

Invasive Species Mapping Protocols

Objective

The objective for creating these mapping protocols is to develop a unified database of invasive species occurrences within the Midwest region of the United States. These protocols were created in partnership with the Michigan Invasive Species Coalition (MISC). These guidelines will assist all partners within the region in documenting the occurrence and spread of invasive species. The data collected will allow for the development and implementation of effective control strategies in the region.

Documentation: All information about invasive species occurrences must be documented using the categories on the official data form. All locations must be recorded using GPS. New occurrences should be marked with flagging **ONLY** if necessary to help relocate the invasive species for treatment. Volunteers must obtain permission before using flagging. The use of flagging or other references should be noted on the data form under the comments section.

All equipment, materials and instructions will be provided by project partners as needed.

GPS Protocols: For all observations, record a point location in the center of each population. If the area is heavily infested and distinct populations can be easily seen one to the next, mark no more than **ONE** point per 100ft. An average of 25 points should be taken per waypoint. All GPS points must be labeled with a unique ID number using the numbering convention explained below.

Unique ID: For each GPS position collected, record a unique twelve or thirteen digit number (depending on the invasive species code) in the GPS unit for each point as follows: “BBJGM0014IU” where BB is the two letter code for the natural area, JJ is the mapper’s initials, GM is the invasive species code, 001 is the three digit sequence number, 4 is the area, I is the sparse density, and U is for untreated. Within each location, the three digit sequence number of the ID for each person should not be repeated. If the GPS unit you are using does not allow for a twelve digit number, only record the first nine digits. These nine digits are considered the waypoint number and can be matched to the data sheet later.

Data Collection – Standard Operating Procedure

1. Identify which volunteers have received invasive species identification training and/or mapping training. (<http://www.misin.msu.edu/training/>)
2. Ensure each mapping team contains at least one member with experience in both mapping and identification methods.
3. Provide basic refresher training to all volunteers regarding the invasive species which the group expects to encounter and the mapping protocol for recording GPS waypoints.
4. Before sending teams out to map independently, direct volunteers to locate targeted invasive species in the immediate area, to ensure teams are equipped to identify target species and have the opportunity to ask questions.
5. Provide each team with a GPS unit, a data collection form, and have them fill out the following details on the form:
 - a. Date
 - b. GPS Unit #
 - c. Observer(s)
 - d. Site/Location
6. Divide overall site into reasonable chunks for each team. Whenever team members encounter one of the targeted invasive species in their assigned area, log a waypoint as per the directions below, making sure the calculated precision of the GPS unit is within 10 meters.

Logging a GPS Waypoint

GPS waypoints may be logged in one of two ways; either log the location on the GPS unit as a point and label using the format described below and on the lower left hand corner of the data collection sheet, or record the latitude and longitude on the data collection sheet manually.

- The GPS Waypoint Code includes:
 - Location Code: “BB”- volunteers should create a two digit code representing the natural area the observation was recorded. E.g. “IW” for inland wetland.
 - Observer Initials: First initial of first name and first initial of last name. E.g. “JJ”
 - Species: Enter the two or three digit code for the invasive plant species found at the location. Each person will be given a code sheet with all of the invasive plant common names, scientific names, and the abbreviation codes. E.g. phragmites = PH
 - Waypoint ID Number: This is a three digit sequence number. The first entry should be “001”, the second “002”, the third “003”, etc. A sequence number of the ID for each person should never repeat in the site being surveyed.

- **Record Area**—Select one of the following:
 - 0 = None / NA
 - 1 = Individual/few/several
 - 2 = < 1,000 square feet (half tennis court)
 - 3 = 1,000 square feet to 0.5 acre
 - 4 = 0.5 acre to 1 acre (football field w/o end zones)
 - 5 = > 1 acre

- **Record Density**—Select one of the following options:
 - 0 = None / NA
 - 1 = Sparse (scattered individual stems or very small stands)
 - 2 = Patchy (a mix of sparse and dense areas)
 - 3 = Dense (greater than 40% of the area)
 - 4 = Monoculture (nearly 100% of area)

- **Record Treatment Status**—Enter “U” for untreated; or “N” for nonconsecutive years treated; or enter the number of years of consecutive treatment; or “D” for don’t know.

