign-up for EQIP is continuous, with an annual deadline for ranking. This deadline usually falls in December, but may be extended as funds are allocated. Please be advised that EQIP payments do not allow for reimbursement of costs associated with previously installed buffers. To participate in this cost-share program you must have a contract signed with NRCS and be authorized to begin the project *before* installing your buffer. For more information, including current cost-share rates, you may contact your local NRCS service center or soil conservation district.



Be aware that all cost-share opportunities, including EQIP, have specific contract requirements and impose legal obligations. Anyone interested in participating must fully understand and carefully weigh these contractual commitments.

CRP – The Conservation Reserve Program (CRP) is a voluntary land retirement program administered through the United States Department of Agriculture, Farm Service Agency (FSA). The program is limited to existing farmland that can be converted to some environmental conservation practice, such as a tree buffer. Installation cost-share is

available along with maintenance incentives and annual federal rent payments. Contracts are written to cover a 10-15 year period and there are other program requirements. Please contact your local FSA office or soil conservation district office for more details.

Local Conservation Districts – While working in partnership with the NRCS to administer conservation programs at the local level, your county soil conservation district may have access to additional funding opportunities. Be sure to ask about any district programs for which you might qualify.

State Programs – Various state agencies from time to time may offer programs or special allocations to help subsidize conservation projects, like vegetative buffers. These governmental resources might be available through your state's department of agriculture, forestry, or natural resources. Notification concerning programs is normally available on the agency website or by contacting the appropriate office. Your local soil conservation district may also have information about any state-sponsored funding opportunities.

Farm Credit Financing – Mid-Atlantic Farm Credit (MAFC) supports the installation of vegetative buffers by offering various financing opportunities for new and established poultry growers. To discuss what options might be available to you, including financing for the grower's portion of cost-share programs, please contact your local MAFC office.

Bank Loan Financing – Financing your buffer through your personal bank or another lending institution may be a possibility in some instances. The specific terms and availability of credit will be determined by the bank itself.

Other Sources – Various other agencies and organizations could offer a potential source for funding your buffer project. These could include county government, private foundations, environmental organizations, land trusts, or even your poultry company. Do not be afraid to look into these possibilities. In addition, DPI will continue to explore new opportunities to ease the costs associated with installing and maintaining your buffer.



The availability of financial assistance for the installation and maintenance of your buffer will depend on many factors which change from time to time. Please be sure to contact the appropriate agency for the most current information on opportunities which may apply to your situation.

Finding Help

Many resources are available to you as you navigate the process of planning, installing, and maintaining your vegetative buffer. Technical and logistical support for the project from start to finish can be obtained from many cooperating agencies. Please do not hesitate to take advantage of these resources.

The Delmarva Poultry Industry, Inc. is especially committed to helping you. A Vegetative Environmental Buffers Coordinator is on staff to provide assistance at no charge. For more information, feel free to contact the DPI office:

Delmarva Poultry Industry, Inc.
16686 County Seat Highway
Georgetown, Delaware 19947-4881
(302) 856-9037
(800) 878-2449
www.dpichicken.org

In addition to DPI, other sources of assistance include:

- Your local NRCS service center
- Your local soil conservation district
- Your county cooperative extension service
- Your state forestry agency
- Your state Department of Agriculture

A list of contact information for these agencies is given in the Appendix for your convenience.

APPENDIX

A. Suitable Plants for Poultry Buffers

B. Sources for Plant Stock

C. Useful Contacts

D. Further Information

APPENDIX - A

Suitable Plants for Poultry Buffers

Numerous plants have been identified as having potential for use in vegetative buffers. The following tables provide information on trees and shrubs that have been shown to be suitable for use around poultry houses or have characteristics that may make them desirable for a VEB. Since plant materials are continually being evaluated for buffer performance, the list of recommended plants is subject to change.

Please remember that this information is provided only as a reference. A particular tree or shrub on the list may not be best for your specific situation. In addition, there are plants which might work, but have not been included for various reasons. You are encouraged to thoroughly research any species, and seek advice, before planting it on your farm.

