Assessment of natural vegetation along Fall Creek, Pogue's Run, and Pleasant Run in 2015

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Summary

1) During the late summer of 2015, vegetation was surveyed in 30 plots at each of the three waterways. All three creeks had an abundance of Amur bush honeysuckle present, with the heaviest infestation along Pogue's Run.
2) Mature native riparian tree species are present at all three sites, with hackberry among the most common. Non-native white mulberry is present along all creeks, but especially prominent at Pleasant Run.
3) Fall Creek had the most vegetational diversity, likely reflecting positive effects of restoration efforts over the last three years. A few fairly high quality native species were found among the three sites, but many invasive non-natives were present, too.
4) Although similar, each waterway has a distinctive flora. This is likely due to historical land management and landscape plantings during the Kessler Plan period and more recent habitat improvement effort undertaken along each creek.
5) First year baseline surveys for Pogue's Run and Pleasant Run presented here provide data which can be used to monitor success of future restoration efforts. They document flora currently present and, along with data collected at Fall Creek 2012-2015, provide a dynamic look at flora growing outside of cultivation along the waterways.

Methods

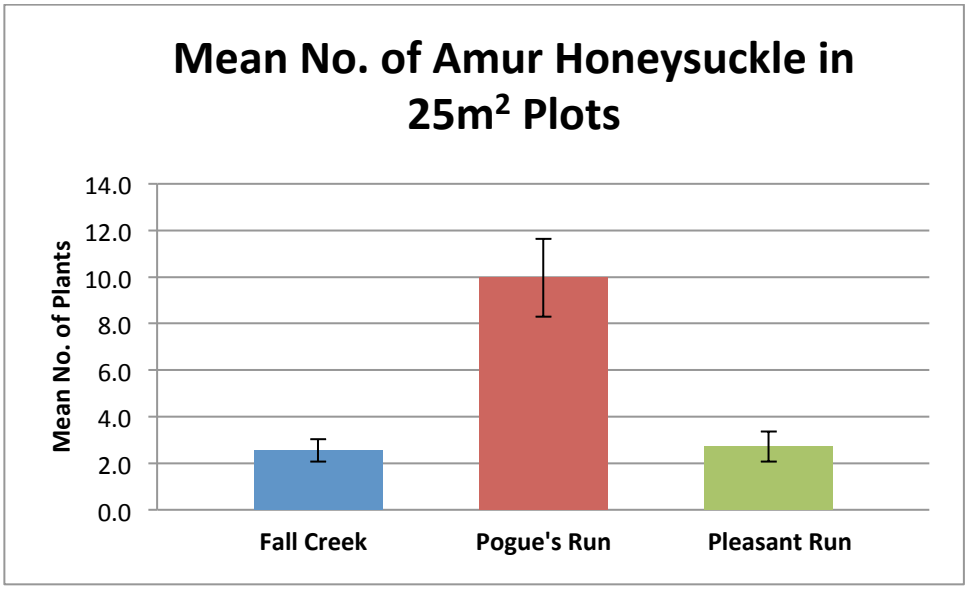
In late summer of 2015, we established transects (sample lines) along the vegetated sides of Fall Creek, Pogue's Run, and Pleasant Run. Three 100 meter long transects were established along each waterway (Figures 1–3). We counted stems of Amur honeysuckle within 25m^2 quadrats (subsample squares) located every 10 meters along the transects. This gave us data for 3 x 10 quadrats. We recorded species and diameter at breast height (dbh) for all trees larger than 5 cm dbh (= tree-layer data). We also recorded the species of all smaller trees and any other plants occurring in the quadrat, along with their cover class (=herbaceous-layer or herb-layer data). Cover was estimated in equal angular (arcsine square root) classes (1 = 1-7%, 2 = 8-25%, 3 = 26-50%, 4 = 51-75%, 5 = 76-93%, 6 = 94-100%). A list of all plants seen in the herbaceous layer is in the Appendix.

We have data for Fall Creek going back to 2012, before honeysuckle removal there. Here we present only the 2015 data, unless otherwise indicated.

