Northeast Temperate Network
Forest Health Monitoring Program

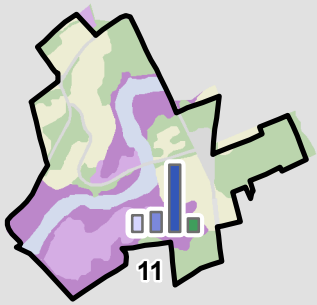
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U.S. Department of the Interior

Minute Man National Historical Park

# Map 1. Tree Regeneration by Cycle

Trends in tree regeneration, including seedlings and saplings, observed in forest plots sampled from 2006-2023. Plots are sampled in an alternating panel, with plots 1-10 sampled in 2006, 2010, 2014, 2018, and 2023 and plots 11-20 sampled in 2008, 2012, 2016, and 2022. Densities range from 0 to 1.0 stems/$m^2$ and only include native canopy-forming species. Date: 7/17/2023.

## North Bridge



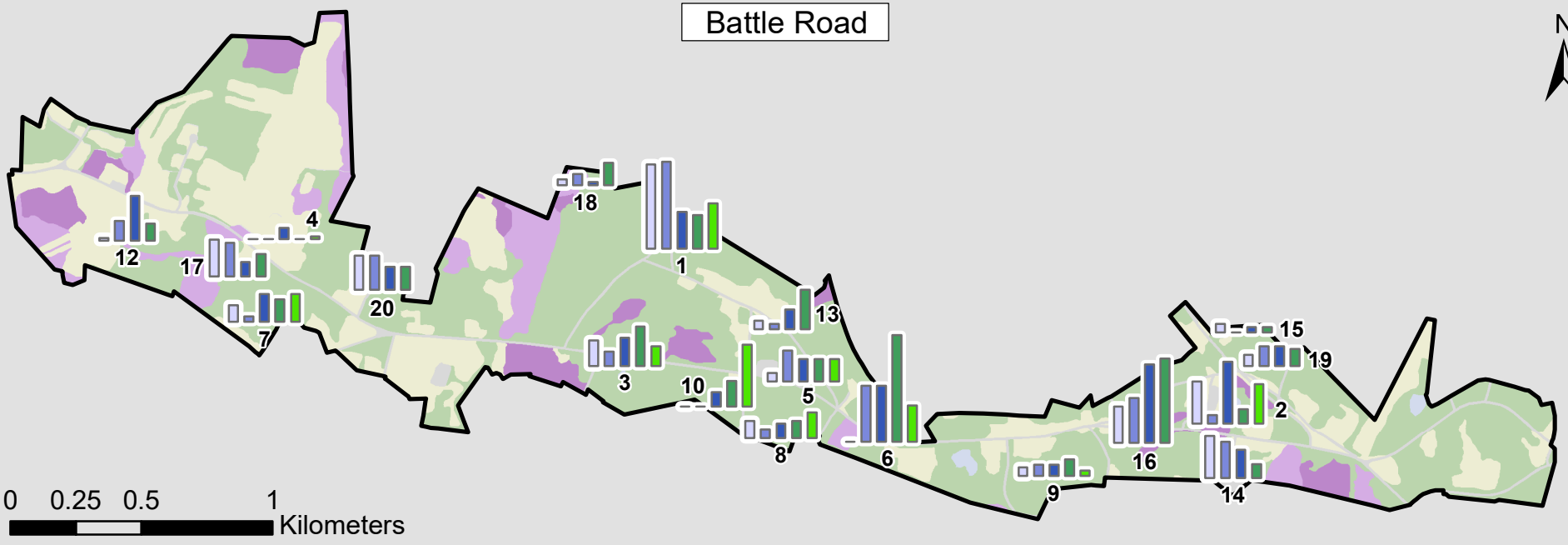

## Legend

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

## Regeneration densities

- Cycle 1: 2006 & 2008
- Cycle 2: 2010 & 2012
- Cycle 3: 2014 & 2016
- Cycle 4: 2018 & 2022
- Cycle 5: 2023

## Battle Road



Northeast Temperate Network
Forest Health Monitoring Program

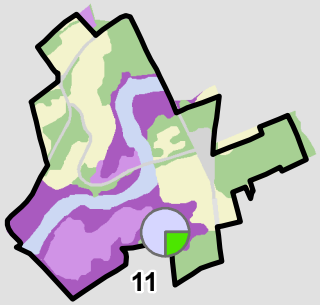
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Minute Man National Historical Park

# Map 2. Tree Regeneration by Size Class

Trends in tree regeneration by size class observed in forest plots in the most recent 4-year census (2022 and 2023). Plots are sampled in an alternating panel, with plots 1-10 sampled in 2023, and plots 11-20 sampled in 2022. Pie size is proportional to plot-level regeneration and location may be shifted to prevent overlap. Total densities range from 0 to 0.8 stems/$m^2$ and only include native canopy-forming species. Date: 7/17/2023.

North Bridge



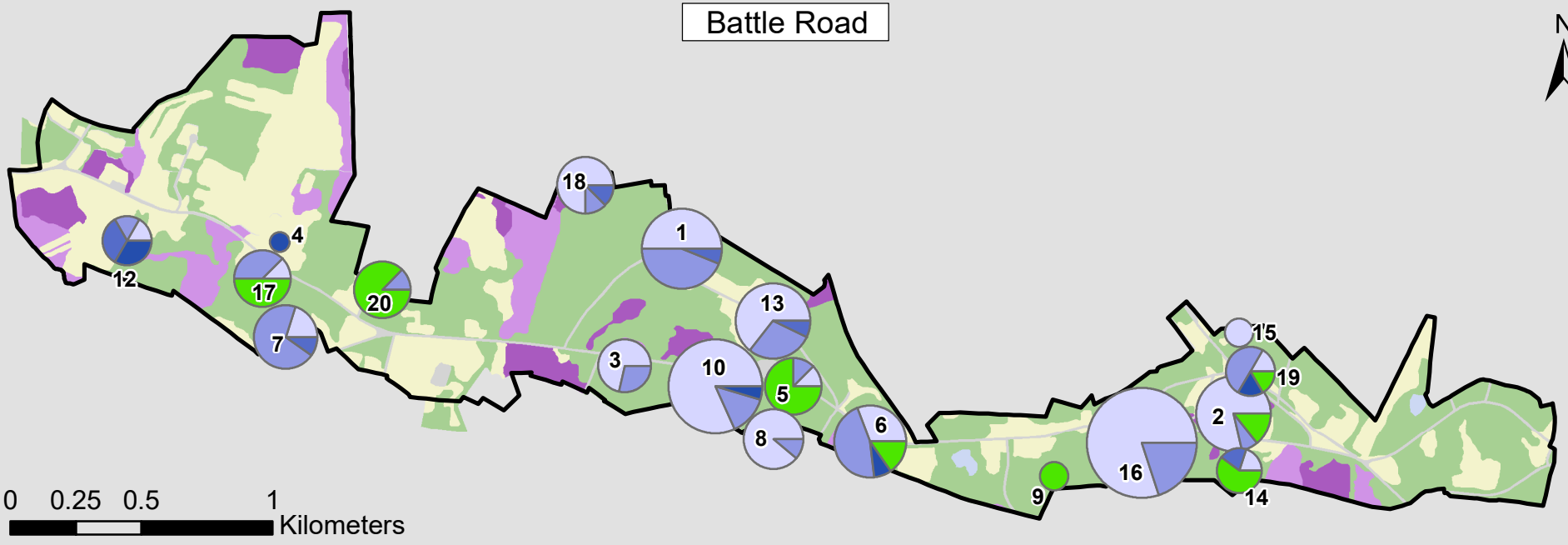

**Legend**

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

**Stem densities by size class**

- 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)

Battle Road



Northeast Temperate Network
Forest Health Monitoring Program

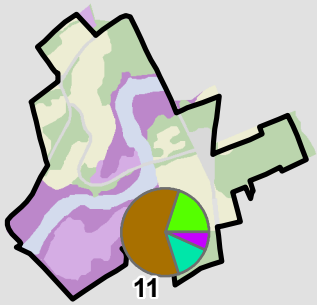
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# Map 3. Tree Regeneration Composition

Trends in tree regeneration, including seedlings and saplings, by species group observed in forest plots in the most recent 4-year census (2022 and 2023). Plots are sampled in an alternating panel, with plots 1-10 sampled in 2023, and plots 11-20 sampled in 2022. Pie size is proportional to the total plot-level regeneration (range: 0 to 0.98 stem/m$^2$). Pies may be shifted from actual plot location to prevent overlap. Date: 7/17/2023.

North Bridge



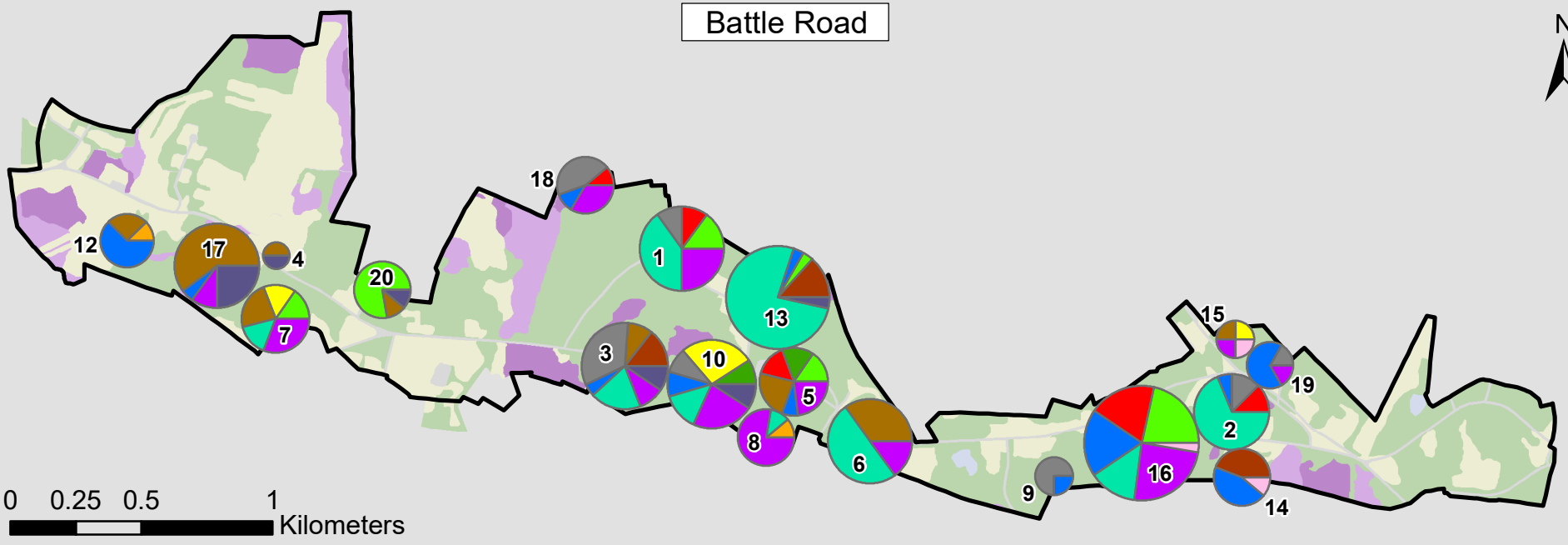

**Legend**

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

**Species in Pie Charts**

- Acer platanoides (Norway maple)
- Acer spp. (maple - native)
- Betula lenta (sweet birch)
- Carya spp. (hickory)
- Fagus grandifolia (beech)
- Fraxinus spp. (ash)
- Pinus strobus (white pine)
- Prunus spp. (cherry)
- Quercus spp. (oak)
- Ulmus spp. (elm)
- Subcanopy species
- Other exotic species
- Other native species

