

SUPPLEMENTAL INFORMATION

**GRAZING FOR BOG TURTLE (*GLYPTEMYS MUHLENBERGII*) HABITAT
MANAGEMENT: CASE STUDY OF A NEW YORK FEN**

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APPENDIX A. Vegetation plot variables, descriptive statistics, and box plots of selected variables by year at New York bog turtle study site.

TABLE A1. Definitions of the composite vegetation variables and explanation of abbreviations for selected prominent individual species. Astsol (asters plus goldenrods) and Carjun (most sedges and rushes) were recorded as such because it was not feasible to separate species during plot sampling in July when many species were immature. Mean, median, minimum, and maximum percent cover values include data from 10 plots in all years sampled (3-5 years, n = 41), all in the West Paddock grazing treatment area. (Quantitative analyses in results section and graphs in figures A1-A2 were based on a subset of these, the seven plots with data from 2012-2015.) Because plots were located within different habitat types (rich fen, wet meadow, shrub swamp) within the core wetland, these percent cover values characterize the whole wetland rather than a single habitat. Total cover values in a plot can sum to > 100% because of vertical overlap of plant structures.

Variable	Definition	Mean	Median	Minimum	Maximum
Richness	Total number of taxa (as recorded separately in sampling)	21.2	21	9	37
xTallest	Mean of stretched lengths of the three longest plants in a plot (cm)	144.4	147	74	196
TOTShrub	Total shrub cover (sum of cover values for all shrub species)	3.5	1	0	27
TOTGrass	Total grass cover (sum of cover values for all grass species)	9.5	4	0	61
SEDGERUSH	Total sedge and rush cover (sum of all cover values for all <i>Carex</i> and <i>Juncus</i>)	24.4	12	0	105

(continued)

Table A1, cont.

Variable	Definition	Mean	Median	Minimum	Maximum
Carjun	Cover of <i>Carex</i> (other than <i>C. stricta</i>) and <i>Juncus</i> (other than <i>J. effusus</i> and <i>J. tenuis/dudleyi</i>)	20.8	4	0	95
TOTShort	Total cover of short species (sum of cover values for those species usually < 1 m tall)	38.7	25	1	115
TOTTall	Total cover of tall species (sum of cover values for those species usually > 1 m tall)	38.8	35	7	100
TOTNative	Total cover of native species (sum of cover values for unambiguously native species)	59.5	43	14	146
TOTIntrod	Total cover of introduced species (sum of cover values for unambiguously nonnative species)	9.9	6	1	60
TOTFen	Total fen species cover (sum of cover values for all species typical of fens)	25.7	10	0	124
TOTDist	Total disturbance species cover (sum of cover values for all species typical of disturbed soil in fens)	22.4	19	3	95
TOTNFW	Total non-fen woody cover (sum of cover values for all woody plants not typical of fens)	1.8	1	0	25
Astsol	Total cover of asters (<i>Aster</i> s.l. spp.) plus goldenrods (<i>Solidago</i> spp. other than <i>S. patula</i>)	10.7	5	0	85
Dasfru	<i>Dasiphora fruticosa</i> (shrubby cinquefoil) cover	2.2	0	0	30
Eupmac	<i>Eutrochium maculatum</i> (spotted Joe Pye weed) cover	2.3	1	1	10
Impcap	<i>Impatiens capensis</i> (spotted jewelweed) cover	1.5	1	0	15
Lycopus	<i>Lycopus</i> spp. (water-horehound) cover	1.0	1	0	4
Lytsal	<i>Lythrum salicaria</i> (purple loosestrife) cover	7.8	3	1	60
Solpat	<i>Solidago patula</i> (spreading goldenrod) cover	0.4	0	0	2
Typlat	<i>Typha latifolia</i> (Broad-leaved Cattail) cover	6.9	2	0	85

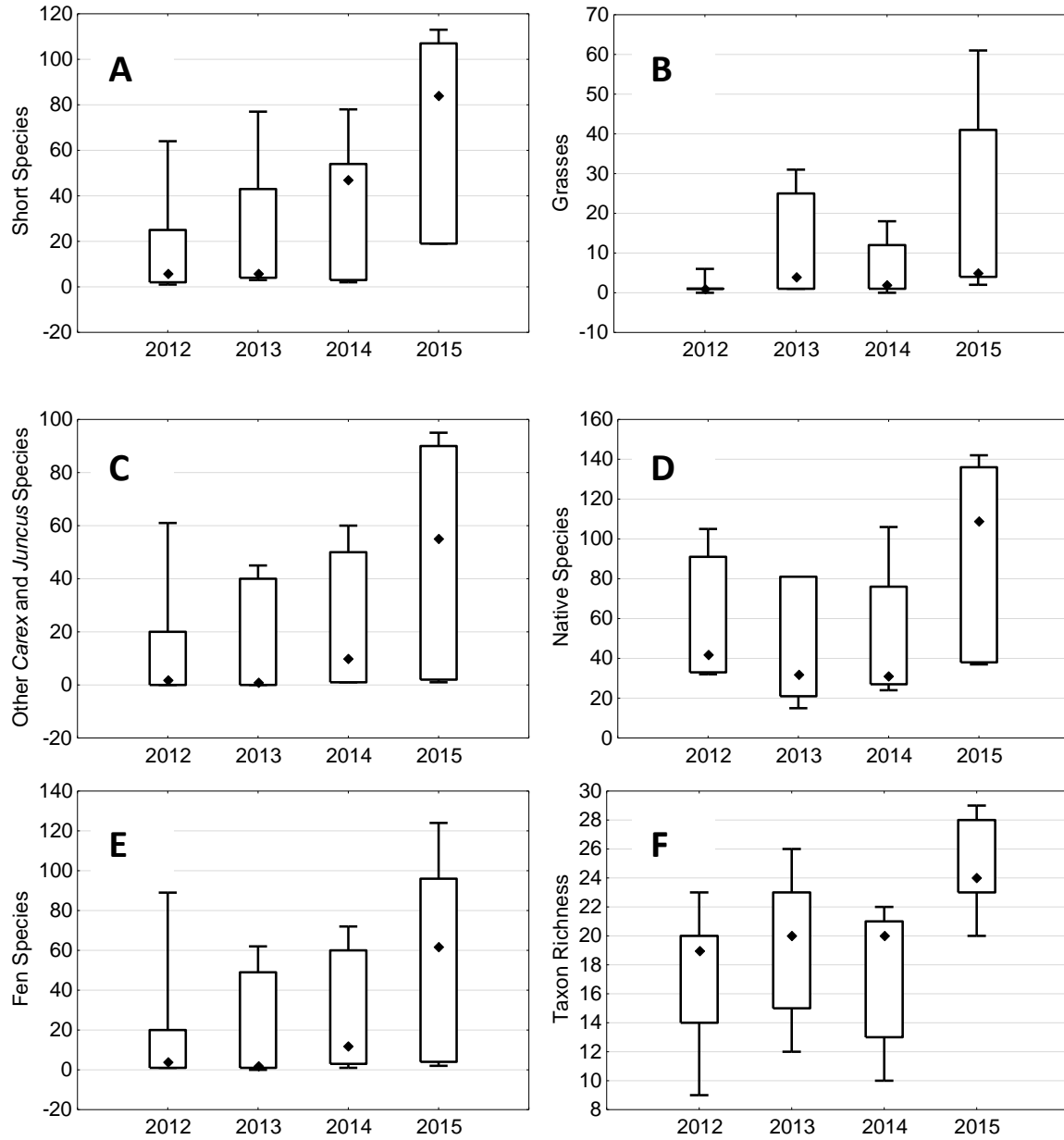


FIGURE A1. Median percent cover of groups of plant species (cover of each species added together, so totals may exceed 100%; A-E) and median taxon richness (number of species or genera recorded; F) in vegetation plots 1-7 (West Paddock) in 2012-2015. All graphs were prepared from raw data; all variables showed significant differences at $\alpha = 0.05$ (values reported in text; all $n = 7$, $df = 3$). Boxes represent 1st and 3rd quartile; whiskers depict total range.

