State Forest Invasive Plant Management and Opportunities for Collaboration

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PA Bureau of Forestry
October 15, 2014

State Forest Invasive Plant Management

What is an invasive plant?

Ecology of invasive plants

Management & Prioritization

Plant monitoring strategies

Collaborative opportunities

Michig

PA Bureau of Forestry Mission

The mission of the Bureau of Forestry is to ensure the long-term health, viability, and productivity of the Commonwealth's forests and to <u>conserve native wild plants.</u>

Pennsylvania's Plant Species

Over 3100 Plant Species in PA:

- Flowering Plants: ~1900 native & ~1200 Non-native
- Conifers: ~25 species
- Ferns: ~100 species

Currently 496 PA Plant Species of Special Concern:

- 228 PA Endangered Plants
- 78 PA Threatened
- 39 PA Rare
- 148 "Tentatively Undetermined" Species
- 3 PA Vulnerable
- 2 US Federally Endangered Species

Threats to Native Wild Plants

Threats to Native Wild Plants

Threats to Native Wild Plants

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What is an invasive plant species?

"Those species that are not native to the state, grow aggressively, and spread and displace native vegetation."

DCNR recognizes 89 invasive plant species and 25 plant species on an invasive "watch list"

Purple Loosestrife (*Lythrum salicaria*)

Japanese Barberry (*Berberis thunbergii*)

Burning Bush (*Euonymus alatus*)

Inhibit Native Tree Regeneration

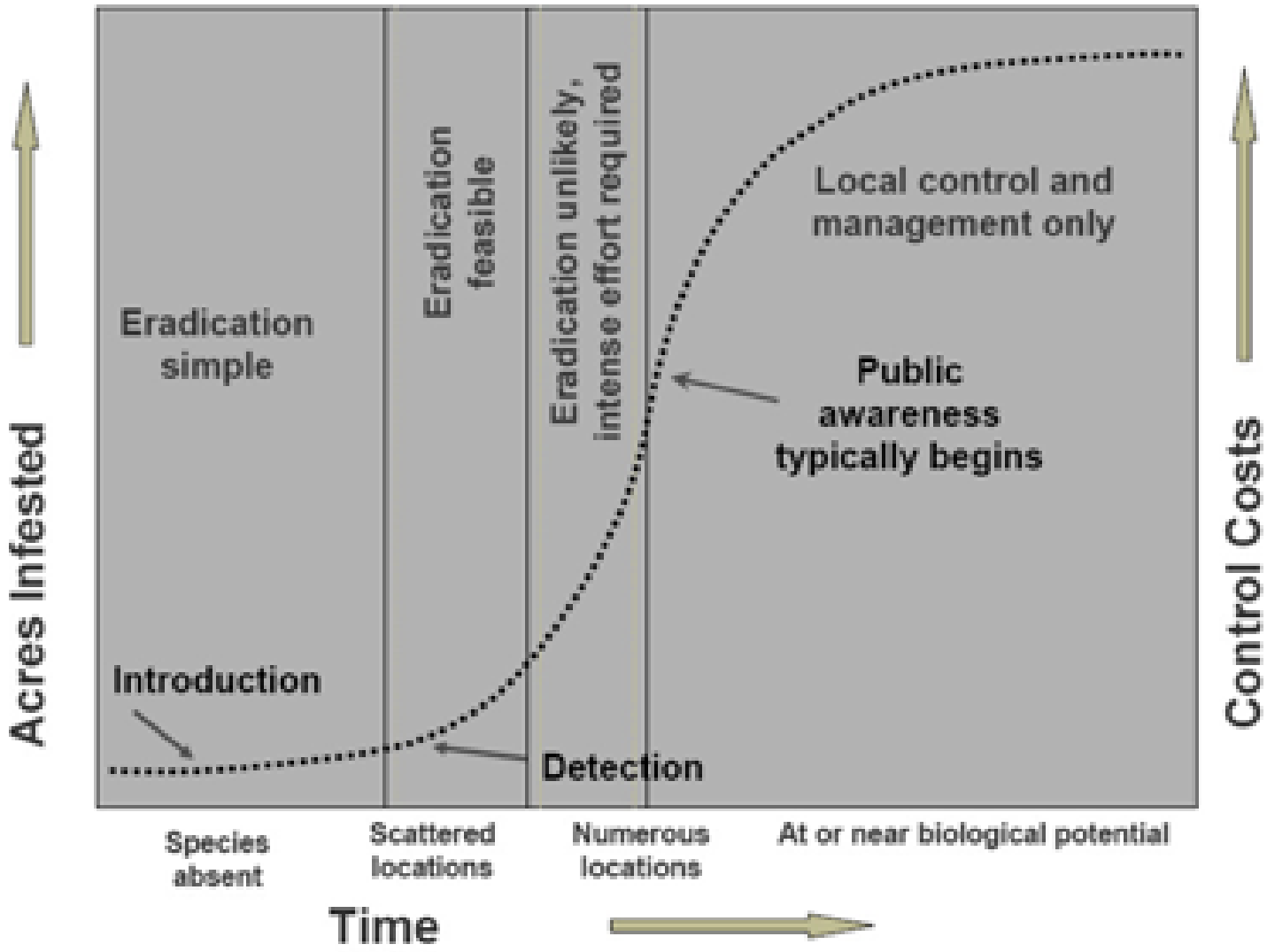
Exclude native herbaceous plants

Disrupt wetland communities

Arrested successional pathways

Increase in small rodents and ticks

High monetary and manpower costs



Adapted from Hobbs and Humphries 1995

How do invasive plants spread?

Natural pathways do exist…BUT…mostly humans are to blame

Transportation
- Corridors
- Vehicles
- Shipping Materials
- Barge ballast water

Live Plants
- Nursery Trade
- Seed mix contamination
- Habitat Plantings

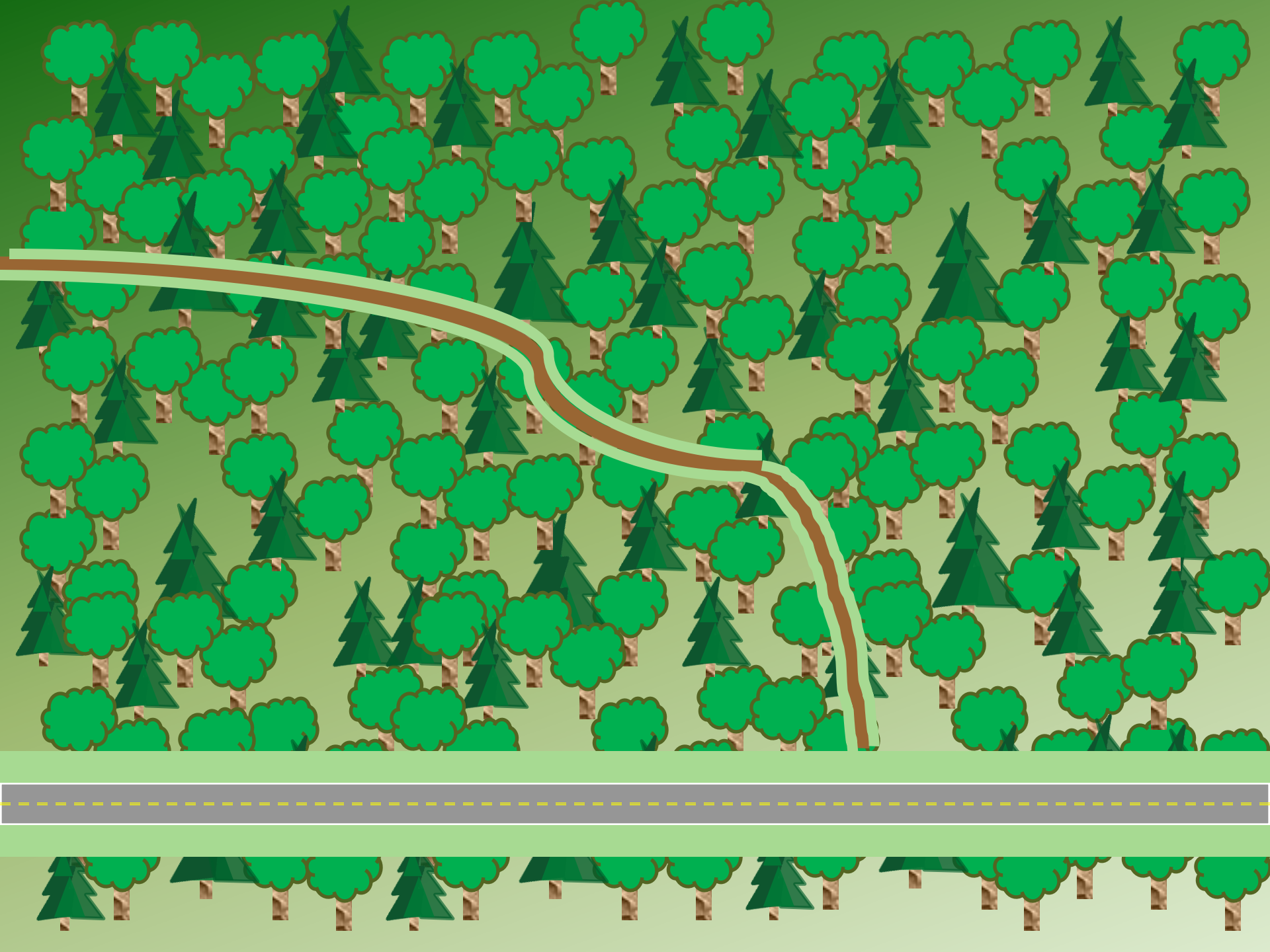
Recreation
- Hiking Trails
- Equestrian waste
- Attached to hulls
- Fragmented by propellers

