Natural Lands Trust

Controlling Invasive Plants

INTRODUCTION

One of the most serious problems encountered in the management of open space in southeastern Pennsylvania is the presence of exotic, invasive vegetation. Woodlands and hedgerows smothered by vines and fields invaded by exotic shrubs may offer food and fortified shelter for birds and other wildlife, but they eventually create an unsightly landscape and restrict human transit. Most importantly, if left unchecked, invasives can rapidly destroy the native flora and stall ecological succession in natural areas. Through their displacement of native vegetation they homogenize the structural and food resources of a site, thereby reducing its habitat value for native fauna, particularly songbirds.

An historical land use dominated by agriculture and logging, coupled with recent sprawl development, has disturbed natural areas throughout the region. The division and clearing of land parcels through these activities has created countless miles of edge condition that is highly favorable to the proliferation of invasives. The misguided promotion of several exotic species for erosion and livestock control and the region's rich horticultural history (often using exotic species) have provided plentiful seed sources for regional dispersal of numerous invasive exotic species.

The control of invasive plants will be a long-lasting concern of land managers in southeastern Pennsylvania. The extensive edge and seed sources within the region and the prolific nature of these plants guarantee that even with complete eradication on a given property, invasives can quickly reestablish themselves as a serious management problem. A strategy for coexisting with these plants is needed—one which will minimize their effect on the aesthetics and ecological stability of a property, with a minimum of management effort.

MANAGEMENT STRATEGY

In natural areas management the most efficient and effective strategy usually results from a thorough understanding of the environmental forces in the area and the management goals that work with and not against these forces. This is true in developing a strategy for minimizing the impact of invasive plants. Any attempt to alter the vegetation of a site will succeed or fail according to its effects on the major forces (light, water, inorganic nutrients, soil structure, collectively known as the "growing space") that support plant growth in that area. Given that growing space in any area is finite, successful management will consist of those practices which make more growing space available to

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desirable species and less to non-desirable species—in this case, invasives.

Often the most difficult step in controlling invasives is deciding what to do first. Creating a "plan of attack" is critical in order to make the most efficient and effective use of limited stewardship resources. Although it may seem logical to address the most severely degraded areas first, this may not be the best use of resources. The following two rules may help focus management efforts.

The first rule is that, in general, the future rate of forest degradation is inversely proportional to the current level of degradation. When a tree within a healthy, closed-canopy forest is toppled by invasive vines or a gap is colonized by an invasive tree, the resulting loss of growing space can have a major impact on the entire forest stand, by providing a seed source for the rapid spread of invasives from that point. On the other hand, the loss of a single tree in a heavily degraded, open-canopy area creates relatively little change in the total amount of growing space in the stand that is controlled by invasives.

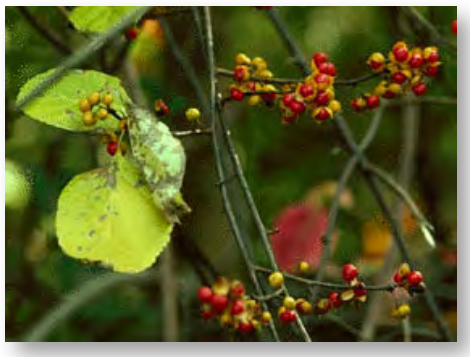
The second rule is that management efforts should be focused on restoring that part of the plant community that controls the most growing space. In a forest community, canopy trees take up the majority of the growing space. Once the canopy is free of invasive impact, the manager can proceed to the next layer until the ground level is reached.

The focus of initial restoration efforts, therefore, should be to halt the degradation of the canopy layer in the healthiest areas, moving then to the moderately invaded areas, and so on to the most degraded areas. Those areas that are severely invaded should, for now, be left for "dead." Since they essentially cannot degrade any further, their restoration (which will usually require significant resources, including heavy equipment and years of high maintenance) is best left until the healthier, less impacted sites are stabilized. This approach is also healthier, psychologically, for the persons involved in restoration. Spending the initial phase of a project stabilizing the majority of a site is more rewarding than struggling through a highly degraded area that is only a small portion of the site.