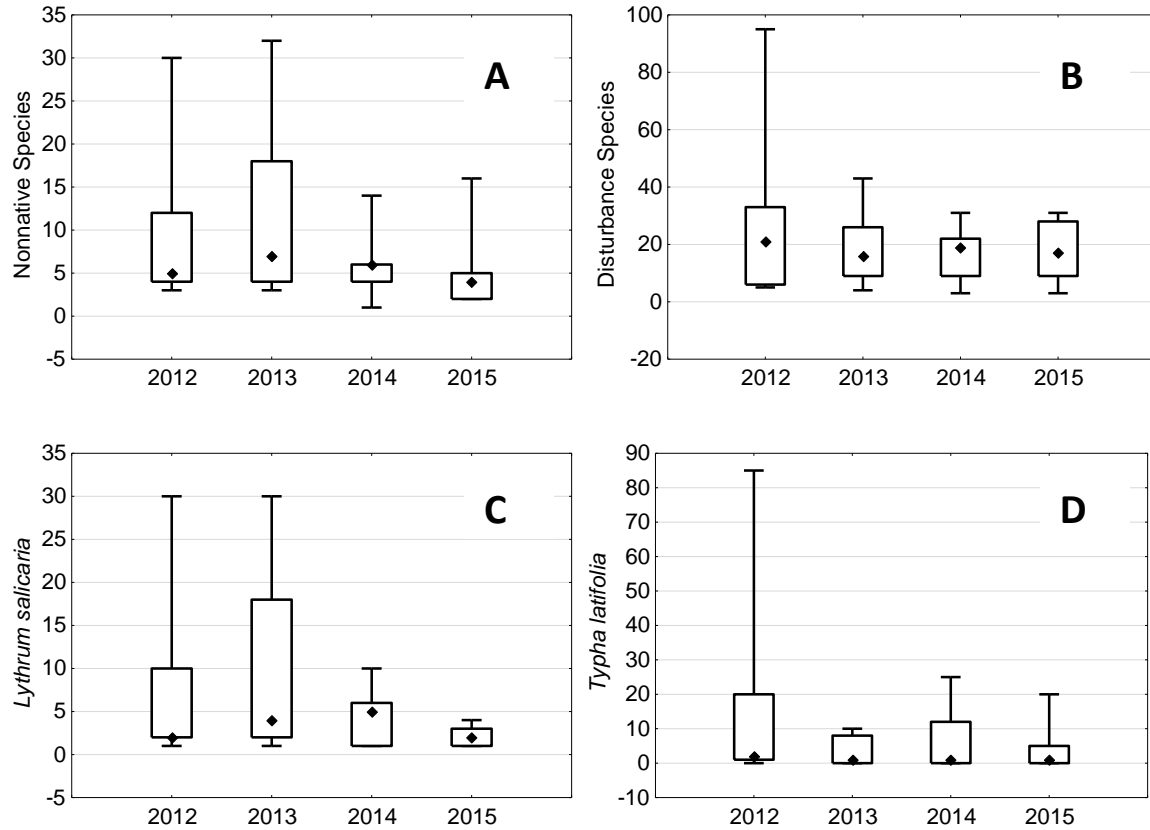


FIGURE A2. Median percent cover of groups of nonnative and disturbance-associated plant species (cover of each species added together, so totals may exceed 100%; A, B) and of two disturbance-associated species (*L. salicaria* is also nonnative; C, D) in vegetation plots 1-7 (West Paddock) in 2012-2015. A-C showed no significant differences at $\alpha = 0.05$; D was significantly different (values reported in text; all $n = 7$, $df = 3$). Boxes represent 1st and 3rd quartile; whiskers depict total range.

APPENDIX B. Vascular flora of the study site. This list is principally from the core habitat; species found outside are indicated with an asterisk (*). Nomenclature and native (n) or introduced (i) status follow USDA (2015); we have used regional common names where available. We subjectively ranked abundance at the site for each year of study: Rar = Rare, Unc = Uncommon, Com = Common, Abd = Abundant, LC = Locally common, LA = Locally abundant. Species marked with number sign (#) were represented by only one or two plants. Species difficult to distinguish in the field (e.g., goldenrods, *Carex* sedges) were not specifically ranked and question marks (?) are in the Rank columns.

There were apparent increases in Yellow Sedge (*Carex flava*), Field Horsetail (*Equisetum arvense*), and Spotted Joe Pye Weed (*Eutrochium maculatum*). There were apparent decreases in Red-osier Dogwood (*Cornus sericea*) and the tall nonnative forb Hairy Willow-herb (*Epilobium hirsutum*). Red-osier appeared to be browsed heavily by the cattle. The spike-rush *Eleocharis erythropoda* increased during the three years of grazing then decreased in the fourth, non-grazed, year. Our ranking of other plant species did not vary enough to indicate changes in abundance.

Scientific name	Common name	Native /Int	Rank 2012	Rank 2013	Rank 2014	Rank 2015
<i>Acer rubrum</i>	Red Maple	n	Rar	Rar	Rar	Rar
<i>Achillea millefolium</i>	Yarrow	?	Rar	Rar	Rar	Rar
<i>Acorus</i>	Sweetflag	?	LC	LC	LC	LC
<i>Aethusa cynapium</i>	Fool's Parsley	i	Rar?	Rar?	Rar	?
<i>Agrimonia gryposepala</i>	Tall Hairy Agrimony	n	Rar?	Rar	Rar	?
<i>Agrimonia striata</i>	Roadside Agrimony	n	?	?	Rar	?
<i>Agrostis stolonifera</i>	Creeping Bentgrass	i	?	?	?	?
<i>Alliaria petiolata</i>	Garlic-mustard	i	Rar	Rar	LC	Rar- LC?
<i>Amphicarpaea bracteata</i>	Hog-peanut	n	Rar?	Unc?	Rar/Unc	Unc
<i>Anemone virginiana</i>	Tall Thimbleweed	n	Rar	Rar	Rar	Rar
<i>Antennaria howellii</i> #?	Pussytoes	n	Rar	Rar	Rar	Rar
<i>Anthoxanthum odoratum</i>	Sweet Vernal Grass	i	?	Rar?	Unc	Rar
<i>Arctium lappa</i> *	Great Burdock	i	Rar	Rar	Rar	Rar
<i>Asclepias incarnata</i>	Swamp Milkweed	n	?	Rar	?	Rar?
<i>Asclepias syriaca</i>	Common Milkweed	n	Rar	Rar	Rar	Rar?
<i>Barbarea vulgaris</i>	Wintercress	i	Rar?	Rar	Rar	Rar?
<i>Berberis thunbergii</i>	Japanese Barberry	i	Rar	Rar	Rar	Rar?
<i>Bidens cernua</i>	Bur-marigold	n	Rar	Rar?	Rar?	Rar
<i>Bidens frondosa</i>	Beggar Ticks	n	Rar?	Unc	Unc?	Rar?
<i>Bromus ciliatus</i>	Brome Grass	n	Rar?	Rar?	Unc	Rar
<i>Bromus tectorum</i>	Cheat Grass	i	?	?	?	?

Scientific name	Common name	Native /Int	Rank 2012	Rank 2013	Rank 2014	Rank 2015
<i>Caltha palustris</i>	Marsh-marigold	n	Unc-Local	Rar?	Local	Rar?
<i>Calystegia sepium</i>	Bindweed	?	Rar	Rar	Rar	Rar?
<i>Cardamine pensylvanica</i>	Bittercress	n	Rar	Rar	Rar? Local	Rar?
<i>Carex annectens</i>	Yellow-fruited Sedge	n	?	?	?	?
<i>Carex blanda</i>	Woodland Sedge	n	?	?	?	?
<i>Carex digitalis var. digitalis</i>	Slender Woodland Sedge	n	?	?	?	?
<i>Carex flava</i>	Yellow Sedge	n	Rar?	Rar-Unc?	Com	LC?
<i>Carex granularis</i>	Limestone Meadow Sedge	n	Rar	?	?	?
<i>Carex hystericina</i>	Porcupine Sedge	n	Com?	?	?	Com-Abd
<i>Carex ?laevivaginata</i>	Smooth-sheathed Sedge	n	?	?	?	?
<i>Carex lasiocarpa</i>	Woolly-fruited Sedge	n	Unc?	?	?	?
<i>Carex leptalea var. leptalea</i>	Bristly-stalked Sedge	n	Unc?	?	?	?
<i>Carex lurida</i>	Shallow Sedge	n	Com?	?	Com	?
<i>Carex molesta</i>	Troublesome Sedge	n	?	?	?	?
<i>Carex pellita (C. lanuginosa)</i>	Woolly Sedge	n	Unc	?	?	?
<i>Carex scoparia</i>	Broom sedge	n	?	?	?	?
<i>Carex ?sterilis</i>	Dioecious Sedge	n	?	?	?	?
<i>Carex sterilis or C. interior</i>	Sedge	n				?
<i>Carex stipata</i>	Awl-fruited Sedge	n	Rar/Unc	Rar?	?	?
<i>Carex stricta</i>	Tussock Sedge	n	Com	Com	Com	Com
<i>Carex tetanica</i>	Rigid Sedge	n	LC	?	?	?
<i>Carex tribuloides</i>	Blunt Broom Sedge	n	?	?	?	?
<i>Carex vulpinoidea</i>	Fox Sedge	n	Com?	?	?	?
<i>Cerastium fontanum</i>	Mouse-ear Chickweed	i	?	?	Rar?	Rar
<i>Chelone glabra</i>	Turtlehead	n	Unc	Rar/Unc	Rar	Rar-Unc
<i>Cicuta bulbifera</i>	Bulblet Water-hemlock	n	?	Rar	Rar	Rar

