

Appendix A-IPANE

Invasive Plant Atlas of New England

Overview

EDDMapS is a web-based mapping system for documenting invasive species distribution. It is fast, easy to use and doesn't require Geographic Information Systems experience. Launched in 2005 by the Center for Invasive Species and Ecosystem Health at the University of Georgia, it was originally designed as a tool for state Exotic Pest Plant Councils to develop more complete distribution data of invasive species.

EDDMapS goal is to maximize the effectiveness and accessibility of the immense numbers of invasive species observations recorded each year. As of November 2015, EDDMapS has over 2.7 million records.

EDDMapS combines data from other databases and organizations as well as volunteer observations to create a national network of invasive species distribution data that is shared with educators, land managers, conservation biologists, and beyond. This data will become the foundation for a better understanding of invasive species distribution around the world.

How does it work?

EDDMapS documents the presence of invasive species. A simple, interactive Web interface engages participants to submit their observations or view results through interactive queries into the EDDMapS database. EDDMapS encourages users to participate by providing Internet tools that maintain their personal records and enable them to visualize data with interactive maps.

Users simply enter information from their observations into the standardized on-line data form, which allows specific information about the infestation and images to be added. Data entered is immediately loaded to the Website, allowing real time tracking of species. Being able to see the current data of a species as it moves into a new area helps to facilitate Early Detection and Rapid Response programs (EDRR). EDRR programs help stop or control an invasive species before it becomes an unmanageable problem.

All data is reviewed by state verifiers to ensure all data is accurate. The data is made freely available to scientists, researchers, land managers, land owners, educators, conservationists, ecologists, farmers, foresters, state and national parks.

Where is it?

Further information, online maps, and training materials are available at:
<https://www.eddmaps.org/pane/>

Further information is available by contacting Sarah T. Bois, PhD, Interim Program Director, at: IPANE.uconn@gmail.co

Appendix B

Below is the plant community found at each sample site within the Chicopee watershed. All plant nomenclature is in accordance with: USDA, NRCS. 2015. The PLANTS Database, National Plant Data Team, Greensboro, NC 27401-4901 USA (<http://plants.usda.gov>). Abundance is based on a tally of plant species encountered along defined transects as described in Section 3.1 *Site Analysis Procedure*. Plants identified as invasive plant species in “*The Evaluation of Non-Native Plant Species for Invasiveness in Massachusetts*”, Massachusetts Invasive Plant Advisory Group, February 28, 2005 (<http://www.mass.gov/eea/docs/dgf/nhesp/land-protection-and-management/invasive-plant-list.pdf>) are highlighted in yellow and presented in italic font.

Site Low 1

genus	species	abundance	genus	species	abundance
Acer	rubrum	83	Maianthemum	canadense	2
Osmunda	cinnamomea	51	Symplocarpus	foetidus	2
Carex	stricta	28	Chelone	glabra	1
Onoclea	sensibilis	22	Clematis	virginiana	1
Calamagrostis	canadensis	20	Cornus	amomum	1
Thelypteris	palustris	19	Equisetum	pratense	1
Carex	crinita	16	Galium	aparine	1
Ilex	verticillata	11	Glyceria	striata	1
Lyonia	ligustrina	11	Hydrocotyle	americana	1
Symplocarpus	foetidus	9	Leersia	oryzoides	1
Typha	latifolia	7	Lindera	benzoin	1
Impatiens	capensis	6	Photinia	melanocarpa	1
Salix	discolor	5	Pinus	strobos	1
Rubus	hispidus	3	Polygonum	arifolium	1
Vaccinium	corymbosum	3	Rhododendron	viscosum	1
Alnus	serrulata	2	Rosa	<i>multiflora</i>	1
Carex	intumescens	2	Scirpus	atrovirens	1
Carex	lurida	2	Solidago	uliginosa	1
Lycopus	uniflorus	2	Sympyotrichum	puniceum	1
<i>Lythrum</i>	<i>salicaria</i>	2	Vitis	labrusca	1

Site: Low 2

genus	species	abundance	genus	species	abundance
Acer	rubrum	57	Viola	sororia	3
Lonicera	xylosteum	54	Potentilla	simplex	2
Fraxinus	pennsylvanica	51	Rubus	hispidus	2
Thelypteris	noveboracensis	18	Acer	saccharum	1
Pinus	strobus	15	Betula	populifolia	1
Osmunda	cinnamomea	13	Carex	stipata	1
Arisaema	triphyllum	12	Carpinus	caroliniana	1
Maianthemum	canadense	12	Corylus	americana	1
Athyrium	filix-femina	11	Dryopteris	carthusiana	1
Pilea	pumila	11	Galium	aparine	1
Ilex	verticillata	9	Geranium	maculatum	1
Rubus	hispidus	7	Glyceria	striata	1
Viburnum	lentago	7	Lyonia	ligustrina	1
Scutellaria	lateriflora	6	Onoclea	sensibilis	1
Toxicodendron	radicans	5	Polystichum	acrostichoides	1
Carex	pellita	4	Quercus	alba	1
<i>Celastrus</i>	<i>orbiculatus</i>	4	Solidago	rugosa	1
Mitchella	repens	4	Solidago	gigantea	1
<i>Rosa</i>	<i>multiflora</i>	4	Vitis	labrusca	1
Geum	aleppicum	3			

Low Site 3

genus	species	abundance	genus	species	abundance
Acer	rubrum	99	Carex	pellita	1
<i>Berberis</i>	<i>thunbergii</i>	64	Dryopteris	carthusiana	1
Fraxinus	pennsylvanica	54	Thelypteris	palustris	1
Lonicera	xylosteum	28	Carex		1
Ulmus	americana	15	Carex	intumescens	1
Arisaema	triphyllum	11	Symplocarpus	foetidus	1
Ilex	verticillata	10	Prunus	virginiana	1
<i>Celastrus</i>	<i>orbiculatus</i>	7	Vitis	labrusca	1
Pinus	strobus	6	Quercus	rubra	1
Osmunda	cinnamomea	5	Acer	saccharum	1
Maianthemum	canadense	5	Oxalis	stricta	1
<i>Rosa</i>	<i>multiflora</i>	3	Viola		1
Lindera	benzoin	3	Viburnum	dentatum	1
Mitchella	repens	2	Geum		1

Low Site 4

genus	species	abundance	genus	species	abundance
Symplocarpus	foetidus	67	Aralia	nudicaulis	1
Acer	rubrum	49	Glyceria	striata	1
Impatiens	capensis	39	Ligustrum	vulgare	1
Alnus	serrulata	28	Lonicera	xylosteum	1
Ulmus	americana	27	Morus	alba	1
Vitis	labrusca	21	Onoclea	sensibilis	1
Osmunda	cinnamomea	16	Parthenocissus	quinquefolia	1
<i>Celastrus</i>	<i>orbiculatus</i>	10	Rubus	hispidus	1
Acer	saccharinum	7	Rubus	allegheniensis	1
Quercus	rubra	7	Rubus	idaeus	1
Cornus	amomum	6	Rumex	crispus	1
Sambucus	canadensis	5	Solanum	dulcamara	1
Viburnum	dentatum	4	Solidago	rugosa	1
Arisaema	triphyllum	3	Thelypteris	noveboracensis	1
Catalpa		3	Tilia	americana	1
Quercus	alba	3	Toxicodendron	radicans	1
Acer	saccharum	2			

Low site 5

genus	species	abundance	genus	species	abundance
Acer	rubrum	90	Alnus	serrulata	1
Rubus	hispidus	57	Arisaema	triphyllum	1
Osmunda	cinnamomea	38	Carex	foliosa	1
Carex		28	Carex	scoparia	1
Impatiens	capensis	27	Carya	ovata	1
Onoclea	sensibilis	19	Corylus	americana	1
Prunus	serotina	14	Festuca	rubra	1
Osmunda	regalis	13	Juncus	effusus	1
Vaccinium	corymbosum	11	Maianthemum	canadense	1
Carex		8	Pinus	strobus	1
Vitis	labrusca	7	Potentilla	simplex	1
Glyceria	striata	6	Prunus	avium	1
Lyonia	ligustrina	6	Quercus	alba	1
Solidago	gigantea	6	Quercus	rubra	1
Toxicodendron	radicans	5	Rubus	allegheniensis	1
Viburnum	dentatum	4	Rubus	idaeus	1
Carex	stipata	3	Symplocarpus	foetidus	1
Ilex	verticillata	3	Thalictrum	pubescens	1
Solidago	rugosa	2	Thelypteris	palustris	1
Acer	saccharum	1			

Low Site 6

genus	species	abundance	genus	species	abundance
Acer	Rubrum	97	Trientalis	borealis	2
Osmunda	cinnamomea	41	Viburnum	acerifolium	2
Thelypteris	noveboracensis	37	Amelanchier	canadensis	1
Rubus	hispidus	33	Arisaema	trifolium	1
Maianthemum	canadense	21	Athyrium	filix-femina	1
Symplocarpus	foetidus	18	Carex	intumescens	1
Carpinus	caroliniana	13	Carya	glabra	1
Vaccinium	corymbosum	11	Dennstaedtia	punctilobula	1
Pinus	strobus	7	Fraxinus	pennsylvanica	1
Carex		6	Quercus	alba	1
Prunus	serotina	5	Quercus	rubra	1
Ilex	verticillata	4	Smilax	rotundifolia	1
Corylus	americana	2	Viburnum	dentatum	1
Crataegus		2	Viburnum	lentago	1
Mitchella	repens	2	Viola	sororia	1

Low Site 7

genus	species	abundance	genus	species	abundance
Acer	rubrum	97	Amelanchier	canadensis	1
Carex	stricta	59	Arisaema	trifolium	1
Symplocarpus	foetidus	55	Betula	populifolia	1
Impatiens	capensis	47	Cardamine	pratensis	1
Pinus	strobus	21	Carex	folliculata	1
Rosa	multiflora	21	Carex	lurida	1
Thelypteris	palustris	12	Carya	glabra	1
Cornus	amomum	10	Corylus	americana	1
Glyceria	striata	10	Equisetum		1
Solidago	rugosa	9	Fraxinus	pennsylvanica	1
Lonicera	xylosteum	11	Geum		1
Alnus	serrulata	4	Lyonia	ligustrina	1
Onoclea	sensibilis	4	Osmunda	regalis	1
Quercus	rubra	4	Poa	palustris	1
Toxicodendron	radicans	3	Prunus	serotina	1
Celastrus	orbiculatus	2	Rubus	hispidus	1
Ilex	verticillata	2	Rubus	idaeus	1
Parthenocissus	quinquefolia	2	Thalictrum	pubescens	1
Scirpus	atrovirens	2	Triadenum	virginicum	1