- **Record GPS Coordinates**—If not entering the waypoint code directly into the GPS unit, write the GPS coordinates for each plant species found at each location. All coordinates must be recorded in decimal degrees. For example: 44.75723, -85.65276 (N44.75723 W85.65276).

- **Record Comments**—Use this space to record anything of interest about the observation; i.e. note the use of flagging, general quality of natural community, last year treated (if known) or other pertinent information about the location, species infestation or mapping.

GPS Abbreviation Codes

Invasive Species Network -- Target Species					
Common Name	Abbrev. Code	Scientific Name	Common Name	Abbrev. Code	Scientific Name
Amur honeysuckle	AH	<i>Lonicera maackii</i>	Hickory bark beetle	SQ	<i>Scolytus quadrispinosus</i>
Asian longhorned beetle	ALB	<i>Anoplophora glabripennis</i>	Hickory wilt	CS	<i>Ceratocystis smalleyii</i>
Autumn olive	AO	<i>Elaeagnus umbellata</i>	Japanese barberry	JB	<i>Berberis thunbergii</i>
Baby's breath	BB	<i>Gypsophila paniculata</i>	Japanese honeysuckle	LJ	<i>Lonicera japonica</i>
Bell's honeysuckle	BH	<i>Lonicera xbella</i>	Japanese knotweed	JK	<i>Polygonum cuspidatum</i>
Bighead carp	HN	<i>Hypophthalmichthys nobilis</i>	Leafy spurge	LS	<i>Euphorbia esula</i>
Bishops goutweed	BG	<i>Aegopodium podagraria</i>	Lymegrass	LG	<i>Leymus arenarius</i>
Brown marmorated stink bug	HH	<i>Halyomorpha halys</i>	Morrow's honeysuckle	MH	<i>Lonicera morrowii</i>
Bull thistle	BT	<i>Cirsium vulgare</i>	Multiflora rose	MR	<i>Rosa multiflora</i>
Butterbur	BU	<i>Petasites hybridus</i>	Mute swan	CO	<i>Cygnus olor</i>
Canada thistle	CT	<i>Cirsium arvense</i>	Narrowleaf cattail	NC	<i>Typha angustifolia</i>
Common buckthorn	CB	<i>Rhamnus cathartica</i>	Northern snakehead	NS	<i>Channa argus</i>
Common carp	CC	<i>Cyprinus carpio</i>	Oak wilt	OW	<i>Ceratocystis fagacearum</i>
Dame's rocket	DR	<i>Hesperis matronalis</i>	Oriental bittersweet	OB	<i>Celastrus orbiculatus</i>
Emerald ash borer	EAB	<i>Agrilus planipennis</i>	Phragmites (non-native)	PH	<i>Phragmites australis</i>
Eurasian watermilfoil	EW	<i>Myriophyllum spicatum</i>	Purple loosestrife	PL	<i>Lythrum salicaria</i>
European fly honeysuckle	LX	<i>Lonicera xylosteum</i>	Quagga mussel	QM	<i>Dreissena bugensis</i>
European frog-bit	FB	<i>Hydrocharis morsus-ranae</i>	Reed canarygrass	RC	<i>Phalaris arundinacea</i>
European swamp thistle	ST	<i>Cirsium palustre</i>	Ruffe	GC	<i>Gymnocephalus cernuus</i>
Feral swine	FS	<i>Sus scrofa</i>	Russian olive	RO	<i>Elaeagnus angustifolia</i>
Fishhook waterflea	FWF	<i>Cercopagis pengoi</i>	Rusty crayfish	OR	<i>Orconectes rusticus</i>
Garlic mustard	GM	<i>Alliaria petiolata</i>	Sea lamprey	PM	<i>Petromyzon marinus</i>
Giant knotweed	GK	<i>Polygonum sachalinense</i>	Silver carp	HM	<i>Hypophthalmichthys molitrix</i>
Glossy buckthorn	GB	<i>Rhamnus frangula</i>	Spiny waterflea	SWF	<i>Bythotrephes longimanus</i>
Grass carp	CI	<i>Ctenopharyngodon idella</i>	Tatarian honeysuckle	LT	<i>Lonicera tatarica</i>
Gypsy moth	LD	<i>Lymantria dispar</i>	Wild parsnip	WP	<i>Pastinaca sativa</i>
Hemlock woolly adelgid	HWA	<i>Adelges tsugae</i>	Zebra mussel	ZM	<i>Dreissena polymorpha</i>