Scientific name	Common name	Native /Int	Rank 2012	Rank 2013	Rank 2014	Rank 2015
<i>Cicuta maculata</i>	Water-hemlock	n	Rar	Rar	Rar	Rar
<i>Cirsium arvense</i>	Canada Thistle	n	?	Rar	Rar	Rar
<i>Clematis virginiana</i>	Virgin's Bower	n	Rar	Rar	Rar	Rar
<i>Conyza canadensis</i>	Horseweed	n	Rar	Rar	Rar	Rar
<i>Cornus amomum</i>	Silky Dogwood	n	Rar	Rar?	Unc	Unc?
<i>Cornus racemosa</i>	Gray Dogwood	n	Rar	Rar?	Unc	Rar?
<i>Cornus sericea</i>	Red-osier Dogwood	n	Abd	Abd	Abd	Unc-LC
<i>Cuscuta gronovii</i>	Dodder	n	Unc	Unc	Unc	Unc
<i>Dasiphora fruticosa</i>	Shrubby Cinquefoil	n	Abd	Abd	Abd	Abd
<i>Daucus carota</i>	Queen Anne's Lace	i	Rar	Rar	Rar	Rar?
<i>Dichanthelium acuminatum</i> ssp. <i>fasciculatum</i>	Tapered Rosette Grass	n	?	?	?	?
<i>Drosera rotundifolia</i> #	Round-leaved Sundew	n	Rar	Rar	Rar	?
<i>Dryopteris cristata</i>	Crested Fern	n	Rar	Rar	Rar?	Rar
<i>Elaeagnus umbellata</i>	Autumn-olive	i	Rar	Rar	Rar	Rar
<i>Eleocharis erythropoda</i>	Spike-rush	n	Unc/Com	Com?	Abd	Unc?
<i>Epilobium coloratum</i>	Purple-leaved Willow-herb	n	Rar?	Rar?	Rar	Unc
<i>Epilobium hirsutum</i>	Great Hairy Willow-herb	i	Com	Com	Unc	Unc-LC
<i>Epilobium leptophyllum</i>	Bog Willow-herb	n	?	Rar	Rar	Rar?
<i>Equisetum arvense</i>	Field Horsetail	n	Rar	Unc	Com?	?
<i>Equisetum fluviatile</i>	River Horsetail	n	Abd	Abd/Com	Abd	Com?
<i>Erechtites hieraciifolia</i>	Pilewort	n	?	Rar	Rar	Rar
<i>Erigeron philadelphicus</i>	Philadelphia Fleabane	n	?	?	?	Rar?
<i>Erigeron pulchellus</i>	Robin's Plantain	n	?	?	?	?
<i>Erigeron strigosus</i>	Prairie Fleabane	n	Unc?	Rar?	Rar?	?
<i>Eriophorum viridicarinum</i>	Thin-leaved Cotton-grass	n	Rar	Rar	Rar	Rar?
<i>Euonymus alata</i>	Winged Euonymus	i	Rar	Rar	Rar	Rar
<i>Eupatorium perfoliatum</i>	White Boneset	n	Rar	Unc	Unc	Unc
<i>Euthamia graminifolia</i>	Flat-topped Goldenrod	n	Rar?	Rar?	Rar	Rar?
<i>Eutrochium (Eupatorium) maculatum</i>	Spotted Joe-Pye- weed	n	Unc	Unc	Unc/LC	Com- LA
<i>Fragaria virginiana</i>	Wild Strawberry	n	Rar	Rar	Rar	Rar

Scientific name	Common name	Native /Int	Rank 2012	Rank 2013	Rank 2014	Rank 2015
<i>Frangula alnus</i> (<i>Rhamnus frangula</i>)	Smooth Buckthorn	i	Unc	Unc	Rar	Rar
<i>Galium aparine</i>	Cleavers	i	?	?	Rar	?
<i>Galium boreale</i>	Northern Bedstraw	n	Rar	Rar	Rar	?
<i>Galium mollugo</i>	Stockport Weed	i	Rar?	Rar/Local	Rar	?
<i>Galium tinctorium</i> var. <i>tinctorium</i>	Stiff Marsh Bedstraw	n	?	?	?	?
<i>Geranium maculatum</i>	Wild Geranium	n	Not found	Not found	Not found	Rar
<i>Geum canadense</i>	White Avens	n	Rar	Rar	Rar	Rar?
<i>Glechoma hederacea</i>	Ground-ivy	i	?	Rar	Rar	Rar?
<i>Glyceria canadensis</i>	Rattlesnake Mannagrass	n	Rar?	?	?	(4)
<i>Glyceria striata</i>	Fowl Mannagrass	n	Rar?	?	?	(4)
<i>Hesperis matronalis</i> *	Dame's Rocket	i	Rar?	Rar?	Rar?	
<i>Houstonia caerulea</i>	Bluets	n	?	?	Rar	Rar?
<i>Hydrocotyle americana</i>	Marsh Pennywort	n	Com?	Com/Unc	Com	Com?
<i>Impatiens capensis</i>	Orange Jewelweed	n	Abd?	Unc/Com	Com?	Com
<i>Iris pseudacorus</i>	Yellow Iris	i	Rar?	Rar?	Rar?	Rar
<i>Iris versicolor</i>	Blue Flag	n	LC	LC	LC/LA	Rar?
<i>Juncus acuminatus</i>	Taper-tipped Rush	n	?	?	?	?
<i>Juncus articulatus</i>	Joint-leaved Rush	n	?	?	Rar?	?
<i>Juncus brachycephalus</i>	Small-headed Rush	n	?	?	?	?
<i>Juncus ?brevicaudatus</i>	Narrow-panicked Rush	n	?	?	?	?
<i>Juncus dudleyi</i>	Path Rush	n	Rar?	Rar?	Rar?	?
<i>Juncus effusus</i>	Soft Rush	n	Rar	Rar	Rar	Rar
<i>Juncus nodosus</i>	Knotted Rush	n	Unc?	?	Unc?	?
<i>Juniperus communis</i> #	Common Juniper	n	Rar	Rar	Rar	Rar
<i>Juniperus virginiana</i>	Eastern Red Cedar	n	Rar	Rar	Rar	Rar
<i>Lapsana communis</i>	Nipplewort	i	?	?	Rar	?
<i>Leersia oryzoides</i>	Rice Cutgrass	n	Unc?	Unc? Local	Unc?	Unc-LC
<i>Leonurus cardiaca</i>	Motherwort	i	Rar	Rar	Rar	?
<i>Ligustrum</i>	Privet	i	Not found	Not found	Not found	Rar
<i>Liparis loiselii</i> #	Bog Twayblade	n	Rar	?	?	?
<i>Lobelia kalmii</i>	Kalm's Lobelia	n	Rar	Rar	Rar?	Rar
<i>Lobelia siphilitica</i>	Great Blue Lobelia	n	Unc/Local	Unc/Local	Rar	?
<i>Lonicera × bella</i>	Bell's Honeysuckle	i	Unc	Unc	Unc	Unc?

Scientific name	Common name	Native /Int	Rank 2012	Rank 2013	Rank 2014	Rank 2015
<i>Lycopus americanus</i>	American Water-horehound	n	?	?	? (1)	(1)
<i>Lycopus uniflorus</i>	Northern Bugleweed	n	?	?	? (1)	(1)
<i>Lysimachia ciliata</i>	Fringed Loosestrife	n	Rar	Rar?	Rar?	Rar?
<i>Lysimachia nummularia</i>	Moneywort	i	Rar?	Unc/Rare	Unc/LC	Rar?
<i>Lysimachia terrestris</i>	Swamp Candles	n	Rar	Rar	Rar	Rar?
<i>Lysimachia thyrsoflora</i> #	Tufted Loosestrife	n	Rar	Rar	Rar?	Rar?
<i>Lythrum salicaria</i>	Purple Loosestrife	i	Abd	Com/Abd	Abd	Abd
<i>Malus pumila</i> #	Apple	i	Rar	Rar	Rar	Rar
<i>Medicago lupulina</i>	Black Medic	i	Rar	Rar	Rar	Rar?
<i>Mentha arvensis</i>	Field Mint	n	Unc?	Unc?	Unc?	Unc-LC?
<i>Mentha canadensis</i>	Canada Mint	m	?	?	?	?
<i>Mentha</i> (\times <i>piperita</i> ?)	Peppermint	n	Rar	Rar?	Rar?	Rar-LC?
<i>Mentha spicata</i>	Spearmint	i	Rar?	Rar?	?	Unc?
<i>Monarda fistulosa</i> var. <i>mollis</i>	Horse-mint	n	Rar?	Rar/Unc	Rar?	Rar
<i>Muhlenbergia glomerata</i>	Spiked-muhly Grass	n	?	?	Unc?	Rar?
<i>Myosotis</i>	Forget-me-not		Rar	Rar?	?	?
<i>Onoclea sensibilis</i>	Sensitive Fern	n	Rar?	Unc?	Rar?	Rar-Unc
<i>Oxalis stricta</i> or <i>O. dillenii</i>	Wood-sorrel	n	?	Rar	Rar	Rar?
<i>Packera aurea</i> (<i>Senecio aureus</i>)	Golden Ragwort	n	LC?	Unc?	Com?	?
<i>Packera obovata</i> (<i>Senecio obovatus</i>)*	Round-leaved Ragwort	n	Rar/Unc	Rar/Unc	Rar	Rar?
<i>Parnassia glauca</i>	Grass-of-Parnassus	n	Rar	Unc	Rar?	Rar
<i>Parthenocissus</i>	Virginia Creeper	n	Not found	Not found	Not found	Rar
<i>Penstemon digitalis</i>	Foxglove Beardtongue	n	Rar	Rar	Rar	Rar?
<i>Phalaris arundinacea</i>	Reed Canary Grass	?	Rar	Unc?	Unc?	Unc
<i>Pilea pumila</i>	Clearweed	n	?	?	? (2)	(2)
<i>Pilea fontana</i>	Lesser Clearweed	n	?	?	? (2)	(2)
<i>Plantago lanceolata</i>	English Plantain	i	Rar	Rar	Rar	?
<i>Plantago major</i>	Common Plantain	i	Rar	Rar	Rar	?
<i>Poa compressa</i>	Canada Bluegrass	i	?	Unc?	LC?	Unc?