KEY

General:	☺	=	Proven performer for Delmarva
	✓	=	Recommended buffer plant
	①	=	Potential buffer plant (seek advice before planting)
	✗	=	Not recommended for tunnel-fan area
Growth:	s	=	Slow growth rate (< 1 ft. per year)
	m	=	Moderate growth rate (1-2 ft. per year)
	f	=	Fast growth rate (2-3 ft. per year)
	vf	=	Very fast growth rate (>3 ft. per year)
Light:	○	=	Full sun
	◐	=	Partial shade
	●	=	Shade
Moisture:	d	=	Tolerates dry soils (well-drained)
	mw	=	Tolerates medium wet soils (moderately drained)
	w	=	Tolerates wet soils (poorly drained)

EVERGREEN TREES

	Name	Size (H x W)	Growth Rate	Light Tolerance	Moisture Tolerance	Comments
☺	Green Giant Arborvitae <i>Thuja plicata x standishii</i> 'Green Giant'	60' x 20'	f	○●	d-mw	Preferred alternative to Leyland Cypress
✓	Eastern Redcedar <i>Juniperus virginiana</i>	40' x 20'	m	○●	d	
✓	Japanese Cedar <i>Cryptomeria japonica</i> 'Yoshino'	30' x 15'	m	○●	d-mw	Prefers moist, well-drained soils; highly adaptable
✗	Loblolly Pine <i>Pinus taeda</i>	60' x 40'	f	○	mw-w	Avoid in fan discharge areas; tends to self-prune
✓	Norway Spruce <i>Picea abies</i>	50' x 25'	m/f	○	mw	May suffer heat stress in fan areas
ⓘ	Spartan Juniper <i>Juniperus chinensis</i> 'Spartan'	15' x 5'	s/m	○	d	
ⓘ	Giant Arborvitae <i>Thuja plicata</i>	60' x 20'	m	○●	d-mw-w	
✗	White Pine <i>Pinus strobus</i>	60' x 40'	f	○●	d-mw	Avoid in fan discharge areas; tends to self-prune

SHRUBS

	Name	Size (H x W)	Growth Rate	Light Tolerance	Moisture Tolerance	Comments
☺	Manhattan Euonymus <i>Euonymus kiautschovicus</i> 'Manhattan'	6' x 6'	f	○●	d-mw	Tolerates a variety of soils, except poorly drained
✓	Steeds Holly <i>Ilex crenata</i> 'Steeds'	8' x 4'	m	○●	d-mw	Prefers light, well-drained soils
ⓘ	Bayberry <i>Myrica pensylvanica</i>	10' x 10'	m	○●	d-mw	Adaptable to most site conditions
ⓘ	False Indigo <i>Amphora fruticosa</i>	15' x 10'	m	○	d-mw	Tolerates poor soils; spreads easily by seed
ⓘ	Forsythia <i>Forsythia x intermedia</i>	10' x 8'	f	○●	mw	Drought tolerant; wide adaptability

①	Inkberry Holly <i>Ilex glabra</i>	8' x 10'	s/m	○●	mw-w	
①	Lilac <i>Syringa vulgaris</i>	15' x 10'	m	○●	mw	Spreads by suckering to form a dense hedge
✓	Nellie Stevens Holly <i>Ilex cornuta</i> x 'Nellie R. Stevens'	20' x 15'	f	○●	d-mw	Requires a pollinator to produce fruit
①	Possumhaw Holly <i>Ilex decidua</i>	15' x 10'	s/m	○●	mw-w	Requires a pollinator to produce fruit
①	Siberian Pea Shrub <i>Caragana arborescens</i>	15' x 15'	m/f	○●	d-mw	Very adaptable to poor soils
①	Southern Waxmyrtle <i>Myrica cerifera</i>	10' x 10'	f	○●	d-mw-w	Adaptable to most site conditions; tolerates flooding
①	Yaupon Holly <i>Ilex vomitoria</i>	20' x 15'	m/f	○●	d-mw-w	Adaptable to most site conditions

