

Vermont State Parks

Non-Native Invasive Species Inventory



Prepared for the Vermont Department of Forests, Parks and Recreation
by the LAND Stewardship Program, July 2010



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of
VERMONT



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About the LANDS College Sustainability Corps

The field of conservation is rapidly evolving to meet our growing understanding of ecological health and sustainability. New ideas and strategies are changing how we protect and steward land. The Land Stewardship Program (LANDS) is a new approach to today's stewardship challenges. During the Great Depression, the conservation corps model was pioneered as a means to promote nationwide stewardship and provide jobs for the unemployed. That idea has since been reinvented over 116 times by local and state corps across the United States. However, the general theme is the same – young people learning *and* growing through service. LANDS is an innovative College Sustainability Corps designed to train tomorrow's conservationist practitioners and leaders, and is a pilot partnership between the University of Vermont and the Student Conservation Association in its fourth year of service.

Thanks to college level education and prior experience in environmental science fields, LANDS interns are able to take on projects that are more technical than the work traditionally done by conservation corps crews. LANDS interns draft management plans, map areas of interest using GPS and GIS, inventory resources, survey for non-native invasive species, calculate carbon stocks, survey soils for forestry impact, and even find time to build trails and perform public education and outreach. Municipalities, land trusts, state agencies, university researchers, National Forests and Parks, and volunteer-managed conservation organizations all benefit from LANDS's high quality, affordable services. LANDS interns are advanced undergraduates and recent graduates with natural resource experience from all over the world, who bring a range of skills and interests to the program. LANDS is a unique service-learning model that addresses an ever expanding list of conservation needs while training students as future sustainability leaders.

For more information, visit: http://www.uvm.edu/~conserve/lands_website/

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Vermont State Parks NNIS Project Overview and Goals

State Parks and natural areas in western Vermont were surveyed for non-native invasive species (NNIS) on behalf of the Green Mountain National Forest (GMNF) and the Vermont Department of Forest, Parks, and Recreation. The American Recovery and Reinvestment Act of 2009 (ARRA) provided funding for this project in order to create jobs and achieve healthy, sustainable forests, specifically by surveying and controlling invasive plants in high-use areas. This report contains the findings of NNIS surveys west of the Green Mountains, including prioritization of control.

Criteria to Determine Management Priorities

Feasibility of Removal

Several sites had very minimal NNIS infestation. Such sites are considered high priority because it may be possible to remove either all of a certain plant species or all invasive plants at the site. Because highly infested areas require a greater investment of time and resources, and the seed bank is likely also extensive, more pristine areas should be targeted for control. Removal feasibility is high when infestations are in close proximity to roads or trails, whereas feasibility is low when access is difficult. If only one or two individuals were located and removed, it was not included as a high priority infestation, even if infestation monitoring in the future is a high priority. Overall, early response to new infestations is preferred to prevent the spread of NNIS to more pristine areas. To that end, total removal of NNIS in areas of low abundance is of higher priority than partial NNIS removal in more heavily infested parks.

