



Forest Health Monitoring Update for Minute Man NHP: 2006 - 2018

The Story so Far...

The Northeast Temperate Network (NETN) has been monitoring forest health in Minute Man NHP for 12 years. Data collected over this period indicate that the park's forests are a reflection of a long-period of human use and influence. Many non-native and old field species dot the landscape, and deer impacts may be increasing.

Talkin' Bout Regeneration

Tree regeneration is representative of what the future forest may look like. NETN monitoring shows that regeneration varies across the park, low but stable increases in some areas and decreases in others the past 10 plus years (Map 1).

Healthy forests typically have tree seedlings and saplings of varying sizes, whereas forests with a lot of deer tend to have mostly tiny seedlings less than a foot tall. Over half of the park (about 60%) contains seedlings over a foot tall, and some saplings are also present (Map 2).

Oh Deer

Some forests, including those of several NETN parks, have so many deer that the understory no longer has deer-preferred plants (like sugar maple seedlings and many wildflowers) and is instead dominated by deer-resistant species (beech trees, ferns and many invasive species). NETN monitoring in 2018 showed moderate impacts from deer in the park, which is up from a low-impact rating during the 2014 forest crew visit. The eastern part of the park appears to be most impacted by deer (Map 3).

Today's Tiny Trees are Tomorrow's Forest

NETN forest crews keep track of whether seedlings and saplings in a forest are enough to replace the current canopy in the future, a measure called "stocking index" (Map 4). The more deer there are in an area, the more young trees are needed to accomplish this. Recent surveys show that overall, the forest is considered to be moderately to sufficiently stocked for areas with low deer impacts. If deer impacts continue to grow and reach consistently high levels however, only about 15% of the parks forest is sufficiently stocked

and 70% is severely understocked. The stocking index also has a slight downward trend over time.

Ashes, Ashes - They May All Fall Down

White ash is the most abundant tree species in the park's regeneration layer, followed by black cherry and white pine (Map 5). The major concern for white ash is the spread of the exotic invasive emerald ash borer beetle, which was detected nearby in Waltham, MA in 2017. It hasn't been found in the park yet but threatens long-term status for ash in the forest canopy.

Black cherry regeneration is interesting considering it currently only makes up a small part of the current canopy, though that may change if its dominance in the regeneration layer continues. Black

cherry are a very important native tree for a wide variety of wildlife.

Red maple, white pine, and black oak are the three most common trees of the canopy. They are also fairly easy to find in the regeneration layer and

are likely to continue to be important canopy trees into the future. Exotic and invasive tree species are also relatively easy to find in the regeneration layer and canopy. Norway maple is the seventh most common tree seedling overall. Norway maples can suppress native plant growth with their dense, shallow root systems and deep shade produced by their canopies. Exotic hawthorn and white mulberry are also present.

The fifth most common canopy tree is black locust. Black locust is an efficient nitrogen fixer that can both out-compete native species and make it easier for exotic species to invade a forest by changing the surrounding soil chemistry. Black locust is native to the Southeastern United States but is considered to be an aggressive invader in the Northeast. One good sign is that black locust is nearly absent in the regeneration layer. On the other hand, Norway maple is abundant in both the canopy and regeneration layer. Encouraging native tree regeneration, particularly species that grow to canopy height, and removing seed-bearing individuals of exotic trees will help encourage native forest cover, and thus support other native flora and wildlife, in the park.



Black cherry
leaves

Bottom Line:
Park Forests are Being
Impacted by Deer and
Invasive Species.





Glossy buckthorn is a commonly found and appears to be spreading across the park. NPS photo.

The Buckthorn are Coming!

The park's most common invasive species are shrubs and woody vines, and appear to be increasing over time (Maps 7 & 8). The most abundant invasive shrub is glossy buckthorn, which can be found across the park. Oriental bittersweet and multiflora rose are also spread out, but more sparsely than glossy buckthorn. Encounters with oriental bittersweet doubled over 8 years of monitoring, though frequency of other common invasive species, such as garlic mustard and purple loosestrife, has remained relatively stable.

Though most people don't realize it, earthworms that escape to the forest are considered to be invasive. Since at least the end of the most recent ice age, these slimy critters are not native to the northeast - having been scoured away by tons of ice. Along with overabundant deer and invasive plant species, they

have been linked to losses in native plant diversity when found in forested areas.

Earthworm presence is widespread across the park (Map 9), though areas near wetlands usually lack any sign of them. The aggressive "crazy snake-worm" which has been found by park staff in the past, was not detected by the NETN forest crew in 2018 (see the [NETN Species Spotlight article](#) on crazy snake-



worms for more on these slimy critters). This may only be because the timing of sampling was not ideal for distinguishing snake worms from the more common European earthworms, however.