Priorities may need to be modified for best short-term efficiency of labor and long-term results according to the time of year or availability of labor. For example, the cutting and herbiciding of understory invasive trees is best done during fall and early winter when sap is flowing into the roots, whereas the planting of seedlings is best done in the late winter and early spring. If labor is first available in the spring, then it would be best to plant seedlings in moderately to heavily invaded forest areas first and wait till the fall to cut the invasive trees in lightly to moderately invaded areas.

Two points should be noted while planning an invasives control program. First, invasive plant removal must be done properly or it can have catastrophic impacts to the health of natural lands and its wildlife. Removing trees such as Norway maple and groundcovers such as English ivy opens up the canopy

***Autumn olive** (Eleagnus umbellata): Along with its relative, Russian-olive (Eleagnus angustifolia), this shrub can rapidly invade abandoned fields and open canopy forests to the exclusion of all other plants. Until recently it was promoted as a wildlife food although its fruits have limited nutritional value.*

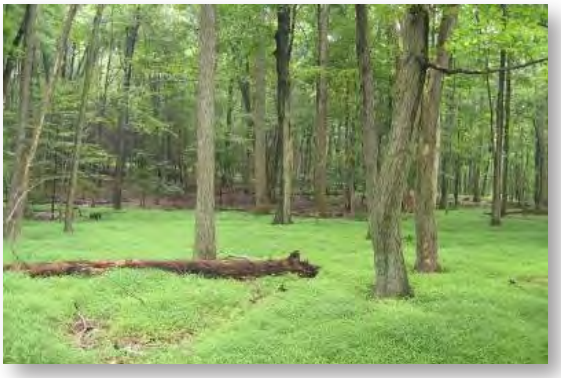


***Oriental bittersweet** (Celastrus orbiculatus): A woody vine that aggressively grows along forest edges or in open meadows. Its seeds are dispersed by birds and human collectors (the bright orange seed capsules are used for fall decorations). By growing into the tree canopy, the vine raises the center of gravity of the tree and increases wind resistance, making it vulnerable to windthrow.*

and scarifies the soil, conditions that are ideal for the rapid establishment from seed of opportunistic species, a category that includes most invasives. Removing understory shrubs such as shrub honeysuckles, privet, or sapphire-berry can transform a forest stand that was a haven for migratory and resident birds and other animals to one devoid of understory cover and thus no longer a viable refuge (from predators), food source, or breeding habitat for many species. Removal without replacement has numerous subtle effects but some effects can be dramatic, such as a striking decline in birds that were once common. In general, the restoration of a degraded community, particularly forest, should be done in stages so that wildlife has time to adjust to cover and food conditions.

Replacement planting should be undertaken in the same year as invasives removal. This will provide the native species with an edge in recapturing the growing space made available by weeding out invasive species. Any site where plants to be removed comprise more than 25% of the cover within their forest layer (canopy, subcanopy, shrub, herbaceous) will probably require planting to augment any natural regeneration. Removal should be undertaken at times of year when direct disturbance of wildlife would be minimal, preferably late fall or winter. Replacement plantings should precede the onset of the spring breeding season because many birds return to the same sites year after year to reestablish territories and renest. To insure their survival and to maintain ecosystem integrity, replacement plants must be of native tree, shrub, or herbaceous species carefully selected to be appropriate to soil conditions and the community type at each individual restoration site within the natural area.

Tree-of-heaven *(Ailanthus altissima): An exotic tree native to Asia that colonizes open areas and forest gaps and edges. It can spread by dispersal of its light seeds or through root sprouts.*



Japanese stiltgrass *(Microstegium vimineum): A warm-season grass dispersed by deer and human walkers that quickly spreads to the detriment of native herbs.*

Replanting after removing invasive plants accomplishes several objectives. It replaces vertical forest structure and bird cover where they had been provided mainly by the invasive species (e.g., where shrub honeysuckles, privet, or sapphire-berry are removed). Where invasive species have eliminated entire forest layers (e.g., Norway maple and English ivy, which eradicate native shrub and herbaceous layers in forests), replanting after removal restores long-lost vertical forest structure and bird cover. Where invasive plants are removed from streambanks or floodplains (especially Japanese knotweed) or from steep slopes, replanting renews protection against soil erosion. In all cases, the planted native species restore lost components of the indigenous food web; invasive species' leaves and stems are little utilized as food by native wildlife, which is one of the reasons they succeed so well here.