Ecological Impact

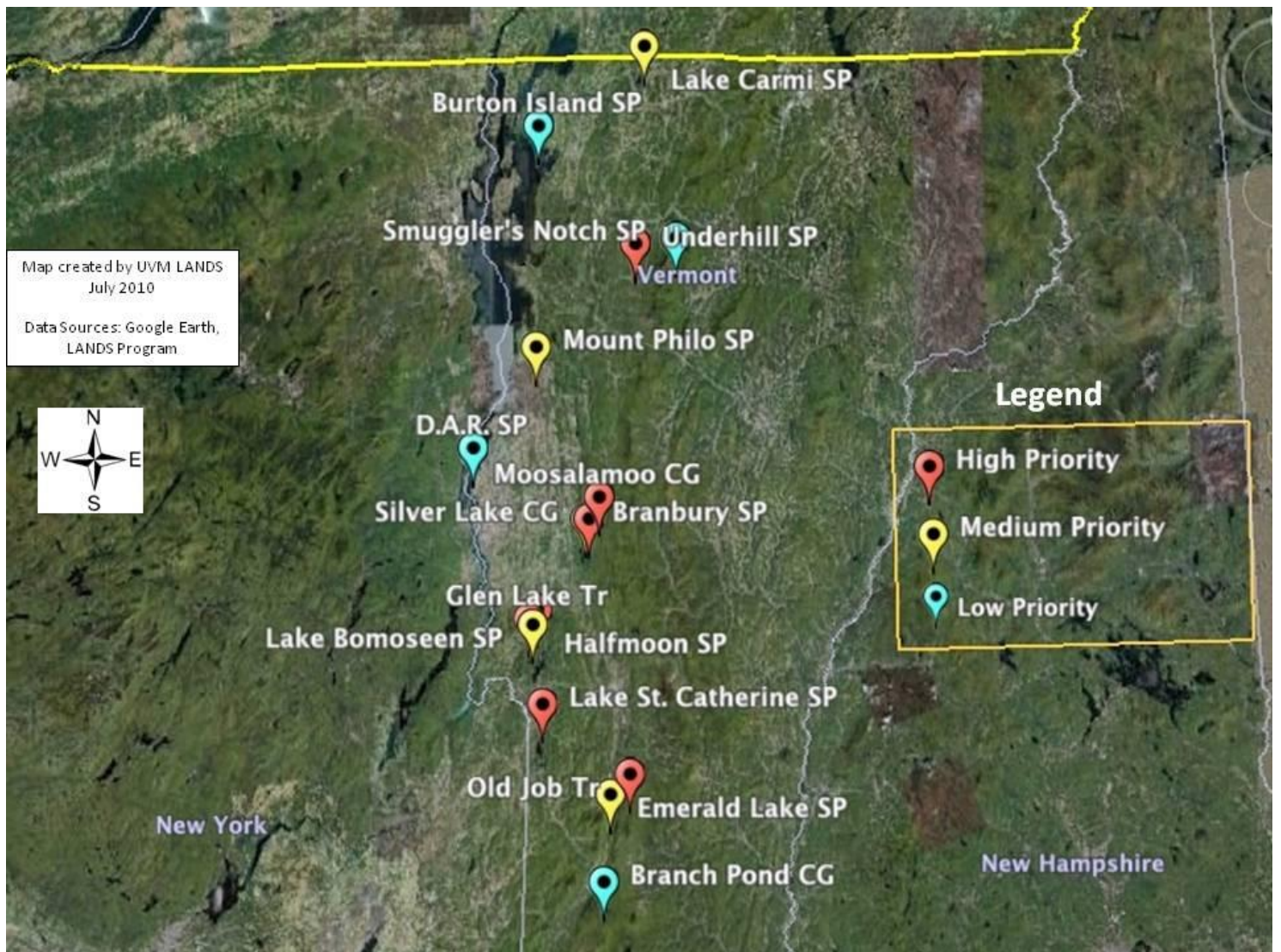
An infestation's ecosystem effects must be taken into account. Many non-natives out-compete native organisms due to a lack of natural predators, competitors, parasites and parasitoids. Non-native species have different ecological impacts, and some are considered more of a threat due to their reproduction methods. For example, species that propagate quickly can spread to surrounding uninfested areas rapidly. Other non-native invasives and take longer to mature or spread, making them lower priority for removal at this time.

Highly Visible Infestations

Many State Parks contain ornamental plantings of non-native invasive plants such as garden loosestrife, Japanese barberry, oriental bittersweet, honeysuckle, and common buckthorn. Areas with high visibility to the public contribute strongly to visitor impressions of state parks, and planted NNIS sends the wrong message. The Vermont Department of Forest, Parks & Recreation works to manage healthy landscapes for the enjoyment and education of the public.

As such, these plantings should be replaced with native ornamentals. Replacement would be a quick and cost effective way to prevent further spread of non-natives to surrounding areas. It is important to maintain a natural, uninfested appearance for both ecological and educational purposes. If mitigation is not feasible in a park, steps should be taken to use the infestation for education and outreach.