Ulmus	americana	2	Trientalis	borealis	1
Acer	platanoides	1	Viola		1

Low Site 8

genus	species	abundance	genus	species	abundance
Acer	rubrum	99	Acer	saccharum	1
<i>Berberis</i>	<i>thunbergii</i>	51	Alnus	serrulata	1
Fraxinus	pennsylvanica	30	Betula	nigra	1
Impatiens	capensis	23	Boehmeria	cylindrica	1
Lonicera	xylosteum	21	Dryopteris	carthusiana	1
Mitchella	repens	16	Equisetum	pratense	1
Ilex	verticillata	15	Geranium	maculatum	1
<i>Rosa</i>	<i>multiflora</i>	12	Geum		1
Onoclea	sensibilis	11	Juncus	effusus	1
Maianthemum	canadense	10	Lycopodium	obscurum	1
Symplocarpus	foetidus	10	Lycopus	virginicus	1
Carex		7	Pinus	strobus	1
Symphytichum	puniceum	5	Quercus	alba	1
Rubus	hispidus	5	<i>Rhamnus</i>	<i>cathartica</i>	1
Carex		4	<i>Frangula</i>	<i>alnus</i>	1
<i>Celastrus</i>	<i>orbiculatus</i>	4	Solidago	gigantea	1
Solidago	rugosa	4	Solidago	uliginosa	1
Ulmus	americana	4	Uvularia	sessilifolia	1
Carex		3	Viburnum	dentatum	1
Lyonia	ligustrina	3	Viburnum	lentago	1
Carex	intumescens	2	Cicuta	maculata	1
Vaccinium	corymbosum	2	Glyceria	striata	1

Low Site 9

genus	species	abundance	genus	species	abundance
Rubus	allegheniensis	61	Maianthemum	canadense	5
Acer	rubrum	36	Toxicodendron	radicans	5
Carex		24	Arisaema	triphyllum	4
Prunus	serotina	24	Acer	saccharum	2
Ulmus	americana	24	Clematis	virginiana	2
Lonicera	xylosteum	21	Glyceria	striata	2
Acer	negundo	18	Impatiens	capensis	2
Ilex	verticillata	15	Sambucus	canadensis	2

Populus	deltoides	15	Aralia	nudicaulis	1
Parthenocissus	quinquefolia	12	Dryopteris	cristata	1
<i>Rosa</i>	<i>multiflora</i>	12	Geum	aleppicum	1
Rubus	idaeus	12	Phytolacca	americana	1
Parthenocissus	quinquefolia	12	Pilea	pumila	1
Rubus	idaeus	12	Pinus	strobus	1
Carex	crinita	11	Rhus	typhina	1
<i>Celastrus</i>	<i>orbiculatus</i>	11	Scutellaria	lateriflora	1
Betula	populifolia	10	Thalictrum	pubescens	1
Dryopteris	carthusiana	10	Urtica	dioica	1
Solidago	rugosa	9	Vitis	labrusca	1
Circaeaa	lutetiana	9	Maianthemum	racemosum	1

Low Site 10

genus	species	abundance	genus	species	abundance
Acer	rubrum	71	Geranium	maculatum	1
<i>Berberis</i>	<i>thunbergii</i>	34	Lycopus	uniflorus	1
Prunus	serotina	19	Parthenocissus	quinquefolia	1
<i>Celastrus</i>	<i>orbiculatus</i>	12	Phytolacca	americana	1
Fraxinus	pennsylvanica	12	Potentilla	simplex	1
Pinus	strobus	12	Quercus	rubra	1
Onoclea	sensibilis	5	<i>Frangula</i>	<i>alnus</i>	1
Ulmus	americana	5	Rubus	hispidus	1
Arisaema	trifolium	4	Rubus	idaeus	1
Ilex	verticillata	3	Scutellaria	lateriflora	1
Osmunda	cinnamomea	3	Solanum	dulcamara	1
Thelypteris	noveboracensis	3	Solidago	rugosa	1
Athyrium	filix-femina	2	Symplocarpus	foetidus	1
Dennstaedtia	punctilobula	2	Thalictrum	pubescens	1
Maianthemum	canadense	2	Uvularia	sessilifolia	1
Osmunda	regalis	2	Vaccinium	corymbosum	1
Toxicodendron	radicans	2	Viburnum	dentatum	1
Acer	saccharum	1	Vitis	labrusca	1
Carex	folliculata	1			

Low Site 11

genus	species	abundance	genus	species	abundance
Acer	rubrum	76	Fraxinus	pennsylvanica	1

Cinna	arundinacea	26	Galium	palustre	1
Carex	crinita	24	Ilex	verticillata	1
Rubus	allegheniensis	21	Lonicera	xylosteum	1
Carex	lurida	16	Lycopus	uniflorus	1
Cornus	amomum	12	Lysimachia	terrestris	1
Impatiens	capensis	12	Onoclea	sensibilis	1
Glyceria	canadensis	10	Phytolacca	americana	1
Boehmeria	cylindrica	8	Pinus	strobus	1
Dryopteris	carthusiana	7	Prunus	serotina	1
Polygonum	sagittatum	6	Rubus	hispidus	1
Symplocarpus	foetidus	5	Thelypteris	noveboracensis	1
Viburnum	dentatum	4	Toxicodendron	radicans	1
Carex	stricta	3	Ulmus	americana	1
Carex	tribuloides	3	Viburnum	lentago	1
Vitis	labrusca	3	Erechtites	hieraciifolius	1
Vaccinium	corymbosum	2	Carex	intumescens	1
Apios	americana	1	Eutrochium	maculatum	1
Bidens	frondosa	1	Spiraea	alba	1
Carex	intumescens	1	Thelypteris	palustris	1

Low Site 12

genus	species	abundance	genus	species	abundance
Acer	rubrum	100	Glyceria	striata	1
Carex	stricta	68	Ilex	verticillata	1
Impatiens	capensis	47	Lycopus	uniflorus	1
Pinus	strobus	18	Polygonum	arifolium	1
Calamagrostis	canadensis	17	Rhododendron	viscosum	1
Symplocarpus	foetidus	16	Rosa	<i>multiflora</i>	1
Sympyotrichum	puniceum	8	Rosa	palustris	1
Onoclea	sensibilis	7	Solidago	gigantea	1
Thelypteris	palustris	6	Solidago	rugosa	1
Dryopteris	cristata	5	Thalictrum	pubescens	1
Mimulus	ringens	5	Typha	latifolia	1
Osmunda	cinnamomea	4	Ulmus	americana	1
Carex	crinita	1	Eutrochium	maculatum	1
Carex	lurida	1	Iris	versicolor	1
Cinna	latifolia	1	Spiraea	alba	1
Cornus	amomum	1	Acorus	calamus	1
Galium	aparine	1			

Low Site 13

genus	species	abundance	genus	species	abundance
Acer	rubrum	79	Ilex	verticillata	3
Carex		34	Carex	folliculata	2
Lonicera	xylosteum	31	<i>Frangula</i>	<i>alnus</i>	2
Alnus	serrulata	29	Symplocarpus	foetidus	2
Lysimachia	ciliata	28	Acer	platanoides	1
Impatiens	capensis	25	Acer	saccharum	1
Cornus	amomum	20	Agrostis		1
Ulmus	americana	17	Bidens	frondosa	1
Vitis	labrusca	16	Boehmeria	cylindrica	1
<i>Arisaema</i>	<i>trifolium</i>	14	Carex	crinita	1
<i>Celastrus</i>	<i>orbiculatus</i>	9	Geum	aleppicum	1
Clematis	virginiana	9	Platanthera	psycodes	1
Onoclea	sensibilis	8	Lactuca	biennis	1
Eutrochium	maculatum	7	Lindera	benzoin	1
Dryopteris	carthusiana	6	Myosotis	scorpioides	1
Rubus	allegheniensis	6	Polygonatum	pubescens	1
Solidago	rugosa	6	Potentilla	simplex	1
Sambucus	canadensis	6	<i>Rosa</i>	<i>multiflora</i>	1
Pinus	strobus	5	Solidago		1
Prunus	serotina	5	Toxicodendron	radicans	1
Betula	populifolia	4	Circaeа	lutetiana	1
Parthenocissus	quinquefolia	4	Populus	tremuloides	1
Thalictrum	pubescens	4	Iris	versicolor	1
Parthenocissus	quinquefolia	4			

Low Site 14

genus	species	abundance	genus	species	abundance
Acer	rubrum	98	Leersia	oryzoides	2
<i>Berberis</i>	<i>thunbergii</i>	23	Osmunda	cinnamomea	2
Maianthemum	canadense	18	Thalictrum	pubescens	2
Pinus	strobus	16	Acer	saccharum	1
Rubus	hispidus	15	Aralia	nudicaulis	1
Toxicodendron	radicans	11	Eupatorium	perfoliatum	1
Impatiens	capensis	9	Carex	crinita	1
Fraxinus	pennsylvanica	8	Cinna	arundinacea	1
Ilex	verticillata	7	Coptis	trifolia	1
<i>Rosa</i>	<i>multiflora</i>	7	Galium	palustre	1
Dennstaedtia	punctilobula	6	Geum		1
Quercus	rubra	6	Mimulus	ringens	1
Onoclea	sensibilis	5	Sorbus	americana	1

Solanum	dulcamara	5	Parthenocissus	quinquefolia	1
Thelypteris	noveboracensis	5	Ligustrum	vulgare	1
Trientalis	borealis	5	Prunus	serotina	1
Amelanchier		4	Quercus	alba	1
Carex		4	Rhus	typhina	1
Corylus	americana	4	Ribes	triste	1
Glyceria	striata	4	Rubus	allegheniensis	1
Crataegus		4	Saxifraga	pensylvanica	1
Sympyotrichum	puniceum	3	Scirpus	cyperinus	1
Lyonia	ligustrina	3	Solidago	gigantea	1
Vitis	labrusca	3	Solidago	rugosa	1
Arisaema	trifolium	2	Tsuga	canadensis	1
Calamagrostis	canadensis	2	Viola		1
Carex	intumescens	2	Erechtites	hieraciifolius	1

Low Site 15

genus	species	abundance	genus	species	abundance
Prunus	serotina	57	Osmunda	cinnamomea	2
Carex		46	Agrostis	scabra	1
Viburnum	lentago	39	Alliaria	<i>petiolata</i>	1
Acer	rubrum	30	Anemone	virginiana	1
Impatiens	capensis	24	Bidens	frondosa	1
Acer	negundo	23	Boehmeria	cylindrica	1
Lonicera	xylosteum	19	Carex	pellita	1
Cornus	amomum	17	Cornus	racemosa	1
Solidago	gigantea	16	Dennstaedtia	punctilobula	1
Rosa	<i>multiflora</i>	12	Dichanthelium	clandestinum	1
Allium	tricoccum	10	Dryopteris	carthusiana	1
Celastrus	<i>orbiculatus</i>	9	Frangula	<i>alnus</i>	1
Circaeaa	lutetiana	8	Juncus	effusus	1
Symplocarpus	foetidus	6	Phytolacca	americana	1
Arisaema	trifolium	5	Polygonum	arifolium	1
Geum	aleppicum	4	Quercus	rubra	1
Rubus	allegheniensis	4	Toxicodendron	radicans	1
Onoclea	sensibilis	3	Viburnum	dentatum	1
Solidago	rugosa	3	Oxalis	stricta	1
Vitis	labrusca	3	Spiraea	alba	1