It must be emphasized, however, that planting should be viewed as only one component of forest restoration where invasive species are removed. The goal of maintaining natural lands as a set of natural communities dominated by native species will be met only by reducing the deer population to a level that allows natural regeneration from seed produced by native species already growing on the natural lands. Once natural regeneration is restored, a healthy crop of seedlings

and saplings of native species will be poised to assume the growing space vacated by the natural decline and mortality of native species or the deliberate removal of invasive species.

Any invasives program must be undertaken in concert with a serious effort to reduce the overabundance of deer, if needed. Without sufficient native regeneration, any long-term effort to restore native plant communities will be futile. If the deer population is not addressed, perpetual reliance on planting will be a severe drain on stewardship resources and will require permanent, extensive use of unsightly measures (fencing, tree shelters) to protect plantings from deer browsing.

MANAGEMENT OPTIONS

There are many management options for controlling invasive vegetation. These include physical removal, cutting, mowing, planting, herbicides, and fire. Usually, the control of invasives on any given site requires a combination of two or more methods. The most effective mixture and timing will be unique to each site. What is common to all sites is the fact that the prolific nature of invasive plants mandates periodic monitoring and control to prevent a major disruption to the aesthetics, native biodiversity, and ecosystem function of the impacted site.

Physical Removal

One of the most effective practices is the selective removal of invasives without disturbing the surrounding desirable vegetation. The invasive plant is denied any growing space and the surrounding desirable vegetation is well-positioned to occupy the vacated growing space. This approach is preferable whenever possible, although it is limited as a practical alternative by the available manpower and equipment relative to the size, quantity, and type of invasive(s) present.

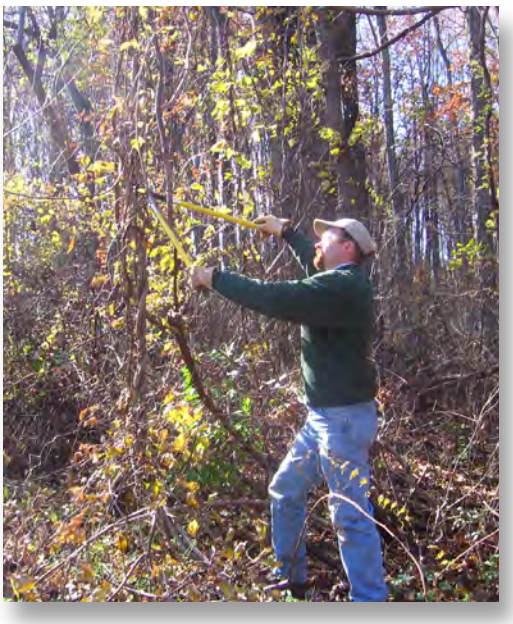
Relatively small quantities of invasives can be effectively removed through manual pulling, digging with hand tools (shovel or spade) or pulling with a heavy duty truck or tractor. One specialized hand tool that works well on small single-stemmed plants is called a *Weed Wrench*. It is designed to clamp to the base of a tree or shrub and leverage the entire plant out of the ground. A tractor-mounted front end loader is ideal for removing larger trees or shrubs by several methods. One method entails elevating the lower branches with the bucket while a chain (a logging slip chain is best) is attached to the base of the plant and then, by raising the bucket, the plant can be removed from the ground. A second, easier tractor method is to use a single fork attachment on the front end loader to pop the shrub out by positioning the fork under the crown (the swollen area from which the roots and stem emerge) and raising the bucket. The third, and most efficient, method requires replacing the loader bucket with a tool called a *Brush Brute*—a 4'–6' steel frame with 18" "teeth." With this tool you simply drive into the unwanted shrub or small tree until the base of the plant is impaled between the teeth and then lift the entire plant out of the ground.

Regardless of which means is employed, it is generally desirable to remove as much of the root system as possible (to prevent resprouting), although removal of the crown is usually sufficient to prevent rapid reestablishment of the plant. The degree of success through this method will depend upon the thoroughness with which the plant is removed and the speed at which desirable vegetation can occupy newly available growing space.