Surveyed Vermont State Parks with NNIS Management Priorities



High Priority

Underhill State Park

Current Conditions: One large patch of Asiatic bittersweet was found and removed and one individual buckthorn was found in the lower campground. The upper campground and the road leading up to it was completely free of NNIS.

Natural Community: Dominant species include aspen, birch, spruce, fir, striped maple, and sugar maple.

Management Prioritization: Underhill S.P. receives many visitors each year who enjoy the many trails up Mt. Mansfield. This park provides visitors with an experience of a forest that is free of NNIS. Since the only remaining invasive is an individual common buckthorn, removing this NNIS is a top priority to make the park completely NNIS free. Additionally, annual monitoring should occur at the locations where Asiatic bittersweet and common buckthorn were removed.

Half Moon Pond State Park

Current Conditions: Common buckthorn and honeysuckle were prominent throughout this state park. Garlic mustard, goutweed, and Norway maple were found in clumps in several areas as well. In a nearby field, we found honeysuckle around the entire perimeter as well as buckthorn and Japanese knotweed.

Natural Community: Dominant species included hemlock, maple, and ash. This community is most likely a Hemlock-Northern Hardwood forest.

Management Prioritization: Half Moon Pond S.P. is a high priority because there are several NNIS which are minimally established and could be effectively removed. Most of the garlic mustard was determined to be first year rosettes, so removal before flowering and spreading should be prioritized. Because garlic mustard is allelopathic (prevents other plants from growing) it is imperative that this species is removed. Continued annual monitoring and removal of additional garlic mustard would need to occur in order to ensure that this plant is eradicated. High priority is also given to NNIS located in the campground such as goutweed and Norway maple, while lower priority is given to NNIS such as honeysuckle, buckthorn, and Japanese knotweed found in a nearby field.

Glen Lake Trails

Current Conditions: The trails were mostly free from invasive species except for a few individual honeysuckle and barberry plants.

Natural Community: Hemlocks lined the lakeshore and this community is most likely a Hemlock-Northern Hardwood forest.

Management Prioritization: Since honeysuckle and barberry were only present in small numbers and near the trailheads, this area is a higher priority in order to keep it pristine and completely free from NNIS, as well as to keep existing NNIS from spreading deeper into the forest along the trails.

Silver Lake Campground (GMNF)

Current Conditions: The campground was fairly pristine, most likely due to its remote location and accessibility only by hiking. Invasive species including honeysuckle, buckthorn, and barberry were scattered throughout in minimal, manageable clumps. Many of the campsites were completely free from invasive species.

Natural Community: Dominant species included sensitive fern, hemlock, yellow birch, and striped maple. Natural communities present are the Hemlock Forest and the Hemlock-Northern Hardwood Forest.

Management Prioritization: Silver Lake S.P.'s remote location, lack of vehicle traffic, and relatively small NNIS infestations makes it a high priority for immediate protection. Removal of the few scattered individuals of honeysuckle, buckthorn, and barberry is highly feasible. Users of this campground – accessible only by trail – are also more likely to expect a natural healthy forest.

Moosalamoo

Campground (GMNF)

Current Conditions:

Moosalamoo is a fairly developed campground with garlic mustard found throughout. Honeysuckle, barberry, common buckthorn, and asiatic bittersweet were found in a labeled garden planted by the park. These NNIS were also scattered around the edge of the central field/meadow behind the ornamental plantings, but many campsites were unaffected by NNIS.



Natural Community: Beech, hemlock, black cherry, and ash were the most common trees. This area can be classified as a Northern Hardwood Forest.

Management Prioritization: The most severe infestations at Moosalamoo S.P. were located in a planted garden. Designed to encourage visitors to plant the showcased species in their own yards, the garden is counterproductive to current outreach and education goals. Removal of the planted non-native species and replacement with native species in the garden should be the highest priority for public outreach and education.