Battle Road



Northeast Temperate Network
Forest Health Monitoring Program

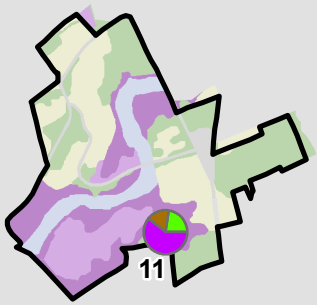
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# Map 4. Tree Canopy Composition

Trends in tree composition, by species group, observed in forest plots in the most recent 4-year census (2022 and 2023). Plots are sampled in an alternating panel, with plots 1-10 sampled in 2023, and plots 11-20 sampled in 2022. Pie size is proportional to the total plot-level basal area (range: 7.6 to 86.0 $m^2$/hectare). Pies may be shifted from actual plot location to prevent overlap. Date: 7/17/2023.

North Bridge



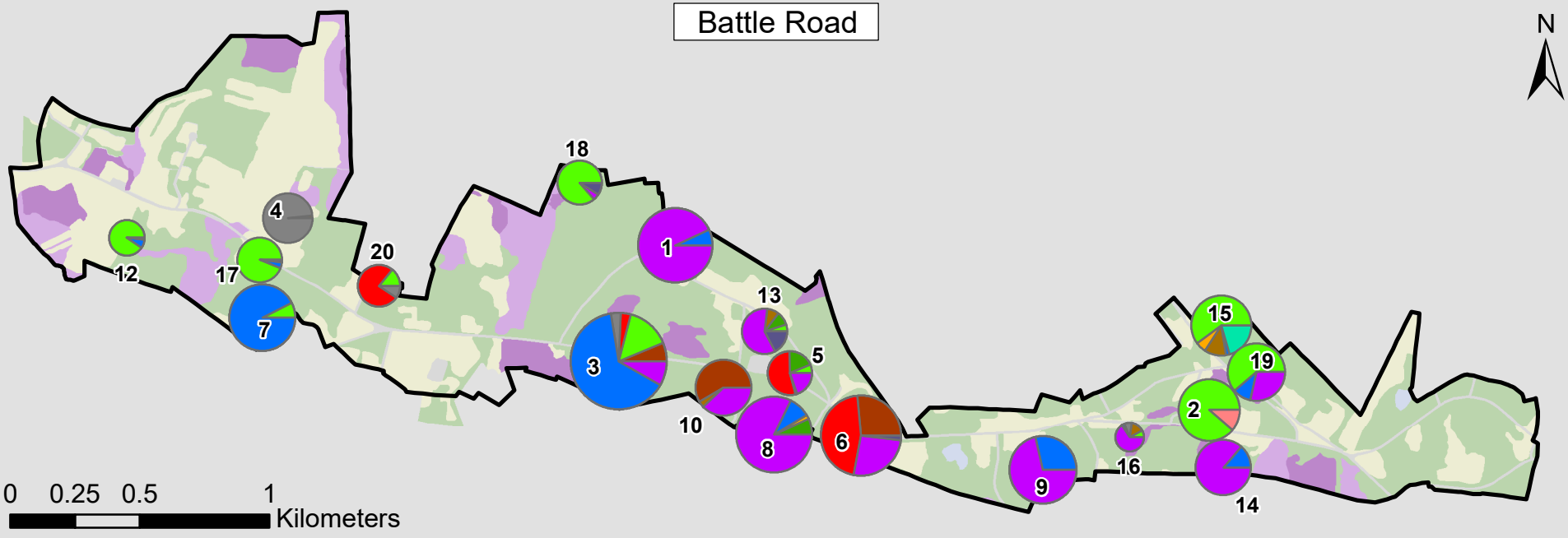

**Legend**

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

**Species in Pie Charts**

- Acer platanoides (Norway maple)
- Acer spp. (maple - native)
- Betula lenta (sweet birch)
- Fagus grandifolia (beech)
- Fraxinus spp. (ash)
- Pinus strobus (white pine)
- Pinus sylvestris (Scots pine)
- Prunus spp. (cherry)
- Quercus spp. (oak)
- Ulmus spp. (elm)
- Subcanopy species
- Other exotic species
- Other native species

Battle Road



Northeast Temperate Network
Forest Health Monitoring Program

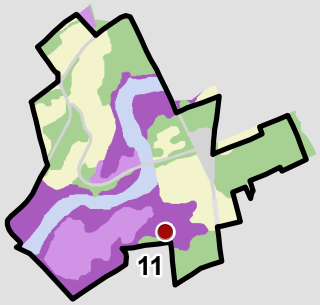
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# Map 5. Tree Regeneration Stocking Index

Trends in the regeneration stocking index for the most recent 4-year census (2022 and 2023). This index is a weighted sum of seedling and sapling densities where larger seedling size classes get higher weights and quantifies whether current regeneration densities are sufficient to restock a forest canopy. The stocking index is averaged over three 2-m radius microplots per forest plot (range 0-50.1), and only includes native canopy-forming species. See Table 1 for plot-level stocking index values. Date: 7/17/2023.

North Bridge



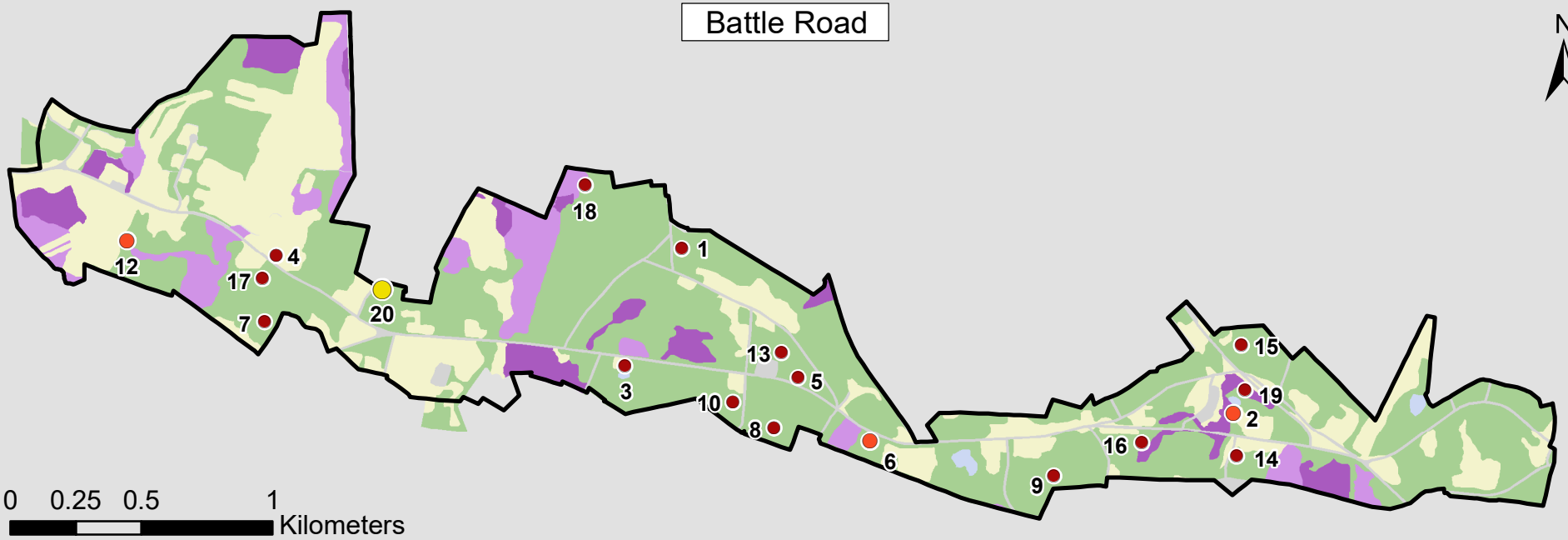

## Legend

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

## 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



Northeast Temperate Network
Forest Health Monitoring Program

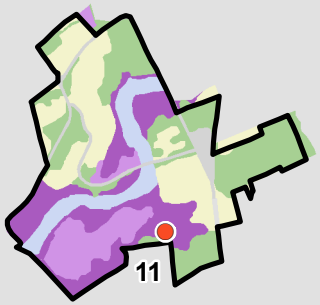
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# Map 6. Index of Deer Browse Impacts

Index of deer browse impacts observed in forest plots in the most recent4-year census (2022 & 2023). Plots are sampled in an alternating panel, with plots 1-10 sampled in 2023 and plots 11-20 sampled in 2022. Deer browse impacts are assessed on a scale of 1-5, with 1 representing no impact and 5 representing severe impacts. Date: 7/17/2023.