Cutting

Removing some or all of the photosynthetic (food producing) area of the plant without disturbing the surrounding vegetation is another way to redistribute the available growing space and control invasives. It is less effective, but also less labor intensive, than physi-

An efficient method for removing unwanted shrubs or small trees involves replacing the loader bucket on a tractor with a Brush Brute *to impale the base of the plant and then lift it out of the ground.*



Cutting vines low to the ground and as high as possible at edge sites or within hedgerows will maximize the delay in their movement back into the canopy .

cal removal. Cutting the plant with a pruner, handsaw, or lightweight chainsaw reduces its above-ground growing space without disturbing surrounding vegetation. However, the entire root system and any uncut stems can resprout and reoccupy the growing space. For this reason, it is best to cut the plant as low as possible to the ground and to combine it with an herbicide application (Refer to *Herbicides* section for further details on use).

This option is most appropriate for controlling invasives in wooded areas. In this situation, the surrounding vegetation (trees) is usually situated above the residual live plant material. Because the surrounding trees limit sunlight needed for food production, the cut plant is forced to rely on stored root reserves to feed the remaining plant material and for refoliation. Although invasives are usually able to survive, they are weakened sufficiently to prevent them from achieving problem status for an extended period.

Cutting is less effective in open areas. In this case, their prolific nature allows invasives to quickly resprout and occupy the available growing space. The problem is alleviated only temporarily—cutting will be required again within a few years. This is particularly true at edge sites (where open fields meet woodlands) and hedgerows. There the vines gain the added benefit of tree support which they can utilize to occupy greater growing space to the detriment of the trees. The practice of pruning the lower limbs of edge trees and cutting vines as high as possible maximizes the delay in vine movement back into the tree canopy.

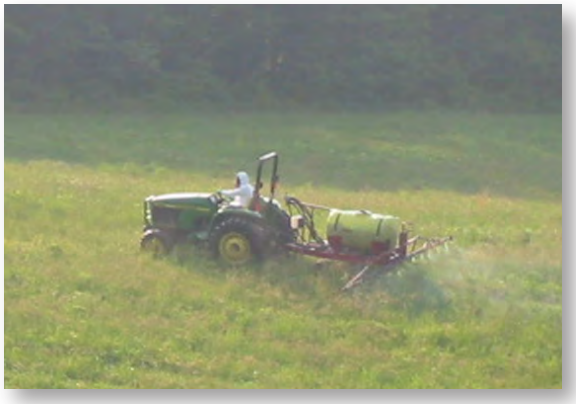
Late fall and winter are the most efficient and least painful times to perform cutting operations. Problem areas are more easily traversed and cool weather clothing gives added protection to the work crew. Following initial treatment, an annual or biennial inspection and control schedule should be adopted to prevent initial conditions from recurring. Frequent treatments are more effective in preserving the native integrity and aesthetic quality of the site.

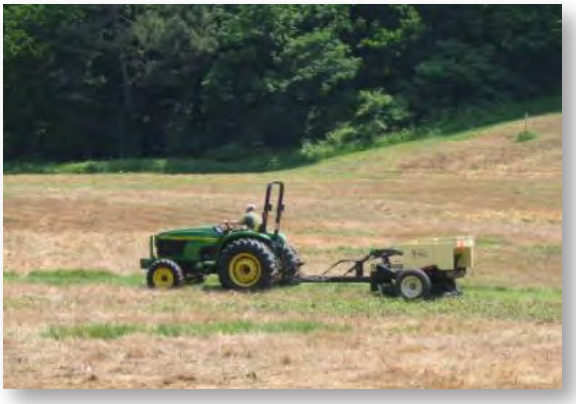
Mowing

Mowing removes most of the photosynthetic material from both desirable and undesirable plants. It effectively puts all plants on an equal basis in regards to the availability of above-ground growing space. This is, however, only a temporary situation. Because species vary greatly in their response to mowing, a mowing treatment will favor those species that can refoliate (occupy the available growing space) faster. Repeated mowings favor grass species (which grow from the base of the stem) and non-grass species which grow close enough to the ground to escape severe defoliation. Given the vigor of invasive plants, repeated treatments are usually necessary to make this method an effective control strategy.

Mowing is effective in the control of invasives in large open areas where physical removal is beyond the manpower available. The initial treatment may require the physical removal of plants (especially multiflora rose) too large to mow, which would interfere with future mowing operations and act as a seed bank from which the species could spread. For this same reason, it is advisable to remove any obstructions, such as fallen trees or rocks, around which invasives can become established and spread.