DECIDUOUS TREES

	Name	Size (H x W)	Growth Rate	Light Tolerance	Moisture Tolerance	Comments
☺	Austree® Hybrid Willow <i>Salix matsudana</i> x <i>alba</i>	60' x 15'	vf	○●	d-mw-w	Tolerates tunnel fan discharge; needs adequate water during establishment
☺	Baldcypress <i>Taxodium distichum</i>	70' x 20'	s/m	○	d-mw-w	Native tree with stable root system
✓	American Holly <i>Ilex opaca</i>	40' x 20'	s/m	○●	d-mw	"Jersey Knight" is a fruitless cultivar
①	American Sweetgum <i>Liquidambar styraciflua</i>	60' x 40'	m/f	○●	d-mw-w	Round, prickly fruit may be undesirable
①	Amur Maackia <i>Maackia amurensis</i>	25' x 30'	s	○●	d-mw	Does not tolerate excessive flooding
①	Blackgum <i>Nyssa sylvatica</i>	40' x 25'	s/m	○●	d-mw-w	Does well in wet, compacted soils
①	Bur Oak <i>Quercus macrocarpa</i>	70' x 70'	s	○●	d-mw-w	Large tree; very tolerant of drought, poor drainage, and clay soil

①	Chestnut Oak <i>Quercus prinus</i>	90' x 90'	m	○▶	d-mw	Tolerates poor, sandy soils; does not do well on poorly drained soils
✓	Common Hackberry <i>Celtis occidentalis</i>	50' x 50'	m/f	○	d-mw	Adaptable to most soil conditions
✓	Dawn Redwood <i>Metasequoia glyptostroboides</i>	80' x 25'	f	○	d-mw-w	Adapted to clay soils
①	Eastern Redbud <i>Cercis canadensis</i>	25' x 25'	m	○▶	d-mw	Adaptable to wide range of soil types
①	Freeman Maple <i>Acer rubrum x saccharinum</i>	50' x 40'	f	○▶	d-mw-w	Adaptable to most site conditions
①	Ginkgo <i>Ginkgo biloba</i>	70' x 30'	s/m	○▶	d-mw	Adaptable to wide range of soils, except wet; plant only male trees
①	Hedge Maple <i>Acer campestre</i>	25' x 35'	s	○▶	d-mw	Poor tolerance of highly compacted soils; 'Queen Elizabeth' is the recommended cultivar
①	Kentucky Coffeetree <i>Gymnocladus dioica</i>	60' x 40'	s/m	○	d-mw	Large native tree; adaptable to most site conditions
①	Northern Red Oak <i>Quercus rubra</i>	60' x 60'	f	○▶	d-mw	Large tree; tolerates moderate salt spray and compacted soils
①	Osage Orange <i>Maclura pomifera</i>	30' x 30'	f	○	d-mw	Male, fruitless trees are recommended
①	Purpleblow Maple <i>Acer truncatum</i> hybrid	35' x 25'	s	○▶	d-mw	
①	Red Maple <i>Acer rubrum</i>	25' x 12'	m/f	○▶	d-mw-w	Optimal growth in wet soil, but very adaptable to most soil conditions
①	Sawtooth Oak <i>Quercus acutissima</i>	50' x 50'	m	○▶	d-mw	
①	Scholar Tree <i>Sophora japonica</i>	60' x 60'	m/f	○	d-mw	Prefers full sun and light soil; tolerates salt spray
✓	Spike Hybrid Polar <i>Populus deltoides x nigra</i> 'Spike'	20' x 30'	f	○▶	d-mw	

✓	Streamco Willow <i>Salix purpurea</i> 'Streamco'	15' x 15'	f	○●	mw-w	Does not tolerate drought
①	Swamp White Oak <i>Quercus bicolor</i>	50' x 50'	s/m	○●	mw-w	Long-lived tree that tolerates flooding and soil compaction
①	Sycamore <i>Platanus occidentalis</i>	90' x 90'	m/f	○●	d-mw-w	Very large tree; tolerates compacted soils
✓	Thornless Honeylocust <i>Gleditsia triacanthos var. inermis</i>	50' x 50'	f	○●	d-mw	Tolerates poor, compacted soils
①	Trident Maple <i>Acer buergerianum</i>	30' x 25'	m	○●	d-mw	Tolerant of salt, wind, and soil compaction
①	Willow Oak <i>Quercus phellos</i>	50' x 35'	m	○●	d-mw-w	Tolerant of salt, soil compaction, and poor drainage

