

Land Management Plan Update
Tyron Farm, Indiana

Prepared for

Tryon Farm Institute

By

Baetis Environmental Services, Inc.

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1.0 INTRODUCTION

The Tryon Farm Institute (TFI) received a grant from the Indiana Lake Michigan Coastal Program to fund an update to the land management plan for development of Tryon Farm (J.F. New and Associates 1991). TFI is collaborating with the Tryon Farm Homeowners Association (TFHA) to develop the plan update. The original land management plan was assembled by J.F. New and Associates in 1991, and updated in 2001. Since that time, homes, roads, and other structures have been built, a native prairie planted, drain tiles broken, and other property management activities performed. In addition, a management plan for the watershed has been developed to reduce nonpoint point source pollutant loadings to Lake Michigan (American Structurepoint, Inc. 2007). With a comprehensive and updated land management plan, Tryon Farm can make positive improvements to its open space, mitigate the influence of invasive species, and reduce adverse effects of its development on downstream habitats and Lake Michigan.

The Indiana Coastal Program grant authorized the retention of a consultant to update the plan. Baetis Environmental Services, Inc. of Chicago was hired to facilitate three meetings with homeowners, to develop a GIS for the property, and to update the land management plan. TFI assisted with this effort, by conducting the field surveys, GPS mapping of invasive species, and coordinating the meetings.

2.0 EXISTING CONDITIONS

This description of existing conditions is taken from the 1991 and 2001 management plans, updated using information provided by the TFI vegetation surveys, personal communications, and various online spatial databases.

2.1 Soils and Hydrology

The earlier management plans presented summary information on soils and drainage of the region (beyond the Tryon Farm site) taken from USDA reports. We have updated the spatial database using the latest data from the Natural Resource Conservation Service for soils and hydrography (in a GIS for TFI that accompanies this report). Most soil series on the site are Maumee, Morocco, Oakville, and Newton, with minor inclusions of Brems, Adrian, drained, and Selfridge.

The GIS allows for ready identification of highly erodible areas, hydric soils, or other soil features affecting natural resources or development on the property. An example is provided as Figure 1 showing hydric soils (cross hatching) at Tryon Farm. Note the

presence of some homes on hydric soils. The map of the hydric soils is, in essence, a surrogate for pre-settlement locations of wetlands.

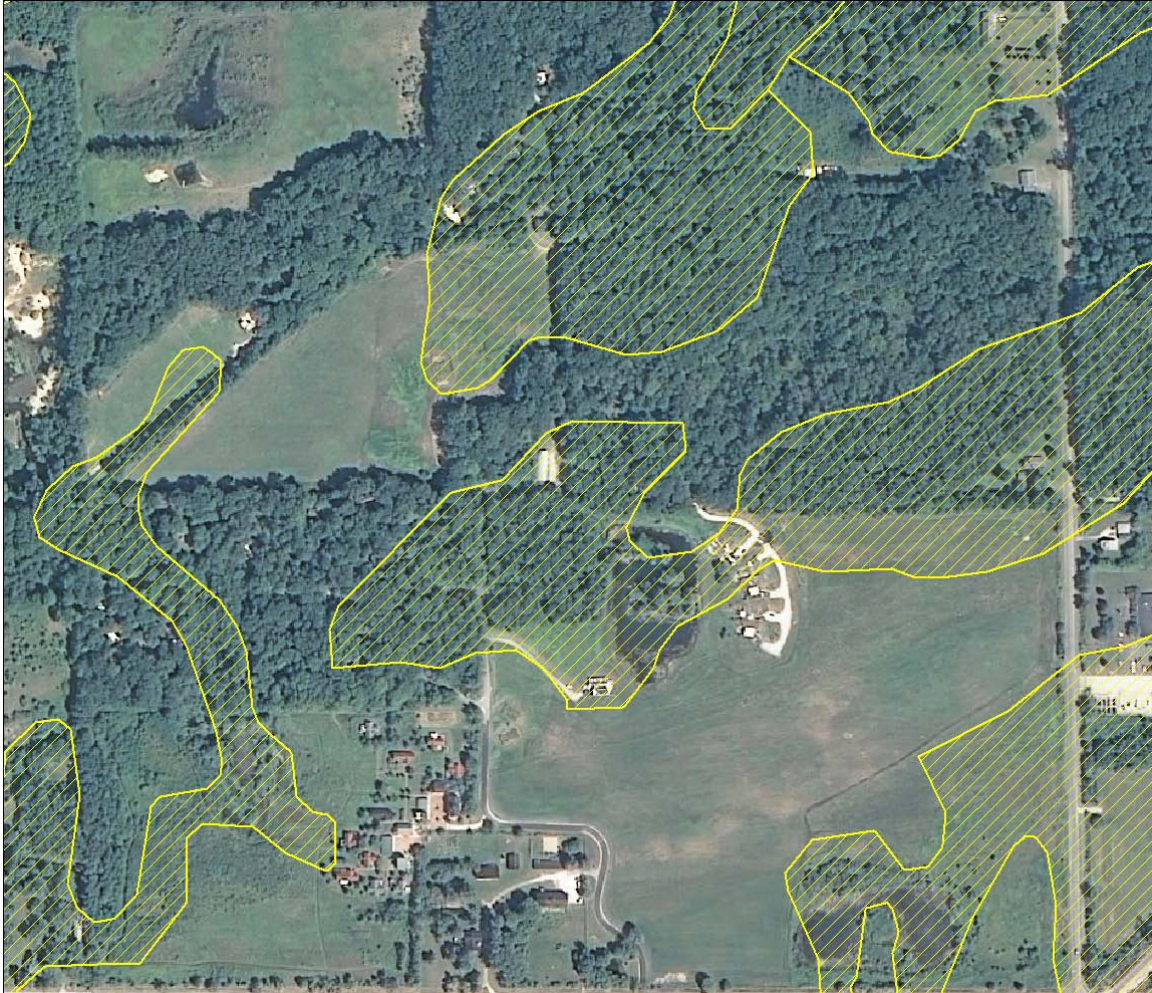


Figure 1. Hydric Soils (Source: USDA NRCS Geospatial Data Gateway)

Tryon Farm drains to the west, through Beck's ditch and Otter Creek, both part of the Trail Creek watershed. Since development of Tryon Farms, some homes have experienced drainage problems. The topography and construction of some homes on hydric soils is responsible for this. In Chapter 3, we include recommendations addressing problems of standing water, and a major thrust of these recommendations is that residents recognize that these are wetlands and are an important natural part of the landscape. Homeowners at Tryon Farm have presumably selected the development at least in part

because of its integration into the natural landscape, and they should recognize the biological and ancillary benefits of forested and emergent wetlands.

Another GIS example is Figure 2, showing identified wetlands on the property using a recently completed dataset prepared by Ducks Unlimited (downloaded from <http://www.ducks.org/conservation/glaro/glaro-gis-nwi-update-data>). The DU dataset was prepared largely using remote sensing data and has limited groundtruthing. Nevertheless, it is the best and most recent wetland maps available for LaPorte County. Note the presence of large areas of forested and shrub-scrub wetlands at Tryon Farm.



Figure 2. Wetlands at Tryon Farm

The pink areas labeled as other on Figure 2 correspond to wetlands developed or modified by Tryon Farm Partners, Ltd. or the City of Michigan City in earlier years.

During their preparation of the original land management plan in 1990, J. F. New and Associates delineated wetlands on the property and prepared a wetland hydrology and development plan. Baetis obtained climate records for Michigan City for the period 1950 – 2009. Figure 3 graphs the difference between the annual precipitation and the long term average precipitation. In years where the ordinate value in Figure 3 is greater than zero, precipitation was greater than the long term average (a wet year). Negative ordinate values indicate a dry, or drought, year. The details of the wetland delineation and field work were not described in J.F. New's report, but appears to have been done during a year of excess precipitation (Figure 3), following a 4-year drought. In the following years, significant fluctuation in annual rainfall occurred. The Tryon Farm development plans may not have reflected long-term hydrologic records, particularly the influence of wet and dry extremes. Further, in the 2001 management plan update, J. F. New and Associates recommended modifications to the wetland outlet structure; those recommendations were not implemented and drainage problems continue.

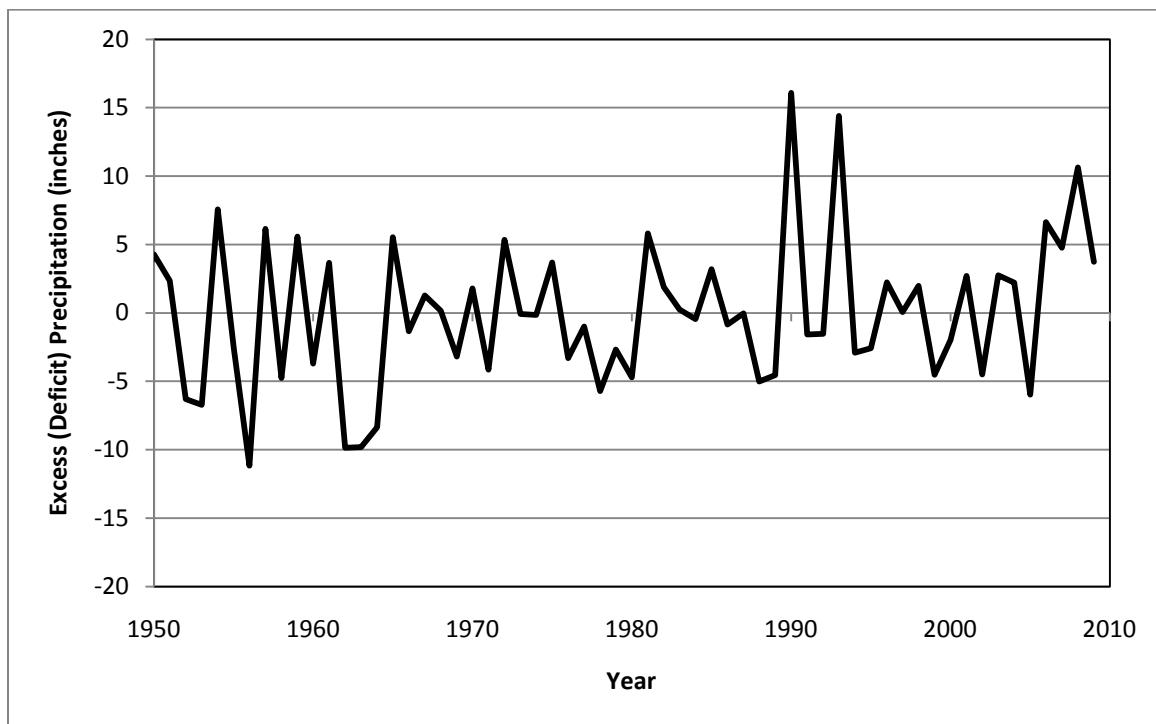


Figure 3. Difference Between Annual Precipitation and Long Term Mean Precipitation (Source: Data downloaded November 16, 2010 from <http://www.esrl.noaa.gov>)

The sedge meadow, or west pond, located just west of the Farmstead Settlement, was identified in the 1991 management plan as wetland # 1. This is an area of approximately 13 acres and was originally known as the Tryon Farm prairie¹. In the 2001 update, it was recognized that the water level in the wetland was higher than anticipated, and recommendations were presented for a water level control structure; this was not installed. Since then, some residents have complained of water problems. TFI recently collected some data points that represent locations of water problems; in general, these data points are in the Woods Settlement and are more than 500 feet away from wetland #1 (Figure 4). While surveys are needed to confirm ground elevations, lowering the invert for the pond in wetland # 1 may not necessarily eliminate water ponding in the Woods Settlement.

¹ Personal communication, Mr. Scott Kuchta, Tryon Farm Homeowners Association.