North Bridge



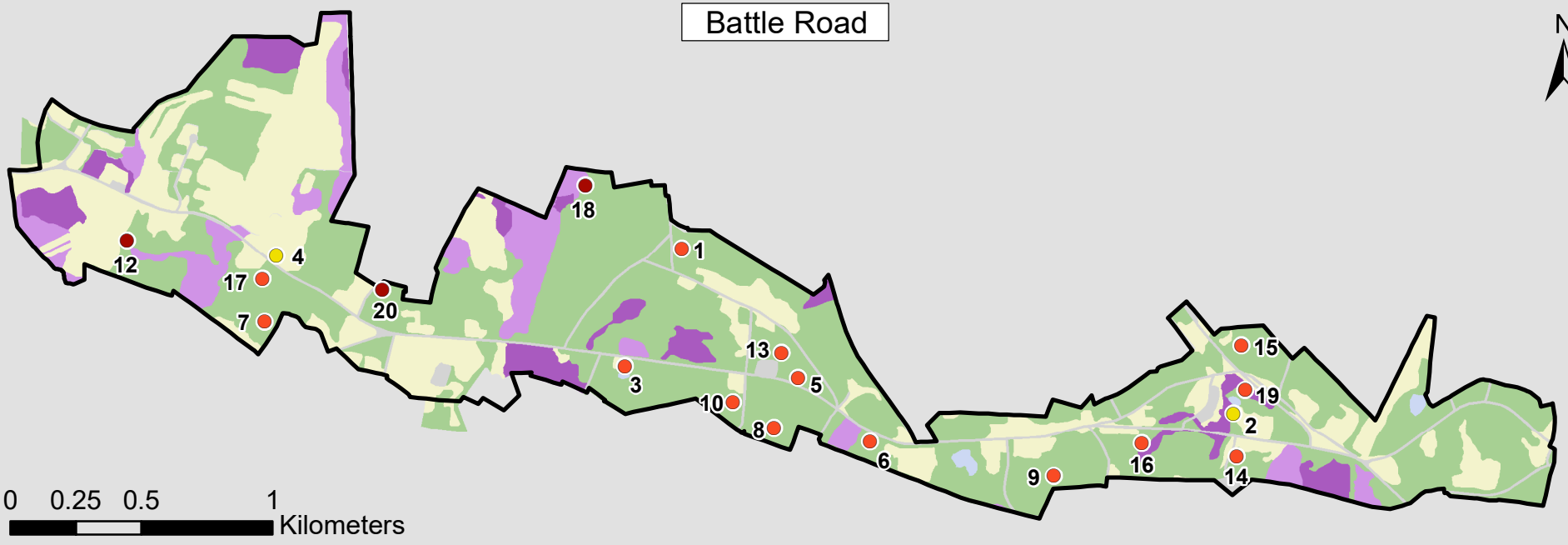

## Legend

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

## 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



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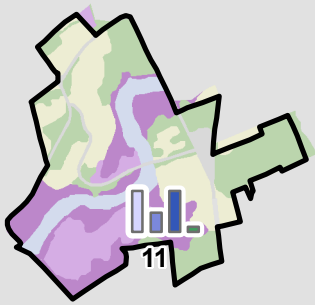
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U.S. Department of the Interior

Minute Man National Historical Park

# Map 7. Canopy Cover by Cycle

Trends in tree canopy cover in forest plots from 2006-2023. Plots are sampled in an alternating panel, with plots 1-10 sampled in 2006, 2010, 2014, 2018, and 2023 and plots 11-20 sampled in 2008, 2012, 2016, 2022. Canopy cover ranges from 0 - 10% to >75%. Date: 7/17/2023.

North Bridge



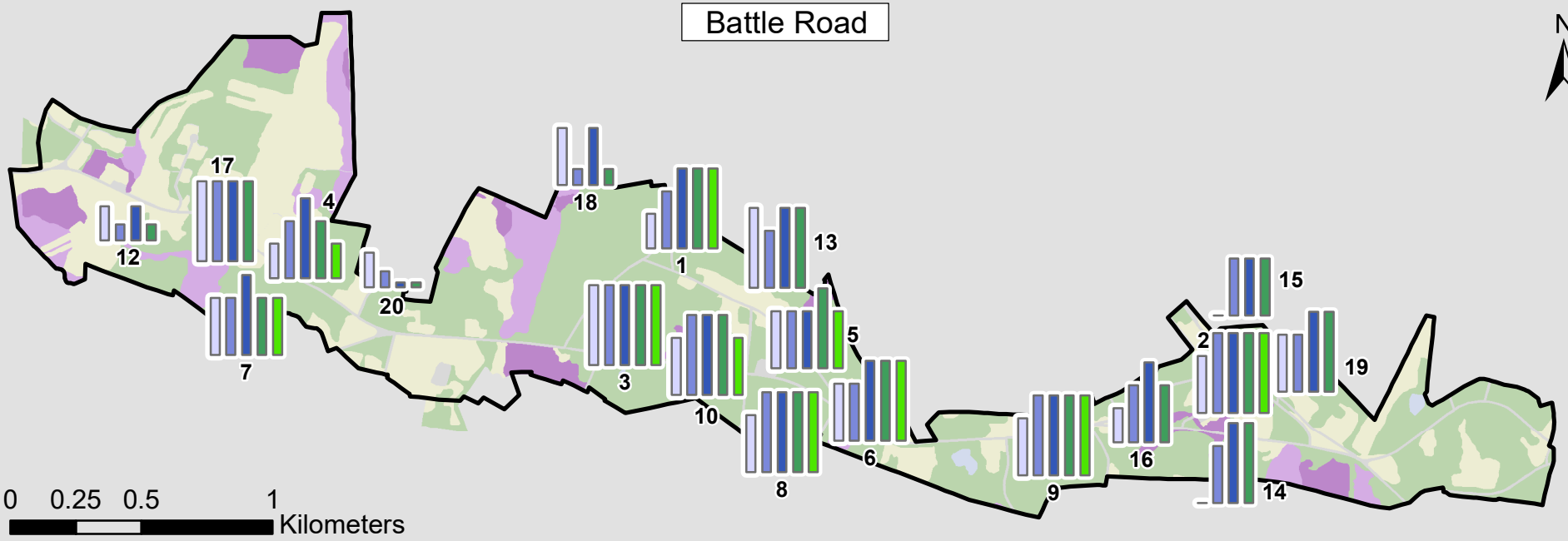

**Legend**

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

**Canopy Cover**

- Cycle 1: 2006 & 2008
- Cycle 2: 2010 & 2012
- Cycle 3: 2014 & 2016
- Cycle 4: 2018 & 2022
- Cycle 5: 2023

Battle Road



Northeast Temperate Network
Forest Health Monitoring Program

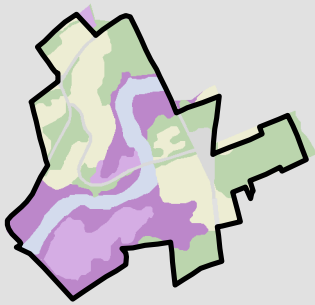
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# Map 8. Forest Pest/Pathogen Detections

Detections of priority forest pests in forest plots sampled during the most recent survey cycle (2022 and 2023). Plots are sampled in an alternating panel with plots 1-10 sampled in 2023 and plots 11-20 sampled in 2022. Beech Bark Disease is also widespread in the park but not noted here. Date 7/17/2023.

North Bridge



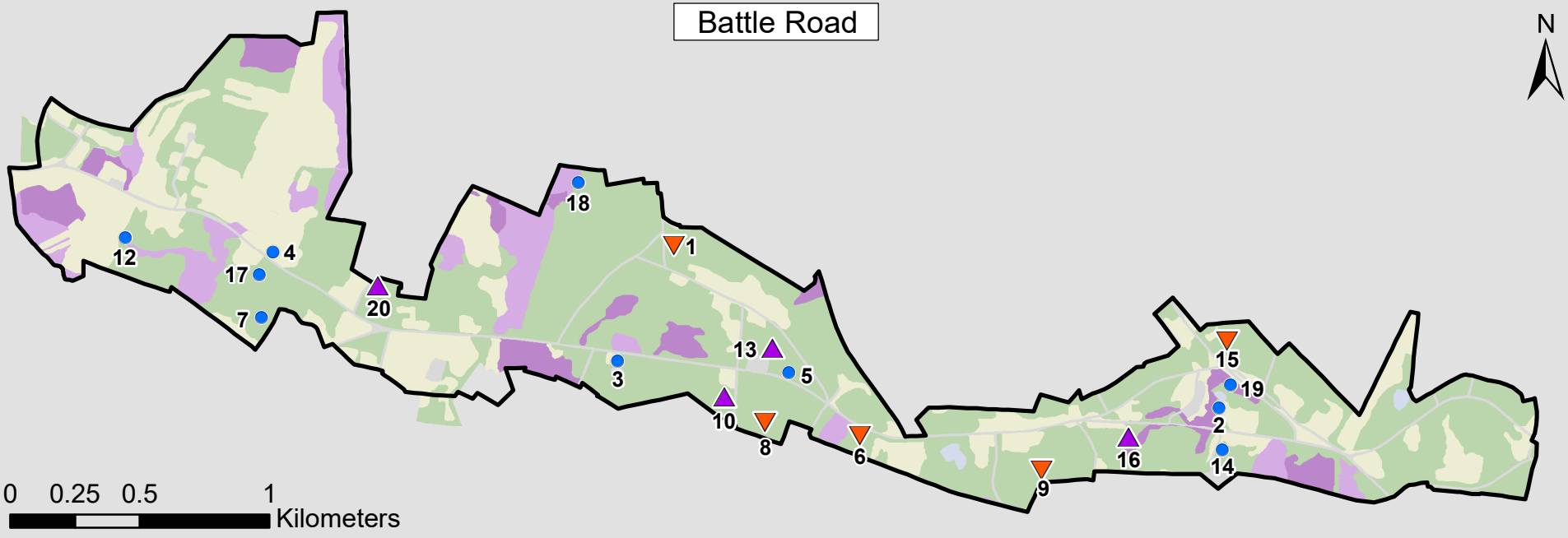
**Legend**

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

**Pests/Pathogens**

- Beech Leaf Disease (BLD)
- Emerald Ash Borer (EAB)
- No detections

Battle Road



Northeast Temperate Network
Forest Health Monitoring Program

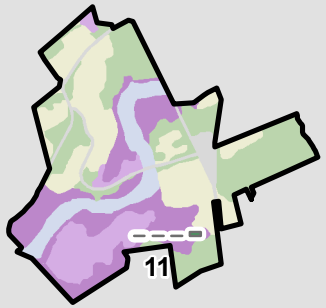
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Minute Man National Historical Park

# Map 9. Coarse Woody Debris By Cycle

Trends in Coarse Woody Debris (CWD) volume observed in plots sampled from 2006-2023. Plots are sampled in an alternating panel, with plots 1-10 sampled in 2006, 2010, 2014, 2018, and 2023 and plots 11-20 sampled in 2008, 2012, 2016, and 2022. CWD volume ranges from 0 - 106.7 $m^3$/ha. Date: 7/17/2023.