Old Job (GMNF)

Current Conditions: Honeysuckle and garlic mustard were found at the very end of the access road; however along the Old Job access road and in the campsites, no invasive species were found.

Natural Community: Dominant species include maple, ash, birch, and hemlock.

Management Prioritization: The Old Job access road is a high priority due to easy access to the site and its pristine nature. Since only a few individuals of honeysuckle and garlic mustard were found near the end of the access road and no NNIS were found along the rest of the road, it is important to keep the infestation from spreading along the rest of the road or into the nearby hiking trail.

Lake St. Catherine State Park

Current Conditions: Garlic mustard, honeysuckle, Japanese barberry, and buckthorn were among the invasive species found. Goutweed was found planted ornamentally, as were several Norway maples, which were also found at the forest edge.

Natural Community: Dominant species include hemlock and maple.

Management Prioritization: Monitoring is crucial to preventing the spread of low-density NNIS infestations throughout Lake St. Catherine S.P. Severe wind damage to hemlock and maple trees earlier this year increases the park's vulnerability to higher density infestations. Ornamental goutweed should be removed immediately.

Medium Priority

Emerald Lake State Park

Current Conditions: Honeysuckle and Japanese and common barberry were identified all along the lake. The largest infestation was near the swimming area. Garlic mustard, buckthorn, and tiny patches of Japanese knotweed and multi-flora rose were also found throughout the campsites. Emerald Lake features a small island, which is also infested by honeysuckle, buckthorn, and Japanese barberry. The entrance road and the hiking trail past the cemetery had several clumps of buckthorn and honeysuckle that could perhaps be mechanically pulled.

Natural Community: Due to the size, topography, and wetlands, many different natural communities were present, including a marshy area, an older hemlock forest, and a beech/ash/maple forest.

Management Prioritization: The diversity and density of NNIS infestations present may require a large-scale removal effort with high time and labor costs. For this reason, Emerald Lake S.P. is a medium priority.

Lake Carmi State Park

Current Conditions: The nature trail was free from NNIS, but phragmites, buckthorn, and honeysuckle were present along roads.

Natural Community: Dominant species include cedar, and balsam fir. The park also contains a large bog dominated by tamarack and spruce.

Management Prioritization: Some areas of this park were NNIS free, but others had fairly large infestations. Since the park had surprisingly few infestations for its size this park is a medium priority for NNIS removal. A road crew would be able to cut and pull many plants efficiently, since the majority of infestations are along roads.



Campsite at Lake Carmi State Park

Mt. Philo State Park

Current Conditions: Japanese barberry, common barberry, honeysuckle, and buckthorn were common along heavily traveled roads and trails.

Natural Community: Dominant species in this area include white pine, Scotch pine, tamarack, bloodroot, jewelweed, and cedar.

Management Prioritization: This park receives high levels of day visitors for its scenic views of Lake Champlain and the surrounding landscape and should be a priority for removal due to the large amount of visitors. Since infestations of Japanese and common barberry were small they would be feasible for removal, but honeysuckle and buckthorn would be more extensive to remove.