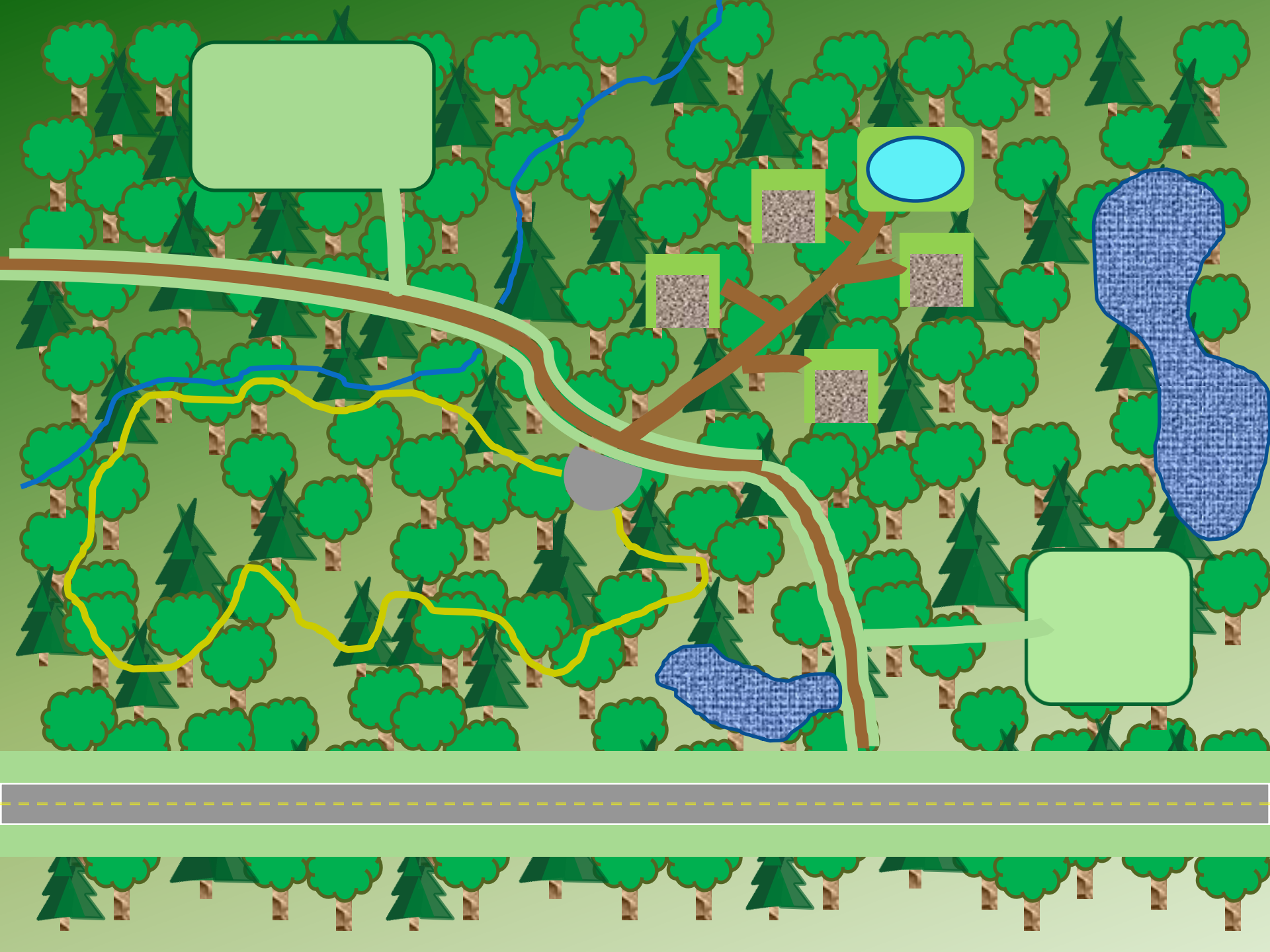
Construction
- Fill material
- Vehicles
- Mowing
- Improper herbicide use

Disturbance
- Timber harvests
- Vacant lots
- Old fields
- Forest fires
- Agriculture