North Bridge



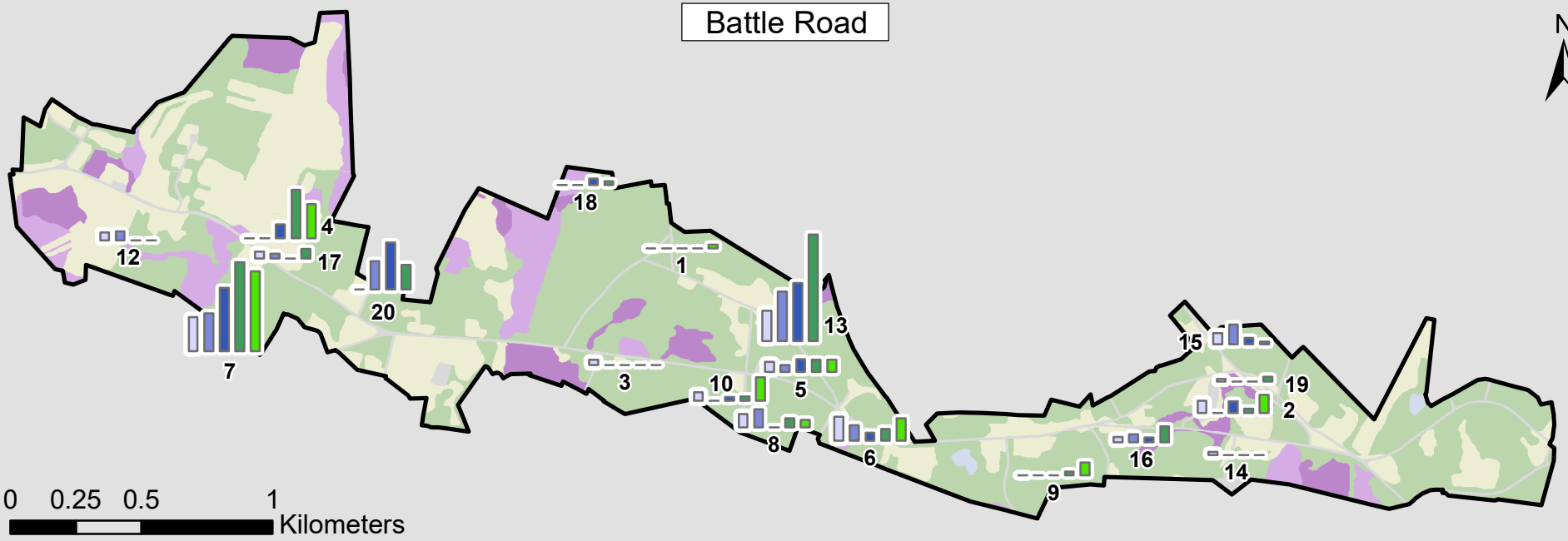

**Legend**

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

**CWD Volume**

- Cycle 1: 2006 & 2008
- Cycle 2: 2010 & 2012
- Cycle 3: 2014 & 2016
- Cycle 4: 2018 & 2022
- Cycle 5: 2023
- No CWD since 2006

Battle Road



Northeast Temperate Network
Forest Health Monitoring Program

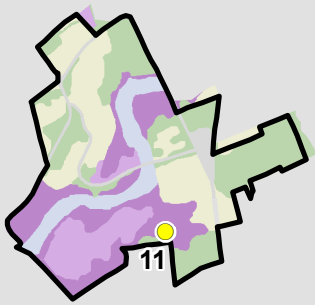
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Minute Man National Historical Park

# Map 10. Coarse Woody Debris Ratings

Coarse woody debris volume ($m^3$/ha) for the most recent 4-year census (2022 and 2023). Plots 1-10 were sampled in 2023, and plots 11-20 were sampled in 2022. Volumes range from 0 to 106.7 $m^3$/hectare. Plots are color coded by volume to indicate whether they meet the 20-50 $m^3$/ha threshold in Müller and Bütler (2010). Date: 7/17/2023.

North Bridge



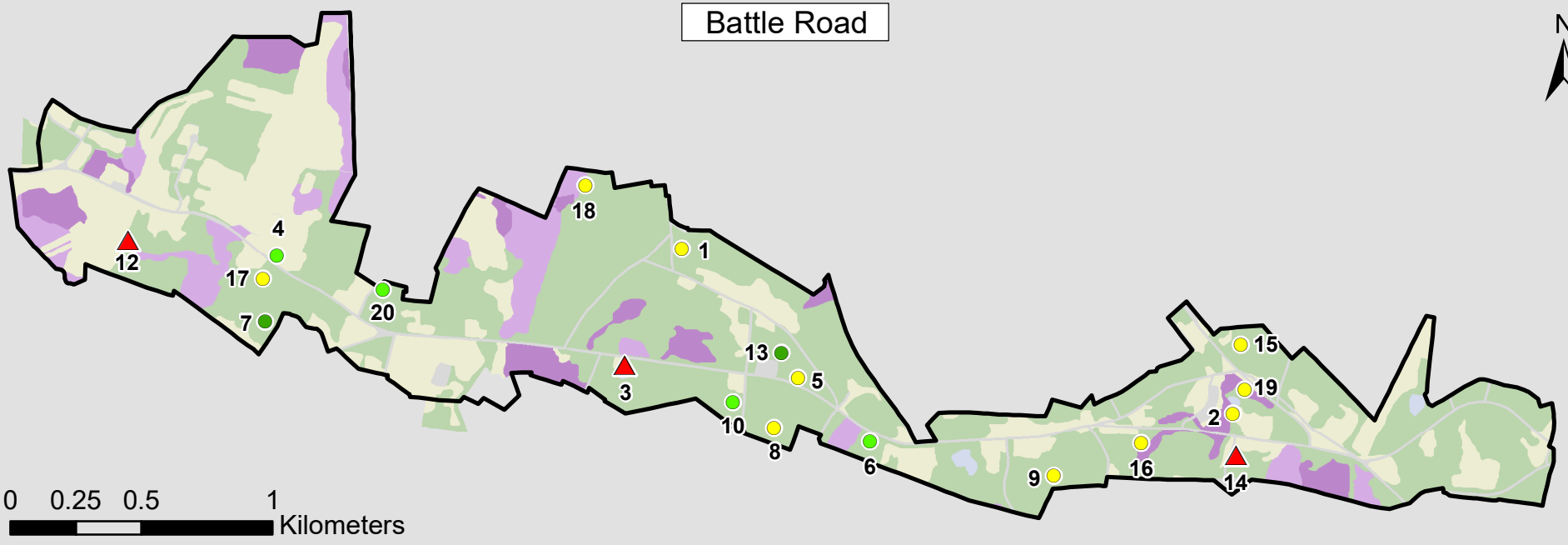

## Legend

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

## CWD Volume Levels

- CWD Absent
- 0.1 - 20 $m^3$/ha
- 20 - 50 $m^3$/ha
- > 50 $m^3$/ha

Battle Road



Northeast Temperate Network
Forest Health Monitoring Program

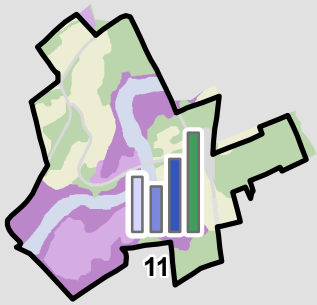
National Park Service
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Minute Man National Historical Park

# Map 11. Invasive % Cover by Cycle

Trends in percent cover of invasive species observed in plots sampled from 2006-2023. Plots are sampled in an alternating panel, with plots 1-10 sampled in 2006, 2010, 2014, 2018, and 2023, and plots 11-20 sampled in 2008, 2012, 2016, and 2022. Average invasive cover ranges from 0 to 53%. See Table 2 for % cover values. Date: 7/17/2023.

North Bridge



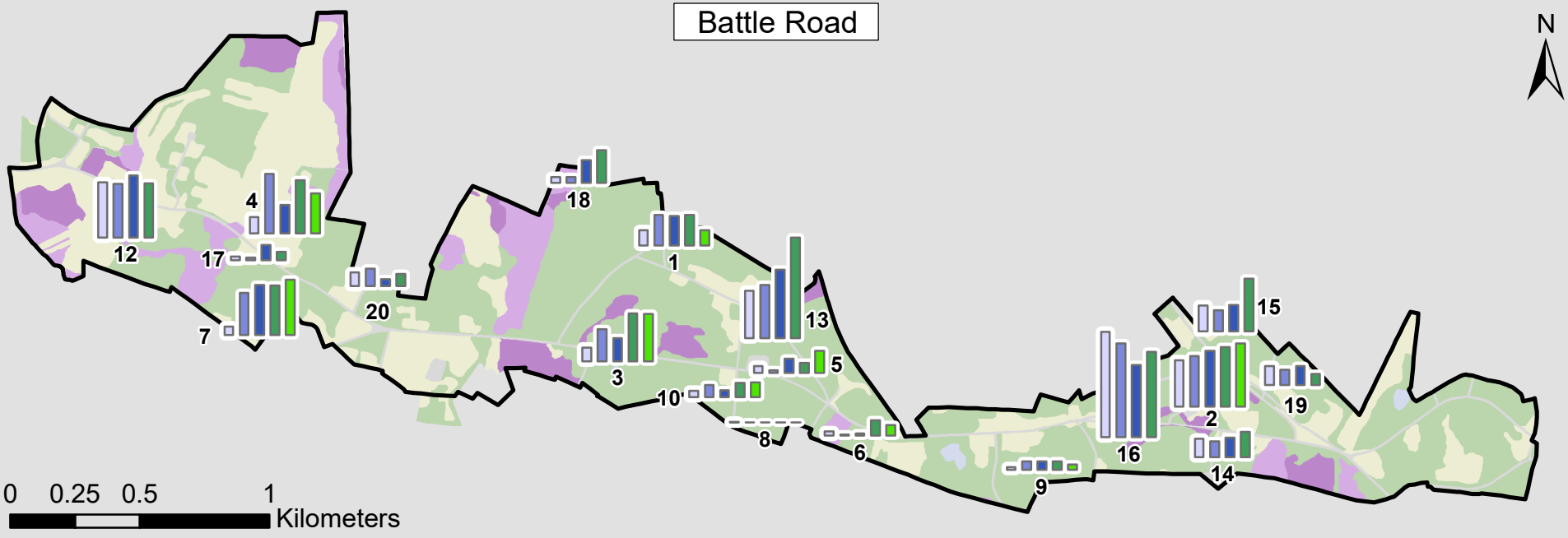

**Legend**

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

**Invasive % Cover**

- Cycle 1: 2006 & 2008
- Cycle 2: 2010 & 2012
- Cycle 3: 2014 & 2016
- Cycle 4: 2018 & 2022
- Cycle 5: 2023

Battle Road



Northeast Temperate Network
Forest Health Monitoring Program

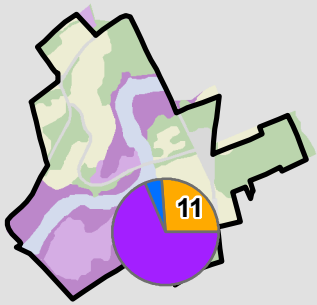
National Park Service
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Minute Man National Historical Park

# Map 12. Invasive % Cover by Species

Trends in % invasive cover by species observed in quadrats for plots in the most recent4-year census (2022 & 2023). Plots are sampled in an alternating panel, with plots 1-10 sampled in 2023 and plots 11-20 sampled in 2022. Pie size is proportional to total invasive cover (range: 0 to 51%), and location may be shifted to prevent overlap. See Table 2 for more information.
Date: 7/17/2023.