Lake Bomoseen State Park

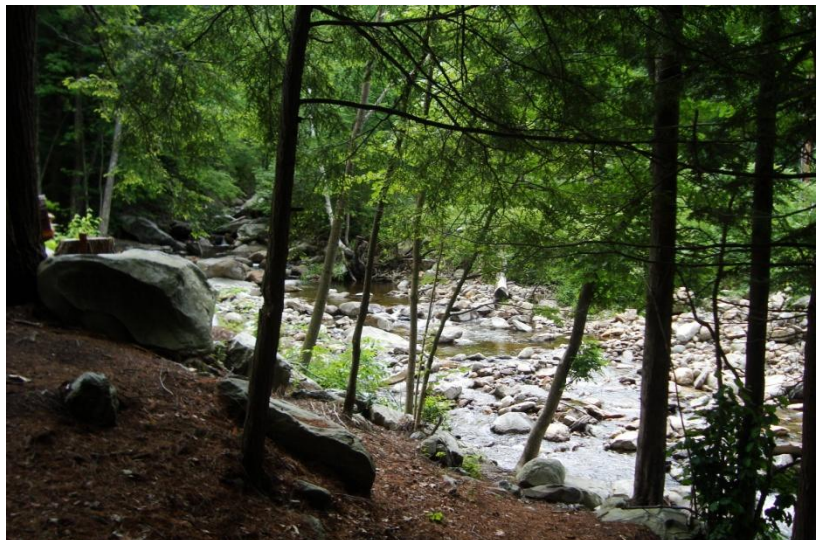
Current Conditions: Multi-flora rose, honeysuckle, buckthorn, goutweed, black-swallowwort, common reed, garlic mustard, and Amur maple were found throughout the recreation area and campsites. Honeysuckle and buckthorn were the most prevalent.

Natural Community: Dominant native species include sugar maple, ash, hickory, oak and hemlock. This community is a Mesic Maple-Ash-Hickory-Oak Forest.

Management Prioritization: Removal of less established NNIS such as goutweed, black-swallowwort, phragmites, Amur maple, and garlic mustard should be the main priority. All of these species were found in very small, localized areas and could easily be removed before further spreading.

Branbury State Park

Current Conditions: Honeysuckle was well established throughout the entire park. Garlic mustard was prevalent in the wooded campsites and goutweed was well established by the woodshed and buildings along the entrance road. Common buckthorn, Norway maple, bittersweet, and barberry were also present, mainly in the recreation area. Garden loosestrife was planted ornamentally at the entrance.



River flowing through Branbury State Park

Natural Community: Ash, maple, white pine, hop hornbeam, and hemlock were the dominant trees present.

Management Prioritization: Top priority is the removal of garden loosestrife since it was planted ornamentally. This site seems to be heavily traveled by day-users and campers, making it an ideal place to educate visitors about invasive plants. Selective eradication of less-established invasive plants, such as garlic mustard, could be an effective management goal for the area.

Low Priority

Smugglers' Notch State Park

Current Conditions: This park was completely free from NNIS except for two small honeysuckle plants. The general lack of NNIS may be due to the park's higher elevation.

Natural Community: Highest elevation park in Vermont, with white and yellow birch, white ash, and striped maple being the most common tree species.

Management Prioritization: It would be very feasible to remove the one infestation present to make the park completely free of NNIS. This park is a high priority for the prevention of ALB infestations due to many campers and visitors from Worcester, MA, and should be periodically monitored, especially in August and September. Since only a few honeysuckle plants were found it would be quick and feasible for park employees to remove these plants.



Ferry at Burton Island State Park



Beautiful views from Smuggler's Notch

Burton Island State Park

Current Conditions: Honeysuckle and buckthorn were prevalent throughout the entire park, including the nature trails. Dame's rocket burdock, reed canary grass, and white clover were found on a nature trail through a prairie ecosystem.

Natural Community: Dominant species include sumac, maple, cedar, basswood, black ash, and aspen. The campsites also contained open grown, centuries-old Burr oaks.

Management Prioritization: There were many infestations of non-native invasive species found in varying habitats around the island. Management of asiatic bittersweet along the southern tip trail should be prioritized. It would be feasible to remove small patches of purple loosestrife along shoreline. Complete NNIS removal would be challenging.

Daughters of the American Revolution (DAR) State Park

Current Conditions: This state park was the mostly heavily infested park visited by the LANDS crew this summer. Buckthorn and honeysuckle were pervasive throughout, completely occupying the understory of the forest. Other NNIS such as yellow loosestrife and barberry were present as well.

Natural Community: Dominant species include shagbark hickory, elm, and sugar maple.

Management Prioritization: With limited resources, it does not seem practical to devote time or energy to DAR. Instead, it could serve as an educational tool showing the public an example of severe NNIS infestation. It could also be used as an experimental plot to try different removal/prevention techniques.