Wildlife
- Birds
- Waterfowl
- Large mammals

Disturbance to Forest Habitat



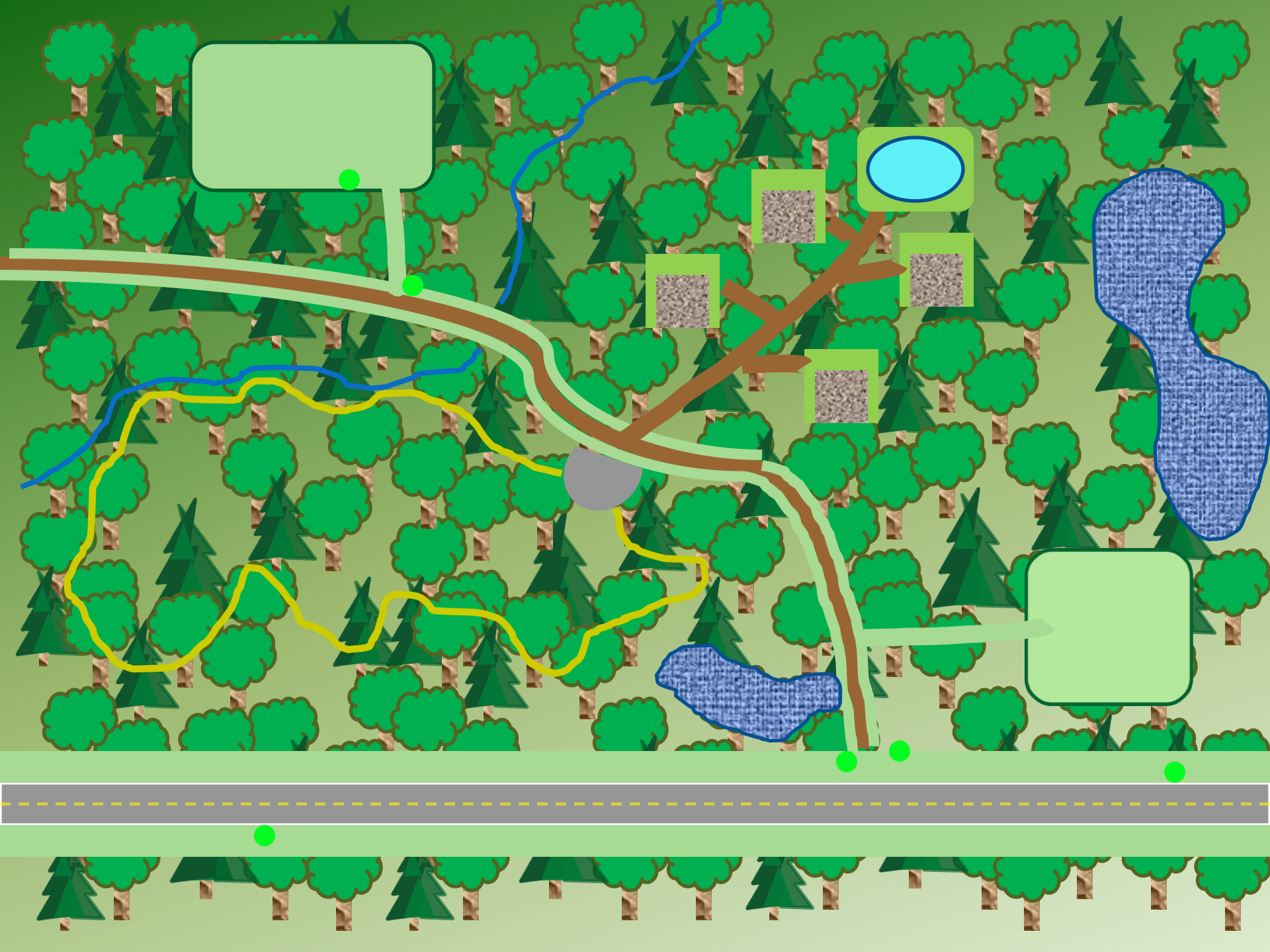


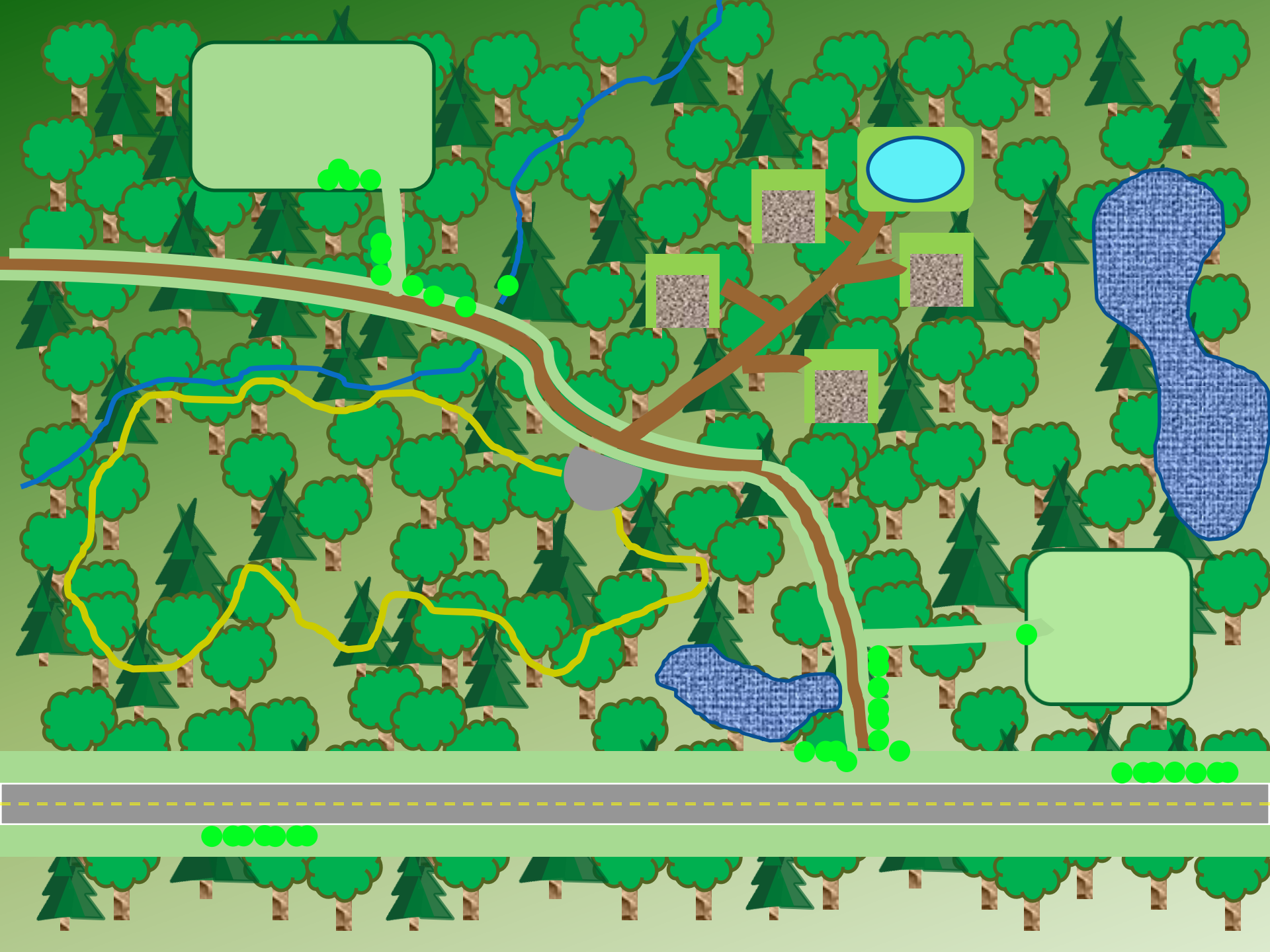
Japanese stiltgrass

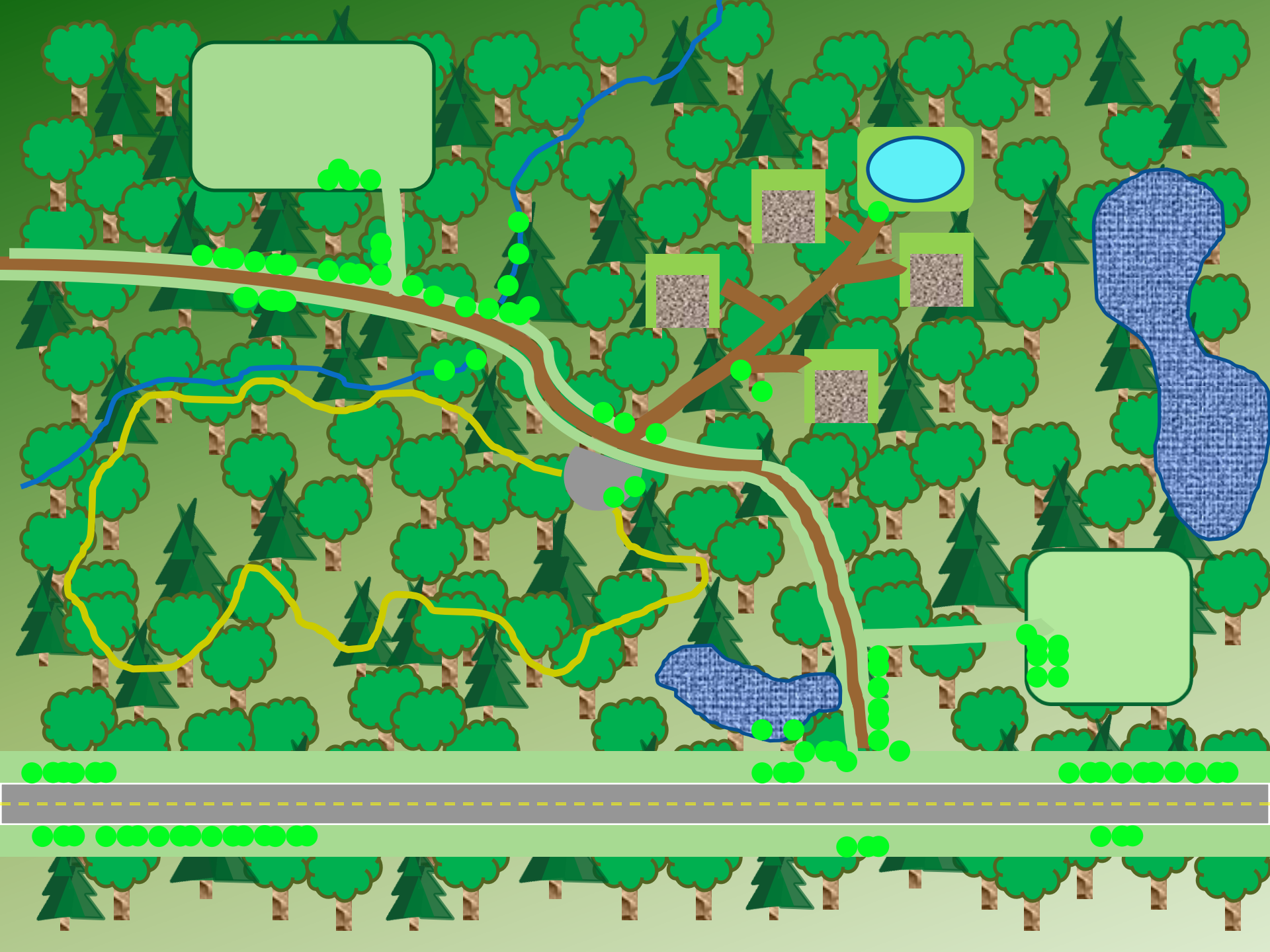
Canada thistle

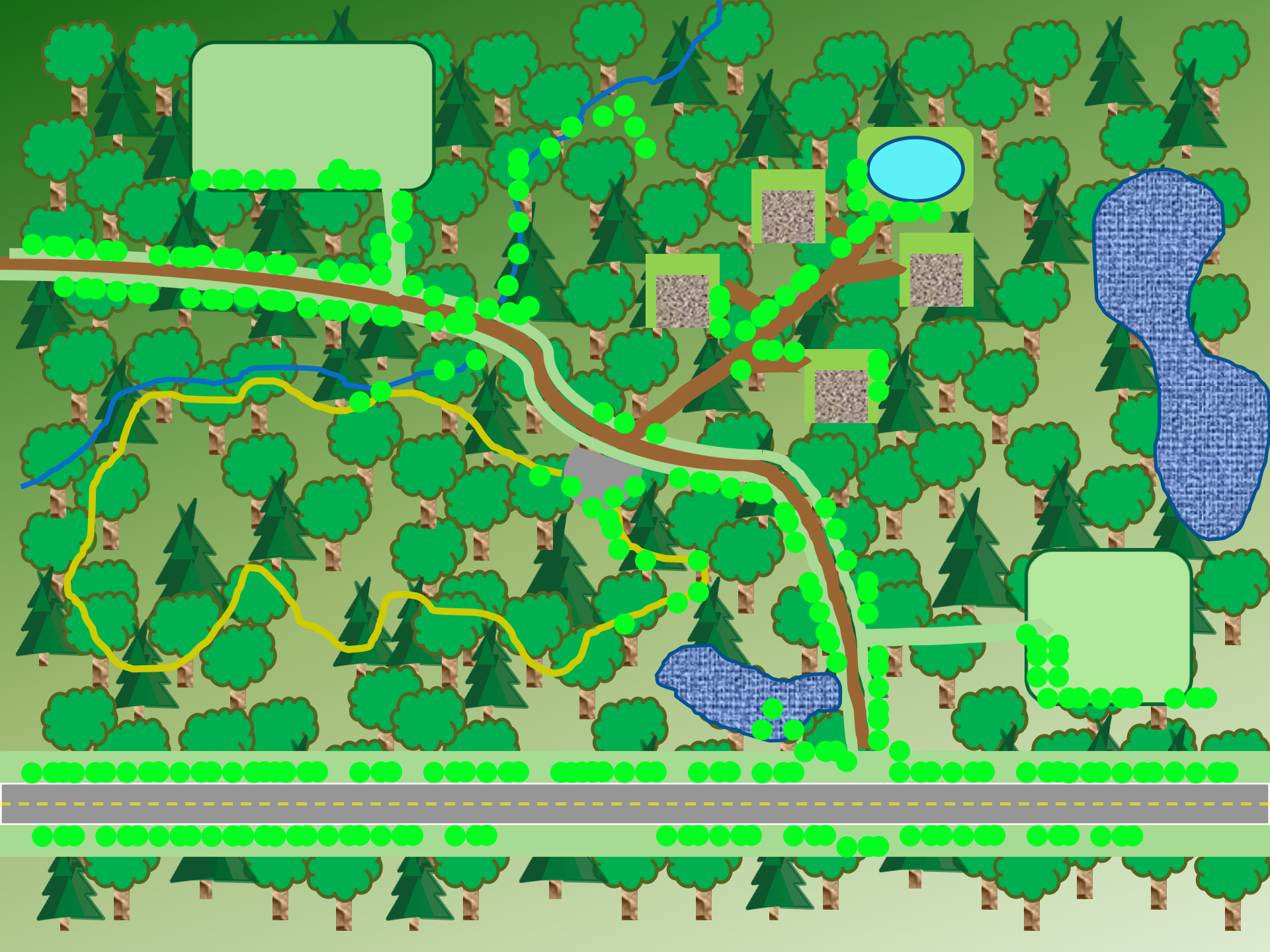
Spotted knapweed