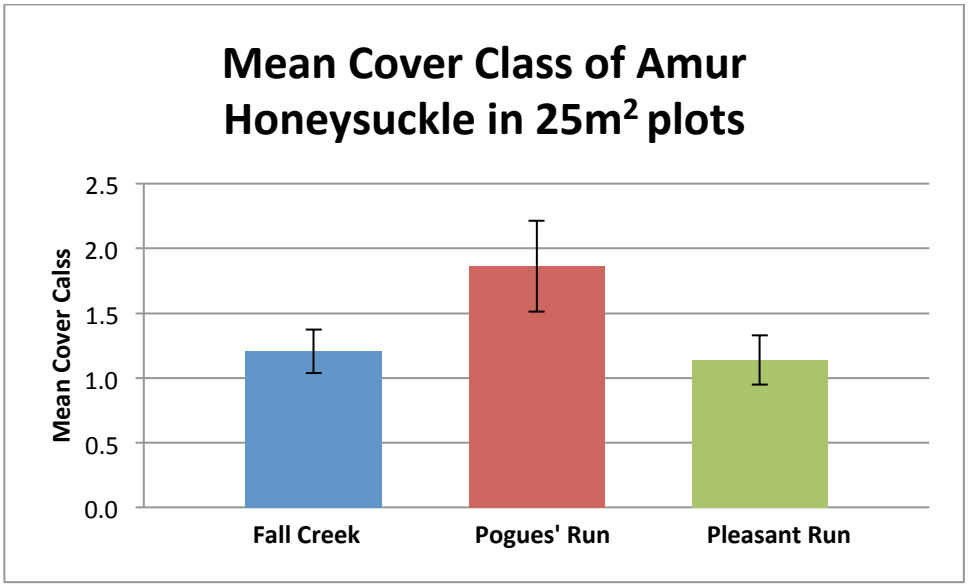
Results

Abundance of Amur honeysuckle

In 2015, plots along Pogue's Run had the most Amur honeysuckle plants, an average of 10 per plot which equates to about 1,500 plants per acre, a heavy infestation. Fall Creek and Pleasant Run had closer to 2.5 plants per plot or 400 plants per acre.



Another way of looking at abundance of honeysuckle is to consider how much of the plot was covered by the plant, not just the number of plants present. Pogue's Run had the most honeysuckle coverage, with an average of 8-25% of each plot being covered. Fall Creek and Pleasant Run plots had lower plot coverage, averaging 1-7%.



Interpretation:

These values provide a baseline from which to compare effectiveness of future honeysuckle removal efforts. They likely reflect past control efforts. It is known that it will take several years of repeat treatment to effectively remove the Amur honeysuckle.

Trees

All trees with diameter at breast height (dbh) greater than 5 cm were recorded in quadrats.

Importance value (I.V.), based on frequency, density, and size of species measured, reflects the overall contribution of each tree in the landscape. For Fall Creek in 2015, natives Ohio buckeye and hackberry were the most important. Many small plants of these species were present too, indicating they are naturally regenerating. Non-native Norway maple, tree of heaven, and white mulberry are also of high importance at Fall Creek.

A greater diversity of native trees occurred in plots along the other two creeks. At Pogue's Run, hackberry, white ash, cottonwood, and slippery elm each had IV values above 10. Pleasant Run plots were dominated by non-native white mulberry (IV = 37), but box elder, cottonwood, and hackberry were important, too.

The largest individual trees in plots along each creek were: 1) Fall Creek – hackberrys of 56 and 83 cm dbh, a tree-of-heaven of 51 and a red mulberry of 50 cm; 2) Pogue's Run – cottonwoods of 99, 76 and 50

cm dbh, a hackberry of 58, a red oak of 66, and a sycamore of 60 cm; 3) Pleasant Run – cottonwoods of 70 and 80 cm, and a large multi-trunked black willow with a main trunk over 60 cm dbh.

Trees in plots with Importance Values (all woody plants with dbh > 5.0 cm)