APPENDIX - B

Sources for Plant Stock

Local nurseries and landscapers are often the best source for plant materials. If they do not carry the stock themselves, they may have access to plant materials from wholesale suppliers.

For a list of licensed plant dealers please contact your state Department of Agriculture or area Landscape & Nursery Association:

Delaware Nursery & Landscape Association (DNLA)

P.O. Box 897

Hockessin, DE 19707

(888) 448-1203

☎: <http://www.dnlaonline.org>

Maryland Nursery & Landscape Association (MNLA)

P.O. Box 726

Brooklandville, MD 21022

(410) 823-8684

☎: <http://www.mnlaonline.org>

Virginia Nursery & Landscape Association (VNLA)

383 Coal Hollow Road

Christiansburg, VA 24073

(800) 476-0055

☎: <http://www.vnla.org>

Consulting your local phone directory, or internet directories such as the *Green Industry Yellow Pages* (www.giyp.com), might also prove useful for identifying potential local suppliers.

Other sources you may wish to consider include:

John S. Ayton State Forest Tree Nursery

(Maryland Department of Natural Resources)

3424 Gallagher Road

Preston, MD 21655

(800) 873-3763

☎: <http://www.easycartsecure.com/MarylandDepartmentofNaturalResources>

***Supplies bare-root seedling stock. Delaware residents may acquire trees through the Delaware Forestry Service.*

Augusta Forestry Center

(Virginia Department of Forestry)

P.O. Box 160

Crimora, VA 24431

(540) 363-7000

☎: <http://www.dof.virginia.gov>

***Supplies bare-root seedling stock. Seedlings are also available to Delaware and Maryland residents.*

Rocky Mountain Austree, Inc.

212 W. Buchanan Street

Colorado Springs, CO 80907

(800) 783-3335

☎: <http://www.austree.com>

*** The official source for Austree® hybrid willows.*

Musser Forests Inc.

1880 Route 119 HWY N

Indiana, PA 15701

(800) 643-8319

☎: <http://www.musserforests.com>

***Sells bare-root and some small containerized stock.*

National Arbor Day Foundation

100 Arbor Avenue

Nebraska City, NE 68410

(888) 448-7337

☎: <http://www.arborday.org>

***Sells bare-root seedlings.*

Autumn Ridge Nursery

Caller Box 750-Dept PL
McMinnville, TN 37110
(931) 474-3386

☎: <http://www.autumnridgenursery.com>

***Sells bare-root stock.*

Carino Nurseries

P.O. Box 538
Indiana, PA 15701
(800) 223-7075

☎: <http://www.carinonurseries.com>

***Sells mostly seedling or small transplant stock.
Limited varieties available.*

Pikes Peak Nurseries

8289 Route 422 Highway East
Penn Run, PA 15765
(800) 787-6730

☎: <http://www.pikespeaknurseries.net>

***Sells mostly seedling or small transplant stock.
Limited wholesale balled-and-burlapped is also
available.*

APPENDIX - C

Useful Contacts

A list of useful contacts for each state is provided below. While not exhaustive, it should provide a starting point for seeking answers to any questions you might have.