Scientific name	Common name	Native /Int	Rank 2012	Rank 2013	Rank 2014	Rank 2015
<i>Polygonum cespitosum</i> <i>var. longisetum</i> (<i>Persicaria longiseta</i>)	Oriental Lady's Thumb	i	?	?	?	Rar?
<i>Polygonum hydropiper</i> (<i>Persicaria hydropiper</i>)	Water-pepper	i	Rar?	Rar?	?	Rar
<i>Polygonum persicaria</i> (<i>Persicaria maculosa</i>)	Lady's-thumb Smartweed	i	Rar?	Rar?	?	?
<i>Polygonum ?punctatum</i>	Dotted Smartweed	n	?	Rar?	Rar?	?
<i>Polygonum sagittatum</i>	Arrow-leaved Tearthumb	n	Rar	Rar	Rar	Rar?
<i>Potentilla simplex</i>	Common Cinquefoil	n	?	?	?	?
<i>Prunella vulgaris</i>	Selfheal	n	Unc	Rar?	Rar	Rar
<i>Pycnanthemum tenuifolium</i>	Narrow-leaved Mountain-mint	n	?	?	Rar	Rar?
<i>Pycnanthemum virginianum</i>	Virginia Mountain- mint	n	Rar	Rar	Rar	Rar?
<i>Ranunculus acris</i>	Tall Buttercup	?	Unc/Rar	Rar?	Rar	?
<i>Rhamnus cathartica</i>	Common Buckthorn	i	Not found	Rar	Rar	Rar
<i>Ribes hirtellum</i>	Swamp Gooseberry	n	Unc	Rar/Unc	Unc	Unc
<i>Rosa multiflora</i>	Multiflora Rose	i	Unc	Unc	Unc	Rar
<i>Rubus ?flagellaris</i>	Dewberry	n	Rar	?	?	Rar?
<i>Rubus occidentalis</i> #	Black Raspberry	n	Not found	Not found	Not found	Rar
<i>Rubus ?vermontanus</i>	Vermont Blackberry	n	?	?	Rar	?
<i>Rudbeckia hirta</i>	Black-eyed Susan	n	Rar	Rar	Rar	Rar?
<i>Rumex crispus</i>	Curly Dock	i	Rar?	Rar	Rar?	Rar
<i>Rumex obtusifolius</i>	Bitter Dock	i	?	Rar?	Rar?	?
<i>Sagittaria latifolia</i>	Broad-leaved Arrowhead	n	?	?	?	Rar
<i>Salix alba</i>	White Willow	i	Rar?	Rar	Rar	Rar?
<i>Salix discolor</i>	Pussy Willow	n	Rar?	Rar?	Rar	Rar?
<i>Salix eriocephala</i>	Missouri River Willow	n	Rar?	Rar?	Rar	Rar?
<i>Salix petiolaris</i>	Meadow Willow	n	?	Rar?	Rar?	Rar?
<i>Schoenoplectus</i> (<i>Scirpus</i>) <i>tabernaemontani</i> #	Soft-stemmed Bulrush	n	Rar	Rar	Rar?	Rar
<i>Scirpus atrovirens</i>	Dark Green Bulrush	n	Rar?	Rar/Unc	Rar/Unc	Unc

Scientific name	Common name	Native /Int	Rank 2012	Rank 2013	Rank 2014	Rank 2015
<i>Scirpus pendulus</i>	Drooping Bulrush	n	Rar	Rar	Rar	?
<i>Scutellaria galericulata</i>	Marsh Skullcap	n	Rar	Rar	Rar	Rar
<i>Scutellaria lateriflora</i>	Mad Dog Skullcap	n	?	Rar?	?	?
<i>Selaginella eclipes</i>	Hidden Spikemoss	n	Rar/Unc	Unc	Unc	Unc
<i>Sisyrinchium montanum</i> <i>var. montanum</i>	Strict Blue-eyed-grass	n	Rar	Rar?	Rar	?
<i>Solanum dulcamara</i>	Bittersweet Nightshade	i	Rar?	Unc	Rar?	Rar?
<i>Solanum ptycanthum</i>	Black Nightshade	n	Rar	Rar	Rar	?
<i>Solidago altissima</i>	Late Goldenrod	n	?	?	?	?
<i>Solidago canadensis</i>	Canada Goldenrod	n	?	?	?	?
<i>Solidago gigantea</i>	Giant Goldenrod	n	?	Rar?	?	Unc?
<i>Solidago patula</i>	Spreading Goldenrod	n	Com?	Unc	Unc	Unc
<i>Solidago rugosa</i>	Rough-stemmed Goldenrod	n	?	?	?	?
<i>Solidago uliginosa</i>	Bog Goldenrod	n	?	?	?	Unc- Com?
<i>Sphenopholis obtusata</i>	Prairie Wedgescale Grass	n	?	?	?	?
<i>Spiraea alba</i>	Meadowsweet	n	?	?	Rar	Rar?
<i>Spiranthes ?lacera</i>	Lady's Tresses	n	?	?	?	?
<i>Spiranthes lucida</i>	Lady's Tresses	n	?	Rar	Rar	?
<i>Stachys palustris</i>	Marsh Woundwort	n	?	Rar	Rar	?
<i>Symphyotrichum lanceolatum</i> <i>var. lanceolatum</i>	White-panicked Aster	n	?	?	?	?
<i>Symphyotrichum lateriflorum</i>	Calico Aster	n	?	?	Unc?	?
<i>Symphyotrichum novae-angliae</i>	New England Aster	n	?	?	Unc?	Rar
<i>Symphyotrichum novi-belgii</i>	New York Aster	n	?	?	?	?
<i>Symphyotrichum puniceum</i>	Purple-stemmed Aster	n	?	?	?	LC
<i>Symplocarpus foetidus</i>	Skunk-cabbage	n	Com?	Unc/Com	Com	Com?
<i>Thalictrum revolutum</i>	Waxy-leaved Meadow-rue	n	Rar?	Rar?	Rar	?
<i>Thelypteris palustris</i>	Marsh Fern	n	Unc/Com	Unc/Com	?	Unc-LC
<i>Thuja occidentalis</i>	Northern White Cedar	n	LC	Unc	Unc/LC	LC
<i>Toxicodendron radicans</i>	Poison-ivy	n	Not found	Not found	Not found	Rar

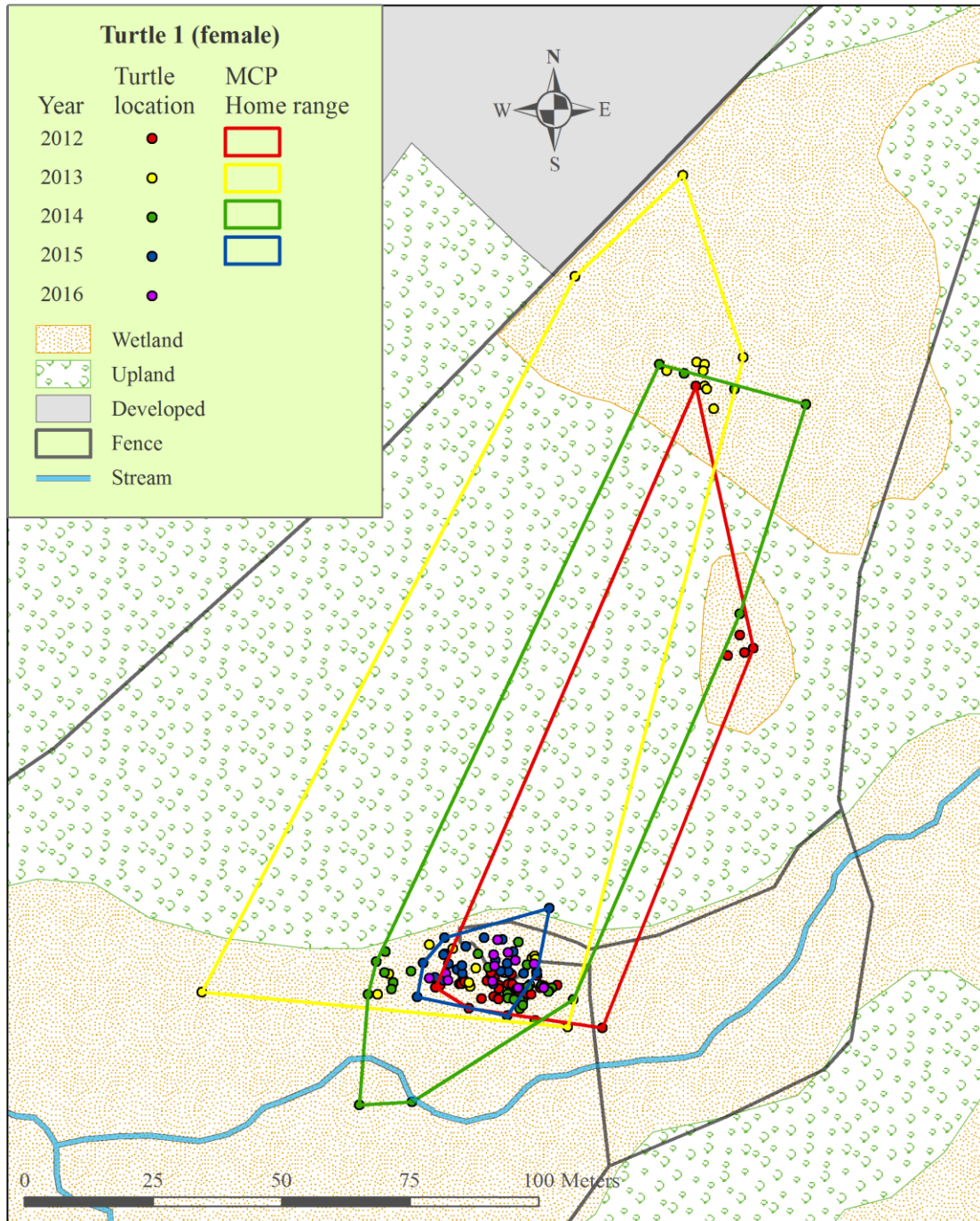
Scientific name	Common name	Native /Int	Rank 2012	Rank 2013	Rank 2014	Rank 2015
<i>Toxicodendron vernix</i> #	Poison Sumac	n	?	?	Rar	Rar?
<i>Trifolium pratense</i>	Red Clover	i	Rar	?	Rar	?
<i>Typha latifolia</i>	Broad-leaved Cattail	n	Abd	Abd	Abd	Abd
<i>Ulmus americana</i>	American Elm	n	Rar	Rar	Rar	Rar
<i>Urtica dioica</i>	Stinging Nettle	?	Rar	Rar	Rar	Rar
<i>Verbena hastata</i>	Blue Vervain	n	Rar?	Rar?	Rar	Rar- Unc
<i>Verbena urticifolia</i>	White Vervain	n	Not found	Not found	Not found	Rar
<i>Veronica anagallis- aquatica</i> (<i>V. catenata</i>)	Water Speedwell	n	Rar	Rar	Unc/Rar	Rar- Unc
<i>Veronica peregrina</i>	Neckweed	n	?	Rar	Rar?	?
<i>Viburnum lentago</i>	Nannyberry	n	Rar	Rar?	Rar	Rar?
<i>Viburnum dentatum</i> var. <i>lucidum</i>	Northern Arrowwood	n	Rar	Rar?	Rar	Rar?
<i>Viola ?affinis</i>	Sand Violet	n	(3)	?	(3)	(3)
<i>Viola cucullata</i> or <i>V. × bisselii</i>	Marsh Blue Violet	n	(3)	?	(3)	(3)
<i>Viola cucullata</i>	Marsh Blue Violet	n	(3)	?	(3)	(3)
<i>Viola nephrophylla</i>	Northern Bog Violet	n	(3)	?	(3)	(3)
<i>Vitis riparia</i>	Riverbank Grape	n	Rar?	Rar?	Rar?	Rar?
<i>Zizia aptera</i>	Meadow Zizia	n	Not found	Not found	Not found	Rar