Common Name	Scientific Name	Fall Creek	Pogue's Run	Pleasant Run
Box elder	*Acer negundo*	-	1.6	9.1
Norway maple*	*Acer platanoides*	10.6	6.4	1.5
Silver maple	*Acer saccharinum*	-	-	1.2
Sugar maple	*Acer saccharum*	-	1.6	-
Ohio buckeye	*Aesculus glabra*	23.1	0.8	-
Tree-of-heaven*	*Ailianthus altissima*	6.2	-	-
Bitternut hickory	*Carya cordiformis*	-	3.1	-
Catalpa	*Catalpa speciosa*	4.9	3.9	6.9
Hackberry	*Celtis occidentalis*	34.1	17.9	14.2
Redbud	*Cercis canadensis*	-	0.8	-
Hawthorn	*Crataegus* sp.	-	1.8	-
European spindle*	*Euonymous europaeus*	1.8	-	-
White ash	*Fraxinus americana*	3.3	10.1	-
Pumpkin ash	*Fraxinus profunda*	-	1.0	-
Blue ash	*Fraxinus quadrangulata*	-	0.8	-
Amur honeysuckle*	*Lonicera maackii*	-	-	1.0
White mulberry*	*Morus alba*	12.2	4.2	36.7
Red mulberry	*Morus rubra*	2.7	-	2.5
Sycamore	*Platanus occidentalis*	-	4.3	1.1
Cottonwood	*Populus deltoides*	-	15.8	9.5
Black cherry	*Prunus serotina*	1.2	5.7	-
Burr oak	*Quercus macrocarpa*	-	1.1	-
Red oak	*Quercus rubra*	-	3.0	-
Black locust	*Robinia pseudoacacia*	-	-	4.9
Black willow	*Salix nigra*	-	-	5.8
Basswood, linden	*Tilia americana*	-	5.6	3.6
Slippery elm	*Ulmus rubra*	-	10.8	-
Grape	*Vitis* sp.	-	-	2.1

*non-native and invasive

The following trees were seen as saplings or seedlings in the herb-layer locations indicated. They are naturally regenerating along the waterways.

Common Name	Scientific Name	Fall Creek	Pogue's Run	Pleasant Run
Box elder	*Acer negundo*		1	7
Norway maple*	*Acer platanoides*	4	5	2
Silver maple	*Acer saccharinum*			1
Red maple	*Acer rubrum*		1	
Ohio buckeye	*Aesculus glabra*	1		
Tree-of-heaven*	*Ailianthus altissima*	3		
Bitternut hickory	*Carya cordiformis*		2	
Catalpa	*Catalpa speciosa*	4	5	1
Hackberry	*Celtis occidentalis*	26	13	15
Redbud	*Cercis canadensis*	1	4	
Flowering dogwood	*Cornus florida*		1	
Ash seedling	*Fraxinus americana*	5	7	2
Blue ash	*Fraxinus quadrangulata*	1	1	1
Red cedar	*Juniperus virginiana*	1		
White mulberry*	*Morus alba*	1		6
Sycamore	*Platanus occidentalis*		1	
Black cherry	*Prunus serotina*		2	
Callery pear	*Pyrus calleriana*	1		
Oak seedling	*Quercus* sp.	2		
Burr oak	*Quercus macrocarpa*		1	1
Red oak	*Quercus rubra*			1
Black locust	*Robinia pseudoacacia*			1
Black willow	*Salix nigra*		1	
Basswood, linden	*Tilia americana*		1	2
American elm	*Ulmus americana*		1	
Siberian elm	*Ulmus pumila*	1	3	
Slippery elm	*Ulmus rubra*	2	2	

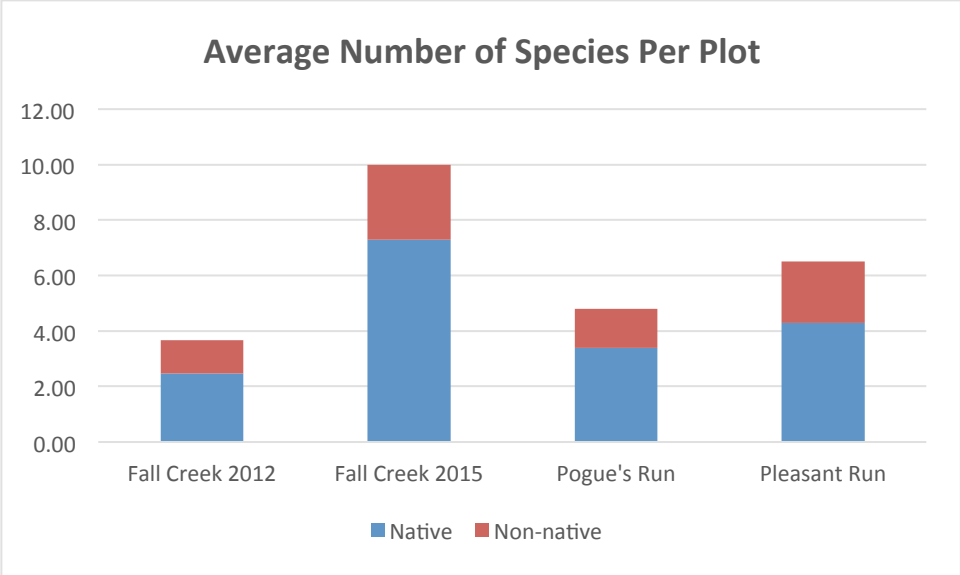
*non-native and invasive

Interpretation:

There are some mature, high quality trees characteristic of natural riparian habitat remaining along the three creeks, and some of these are naturally regenerating. Some invasive non-natives are among the most common, as well. Tree presence and diversity are likely still being influenced by past landscape regimes, including the Kessler Plan plantings and clearings in the early decades of the 1900s.

Overall habitat quality

Compiling data from the herbaceous-layer for all quadrats, both the total number of species per plot and the number of native species were greater at Fall Creek. The values for Pogue's Run and Pleasant Run are more similar to those found for Fall Creek before the 2012 honeysuckle removal, suggesting that species numbers may increase in years following restoration at these sites, too.

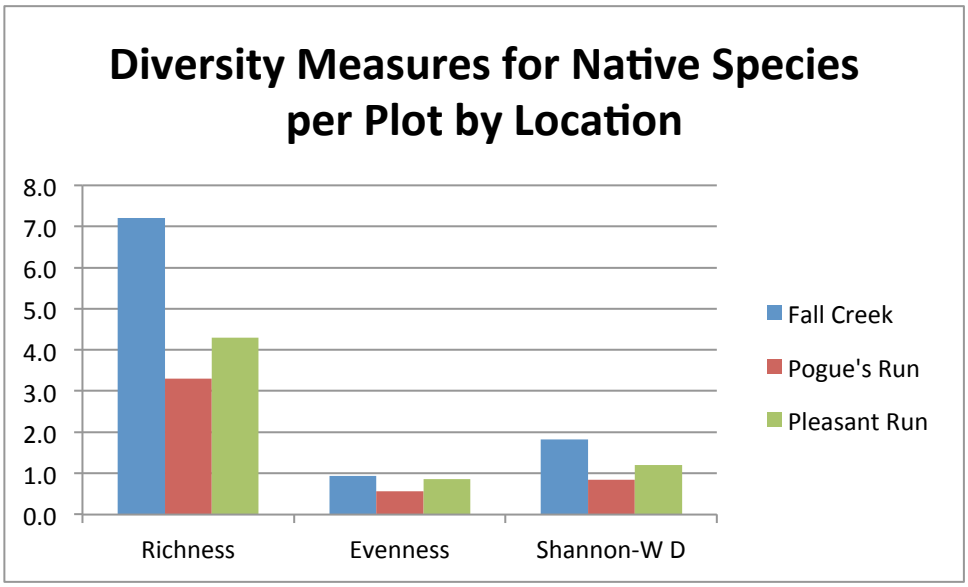


All species found in our herb-layer surveys for each creek are listed in the Appendix, with those considered invasive in the state indicated. The most common native species along each of the waterways were hackberry and poison ivy. Bottlebrush grass was fairly common at Fall Creek and Pleasant Run. It has been sown as seed during the last few years following honeysuckle removal along Fall Creek. The most common non-native at all three sites was Amur honeysuckle, followed by winter-creeper at Fall Creek and Pleasant Run, and Norway maple at Pogue's Run.

Pleasant Run had three highly invasive plants not seen along the other two creeks: Japanese knotweed (present in 1/3 of the plots), Common buckthorn, and multiflora rose. Fall Creek had Callery Pear, winged euonymus, oriental bittersweet, border privet, and Japanese honeysuckle, highly invasive plants not encountered in plots at Pogue's Run or Pleasant Run. Highly invasive garlic mustard was, notably, not seen in plots at Pogue's Run.

One way ecologists evaluate over all habitat quality is by looking at measures of diversity. Generally, more diverse ecosystems, in terms of numbers of species and in terms of evenness or distribution of

species across a landscape, are thought to be more stable and healthier. The following chart presents three indicators of diversity for native plants growing along the creeks. Fall Creek is the most diverse as indicated by all three measures, followed by Pogue's Run and then Pleasant Run. Richness, or the number of native species in each sample plot, is almost twice as great at Fall Creek compared to the other two creeks.