Invasive Species Network -- Species of Concern

Common Name	Abbrev. Code	Scientific Name	Common Name	Abbrev. Code	Scientific Name
African oxygen weed	LM	<i>Lagarosiphon major</i>	Callery pear	CP	<i>Pyrus calleryana</i>
Alewife	AW	<i>Alosa pseudoharengus</i>	Canada bluegrass	CBG	<i>Poa compressa</i>
Amur corktree	AC	<i>Phellodendron amurense</i>	Carolina fanwort	FW	<i>Cabomba caroliniana</i>
Asian clam	CF	<i>Corbicula fluminea</i>	Cheatgrass	CG	<i>Bromus tectorum</i>
Asian giant hornet	AGH	<i>Vespa mandarina</i>	Chinese mitten crab	CMC	<i>Eriocheir sinensis</i>
Asiatic sand sedge	CK	<i>Carex kobomugi</i>	Chinese mystery snail	CMS	<i>Cipangopaludina chinensis</i>
Austrian pine	AP	<i>Pinus nigra</i>	Chinese silvergrass	MS	<i>Miscanthus sinensis</i>
Balsam woolly adelgid	BWA	<i>Adelges piceae</i>	Chinese wisteria	CW	<i>Wisteria sinensis</i>
Banded mystery snail	BMS	<i>Viviparus georgianus</i>	Chinese yam	CY	<i>Dioscorea oppositifolia</i>
Barnyardgrass	BY	<i>Echinochloa crus-galli</i>	Chocolate vine	AQ	<i>Akebia quinata</i>
Beech bark disease	NP	<i>Neonectria spp.</i>	Coltsfoot	TF	<i>Tussilago farfara</i>
Beech scale	BS	<i>Cryptococcus fagisuga</i>	Common barberry	BV	<i>Berberis vulgaris</i>
Bigleaf lupine	BLL	<i>Lupinus polyphyllus</i>	Common bugle	AR	<i>Ajuga reptans</i>
Bigleaf periwinkle	BP	<i>Vinca major</i>	Common chickweed	SM	<i>Stellaria media</i>
Birdfoot trefoil	LC	<i>Lotus corniculata</i>	Common gypsyweed	GW	<i>Veronica officinalis</i>
Bittersweet nightshade	BN	<i>Solanum dulcamara</i>	Common lilac	SV	<i>Syringa vulgaris</i>
Black alder	BA	<i>Alnus glutinosa</i>	Common motherwort	MO	<i>Leonurus cardiaca</i>
Black jetbead	BJ	<i>Rhodotypos scandens</i>	Common mullein	MN	<i>Verbascum thapsus</i>
Black locust	BL	<i>Robinia pseudoacacia</i>	Common periwinkle	VM	<i>Vinca minor</i>
Black swallow-wort	VN	<i>Vincetoxicum nigrum</i>	Common St. Johnswort	SJ	<i>Hypericum perforatum</i>
Bladder campion	BC	<i>Silene vulgaris</i>	Common tansy	TV	<i>Tanacetum vulgare</i>
Bloody red shrimp	HA	<i>Hemimysis anomala</i>	Cotton thistle	OA	<i>Onopordon acanthium</i>
Bouncingbet	SO	<i>Saponaria officinalis</i>	Cow vetch	VV	<i>Vicia cracca</i>
Brazilian elodea	BW	<i>Egeria densa</i>	Crack willow	SF	<i>Salix fragilis</i>
Bristly locust	RH	<i>Robinia hispida</i>	Creeping buttercup	RR	<i>Ranunculus repens</i>
Brittle water-nymph	WN	<i>Najas minor</i>	Creeping charlie	PN	<i>Pilea nummulariifolia</i>
Butter and eggs	BE	<i>Linaria vulgaris</i>	Crown vetch	CV	<i>Coronilla varia</i>