North Bridge



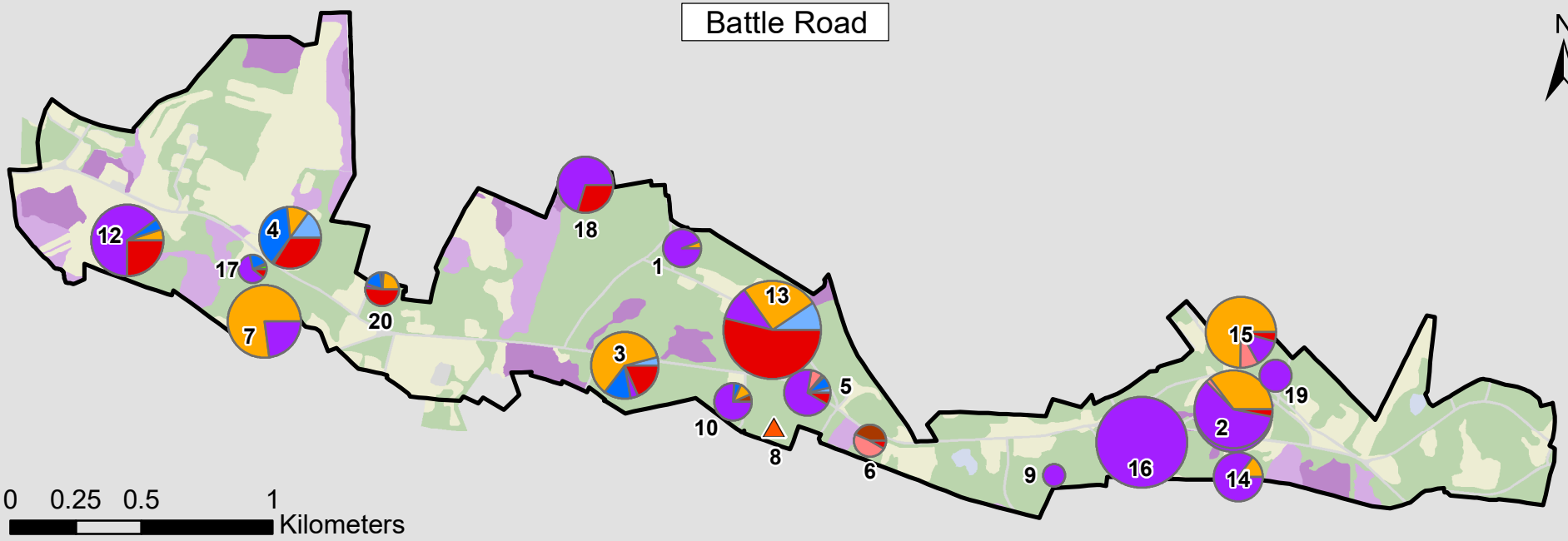

**Legend**

- Open Field
- Forested Land
- Open Wetland
- Forested Swamp
- Open Water
- Paved/ Dev. Land
- Park Boundary
- No invasive cover

**Species in Pie Charts**

- Acer platanoides (Norway maple)
- Alliaria petiolata (garlic mustard)
- Berberis thunbergii (Jap. barberry)
- Celastrus orbiculatus (Asian bittersweet)
- Euonymus alatus (burningbush)
- Ligustrum spp. (privet)
- Lonicera spp. (exotic bush honeysuckle)
- Rhamnus cathartica (comon buckthorn)
- Rhamnus frangula (glossy buckthorn)
- Rosa multiflora (multiflora rose)
- Other invasive spp.

Battle Road



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Forest Health Monitoring Program

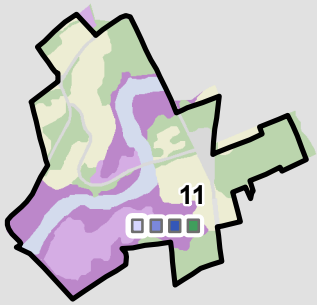
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Minute Man National Historical Park

# Map 13. Ash Tree Density by Cycle

Trends in ash tree density in forest plots sampled from 2006 to 2023. Plots are sampled in an alternating panel with plots 1-10 sampled in 2006, 2010, 2014, 2018, and 2023, and plots 11-20 sampled in 2008, 2012, 2016, and 2022. Densities range from 0 to 7 stems/400m$^2$. Date 7/17/2023.

North Bridge



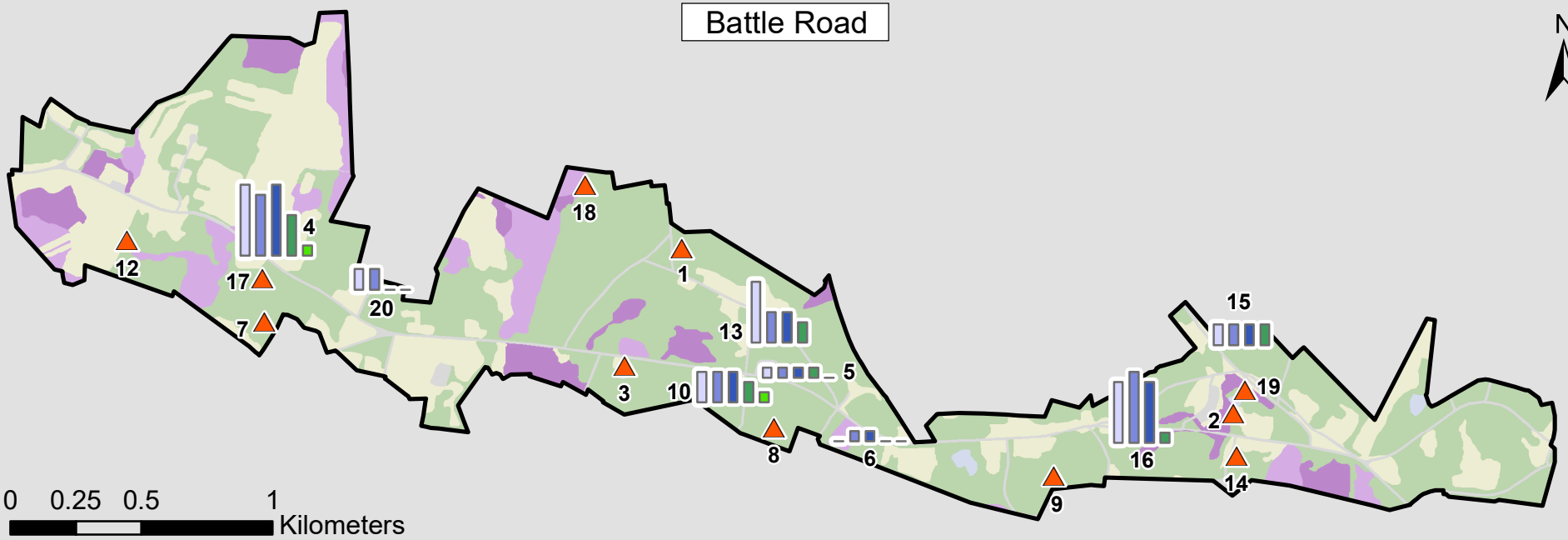

## Legend

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

## Regeneration densities

- Cycle 1: 2006 & 2008
- Cycle 2: 2010 & 2012
- Cycle 3: 2014 & 2016
- Cycle 4: 2018 & 2022
- Cycle 5: 2023