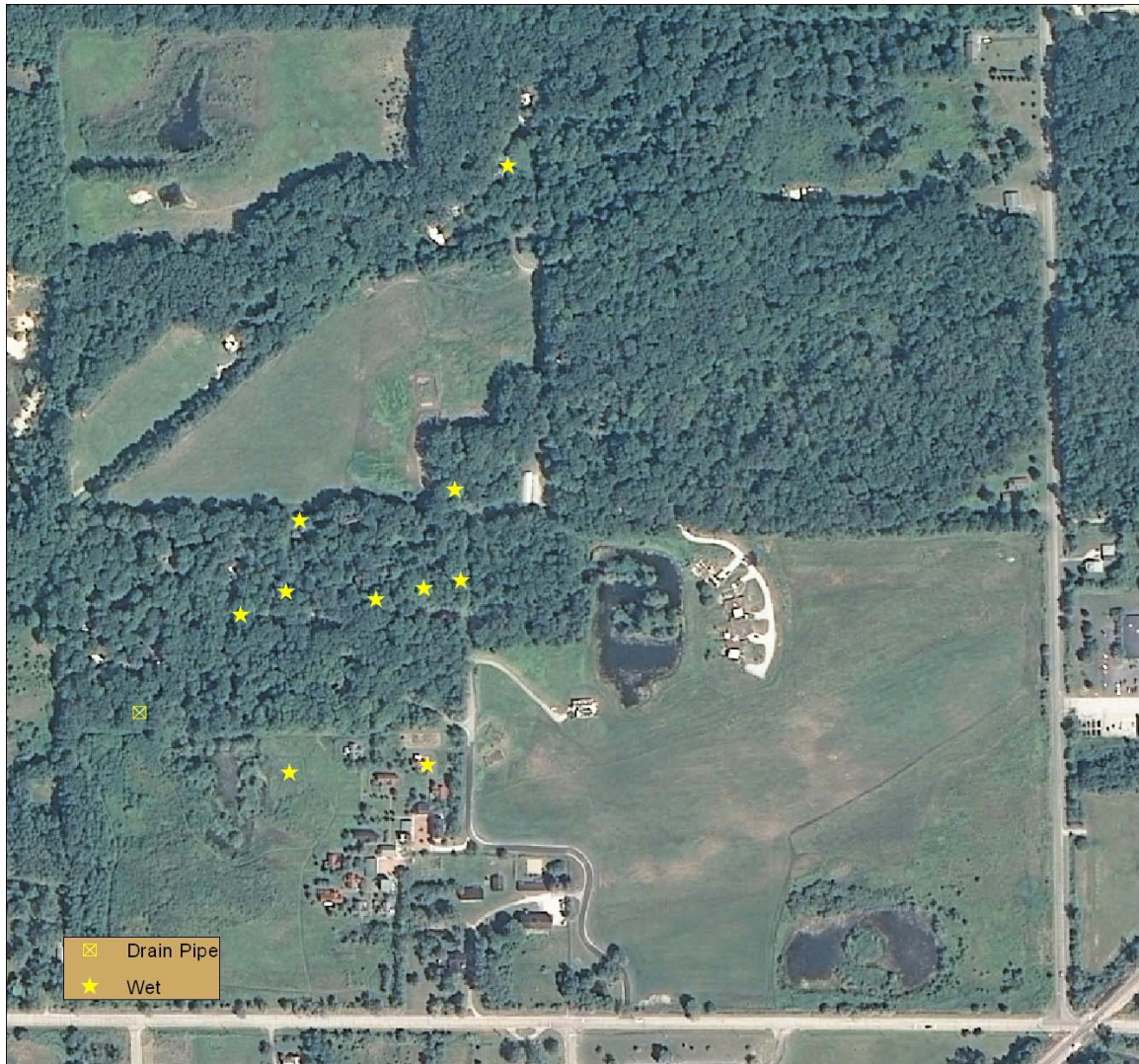


Figure 4. Locations of Drainage Problems

2.2 Vegetation Communities

Tryon Farm contracts with a landscape service for mowing, tree trimming and other vegetation management activities. The 2010 landscape maintenance schedule is reprinted as Appendix A.

We have followed the nomenclature introduced by J. F. New (1991) for the vegetation communities on Tryon Farm. These communities are described below. Other areas such

as the hay fields, meadows and the ponds were not described by J. F. New and were not inventoried by TFI in this update.

Wooded Dunes. Vegetation in the wooded dunes as listed in the 1991 plan is reprinted in Table 1.

Table 1
VEGETATION OF THE WOODED DUNES¹

Latin Name	Common Name
<i>Acer rubrum</i>	Red maple
<i>Aster macrophyllus</i>	Big-leaved aster
<i>Cornus florida</i>	Flowering dogwood
<i>Epifagus virginiana</i>	Beech drops
<i>Fagus grandifolia</i>	American beech
<i>Gaultheria procumbens</i>	Wintergreen
<i>Hamamelis virginiana</i>	Witch hazel
<i>Maianthemum canadense</i>	Canada mayflower
<i>Mitchella repens</i>	Partridge berry
<i>Nyssa sylvatica</i>	Black gum
<i>Ostrya virginiana</i>	Hophornbeam
<i>Parthenocissus quinquefolia</i>	Virginia creeper
<i>Pinus strobus</i>	White pine
<i>Polygonatum canaliculatum</i>	Smooth Solomon's seal
<i>Prunus serotina</i>	Wild black cherry
<i>Querus alba</i>	White oak
<i>Querus rubra</i>	Red oak
<i>Querus velutina</i>	Black oak
<i>Sassafras albidum</i>	Sassafras
<i>Smilacina racemosa</i>	False Solomon's seal
<i>Smilax rotundifolia</i>	Green brier
<i>Solidago caesia</i>	Blue stemmed goldenrod
<i>Vaccinium angustifolium</i>	Lowbush blueberry
<i>Viburnum acerfolium</i>	Maple-leaved viburnum

¹ J.F. New and Associates 1991

Intermediate Woods. The 1991 plan defined the non-dune forested area in the northeast quadrant of Tryon Farm as the “Intermediate Woods”. They listed similar vegetation as the Wooded Dunes (Table 2) and suggested that the area had been logged in the past.

Table 2
VEGETATION OF THE INTERMEDIATE WOODS²

Latin Name	Common Name
<i>Acer rubrum</i>	Red maple
<i>Amelanchier arborea</i>	Shadbush
<i>Aralia nudicaulis</i>	Wild sarsaparilla
<i>Carya ovata</i>	Shagbark hickory
<i>Cornus florida</i>	Flowering dogwood
<i>Fagus grandifolia</i>	American beech
<i>Maianthemum canadense</i>	Canada mayflower
<i>Podophyllum petatum</i>	Mayapple
<i>Polygonatum canaliculatum</i>	Smooth Solomon's seal
<i>Prunus serotina</i>	Wild black cherry
<i>Quercus alba</i>	White oak
<i>Quercus rubra</i>	Red oak
<i>Rubus spp.</i>	Blackberry
<i>Sassafras albidum</i>	Sassafras
<i>Smilacina racemosa</i>	False Solomon's seal
<i>Smilax rotundifolia</i>	Greenbrier
<i>Vaccinium angustifolium</i>	Lowbush blueberry
<i>Viburnum acerifolium</i>	Maple-leaved viburnum

² J.F. New and Associates 1991

Low Woods. The 1991 plan labeled the 12-acre area between Beck’s Ditch and the farmstead along the west property border as the “low woods”; it has since been developed as the Woods Settlement. The 1991 plan described this area as successional, in that it was likely a pasture during the time the land was being farmed. The area is moist, is at least 50% hydric soils, and supports many hydrophilic plants (Table 3). Some residents of the Woods Settlement have complained of the standing water in some years (see Figure 4).

Table 3
VEGETATION OF THE LOW WOODS³

Latin Name	Common Name
<i>Acer rubrum</i>	Red maple
<i>Amelanchier arborea</i>	Shadbush
<i>Arisaema triphyllum</i>	Jack-in-the-pulpit
<i>Betula papyrifera</i>	Paper birch
<i>Botrychium virginianum</i>	Rattlesnack fern
<i>Circaea quadrisulcata</i>	Enchanter's nightshade
<i>Fagus grandifolia</i>	American beech
<i>Festuca obtusa</i>	Nodding fescue
<i>Impatiens</i> spp.	Touch-me-not
<i>Laportea canadensis</i>	Nettle
<i>Lindera benzoin</i>	Spicebush
<i>Liriodendron tulipifera</i>	Tulip tree
<i>Maianthemum canadense</i>	Canada mayflower
<i>Onoclea sensibilis</i>	Sensitive fern
<i>Osmorhiza claytonia</i>	Sweet cicely
<i>Parthenocissus quinquefolia</i>	Virginia creeper
<i>Podophyllum peltatum</i>	Mayapple
<i>Polygonatum canaliculatum</i>	Smooth Solomon's seal
<i>Prunus serotina</i>	Wild black cherry
<i>Prunus virginiana</i>	Choke cherry
<i>Quercus rubra</i>	Red oak
<i>Rhus radicans</i>	Poison ivy
<i>Sassafras albidum</i>	Sassafras
<i>Sambucus canadensis</i>	Elderberry
<i>Smilacian racemosa</i>	False Solomon's seal
<i>Trillium recurvatum</i>	Red trillium
<i>Ulmus americana</i>	American elm
<i>Viola papilionacea</i>	Blue violet
<i>Vitis riparia</i>	River bank grape

³ J.F. New and Associates 1991

Other vegetation communities and habitats include the wet prairie (or sedge meadow), the mesic prairie (WHIP-funded), hayfields, and several small ponds. The areas in the immediate vicinity of homes, including the berms surrounding homes in the Pond Settlement are also classed as special areas for management activities. No surveys beyond the TFI's tree and invasive plant surveys have been performed for these areas.

During the recent fall and winter, TFI surveyed invasive plants on the property. We have converted this database for inclusion in TFI's GIS; Figure 5 is a map of the plants that were found. Maps of each species are included in Appendix C.