Invasive Species Network -- Species of Concern (Cont)		
Common Name	Abbrev. Code	Scientific Name
Curly plumeless thistle	PT	<i>Carduus crispus</i>
Curly pondweed	PW	<i>Potamogeton crispus</i>
Cutleaf teasel	DL	<i>Dipsacus laciniatus</i>
Dalmatian toadflax	DT	<i>Linaria dalmatica</i>
Cypress spurge	EC	<i>Euphorbia cyparissias</i>
Didymo	DG	<i>Didymosphenia geminata</i>
Dotted duck-weed	DD	<i>Landoltia punctata</i>
English ivy	EI	<i>Hedera helix</i>
European cranberrybush	VO	<i>Viburnum opulus</i>
European fireweed	EH	<i>Epilobium hirsutum</i>
European grapevine moth	EGM	<i>Lobesia botrana</i>
European lily of the valley	LV	<i>Convallaria majalis</i>
European privet	PR	<i>Ligustrum vulgare</i>
European waterclover	WC	<i>Marsilea quadrifolia</i>
Fall phlox	FP	<i>Phlox paniculata</i>
Field hedge parsley	TA	<i>Torilis arvensis</i>
Five leaf aralia	ES	<i>Eleutherococcus sieboldianus</i>
Flat pea	PE	<i>Lathyrus slyvestris</i>
Floating marsh pennywort	HR	<i>Hydrocotyle ranunculoides</i>
Flowering rush	FR	<i>Butomus umbellatus</i>
Fuller's teasel	DF	<i>Dipsacus fullonum</i>
Garden yellow loosestrife	YL	<i>Lysimachia vulgaris</i>
Garden yellowrocket	YR	<i>Barbarea vulgaris</i>
Germander speedwell	VC	<i>Veronica chamaedrys</i>
Giant bellflower	BF	<i>Campanula latifolia</i>
Giant hogweed	GH	<i>Heracleum mantegazzianum</i>

Invasive Species Network -- Species of Concern (Cont)		
Common Name	Abbrev. Code	Scientific Name
Giant reed	GR	<i>Arundo donax</i>
Giant salvinia	GS	<i>Salvinia molesta</i>
Giantchickweed	GCW	<i>Myosoton aquaticum</i>
Gingermint	MG	<i>Mentha x gracilis</i>
Goldfish	GF	<i>Carassius auratus</i>
Goldmoss stonecrop	GO	<i>Sedum acre</i>
Himalayan balsam	HB	<i>Impatiens glandulifera</i>
Himalayan knotweed	HK	<i>Polygonum polystachyum</i>
Hoary alyssum	BI	<i>Berteroa incana</i>
Houndstongue	HT	<i>Cynoglossum officinale</i>
Hybrid cattail	HC	<i>Typha x glauca</i>
Hybrid crack willow	SR	<i>Salix x rubens</i>
Hydrilla	HD	<i>Hydrilla verticillata</i>
Indian swampweed	IS	<i>Hygrophila polysperma</i>
Japanese hedge parsley	HP	<i>Torilis japonica</i>
Japanese hop	HJ	<i>Humulus japonicas</i>
Japanese stilt grass	JS	<i>Microstegium vimineum</i>
Japanese tree lilac	TL	<i>Syringa reticulata</i>
Japanese wineberry	RP	<i>Rubus phoenicolasius</i>
Japanese wisteria	JW	<i>Wisteria floribunda</i>
Java waterdropwort	OJ	<i>Oenanthe javanica</i>
Jimsonweed	DS	<i>Datura stramonium</i>
Johnsongrass	JG	<i>Sorghum halepense</i>
Kentucky bluegrass	KB	<i>Poa pratensis</i>
Kudzu	KZ	<i>Pueraria montana</i>
Laurel willow	LW	<i>Salix pentandra</i>