Poison-hemlock







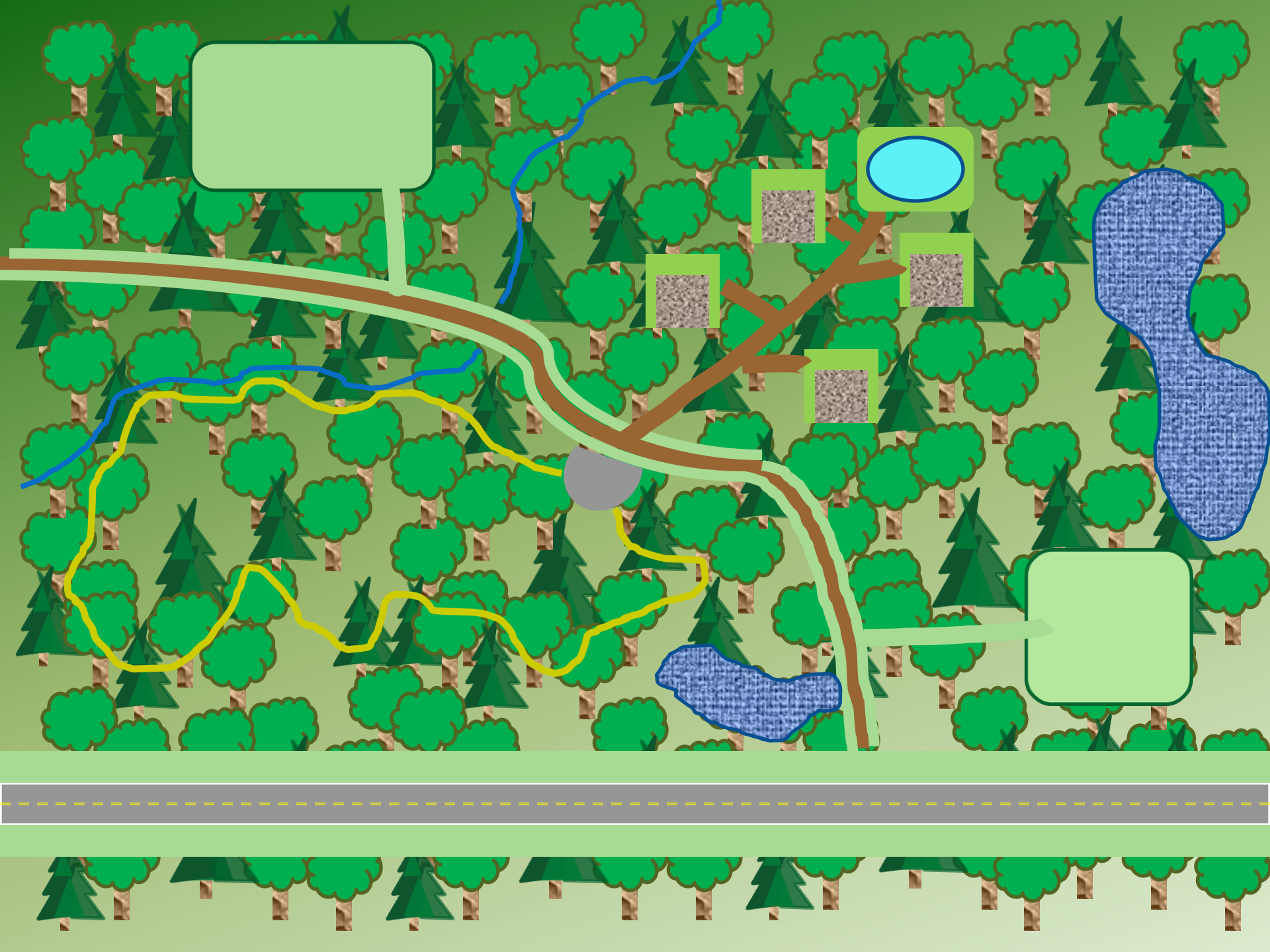


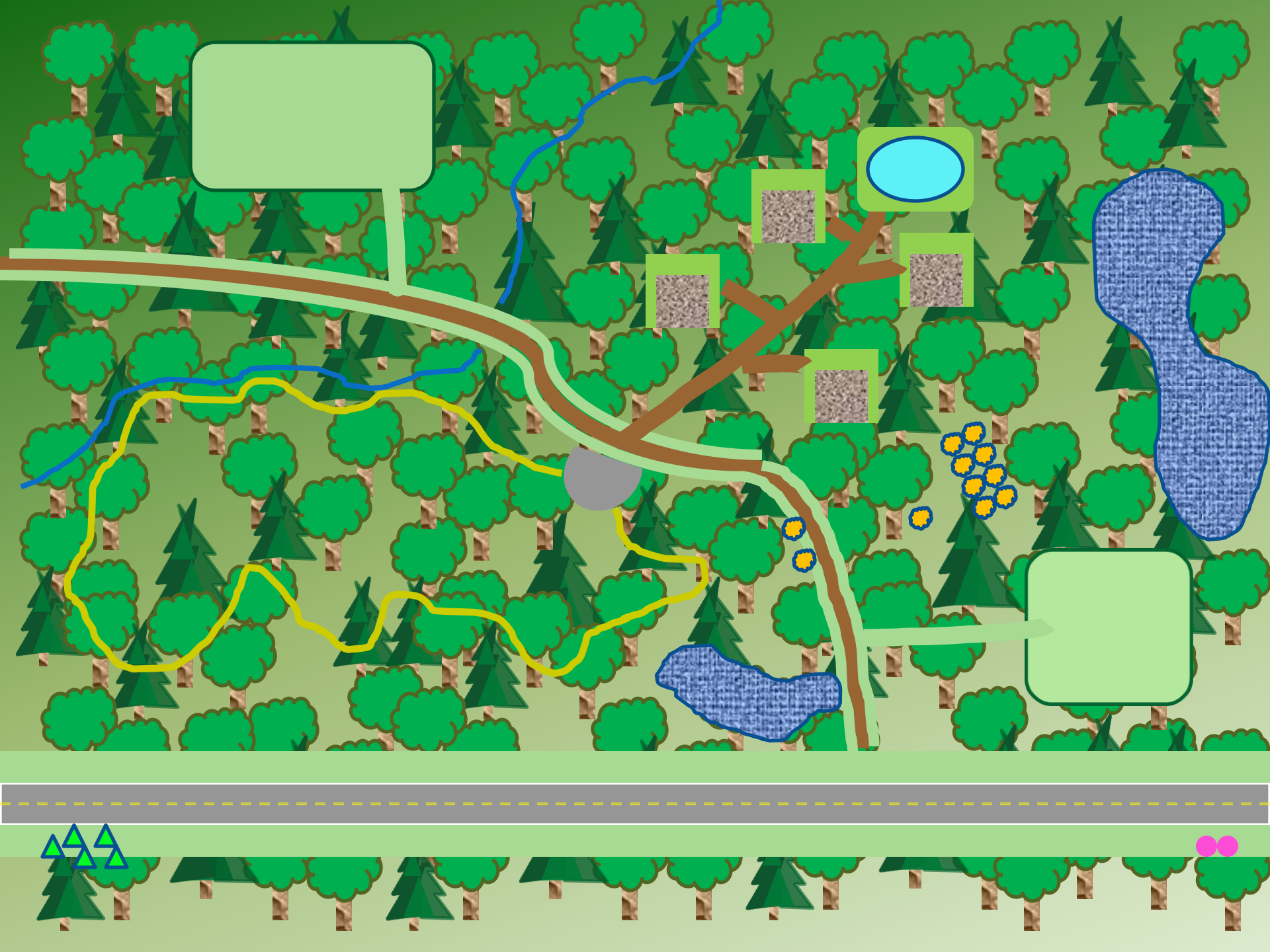
Mile-a-minute

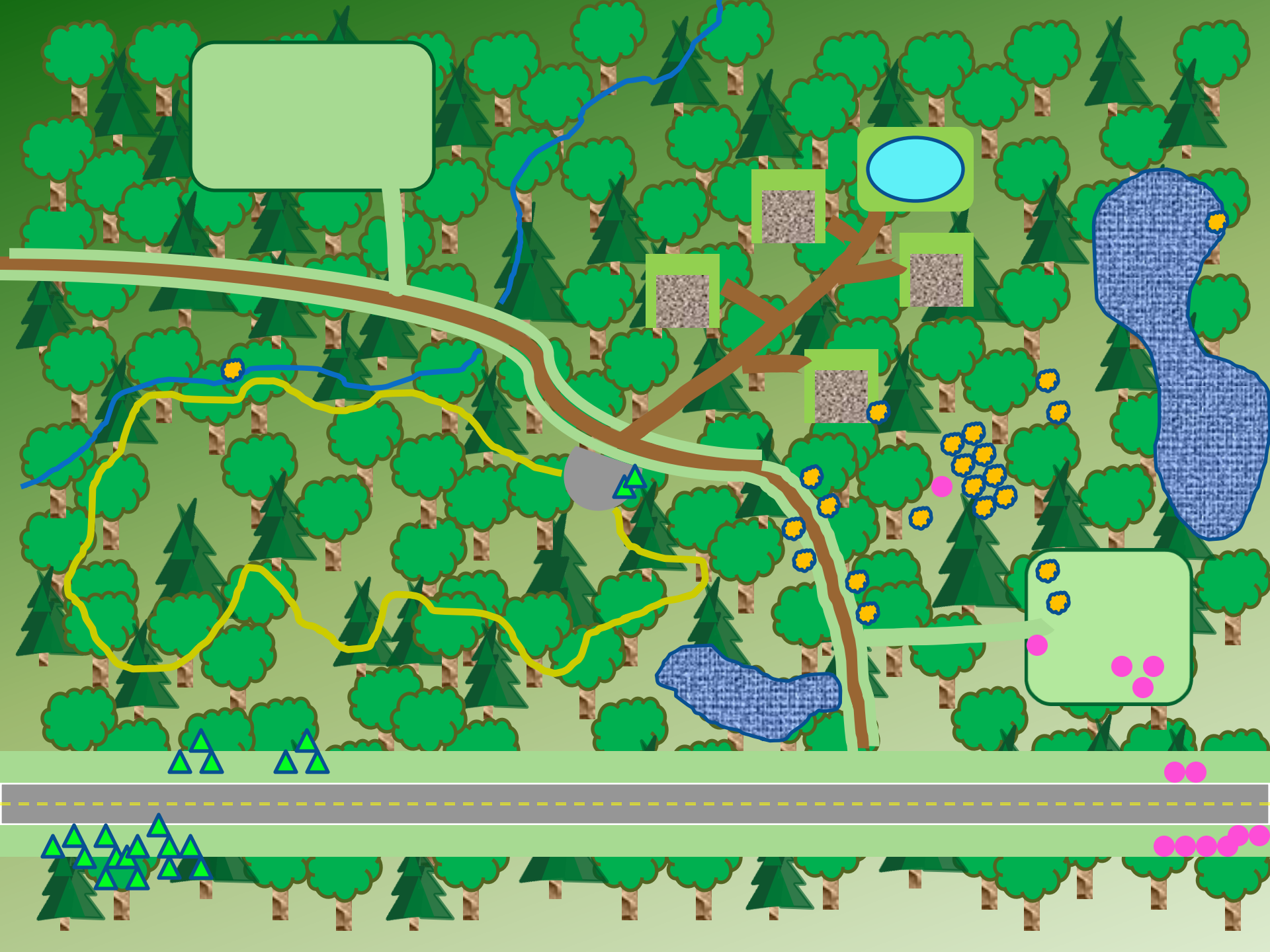
Amur honeysuckle

Japanese angelica tree

Japanese barberry







Invasive Prevention Strategies

Watch fill material!