Low Site 16

genus	species	abundance	genus	species	abundance
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Acer	rubrum	85	Carex	scoparia	2
Ilex	verticillata	41	Aralia	nudicaulis	1
Symplocarpus	foetidus	39	Boehmeria	cylindrica	1
Alnus	incana	23	Carex	intumescens	1
Carex	crinita	22	Carex	lupulina	1
Cornus	amomum	20	Cephalanthus	occidentalis	1
Glyceria	striata	20	Cicuta	maculata	1
Impatiens	capensis	18	Calystegia	sepium	1
Osmunda	cinnamomea	17	Triadenum	virginicum	1
Symplocarpus	foetidus	15	Lycopus	uniflorus	1
Ulmus	americana	15	Lythrum	salicaria	1
Vaccinium	corymbosum	11	Peltandra	virginica	1
Symphyotrichum	puniceum	10	Poa	palustris	1
Carex	stricta	8	Pontederia	cordata	1
Onoclea	sensibilis	8	Ribes	triste	1
Polygonum	arifolium	8	Rosa	palustris	1
Thelypteris	palustris	8	Rubus	hispidus	1
Carex		7	Solanum	dulcamara	1
Rosa	multiflora	7	Solidago	gigantea	1
Glyceria	canadensis	6	Solidago	rugosa	1
Solidago	uliginosa	6	Toxicodendron	radicans	1
Leersia	oryzoides	5	Trientalis	borealis	1
Maianthemum	canadense	4	Viburnum	dentatum	1
Vitis	labrusca	4	Viola	sororia	1
Galium	aparine	3	Triadenum	virginicum	1
Osmunda	regalis	3	Dryopteris	carthusiana	1
Rhododendron	viscosum	3	Calystegia	sepium	1
Thalictrum	pubescens	3			

Low Site 17

genus	species	abundance	genus	species	abundance
Acer	saccharum	60	Rosa	multiflora	3
Symplocarpus	foetidus	54	Symphyotrichum	puniceum	3
Acer	rubrum	34	Arisaema	trifolium	2
Osmunda	cinnamomea	21	Lonicera	xylosteum	2
Carpinus	caroliniana	20	Maianthemum	canadense	2
Onoclea	sensibilis	20	Solidago	gigantea	2
Fraxinus	pennsylvanica	18	Viburnum	dentatum	2
Prunus	serotina	12	Aralia	nudicaulis	1
Viburnum	lentago	11	Carex		1
Carya	ovata	10	Celastrus	orbiculatus	1

Quercus	rubra	9	Calystegia	sepium	1
Sanguinaria	canadensis	7	Cornus	racemosa	1
Clematis	virginiana	6	Galium	aparine	1
Vitis	labrusca	5	Geum	aleppicum	1
Ilex	verticillata	4	Lysimachia	ciliata	1
Impatiens	capensis	4	<i>Phragmites</i>	<i>australis</i>	1
Parthenocissus	quinquefolia	4	Polystichum	acrostichoides	1
Sympyotrichum	cordifolium	4	Solidago	rugosa	1
Thalictrum	pubescens	4	Thelypteris	palustris	1
Thelypteris	noveboracensis	4	Toxicodendron	radicans	1
Ulmus	americana	4	Trientalis	borealis	1
<i>Berberis</i>	<i>thunbergii</i>	3	Trillium	cernuum	1
Dryopteris	carthusiana	3	Tsuga	canadensis	1
<i>Phalaris</i>	<i>arundinacea</i>	3	Zizia	aurea	1

Low site 18

genus	species	abundance	genus	species	abundance
Acer	saccharum	60	Boehmeria	cylindrica	2
Fraxinus	pennsylvanica	44	Carex		2
Symplocarpus	foetidus	43	Carya	ovata	2
Impatiens	capensis	22	Chrysosplenium	americanum	2
Onoclea	sensibilis	10	Cornus	racemosa	2
Ulmus	americana	9	Lactuca	biennis	2
Dryopteris	carthusiana	8	Quercus	rubra	2
Arisaema	triphyllum	7	Ribes	triste	2
<i>Rosa</i>	<i>multiflora</i>	7	Brachyelytrum	erectum	1
Carex	stricta	6	Lindera	benzoin	1
Cornus	amomum	6	Lysimachia	ciliata	1
<i>Rhamnus</i>	<i>cathartica</i>	6	Parthenocissus	quinquefolia	1
Osmunda	cinnamomea	5	Rumex	verticillatus	1
Polystichum	acrostichoides	5	Solidago	rugosa	1
Acer	rubrum	4	Sympyotrichum	cordifolium	1
Lonicera	xylosteum	4	Thelypteris	palustris	1
Tilia	americana	4	Tussilago	farfara	1
Geranium	maculatum	3	Vitis	labrusca	1
Athyrium	filix-femina	2			

Low Site 19

genus	species	abundance	genus	species	abundance
Acer	rubrum	100	Hydrocotyle	americana	2
Carex	stricta	49	Onoclea	sensibilis	2
Impatiens	capensis	46	Rhododendron	viscosum	2
Osmunda	cinnamomea	33	Rubus	hispidus	2
Symplocarpus	foetidus	25	Alnus	serrulata	1
Maianthemum	canadense	22	Carex	folliculata	1
Vaccinium	corymbosum	20	Chrysosplenium	americanum	1
Thelypteris	palustris	15	Dryopteris	carthusiana	1
Pinus	strobus	12	Nasturtium	officinale	1
Toxicodendron	vernix	12	Poa	palustris	1
Glyceria	striata	9	Quercus	alba	1
Rosa	multiflora	3	Scutellaria	lateriflora	1
Solidago	uliginosa	3	Solanum	dulcamara	1
Amelanchier	canadensis	2	Trientalis	borealis	1
Carex	intumescens	2	Tsuga	canadensis	1
Carex	lurida	2			

Low Site 20

genus	species	abundance	genus	species	abundance
Acer	rubrum	98	Carex	crinita	1
Ilex	verticillata	57	carex	stipata	1
Symplocarpus	foetidus	49	Carex	stricta	1
Impatiens	capensis	40	Galium	aparine	1
Vaccinium	corymbosum	27	Glyceria	canadensis	1
Poa	palustris	22	Iris	versicolor	1
Lycopus		17	Maianthemum	canadense	1
Toxicodendron	vernix	9	Osmunda	cinnamomea	1
Rhododendron	viscosum	8	Pinus	strobus	1
Carex	intumescens	6	Polygonum	arifolium	1
Cinna		6	Rosa	palustris	1
Onoclea	sensibilis	6	Rubus	hispidus	1
Carex	lurida	5	Scutellaria	lateriflora	1
Boehmeria	cylindrica	4	Thelypteris	palustris	1
Leersia	oryzoides	4	Toxicodendron	radicans	1
Lyonia	ligustrina	3	Ulmus	americana	1
Viburnum	dentatum	3	Viburnum	lentago	1
Alnus	serrulata	2	Viola		1
Sympyotrichum	puniceum	1	Cicuta	maculata	1
Bidens	frondosa	1	Alisma	subcordatum	1

Low Site 21

genus	species	abundance	genus	species	abundance
Acer	rubrum	87	Apios	americana	1
Symplocarpus	foetidus	85	Arisaema	triphyllum	1
Impatiens	capensis	31	Athyrium	filix-femina	1
Fraxinus	pennsylvanica	16	Carex	lurida	1
Alnus	serrulata	11	Carex	folliculata	1
Equisetum	pratense	11	Carex	stricta	1
Osmunda	cinnamomea	8	Corylus	americana	1
Ulmus	americana	7	Dryopteris	carthusiana	1
<i>Berberis</i>	<i>thunbergii</i>	5	Glyceria	striata	1
Viburnum	lentago	5	Lonicera	xylosteum	1
Sympyotrichum	puniceum	4	Lysimachia	ciliata	1
Ilex	verticillata	4	Onoclea	sensibilis	1
Thalictrum	pubescens	4	Rumex	verticillatus	1
Osmunda	regalis	2	Solidago	uliginosa	1
Prunus	virginiana	2	Thelypteris	palustris	1
Solidago	rugosa	2	Veratrum	viride	1
Viburnum	dentatum	2			

Low Site 22

genus	species	abundance	genus	species	abundance
Symplocarpus	foetidus	60	Echinocystis	lobata	3
Acer	rubrum	48	Onoclea	sensibilis	3
Viburnum	lentago	45	Parthenocissus	quinquefolia	3
Impatiens	capensis	43	Toxicodendron	radicans	3
Ilex	verticillata	29	Glyceria	striata	2
Alnus	serrulata	23	Solidago	uliginosa	2
Ulmus	americana	23	Carex		1
Osmunda	cinnamomea	14	Carex		1
<i>Rosa</i>	<i>multiflora</i>	12	Carex		1
Geum	laciniatum	10	Galium	aparine	1
Fraxinus	pennsylvanica	7	Hydrocotyle	americana	1
Carpinus	caroliniana	6	Laportea	canadensis	1
Dryopteris	carthusiana	5	Prunus	serotina	1
Maianthemum	canadense	4	Rubus	hispidus	1
Ribes	triste	4	Thelypteris	palustris	1
Rubus	idaeus	4	Viburnum	dentatum	1
Solanum	dulcamara	4	Viola		1
Sympyotrichum	puniceum	4	Vitis	labrusca	1
Arisaema	triphyllum	3			

Low Site 23

genus	species	abundance	genus	species	abundance
Acer	rubrum	96	<i>Berberis</i>	<i>thunbergii</i>	2
Onoclea	sensibilis	32	Quercus	palustris	2
Thelypteris	noveboracensis	27	Amelanchier		1
Parthenocissus	quinquefolia	26	Boehmeria	cylindrica	1
Osmunda	cinnamomea	16	Cephalanthus	occidentalis	1
Prunus	serotina	16	Fraxinus	americana	1
Viburnum	dentatum	12	Ilex	verticillata	1
Cornus	amomum	9	Maianthemum	canadense	1
Thalictrum	pubescens	9	Osmunda	regalis	1
Uvularia	sessilifolia	8	Peltandra	virginica	1
Dryopteris	carthusiana	5	Prunus	avium	1
Ulmus	americana	4	<i>Frangula</i>	<i>alnus</i>	1
Acer	platanoides	3	Rubus	hispidus	1
<i>Celastrus</i>	<i>orbiculatus</i>	6	Sambucus	canadensis	1
Quercus	rubra	3	Maianthemum	stellatum	1
Alnus	serrulata	2	Solidago	rugosa	1
Thelypteris	palustris	1			