Par for the Coarse

Coarse woody debris (CWD - large pieces of dead and downed wood on the forest floor) is an important component of a healthy forest ecosystem. NETN monitoring shows it has been increasing in the park over time (Maps 10 and 11). According to a recent study of temperate and boreal forest organisms dependent on dead wood, about a quarter of park forest meets the minimum requirements to sustain these species. CWD is increasing though and suggests that recent park efforts to retain and/or enhance CWD are working. CWD development is a naturally slow process and it will take time for the majority of park forest plots to meet CWD minimums. As long as the park retains dead wood as trees die, NETN expects things to continue to improve.

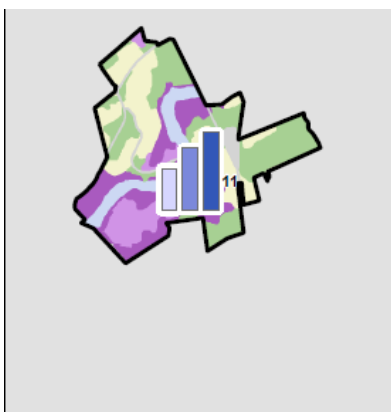
Monitoring Maps and More Detailed Information

A brief explanation of the following monitoring maps: the number next to the pie/bar charts is the NETN forest monitoring plot number. Each plot is monitored once every 4 years. Pie chart size relates to the overall abundance of vegetation per plot. Bar chart length represents density over time per plot. See NETN's Forest Health Monitoring webpage for access to the full monitoring summary. Also view or download other forest health related materials. <https://www.nps.gov/im/netn/forest-health.htm>



Forest Health Monitoring Maps for Minute Man NHP: 2006 to 2018

Regeneration by Cycle and Size Class



Legend

- Open Field
- Forested Land
- Open Wetland
- Forested Swamp
- Open Water
- Paved/ Developed Land
- Park Boundary

Map 1 Regeneration densities

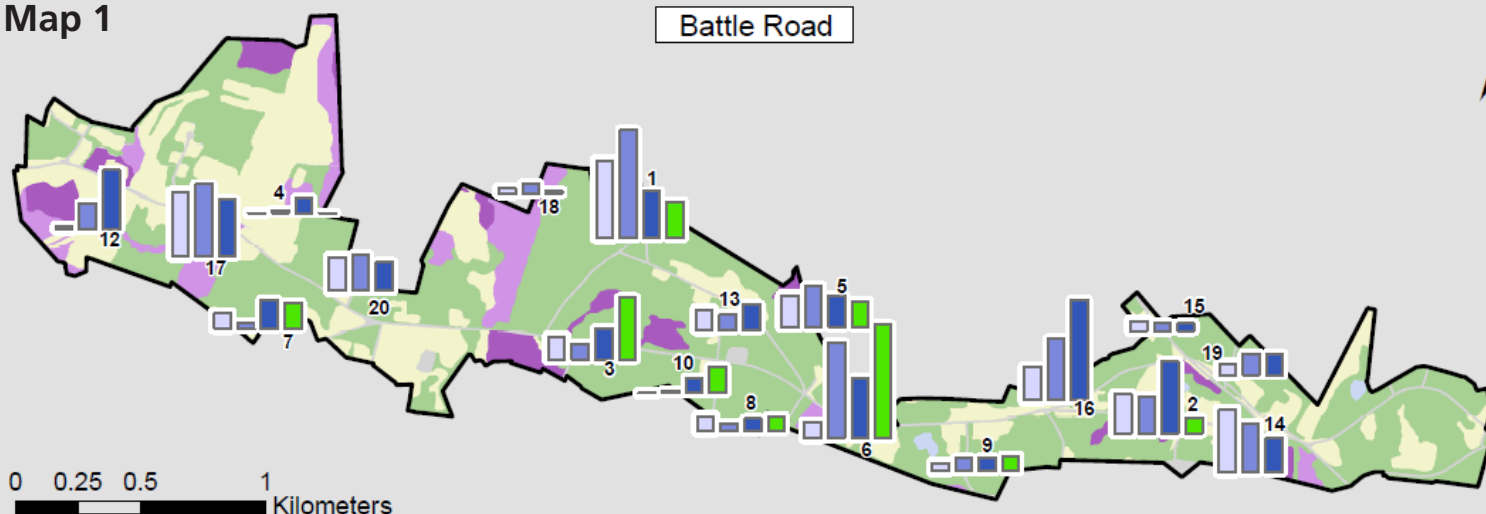
- Cycle 1: 2006 & 2008
- Cycle 2: 2010 & 2012
- Cycle 3: 2014 & 2016
- Cycle 4: 2018

Map 2 Regeneration densities

- ▲ No regeneration observed
- Seedlings 15 to 30 cm
- Seedlings 30 to 100 cm
- Seedlings 100 to 150 cm
- Seedlings >150 cm
- Saplings (≥ 1 cm & <10 cm DBH)