Another way to look at changes in the flora is to use Floristic Quality Assessment. Floristic Quality Index (FQI) measures the overall quality of the habitat as indicated by the native species present. In this approach, native species have been assigned numbers, C- values, from 0 – 10 that indicate their perceived fidelity to high quality habitats. FQI for a site is derived from these values for the species present. Greater numbers indicate greater natural habitat integrity. FQI with non-natives indicates the influence non-native plants have in reducing habitat quality.

Sites with high natural area quality would be expected to have FQI values of 35 or greater. Sites like these waterways that are actively undergoing restoration would be expected to have much lower values. The absolute value is not important here. FQI is a descriptor that can be followed through time to see how it changes after restoration efforts like removing honeysuckle.

Trait	Fall Creek	Pogue's Run	Pleasant Run
Total sp.	69	50	51
No. native sp.	46	43	38
No. non-native	23	7	13
Percent native	67%	86%	75%
Native FQI	14.9	17.5	14.2
FQI with non-natives	12.5	16.1	12.1

The highest C-value species seen were blue ash (C = 7), with one sapling seen in plots at each of the three waterways. All ash are in decline due to emerald ash borer. There is some hope that blue ash may be more naturally resistant that other ash species. Late figwort (C = 5) was also found in one plot at all three sites. Blue phlox (C = 5) was present in one plot at Pogue's Run. The Appendix lists invasive non-native species of concern present at the sites.

Interpretation:

Fall Creek vegetation scores higher on diversity assessments of habitat quality than Pogue's Run or Pleasant Run. This may be due to the past three years of honeysuckle removal along Fall Creek. The data for Pogue's Run and Pleasant Run provide a baseline with which monitor floristic changes as more habitat restoration takes place along these waterways. Pogue's Run data show the highest percentage of natives and highest FQI values, perhaps reflecting the signature of past restoration efforts.

Acknowledgments

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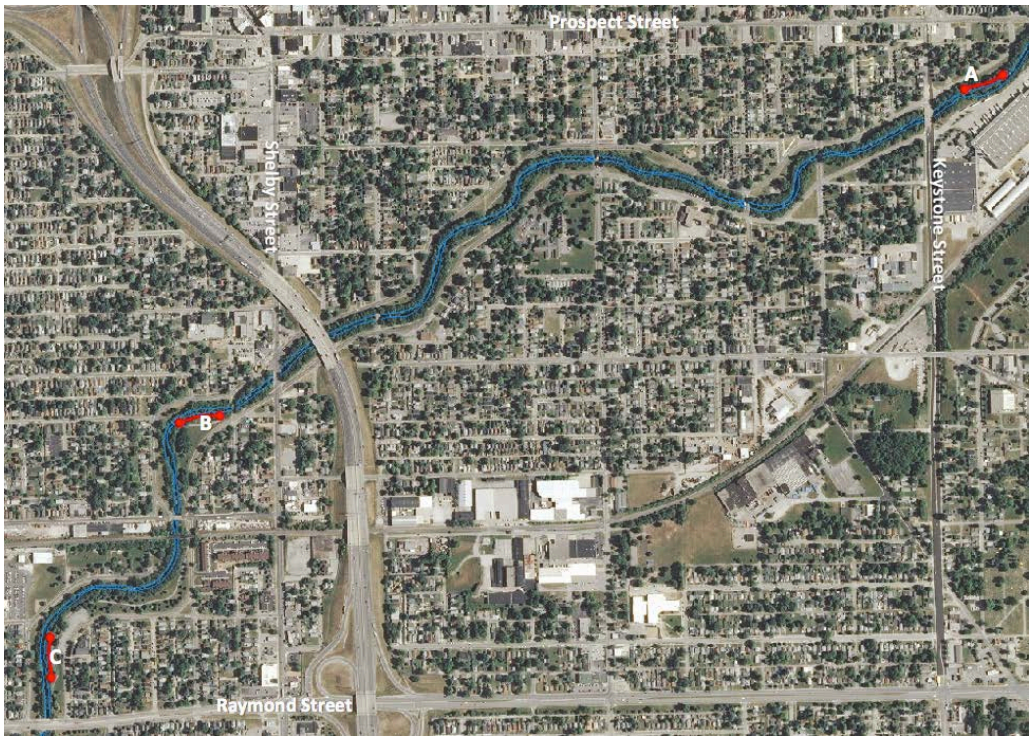
Figure 1. Location of 100 m transects along Fall Creek.