Invasive Species Network -- Species of Concern (Cont)		
Common Name	Abbrev. Code	Scientific Name
Lesser burdock	LB	<i>Arctium minus</i>
Lesser celandine	FV	<i>Ficaria verna</i>
Lombardy poplar	LP	<i>Populus nigra</i> var. <i>italica</i>
Medusahead	TC	<i>Taeniatherum caput-medusae</i>
Mile-a-Minute weed	MW	<i>Polygonum perfoliatum</i>
Money plant	MP	<i>Lunaria annua</i>
Moneywort	LN	<i>Lysimachia nummularia</i>
Mudmat	MM	<i>Glossostigma cleistanthum</i>
Musk mallow	MU	<i>Malva moschata</i>
Nodding thistle	NT	<i>Carduus nutans</i>
Norway maple	NM	<i>Acer platanoides</i>
Nutria	MC	<i>Myocastor coypus</i>
Onerow yellowcress	OY	<i>Nasturtium microphyllum</i>
Orange day lily	OD	<i>Hemerocallis fulva</i>
Orange hawkweed	OH	<i>Hieracium aurantiacum</i>
Orchardgrass	OG	<i>Dactylis glomerata</i>
Oregon grape	MA	<i>Mahonia aquifolium</i>
Oxeye daisy	OX	<i>Leucanthemum vulgare</i>
Pale swallow-wort	VR	<i>Vincetoxicum rossicum</i>
Paradise plant	PP	<i>Daphne mezereum</i>
Parrot feather watermilfoil	PF	<i>Myriophyllum aquaticum</i>
Perennial cornflower	CM	<i>Centaurea montana</i>
Perennial pea	LL	<i>Lathyrus latifolius</i>
Perfumed cherry	PC	<i>Prunus mahaleb</i>
Pond water-starwort	PWS	<i>Callitriche stagnalis</i>
Porcelainberry	PB	<i>Ampelopsis brevipedunculata</i>
Purple foxglove	DP	<i>Digitalis purpurea</i>

Invasive Species Network -- Species of Concern (Cont)		
Common Name	Abbrev. Code	Scientific Name
Quackgrass	QG	<i>Elymus repens</i>
Queen Anne's lace	DC	<i>Daucus carota</i>
Queen of the meadow	FU	<i>Filipendula ulmaria</i>
Rabbitfoot clover	RF	<i>Trifolium arvense</i>
Rampion bellflower	RB	<i>Campanula rapunculoides</i>
Red swamp crayfish	RS	<i>Procambarus clarkii</i>
Reed mannagrass	RM	<i>Glyceria maxima</i>
Round goby	RG	<i>Neogobius melanostomus</i>
Rugosa rose	RU	<i>Rosa rugosa</i>
Sacred lotus	NN	<i>Nelumbo nucifera</i>
Sawtooth oak	QA	<i>Quercus acutissima</i>
Scotch thistle	SH	<i>Onopordum acanthium</i>
Scots pine	SP	<i>Pinus sylvestris</i>
Seaside goldenrod	SG	<i>Solidago sempervirens</i>
Shasta daisy	SD	<i>Leucanthemum x superbum</i>
Siberian elm	UP	<i>Ulmus pumila</i>
Siberian peashurb	SI	<i>Caragana arborescens</i>
Siberian squill	SS	<i>Scilla siberica</i>
Smooth brome	SB	<i>Bromus inermis</i>
Southern cattail	TD	<i>Typha domingensis</i>
Spiny plumeless thistle	CA	<i>Carduus acanthoides</i>
Spotted knapweed	SK	<i>Centaurea maculosa</i>
Starry stonewort	NO	<i>Nitellopsis obtusa</i>
Stinking willie	JV	<i>Senecio jacobaea</i>
Sulphur cinquefoil	CQ	<i>Potentilla recta</i>
Sweet woodruff	SW	<i>Galium odoratum</i>
Sweetbriar rose	RE	<i>Rosa eglanteria</i>