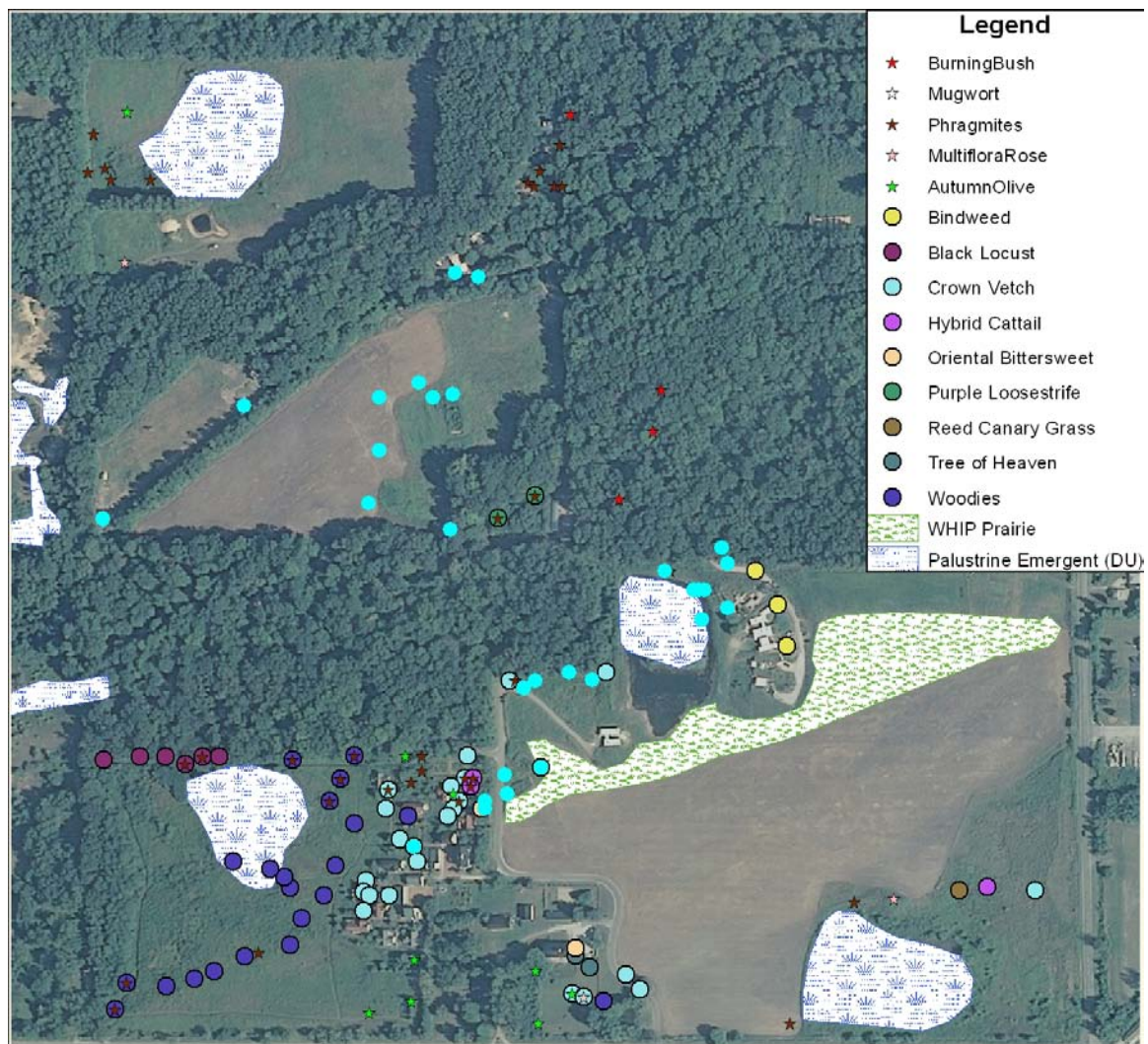


Figure 5. Survey of Invasive Plants at Tryon Farm (Source: TFI)

3.0 MANAGEMENT PLAN UPDATE

Herein we outline a plan for managing some of the common properties at Tryon Farm, with particular attention paid to vegetation. Tryon Farm markets itself as a livable, sustainable conservation-minded community, so these values are reflected in the management strategies and recommendations below. Homeowners have selected Tryon Farm presumably because of its stated intent to develop homes with access to open space, wise use of resources, preservation and restoration of wetlands and prairie, and the overall natural setting.

3.1 General Vegetation Management

Management of plant communities, particularly invasive plants, is a principal reason for this update. Invasive plants are a problem because they have competitive advantages over native species that lead to a more rapid reproductive and survival ability. These advantages include:

- Absence of predators and diseases that keep populations down
- Competitive advantages for earlier leaf-out or the use of water or nutrients

Most agricultural weeds are non-indigenous to the areas they inhabit and are primarily disturbance-oriented species. Usually agricultural weeds are not problematic in natural areas, although they can be for restorations of former agricultural land, such as the prairie restoration area east of the Pond Settlement.

While eradication of invasive species may be desirable, it is rarely possible. In many situations, a practical goal is to reduce a non-native's population to a level that does not affect the integrity of the native community. The more common techniques for controlling invasive plants are briefly described below. More specific controls recommended for individual species are in Appendix C.

Prioritizing areas for control of invasives generally involves consideration of both ecological and social factors. Ecological considerations focus on invasive plants having the greatest potential to damage areas with rare or diverse species, areas in the earliest stages of invasion, or locations along streams where seeds can be readily spread to other areas. Social considerations include visibility or importance to land uses.

A wide variety of techniques are available to control invasive plants. There are manual methods like hand-pulling, digging, flooding, and burning. Mechanical methods include cutting, mowing, tilling, and girdling. Chemical methods (herbicides) and biological

controls also are available. Combining two or more of these techniques is commonly referred to as integrated vegetation management and is the most effective form of invasive plant control. We briefly detail some of these techniques below.

3.1.1 Controlled and Spot Burns

Fire is a very effective but hazardous technique for managing vegetation. J.F. new recommended annual burns for three years in their 2001 land management update. They suggested that a late fall burn would have ample amounts of dry fuel, to provide a fire sufficiently hot to control the woody plants invading wetland #1. At the time, they also recommended a spring burn to help the native plant community out-compete the exotic, cool season herbaceous plants. We understand that spring conditions in the sedge meadow have sometimes been too wet to allow for a fire sufficiently hot to benefit the natives.

The 2001 recommendations recognized safety concerns for Tryon Farm and the necessity of maintaining fire lanes around the entire sedge meadow area.

Michigan City Ordinance (Section 54.1 – Open Burning) requires a permit from the Fire Department, and, IDEM air pollution permits may also be required. Grass or prairie fires can spread rapidly and fire management experts should be utilized for burning. Controlled or prescribed burns are effective at reducing invasive and woody plant density and competition, stimulating the growth of more desirable, native species, returning nutrients to the soil, promoting germination of dormant native seeds, and enhancing wildlife habitat values. Oak woodlands, prairies, savannas and sedge meadows are communities that have evolved with periodic fire, and it can be very effective restoration tool for these habitats.

Sometimes spot treatments using fire are more appropriate and/or safer. This is typically done using a torch with a long wand to ignite individual plants or small groups of plants. Spot treatments with fire may be less expensive than herbicides and less labor intensive than hand-pulling.

3.1.2 Herbicide Use

Herbicides are also commonly used to control invasive plants, and some species cannot be effectively controlled without herbicides. J. F. New recommended equipment and chemicals in their 2001 land management plan update.

Buckthorn, black locust, and other invasive trees and shrubs if cut and if the stumps are not treated with an herbicide, the tree will resprout. Other species may have extensive root systems, like Canada thistle, that are difficult to completely pull out of the ground.

In Indiana, commercial herbicide applicators must have a license from the State Chemist. The label has instructions for use, storage, and clean-up, and such instructions are legal requirements to be followed. Personal protection equipment is commonly used, per the label.

Herbicides are formulated for spraying or painting onto cut stumps, for basal bark treatment of trees and shrubs, foliar treatment, and injection.

3.1.3 Biological Controls

Biological controls of invasive plants involve the use of fungi, animals, or microbial diseases to target a particular species. Generally biological controls will not eliminate a population of invasives, but a few biological controls have been effective. For example, two species of beetles (genus *Galerucella*) are used for biocontrol of the exotic wetland weed purple loosestrife (*Lythrum salicaria*). Much research is being done, and more is needed, in the field of biological controls.

Animal grazing can either promote or reduce invasive plants at a particular site. Cattle, sheep, horses, goats, geese, and bison have been used, usually in combination with other techniques, to control invasive plants. At Midewin National Tallgrass Prairie in Will County, Illinois, 20,000 acres of farmland and industrial land is being restored to prairie and wetland; cattle grazing is one of the tools for land management being done there.

3.1.4 Mechanical Controls

Water level manipulation, weeding, tilling, mowing, girdling and sawing are all used to control or kill invasive plants. These techniques can be labor intensive, but as they can also be safer than herbicides or fire, are popular with volunteer-based restoration efforts. Most of the ongoing plant management at Tryon Farm could be considered as mechanical controls (Appendix A).

3.2 Vegetation Recommendations

3.2.1 Sedge Meadow

The sedge meadow is located just west of the Farmstead Settlement. The objectives for management of this area at Tryon Farm are to enhance the balance and diversity of native sedge meadow vegetation, and to improve water level control for protection of nearby

homes. The first of these objectives can be achieved by removing or controlling non-native and weedy native vegetation, and planting native wetland plants. In a meeting of TFHA on October 17, 2010, we queried attendees regarding their personal priorities for land management, and the sedge meadow was rated as the most important habitat type at Tryon Farm for restoration. Attendees were especially interested in the control of phragmites and woody species (e.g., willows, black locust). Recommendations of the prior management plans were not fully implemented, including the lowering of the water level.

Management activities that will meet the above habitat objectives include:

- Remove all non-native shrubs and thin weedy native species. According to the TFI's recent surveys, this mainly includes hybrid cattail (*Typha xglauca*), phragmites (*Phragmites australis*), crown vetch (*Securigera varia*), black locust (*Robinia pseudoacacia*), and willow species (*Salix* sp.). Reed canary grass (*Phalaris arundinacea*) is also present. An integrated approach to invasive plant control is recommended (i.e. the use of two or more techniques, such as manual and herbicidal), and it will likely require several years to be effective.
- Eliminate phragmites as soon as possible from this area and from all of Tryon Farm.
- Retain professional service to assess the sedge meadow for a prescribed burn. Maintain fire lanes around the entire perimeter.
- Control woody species by cutting and treating stumps with effective herbicides.
- Supplement vegetation community with plantings of native sedges, grasses and forbs.
- Monitor and evaluate response of the sedge meadow to prescribed burn and supplemental plantings.
- Spot-herbicide species that are difficult to control (e.g., hybrid cattail, phragmites, reed canary grass).

Cattails can be controlled by cutting (or burning) of the foliage in early spring, followed by an extended period of flooding. Submerging the shoots in early spring will eliminate gas diffusion and "suffocate" the plant. At Tryon Farm, raising the water level sufficiently to do this may not be possible without damaging some homes. As such, mechanical techniques, enhanced with herbicide use, would be more appropriate for the sedge meadow. Repeated treatments will likely be needed. Mechanical techniques, in

combination with herbicide treatments, are also recommended for removal of the woody species invading the meadow.

J. F. New's (2001) schedule for integrated management of invasive plants in the sedge meadow area is reprinted below. It remains valid, and nearly timely if a decade is added to the implementation schedule. We reprint this schedule to emphasize that problems with invasive plants do not remedy themselves, and in fact, invariably worsen over time and become more costly.

Activity	Jan 01	Feb 01	Spring 01	Summer 01	Fall 01	Winter 01
Woody control	X					X
Herbaceous control			X	X	X	
Mow burn lanes		X				
Burn			X			
Supplemental seeding			X			
Supplemental plugging			X			
Water control structure			X			

Figure 6. Schedule Management for Natural Areas at Tryon Farm (Source: J. F. New 2001)

Monitoring in coming years should include both vegetation and water levels. We recommend that a staff gage be used for a quick visual indication of the surface level in the pond. A surveyor could determine the datum for a staff gage, but the community need not wait for that to occur in order to install the gage. Daily water level records should be kept. Staff gages are environmentally rugged and do not need replacement under normal conditions. A staff gage and mounting post could be purchased from online suppliers, and installed by a contractor (or even a volunteer). Subsequently, when a surveyor is on the property, the datum of the gage should be established and tied to a local benchmark.

Vegetation in the sedge meadow, as in other communities around Tryon Farm, should be monitored and good records kept. We recommend a Floristic Quality Assessment (FQA) based upon quadrants surveyed along one or more walking transects in the sedge meadow. Section 3.6 provides more details on this technique. Once the transects are

established, this approach is straight-forward, results in a species list, and is a very useful tool for tracking restoration progress. The field crew need only be able to use a GPS and to identify the flora.

Table 4
MANAGEMENT RECOMMENDATIONS FOR SEDGE MEADOW

Action Item	Season	Cost Range*
Remove or kill woody plants by pulling / cutting / herbicide treatment	Winter	\$ 500 - \$ 1,000
Mow burn lanes, perform control burn	Fall or spring	\$2,000 or more, depending on acreage
Supplemental seeding and/or plugging with native plants	Spring	\$1,000 - >\$10,000 depending on acreage & types
Install staff gage	Immediately	\$300
Spot treatment of herbaceous species, including phragmites, cattails followed by mowing or burning of dead foliage	Summer	\$ 500 - \$ 1,000
Implement monitoring program	Immediately	Variable

* Costs are presented as ranges because the area of the action item vary (e.g., 1 acre versus 10 acres) and the action may be performed by volunteers, not-for-profit groups, or professional contractors.