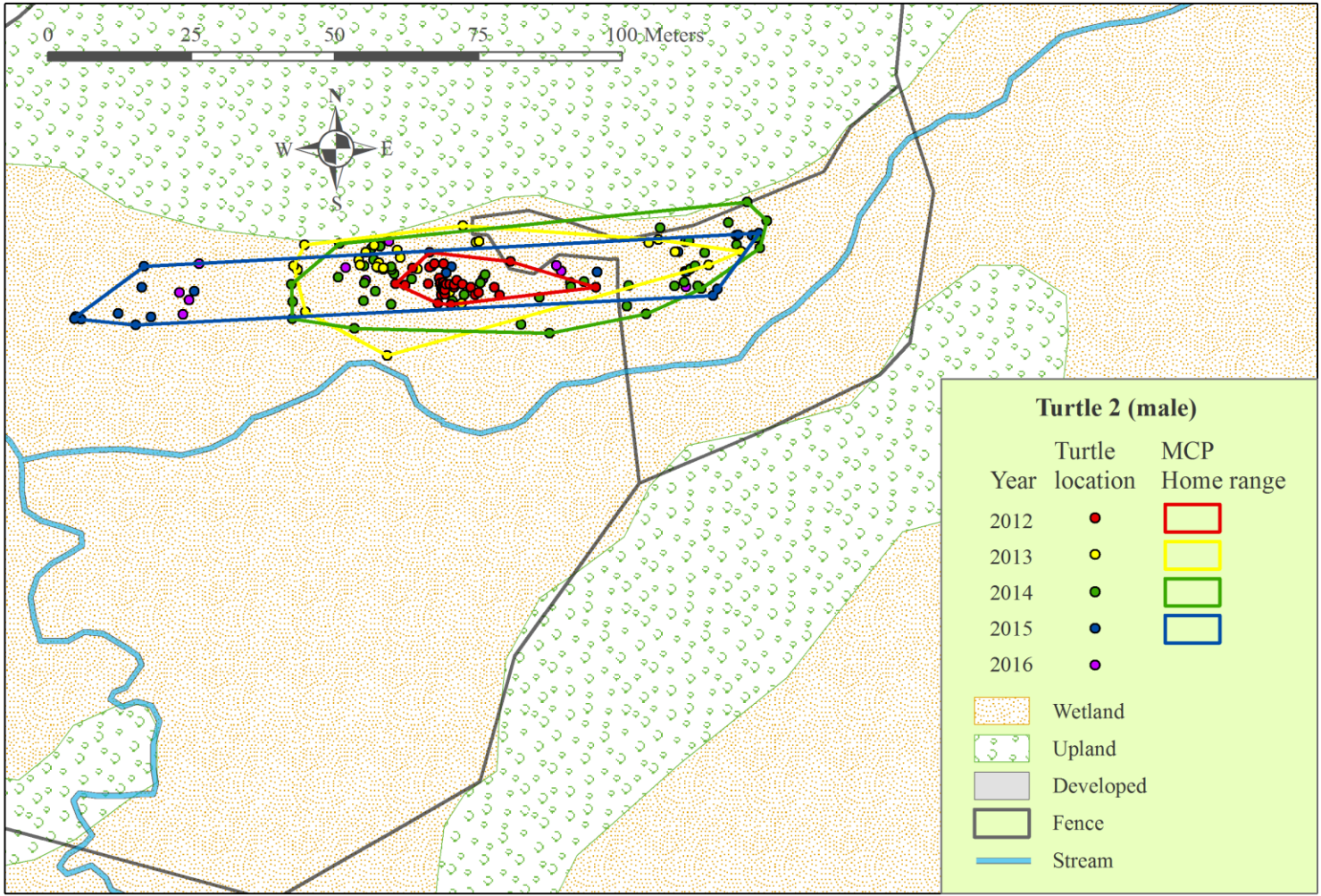
- (1) *Lycopus* spp. were probably collectively Unc-Com (increasing during study)
- (2) *Pilea* spp. were probably collectively Unc but Com-Abd in 2015
- (3) The blue violets were collectively Unc or Rar
- (4) *Glyceria* spp. collectively Unc-Rar

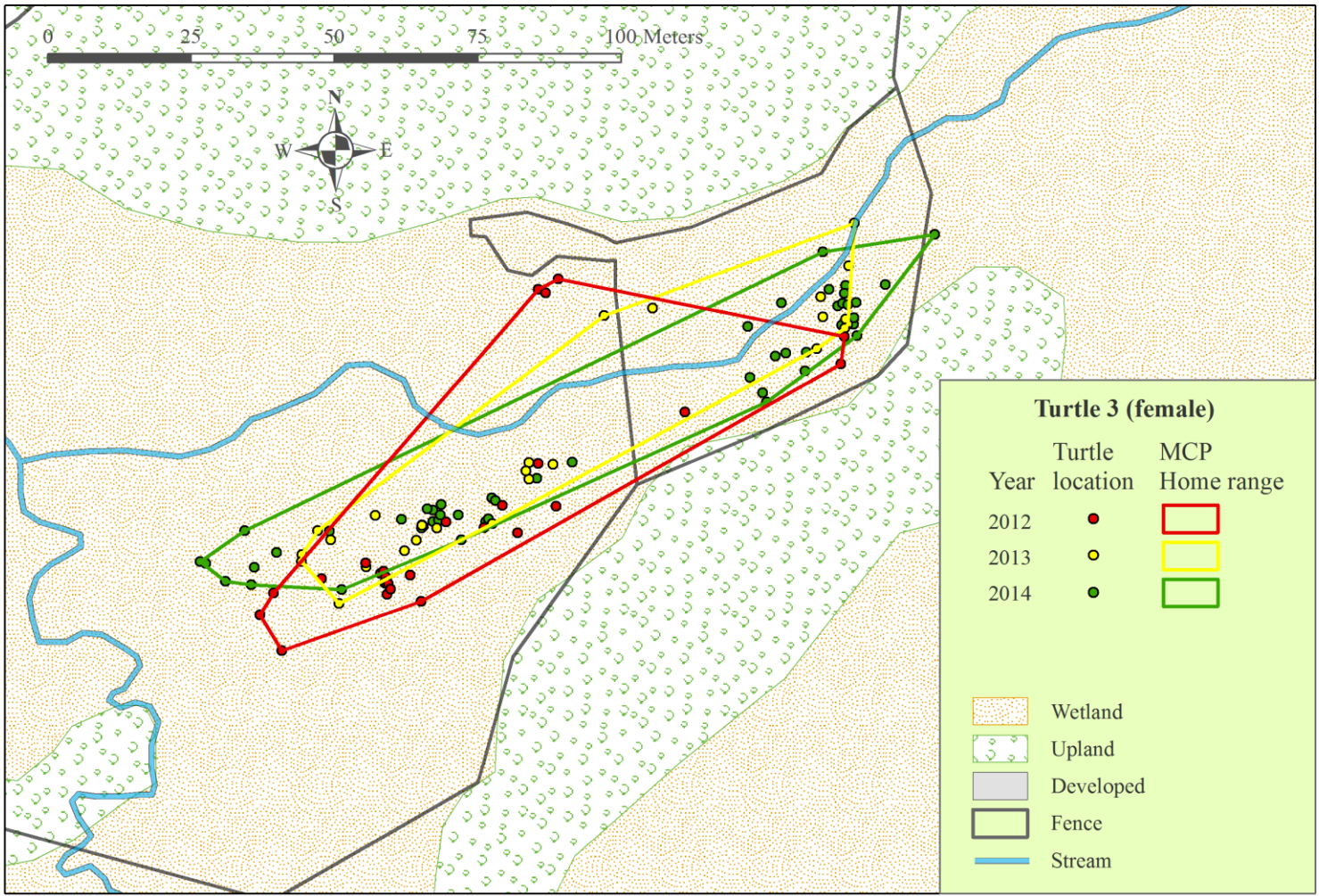
APPENDIX C. Mann-Whitney U tests of soil variables at Turtle locations and random Cattail locations (see Fig. 1 for sampling locations). Rank sums show which group (Turtle vs. Cattail) has higher values of the variable. The null hypothesis is no difference in values between Turtle and Cattail. We set alpha = 0.1 because of the small sample size. The bolded variables (first set) are statistically significant ($p < 0.1$) and the values in the Turtle and Cattail groups do not overlap. Concentrations of toxic elements do not seem high enough to be a threat to the turtles.