Low Site 24

genus	species	abundance	genus	species	abundance
Acer	rubrum	61	Viburnum	dentatum	2
Symplocarpus	foetidus	49	Alnus	serrulata	1
carex	stricta	42	Symphytum	puniceum	1
Thelypteris	palustris	26	Boehmeria	cylindrica	1
Typha	latifolia	12	<i>Celastrus</i>	<i>orbiculatus</i>	1
Carex	crinita	11	Dichanthelium	clandestinum	1
Osmunda	cinnamomea	10	Galium	palustre	1
Calamagrostis	canadensis	9	Juncus	effusus	1
Betula	populifolia	8	Lonicera	xylosteum	1
Carex	lurida	8	Lyonia	ligustrina	1
Onoclea	sensibilis	8	<i>Lythrum</i>	<i>salicaria</i>	1
Ilex	verticillata	5	Maianthemum	canadense	1
Vitis	labrusca	5	Poa	palustris	1
Pinus	strobis	3	Polygonum	arifolium	1
Rubus	hispidus	3	Polygonum	sagittatum	1
Solidago	rugosa	3	Potentilla	simplex	1
Ulmus	americana	3	Quercus	alba	1

Carex	scoparia	2	Ribes	triste	1
Dryopteris	cristata	2	Scirpus	atrovirens	1
Hydrocotyle	americana	2	Spiraea	tomentosa	1
Vaccinium	corymbosum	2			

Low Site 25

genus	species	abundance	genus	species	abundance
Acer	saccharinum	91	Cinna	arundinacea	8
Polygonum	<i>cuspidatum</i>	41	Acalypha	rhomboidea	1
Leersia	virginica	33	Cephalanthus	occidentalis	1
Toxicodendron	radicans	21	Laportea	canadensis	1
Fraxinus	pennsylvanica	18	Onoclea	sensibilis	1
Impatiens	capensis	13	Osmunda	regalis	1
Boehmeria	cylindrica	9	Pilea	pumila	1
Matteuccia	struthiopteris	9	Populus	deltoides	1
Polygonum	persicaria	9			

Low Site 26

genus	species	abundance	genus	species	abundance
Acer	rubrum	29	Onoclea	sensibilis	56
Aegopodium	podagraria	1	Parthenocissus	quinquefolia	1
Alnus	serrulata	3	Phalaris	<i>arundinacea</i>	10
Arisaema	trifolium	1	Polygonum	arifolium	4
Calamagrostis	canadensis	1	Rosa	<i>multiflora</i>	2
Calystegia	sepium	1	Rubus	hispidus	3
Carex		1	Salix	discolor	3
Carex	stricta	1	Solidago	gigantea	28
Chelone	glabra	1	Solidago	rugosa	1
Cornus	amomum	40	Symphytum	puniceum	2
Cornus	racemosa	4	Symplocarpus	foetidus	20
Fraxinus	pennsylvanica	1	Thalictrum	pubescens	2
Galium	aparine	9	Toxicodendron	radicans	1
Geranium	maculatum	1	Ulmus	americana	5
Glyceria	canadensis	1	Viburnum	dentatum	5
Glyceria	striata	2	Viburnum	lentago	4
Ilex	verticillata	9	Vitis	labrusca	7
Impatiens	capensis	29	Sambucus	canadensis	1
Juncus	effusus	1	Osmunda	claytoniana	5
Lonicera	xylosteum	26	Populus	tremuloides	19
Lysimachia	ciliata	15	Hylotelephium	telephium	1

Low Site 27

genus	species	abundance	genus	species	abundance
Acer	rubrum	40	Polygonum	persicaria	4
Acer	saccharinum	28	Cornus	amomum	3
<i>Celastrus</i>	<i>orbiculatus</i>	21	Populus	deltoides	3
Ulmus	americana	20	Pilea	pumila	2
Dichanthelium	clandestinum	19	Carex	crinita	1
Onoclea	sensibilis	16	Carex	tribuloides	1
Cinna	arundinacea	14	Carya	ovata	1
Boehmeria	cylindrica	13	Helianthus	tuberosus	1
Leersia	virginica	13	Hydrocotyle	americana	1
Parthenocissus	quinquefolia	10	Iris	versicolor	1
Leersia	oryzoides	8	Juncus	effusus	1
<i>Rosa</i>	<i>multiflora</i>	8	Lobelia	cardinalis	1
Carex		6	<i>Lythrum</i>	<i>salicaria</i>	1
Salix	nigra	6	Osmunda	regalis	1
Fraxinus	pennsylvanica	5	Peltandra	virginica	1
Glyceria	striata	5	<i>Polygonum</i>	<i>cuspidatum</i>	1
Malus		5	Prunus	serotina	1
Ageratina	altissima	4	Solidago	rugosa	1

Low Site 28

genus	species	abundance	genus	species	abundance
Acer	rubrum	72	Arisaema	trifolium	1
Ilex	verticillata	51	Carex	crinita	1
Onoclea	sensibilis	35	Apios	americana	1
Fraxinus	americana	22	Lysimachia	terrestris	1
Vitis	labrusca	19	Osmunda	cinnamomea	1
Osmunda	regalis	16	Parthenocissus	quinquefolia	1
Maianthemum	canadense	12	Prunus	virginiana	1
Toxicodendron	radicans	10	Quercus	rubra	1
Pinus	strobus	6	<i>Rosa</i>	<i>multiflora</i>	1
Carex	folliculata	3	Rosa	palustris	1
Cornus	amomum	3	Rubus	hispidus	1
Nyssa	sylvatica	3	Viburnum	dentatum	1
Vaccinium	corymbosum	3			

Low Site 29

genus	species	abundance	genus	species	abundance
Acer	rubrum	88	Arisaema	triphyllum	2
Impatiens	capensis	71	Solidago	rugosa	2
Symplocarpus	foetidus	60	Vaccinium	corymbosum	2
Osmunda	cinnamomea	15	Vitis	labrusca	2
<i>Celastrus</i>	<i>orbiculatus</i>	13	Acer	saccharum	1
Rubus	idaeus	9	Carya	ovata	1
Ageratina	altissima	5	Corylus	americana	1
Ilex	verticillata	4	Ligustrum	vulgare	1
Pteridium	aquilinum	4	Phytolacca	americana	1
Ulmus	americana	4	<i>Polygonum</i>	<i>cuspidatum</i>	1
<i>Berberis</i>	<i>thunbergii</i>	3	Prunus	serotina	1
Dryopteris	carthusiana	3	Quercus	rubra	1
<i>Frangula</i>	<i>alnus</i>	3	Maianthemum	racemosum	1
Rubus	allegheniensis	3			

Low Site 30

genus	species	abundance	genus	species	abundance
Acer	saccharinum	100	Cephalanthus	occidentalis	6
Leersia	virginica	83	Onoclea	sensibilis	4
Polygonum	persicaria	31	Oxalis	stricta	4
Polygonum	lapathifolium	16	Vitis	riparia	3
Bidens	frondosa	13	Cinna	arundinacea	1
Boehmeria	cylindrica	13	Echinochloa	crus-galli	1
Quercus	palustris	11	Eupatorium	perfoliatum	1
Fraxinus	pennsylvanica	8	Impatiens	capensis	1
Toxicodendron	radicans	8	Lycopus	uniflorus	1
Catalpa	speciosa	7	Pilea	pumila	1

Low site 31

genus	species	abundance	genus	species	abundance
Acer	rubrum	100	Carex	lurida	1
Impatiens	capensis	61	Crataegus		1
Cornus	amomum	35	Fraxinus	americana	1
Onoclea	sensibilis	30	Geum	aleppicum	1
Lonicera	xylosteum	29	Iris	versicolor	1
Glyceria	striata	17	Juncus	effusus	1
Carex	stricta	9	Osmunda	regalis	1
Malus		7	Parthenocissus	quinquefolia	1
<i>Celastrus</i>	<i>orbiculatus</i>	4	<i>Polygonum</i>	<i>cuspidatum</i>	1

Arisaema	trifolium	3	Polygonum	sagittatum	1
Calamagrostis	canadensis	3	Prunus	serotina	1
Solidago	gigantea	3	Scutellaria	lateriflora	1
Symplocarpus	foetidus	3	Solanum	dulcamara	1
Symplocarpus	foetidus	2	Toxicodendron	radicans	1
Sympyotrichum	puniceum	1	Ulmus	americana	1
Bidens	frondosa	1	Sambucus	canadensis	2
Carex	intumescens	1			

Low Site 32

genus	species	abundance	genus	species	abundance
Acer	rubrum	95	Alnus	serrulata	3
Ilex	verticillata	46	Epilobium	coloratum	3
Symplocarpus	foetidus	30	Hydrocotyle	americana	3
Impatiens	capensis	25	Carex	crinita	2
Fraxinus	pennsylvanica	18	Carex	lurida	2
Maianthemum	canadense	18	Cornus	amomum	2
Osmunda	cinnamomea	14	Acer	saccharum	1
Lindera	benzoin	12	<i>Berberis</i>	<i>thunbergii</i>	1
Toxicodendron	radicans	12	Carex	foliosculata	1
Pinus	strobus	10	Dryopteris	cristata	1
Rubus	hispidus	7	Eupatorium	perfoliatum	1
Ulmus	americana	7	Glyceria	striata	1
Boehmeria	cylindrica	6	Lyonia	ligustrina	1
Lonicera	xylosteum	6	Osmunda	regalis	1
Arisaema	trifolium	5	Parthenocissus	quinquefolia	1
Dryopteris	carthusiana	5	Prunus	serotina	1
Onoclea	sensibilis	5	<i>Rosa</i>	<i>multiflora</i>	1
Vaccinium	corymbosum	5	Sambucus	canadensis	1
Mitchella	repens	4			

Low site 33

genus	species	abundance	genus	species	abundance
Acer	rubrum	82	Carex	lurida	2
Impatiens	capensis	70	Lycopus	uniflorus	2
Symplocarpus	foetidus	24	Boehmeria	cylindrica	1
<i>Celastrus</i>	<i>orbiculatus</i>	20	Carex		1
Osmunda	cinnamomea	11	Cinna	arundinacea	1
Nyssa	sylvatica	10	Fraxinus	pennsylvanica	1
Rubus	idaeus	8	Parthenocissus	quinquefolia	1

Urtica	dioica	8	Phytolacca	americana	1
Vitis	labrusca	6	Pilea	pumila	1
Prunus	serotina	5	Polystichum	acrostichoides	1
Rubus	hispidus	5	Solidago	rugosa	1
Ilex	verticillata	4	Toxicodendron	radicans	1
Quercus	bicolor	3	Vaccinium	corymbosum	1
Frangula	alnus	3			