3.2.2 Woodlands

For management purposes, the woodlands identified in the original management plan are treated as one unit. The objective for woodland management at Tryon Farm is to enhance the balance and diversity of native woodland vegetation. This objective can be achieved by removing or controlling non-native and weedy native vegetation, minimizing disturbance of the woodland areas, and, as appropriate, planting native woodland plants. Development has adversely affected some native trees, and several have died. Standing dead timber has significant wildlife benefits, but can be hazardous. Depending on the location and size of dead trees, the community may need to cut them to prevent potential damage when the trees fall.

Beech-maple forests are naturally diverse, both in terms of species and size classes. Therefore, maintaining stand-level structural complexity can be fairly easy, but will not necessarily occur on its own, especially given the pressures of landscape fragmentation, human habitation, and invasive species.

Management activities identified for Tryon Farm's woodlands are:

- Remove all non-native shrubs and thin weedy native species from the understory. According to the TFI's recent surveys, this mainly includes burning bush (*Euonymus alata*).
- Eliminate phragmites as soon as possible from the woodlands and the entire Tryon Farm property.
- Monitor and control as necessary all non-native ground cover species such as garlic mustard (*Alliaria petiolata*).
- Thin weedy native vine species (grape, poison ivy, Virginia creeper) as needed to open canopy.
- Maintain trails, including prevention of soil erosion in highly used reaches.
- Protect old trees, notably the beeches, from damage and disease by monitoring for stress and restricting development. American beech, and the associated parasite beechdrop, are on the edge of their distribution range and represent somewhat rare occurrences for northwestern Indiana.

Cut trees and shrubs can be used to create brushpiles in selected areas. Brushpiles are piles of limbs arranged to permit entry of small wildlife to the exclusion of larger animals that may prey on them. Few wildlife management practices can provide a more important part of wildlife habitat for the amount of effort as brushpiles. They are suitable for wildlife protection from severe weather and predators, and a place to rear young. The main benefactor of brushpiles is often rabbits, but brushpiles can also benefit various reptiles (box turtles, fence lizards, snakes), songbirds, other rodents, and other mammals.

The Food, Conservation, and Energy Act of 2008 (that is, the 2008 Farm Bill) clarifies the NRCS' Environmental Quality Incentives Program (EQIP) purposes to include forest management and energy conservation, as well as practices related to organic production and fuels management. Indiana's NRCS Environmental Quality Incentives Program (EQIP) includes a new incentive option for landowners with forested and wooded acres. Eligible applicants receive some funding to retain a professional forester to inventory the site and prepare a complete woodland management plan. Tryon Farm may be an eligible participant in this program for cost sharing some implementation measures.

Vegetation in the woodland areas, as in the sedge meadow, should be monitored using walking transects and the FQA. This approach is relatively simple, yet results in a species list, so data is generated that can be used to measure biodiversity. Presence/absence

surveys could also denote the abundance of desirable or non-desirable species, which would be helpful to landscape contractors responsible for managing the vegetation.

Table 5
MANAGEMENT RECOMMENDATIONS FOR WOODLANDS

Action Item	Season	Cost Range*
Remove or kill non-native woody plants by pulling / cutting / herbicide treatment	Winter	\$ 500 - \$ 1,000
Control herbaceous species	Spring, Summer, Fall	\$ 500 - \$ 1,000
Implement monitoring program	Immediately	

* Costs are presented as ranges because the area of the action item vary (e.g., 1 acre versus 10 acres) and the action may be performed by volunteers, not-for-profit groups, or professional contractors.

3.2.3 Prairie

The restored mesic prairie area at Tryon Farm was rated lowest priority for vegetation at the October 17, 2010 meeting where the opinions of residents were polled. No invasives are recorded in the current dataset for the restored prairie although they undoubtedly are present there. Invasive species, including agricultural weeds from the seed bank, will germinate and spread in that newly planted area. Prescribed burns should be performed by a professional contractor. Monitoring is recommended, and the transect approach is suitable for the prairie as well.

3.2.4 Ponds

No surveys have been performed of aquatic plants in the ponds. Many exotic aquatic plants such as Eurasian watermilfoil (*Myriophyllum spicatum*) can be carried onto the site by waterfowl and rapidly colonize a pond or lake and crowd out native plants. We recommend a survey of the ponds be performed by qualified contractor. If non-native aquatic plants are found, the contractor can recommend management measures.

Phragmites is present along the edges of some ponds at Tryon Farm. We recommend that all phragmites be eliminated as soon as possible from the entire property.

3.2.5 Berms

The Pond Settlement has bermed homes and several weedy forbs have colonized the berms and surrounding area, including mugwort, bindweed and crown vetch. The berms are disturbed soils, being recently constructed, so pioneering sun-loving species like these three species are able to take advantage and outcompete the native species. Burns are not recommended for management of areas close to dwellings, so we recommend mechanical controls and herbicide treatment of the berms. Replanting with native species is also strongly encouraged after the invasive plants are removed.

Table 6
MANAGEMENT RECOMMENDATIONS FOR BERMED AREAS

Action Item	Season	Cost Range [*]
Remove or kill mugwort, bindweed and crown vetch plants by pulling and digging (remove all mugwort roots) / herbicide treatment	Spring Summer	\$ 500 - \$ 1,000
Supplemental seeding and/or plugging with native plants	Spring	\$1,000 ±
Implement monitoring program	Immediately	

^{*} Costs are presented as ranges because the area of the action item vary (e.g., 1 acre versus 10 acres) and the action may be performed by volunteers, not-for-profit groups, or professional contractors.

3.3 Stormwater Management Recommendations

TFI mapped ten locations where homeowners reported problems with occasional standing water. Nearly all of these wet areas are in the Woods Settlement in areas of poorly draining soils. As indicated earlier, a survey would be required to confirm ground elevations, but there is little likelihood that lowering the water level in the west pond (sedge meadow pond) would eliminate standing water in the Woods Settlement. Residents there should recognize the inherent values of forested wetlands and embrace them. If the standing water causes economic damages, then options for eliminating the standing water include:

1. Installing drains to route the water elsewhere, or,
2. Raising the ground elevation sufficiently to eliminate surface ponding

In some years mosquito populations will become a nuisance in summer. This is normal and will not be measurably changed by draining a few low-lying wet areas. The weather patterns and overall preponderance of mosquitoes breeding habitat at and around Tryon Farm are responsible for year-to-year variation in mosquito populations.

Future developments at Tryon Farm should continue to include low-impact development techniques for stormwater management (i.e. green infrastructure methods).

3.4 Institutional Recommendations

The condominium declarations require each Settlement Committee at Tryon Farm to manage the limited common areas, common areas and facilities to “blend with and enhance the beauty and peace of the environmentally preserved natural settings, regenerated natural areas, and traditional farming cycles”. The condominium declarations also require that a member of TFI serve as a non-voting member on the Settlement Committees to advise them on the effects of their management of the limited common areas, common areas and facilities on surrounding natural areas that TFI is chartered to protect and preserve. This land management plan update is part of TFI’s advice to the Settlement Committees.

We understand that TFI is chartered to manage several parcels within the Tryon Farm perimeter. Many of the land management recommendations made to the developer by J. F. New (1991, 2000) were not implemented prior to transfer of the property to TFI, thereby leaving TFI with environmental liabilities from its inception. TFI is funded through a percentage of property sales; the burden of its resource management responsibilities is substantial, particularly when property sales are limited. We recommend a review of this organizational and financial model for financial sustainability.

3.5 Opportunities for External Funding

There are numerous grant programs to support implementation of watershed improvement projects for the Trail Creek watershed, particularly due to its presence in the Great Lakes drainage. Any endeavor to reduce soil erosion or the associated pollutants would qualify for one of many cost-sharing programs. Few grant programs are available to finance control of nuisance plants on private land.

The US Department of Agriculture North Central Integrated Pest Management Center (IPM) has a competitive mini-grant program to address information, resource, and research needs in region-wide or broad area categories including: crops, non-crop areas,

IPM metrics and/or impact assessments, urban IPM, cropping systems, geographical, school IPM and other issues. Funding for this program varies from year to year.

There are at least two federally-funded programs for soil and water conservation that may be worthy of mention, including the Wetlands Reserve Program (WRP) and the Wildlife Habitat Incentives Program (WHIP). The WRP is a voluntary program (<http://www.nrcs.usda.gov/programs/wrp/>) providing technical and financial assistance to eligible landowners to restore, enhance, and protect wetlands. At least 70 percent of each project area will be restored to the original natural condition, to the extent practicable. The program is administered through the NRCS and under the 2008 Farm Bill offers three enrollment options:

1. Permanent Easement is a conservation easement in perpetuity. USDA pays 100 percent of the easement value and up to 100 percent of the restoration costs.
2. 30-Year Easement is an easement that expires after 30 years. USDA pays up to 75 percent of the easement value and up to 75 percent of the restoration costs.
3. Restoration Cost-Share Agreement is an agreement to restore or enhance the wetland functions and values without placing an easement on the enrolled land. USDA pays up to 75 percent of the restoration costs.

The Wildlife Habitat Incentives Program (WHIP) (materials available online at <http://www.in.nrcs.usda.gov/programs/whip/whip.html>) is also a NRCS program; it is intended to develop and improve wildlife habitat, primarily on private lands. It provides both technical assistance and cost-share payments to help establish and improve fish and wildlife habitat. TFI has recently utilized a WHIP grant for prairie restoration.

The Healthy Reserve Forest Program (HRFP) is a voluntary program established for the purpose of restoring and enhancing forest ecosystems to:

1. Promote the recovery of threatened and endangered species;
2. Improve biodiversity; and
3. Enhance carbon sequestration (general information at <http://www.nrcs.usda.gov/programs/HFRP/ProgInfo/Index.html>).

Under the President's 2010 budget, \$475 million has been dedicated to the Great Lakes Restoration Initiative (GLRI) which targets significant environmental problems in the Great Lakes Region, under five major focus areas, one of which deals with aquatic invasive species.

3.6 Adaptive Management

Adaptive management is, in essence, learning to manage by managing to learn. It involves finding out where imperfect understanding is most likely to lead to an undesirable outcome, then modifying the program to improve understanding and reduce that risk. This increases the payoff from learning, and when funding is difficult, helps prioritize the most important measures for implementation. This approach allows for land managers to not be too presumptuous about their ability to predict the effects of their actions, and the actions of others (such as the developer, residents or even outside factors like climate change).

3.7 Measuring Progress

Botanists and plant ecologists sometimes use a quantitative technique called the Floristic Quality Assessment (FQA) to express the "quality" of a natural area. This standardized tool, replaces subjective assessments, and although approximate, provides a useful number for comparing various natural areas. We recommend it for use at Tryon Farm to track progress restoring natural areas there.

The basis of the FQA is the calculation of a Floristic Quality Index (FQI) from species richness and a coefficient of conservatism (C). Each native species is assigned a C value ranging from 0 to 10 representing the probability that the plant is likely to occur in landscapes relatively unaltered from those of pre-settlement times. For instance, a plant with a C value of 0 may have come from a natural community or may have come from the edge of a sidewalk or parking area. A plant with a C value of 10 probably came from a natural area. A plant with a C value of 5 probably came from a remnant natural plant community, which may or may not have been degraded. The C values for LaPorte County are given in Swink and Wilhelm (1994).