Invasive Species Network -- Species of Concern (Cont)		
Common Name	Abbrev. Code	Scientific Name
Sweetwilliam	DB	<i>Dianthus barbatus</i>
Swordleaf rush	JE	<i>Juncus ensifolius</i>
Tall buttercup	TB	<i>Ranunculus acris</i>
Tall hawkweed	HF	<i>Hieracium piloselloides</i>
Thousand canker disease	TCD	<i>Geosmithia morbida</i>
Timothy	TM	<i>Phleum pratense</i>
Toringo crab	MT	<i>Malus toringo</i>
Tree of Heaven	TH	<i>Ailanthus altissima</i>
True forget-me-not	FM	<i>Myosotis scorpioides</i>
Vanhoutte spirea	VS	<i>Spiraea x vanhouttei</i>
Vervain mallow	VE	<i>Malva alcea</i>
Wall hawkweed	HW	<i>Hieracium murorum</i>
Walnut twig beetle	WTB	<i>Pityophthorus juglandis</i>
Water chestnut	TN	<i>Trapa natans</i>
Water hyacinth	WH	<i>Eichhornia crassipes</i>
Water lettuce	PS	<i>Pistea stratioides</i>
Water soldier	SA	<i>Stratiotes aloides</i>
Watercress	CR	<i>Nasturtium officinale</i>
Wavyleaf basketgrass	OU	<i>Oplismenus undulatifolius</i>
Wayfaring-tree	VL	<i>Viburnum lantana</i>
Weather loach	WL	<i>Misgurnus anguillicaudatus</i>
Wels catfish	WE	<i>Sulurus glanis</i>
White campion	SL	<i>Silene latifolia</i>
White mulberry	MB	<i>Morus alba</i>
White poplar	PA	<i>Populus alba</i>
White stonecrop	SC	<i>Sedum album</i>

Invasive Species Network -- Species of Concern (Cont)		
Common Name	Abbrev. Code	Scientific Name
White sweet clover	WS	<i>Melilotus alba</i>
White willow	WW	<i>Salix alba</i>
Wild chervil	AS	<i>Anthriscus sylvestris</i>
Wild garlic	WG	<i>Allium vineale</i>
Wild mint	WM	<i>Mentha x gentilis</i>
Willowleaf meadowsweet	WI	<i>Spiraea salicifolia</i>
Winged burningbush	EA	<i>Euonymus alatus</i>
Winged sumac	SU	<i>Rhus copallinum</i>
Winter creeper	EF	<i>Euonymus fortunei</i>
Witch's moneybags	WT	<i>Hylotelephium telephium</i>
Wood bluegrass	WD	<i>Poa nemoralis</i>
Yabby	CD	<i>Cherax destructor</i>
Yellow archangel	YA	<i>Lamiastrum galeobdolon</i>
Yellow floating heart	FH	<i>Nymphoides peltata</i>
Yellow foxglove	YF	<i>Digitalis grandiflora</i>
Yellow iris	IP	<i>Iris pseudacorus</i>
Yellow sweet clover	YS	<i>Melilotus officinalis</i>
Zander	ZA	<i>Sander lucioperca</i>