Branch Pond (GMNF)

Current Conditions: Branch Pond was one of the most pristine locations that was visited. Two honeysuckle plants were located and removed, but no other NNIS were found.

Natural Community: Dominant species were spruce and fir. Also contains a high elevation bog which was host to a large population of flowering pitcher plants.

Management Prioritization: It is very feasible to eradicate NNIS from the Branch Pond access road area. Two individual honeysuckles were located and removed, and periodic monitoring is suggested due to its near pristine habitat.

Site-specific Non-native Invasive Species Priority Table

This table shows the priority level for each site, specific species infestations and their priorities, and brief explanations in the notes.

Site	Site Priority	Species	Species Priority	Notes
Underhill SP	High	Bittersweet Buckthorn	High High	One patch of bittersweet and one individual buckthorn plant.
Half Moon SP	High	Garlic Mustard Norway Maple Goutweed Japanese Knotweed Buckthorn Honeysuckle	High High High Medium Low Low	High priority was given to infestations in campground. Low priority given to infestations in fields nearby.
Glen Lake Trails	High	Honeysuckle Japanese Barberry	High High	Only a few individuals along lake shore.
Silver Lake CG	High	Honeysuckle Buckthorn Japanese Barberry	High High High	Very few individuals. Feasibility of removal is high.
Moosalamoo CG	High	Garlic Mustard Japanese Barberry Honeysuckle Bittersweet Buckthorn	High High High High High	All of these NNIS except garlic mustard were ornamentally planted at the park.
Old Job	High	Garlic Mustard Honeysuckle	High High	Few individuals easily removed at end of road.
Lake St. Catherine	High	Goutweed Garlic Mustard Honeysuckle Japanese Barberry Buckthorn	High Medium Medium Medium Medium	Should be monitored carefully due to recent storm damage which could worsen infestation. Also ornamentally planted goutweed should be replaced with native plantings.
Emerald Lake SP	Medium	Japanese Knotweed Buckthorn Honeysuckle Japanese Barberry Garlic Mustard Multi-flora Rose	High High High Low Low Low	Lakeside areas are a priority. Localized infestations are given a high priority.

Continued on page 15.

Site	Site Priority	Species	Species Priority	Notes
Lake Carmi SP	Medium	Phragmites Buckthorn Honeysuckle	High Medium Medium	Most plants were found along access roads.
Mt. Philo SP	Medium	Japanese Barberry Common Barberry Bittersweet Honeysuckle Buckthorn	High High High Low Low	Site priority is medium due to high visitation, but difficulty of removal. Large patches of honeysuckle and buckthorn near parking areas.
Lake Bomoseen SP	Medium	Black Swallow-wort Phragmites Garlic Mustard Amur Maple Japanese Knotweed Multi-flora Rose Honeysuckle Buckthorn Goutweed	High High High High High Low Low Low Low	The camping areas were less infested than openings such as the rec. areas. Black swallow-wort and common reed were found near parking areas. Amur maple was found ornamentally planted and has spread into some campsites.
Branbury SP	Medium	Garden Loosestrife Japanese Barberry Bittersweet Garlic Mustard Norway Maple Buckthorn Honeysuckle Goutweed	High High High High Medium Low Low Low	Garden loosestrife and Norway Maple were ornamentally planted. Few individuals of Japanese barberry and bittersweet. Garlic mustard in wooded areas.
Smuggler's Notch SP	Low	Honeysuckle	High	Two individual honeysuckle plants. Inform park employees for removal.
Burton Island SP	Low	Bittersweet Dame's Rocket Phragmites Purple Loosestrife	High High High High	Extensive honeysuckle and buckthorn not worth removing.
D.A.R. SP	Low	Honeysuckle Buckthorn Black Locust Honey Suckle Buckthorn Garden Loosestrife Japanese Barberry	Low Low Low Low Low Low Low	Overwhelming infestations of buckthorn and honeysuckle. Ideal for education and experimental control plots.
Branch Pond	Low	Honeysuckle	Low	Two individuals were removed and continued monitoring is needed to maintain the pristine habitat.