Check sources of erosion materials, gravel, soil, etc.

Don't spread infestations!

Inspect sites first, know where invasives occur.

Pre-treat heavily infested areas with herbicide.

Schedule work with same equipment to start in least infested areas to most infested areas.

Clean equipment that was in heavily infested areas – <u>know where equipment has been</u>.

Bureau of Forestry Invasive Plant Monitoring

Pad Edge Walkabouts
Roadside Vegetation Sampling
Listed Plant Species Monitoring
ROW Vegetation Assessments
Loyalsock Vegetation Inventory

Early Detection Rapid Response
ROW Stream Crossings
ROW Census
Permanent Wellpad Veg Sampling
Loyalsock Invasives Surveys

Invasive Plant Monitoring – Pad Walkabouts

2012 & 2013: Pad Edges

Only 31 pads out of 136 did not have invasive species present (23%).

Of those 31 pads, 17 had invasives on access roads.

The average number of invasive species was 2 per pad.

Highest number of invasives was 12 (Sproul)

48 pads had an above average number of species.

Species	Number of Well Pads	Average Population Size
Centaurea stoebe (Spotted knapweed)	44	125
Cirsium arvense (Canada thistle)	40	62
Cirsium vulgare (Bull-thistle)	36	12
Securigera varia (Crown-vetch)	31	109
Phalaris australis (Reed canary-grass)	30	127
Microstegium vimineum (Japanese stiltgrass)	25	178
Berberis thunbergii (Japanese barberry)	9	24
Rosa multiflora (Multiflora rose)	9	23
Lonicera morrowii (Morrow's honeysuckle)	7	19
Elaeagnus umbellata (Autumn olive)	7	12
Persicaria longiseta (Bristled knotweed)	5	25
Alliaria petiolala (Garlic-mustard)	5	5
Phragmites australis ssp. australis (Common reed)	3	26
Fallopia japonica (Japanese knotweed)	3	3
Centaurea jacea (Brown knapweed)	2	202

Invasive Plant Monitoring – Pad Walkabouts

2012 & 2013: Access Roads

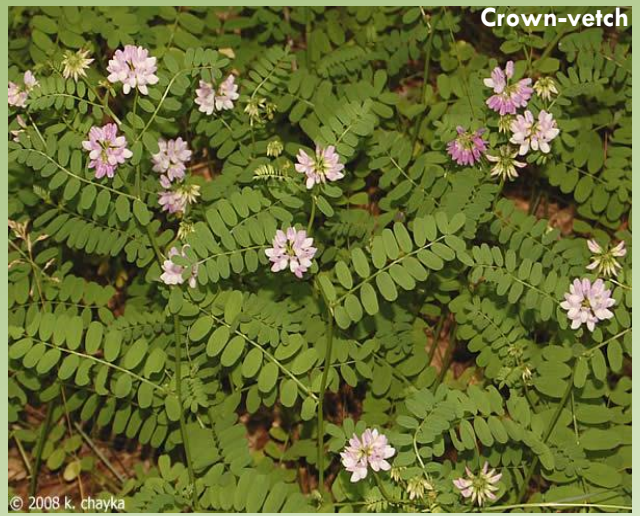
The average number of invasives species was 2.5 per access road.

Highest number of invasives was 8 (Tiadaghton)

51 access roads had an above average number of species.

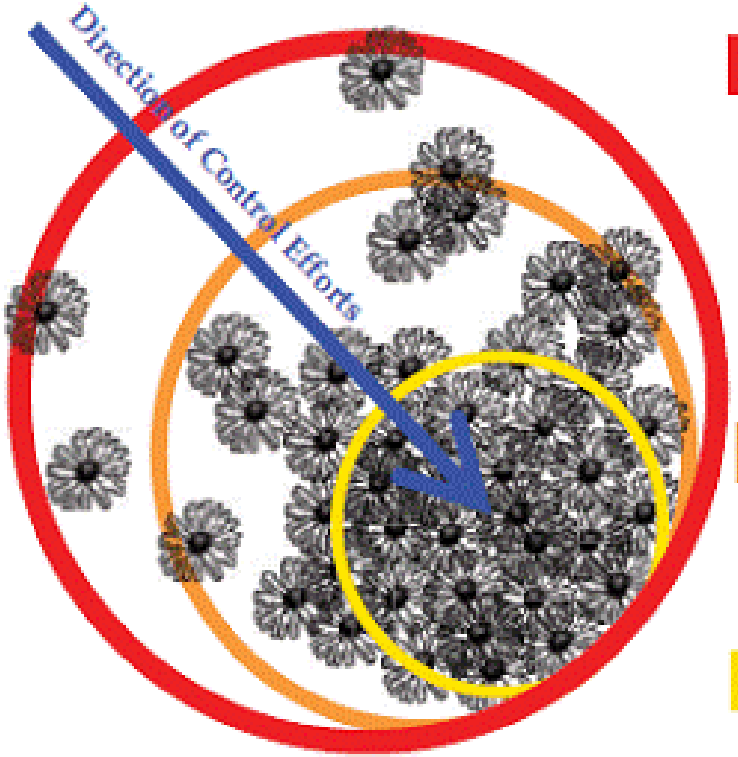
Species	Number of Access Roads	Average Population Size
Microstegium vimineum (Japanese stiltgrass)	38	854
Cirsium vulgare (Bull-thistle)	37	37
Securigera varia (Crown-vetch)	32	528
Phalaris australis (Reed canary-grass)	30	138
Centaurea stoebe (Spotted knapweed)	29	349
Rosa multiflora (Multiflora rose)	28	23
Elaeagnus umbellata (Autumn olive)	26	32
Cirsium arvense (Canada thistle)	24	135
Berberis thunbergii (Japanese barberry)	15	32
Lonicera morrowii (Morrow's honeysuckle)	8	36
Persicaria longiseta (Bristled knotweed)	4	154
Centaurea jacea (Brown knapweed)	3	38

Invasive Plant Monitoring – Pad Walkabouts



Prioritizing Invasive Species Control

Prioritizing Control Efforts for a Single Species by Density of Infestation



Outliers – Highest priority

- Lowest density of infestation
- Goal = eliminate small, isolated infestations
- Prevent the reproduction and survival of outliers
- Monitor annually beyond the known infestation for new outliers
- Lowest level of commitment, resources and effort needed

Advancing Front

- Goal = control the advancing front and perimeter of core infestations
- Prevent the expansion of the core infestation

Core – Lower priority

- Highest density of infestation
- Goal = suppress the interior of core infestations
- Highest level of commitment, resources and effort needed

Note: Effective control may require the use of multiple control methods. Control efforts must be followed up by monitoring for new plants, regrowth, and flowering, generally within the same growing season. Monitoring should be done annually.

Adapted from work by Fred Clark, Clark Forestry, Inc. and Wisconsin DNR-Urban Forestry

Early Detection Rapid Response (EDRR)

Target new invasions/populations <u>before</u> they become a well-established.