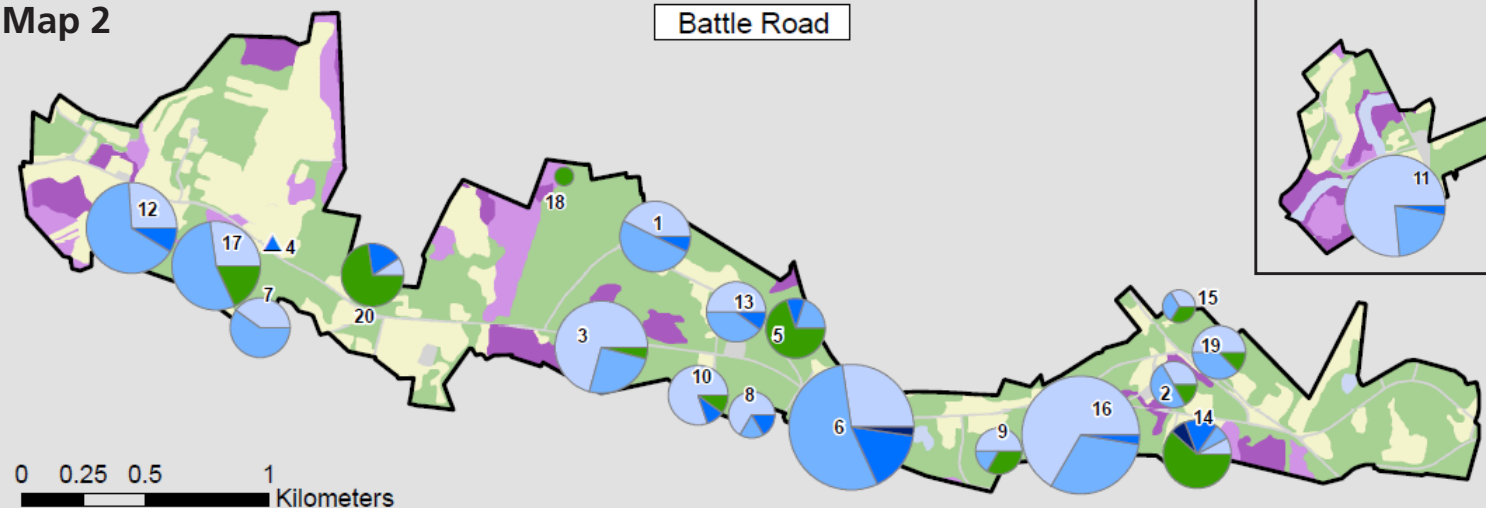
Map 1

Battle Road

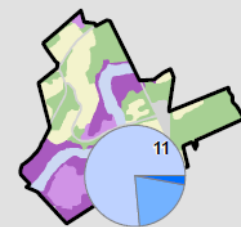


Map 2

Battle Road



North Bridge



Map 3 - Deer Browse Impacts

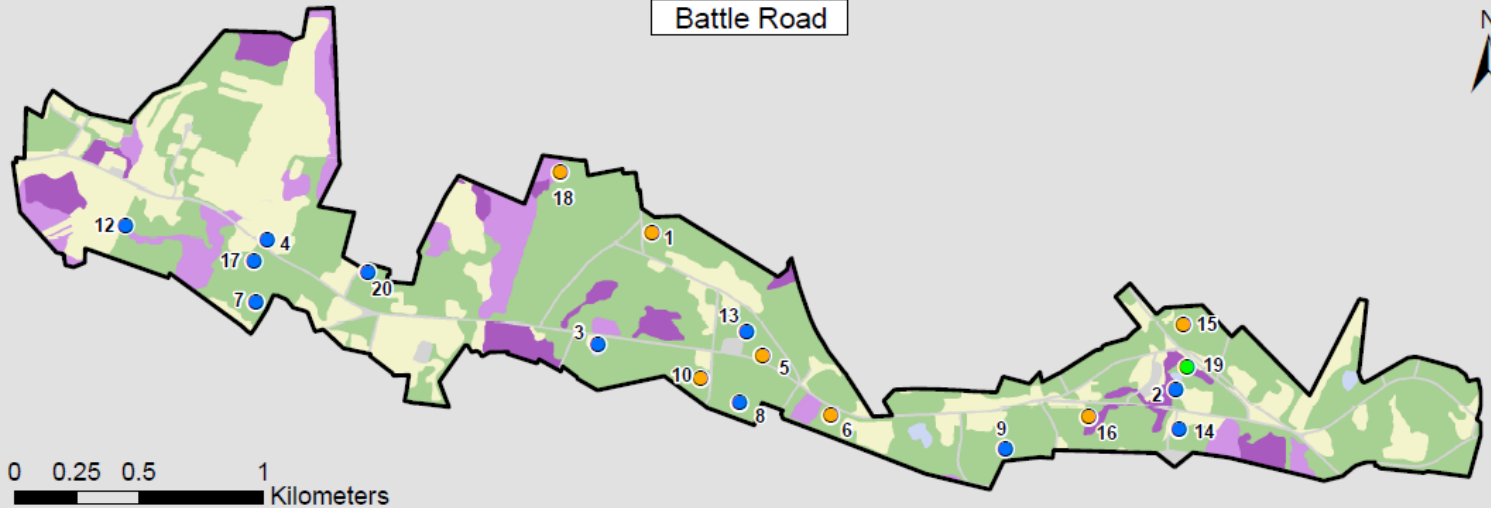
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Deer Browse Index