In most cases it is sufficient to combine invasive control with annual meadow mowing. Areas heavily infested with vines may require more frequent mowing for several years to weaken the invasives and encourage competitive grass species. Meadow areas heavily impacted by invasives may warrant herbicide application (see *Herbicides*).





A meadow overtaken by invasives has been sprayed with herbicides (left) and is now being planted with native warm-season grasses and wildflowers with a no-till drill (right).

Planting

Another option to remove growing space from invasives is through the planting of desirable species. This includes planting trees and shrubs to increase the density of wooded areas (to shade out invasives) and over-seeding meadows with grasses and wildflowers to increase competition for above and below ground growing space.

Planting should occur in early spring or fall to optimize plant survival. Because they must compete with invasives, only species highly adapted to a site's condition (particularly light and soil water availability) should be planted. Since most native grasses and wildflowers require minimum soil fertility to survive, it is usually not necessary to fertilize meadow planting sites.

It is particularly important to plant trees and shrubs in wooded areas where invasives have been removed. Killing or removing the invasives often disturbs the area and opens up the growing space. Invasives will quickly reoccupy the available growing space unless they are suppressed by other plantings.

Evergreen trees are especially effective in shading invasives. They grow quickly and produce heavy shade throughout the year. Evergreens also increase diversity of wildlife habitat. They are particularly helpful along south and west-facing forest edges where invasives are most prolific. The area around planted trees should be mowed for several years until they become established and start to shade out invasives. This technique is also useful along trails and other areas that are frequently mowed and maintained.

Herbicides

In most cases the exclusive use of herbicides is not an effective long-term solution for controlling invasives. Difficulties in delivering an adequate amount of the chemical only to the target plants at the correct time in their growth cycle, and the potential health risks to workers and the environment are all legitimate drawbacks to their use. In addition, inherent in the sole reliance on herbicides is a "once and done" attitude that is not conducive to the long-term control of invasives. Used appropriately, however, herbicides can be an important tool for land managers in certain situations. Herbicides should only be applied by personnel properly trained in both the safe use of each herbicide and the identification of desirable verses undesirable species.

While the use of herbicides is not an effective long-term solution for controlling invasives, used appropriately, they can be an important tool in certain situations.

To safely administer herbicides to the target plant it is best to minimize the above ground volume of the plant prior to herbicide application. To control small trees, shrubs (multiflora rose, autumn olive, bush honeysuckle) or vines, apply an herbicide with glyphosphate (such as *Roundup*) to the fresh sprouts two weeks after cutting. Larger plants can be most effectively controlled by applying *Garlon* or *Roundup* directly to the freshly cut stump. This second method works best in fall and winter when sap flow is into the roots.

Another appropriate use of herbicides is in the establishment or restoration of meadows overrun with invasives. Meadows with moderate infestation can be sprayed with a broadleaf herbicide (most invasives are broadleaf plants) such as *Banvel* or *2-4-D*. In combination with mowing this should give an advantage to the remaining grass species. Severely impacted meadows may warrant starting from scratch using the following procedure. After mowing, spray the area with a broad-range herbicide, such as *Roundup* or *Banvel*, to remove all the existing vegetation. Allow the herbicide to work for approximately two weeks, then plow and disc the site. After another two weeks, reapply herbicide to kill any surviving or newly established vegetation. Wait another two weeks and disc and plant the area with preferred species. The quick establishment of desirable species through planting is important to prevent the re-establishment of the invasive plants.

The use of prescribed fire can control invasives by giving an advantage to desirable native species as seen here in the restoration of a serpentine woodlands.

Fire

Fire has been a major influence in the evolution of the herbaceous flora of this area. Deliberate fires set by Native Americans and colonists, and accidental lightning fires gave a strong edge to fire tolerant species in some areas. The use of fire to control invasives by giving an advantage to desirable native species is an exciting new application for an old management tool. The difficulty in utilizing this tool is the obvious destructive power that can arise from its misuse. Local governments and fire companies are often not receptive to the use of fire. Some fire companies, however, use controlled burns as training exercises. In certain circumstances, the potential benefits for the control of invasives may be sufficient to face the bureaucratic challenge.