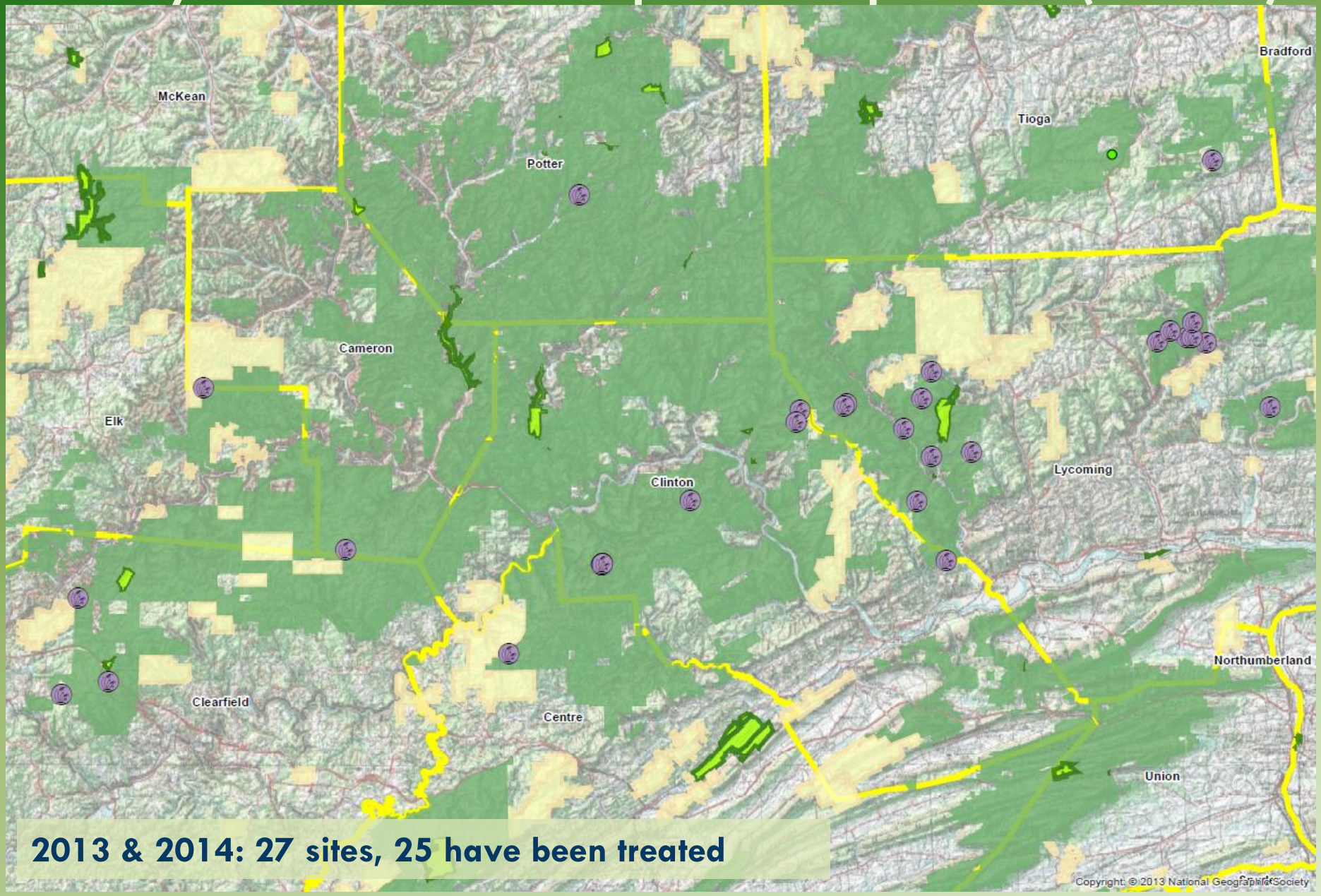
Allows for a very quick survey (less than 5 minutes) – but immediate treatment or removal.

Requires tracking sites for follow-up treatment or monitoring

Start with <u>small target list</u> (8-10 species)

Focuses efforts to species that are just appearing in and area or have yet to arrive.

Early Detection Rapid Response (EDRR)



2013 & 2014: 27 sites, 25 have been treated

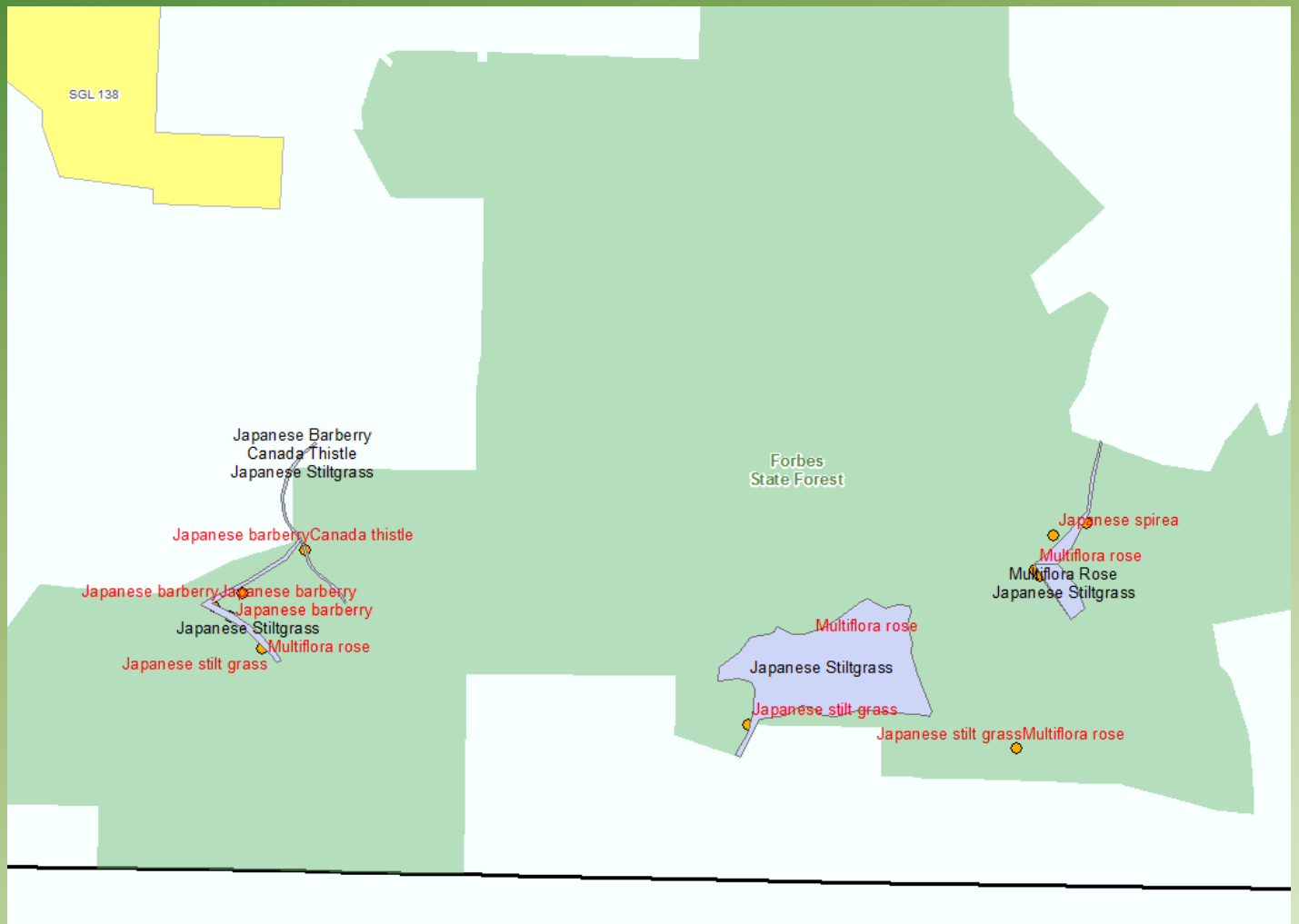
Early Detection Rapid Response (EDRR)

District	Species	Closest Road /Location	Population Size	Treated?
Moshannon	**Japanese knotweed**	**US Rt 322**	**25**	**Yes**
	Phragmites	Bark Camp Road	100+	No
	Phragmites	COP 323 Pad 2 Impoundment	25	Yes
	Phragmites	Quehanna Highway	100	Yes
Sproul	**Glossy buckthorn**	**Tract 285 Compressor & ROW**	**100+**	**Yes**
	Phragmites	Tract 285 Pad C	5	Yes
	Phragmites	Jews Run Rd / Dominion ROW	100+	No
	Poison-hemlock	Jews Run Rd / Dominion ROW	8	No
	Japanese knotweed	Tract 706, Rt 144	3	No
	Japanese knotweed	Tract 678 Pad B	1	Yes
Tiadaghton	Goat's rue	Huntley Road, Tract 293 ROW	1	Yes
	Phragmites	Tract 289 Pad D	25	Yes
	Phragmites	**Tract 289, Pipeline & Lebo Road**	**25**	**Yes**
	Phragmites	**Tract 322, Bark Cabin Road**	**5**	**Yes**
	Phragmites	**T 356, Moore Road**	**25**	**Yes**
	Japanese angelica tree	Route 414, Pine Creek Rail Trail	100+	Yes
	Japanese knotweed	**Tract 685 Compressor**	**5**	**Yes**
	Japanese knotweed	Tract 728 Pad D	5	Yes
	Tree-of-heaven	**Tract 322 Pad A**	**5**	**Yes**
Susquehannock	Goat's rue	Horton Run Colony Road	25	Yes
Loyalsock	Goat's rue	Chapman Road, Tract 724	25	Yes
	Mile-a-minute	**T100 Compressor**	**100+**	**Yes**
	Mile-a-minute	**T100, Kenney Ridge ROW**	**100+**	**Yes**
	Tree-of-heaven	Bodine Mtn Road, Tract 100	1	Yes
	Tree-of-heaven	Hagermans Run Road, Tract 100	1	Yes
	Tree-of-heaven	**Hefner Hollow Trail**	**1**	**Yes**
	Tree-of-heaven	**Bodine Mtn Road**	**2**	**Yes**

NO
SMOKING

Statewide Invasive Plant Tracking

-Examples of points and polygons that may be *quickly* entered based on field observations



Invasive Management Strategies

Control

Managing large populations

"Leveling the playing field"

Providing opportunities for other vegetation or regeneration

Slowing/eliminating the spread of a species into a sensitive area

Careful monitoring and re-treating

Eradication

Removing small populations

Completely shifting plant composition

One to three year treatment programs

Carefully surveying a landscape and systematically removing novel infestations

Difficult to achieve

Invasive Management Strategies

Control

Eradication

Dependent on a multitude of factors:

Species-specific threat

Size of infestation

Management goals

Novelty of species

Time

Manpower

Funding

Equipment

Responsibility to adjacent lands

Condition of adjacent lands

Invasive Plant Management: ’08 & ‘10 Lease Exhibit

4.1 Lessee shall make provisions to monitor for invasive species within the area(s) disturbed by the construction activity for a period of five (5) years following construction or until invasive species are not observed on-site for two consecutive years, whichever is longer.

4.2 Lessee shall perform an annual survey for the presence of invasive species within the construction area, as described in 4.1 above, following major construction. The annual survey should follow the same methods as the pre-construction survey method described in Section 1. The only exception to the method described in Section 1 is the grid cell boundaries only need to be checked occasionally with the GPS to ensure that monitoring alignment is consistent with the original inventory alignment.

Invasive Plant Management: '08 & '10 Lease Exhibit

3. Management

3.1 Management and control of established invasive plant populations shall be planned on a species by species basis to determine the best method of control. Lessee and its consultant shall submit a "Management and Control Plan" to District Forester no fewer than three (3) months after the conclusion of all construction activity.