- 1) No Impact: found only in well-maintained deer exclosures.
- 2) Low Impact: deer-preferred (DP) species abundant and of varying heights.
- 3) Medium Impact: DP species present, but mostly < 30 cm tall. DP herbs present but stunted and flowering is uncommon.
- 4) High Impact: DP species are rare to absent. Non-preferred (NP) and browse-resilient vegetation (e.g. beech) limited in height by deer browse. DP herbs absent or severely stunted.
- 5) Very High Impact: DP regeneration absent. NP species also reduced by heavy browsing. Distinct deer browse line.

Battle Road



Map 4 - Regeneration Stocking Index

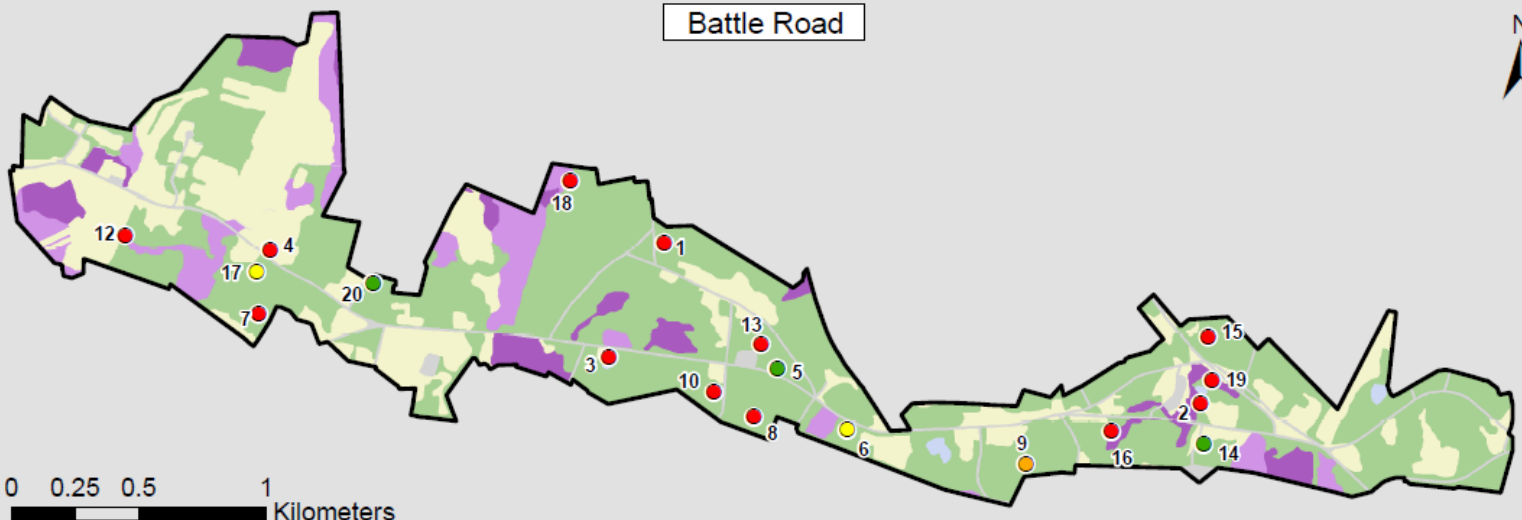
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Stocking Index Ranges

- < 25: Severely understocked. Regeneration is insufficient to replace the forest canopy.
- 25 to 50: Moderately stocked regeneration for areas with low deer impacts.
- 50 to 100: Sufficient regeneration to replace forest canopy in areas with low deer impacts.
- > 100: Sufficiently stocked with regeneration for areas with high deer impacts.