As with herbicides only properly trained individuals should utilize fire as a management tool. To be effective and safe, weather and fuel conditions must meet exacting standards. It is usually best to burn in early spring since invasives usually sprout before native species.

RECOMMENDED TECHNIQUES AND PROCEDURES

Groundcover and Vine Removal

Equipment: ***Pruners, pruning saws, loppers, blade weedwhips, chainsaws, herbicides***

Groundcovers can be pulled on a regular basis or herbicides can be used to control or eliminate patches. A mixture of *Garlon* and diesel fuel has been used successfully when sprayed on foliage in the winter. Care must be given to not spray non-target species.

As mentioned above, the first priority in invasive control is to address vines impacting canopy trees. Cut woody vines at ground level and at least 5' above ground level and remove from trees if removal won't cause damage. Immediately following cutting, large

stumps should be painted with a systemic herbicide such as *Roundup* or *Garlon*.

It should be noted that while invasive vines pose a significant threat to the forest, there may be native vine species within a natural area that have high food value for wildlife. Poison-ivy, Virginia creeper, and grape should not be cut from trees unless they begin to seriously compromise the health of the tree. Usually, this only happens with grape, which can eventually overtop the canopy of a tree. At this point the grape should be cut and not treated with herbicide so that it can resprout.

Shrub and Sapling Removal

Equipment: ***Pruners, pruning saws, loppers, blade weedwhips, Weed Wrench, chainsaws, tractor-mounted brush hog, front-end loader, herbicides***

Eliminate or control invasive and undesired shrubs and saplings by manually or mechanically pulling or by cutting. Stumps cut manually should be immediately painted with a systemic herbicide such as *Roundup* or *Garlon*. In areas that have been brush-hogged, cleanly recut all saplings over 2" in diameter and immediately paint with the systemic herbicide. Limbs and related debris can be flychipped on-site or removed if there are fruits with viable seeds.

Tree Removal

Equipment: ***Pruners, pruning saws, loppers, Weed Wrench, chainsaws, front-end loader, herbicides***

In areas adjacent to trails and other high-use locations, drop invasive and hazardous trees without damage to surrounding desirable trees and either let lie or section trunks to create brush piles for wildlife habitat (see below). Trunks and limbs of Norway maple that are large (>6" diameter) and straight (>8' sections) may be useful for trail stabilization and restoration. Some other invasive tree species such as ailanthus will decay rapidly and are not useful for this purpose. Stumps of felled trees should be cut flush to the ground and immediately treated with a systemic herbicide such as *Roundup* or *Garlon*. In many areas ailanthus will root-sprout vigorously following cutting, even with herbicide treatment. If this occurs do not cut, but apply herbicide directly to the bark at the base of the tree using oil-based Garlon mixed with a basal oil. For more information refer to the Nature Conservancy's weed-control website (**http://tncweeds.ucdavis.edu/esadocs/documnts/ailaalt.html**). Smaller limbs and related debris should be left to rot or fly-chipped on-site. In appropriate areas, larger (>6") trees can be girdled to create snags for cavity-nesting wildlife. All dead trees, snags, or branches that do not pose a safety hazard or a threat to the ecological health or stability of the forest should be left in place for their wildlife habitat benefits.

To create a brush pile, first build a base by placing four large logs, set 1' apart and parallel to each other, and then place four more logs of the same size, stacked perpendicular to the first logs. Add brush to the top and sides, starting with the larger limbs first, then adding smaller pieces until the pile is about 6' high and 6' wide.

Planting

As mentioned previously, it is particularly important to establish trees and shrubs in forested areas where invasives have been removed. This can be done through natural or artificial (planting) regeneration. The former is the preferred method because new seedlings will be derived from a gene pool that has evolved under the environmental conditions of the property over centuries or thousands of years.

Only wild-type (no cultivars) native tree and shrub species appropriate to site conditions should be used. Selecting species that are high in wildlife food and

When planting to fill forest gaps, the trees and shrubs should be only wild-type (no cultivars) native species appropriate to the site conditions and they should be protected from deer damage with fencing, tree shelters (shown here), or flexible tree wraps.

cover value increases the benefits. They should also be locally grown if possible. Ideally, they would be grown from seeds or cuttings collected on-site. Trees should be 4'–6' tall at planting to help assure that they can outcompete invasives and so that most of their foliage is above the reach of browsing deer. Container trees, both potted and in tree bands, are easier to plant and have a much greater survival rate than bare-root trees, especially if soil conditions in the planting area become dry. Using container trees also extends the planting season.