Battle Road



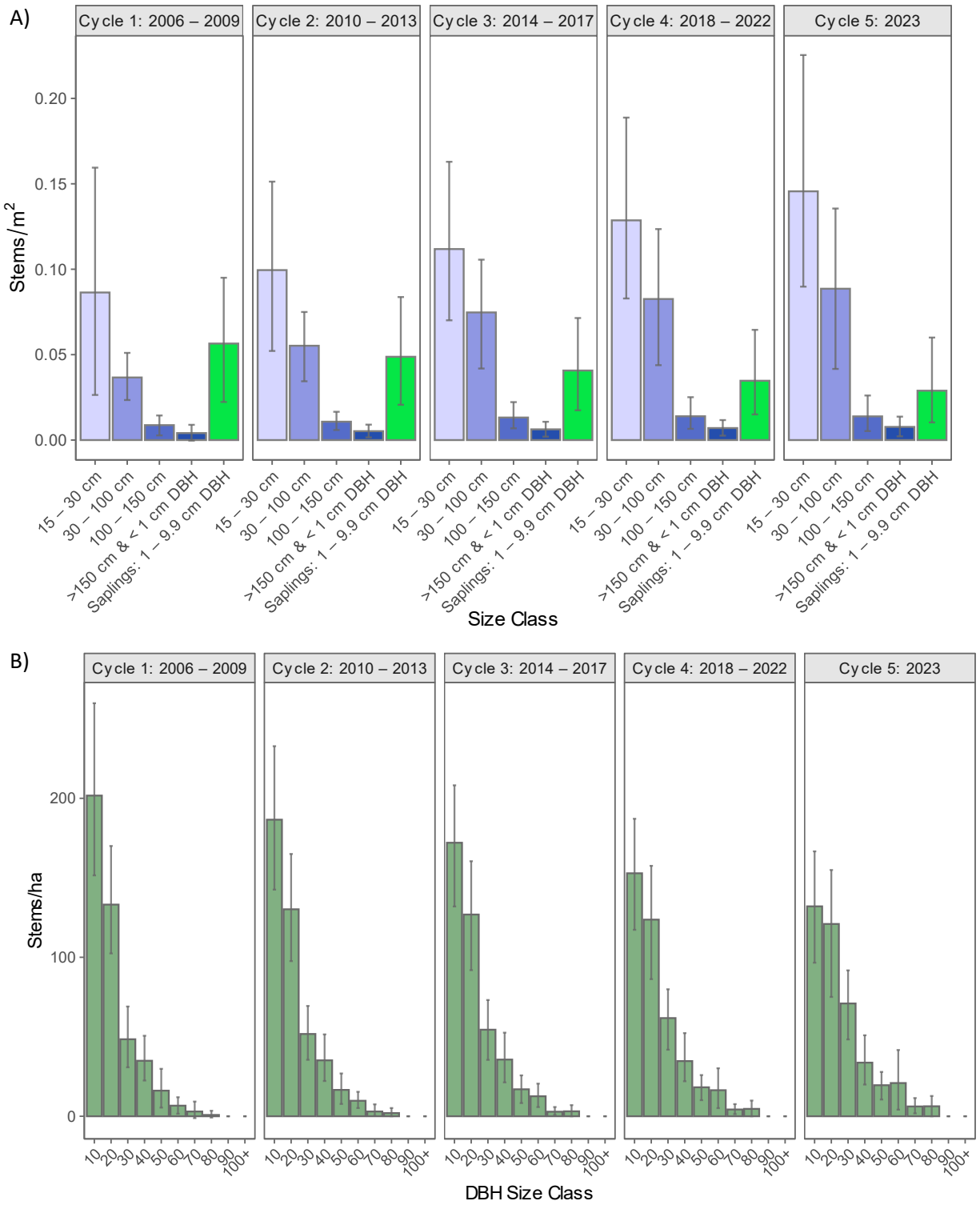



**Figure 1.** Stem density distributions in 10 cm increments by survey cycle in Minute Man National Historical Park. Cycle 1 is 2006-2009; Cycle 2 is 2010-2013; Cycle 3 is 2014-2017; Cycle 4 is 2018-2022; Cycle 5 is 2023. Note that Cycle 5 only includes the first panel of 10 plots. Figure A shows regeneration densities by size class. Figure B shows tree density by diameter at breast height (DBH) increments. Error bars are 95% bootstrapped confidence intervals. An asterisk denotes a linear DBH distribution that is indicative of long-term recruitment failure.

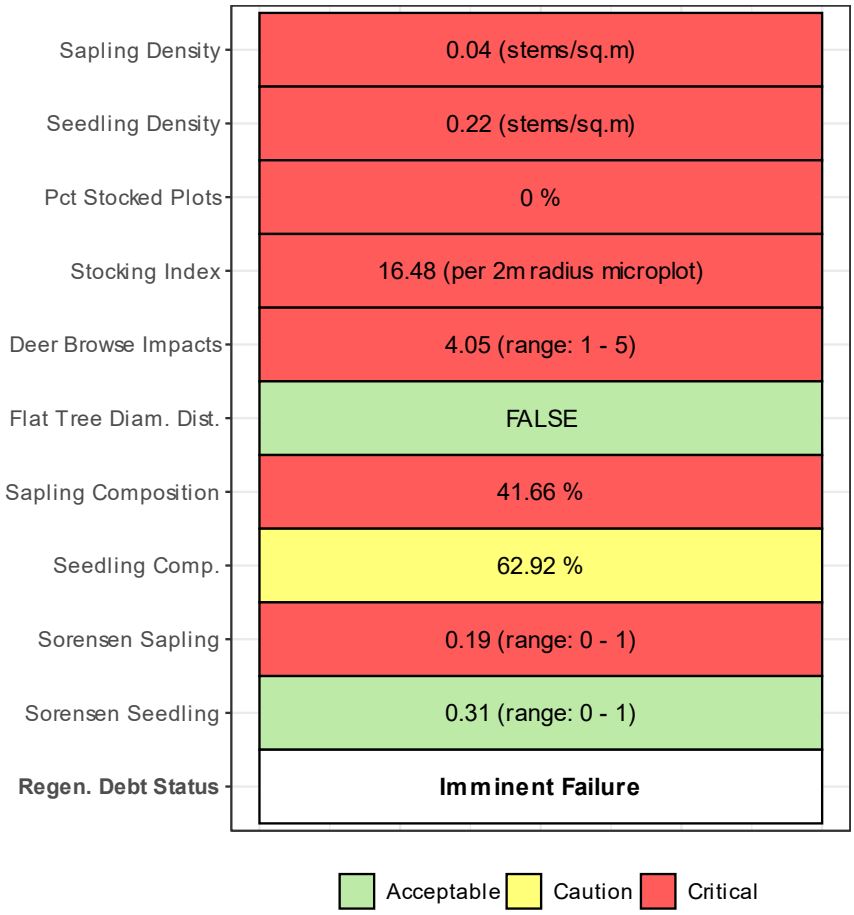



**Figure 2.** Regeneration Debt metrics and status for the most recent 4-year census (2022 and 2023) in Minute Man National Historical Park. Flat Tree Diam. Dist. stands for Flat Tree Diameter Distribution. If TRUE, the density of small trees is lower than expected due to chronic regeneration failure. See Miller et al. 2023 for more details on metric calculations, thresholds, and assessment of status.

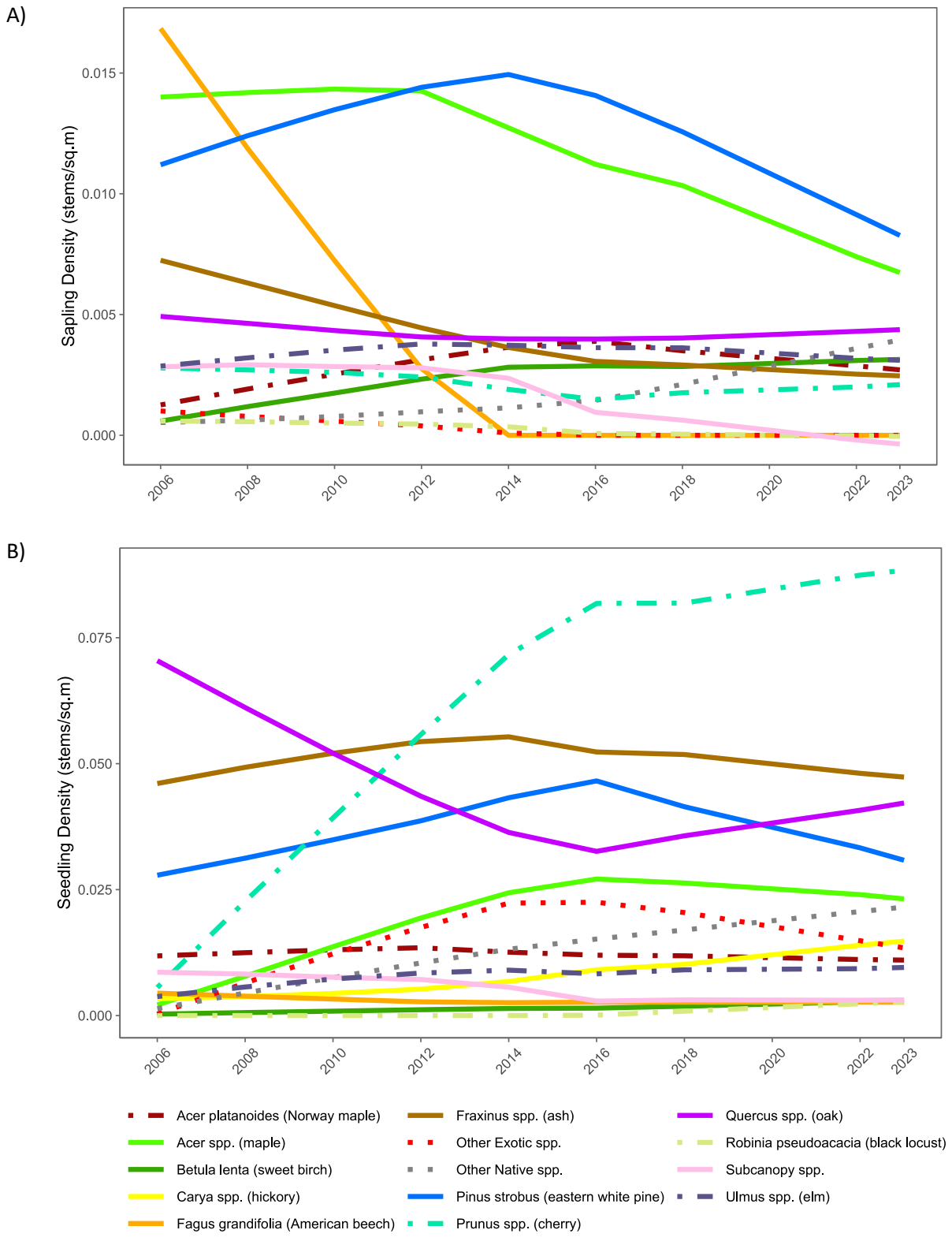



**Figure 3.** Loess smoothed changes in stem density for saplings (A) and seedlings (B) by species group and sample year in Minute Man National Historical Park. Specified loess span approximated a linear trend between consecutive sample events per panel.