DELAWARE

Delaware Department of Agriculture	(302) 698-4500 (800) 282-8685 (<i>Delaware only</i>)  : http://dda.delaware.gov
Delaware Forest Service	(302) 856-2893 [Southern Region Office] (302) 653-6505 [Northern Region Office]  : http://dda.delaware.gov/forestry
NRCS Service Centers	State Office (302) 678-4160  : http://www.de.nrcs.usda.gov
	Sussex County (302) 856-3990
	Kent County (302) 741-2600
Soil Conservation Districts	
	Kent Conservation District (302) 741-2600  : http://www.kentcd.org
	Sussex Conservation District (302) 856-3990  : http://www.sussexconservation.org

University of Delaware Cooperative Extension

Kent County (302) 730-4000

☎: <http://ag.udel.edu/extension/kent>

Sussex County (302) 856-7303

☎: <http://www.rec.udel.edu>

MARYLAND

Maryland Department of Agriculture (410) 841-5700

☎: <http://www.mda.state.md.us>

Maryland Forest Service

(410) 713-3862 [Eastern Region Office]

☎: <http://www.dnr.state.md.us/forests>

NRCS Service Centers

State Office (410) 757-0861

☎: <http://www.md.nrcs.usda.gov>

Caroline County (410) 479-1202

Dorchester County (410) 228-5640

Kent County (410) 778-5353

Queen Anne's County (410) 758-1671

Somerset County (410) 651-0370

Talbot County (410) 822-1577

Wicomico County (410) 546-4777

Worcester County (410) 632-5439

Soil Conservation Districts

Caroline Conservation District (410) 479-1202

Dorchester Conservation District (410) 228-5640

Kent Conservation District (410) 778-5150

Queen Anne's Conservation District (410) 758-3136

Somerset Conservation District (410) 651-1575

Talbot Conservation District (410) 822-1344

Wicomico Conservation District (410) 546-4777

Worcester Conservation District (410) 632-5439

Maryland Cooperative Extension (410) 827-8056 [Eastern Region Office]
☎: <http://extension.umd.edu>

Caroline County (410) 479-4030
Dorchester County (410) 228-8800
Kent County (410) 778-1661
Queen Anne's County (410) 758-0166
Somerset County (410) 651-1350
Talbot County (410) 822-1244
Wicomico County (410) 749-6141
Worcester County (410) 632-1972

VIRGINIA

Virginia Department of Agriculture
and Consumer Services (804) 786-2373
☎: <http://www.vdacs.virginia.gov>

Virginia Department of Forestry (757) 787-5812 [Accomac Office]
☎: <http://www.dof.virginia.gov>

NRCS Service Centers State Office (804) 287-1691
☎: <http://www.va.nrcs.usda.gov>

Accomac Service Center (757) 787-0918

Eastern Shore Conservation District (757) 787-0918

Virginia Cooperative Extension Accomack County (757) 787-1361
☎: <http://offices.ext.vt.edu/accomack>

APPENDIX - D

Further Information

VEB References

Belt, S.V., M. van der Grinten, G. Malone, P. Patterson and R. Shockey. *Windbreak Plant Species for Odor Management around Poultry Production Facilities*. Maryland Plant Materials Technical Note No. 1. USDA-NRCS National Plant Materials Center, Beltsville, MD. 21p. (March 2007)

Malone, G. and D. Abbott-Donnelly. *The Benefits of Planting Trees around Poultry Farms*. PO-159. University of Delaware Cooperative Extension, Newark, DE. 6p. (November 2004)

: <http://ag.udel.edu/extension/agnr/pdf/po-159.pdf>

General Resources

National Agroforestry Center (USDA)

: <http://www.unl.edu/nac>

NRCS Windbreak Resources (USDA)

: <http://www.nrcs.usda.gov/TECHNICAL/ECS/forest/wind/windbreaks.html>

PFRA Shelterbelt Centre (Canada)

: http://www.agr.gc.ca/pfra/shelterbelt_e.htm

National Arbor Day Foundation

: <http://www.arborday.org>

International Society of Arboriculture

: <http://www.treesaregood.com>

Riparian Buffer Systems (Maryland Cooperative Extension)

: <http://www.riparianbuffers.umd.edu>

Plant Information Resources

NC State University Plant Fact Sheets

: <http://www.ces.ncsu.edu/depts/hort/consumer/factsheets/index.html>

University of Florida Plant Fact Sheets

: <http://hort.ifas.ufl.edu/trees>

: <http://hort.ifas.ufl.edu/shrubs>

USDA-NRCS Plants Database

: <http://www.plants.usda.gov>

Site and Soil Concerns

Wet and Dry Sites

(Virginia Cooperative Extension, Pub. 430-026)