Low Site 34

genus	species	abundance	genus	species	abundance
Acer	saccharinum	78	Bidens	frondosa	1
Onoclea	sensibilis	47	Carex	intumescens	1
Populus	deltoides	18	Carex		1
Cornus	amomum	17	Dichanthelium	clandestinum	1
Boehmeria	cylindrica	14	Dryopteris	carthusiana	1
Solidago	rugosa	14	Equisetum	arvense	1
Ulmus	americana	14	Fraxinus	pennsylvanica	1
Carex	lupulina	11	Geum	aleppicum	1
Acer	negundo	8	Helianthus	divaricatus	1
Vitis	riparia	8	Laportea	canadensis	1
Carex	crinita	7	Lindera	benzoin	1
Leersia	virginica	7	Lycopus	uniflorus	1
Cinna	arundinacea	6	Parthenocissus	quinquefolia	1
Rosa	multiflora	5	Phytolacca	americana	1
Alnus	serrulata	4	Pilea	pumila	1
Sambucus	canadensis	4	Polygonum	cuspidatum	1
Toxicodendron	radicans	4	Polystichum	acrostichoides	1
Impatiens	capensis	3	Quercus	bicolor	1
Polygonum	lapathifolium	3	Viola		1
Celastrus		2			

Low site 35

genus	species	abundance	genus	species	abundance
Acer	rubrum	100	Acer	saccharum	1
Frangula	alnus	44	Commelina	communis	1
Rubus	hispidus	40	Berberis	thunbergii	1
Maianthemum	canadense	31	Betula	populifolia	1
Dennstaedia	punctilobula	18	Boehmeria	cylindrica	1
Rubus	allegheniensis	11	Cornus	amomum	1
Dryopteris	carthusiana	11	Dichanthelium	clandestinum	1

Fraxinus	pennsylvanica	8	Lindera	benzoin	1
Prunus	serotina	8	Lycopus	uniflorus	1
Toxicodendron	radicans	8	Phytolacca	americana	1
Rubus	idaeus	6	Quercus	rubra	1
Carex	lurida	3	Rosa	multiflora	1
Parthenocissus	quinquefolia	3	Solidago	rugosa	1
Carya	ovata	2	Sorbus	americana	1
Osmunda	cinnamomea	2	Thalictrum	pubescens	1
Pinus	strobus	2	Ulmus	americana	1
<i>Celastrus</i>	<i>orbiculatus</i>	2	Urtica	dioica	1

Low Site 36

genus	species	abundance	genus	species	abundance
Acer	rubrum	59	Amphicarpa	bracteata	1
Cornus	amomum	55	Symphytum	puniceum	1
Onoclea	sensibilis	47	Boehmeria	cylindrica	1
<i>Phalaris</i>	<i>arundinacea</i>	17	Dichanthelium	clandestinum	1
Solidago	rugosa	14	Glyceria	striata	1
Vitis	labrusca	14	Iris	versicolor	1
Impatiens	capensis	12	Ilex	verticillata	1
Quercus	palustris	12	Lindera	benzoin	1
Carex	stricta	11	Lysimachia	ciliata	1
Symplocarpus	foetidus	11	Maianthemum	canadense	1
Prunus	serotina	7	Malus		1
Viburnum	dentatum	7	Pinus	strobus	1
<i>Lythrum</i>	<i>salicaria</i>	5	Polygonum	sagittatum	1
Polygonum	arifolium	5	Rubus	idaeus	1
<i>Frangula</i>	<i>alnus</i>	5	Solanum	dulcamara	1
Acorus	calamus	4	Sorbus	americana	1
Rubus	hispidus	3	Spiraea	tomentosa	1
Osmunda	cinnamomea	2	Thalictrum	pubescens	1
Ulmus	americana	2	Toxicodendron	radicans	1
Maianthemum	racemosum	2	Typha	latifolia	1

Low Site 37

genus	species	abundance	genus	species	abundance
Acer	rubrum	77	Lysimachia	ciliata	2
Impatiens	capensis	73	Agrostis		1
<i>Frangula</i>	<i>alnus</i>	41	Arisaema	triphyllum	1
Acer	saccharinum	13	Bidens	cernua	1

<i>Celastrus</i>	<i>orbiculatus</i>	13	Clematis	virginiana	1
Onoclea	sensibilis	11	Dichanthelium	clandestinum	1
Salix	nigra	10	Echinocystis	lobata	1
Alnus	serrulata	9	Lindera	benzoin	1
Leersia	virginica	9	Osmunda	cinnamomea	1
Cinna	arundinacea	8	Parthenocissus	quinquefolia	1
Maianthemum	canadense	6	Pilea	pumila	1
Ilex	verticillata	5	Prunus	serotina	1
Carex		4	Solanum	dulcamara	1
Sambucus	canadensis	4	Solidago	gigantea	1
Boehmeria	cylindrica	3	Symplocarpus	foetidus	1
Cornus	amomum	3	Toxicodendron	radicans	1
<i>Rosa</i>	<i>multiflora</i>	3	Vitis	labrusca	1
Ulmus	americana	3	Maianthemum	racemosum	1
Symphyotrichum	puniceum	2			

Low site 38

genus	species	abundance	genus	species	abundance
Acer	rubrum	80	Quercus	rubra	2
<i>Frangula</i>	<i>alnus</i>	60	Vaccinium	corymbosum	2
Symplocarpus	foetidus	31	Circaeа	lutetiana	2
Osmunda	cinnamomea	18	Apios	americana	1
Onoclea	sensibilis	15	Dryopteris	cristata	1
Pilea	pumila	15	Geum	aleppicum	1
Quercus	palustris	10	Impatiens	capensis	1
Quercus	alba	9	Lindera	benzoin	1
Bidens	cernua	7	Lycopodium	obscurum	1
Chrysosplenium	americanum	7	Parthenocissus	quinquefolia	1
Boehmeria	cylindrica	5	Pinus	strobus	1
Cinna	arundinacea	5	Prunus	serotina	1
Lyonia	ligustrina	4	Sambucus	canadensis	1
Alnus	serrulata	3	Solanum	dulcamara	1
Viola		3	Thelypteris	palustris	1
Vitis	labrusca	3	Toxicodendron	radicans	1
Betula	populifolia	2	Typha	latifolia	1
Dryopteris	carthusiana	2	Viburnum	dentatum	1

Low Site 39

genus	species	abundance	genus	species	abundance
Acer	saccharinum	97	Matteuccia	struthiopteris	4

<i>Polygonum</i>	<i>cuspidatum</i>	62	Nepeta	cataria	4
Toxicodendron	radicans	26	Solidago	rugosa	4
Catalpa	speciosa	13	<i>Phalaris</i>	<i>arundinacea</i>	2
Cinna	arundinacea	12	Acalypha	rhomboidea	1
Parthenocissus	quinquefolia	11	Boehmeria	cylindrica	1
Ulmus	americana	9	Commelina	communis	1
Phryma	leptostachya	8	Dennstaedtia	punctilobula	1
Leersia	virginica	7	Laportea	canadensis	1
Vitis	riparia	7	Populus	deltoides	1
Fraxinus	pennsylvanica	5	Prunus	serotina	1
<i>Celastrus</i>	<i>orbiculatus</i>	5	Dryopteris	carthusiana	1

Low site 40

genus	species	abundance	genus	species	abundance
Acer	rubrum	100	Fraxinus	pennsylvanica	3
Symplocarpus	foetidus	47	Toxicodendron	radicans	2
Ulmus	americana	34	<i>Berberis</i>	<i>thunbergii</i>	1
Impatiens	capensis	33	Carex	lurida	1
Maianthemum	canadense	31	Cinna	arundinacea	1
Pinus	strobus	30	Clematis		1
Poa	palustris	13	Equisetum	pratense	1
Osmunda	cinnamomea	10	Lonicera	xylosteum	1
Thelypteris	palustris	10	Mitchella	repens	1
Trientalis	borealis	8	Parthenocissus	quinquefolia	1
Ilex	verticillata	7	Prunus	serotina	1
Hydrocotyle	americana	6	Quercus	alba	1
Vaccinium	corymbosum	5	<i>Frangula</i>	<i>alnus</i>	1
Carex		4	Rubus	hispidus	1
Onoclea	sensibilis	4	Solidago	gigantea	1
<i>Rosa</i>	<i>multiflora</i>	4	Solidago	rugosa	1
Sympyotrichum	puniceum	3	Galium	aparine	1
Carex	stricta	3	Carex	pellita	1

High Site 1

genus	species	abundance	genus	species	abundance
Acer	rubrum	76	Solanum	dulcamara	2
Carex	crinita	68	Calystegia	sepium	1
Impatiens	capensis	41	Toxicodendron	vernix	1
Carex	stricta	34	Polygonum	arifolium	1

Cornus	amomum	24	Glyceria	canadensis	1
Galium	aparine	18	Carex	lurida	1
Onoclea	sensibilis	17	Carex		1
Calamagrostis	canadensis	17	Osmunda	regalis	1
Glyceria	striata	16	Viburnum	dentatum	1
<i>Frangula</i>	<i>alnus</i>	14	Oxalis	stricta	1
Symphyotrichum	puniceum	13	Thalictrum	pubescens	1
Mimulus	ringens	6	Symplocarpus	foetidus	1
Solidago	gigantea	6	Leersia	oryzoides	1
Spiraea	alba	5	Ludwigia	palustris	1
Sagittaria	latifolia	5	Arisaema	trifolium	1
Thelypteris	palustris	5	Boehmeria	cylindrica	1
Alnus	serrulata	4	Parthenocissus	quinquefolia	1
Eutrochium	maculatum	4	Quercus	rubra	1
Chelone	glabra	3	Toxicodendron	radicans	1
Solidago		2	Caltha	palustris	1

High Site 2

genus	species	abundance	genus	species	abundance
Acer	rubrum	68	Carex	lurida	1
Calamagrostis	canadensis	38	Carex		1
Carex	crinita	38	Cornus	alternifolia	1
Leersia	oryzoides	32	Cornus	canadensis	1
Bidens	cernua	17	Corylus	americana	1
Typha	latifolia	17	Eutrochium	maculatum	1
Lysimachia	terrestris	16	Glyceria	canadensis	1
Ilex	verticillata	15	Impatiens	capensis	1
Lycopus	uniflorus	13	Maianthemum	canadense	1
Epilobium	ciliatum	12	Pinus	strobos	1
Lyonia	ligustrina	11	Populus	tremuloides	1
Symphyotrichum	puniceum	7	<i>Frangula</i>	<i>alnus</i>	1
Galium	aparine	5	Solidago	uliginosa	1
Carex	intumescens	3	Symplocarpus	foetidus	1
Aronia	melanocarpa	1	Trientalis	borealis	1
Bidens	frondosa	1	Tsuga	canadensis	1