The FQI and a mean coefficient of conservatism (C) are two useful values derived from the FQA. Other useful parameters can be derived if TFI is inclined: species richness (N), relative importance, percent of taxa that are native and adventive (non-native), number of rare species, and guild diversity. FQA is a tool that can be used to discriminate natural quality of vegetation and to make spatial and time-series comparisons for gauging restoration progress. Further, the results are amenable to certain parametric and nonparametric statistical testing to aid in distinguishing nonrandom differences in floristic quality (analysis of variance (ANOVA), mean-separation techniques, goodness-of-fit).

The FQI is a weighted index of species richness and is computed as the arithmetic product of the average coefficient of conservatism and the square-root of species richness of an inventory unit:

—

For the floristic parameters FQI, C, and N, Swink and Wilhelm recommend that calculations be made using all species (native and adventive) as well as native species only. They suggest that the exotic species in a natural community often can result in the replacement of native species and interfere with recovery processes. Differences in these values provide a measure for the erosion of floristic integrity at the study site.

Because FQI is sensitive to species richness, increases in the effort of field surveys will introduce bias to the FQI and its usefulness to TFI for gauging progress will be compromised. Also, repeated sampling over the course of a growing season will allow the closest approximation of the “true” FQI. Therefore, steps are required to minimize bias in the FQA; we recommend that any monitoring of natural areas at Tryon Farm follow these precepts:

1. Establish a standard number of transects and quadrants for floral surveys that can be repeated each year. This can be done for the woodlands, mesic prairie and sedge meadow separately, as comparisons between these communities is less important than longitudinal assessments (over time). Document the locations of the “permanent” transects in the field (establish monuments) or in the GIS using GPS coordinates.
2. Quadrats should be standardized and may be a 1-m² square ordered from a supplier or a simple “hula-hoop”. The same quadrat should be used and the same number of quadrats counted in the transects each year in order to standardize counting effort.
3. Utilize standard taxonomic references each year. Swink and Wilhelm (1994) is recommended but other references and keys may be needed.

When used to monitor restoration quality, Swink and Wilhelm recommended that transects or a quadrat matrix be laid out and the analysis be repeated on a periodic basis. If assessment is performed in this way, FQI should not be influenced by site area or sampling intensity (Matthews et al. 2005; Jog et al. 2006).

4.0 REFERENCES

American Structurepoint, Inc. 2007. *Trail Creek Watershed Management Plan*. Prepared for the Indiana Department of Environmental Management, the Unity Foundation, and the Michigan City Sanitary District. Available online at http://www.emichigancity.com/pdf/Trail_Creek_Watershed_Management_Plan.pdf

Czarapata, E.J. 2005. *Invasive Plants of the Upper Midwest: An Illustrated Guide to their Identification and Control*. Madison, WI: University of Wisconsin Press.

J. F. New and Associates. 1991. *Tryon Farm Environmental Management Plan*. Prepared for Tryon Farm Partners, Ltd., Chicago, Illinois.

J. F. New and Associates. 2000. *Tryon Farm Prairie Rehabilitation and Management Plan*.

Jog, S., K. Kindscher, E. Questad, B. Foster and H. Loring. 2006. Floristic Quality as an Indicator of Native Species Diversity in Managed Grasslands. *Natural Areas Journal* 26:149-167.

Kaufman, S.R. and W. Kaufman. 2007. *Invasive Plants: A Guide to the Identification and the Impacts and Control of Common North American Species*. Mechanicsburg, PA: Stackpole Books.

Matthews, J.W., P.A. Tessene, S.M. Wiesbrook & B.W. Zercher. 2005. Effect of Area and Isolation on Species richness and Indices of Floristic Quality in Illinois, USA Wetlands. *Wetlands* 25:607-615.

Swink, F. and G. Wilhelm. 1994. *Plants of the Chicago Region, 4th edition*. Indianapolis: Indiana Academy of Science.

Appendix A

2010 MOWING SCHEDULE FOR TRYON FARM - THOROUGH SEPTEMBER 2010

De Lau Landscape Maintenance, Inc. - Tryon Farm Maintenance Plan

9/18/2010

Task Type	Ops Code	Farm Location	Task Description	Frequency (#)	Projected # of Times	Actual # of Times	# To Go (-); # Over (+)
Mow/Trim	3020T	Barn Area	Mowing lawns north of Dairy Barn; around gardens and barns	Weekly (28)	28	22	-6
Mow/Trim	3048F	Farmstead	Mowing/Trimming: Farmstead walking paths and around small pond	Bi-Weekly (14)	14	10	-4
Mow/Trim	3049W	Farm Wide	Mowing/Trimming: Farm Wide; along TFL to Coffee Pond Entrance & roadside in Dune area	Bi-Weekly (14)	14	12	-2
Mow/Trim	3047C	Farm Wide	Bonfire Circle: mow/trim area	Monthly (6)	6	6	0
Mow/Trim	3049M	Meadows	Mowing/Trimming: Meadows - all paths; (except Farmstead & small pond, included above)	3 Times/Year	3	5	2
Trimming	3047B	Pond	Trimming/Cutting: Pond - Trimming/Cutting berms	Twice/Year (2)	2	1	-1
Mow/Trim	3028B	Barnyard	Mowing/Trimming: Barnyard south of Dairy Barn & entry gates	Twice/Year (2)	2	1	-1
Mow/Trim	3049F	Farmstead	Mowing/Trimming: Farmstead road sides and paths	Bi-Weekly (14)	14	10	-4
Pruning	3075T	Barnyard	Pruning trees: Barnyard	Annually (1)	1	1	0
Pruning	3075V	Barnyard	Pruning vines: Barnyard	Annually (1)	1	1	0
Sweeping	3102F	Farmstead	Sweep/Clear: Farmstead - walks and paved areas	Weekly (28)	28	21	-7
Sweep Blow	3108R	Woods	Sweep/Blow: Woods - leaves cleared from roads	Fall-Weekly (8)	8	3	-5
Sweeping	3108T	Woods	Woods - Other -leaves sweep from Trex walkways	Bi-Weekly (10)	10	10	0
Sweeping	3108T	Woods	Woods - Other -leaves sweep from Trex walkways	Fall-Weekly (8)	8	2	-6
Pruning	3075B	Barnyard	Trimming: Barnyard bushes	Monthly (6)	6	5	-1
Trimming	3047F	Farmstead	Trimming: Farmstead - edges of paths	Monthly (6)	6	5	-1
Trimming	3047U	Farm Wide	Trimming: Farm Wide - around utility meters for access	Bi-Monthly (4)	4	5	1
Trimming	3047T	Woods	Trimming: Woods - around farm implements; (included with Farm Wide Mowing/Trimming)	Bi-Weekly (14)	14	10	-4
Pruning	3076B	Barnyard	Trim/Prune: Barnyard - tree limbs, and around Hen House, remove Tree of Heaven & Olive trees	Twice/Year (2)	2	3	1
Watering	3118P	Pond	Watering: Pond - new trees	Weekly (28)	28	12	-16
Watering	3118F	Farmstead	Maintain/Water/Fertilize: Farmstead - landscape at entrance, common area including mailboxes	Weekly (28)	28	12	-16
Watering	3118B	Barnyard	Watering/Fertilize: Barnyard - parking lot trees	Weekly (28)	28	12	-16
Weeding	3059P	Farmstead	Weeding: Farmstead - beds in parking areas	Varied - Monthly (8)	8	6	-2
Weeding	3059B	Farmstead	Weeding: Farmstead - landscape and maintained beds in common areas beside garage doors	Bi-Weekly (14)	14	8	-6
Cleanup	3000T	Farm Wide	Spring Cleanup: FS, Barn, Roadsides in Woods - landscape beds, lawns, and roadsides	Annually (1)	1	0	-1
Weed Mgt.	3060P	Pond	Trimming: Keeping weeds cut down as described in Mowing Standards - April, July, and Sept.	3 Times/Year	3	2	-1
W. Mgt. Extra	306PX	Pond	Mow/Trim Weed Management - Extra	As Requested	0	2	2
Mow/Trim	3033P	Pond	Mow/Trim - Weed Management - John Deere	As Requested	0	1	1
Weed Mgt.	3060F	Farmstead	Trimming: Keeping weeds cut down as described in Mowing Standards - April, July, and Sept.	3 Times/Year	3	1	-2
W. Mgt. Extra	306FX	Farmstead	Mow/Trim Weed Management - Extra	As Requested	0	2	2
Weed Mgt.	3060D	203 & 204	Trimming: Keeping weeds cut down as described in Mowing Standards - April, July, and Sept.	3 Times/Year	3	3	0
W. Mgt. Extra	306DX	203 & 204	Mow/Trim Weed Management - Extra	As Requested	0	0	0
Weed Killer	3270F	Farmstead	Applying Roundup: Red Gravel Paths	As Needed (Min.)	2	2	0
Weed Killer	3270P	Farmstead	Applying Roundup: Red Gravel Parking Area	As Needed (Min.)	2	2	0
Weed Mgt.	3060G	Grove	Mow/Trim Weed Management - Walkbehind Mower	As Requested	0	2	2
W. Mgt. Extra	306GX	Grove	Mow/Trim Weed Management - Extra	As Requested	0	0	0
Mow/Trim	3033G	Grove	Mow/Trim - Weed Management - John Deere	As Requested	0	2	2
Special	3086	Farm Wide	Cut Brush	As Requested	0	4	4
Special	3170T	Farm Wide	Loader	As Requested	0	2	2
Special	3100T	Farm Wide	Cleanup Storm	As Needed	0	2	2
Special	3120I	Farm Wide	Remove Invasive Weeds	As Needed	0	2	2
Weed Mgt.	3060WX	Farm Wide	Trim/Cleanup Waste Treatment -Weed Management	As Requested	0	1	1
Special	3086T	Farm Wide	Stump Removal	As Requested	0	1	1
Weed Killer	3271X	Farm Wide	Apply Roundup Extra	As Requested	0	2	2

APPENDIX B

SURVEY OF HOMEOWNERS LAND MANAGEMENT PRIORITIES

During the meeting of October 17, 2010 with TFI and the Tryon Farm Homeowners Association, we conducted a cursory survey to gain some understanding of their land management concerns. In general, the sedge meadow (west of the Farmstead Settlement and south of the Woods Settlement) was of the highest concern for habitat management (Figure B-1). Ponds, low woods, and bermed areas (Pond Settlement) were the secondmost priority for management.