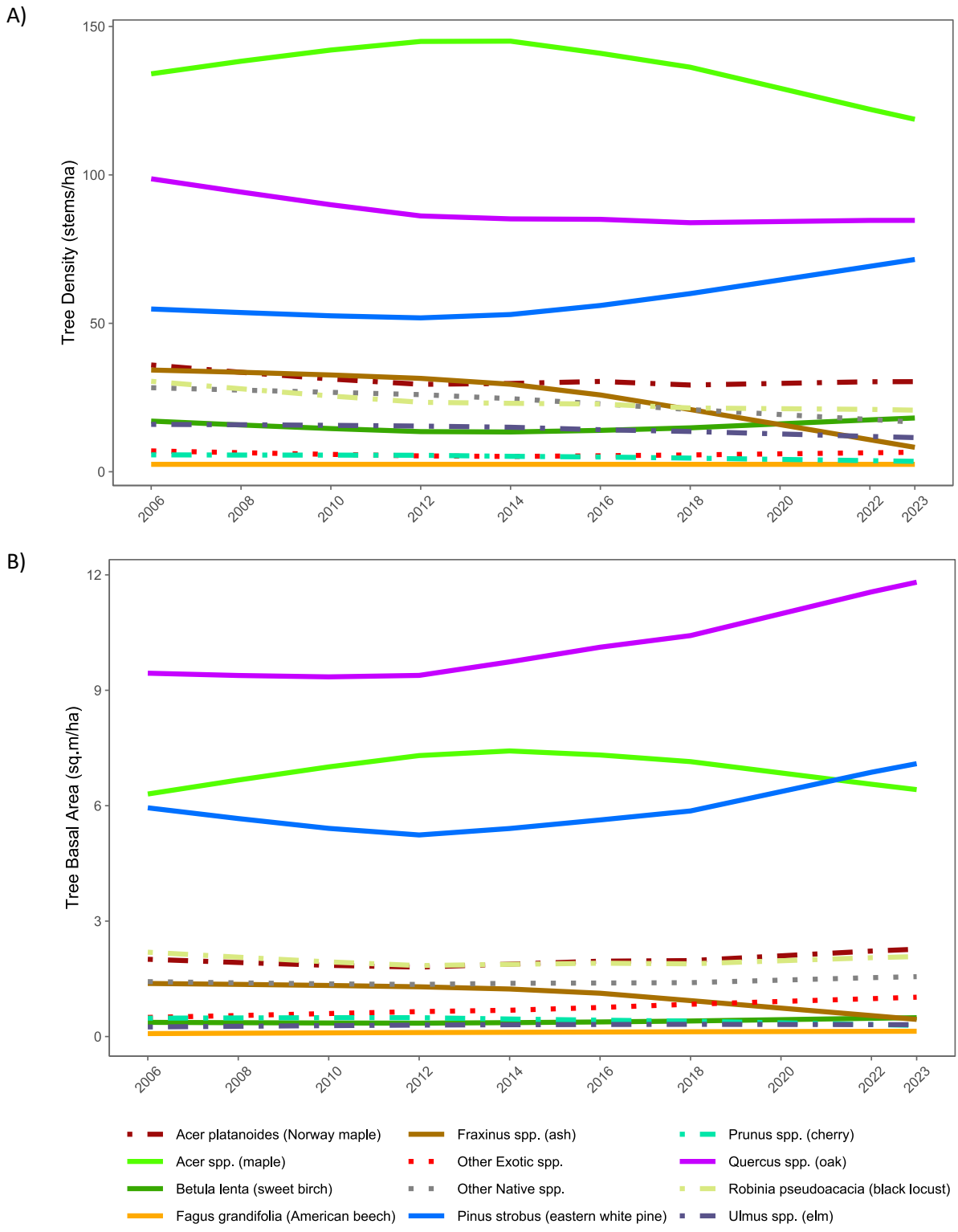



**Figure 4.** Loess smoothed changes in tree stem density (A) and basal area (B) by species group and sample year in Minute Man National Historical Park. Specified loess span approximated a linear trend between consecutive sample events per panel.

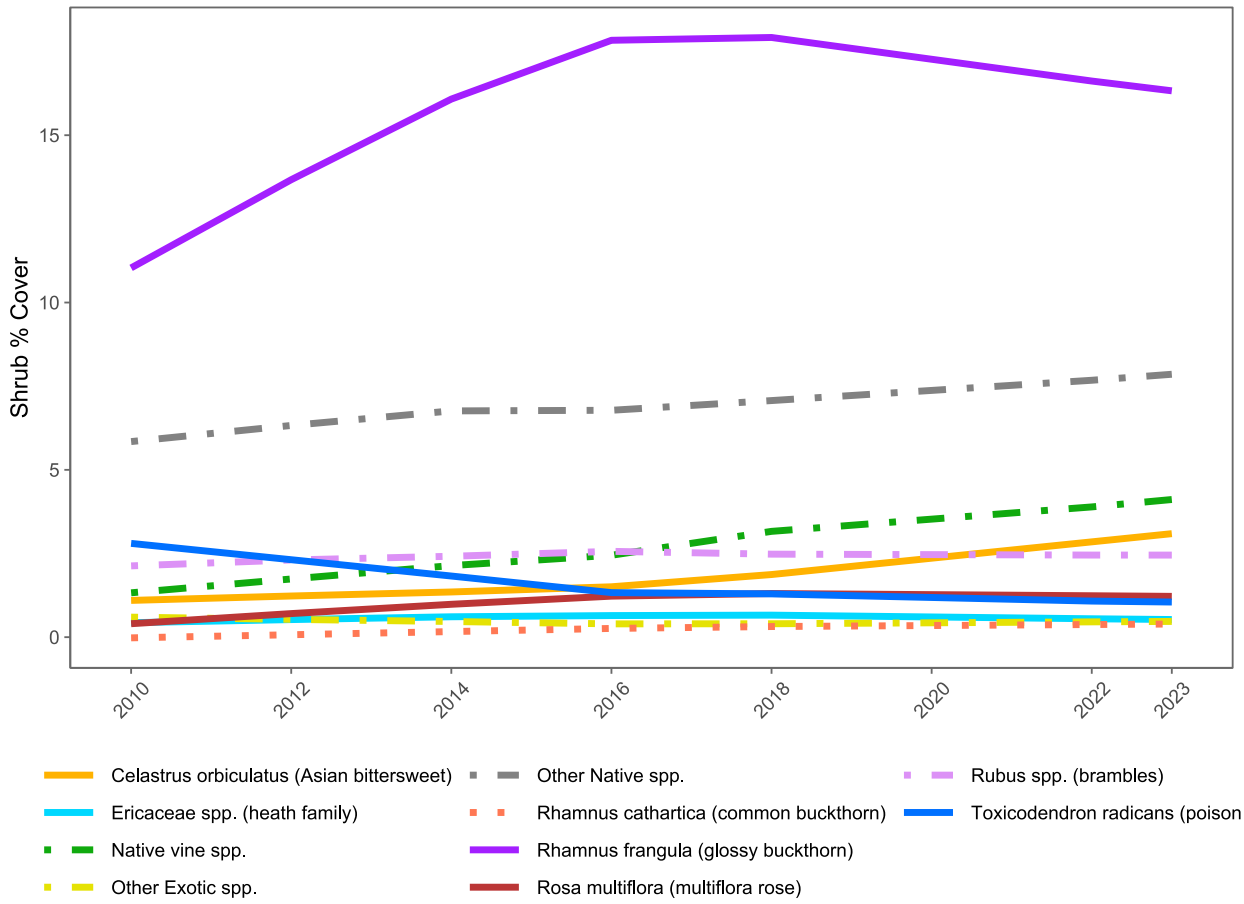



**Figure 5.** Loess smoothed changes in shrub % cover collected in 2-m radius microplots by species group and sample year in Minute Man National Historical Park. Specified loess span approximated a linear trend between consecutive sample events per panel. Note that this metric differs from quadrat % cover in that data collection started in 2010, and there's no height limit for shrub cover (vs. quadrats only including cover up to 1.5m).

**Table 1.** Average plot-level seedling and sapling stem densities, converted to stems per $m^2$, and stocking index by cycle. Only native, canopy-forming species are included. Note that Fraxinus spp. (ash species) are no longer considered canopy-forming species. Cycle 1 = 2006 & 2008; Cycle 2 = 2010 & 2012; Cycle 3 = 2014 & 2016; Cycle 4 = 2018 & 2022; Cycle 5 = 2023. Plots are sampled in alternating years, with Panel 1 sampled the first year, and Panel 2 sampled the second year. The stocking index quantifies whether current regeneration densities are sufficient to restock a forest canopy. The index is a weighted sum of seedling and sapling densities where larger seedling size classes get higher weights. Cells highlighted in green are plots that meet the minimum management target of 0.25 seedlings/$m^2$ and 0.14 saplings/$m^2$ or have a stocking index >100. Plots 11-20 have not yet been sampled in Cycle 5.

| | | Seedlings per $m^2$ | | | | | Saplings per $m^2$ | | | | | Stocking Index | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Plot | Panel | Cycle 1 | Cycle 2 | Cycle 3 | Cycle 4 | Cycle 5 | Cycle 1 | Cycle 2 | Cycle 3 | Cycle 4 | Cycle 5 | Cycle 1 | Cycle 2 | Cycle 3 | Cycle 4 | Cycle 5 |
| 1 | 1 | **0.80** | **0.82** | **0.34** | **0.32** | **0.42** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 10.00 | 44.67 | 27.33 | 12.00 | 14 |
| 2 | 1 | 0.08 | 0.08 | **0.58** | 0.11 | **0.32** | **0.32** | 0.00 | 0.00 | 0.03 | 0.05 | 51.00 | 2.00 | 77.00 | 19.00 | 37.67 |
| 3 | 1 | 0.24 | 0.13 | **0.27** | **0.37** | 0.19 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 3.00 | 1.67 | 6.00 | 6.00 | 3 |
| 4 | 1 | 0.00 | 0.00 | 0.11 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.33 | 0.00 | 16.67 |
| 5 | 1 | 0.00 | 0.13 | 0.05 | 0.05 | 0.05 | 0.08 | **0.16** | **0.16** | **0.16** | **0.16** | 0.00 | 19.67 | 24.00 | 7.33 | 1 |
| 6 | 1 | 0.00 | **0.53** | **0.53** | **1.01** | **0.29** | 0.00 | 0.00 | 0.00 | 0.00 | 0.05 | 0.00 | 35.00 | 26.67 | 80.00 | 38.67 |
| 7 | 1 | 0.16 | 0.05 | 0.21 | 0.21 | **0.27** | 0.00 | 0.00 | 0.05 | 0.00 | 0.00 | 3.00 | 0.67 | 37.67 | 4.00 | 12 |
| 8 | 1 | 0.16 | 0.08 | 0.13 | 0.16 | 0.24 | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 3.00 | 1.33 | 2.00 | 8.67 | 3.33 |
| 9 | 1 | 0.00 | 0.03 | 0.03 | 0.11 | 0 | 0.08 | 0.08 | 0.08 | 0.05 | 0.05 | 50.00 | 17.33 | 0.67 | 1.67 | 0 |
| 10 | 1 | 0.00 | 0.00 | 0.13 | 0.24 | **0.58** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.67 | 9.33 | 24.67 |
| 11 | 2 | 0.11 | 0.13 | **0.53** | 0.08 | --- | 0.03 | 0.03 | 0.00 | 0.03 | --- | 31.00 | 2.00 | 7.00 | 1.00 | --- |
| 12 | 2 | 0.03 | 0.19 | **0.42** | 0.16 | --- | 0.00 | 0.00 | 0.00 | 0.00 | --- | 0.67 | 3.67 | 15.33 | 47.67 | --- |
| 13 | 2 | 0.08 | 0.05 | 0.19 | **0.37** | --- | 0.00 | 0.00 | 0.00 | 0.00 | --- | 1.33 | 7.33 | 9.33 | 12.33 | --- |
| 14 | 2 | 0.21 | 0.13 | 0.08 | 0.05 | --- | **0.19** | **0.21** | **0.19** | 0.08 | --- | 75.67 | 32.00 | 40.67 | 7.00 | --- |
| 15 | 2 | 0.03 | 0.00 | 0.05 | 0.05 | --- | 0.05 | 0.00 | 0.00 | 0.00 | --- | 6.67 | 0.00 | 1.00 | 0.67 | --- |
| 16 | 2 | **0.32** | **0.40** | **0.74** | **0.80** | --- | 0.03 | 0.03 | 0.00 | 0.00 | --- | 21.33 | 19.33 | 19.33 | 12.00 | --- |
| 17 | 2 | **0.27** | 0.24 | 0.03 | 0.11 | --- | 0.08 | 0.08 | 0.11 | 0.11 | --- | 11.33 | 20.67 | 17.33 | 19.00 | --- |
| 18 | 2 | 0.05 | 0.11 | 0.00 | 0.21 | --- | 0.00 | 0.00 | 0.03 | 0.00 | --- | 0.67 | 2.33 | 16.67 | 9.33 | --- |
| 19 | 2 | 0.05 | 0.16 | 0.16 | 0.13 | --- | 0.05 | 0.03 | 0.03 | 0.03 | --- | 7.00 | 9.00 | 2.67 | 19.00 | --- |
| 20 | 2 | 0.03 | 0.05 | 0.00 | 0.03 | --- | **0.29** | **0.27** | **0.21** | **0.19** | --- | **150.00** | 67.67 | 50.00 | 50.67 | --- |