High Site 3

genus	species	abundance	genus	species	abundance
Acer	rubrum	94	Prunus	serotina	2
Rubus	hispidus	39	Kalmia	angustifolia	2
Coptis	trifolia	36	Onoclea	sensibilis	1
Osmunda	cinnamomea	27	Solidago	rugosa	1
Carpinus	caroliniana	26	Thalictrum	pubescens	1
Gaultheria	procumbens	23	Lycopodium	obscurum	1
Aralia	nudicaulis	20	Sympyotrichum	puniceum	1
Brachyelytrum	erectum	19	ocleomena	acuminata	1
Vaccinium	corymbosum	18	Crataegus		1
Ilex	verticillata	16	Mitchella	repens	1
Maianthemum	canadense	12	Tiarella	cordifolia	1
Carex	folliculata	12	Tsuga	canadensis	1
Quercus	rubra	9	Sparganium	americanum	1
Calamagrostis	canadensis	9	Frangula	alnus	1
Viburnum	lentago	7	Bidens	frondosa	1
Uvularia	sessilifolia	5	Carex	lurida	1
Glyceria	canadensis	5	Scirpus	cyperinus	1
Lyonia	ligustrina	4	Rubus	allegheniensis	1
Spiraea	alba	4	Osmunda	regalis	1
Thelypteris	palustris	3	Thelypteris	noveboracensis	1
Carex	stricta	3	Galium	aparine	1
Pinus	strobos	3	Lycopodium	clavatum	1
Quercus	alba	3			

High Site 4

genus	species	abundance	genus	species	abundance
Acer	rubrum	91	Sympyotrichum	puniceum	3
Ilex	verticillata	64	Cornus	canadensis	2
Osmunda	cinnamomea	49	Frangula	alnus	2
Vaccinium	corymbosum	26	Lycopus	uniflorus	2
Carex		22	Aralia	nudicaulis	1
Rubus	hispidus	17	Arisaema	trifolium	1
Carex	folliculata	15	Betula	alleghaniensis	1
Coptis	trifolia	14	Calamagrostis	canadensis	1
Onoclea	sensibilis	14	Carex		1
Pinus	strobos	14	Chelone	glabra	1
Maianthemum	canadense	12	Dryopteris	cristata	1
Amelanchier	canadensis	10	Glyceria	canadensis	1
Spiraea	alba	8	Impatiens	capensis	1

Lysimachia	terrestris	7	Quercus	rubra	1
Alnus	serrulata	6	Rhododendron	viscosum	1
Carex		6	Ribes	triste	1
Lyonia	ligustrina	6	Rosa	palustris	1
Thelypteris	palustris	5	Saxifraga	pensylvanica	1
Hamamelis	virginiana	4	Solidago	rugosa	1
Picea	rubens	4	Solidago	uliginosa	1
Toxicodendron	vernix	4	Toxicodendron	radicans	1
Glyceria	striata	3	Viburnum	lentago	1

High Site 5

genus	species	abundance	genus	species	abundance
Fraxinus	pennsylvanica	85	Thalictrum	pubescens	3
Toxicodendron	radicans	54	Carex	pellita	2
Dryopteris	carthusiana	41	Lindera	benzoin	2
Acer	rubrum	38	Acer	saccharum	1
Quercus	rubra	37	Arisaema	triphyllum	1
Ilex	verticillata	22	Carex	crinita	1
Rubus	hispidus	21	Carex	intumescens	1
Oclemena	acuminata	11	Castanea	dentata	1
Parthenocissus	quinquefolia	10	Chelone	glabra	1
Betula	alleghaniensis	8	Dryopteris	cristata	1
Onoclea	sensibilis	8	Hamamelis	virginiana	1
Viola		7	Maianthemum	canadense	1
Carya	ovata	6	Mitchella	repens	1
Glyceria	striata	6	Osmunda	cinnamomea	1
Aralia	nudicaulis	5	Pinus	strobos	1
Corylus	americana	5	Ribes	triste	1
Solidago	rugosa	4	Scutellaria		1
Crataegus		3	Symplocarpus	foetidus	1
Lysimachia	ciliata	3	Tsuga	canadensis	1
Rubus	idaeus	3	Vaccinium	corymbosum	1
Sambucus	canadensis	3	Vitis	labrusca	1

Appendix C:

IBI and CALU Assessment Results and Data for IEI Metric and Three Stressor/Resiliency Metrics

Index of Ecological Integrity Metric:

Chicopee Watershed: CALU Results

Expected Low IEI	Expected High IEI
Exceeds	Exceeds
Meets	Meets
Fails	Fails
Null	Null



All 40 of the sites sampled in Low IEI forested wetlands met expectations. Two of the forested wetlands sampled in high IEI wetlands met expectations and three of them failed to meet

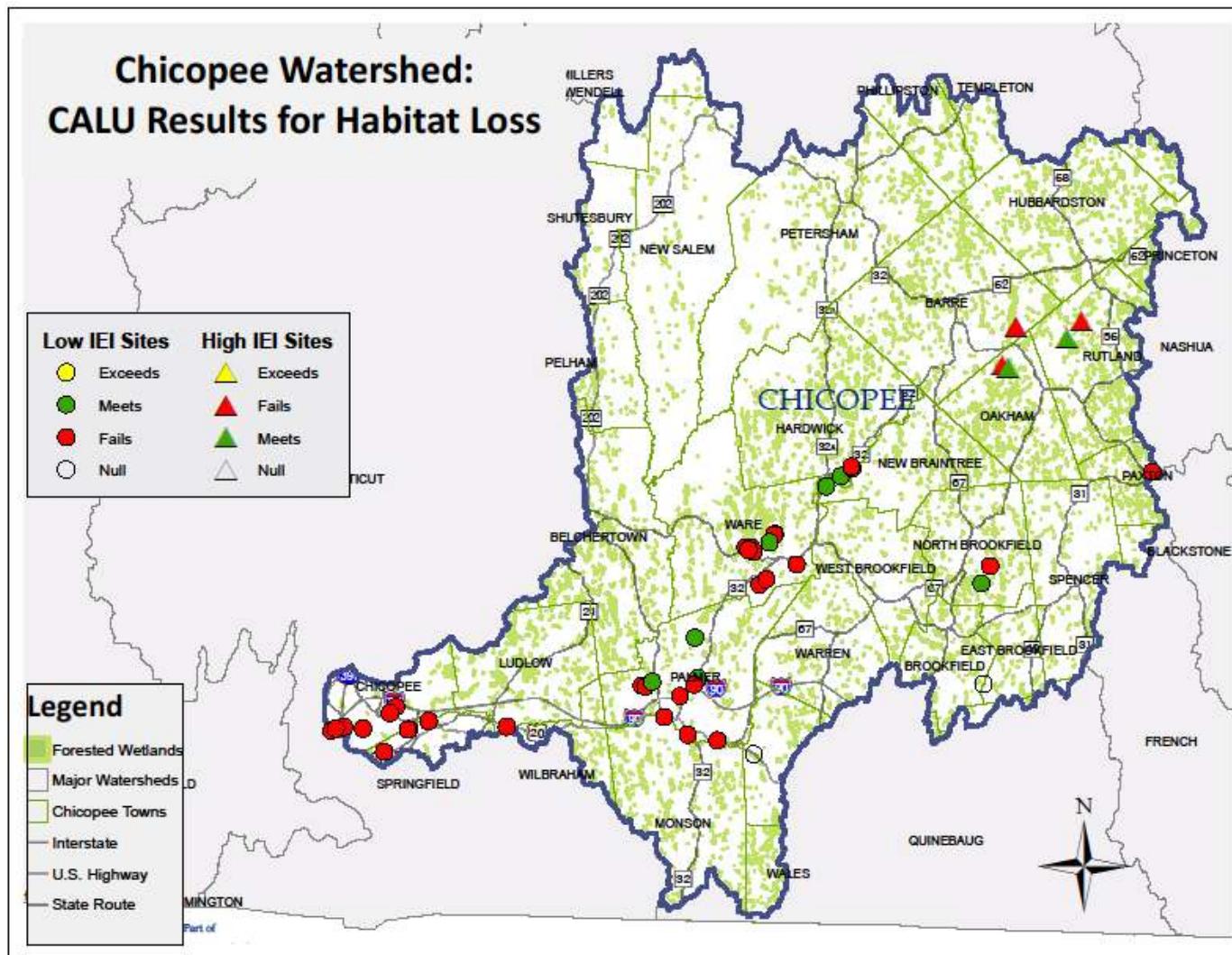
Site Number	TOWN	IBI Score (IEI Metric)	Target		Compliance Level	Percentile_IEI
			Score IEI	IEI		
Low 1	NEW BRAINTREE	0.337	0.25	meets expectations	64	
Low 2	WARE	0.129	0.36	meets expectations	18	
Low 3	WARE	0.010	0.24	meets expectations	18	
Low 4	SPRINGFIELD	0.040	0.15	meets expectations	32	
Low 5 ¹	BRIMFIELD	n/a	n/a	n/a	n/a	
Low 6	NORTH BROOKFIELD	0.218	0.20	meets expectations	52	
Low 7	WARE	0.109	0.14	meets expectations	45	
Low 8	WARE	0.060	0.29	meets expectations	18	
Low 9	PALMER	0.089	0.20	meets expectations	31	
Low 10	PALMER	0.030	0.25	meets expectations	19	
Low 11	WARE	0.218	0.12	meets expectations	64	
Low 12	WARE	0.109	0.22	meets expectations	31	
Low 13	PALMER	0.198	0.19	meets expectations	50	
Low 14	PAXTON	0.099	0.09	meets expectations	50	
Low 15	PALMER	0.010	0.11	meets expectations	35	
Low 16	PALMER	0.238	0.13	meets expectations	65	
Low 17	HARDWICK	0.129	0.21	meets expectations	36	
Low 18	HARDWICK	0.010	0.24	meets expectations	18	
Low 19	WARE	0.129	0.22	meets expectations	35	
Low 20	WARE	0.089	0.23	meets expectations	25	
Low 21	PALMER NORTH	0.060	0.18	meets expectations	29	
Low 22	BROOKFIELD	0.010	0.20	meets expectations	21	
Low 23	CHICOPEE	0.168	0.19	meets expectations	47	
Low 24	PALMER	0.228	0.10	meets	67	

¹ The IBI software failed to accept the field verified coordinates for this site, thus there is no data for it. The reason for this occurrence has not yet been determined.

					expectations	
					meets	
Low 25	CHICOPEE		0.129	0.24	expectations	31
					meets	
Low 26	HARDWICK		0.228	0.17	expectations	58
					meets	
Low 27	CHICOPEE		0.060	0.25	expectations	21
Low 28²	BROOKFIELD	n/a		n/a	n/a	
					meets	
Low 29	SPRINGFIELD		0.069	0.13	expectations	40
					meets	
Low 30	CHICOPEE		0.129	0.25	expectations	28
					meets	
Low 31	WARE		0.030	0.35	expectations	11
					meets	
Low 32	WARE		0.040	0.39	expectations	11
					meets	
Low 33	SPRINGFIELD		0.069	0.11	expectations	43
					meets	
Low 34	PALMER		0.159	0.25	expectations	35
					meets	
Low 35	PALMER		0.010	0.18	expectations	21
					meets	
Low 36	CHICOPEE		0.188	0.19	expectations	48
					meets	
Low 37	CHICOPEE		0.010	0.18	expectations	21
					meets	
Low 38	WILBRAHAM		0.069	0.10	expectations	45
					meets	
Low 39	CHICOPEE		0.139	0.04	expectations	64
					meets	
Low 40	PALMER		0.139	0.18	expectations	43
					Fails to meet	
High 1	Barre		0.277	0.880	expectations	1
					Fails to meet	
High 2	Rutland		0.386	0.790	expectations	7
					Meets	
High 3	Oakham		0.733	0.890	expectations	23
					Meets	
High 4	Rutland		0.693	0.810	expectations	30
					Fails to meet	
High 5	Oakham		0.287	0.950	expectations	1

² The IBI software failed to accept the field verified coordinates for this site, thus there is no data for it. The reason for this occurrence has not yet been determined.