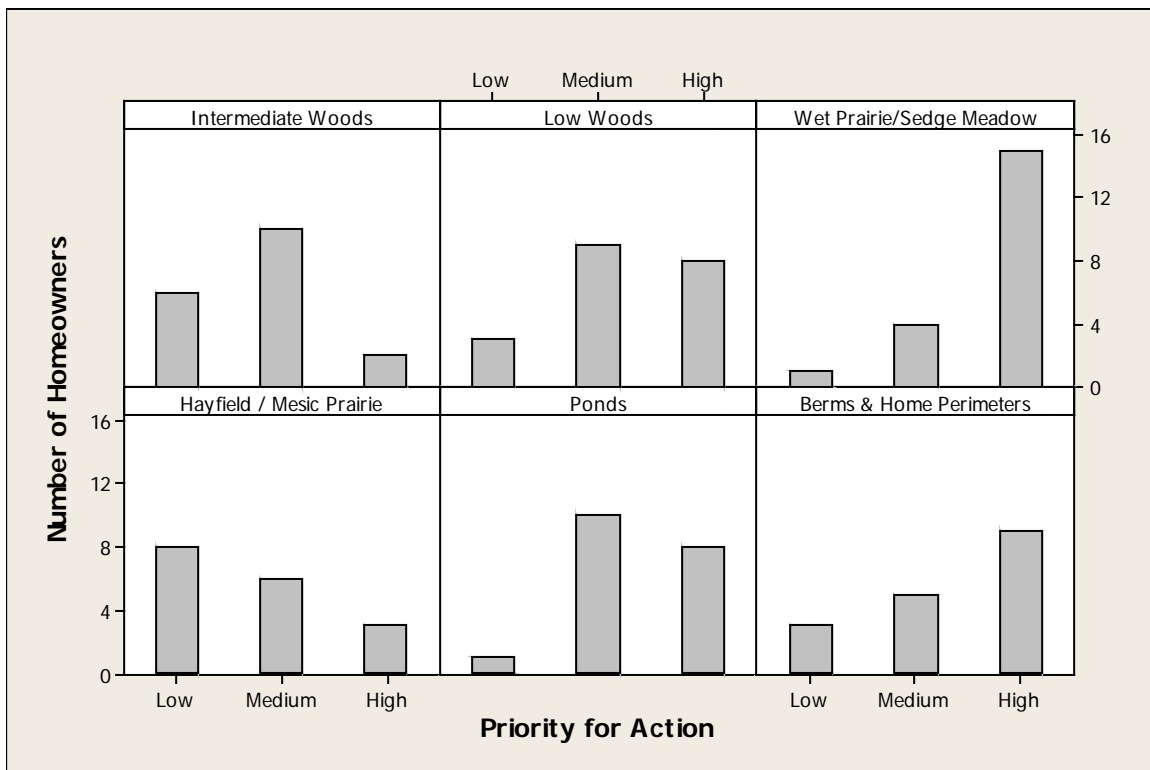


Figure B.1. Priorities for Land Management.

During the meeting, the homeowners also recorded comments regarding each of the habitat types at Tryon Farm. One of the most common comments was the recognition of a need for surveys and documentation of invasive species. Other comments are tabulated below.

**Table B-1
HOMEOWNER COMMENTS**

Habitat Type	Comments
Wooded Dunes	<ul style="list-style-type: none"> • Need survey • Grape / standing dead trees • Lots of invasives • Look pretty good but may need to watch maples crowding oak regeneration • Remove trees that may damage homes • Personally not as familiar with these areas, so may have more invasives than I am aware of • Underbrush should be removed
Intermediate Woods	<ul style="list-style-type: none"> • Not as familiar with these areas-may have more invasives than I am aware of • Remove trees that may damage homes • Garlic mustard can be managed by seasonal volunteer efforts • Very wet around homes • Need survey
Low Woods	<ul style="list-style-type: none"> • Need survey • Very wet around homes • Remove trees that may damage homes • Personally not as familiar with these areas, so may have more invasives than I am aware of • Grape vine – old and ubiquitous, mature – creates shade • Cat briar
Wet Prairie / Sedge Meadow	<ul style="list-style-type: none"> • Phragmites (X3) • Eliminate phragmites, reed grass; pond draining into woods in the “pocket” – need to eliminate this problem • There are lots of great natives in this area, too! • Should we cut down on a continued basis- growth • Mugwort along Becks Ditch coming to mid. meadow from both ends • All weeds ☹ • Invasives • Becoming woods • Need survey
Hayfield / Mesic Prairie	<ul style="list-style-type: none"> • Need survey • Degraded land • Lots of invasives / weeds • Phragmites in wet areas & mess of invasives at constructed wastewater wetlands • Continue farming

Table B-1
HOMEOWNER COMMENTS

Habitat Type	Comments
	<ul style="list-style-type: none">• This is fairly well managed, due to hay, recently seeded w/ natives• What should it actually be?
Ponds	<ul style="list-style-type: none">• Is there a way to ... [illegible]... to benefit the pond• Phragmites – water lilies; west pond – needs drainage, stagnates at north end into low woods; pond dries up in fall• Aquatic weeds here – milfoil, etc.• Should/ can west pond be dug deeper? Currently dry• Reed canary grass + phragmites + purple loosestrife• Need more work• Pond drainage• Need survey
Berms & Home Perimeters	<ul style="list-style-type: none">• Need survey• Mugwort; non-native plantings• Drainage needed• What can be done w/ mugwort & what happens if we don't manage it?• Location of new construction & disruption of land and trees• There needs to be some sort of “policy” for these areas• How or what is the best way to get rid of invasives?

Appendix C

SYNOPOSIS OF PLANT CONTROL METHODS


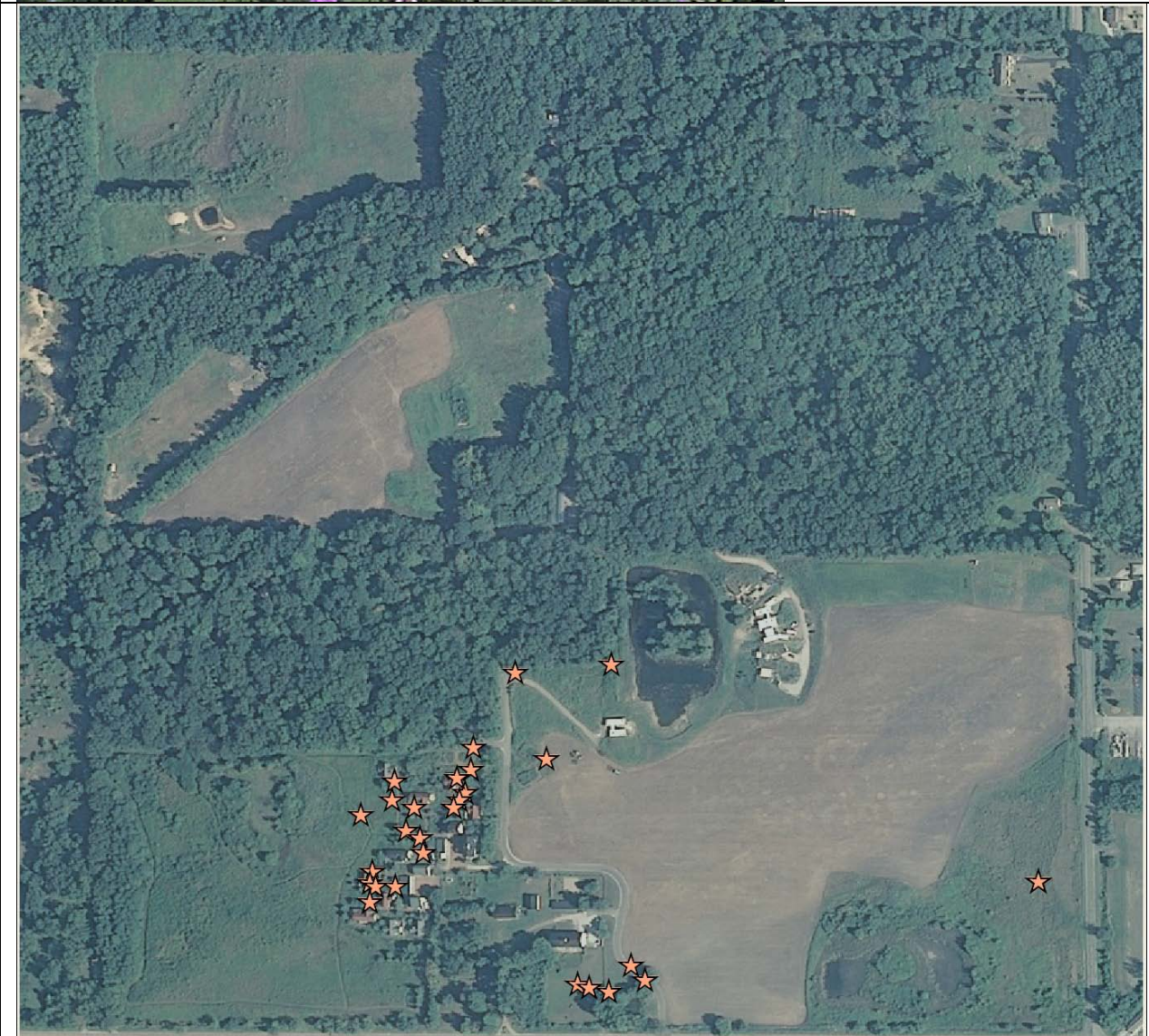
Scientific Name	Common Name	Growth Form	Map Code	Native/Exotic	Invasiveness	Habitat(s)	Control Methods	Comments
<i>Artemisia vulgaris</i>	Mugwort, chrysanthemum weed	Forb	MUG	Exotic	High	Disturbed soils in meadows and open fields	Dig up small infestations, including roots. Repeated close mowing will control spreading. Herbicides clopyralid and glyphosate are effective if applied several times during the season.	
<i>Ailanthus altissima</i>	Tree of Heaven, Chinese sumac	Tree	TOH	Exotic	Moderate	Disturbed soils, fence rows, open fields, and woodland edges; not found in wetlands or shaded areas.	Pull saplings, but all root fragments should be removed. Repeated and frequent cutting of all stems close to the ground may control this tree, resprouting will occur. Best controls include herbicide treatments (glyphosate or triclopyr)	Leaves and flowers can cause contact dermatitis.
<i>Coronilla varia</i>	Crown vetch	Forb	CV	Exotic	Moderate	Often spreads from roadside plantings into open fields.	Dig up small patches, or cover with black plastic. Burning is effective but may need to be repeated. Mowing repeatedly in spring and summer over several years will control plants. Clopyralid (more selective), 2,4-D, glyphosate and triclopyr applied in late spring are effective.	
<i>Typha x glauca</i>	Hybrid cattail	Grass	CAT	Native-exotic hybrid	High	Wetlands, ditches, streambanks, disturbed wet areas.	Cutting or burning, followed by water level drawdown is effective, as are chemical controls.	Aquatic herbicide licensing required.
<i>Phragmites australis</i>	Common reed, phragmites	Grass	PHRAG	Native-exotic hybrid	High	Wetlands, treatment cells, ditches, stream banks, disturbed moist areas.	Applications of glyphosate in early fall, followed by a spring burn can control large stands. Mechanical controls alone are not usually effective.	Aquatic herbicide licensing required.
<i>Celastrus orbiculatus</i>	Oriental Bittersweet	Vine	ORI	Exotic	High	Forest edges, fencerows, old fields, sun to part shade.	Individual plants can be pulled, but resprouting may occur. Spray with triclopyr (formulated for use with penetrating oil) or glyphosate applied to cut stems in fall or early spring. Weekly mowing will discourage spreading.	
<i>Rosa multiflora</i>	Multiflora Rose	Shrub	MULTI	Exotic	Moderate	Woodland gaps, forest edges, fence rows, old fields.	Cut canes and remove root wad or paint stubs with glyphosate or triclopyr. In fields, mow repeatedly during growing season. Early spring burning also effective.	
<i>Elaeagnus umbellata</i>	Autumn Olive	Tree	AUTOL	Exotic	High	Open forests, prairies, roadsides.	Pull saplings, but larger individuals should be cut and painted with glyphosate.	
<i>Euonymus alatus</i>	Burning Bush, winged euonymus	Shrub	BB	Exotic	Low	Open woods, disturbed soils, floodplains, early successional fields	Pull saplings, but larger individuals can be cut and painted with glyphosate.	
<i>Convolvulus arvensis</i>	Bindweed, creeping Jenny, field morning glory	Vine	BIN	Exotic	Moderate	Disturbed locations along roadsides, streams and field edges.	Individual plants can be pulled, but repeating removal may be necessary. 2,4-D or glyphosate control bindweed if sprayed just before or during first flowering.	
<i>Lythrum salicaria</i>	Purple Loosestrife	Forb	PURPLEL	Exotic	High	Wetlands, stream banks	Pull or dig small plants, but do not leave roots or stems. Landfill or burn removed plants. Do not mow. Large areas can be controlled using glyphosate or triclopyr. Successful control using <i>Galerucella</i> beetles has been recorded.	Aquatic herbicide licensing may be required.
<i>Robinia pseudoacacia</i>	Black Locust	Tree	BL	Native to eastern forests, but not LaPorte Co	High	Forest, pastures, olds fields, fence rows, roadsides.	Cutting or girdling without applying herbicide will stimulate resprouting. Mowing and burning will temporarily control BL. Cut and paint with triclopyr or glyphosate.	
<i>Myriophyllum spicatum</i>	Eurasian Water-milfoil	Aquatic		Exotic	High	Aquatic	Rake or hand pull small infestations, being careful to	Aquatic herbicide licensing