3.2 Lessee shall include a post-construction invasive survey report with the same survey parameters as described in Section 1 above, in the Management and Control Plan. The District Forester and Ecological Services Section will assist Lessee in the development of appropriate management methods by species and/or invasive occurrence.

3.3 Post-construction invasive species surveys along access roads shall be limited to areas where gravel was placed or the existing road was widened for Lessee use. After a period of two growing seasons, any new invasive populations will be assumed to be the result of sources other than the Lessee's construction materials and equipment. Control and monitoring of invasive species found along access roads within two growing seasons post-construction will continue until populations are eradicated.

Invasive Plant Management: Lessee Monitoring Reports

INVASIVE SPECIES REPORT
DCNR TRACT 587
ALL WELL PADS, ACCESS ROADS, & PIPELINES
Ward Township
Tioga County, PA

February 2014

Botanical Survey Report for Invasive Plants

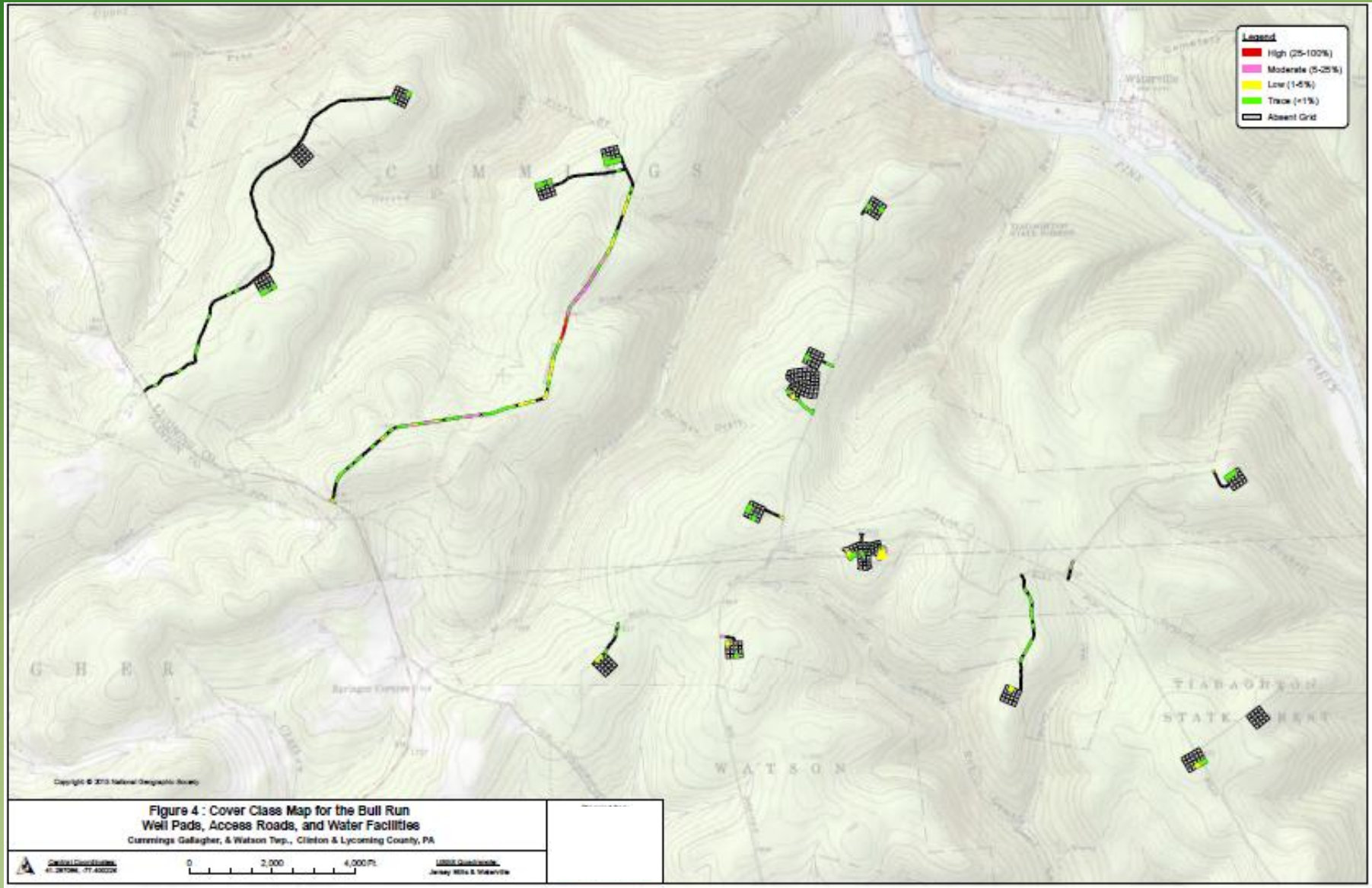
DCNR Phase IV Pipeline

Invasive/Watch List Species Survey Report for the Grugan Well Pads, Access Roads, and Water Facilities (Tiadaghton Forest)

McHenry Township
Lycoming County, PA

February 2014

Invasive Plant Management: Operator Monitoring Reports



Invasive Plant Management: Operator Monitoring Reports

Bull Run Well Pads (Tiadaghton Forest) Invasive/Watch List Results 2013

Project Name	Grid #	Species	Watch List (Yes/No)	Cover Class Trace (<1%) Low (1-5%) Moderate (5-25%) High (25-100%)	Growth Stage	Stratum	Dominant Species	Latitude (DD)	Longitude (DD)	Date
685_A	14	Microstegium vimineum	N	Trace (<1%)	Bolt	Herb	Unspecified	41.292784	-77.389716	8/21/2013
685_A	14	Persicaria longiseta	N	Trace (<1%)	Flower	Herb	Unspecified	41.292784	-77.389716	8/21/2013
685_B	8	Holcus lanatus	Y	Trace (<1%)	Mature	Herb	Unspecified	41.302748	-77.384244	8/21/2013
685_B	12	Persicaria longiseta	N	Trace (<1%)	Flower	Herb	Unspecified	41.302526	-77.383132	8/21/2013
685_C	5	Schedonorus arundinaceus	Y	Trace (<1%)	Mature	Herb	Unspecified	41.282177	-77.394442	8/21/2013
685_C	14	Schedonorus arundinaceus	Y	Trace (<1%)	Mature	Herb	Unspecified	41.282658	-77.394947	8/21/2013
685_C	15	Schedonorus arundinaceus	Y	Trace (<1%)	Mature	Herb	Unspecified	41.282906	-77.394792	8/21/2013
728_A	4	Cirsium vulgare	N	Trace (<1%)	Flower	Herb	Unspecified	41.265957	-77.355000	8/21/2013
728_A	4	Microstegium vimineum	N	Trace (<1%)	Bolt	Herb	Unspecified	41.265957	-77.355000	8/21/2013
728_A	5	Centaurea stoebe	N	Trace (<1%)	Flower	Herb	Unspecified	41.265822	-77.355317	8/21/2013
728_A	12	Microstegium vimineum	N	Low (1-5%)	Bolt	Herb	Unspecified	41.265687	-77.355634	8/21/2013
728_B	3	Persicaria longiseta	N	Low (1-5%)	Flower	Herb	Unspecified	41.270800	-77.371934	8/21/2013
728_D	4	Holcus lanatus	Y	Trace (<1%)	Mature	Herb	Unspecified	41.284726	-77.352899	8/21/2013
728_D	5	Holcus lanatus	Y	Trace (<1%)	Mature	Herb	Unspecified	41.284878	-77.352596	8/21/2013
728_D	12	Holcus lanatus	Y	Trace (<1%)	Mature	Herb	Unspecified	41.285030	-77.352293	8/21/2013
728_G	4	Schedonorus arundinaceus	Y	Low (1-5%)	Mature	Herb	Unspecified	41.273878	-77.396783	8/21/2013
728_G	15	Persicaria longiseta	N	Trace (<1%)	Flower	Herb	Unspecified	41.273076	-77.396015	8/21/2013
731_A	4	Holcus lanatus	Y	Trace (<1%)	Seed Set	Herb	Unspecified	41.297197	-77.437436	8/21/2013
731_A	5	Holcus lanatus	Y	Trace (<1%)	Seed Set	Herb	Unspecified	41.297334	-77.437120	8/21/2013
731_A	13	Persicaria longiseta	N	Trace (<1%)	Flower	Herb	Unspecified	41.297606	-77.436488	8/21/2013
731_C	4	Bromus tectorum	N	Trace (<1%)	Mature	Herb	Unspecified	41.309928	-77.426011	8/21/2013
731_C	16	Cirsium vulgare	N	Trace (<1%)	Flower	Herb	Unspecified	41.310325	-77.424559	8/21/2013
731_C	16	Persicaria longiseta	N	Trace (<1%)	Flower	Herb	Unspecified	41.310325	-77.424559	8/21/2013
731_D	13	Microstegium vimineum	N	Trace (<1%)	Bolt	Herb	Unspecified	41.304214	-77.413284	8/21/2013
731_D	14	Cirsium arvense	N	Trace (<1%)	Mature	Herb	Unspecified	41.304299	-77.412938	8/21/2013
731_D	16	Cirsium arvense	N	Trace (<1%)	Mature	Herb	Unspecified	41.304471	-77.412247	8/21/2013
731_E	1	Holcus lanatus	Y	Trace (<1%)	Seed Set	Herb	Unspecified	41.305887	-77.406160	8/21/2013
731_E	2	Holcus lanatus	Y	Trace (<1%)	Seed Set	Herb	Unspecified	41.305818	-77.406512	8/21/2013
731_E	3	Holcus lanatus	Y	Trace (<1%)	Seed Set	Herb	Unspecified	41.305749	-77.406865	8/21/2013
731_E	4	Holcus lanatus	Y	Trace (<1%)	Seed Set	Herb	Unspecified	41.305680	-77.407217	8/21/2013
731_E	5	Holcus lanatus	Y	Trace (<1%)	Seed Set	Herb	Unspecified	41.305945	-77.407309	8/21/2013