: <http://www.ext.vt.edu/pubs/nursery/430-026/430-026.pdf>

Soil Drainage

(Bartlett Tree Research Laboratories)

: <http://www.mygardenguide.com/care/Soil%20drainage.pdf>

Tree Planting and Care

TLC for Trees

: <http://www.tlcfortrees.info>

Common Tree Planting Mistakes

(Kelly Tree Farm, Iowa)

: <http://www.windbreaktrees.com/nottodo.html>

Planting Guidelines for Bareroot Trees and Shrubs

(NRCS Plant Materials Program, Montana)

: <http://plant-materials.nrcs.usda.gov/pubs/mtpmcar5149.pdf>

Planting Guidelines for Containerized and Balled & Burlapped Stock

(NRCS Plant Materials Program, Montana)

: <http://plant-materials.nrcs.usda.gov/pubs/mtpmcar2625.pdf>

Proper Planting of Trees and Shrubs
(Nebraska Statewide Arboretum)

: <http://arboretum.unl.edu/poppages/treeplanting.html>

Tree and Shrub Planting Guidelines
(Virginia Cooperative Extension, Pub. 430-295)

: <http://www.ext.vt.edu/pubs/trees/430-295/430-295.html>

Plant Health Resources

Online Plant Pest Handbook
(Connecticut Agriculture Experiment Station)

: <http://www.ct.gov/caes/cwp/view.asp?a=2823&q=378182>

Woody Ornamental IPM
(Pennsylvania State University)

: <http://woodypests.cas.psu.edu/>

Buffer Design Tools

CanVis - Buffer Simulation Software
(USDA National Agroforestry Center)

: <http://www.unl.edu/nac/simulation/products.htm>

TreeSelector - Online Plant Selection Tool
(University of Florida)

: <http://orb.at.ufl.edu/TREES/index.html>

VegSpec - Online Plant Decision Software
(NRCS/US Army Corps of Engineers)

: <http://vegspec.nrcs.usda.gov/vegSpec/index.jsp>

Buffer Establishment and Management


Windbreak Establishment
(University of Nebraska Extension, EC91-1764-B)


: <http://www.unl.edu/nac/morepublications/ec1764.pdf>

Windbreak Management
(University of Nebraska Extension, EC96-1768-X)

: <http://www.unl.edu/nac/morepublications/ec1768.pdf>


Benefits of Vegetative Buffers


Working Trees for Water Quality
(USDA National Agroforestry Center)
: <http://www.unl.edu/nac/workingtrees/wtwq.pdf>

Working Trees for Carbon Cycle Balance
(USDA Agroforestry Center)
: <http://www.unl.edu/nac/workingtrees/wtccb.pdf>


Neighbor Relations

Best Management Practices for Good Neighbor Relations
(Delmarva Poultry Industry, Inc., September 2005)

Odor: Can Trees Make a Difference? (*Inside Agroforestry*, Spring 2002)
: <http://www.unl.edu/nac/insideagroforestry/2002spring.pdf>

Coexisting with Neighbors: A Poultry Farmer's Guide
(University of Georgia CAES, Bulletin 1263)
: <http://www.pubs.caes.uga.edu/caespubs/pubs/PDF/B1263.pdf>

Funding Information

USDA, Natural Resources Conservation Service
: <http://www.nrcs.usda.gov/programs/>

USDA, Farm Service Agency
: <http://www.fsa.usda.gov/FSA> (Click on "Conservation Programs")

Maryland Agricultural Cost-Share Program
: http://www.mda.state.md.us/resource_conservation/financial_assistance



Delmarva Poultry Industry, Inc.

16686 County Seat Highway
Georgetown, Delaware 19947-4881
(302) 856-9037
(800) 878-2449

www.dpichicken.org

*This project was funded in part by a grant from the
USDA, Natural Resources Conservation Service.*