Appendix C

SYNOPOSIS OF PLANT CONTROL METHODS

Scientific Name	Common Name	Growth Form	Map Code	Native/Exotic	Invasiveness	Habitat(s)	Control Methods	Comments
							remove all fragments (desiccate & compost or use as mulch). 2,4-D and fluridone are commonly used for large infestations.	required.
<i>Phalaris arundinacea</i>	Reed canary grass	Grass		Native	High	Stream banks, ditches wetlands, full sun areas. Prefers moist soils, but can grow in uplands.	Small patches can be dug up or covered with black plastic for one year. Reseed with native species. Close repeated mowing can help control, but will not likely eliminate. Burning, over multiple years, will help. Integrated methods, including use of herbicides, is most often associated with suppressionof reed canary grass.	Aquatic herbicide licensing may be required.
<i>Alliaria petiolata</i>	Garlic mustard	Forb		Exotic	High	Shady forest areas, but also in full-sun fields, roadsides and uplands.	Individual first-year plants are easily pulled, and best done before flowering. Mowing prior to flowering can be effective. Large patches are controlled by burning in fall or early spring, but 3 to 5 years of burned may be required. Glyphosate, 2,4-D, triclopyr, or other herbicides can control of large patches.	

Appendix C.2 PLANT CONTROL METHODS


Crown Vetch	<i>Coronilla varia</i>
	<p>Control: Dig up small patches, or cover with black plastic. Burning is effective but may need to be repeated. Mowing repeatedly in spring and summer over several years will control plants. Clopyralid (more selective), 2,4-D, glyphosate and triclopyr applied in late spring are effective.</p>
	

Appendix C.2


PLANT CONTROL METHODS

Mugwort, chrysanthemum weed	<i>Artemisia vulgaris</i>
	<p>Control: Dig up small infestations, including roots. Repeated close mowing will control spreading. Herbicides clopyralid and glyphosate are effective if applied several times during the season. Replant area with more desirable, native plants and continue weeding to keep mugwort out.</p>
	

Appendix C.2 PLANT CONTROL METHODS

Common reed, phragmites	<i>Phragmites australis</i>
	<p>Control: Applications of glyphosate in early fall, followed by a spring burn can control large stands. Mechanical controls alone are not usually effective, and may exacerbate the problem.</p>
	

Appendix C.2
PLANT CONTROL METHODS

Autumn Olive	<i>Elaeagnus umbellata</i>
	<p>Control: Pull saplings, but larger individuals should be cut. Treat the stumps with glyphosate.</p>
	

Appendix C.2 PLANT CONTROL METHODS

Multiflora Rose	<i>Rosa multiflora</i>
	<p>Control: Cut canes and remove root wad or paint stubs with glyphosate or triclopyr. In fields, mow repeatedly during growing season. Early spring burning also effective.</p>
	

Appendix C.2 PLANT CONTROL METHODS

Bindweed, creeping Jenny, field morning glory	<i>Convolvulus arvensis</i>
	<p>Control: Individual plants can be pulled, but repeating removal may be necessary. 2,4-D or glyphosate herbicides control bindweed if sprayed just before or during first flowering.</p>
	

Appendix C.2 PLANT CONTROL METHODS

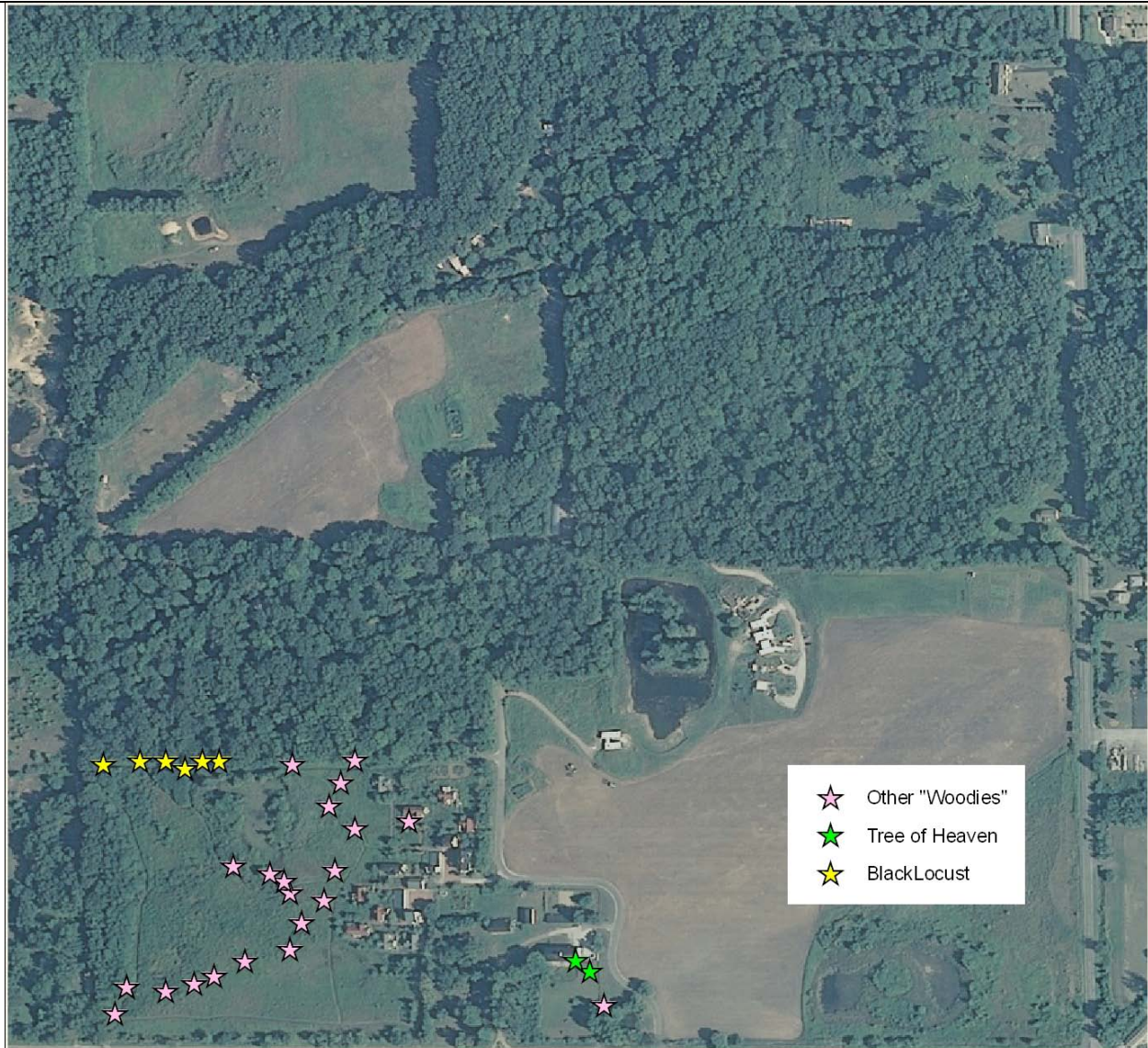
Trees, including tree of heaven, black locust, Norway maple, others




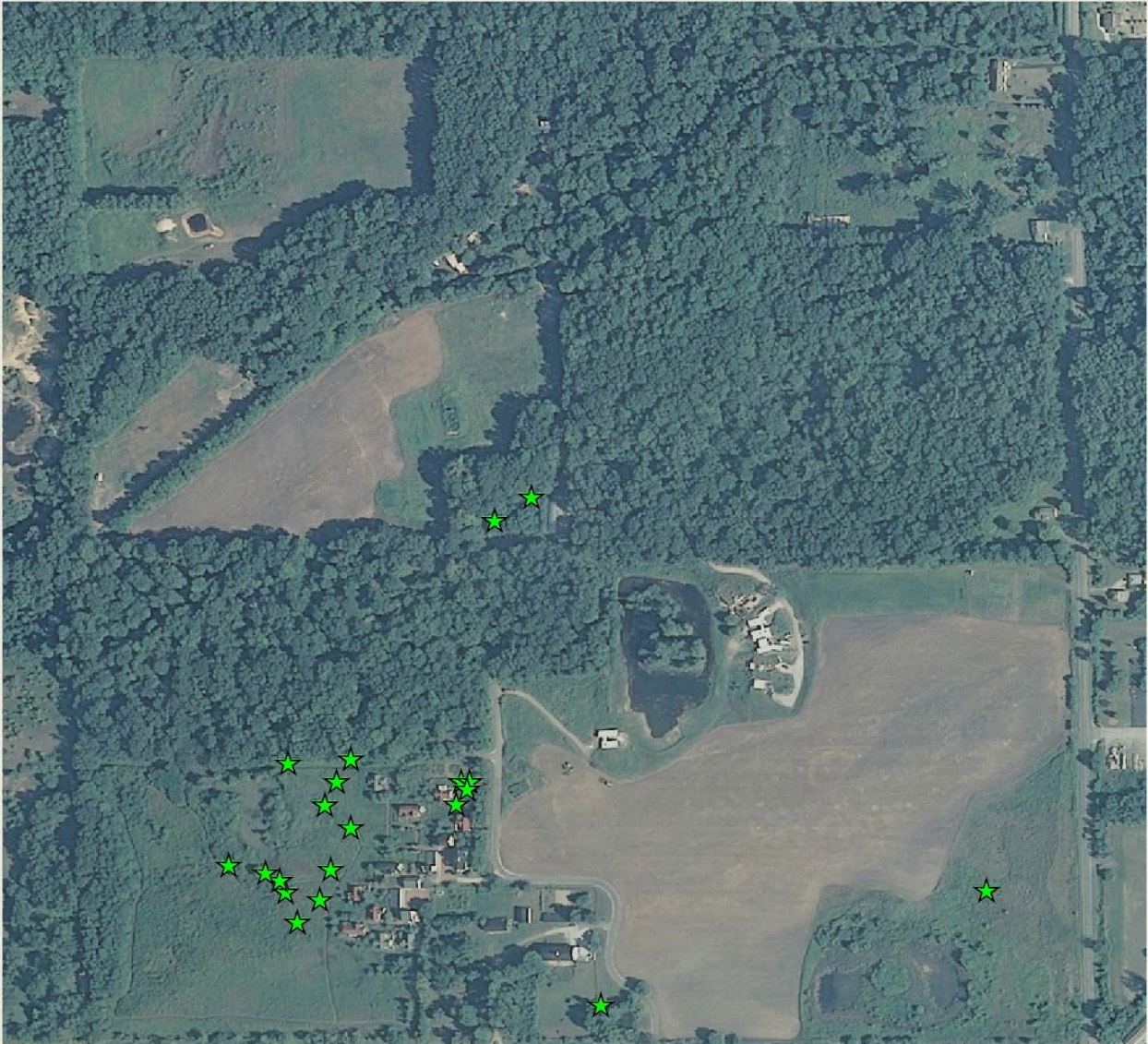
Control: Pull saplings and treat stumps with herbicide.

Best controls include herbicide treatments (glyphosate or triclopyr).