Habitat Loss Metric



Habitat loss is a stressor metric. It measures the intensity of all forms of anthropogenic development in the neighborhood of and undeveloped area. Results of this metric analysis were wide ranging, and more site specific data collection would be necessary to make any conclusive findings

For the majority of low IEI sites, habitat loss in forested wetlands is impacting biological condition more than predicted by the CAPS model

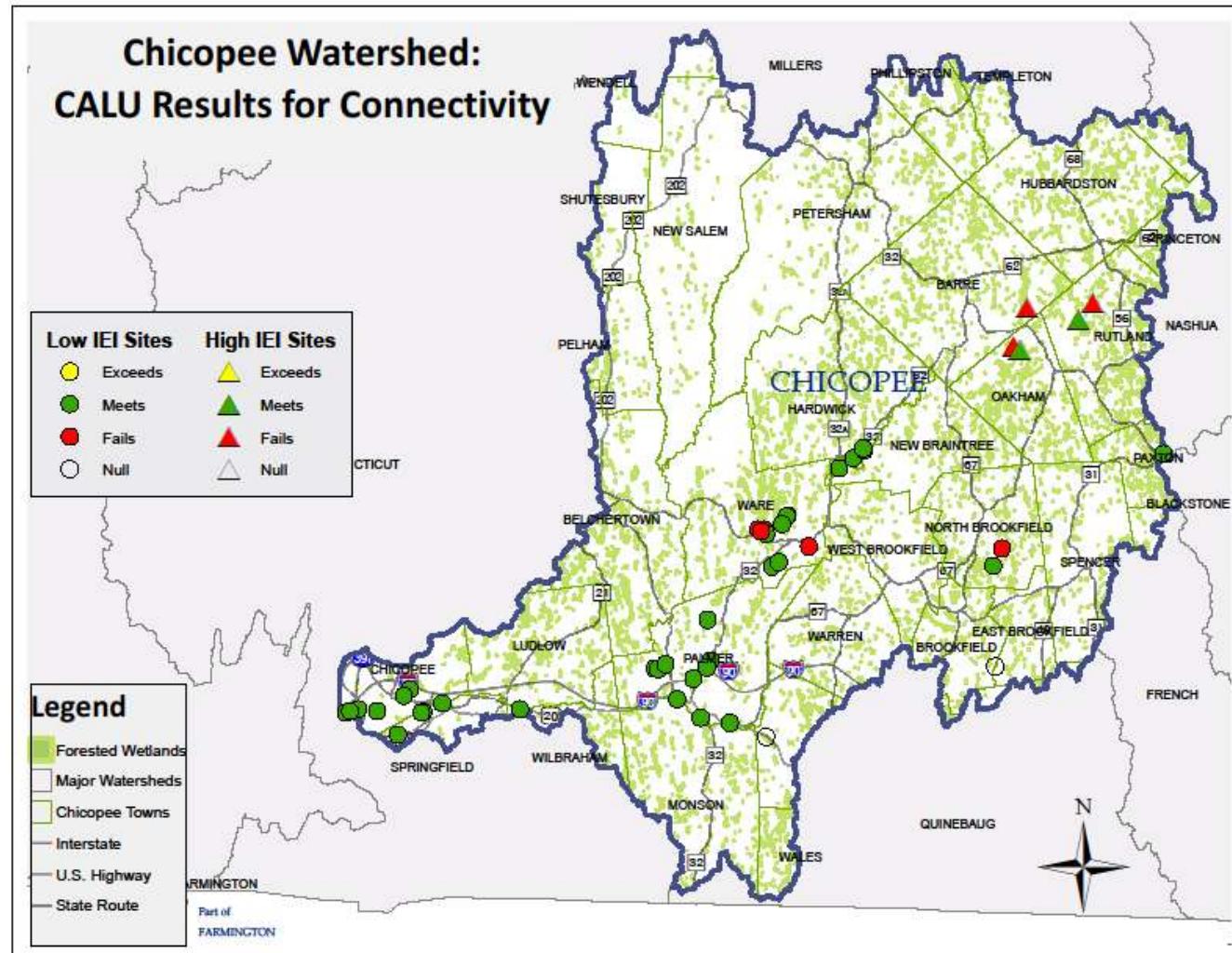
Site Number	TOWN	IBI Score Habitat Loss	Target Score Habitat Loss	Compliance Level Habitat Loss	Percentile Habitat Loss
Low 1	NEW BRAINTREE	0.307	0.114	expectations fails to meet	10
Low 2	WARE	0.445	0.082	expectations fails to meet	1
Low 3	WARE	0.553	0.183	expectations fails to meet	1
Low 4	SPRINGFIELD	0.568	0.067	expectations	0
Low 5 ³	BRIMFIELD NORTH	n/a	n/a	n/a	n/a
Low 6	BROOKFIELD	0.307	0.164	expectations meets	15
Low 7	WARE	0.484	0.336	expectations fails to meet	15
Low 8	WARE	0.384	0.178	expectations fails to meet	9
Low 9	PALMER	0.476	0.168	expectations fails to meet	3
Low 10	PALMER	0.530	0.168	expectations fails to meet	1
Low 11	WARE	0.599	0.196	expectations fails to meet	1
Low 12	WARE	0.514	0.203	expectations meets	3
Low 13	PALMER	0.430	0.260	expectations fails to meet	13
Low 14	PAXTON	0.453	0.196	expectations fails to meet	7
Low 15	PALMER	0.576	0.172	expectations meets	1
Low 16	PALMER	0.468	0.270	expectations fails to meet	10
Low 17	HARDWICK	0.468	0.249	expectations fails to meet	8
Low 18	HARDWICK	0.545	0.211	expectations fails to meet	2
Low 19	WARE	0.461	0.192	expectations fails to meet	6
Low 20	WARE	0.584	0.104	expectations fails to meet	0
Low 21	PALMER	0.530	0.166	expectations	1

³ The IBI software failed to accept the field verified coordinates for this site, thus there is no data for it. The reason for this occurrence has not yet been determined.

	NORTH				
Low 22	BROOKFIELD	0.522	0.235	fails to meet expectations fails to meet expectations	4
Low 23	CHICOPEE	0.476	0.155	fails to meet expectations	3
Low 24	PALMER	0.422	0.191	fails to meet expectations	8
Low 25	CHICOPEE	0.637	0.038	fails to meet expectations meets	0
Low 26	HARDWICK	0.399	0.230	fails to meet expectations	13
Low 27	CHICOPEE	0.538	0.094	fails to meet expectations	1
Low 28⁴	BROOKFIELD	n/a	n/a	n/a	n/a
Low 29	SPRINGFIELD	0.476	0.080	fails to meet expectations	1
Low 30	CHICOPEE	0.683	0.055	fails to meet expectations	0
Low 31	WARE	0.561	0.173	fails to meet expectations	1
Low 32	WARE	0.476	0.168	fails to meet expectations	3
Low 33	SPRINGFIELD	0.491	0.051	fails to meet expectations	1
Low 34	PALMER	0.468	0.048	fails to meet expectations	1
Low 35	PALMER	0.491	0.152	fails to meet expectations	2
Low 36	CHICOPEE	0.453	0.204	fails to meet expectations	7
Low 37	CHICOPEE	0.538	0.163	fails to meet expectations	1
Low 38	WILBRAHAM	0.522	0.143	fails to meet expectations	1
Low 39	CHICOPEE	0.637	0.176	meets expectations	0
Low 40	PALMER	0.415	0.219	fails to meet expectations	10
High 1	Barre	0.399	0.025	Fails to meet expectations	1
High 2	Rutland	0.284	0.079	Meets expectations	9
High 3	Oakham	0.138	0.016	Meets expectations	18
High 4	Rutland	0.161	0.034	Fails to meet expectations	18
High 5	Oakham	0.361	0.003	expectations	1

⁴ The IBI software failed to accept the field verified coordinates for this site, thus there is no data for it. The reason for this occurrence has not yet been determined.

Connectedness Metric:



The connectedness metric is a resiliency metric, in that it identifies the degree that a wetland can recover or adapt to perturbations. It measures the disruption of habitat connectivity caused by all forms of anthropogenic development between and surrounding the undeveloped landscape. The results of this metric analysis showed that most sites performed as expected given their landscape context. The few sites that failed to perform as expected would require further site specific analysis to determine the cause.