Forest gaps should be planted with trees on roughly 10' x 10' spacings and protected, if needed, from deer damage with fencing, tree shelters, flexible tree wraps, or rigid stakes. Fencing and tree shelters prevent deer from browsing leaves and buds. The tree wraps and stakes minimize damage to the bark and cambium layer (girdling) of young trees caused by antler rubbing. The wraps should cover the trunk from 1' to 5' above the ground. The stakes should be placed in the ground close to, and on opposite sides of, the trunks. They can be made of wood, metal, or other rigid materials (including bamboo) and should be at least 5' tall (above ground level). Shrubs should be a minimum of 18"–24" inches tall at planting. Where it is not practical to reduce and maintain deer at a density of 5 to 10 per square mile, only the most highly unpalatable species, such as spicebush, should be planted.

Planting design should be spaced to allow access to control competing vegetation, but close enough for the canopy to close quickly. It should also be naturalistic in form (i.e., straight lines or rows should be avoided).

Watering at the time of planting is recommended, especially if the plant is not dormant or planted during warm or dry weather. If water is easily accessible, water all plants at the time of planting to help remove air pockets from backfilled soil. Monitor the plantings for at least the first summer, watering them if conditions become dry. A little maintenance goes a long way. If available, put a layer of mulch 2"–3" inches thick over the planting area, but no closer than 2" to planted trees' and shrubs' trunks.

Schedule

Invasive and undesired vegetation is best addressed in September through February when temperatures are cooler, workers are more protected from thorns, and systemic herbicides are most effective (when sap is flowing into the roots). Any heavy equipment use should be conducted when the ground is dry.

Plant trees and shrubs in early spring before they leaf out or in early fall to allow for root growth before the ground freezes. If needed, install flexible tree guards in August and remove in January, until the tree is large enough (2" in diameter) to withstand buck rubs.

Ongoing Management

Following restoration, every effort should be made to minimize future disturbance to forest areas, from both natural and human sources. This includes removing any trash and monitoring annually for intrusion or regrowth by invasive or other undesirable plants.

Control invasive trees and shrubs by spot spraying or wick application of an appropriate systemic herbicide or by manual or mechanical pulling. Areas that are disturbed by removal should be replanted with native trees and shrubs and mulched with woodchips or on-site leaf litter. Any resprouting invasive and undesirable vines should be prevented from climbing into trees and shrubs at a minimum by pruning. They should eventually be eliminated by spot spraying or wick application of an appropriate systemic herbicide or by manual or mechanical pulling and replanting of the area with native trees and shrubs.

Until natural regeneration becomes adequate, the planting of trees and shrubs should continue on an as-needed basis to assure that sufficient regeneration is available to replace canopy trees as they die. Reduce vegetative competition through selective cutting or herbicide use around the bases of trees during the growing season until the canopy has closed.

SUMMARY

There are many techniques available for controlling invasive vegetation. These options are not mutually exclusive. Usually the control of invasives on any given site requires a combination of two or more methods. The exact mixture and timing will be unique to each site. What will be common to all sites is the fact that the prolific nature of invasive plants mandates periodic monitoring and control to prevent a major disruption to the aesthetics and ecology of the impacted site.

INVASIVE INTRODUCED SPECIES OF PLANTS, currently associated with the greatest harm to native biodiversity in southeastern Pennsylvania