Figure 2. Location of 100 m transects along Pogue's Run.

Figure 3. Location of 100 m transects along Pleasant Run.



Appendix. Entire species list for all plants seen in herb-layer plots each sample year. Species found in 10 or more plots have frequencies in bold.

Common Name	Scientific Name	Native	Invasive	C	Growth Form	Fall Creek	Pogue's Run	Pleasant Run
Three-seeded mercury	*Acalypha virginica*	x		0	annual forb	8		
Boxelder	*Acer negundo*	x		1	tree	6	1	7
Norway maple	*Acer platanoides*		***		tree	4	5	2
Red maple	*Acer rubrum*	x		5	tree		1	
Silver maple	*Acer saccharinum*	x		1	tree			1
Ohio buckeye	*Aesculus glabra*	x		5	tree	1	2	
White snakeroot	*Ageratina altissima*	x		2	perennial forb	9	9	3
Tree-of-heaven	*Ailanthus altissima*		***		tree	3		
Garlic mustard	*Alliaria petiolata*		***		biennial forb	7		9
Common ragweed	*Ambrosia artemisiifolia*	x		0	annual forb		1	
Giant ragweed	*Ambrosia trifida*	x		0	annual forb		2	1
Common burdock	*Arctium minus*				biennial forb	3		
Spanish needles	*Bidens bipinnata*	x		0	annual forb	3		
False nettle	*Boehmeria cylindrica*	x		3	perennial forb		1	
Common wood sedge	*Carex blanda*	x		1	perennial sedge	**10**	4	**11**
Bitternut hickory	*Carya cordiformis*	x		5	tree		2	
Cigar tree	*Catalpa speciosa*	x		0	tree	4	5	1
Hackberry	*Celtis occidentalis*	x		3	tree	**26**	**15**	**15**
Eastern redbud	*Cercis canadensis*	x		3	tree	1	4	
Southern wild chervil	*Chaerophyllum tainturieri*	x		1	annual forb	1	1	
Chicory	*Cichorium intybus*				perennial forb			1
Autumn virgin's bower	*Clematis terniflora*		c		woody vine	1		1
Horseweed	*Conza canadensis*	x		0	annual forb	3		
Flowering dogwood	*Cornus florida*	x		4	tree		1	
Queen Anne's lace	*Daucus carota*		**		biennial forb	2		
Fuller's teasel	*Dipsacus follonum*		***		biennial forb	1		
Indian strawberry	*Duchesnea indica*				perennial forb	2		

Common Name	Scientific Name	Native	Invasive	C	Growth Form	Fall Creek	Pogue's Run	Pleasant Run
Bottlebrush grass[P]	*Elymus hystrix*	x		5	perennial grass	**15**		**12**
Annual fleabane	*Erigeron annuus*	x		0	biennial forb	3		
Winged euonymus	*Euonymus alata*		**		shrub	1		
Winter-creeper	*Euonymus fortunei*		***		shrub	**24**	1	**10**
Japanese spindle tree	*Euonymus hamiltoniana*				tree	1		
Tall boneset	*Eupatorium altissimum*	x		1	perennial forb	3		
Japanese knotweed	*Fallopia japonica*		***		shrub			9
Climbing false buckwheat	*Fallopia scandens v. scandens*	x		0	herbaceous vine	2		
White ash	*Fraxinus americana*	x		4	tree	5	5	
Green ash	*Fraxinus pennsylvanica*	x		1	tree		2	5
Blue ash	*Fraxinus quadrangulata*	x		7	tree	1	1	1
White avens	*Geum canadense*	x		1	perennial forb	2		
Jerusalem artichoke	*Helianthus tuberosus*	x		2	perennial forb			2
Eastern red cedar	*Juniperus virginiana*	x		2	tree	1		
Blue lettuce	*Lactuca floridana*	x		5	biennial forb		1	1
Prickly lettuce	*Lactuca serriola*				biennial forb	2		
Canada wood nettle	*Laportea canadensis*	x		2	perennial forb	1		1
Rice cut grass	*Leersia oryzoides*	x		2	perennial grass	1		1
Motherwort	*Leonurus cardiaca*				perennial forb	1		
Amur honeysuckle	*Lonicera maackii*		***		shrub	**19**	**22**	**19**
Moonseed	*Menispermum canadense*	x		3	woody vine	3		2
White mulberry	*Morus alba*		***		tree	1		6
Evening primrose	*Oenothera biennis*	x		0	biennial forb	1		1
Tall wood sorrel	*Oxalis stricta*	x		0	perennial forb	6	2	2
Prairie switch grass[P]	*Panicum virgatum*	x		4	perennial grass	1		
Virginia creeper	*Parthenocissus quinquefolia*	x		2	woody vine	**10**	4	7
Lady's thumb	*Persicaria vulgaris*				annual forb	1		
Blue phlox	*Phlox divaricata*	x		5	perennial forb		1	