Battle Road



Map 5 - Regeneration Composition

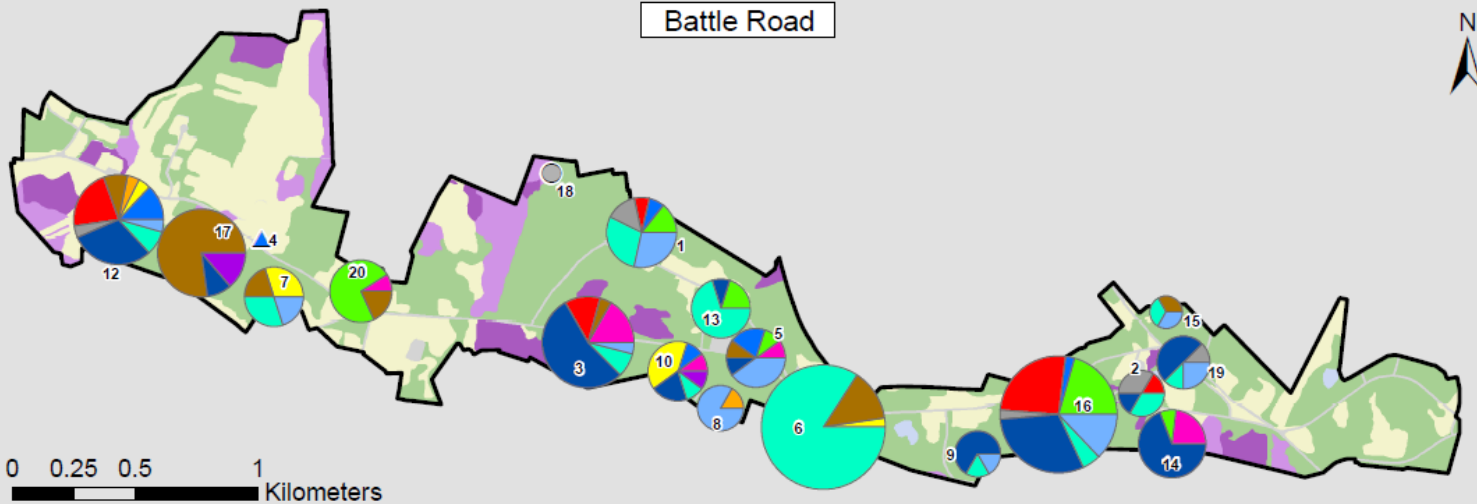
Legend

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- Park Boundary

▲ No regeneration observed

Species in Pie Charts

- | | |
|---|---|
| Acer platanoides (Norway maple) | Other exotic species |
| Acer spp. (Maple - Native) | Other native species |
| Betula spp. (Birch) | Pinus strobus (White pine) |
| Carya spp. (Hickory) | Prunus spp. (Cherry) |
| Fagus grandifolia (Beech) | Quercus spp. (Oak) |
| Fraxinus spp. (Ash) | Ulmus spp. (Elm) |