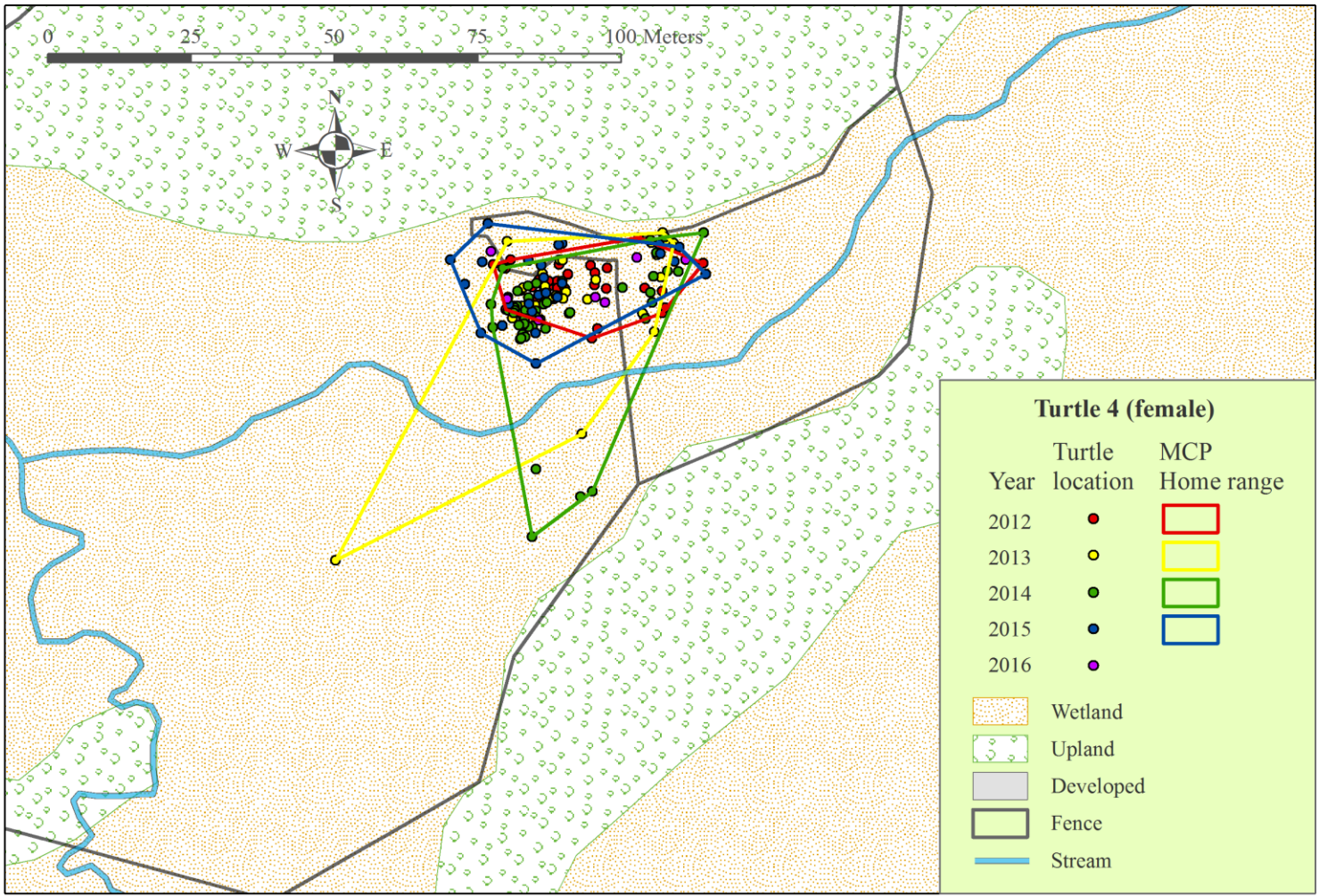
Variable	Rank sum turtle	Rank sum cattail	U	p
Arsenic	22	6	0.0	0.057
Boron	22	6	0.0	0.057
Bulk Density (dry g/mL)	10	18	0.0	0.057
Calcium	22	6	0.0	0.057
Chromium	22	6	0.0	0.057
Cobalt	22	6	0.0	0.057
Iron	22	6	0.0	0.057
Lead	22	6	0.0	0.057
Magnesium	22	6	0.0	0.057
Molybdenum	22	6	0.0	0.057
NH₄-N	22	6	0.0	0.057
Nickel	22	6	0.0	0.057
NO₃+NO₂	10	18	0.0	0.057
Organic Matter	22	6	0.0	0.057
Phosphorus	22	6	0.0	0.057
Strontium	22	6	0.0	0.057
Sulfur	22	6	0.0	0.057
Titanium	22	6	0.0	0.057
Vanadium	22	6	0.0	0.057
Zinc	22	6	0.0	0.057
Aluminum	21	7	1.0	0.114
Potassium	21	7	1.0	0.114
Sodium	20	8	2.0	0.229
Cadmium	13	15	3.0	0.400
pH	13	15	3.0	0.400
Copper	18	10	4.0	0.629
Manganese	14	14	4.0	0.629
Silicon	14	14	4.0	0.629
Selenium	17	11	5.0	0.857
Barium	16	12	6.0	1.000

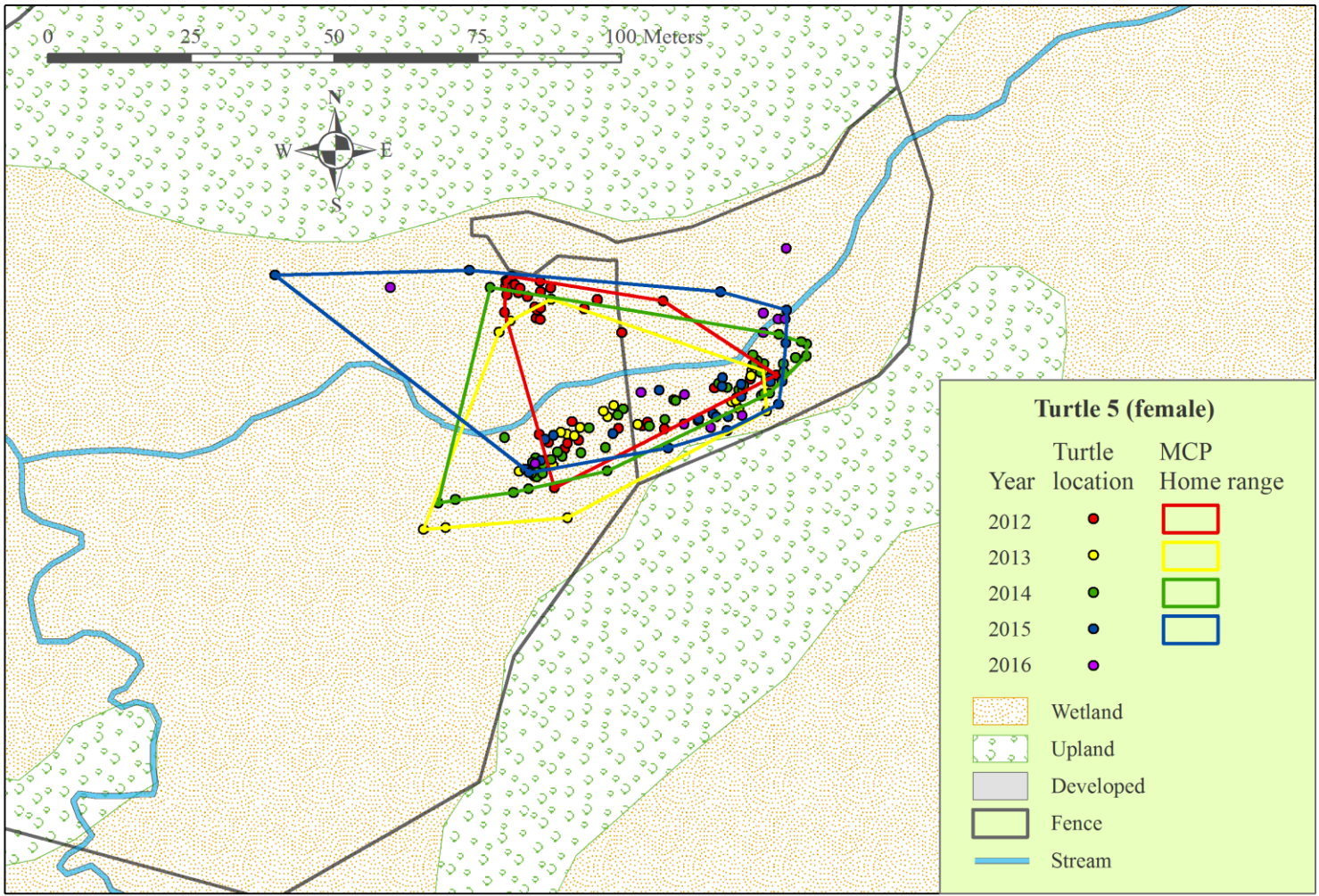
APPENDIX D. Locations of individual bog turtles radio-tracked across years at the New York study site, and minimum convex polygon (MCP) home ranges for each year. No home ranges were calculated for 2016 since tracking ended in early July.