COMMON NAME	SCIENTIFIC NAME	DESCRIPTION	RECOMMENDED CONTROL TECHNIQUES
akebia, five-leaved	*Akebia quinata*	woody vine or creeping shrub	physical removal; herbiciding bark or cut stem
angelica-tree, Japanese	*Aralia elata*	tree	physical removal (small seedlings); herbiciding bark or cut stem
bamboo, garden	*Pseudosasa japonica*	upright shrub	mowing; herbiciding young foliage
bittersweet, oriental	*Celastrus orbiculatus*	woody vine	cutting; herbiciding bark or cut stem
cherry, bird	*Prunus avium*	tree	physical removal (small seedlings); herbiciding cut stem
burning-bush	*Euonymus alatus*	shrub	physical removal; herbiciding cut stem
celandine, lesser	*Ranunculus ficaria*	perennial spring-ephemeral herb	physical removal (small areas); herbiciding foliage; planting
corktree, amur	*Phellodendron amurense*	tree	physical removal (small seedlings); herbiciding cut stem
crownvetch	*Coronilla varia*	herbaceous plant aggressively spreading in open areas	mowing; herbiciding foliage; planting
gill-over-the-ground	*Glechoma hederacea*	herbaceous plant aggressively spreading in the forest	mowing; herbiciding foliage; planting
goutweed	*Aegopodium podagraria*	perennial herb	mowing; herbiciding foliage; planting
honeysuckle, amur	*Lonicera maackii*	shrub	physical removal; herbiciding bark or cut stem
honeysuckle, Japanese	*Lonicera japonica*	creeping shrub or liana	physical removal; herbiciding foliage
honeysuckle, Morrow's	*Lonicera morrowii*	shrub	physical removal; herbiciding bark or cut stem
hops, Japanese	*Humulus japonicus*	herbaceous plant aggressively spreading in open areas, particularly on floodplains	mowing; herbiciding foliage; planting
jetbead	*Rhodotypos scandens*	upright shrub	physical removal; herbiciding bark or cut stem
ivy, English	*Hedera helix*	prostrate or climbing woody vine	physical removal; herbiciding foliage or cut stem

COMMON NAME	SCIENTIFIC NAME	DESCRIPTION	RECOMMENDED CONTROL TECHNIQUES
knotweed, Japanese	*Fallopia japonica*	very large Eurasian perennial herb	physical removal; herbiciding foliage
loosestrife, purple	*Lythrum salicaria*	herbaceous plant aggressively spreading in wet open areas	herbiciding foliage
maple, Norway	*Acer platanoides*	tree	physical removal (small seedlings); herbiciding bark or cut stem
mile-a-minute	*Persicaria perfoliata*	herbaceous plant aggressively spreading in open areas	physical removal; herbiciding foliage
multiflora rose	*Rosa multiflora*	upright or often climbing shrub	physical removal; herbiciding bark or cut stem
garlic-mustard	*Alliaria petiolata*	biennial herb	physical removal
periwinkle	*Vinca minor*	creeping shrub	physical removal; herbiciding foliage
phragmites, common reed	*Phragmites australis*	very large perennial herb; the species is native to both North America and Eurasia, but the invasive form is thought to be descended from Eurasian populations	physical removal; herbiciding foliage
plumegrass, Japanese	*Miscanthus sinensis*	herbaceous plant aggressively spreading in open areas	physical removal; herbiciding foliage
porcelain-berry	*Ampelopsis brevipedunculata*	woody vine	cutting; herbiciding foliage, bark, or cut stem
privet, border	*Ligustrum obtusifolium*	shrub	physical removal; herbiciding bark or cut stem
sapphire-berry	*Symplocos paniculata*	upright shrub	physical removal; herbiciding bark or cut stem
spurge, Japanese	*Pachysandra terminalis*	creeping shrub	physical removal; herbiciding foliage
stilt grass, Japanese	*Microstegium vimineum*	herbaceous plant aggressively spreading in the forest	physical removal; herbiciding foliage
strawberry, Indian	*Duchesnea indica*	herbaceous plant aggressively spreading in the forest	physical removal
tree-of-heaven	*Ailanthus altissima*	tree	physical removal (small seedlings); herbiciding bark

COMMON NAME	SCIENTIFIC NAME	DESCRIPTION	RECOMMENDED CONTROL TECHNIQUES
viburnum, linden	*Viburnum dilatatum*	upright shrub	physical removal; herbiciding bark or cut stem
viburnum, doublefile	*Viburnum plicatum*	upright shrub	physical removal; herbiciding bark or cut stem
viburnum, Siebold	*Viburnum sieboldii*	upright shrub	physical removal; herbiciding bark or cut stem
wisteria, Japanese/Chinese	*Wisteria frutescens/sinensis*	woody vine	herbiciding bark or cut stem