Map 6 - Canopy Tree Composition

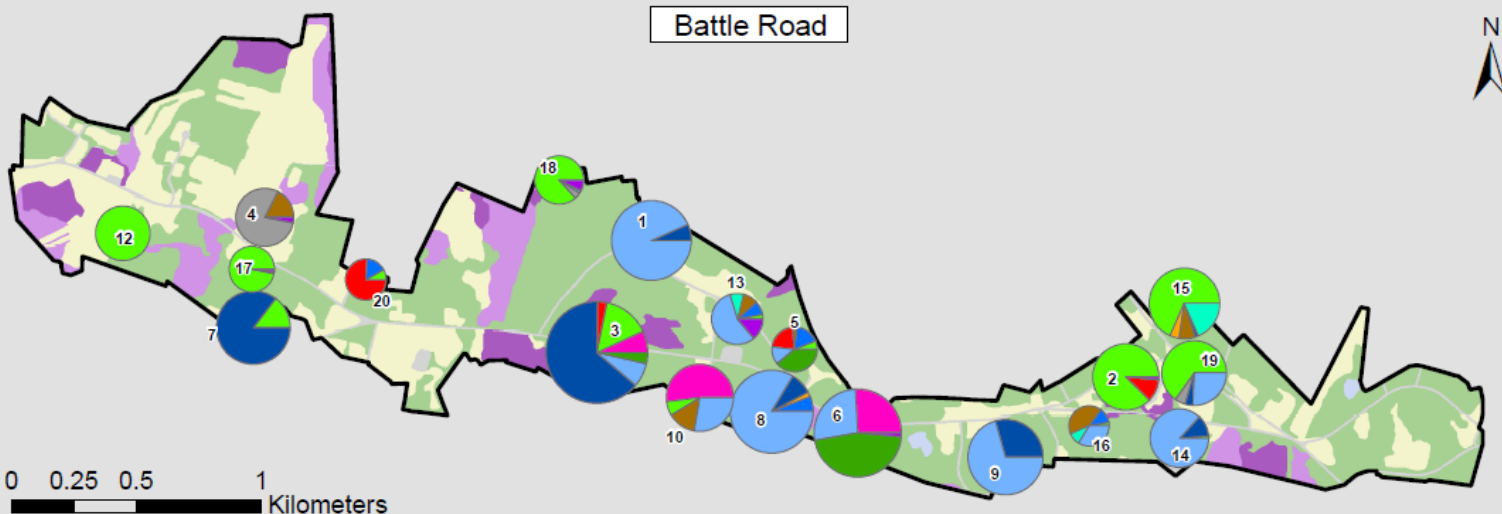
Legend

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| Betula spp. (Birch) | Prunus spp. (Cherry) |
| Carya spp. (Hickory) | Quercus spp. (Oak) |
| Fagus grandifolia (Beech) | Robinia pseudoacacia (Black locust) |
| Fraxinus spp. (Ash) | Ulmus spp. (Elm) |
| Other exotic species | |

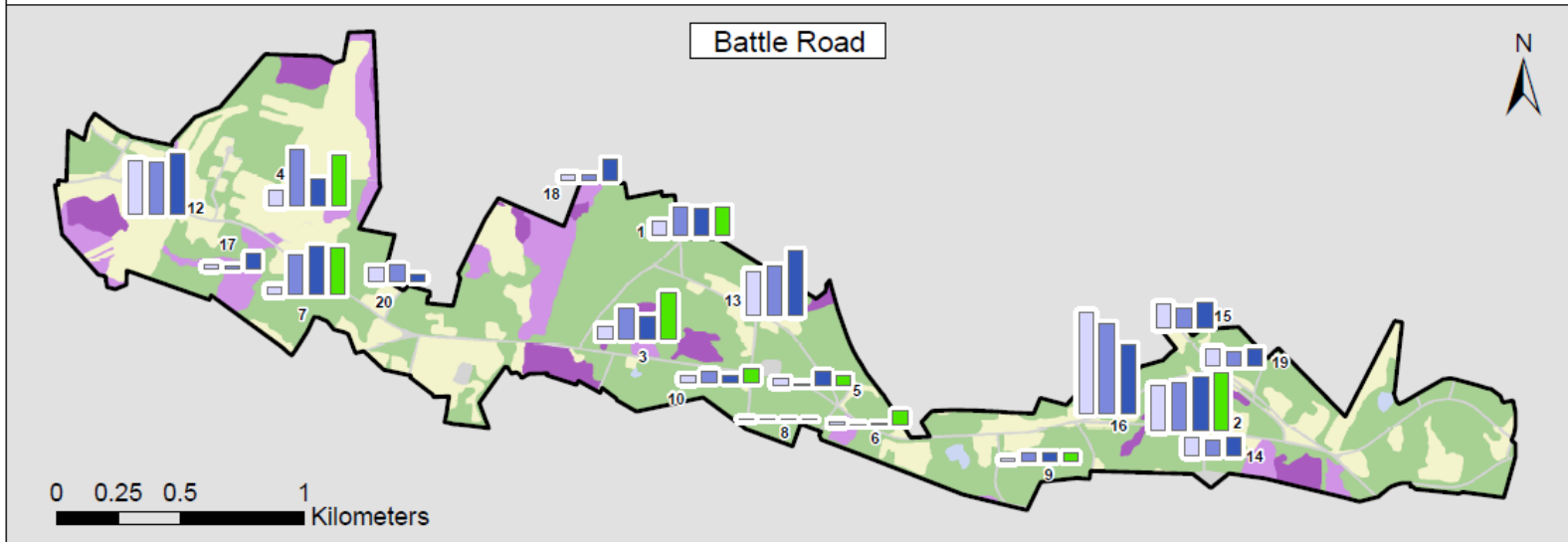
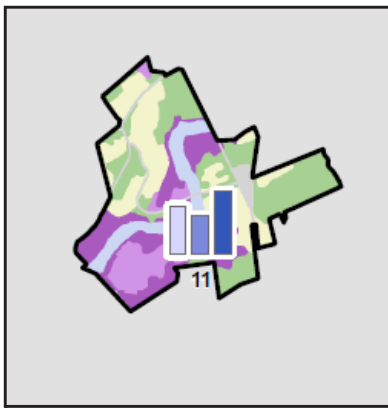
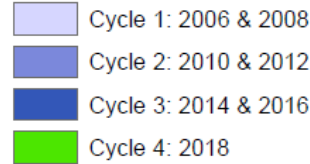