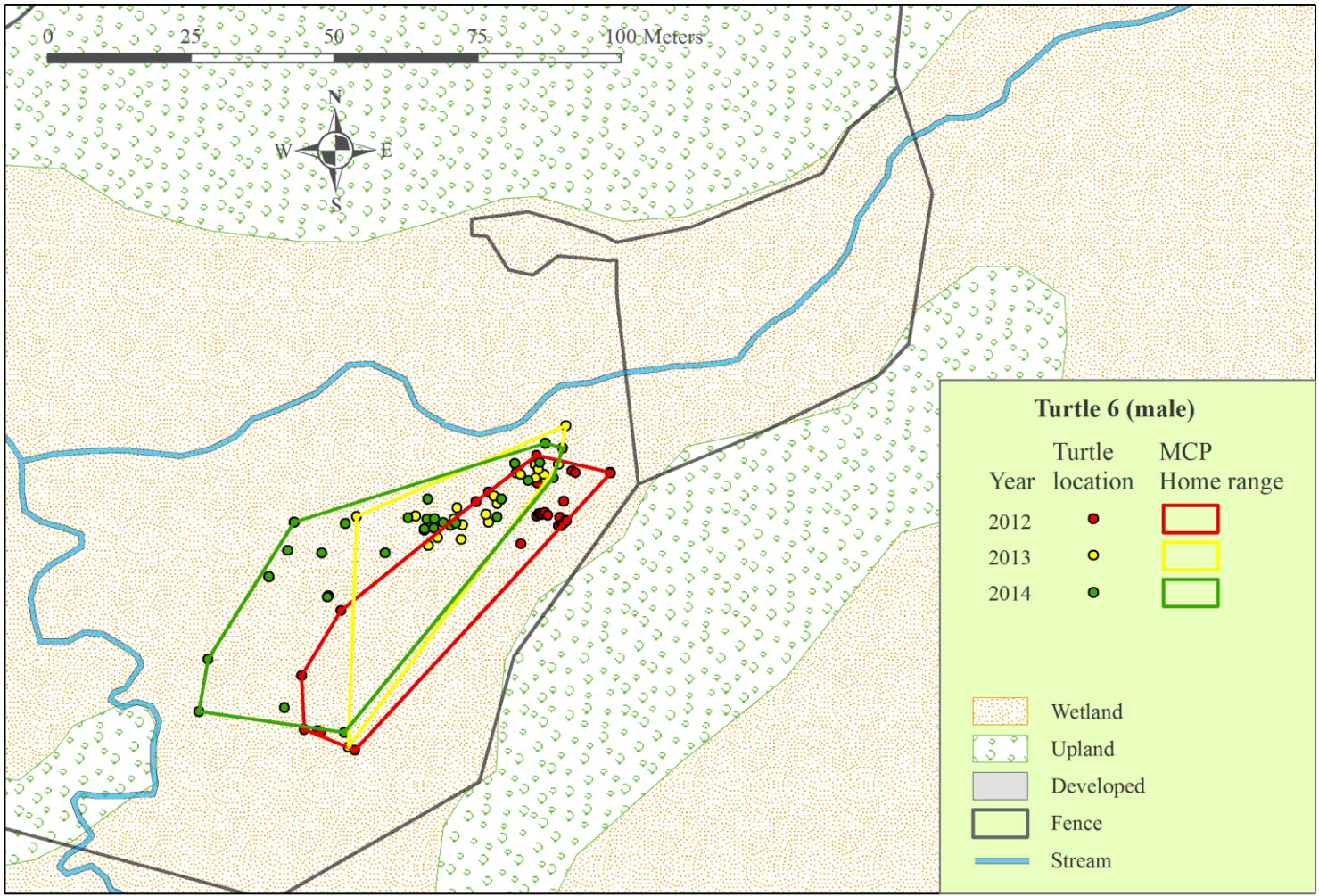


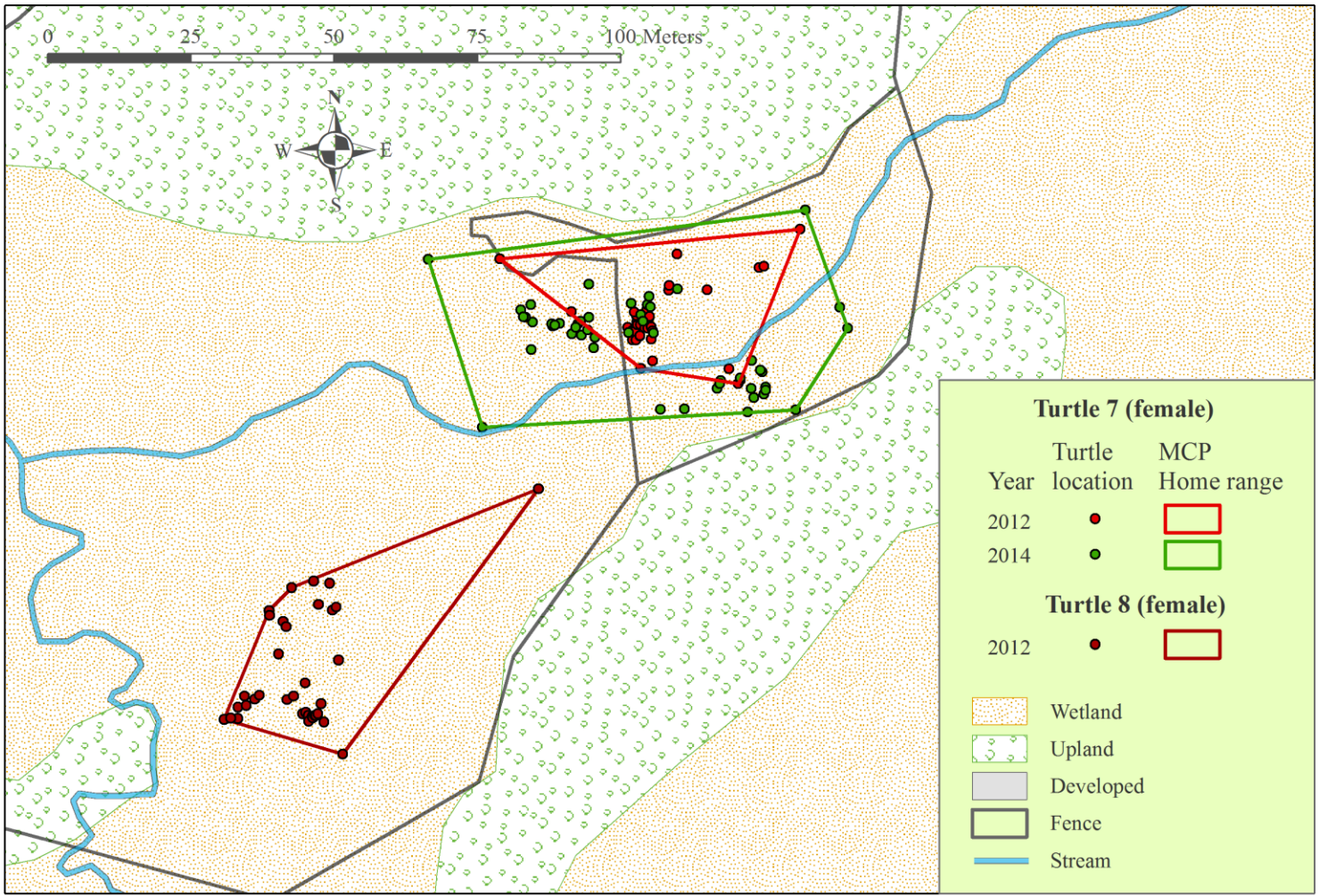


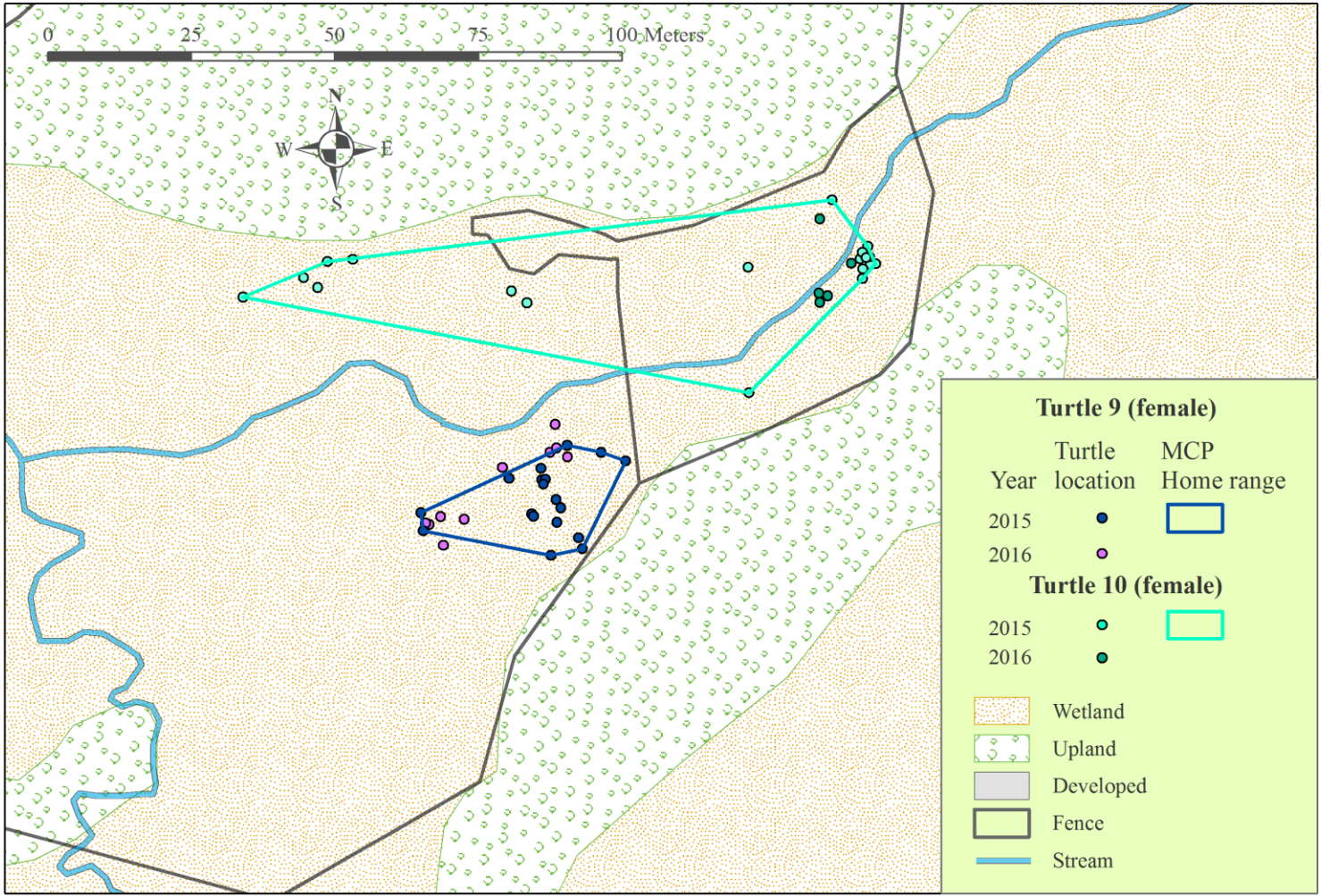












APPENDIX E. Weather data from nearest weather station, Jan 2012-Aug 2016, obtained from www.ncdc.noaa.gov.

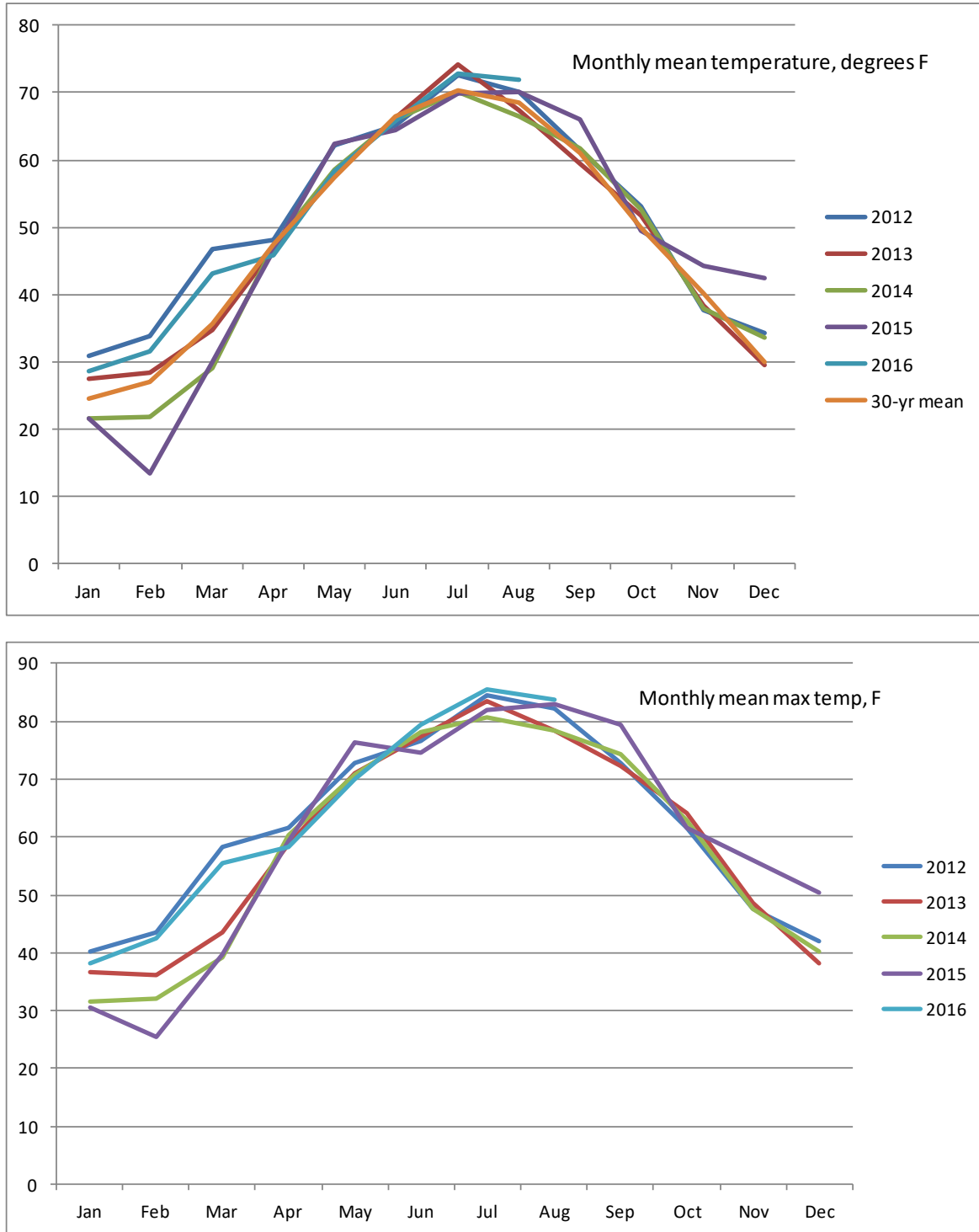