**Table 2.** Average % cover and number of invasive species detected in each plot by cycle. Cycle 1= 2006 & 2008; Cycle 2= 2010 & 2012; Cycle 3= 2014 & 2016; Cycle 4= 2018 & 2022; Cycle 5 = 2023. Plots are sampled in alternating years, with Panel 1 sampled the first year, and Panel 2 sampled the second year. Note that plots 11-20 have not yet been sampled in Cycle 5.

| Plot | Panel | Average % Cover | | | | | Number of Species per Plot | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Cycle 1 | Cycle 2 | Cycle 3 | Cycle 4 | Cycle 5 | Cycle 1 | Cycle 2 | Cycle 3 | Cycle 4 | Cycle 5 |
| 1 | 1 | 15.3 | 15.3 | 14.9 | 15.5 | 7.6 | 3 | 3 | 3 | 3 | 4 |
| 2 | 1 | 23.6 | 25.4 | 28.3 | 30.2 | 32.2 | 3 | 4 | 5 | 6 | 4 |
| 3 | 1 | 6.7 | 16.1 | 11.7 | 24.3 | 23.8 | 9 | 8 | 8 | 8 | 9 |
| 4 | 1 | 8.3 | 30.2 | 14.5 | 27.0 | 20.4 | 4 | 6 | 6 | 6 | 8 |
| 5 | 1 | 3.5 | 1.3 | 7.4 | 5.2 | 11.3 | 8 | 9 | 10 | 10 | 11 |
| 6 | 1 | 2.1 | 0.7 | 1.0 | 7.7 | 5.5 | 6 | 4 | 7 | 9 | 9 |
| 7 | 1 | 4.1 | 21.3 | 25.4 | 25.1 | 28.1 | 4 | 5 | 4 | 4 | 6 |
| 8 | 1 | 0.4 | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 1 | 1 | 1 | 1 |
| 9 | 1 | 1.4 | 4.4 | 4.4 | 4.4 | 2.6 | 2 | 2 | 2 | 1 | 1 |
| 10 | 1 | 3.2 | 6.3 | 3.6 | 7.3 | 7.5 | 6 | 7 | 8 | 7 | 8 |
| 11 | 2 | 23.0 | 19.0 | 30.6 | 41.6 | --- | 4 | 5 | 5 | 6 | --- |
| 12 | 2 | 27.9 | 27.2 | 31.6 | 27.5 | --- | 4 | 4 | 5 | 6 | --- |
| 13 | 2 | 24.0 | 53.9 | 34.8 | 51.0 | --- | 5 | 12 | 9 | 9 | --- |
| 14 | 2 | 9.3 | 8.2 | 9.8 | 12.8 | --- | 6 | 7 | 6 | 7 | --- |
| 15 | 2 | 13.0 | 10.5 | 13.3 | 26.6 | --- | 4 | 5 | 7 | 8 | --- |
| 16 | 2 | 53.5 | 47.5 | 36.6 | 43.4 | --- | 3 | 5 | 5 | 3 | --- |
| 17 | 2 | 1.9 | 1.2 | 7.8 | 4.3 | --- | 3 | 4 | 5 | 5 | --- |
| 18 | 2 | 2.9 | 2.9 | 11.4 | 16.5 | --- | 3 | 5 | 4 | 6 | --- |
| 19 | 2 | 9.4 | 7.7 | 9.4 | 5.4 | --- | 2 | 4 | 2 | 4 | --- |
| 20 | 2 | 6.9 | 8.6 | 3.4 | 5.0 | --- | 5 | 7 | 7 | 7 | --- |

**Table 3**. Number of plots out of 21 where priority invasive species were detected by cycle. Cycle 1= 2006 & 2008; Cycle 2= 2010 & 2012; Cycle 3= 2014 & 2016; Cycle 4= 2018 & 2022; Cycle 5 = 2023. This list includes all exotic vascular plant species that are capable of dominating Northeastern US forest habitats, but does not include all exotic species detected in MIMA forest plots. Note that only 10 plots have been sampled in cycle 5.

| Latin Name | Common Name | Cycle 1 | Cycle 2 | Cycle 3 | Cycle 4 | Cycle 5 |
|---|---|---|---|---|---|---|
| *Acer palmatum* | Japanese maple | 1 | 1 | 1 | 1 | 0 |
| *Acer platanoides* | Norway maple | 10 | 9 | 9 | 10 | 5 |
| *Aegopodium podagraria* | bishop's goutweed | 1 | 0 | 0 | 0 | 1 |
| *Ajuga* spp. | bugle | 0 | 0 | 1 | 1 | 1 |
| *Alliaria petiolata* | garlic mustard | 7 | 7 | 7 | 6 | 5 |
| *Berberis thunbergii* | Japanese barberry | 4 | 5 | 5 | 6 | 3 |
| *Cardamine impatiens* | narrowleaf bittercress | 0 | 0 | 1 | 0 | 0 |
| *Celastrus orbiculatus* | Asian bittersweet | 9 | 17 | 18 | 16 | 8 |
| *Chelidonium majus* | celandine | 4 | 2 | 3 | 3 | 2 |
| *Cirsium vulgare* | bull thistle | 0 | 0 | 1 | 1 | 0 |
| *Conium maculatum* | poison parsley | 0 | 0 | 0 | 1 | 0 |
| *Cotoneaster divericatus* | spreading cotoneaster | 0 | 0 | 0 | 0 | 1 |
| *Elaeagnus* spp. | exotic olive | 0 | 0 | 1 | 1 | 1 |
| *Euonymus alatus* | burningbush | 2 | 2 | 7 | 7 | 5 |
| *Fallopia japonica* | Japanese knotweed | 2 | 0 | 0 | 0 | 0 |
| *Iris pseudacorus* | paleyellow iris | 0 | 0 | 0 | 1 | 0 |
| *Ligustrum* | privet | 0 | 4 | 3 | 4 | 3 |
| *Lonicera* spp. | exotic bush honeysuckle | 10 | 11 | 11 | 12 | 5 |
| *Lonicera japonica* | Japanese honeysuckle | 0 | 1 | 1 | 2 | 1 |
| *Lysimachia nummularia* | creeping jenny | 1 | 1 | 1 | 1 | 0 |
| *Lythrum salicaria* | purple loosestrife | 3 | 5 | 4 | 4 | 0 |
| *Morus alba* | mulberry | 0 | 3 | 1 | 0 | 0 |
| *Paulownia tomentosa* | princess tree | 1 | 0 | 0 | 0 | 0 |
| *Phalaris arundinacea* | reed canary grass | 3 | 1 | 2 | 1 | 0 |
| *Phragmites australis* | common reed | 1 | 0 | 0 | 0 | 0 |
| *Rhamnus cathartica* | common buckthorn | 4 | 7 | 5 | 11 | 4 |
| *Rhamnus frangula* | glossy buckthorn | 20 | 19 | 19 | 19 | 10 |
| *Robinia hispida* | bristly locust | 0 | 0 | 1 | 0 | 0 |
| *Robinia pseudoacacia* | black locust | 4 | 4 | 4 | 4 | 4 |
| *Rosa multiflora* | multiflora rose | 14 | 18 | 15 | 16 | 7 |
| *Viburnum lantana* | wayfaringtree | 0 | 0 | 1 | 0 | 0 |
| *Wisteria spp.* | wisteria | 0 | 0 | 0 | 0 | 1 |

**Table 4.** Priority forest pest and invasive plant detections by plot in the most recent 4-year census (2022 & 2023) in MInute Man National Historical Park. Coordinates are in NAD83 UTM Zone 19N. No early detection plant species were observed in the most recent census.

| Plot | X | Y | Latin Name | Common Name | Type |
|---|---|---|---|---|---|
| MIMA-001 | 311196 | 4702923 | | beech leaf disease | pest |
| MIMA-006 | 311859 | 4702140 | | beech leaf disease | pest |
| MIMA-008 | 311498 | 4702216 | | beech leaf disease | pest |
| MIMA-009 | 312549 | 4701959 | | beech leaf disease | pest |
| MIMA-010 | 311349 | 4702325 | *Agrilus planipennis* | emerald ash borer | pest |
| MIMA-013 | 311546 | 4702501 | *Agrilus planipennis* | emerald ash borer | pest |
| MIMA-015 | 313297 | 4702406 | | beech leaf disease | pest |
| MIMA-016 | 312891 | 4702061 | *Agrilus planipennis* | emerald ash borer | pest |
| MIMA-020 | 310046 | 4702848 | *Agrilus planipennis* | emerald ash borer | pest |