Map 7 - Invasive Shrub Cover

Legend



Average Quadrat % Cover

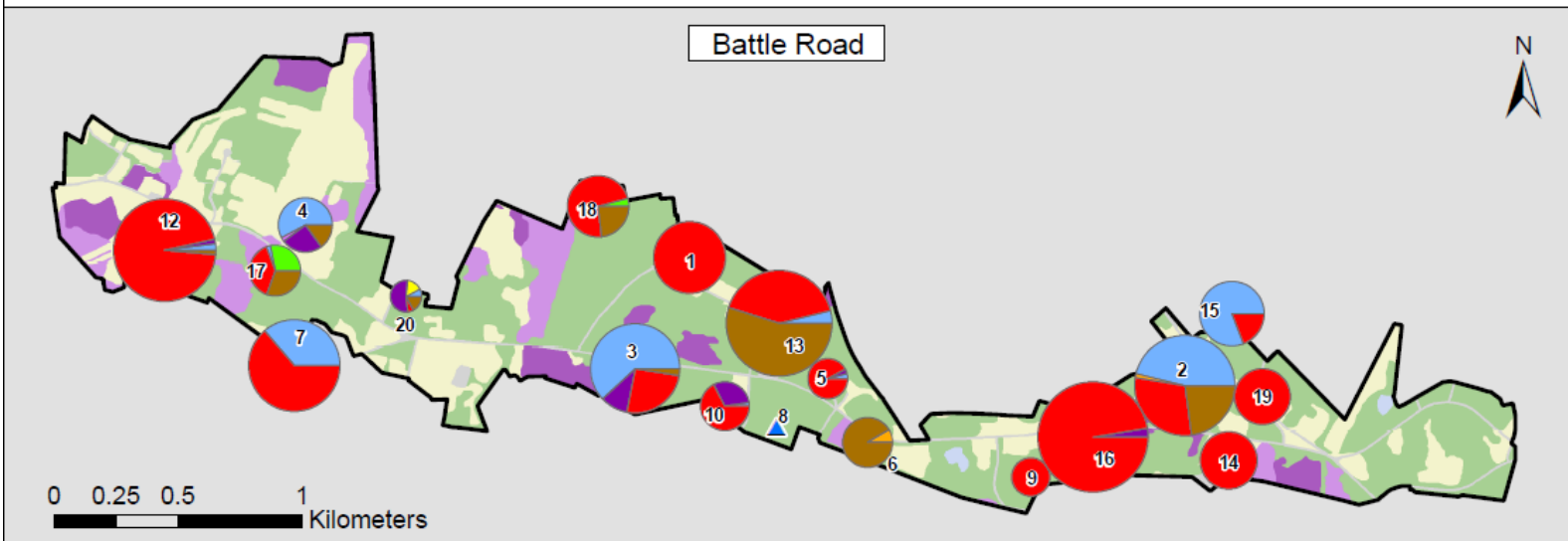
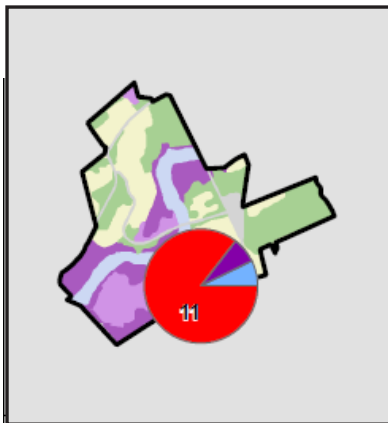


Map 8 - Invasive Shrub Species

Legend



Species in Pie Charts



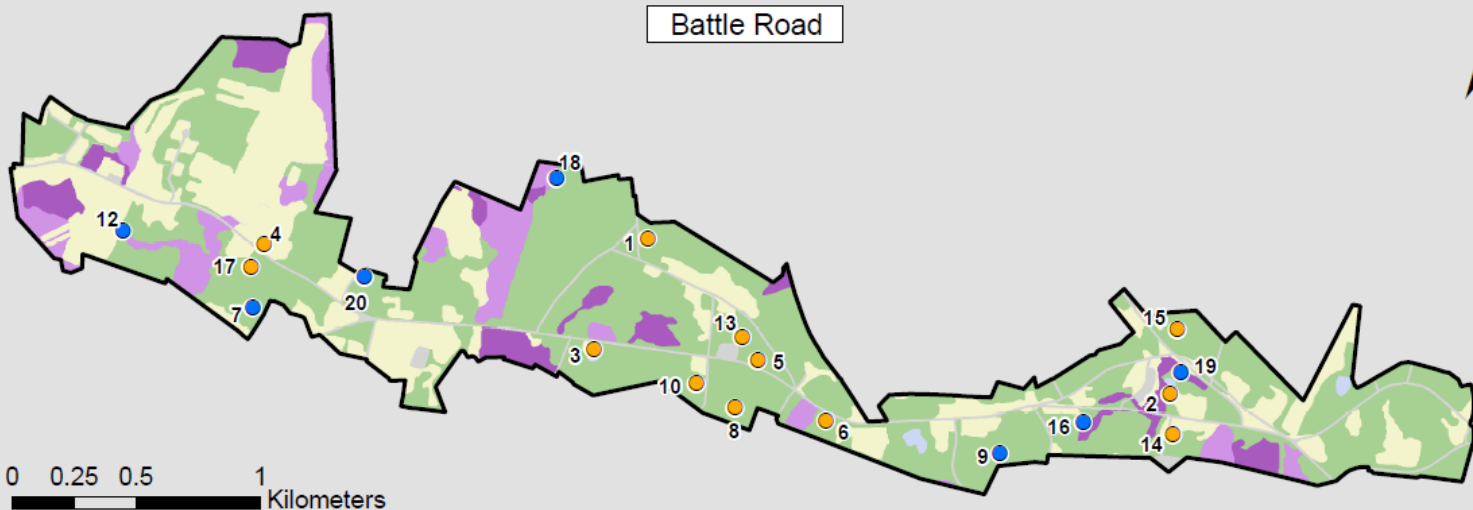
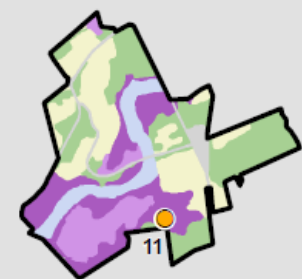
Map 9 - Earthworm Presence