Photo: Tree of heaven, *Ailanthus altissima*



Appendix C.2 PLANT CONTROL METHODS

Hybrid cattail	<i>Typha x glauca</i>
	<p>Control: Cutting or burning, followed by water level drawdown is effective, as are chemical controls.</p> <p>Herbicide use in wetlands requires an applicators license.</p>
	

Appendix C.2
PLANT CONTROL METHODS

Burning Bush, winged euonymus	<i>Euonymus alatus</i>
	<p>Control: Pull saplings, but larger individuals can be cut. Treat stumps with glyphosate.</p>
	

Appendix C.2

PLANT CONTROL METHODS

Purple Loosestrife


Lythrum salicaria





Control: Pull or dig small plants, but do not leave roots or stems. Landfill or burn removed plants. Do not mow. Large areas can be controlled using glyphosate or triclopyr. Successful control using *Galerucella* beetles has been recorded.



Appendix C.2
PLANT CONTROL METHODS

Garlic mustard	<i>Alliaria petiolata</i>
	<p>Control: Young individual plants are easily pulled, and should be removed before flowering. Mowing prior to flowering can be effective. Large patches are controlled by burning in fall or early spring, but 3 to 5 years of burned may be required. Glyphosate, 2,4-D, triclopyr, or other herbicides can control of large patches.</p>
Garlic mustard was not found in the survey by TFI.	

Appendix C.2 PLANT CONTROL METHODS

Oriental Bittersweet	<i>Celastrus orbiculatus</i>
	<p>Control: Individual plants can be pulled, but resprouting may occur. Spray with triclopyr (formulated for use with penetrating oil) or glyphosate applied to cut stems in fall or early spring. Weekly mowing will discourage spreading.</p>
	

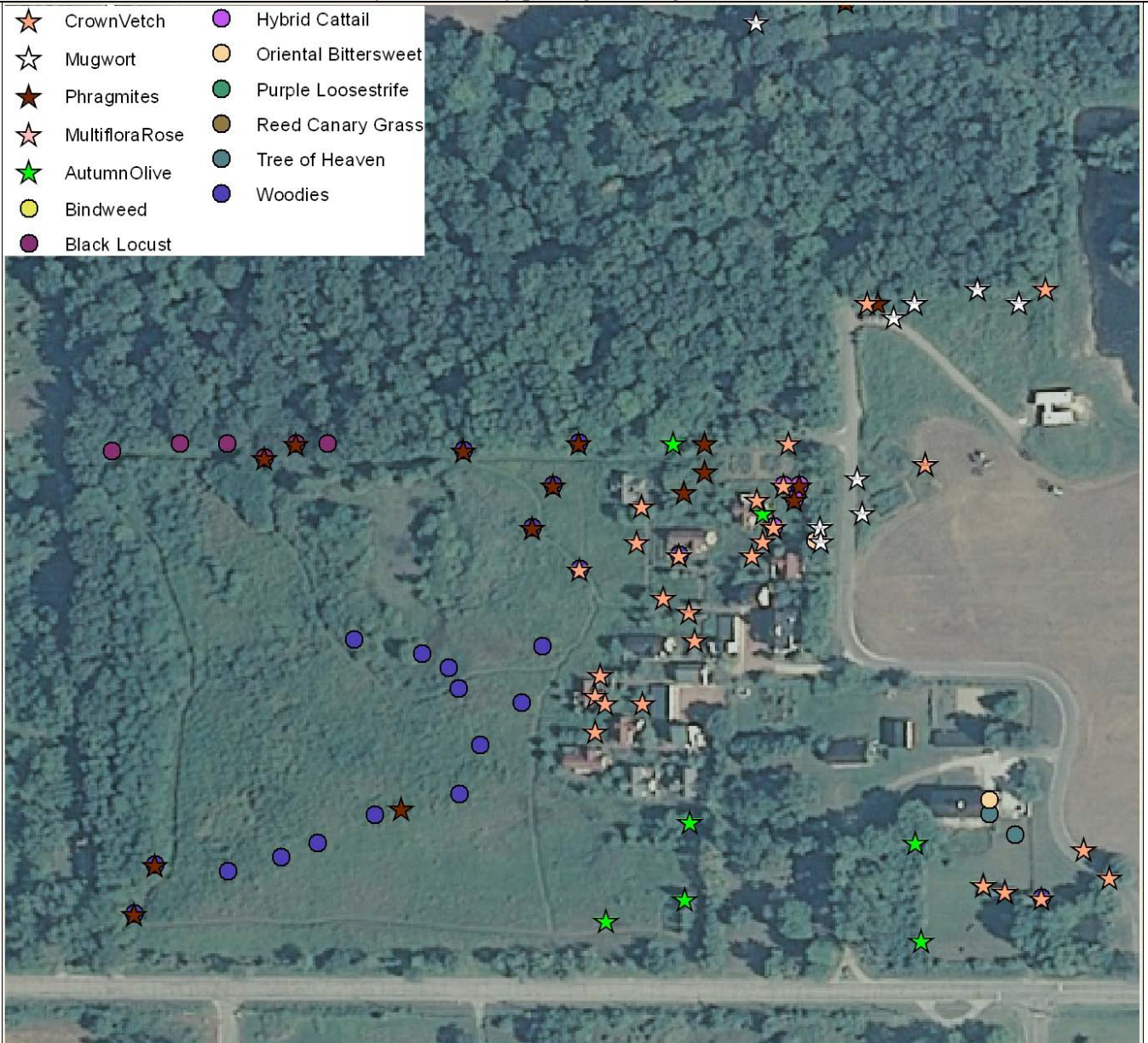
Appendix C.3

ACTIONS FOR TRYON FARM SETTLEMENTS AND HABITATS

Sedge Meadow and Farmstead Settlement

1. Immediately endeavor to eliminate phragmites
2. Install staff gage and begin daily logging of water surface elevation
3. Begin planning of monitoring program
4. Spring
 - a. Mow burn lanes, consult with fire ecologist, perform control burn
 - b. Supplemental seeding and/or plugging with native plants (recommended list in J. F. New plans)
5. Summer
 - a. Spot treatment of herbaceous species, including phragmites and cattails, followed by mowing or burning of dead foliage
6. Winter
 - a. Remove or kill woody invasives by pulling / cutting / herbicide treatment

★ CrownVetch	● Hybrid Cattail
☆ Mugwort	● Oriental Bittersweet
★ Phragmites	● Purple Loosestrife
★ MultifloraRose	● Reed Canary Grass
★ AutumnOlive	● Tree of Heaven
● Bindweed	● Woodies
● Black Locust	

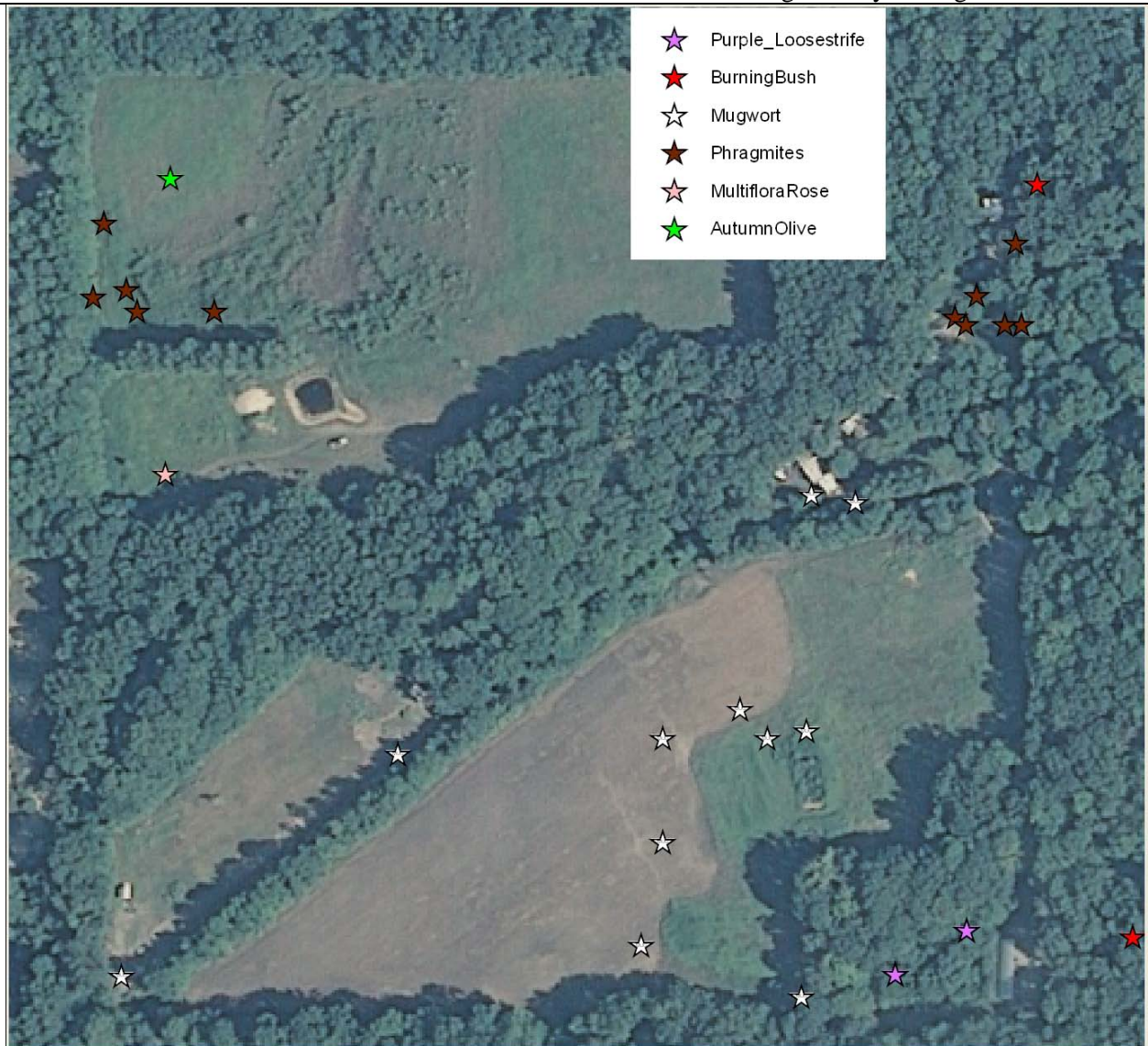


Appendix C.3

ACTIONS FOR TRYON FARM SETTLEMENTS AND HABITATS

Middle Meadow, Woods, Dune, Grove and Meadow Settlements, and Back Meadow

1. Immediately endeavor to eliminate phragmites and purple loosestrife
2. Begin monitoring program
3. Spring
 - a. Consult with fire ecologist, maintain fire lanes, perform control burn
 - b. Supplemental seeding or plugging with native plants (recommended list in J. F. New plans)
4. Summer
 - a. Spot herbicide treatment of mugwort in Middle Meadow
 - b. Spot herbicide treatment of other invasive herbaceous species
5. Winter
 - a. Remove or kill multiflora rose, autumn olive and burning bush by cutting / herbicide treatment



Appendix C.3

ACTIONS FOR TRYON FARM SETTLEMENTS AND HABITATS

Pond Settlement and Entry Road

1. Immediately endeavor to eliminate phragmites
2. Begin monitoring program
3. Spring
 - a. Consult with fire ecologist, maintain fire lanes, perform control burn of WHIP restoration area
 - b. Supplemental seeding or plugging with native plants (recommended list in J. F. New plans)
4. Summer
 - a. Spot herbicide treatment of mugwort and bindweed on berms, along roadsides, and elsewhere
 - b. Spot herbicide treatment of other invasive herbaceous species
 - c. Perform aquatic plant inventory of ponds and use licensed aquatic herbicide applicator to kill any exotic plants found
5. Winter
 - a. Remove or kill multiflora rose, autumn olive and burning bush by cutting / herbicide treatment