Invasive Plant Management: Operator Monitoring Report Response

I. Field Districts receive survey reports

II. Reports forwarded to Ecological Services for review

III. Botanist produces 1st draft of treatment requirements

IV. Eco, Minerals and Foresters meet to discuss findings

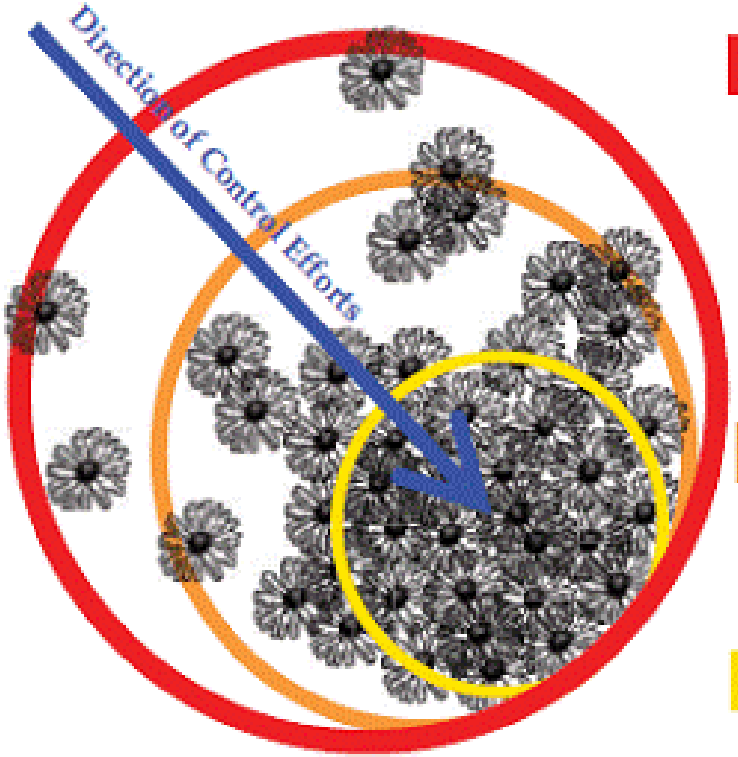
V. Final treatment requirements are prepared

VI. Meeting with operator, surveyor, district, Ecological Services, Minerals

VII. Treatment:: Gas Foresters follow-up with operator/contractor as necessary

Prioritizing Invasive Species Control

Prioritizing Control Efforts for a Single Species by Density of Infestation



Outliers – Highest priority

- Lowest density of infestation
- Goal = eliminate small, isolated infestations
- Prevent the reproduction and survival of outliers
- Monitor annually beyond the known infestation for new outliers
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Advancing Front

- Goal = control the advancing front and perimeter of core infestations
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Note: Effective control may require the use of multiple control methods. Control efforts must be followed up by monitoring for new plants, regrowth, and flowering, generally within the same growing season. Monitoring should be done annually.

Adapted from work by Fred Clark, Clark Forestry, Inc. and Wisconsin DNR-Urban Forestry

Landscape Prioritization and Treatment of Invasive Plants in Development Areas

Landscape-level Management

Managing infestations of invasive plants requires diligence and effective planning, as well as an understanding of the plants-both where they currently occur and how they are spreading across a landscape. Each invasive plant species recognized by the Bureau of Forestry has different modes of spread and preferred habitat, and as such, each infestation and situation can be unique and require an individualized treatment strategy. The Bureau of Forestry is committed to managing invasive plant species across all state forest lands, which requires adaptive management and landscape-level prioritization based on efficiency, availability of resources, and perceived threat to ecosystem health. At the landscape level, rarely is it as simple as adopting a strategy of eradicating all known invasive plant populations. There are many different methods available to land managers to prioritize invasive species management across their state forest district. Many of these methods require an understanding of the current levels of infestations across a given landscape. It is recommended that prior to developing a prioritization strategy, thorough invasive plant surveys are conducted and the data is compiled spatially. The goals of the Bureau of Forestry's invasive plant management program are to: 1) control and eradicate novel and high threat invasive plant species populations, and 2) limit the spread of additional invasive species that threaten forest and wetland ecosystems or forest management activities.

Most landscape level strategies used by Bureau for establishing invasive plant treatment priorities consider (but are not limited to) the following factors:

1. **Threats to forest ecosystems** – As forest managers, the Bureau's primary role is to promote the health of forest ecosystems and native plant species. Some invasive species pose a greater threat than others to forest health by easily out-competing native herbaceous plant species for nutrients and growing space, as well as inhibiting desired tree regeneration in forest stands. Threats to state-listed species populations or Wild Plant Sanctuaries are also considered.
2. **Density and scale of infestation** – Small or newly established populations of any invasive are easier to treat than dense, large-scale infestations. Treating these small populations provides a higher probability of success and limits the spread of species across a landscape, confining species to "core" areas of infestation.
3. **Novelty of species on the landscape** – Species that are new or novel to a particular landscape are often given a higher priority than established invasive species. As with small populations, the probability of eradicating a particular species on a given landscape is higher with novel, populations. This is often accomplished on state forest lands using Early Detection and Rapid Response strategies.
4. **Areas targeted for forest management** – Forest managers treat well-established invasives in areas that are targeted for forest management activities such as timber harvesting and habitat restoration or recreational activities like trails and parking lots. This helps control the spread of established populations into newly disturbed areas or areas with high visitation by the public.
5. **Resources available for treatment** – After ecological and management decisions are made using the points described above, forest managers consider the amount of time, manpower, and funds that are available for invasive species management and allocate their resources accordingly.

Invasive Plant Management: Prioritizing Invasive Species Control

Potential threat to forest and wetland ecosystems

Density and scale of infestation

Novelty of species on the landscape

Areas targeted for forest management

Resources available for treatment

Chinese lespedeza (*Lespedeza cuneata*)

Invasive Plant Management: Selecting Species for Treatment

Following review of post-construction surveys, invasive plant populations that were required to be treated:

1) High priority species that are new or novel to the State Forests and/or recognized as posing the highest threat to all native species and ecosystems.

2) Additional invasive species that are known to specifically threaten forest or wetland ecosystems.

3) Species or populations that threaten existing or proposed forest management activities in the immediate vicinity of the occurrence.

Invasive Plant Management: Providing Treatment Requirements

Bull Run Pads

Treatment is required for the following populations:

Population	Number of Cells	Location / Cell(s)
Musk thistle	1	731ABCF-27
Japanese barberry	9	731D-14, 731D-51, 731D-63, 731D-85, 731D-86, 731D-88, 731D-93, 731D-96, 731D-112
Reed canary grass	4	728-12, 728-14, 728-15, 728-35

- Musk thistle is rarely detected growing on well pad edges by the Bureau's monitoring staff. Since this is may be a novel population in the Tiadaghton, it is a target for removal. Musk thistle was only found in one cell occupying <1% total cover.

- Japanese barberry can quickly colonize the forest understory, inhibiting the growth of native vegetation and tree regeneration. Within this section, Japanese barberry was found in nine cells, in each case, the populations occupied <1% total cover.

- Reed canary grass has been observed spreading quickly on disturbed sites on state forest lands and into adjacent forest habitats. Within this section, reed canary grass was found in four cells, each population occupying <1% total cover.

Invasive Plant Management: Providing Treatment Requirements

Treatment Guidance

The Bureau of Forestry **requires** the following species-specific treatment methods. Deviations from these treatments or chemicals shall not be undertaken unless with prior consent of the Bureau Ecological Services Section.

Reed Canary Grass

If found in "trace" populations, hand pull or dig out the plants. When attempting to remove reed canary grass, it is essential to remove the entire rhizome carefully to ensure no re-sprouting occurs.

Larger populations must be cut or mowed, then allowed to re-sprout prior to herbicide treatment, thus depleting the rhizome reserves. Herbicides must be applied following re-sprouting, but prior to stems reaching 12 inches in height. Gyphosate (a broad spectrum herbicide) can be applied if non-target species are absent (glyphosate will impact all vegetation present) or Poast Plus (sethoxydim), a grass specific herbicide that controls annual and perennial grasses, can be used to reduce impacts to non-target herbaceous vegetation in the vicinity of reed canary grass.

Invasive Plant Management Collaboration: Increasing Training Opportunities

2015: High-priority species identification for foresters

Extend training to targets Operator staff
- Smaller number of targeted species

Field staff training materials could be shared with Operators

Work with consultants to ensure appropriate knowledge of species and treatments

Collaborate with operators on best approach to train their field staff

Invasive Plant Management Collaboration: Proposed Training Workshop

2 day Workshop – late June/early July

Three portions:

Classroom – Basic Instruction
Field Instruction – Species ID
Field Practicum – Survey known sites
Treatment Basics

Provide Identification Guides to participants

Not just what to look for – HOW to look

Provide same training opportunities to foresters and operator field staff

Invasive Plant Management Collaboration: Sharing Prevention & Monitoring Responsibilities

Work with Operators to establish practical equipment washing protocols

Track sources of fill and placement in State Forests

Sharing Bureau monitoring data to predict future infestations

Share monitoring workload across development tracts

Collaborative EDRR Protocols – increase opportunity for detection

Invasive Plant Management Collaboration: Partnerships to Control and Eradicate

Share effective forest treatment protocols

Partnerships that improve restoration practices –

Better restoration = fewer invasives

Collaborative management planning in development tracts

Management planning in private land tracts

Share responsibility for tracking invasives across the landscape

Invasive Plant Management: Moving Forward

Gas Monitoring Team will continue to monitor infrastructure
2015 Priority: ROWs

NGAC comments for Invasive Provisions and Prioritization approach

Prepare more ID Guides

BOF can provide collaboration for effective treatment

Workshop for foresters & Operator staff

Questions?

Goats rue

Oriental bittersweet

Glossy buckthorn

Wineberry

Didymo

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Royal paulownia tree