For the majority of low IEI sites, the loss of connectedness (fragmentation) of forested wetlands is impacting biological condition as predicted by the CAPS model

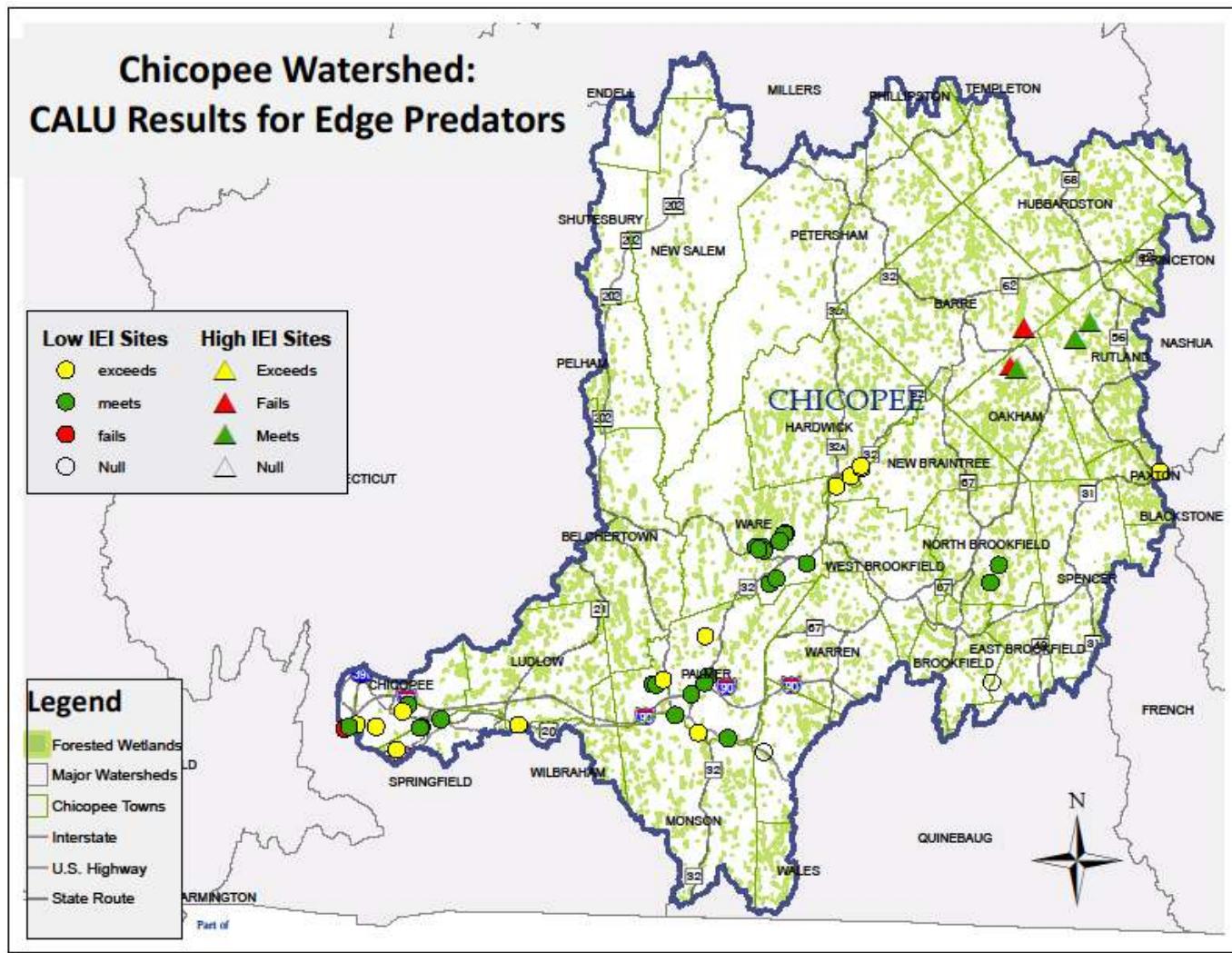
Site Number	Town			Compliance		Percentile Connectedness
		IBI Score Connectedness	Target Score Connectedness	Level Connectedness	meets expectations	
Low 1	NEW BRAINTREE	0.0731	0.127	meets expectations	meets expectations	22
Low 2	WARE	0.0334	0.113	meets expectations	fails to meet expectations	12
Low 3	WARE	0.0059	0.120	meets expectations	meets expectations	5
Low 4	SPRINGFIELD	0.0181	0.014	meets expectations	meets expectations	52
Low 5 ⁵	BRIMFIELD NORTH	n/a	n/a	n/a	meets expectations	n/a
Low 6	BROOKFIELD	0.0762	0.113	meets expectations	meets expectations	29
Low 7	WARE	0.0120	0.085	fails to meet expectations	fails to meet expectations	15
Low 8	WARE	0.0181	0.113	meets expectations	meets expectations	8
Low 9	PALMER	0.0059	0.038	meets expectations	meets expectations	33
Low 10	PALMER	0.0151	0.092	meets expectations	meets expectations	14
Low 11	WARE	0.0090	0.082	fails to meet expectations	fails to meet expectations	15
Low 12	WARE	0.0273	0.125	meets expectations	meets expectations	7
Low 13	PALMER	0.0670	0.070	meets expectations	meets expectations	50
Low 14	PAXTON	0.0273	0.065	meets expectations	meets expectations	28
Low 15	PALMER	0.0090	0.041	meets expectations	meets expectations	31
Low 16	PALMER	0.0365	0.029	meets expectations	meets expectations	55
Low 17	HARDWICK	0.0334	0.082	meets expectations	meets expectations	23
Low 18	HARDWICK	0.0181	0.085	meets expectations	meets expectations	18
Low 19	WARE	0.0365	0.125	meets expectations	meets expectations	10
Low 20	WARE	0.0090	0.069	meets expectations	meets expectations	20
Low 21	PALMER NORTH	0.0120	0.086	fails to meet expectations	fails to meet expectations	15
Low 22	BROOKFIELD	0.0090	0.119	meets expectations	meets expectations	6

⁵ The IBI software failed to accept the field verified coordinates for this site, thus there is no data for it. The reason for this occurrence has not yet been determined.

					meets	
Low 23	CHICOPEE	0.0517	0.024	expectations	61	
				meets		
Low 24	PALMER	0.0365	0.058	expectations	38	
				meets		
Low 25	CHICOPEE	0.0090	0.034	expectations	35	
				meets		
Low 26	HARDWICK	0.0579	0.088	expectations	34	
				meets		
Low 27	CHICOPEE	0.0059	0.022	expectations	43	
Low 28⁶	BROOKFIELD	n/a	n/a	n/a	n/a	
				meets		
Low 29	SPRINGFIELD	0.0151	0.024	expectations	46	
				meets		
Low 30	CHICOPEE	0.0059	0.031	expectations	36	
				fails to meet		
Low 31	WARE	0.0120	0.123	expectations	5	
				fails to meet		
Low 32	WARE	0.0212	0.179	expectations	2	
				meets		
Low 33	SPRINGFIELD	0.0151	0.025	expectations	46	
				meets		
Low 34	PALMER	0.0090	0.072	expectations	19	
				meets		
Low 35	PALMER	0.0059	0.036	expectations	34	
				meets		
Low 36	CHICOPEE	0.0334	0.029	expectations	52	
				meets		
Low 37	CHICOPEE	0.0059	0.023	expectations	42	
				meets		
Low 38	WILBRAHAM	0.0212	0.020	expectations	52	
				meets		
Low 39	CHICOPEE	0.0059	0.015	expectations	46	
				meets		
Low 40	PALMER	0.0334	0.090	expectations	21	
				fails to meet		
High 1	Barre	0.058	0.181	expectations	4	
				Fails to meet		
High 2	Rutland	0.104	0.219	expectations	5	
				Meets		
High 3	Oakham	0.220	0.218	expectations	52	
				Meets		
High 4	Rutland	0.195	0.222	expectations	35	
				Fails to meet		
High 5	Oakham	0.024	0.216	expectations	1	

⁶ The IBI software failed to accept the field verified coordinates for this site, thus there is no data for it. The reason for this occurrence has not yet been determined.

Edge Predator Metric



Edge predators are animals mid-level on the food chain such as raccoons and skunks that predate upon other, smaller animals and are also predated upon by larger predators. When edge predator populations expand, it creates stress on the population of smaller animals on the food chain such as reptiles and amphibians and can degrade biological condition. Edge Predators benefit from the activities of humans, such as the clearing of fields for agriculture or suburbanization which results in increased food sources (i.e. garbage and trash). The edge predator metric is based on land uses that provide increased habitat and food sources. The CALU results indicate that many sites exceed expectations – possibly indicating restoration of land uses (e.g. agricultural reverting back to forest, etc.) – further investigation would be needed to make any conclusive findings.

Site Number	Town	Target		Compliance Level	Percentile Edge
		IBI Score Edge Predators	Score Edge Predators		
Low 1	NEW BRAINTREE	0.197	0.342	expectations exceeds	91
Low 2	WARE	0.282	0.341	expectations meets	75
Low 3	WARE	0.315	0.338	expectations meets	63
Low 4	SPRINGFIELD	0.347	0.698	expectations exceeds	100
Low 5 ⁷	BRIMFIELD NORTH	n/a	n/a	n/a	n/a
Low 6	BROOKFIELD	0.207	0.332	expectations meets	88
Low 7	WARE	0.352	0.417	expectations meets	77
Low 8	WARE	0.254	0.377	expectations meets	88
Low 9	PALMER	0.376	0.511	expectations meets	89
Low 10	PALMER	0.333	0.366	expectations meets	65
Low 11	WARE	0.408	0.432	expectations fails to meet	63
Low 12	WARE	0.432	0.262	expectations exceeds	7
Low 13	PALMER	0.263	0.491	expectations exceeds	97
Low 14	PAXTON	0.315	0.492	expectations exceeds	94
Low 15	PALMER	0.362	0.534	expectations exceeds	94
Low 16	PALMER	0.324	0.588	expectations exceeds	98
Low 17	HARDWICK	0.324	0.514	expectations exceeds	96
Low 18	HARDWICK	0.352	0.509	expectations meets	92
Low 19	WARE	0.399	0.268	expectations meets	13
Low 20	WARE	0.366	0.426	expectations meets	75
Low 21	PALMER NORTH	0.315	0.336	expectations meets	62
Low 22	BROOKFIELD	0.362	0.405	expectations exceeds	71
Low 23	CHICOPEE	0.329	0.476	expectations	92

⁷ The IBI software failed to accept the field verified coordinates for this site, thus there is no data for it. The reason for this occurrence has not yet been determined.

					meets	
Low 24	PALMER	0.286	0.398	expectations		86
				fails to meet		
Low 25	CHICOPEE	0.437	0.254	expectations		6
				exceeds		
Low 26	HARDWICK	0.263	0.579	expectations		100
				meets		
Low 27	CHICOPEE	0.362	0.500	expectations		90
Low 28⁸	BROOKFIELD	n/a	n/a	n/a	meets	n/a
Low 29	SPRINGFIELD	0.357	0.477	expectations		87
				meets		
Low 30	CHICOPEE	0.343	0.367	expectations		63
				meets		
Low 31	WARE	0.394	0.349	expectations		31
				meets		
Low 32	WARE	0.343	0.347	expectations		54
				meets		
Low 33	SPRINGFIELD	0.380	0.449	expectations		79
				meets		
Low 34	PALMER	0.338	0.363	expectations		63
				meets		
Low 35	PALMER	0.470	0.471	expectations		50
				meets		
Low 36	CHICOPEE	0.343	0.366	expectations		63
				exceeds		
Low 37	CHICOPEE	0.408	0.600	expectations		96
				exceeds		
Low 38	WILBRAHAM	0.324	0.613	expectations		99
				exceeds		
Low 39	CHICOPEE	0.432	0.635	expectations		97
				meets		
Low 40	PALMER	0.324	0.339	expectations		60
				Fails to meet		
High 1	Barre	0.324	0.070	expectations		2
				Meets		
High 2	Rutland	0.178	0.088	expectations		23
				Meets		
High 3	Oakham	0.056	0.057	expectations		49
				Meets		
High 4	Rutland	0.070	0.198	expectations		88
				Fails to meet		
High 5	Oakham	0.225	0.053	expectations		7

⁸ The IBI software failed to accept the field verified coordinates for this site, thus there is no data for it. The reason for this occurrence has not yet been determined.