Legend

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Earthworms

- Absent: Earthworms not detected
- Present: Earthworms detected



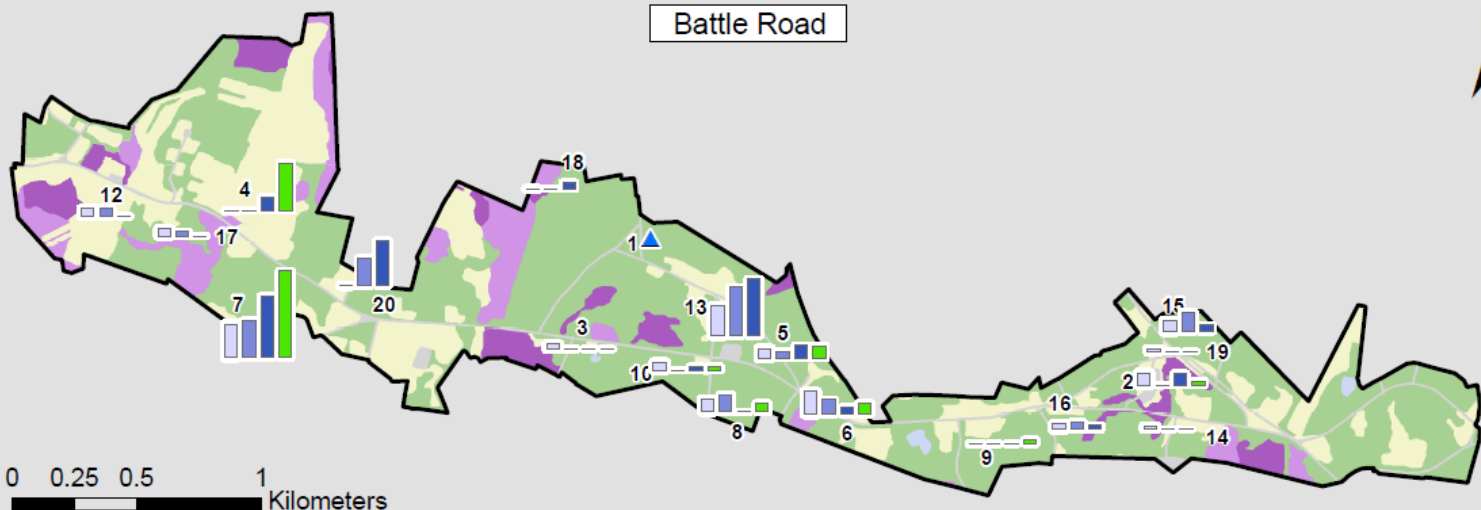
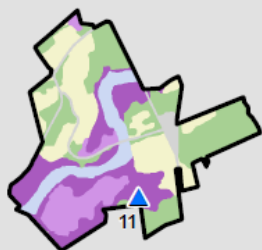
Map 10 - CWD by Cycle

Legend

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- Forested Swamp
- Open Water
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- Park Boundary

CWD Volume

- Cycle 1: 2006 & 2008
- Cycle 2: 2010 & 2012
- Cycle 3: 2014 & 2016
- Cycle 4: 2018
- No CWD Present



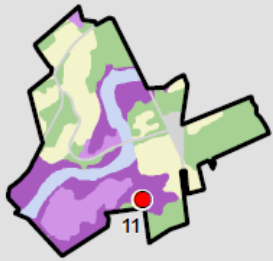
Map 11 - CWD Levels

Legend

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- Open Water
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- Park Boundary

CWD Volume Levels

- CWD Absent
- 0.1 - 20 m³/ha
- 20 - 50 m³/ha
- > 50 m³/ha



Battle Road



0 0.25 0.5 1 Kilometers