FIGURE E1. Monthly mean temperature and monthly mean maximum temperature over the study period. Bog turtle active season is April-October.

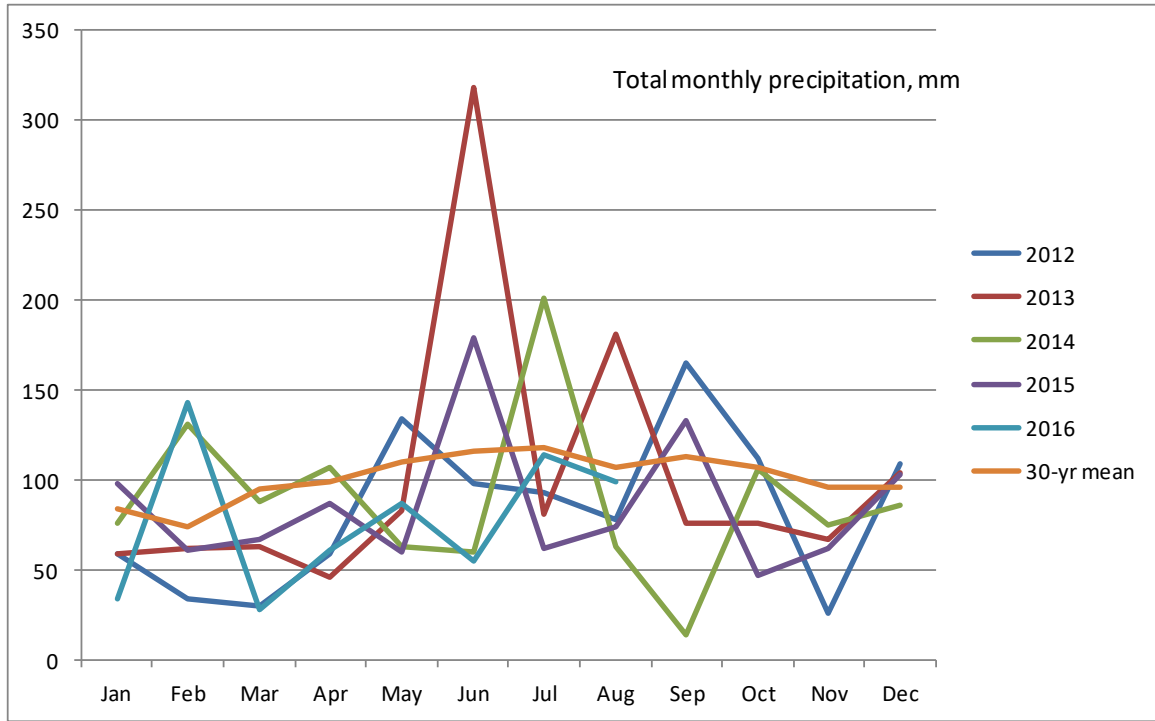


FIGURE E2. Total monthly precipitation over the study period. Bog turtle active season is April-October.