Common Name	Scientific Name	Native	Invasive	C	Growth Form	Fall Creek	Pogue's Run	Pleasant Run
Ground cherry	*Physalis heterophylla*	x		3	perennial forb			1
Pokeweed	*Phytolacca americana*	x		0	perennial forb	9	1	3
Canada clearweed	*Pilea pumila*	x		2	annual forb			2
English plantain	*Plantago lanceolata*				perennial forb	1		
Common plantain	*Plantago major*				perennial forb		1	
Sycamore	*Platanus occidentalis*	x		3	tree		1	
Annual bluegrass	*Poa annua*				annual grass	1		
Common knotweed	*Polygonum aviculare*				annual forb			2
Solomon's seal	*Polygonatum biflorum*	x		4	perennial forb	1		
Pale leafcup	*Polymnia canadensis*	x		3	perennial forb	2		
Black cherry	*Prunus serotina*	x		1	tree		2	
Smooth wafer ash	*Ptelea trifoliata*	x		4	shrub	1		
Callery pear	*Pyrus calleryana*		***		tree	1		
Burr oak	*Quercus macrocarpa*	x		5	tree	2	1	1
Northern red oak	*Quercus rubra*	x		4	tree	1		
Common buckthorn	*Rhamnus cathartica*		***		shrub			1
Black locust	*Robinia pseudoacacia*	x		1	tree			1
Multiflora rose	*Rosa multiflora*		***		shrub			1
Green-headed coneflower	*Rudbeckia laciniata*	x		3	perennial forb			1
Black willow	*Salix nigra*	x		3	tree		1	
Common elderberry	*Sambucus nigra*	x		2	shrub		1	
Late figwort	*Scrophularia marilandica*	x		5	perennial forb	4	2	3
Bristly green brier	*Smilax hispida*	x		3	woody vine	**17**	2	1
Cat brier	*Smilax rotundifolia*	x		4	woody vine	3	1	1
Bittersweet nightshade	*Solanum dulcamara*				woody vine	1	2	1
Canada goldenrod	*Solidago canadensis*	x		0	perennial forb	5	1	3
Hairy aster	*Symphyotrichum pilosum*	x		0	perennial forb	2	7	1
Common dandelion	*Taraxacum officinale*				perennial forb	1		

Common Name	Scientific Name	Native	Invasive	C	Growth Form	Fall Creek	Pogue's Run	Pleasant Run
American linden	*Tilia americana*	x		3	tree		1	2
Virginia knotweed	*Tovara virginiana*	x		3	perennial forb	3		4
Poison ivy	*Toxicodendron radicans*	x		1	woody vine	**21**	**10**	**20**
Broad-leaved spiderwort	*Tradescantia subaspera*	x		4	perennial forb			1
American elm	*Ulmus americana*	x		3	tree		1	
Siberian elm	*Ulmus pumila*		**			1		3
Slippery elm	*Ulmus rubra*	x		3	tree	2	2	
White vervain	*Verbena urticifolia*	x		3	perennial forb		1	3
Wingstem	*Verbesina alternifolia*	x		3	perennial forb	4	1	
Purple violet	*Viola sororia*	x		1	perennial forb	4	1	3
Riverbank grape	*Vitis riparia*	x		1	woody vine	**12**	8	8

Official IISC Invasive Plant List Indiana Invasive Species Council
http://www.entm.purdue.edu/iisc/invasiveplants.php

*** high

** medium

c caution

P - planted