Insect Surveys

LANDS interns also surveyed Vermont's state parks for three invasive insect species. The Asian-Longhorned Beetle, Emerald Ash Borer, and Hemlock Woolly Adelgid affect native maple species, native ash species and hemlock trees respectively.

The Asian-Longhorned Beetle and Emerald Ash Borer are exotic wood-boring insects from Asia that have been found in neighboring Massachusetts and Quebec, but have not yet been found in Vermont. These insects are transported by firewood, and produce larvae that weaken and ultimately kill host trees. Because maple and ash are critical components of Vermont's Northern Hardwood forests, the arrival of these non-native insects would have a major ecological and economic impact if established in Vermont.

The Hemlock Woolly Adelgid has been found on native trees in southern Vermont, and is primarily transported by birds along riparian corridors. The tiny insect feeds on young twigs, causing needles to dry out and drop prematurely. Resulting sparse foliage removes hemlocks' value as shelter for wildlife and their ability to shade streams. Hemlock is also crucial to Vermont forest ecosystems.

Surveying techniques for non-native insect species were based on state protocol (see Appendix). Maple, ash and hemlock trees were visually inspected for signs and symptoms of invasive insect species. No signs of invasive insect presence were detected in the state parks surveyed.



From left to right: Hemlock Woolly Adelgid, Asian Longhorned Beetle, Emerald Ash Borer.

Conclusions

The Vermont State Park system is highly heterogeneous. Varying degrees of infestation exist both on a state-wide and region-wide basis. Ecological, climactic, and anthropogenic factors determine the presence or absence of a given species in a park. Several parks close in proximity displayed completely different patterns of infestation.

The prioritization system LANDS developed in this report is designed to transform field observations and analyzed data into a cohesive and accessible set of recommendations for removal crews. Education and public outreach materials will be key components of NNIS mitigation. This includes working with visitors to raise general awareness of the pressures NNIS put on the natural ecosystems they come to enjoy, as well as collaboration with nearby private landholders to coordinate regional infestation management.



The view from atop Mt. Philo.

Appendix:

NNIS Species List

Scientific Name	Common Name	Species Code
<i>Heracleum mantegazzianum</i>	giant hogweed	HEMA17
<i>Aegopodium podagraria</i>	goutweed	AEPO
<i>Ailanthus altissima</i>	tree-of-heaven	AIAL
<i>Alliaria petiolata</i>	garlic mustard	ALPE4
<i>Butomus umbellatus</i>	flowering rush	BUUM
<i>Celastrus orbiculatus</i>	asiatic bittersweet	CEOR
<i>L. maackii</i> , <i>L. morrowii</i> , <i>L. tatarica</i> , & <i>L. x bella</i>	invasive bush honeysuckles (amur, morrow, tatarian, & Bell's)	LOMA6, LOMO2, LOTA, & LOBE or LONIC for all
<i>Lonicera japonica</i>	Japanese honeysuckle	LOJA
<i>Lythrum salicaria</i>	purple loosestrife	LYSA2
<i>Phragmites australis</i>	common reed	PHAU7
<i>Polygonum cuspidatum</i>	Japanese knotweed	POCU6
<i>Rhamnus cathartica</i>	common buckthorn	RHCA3
<i>Rhamnus frangula</i>	glossy buckthorn	FRAL4
<i>Vincetoxicum nigrum</i>	black swallow-wort	CYLO11
<i>Acer ginnala</i>	Amur maple	ACGI
<i>Acer platanoides</i>	Norway maple	ACPL
<i>Alnus glutinosa</i>	European black alder	ALGL2
<i>Amorpha fruticosa</i>	false indigo	AMFR
<i>Ampelopsis brevipedunculata</i>	porcelainberry	AMBR7
<i>Anthriscus sylvestris</i>	wild chervil	ANSY
<i>Berberis thunbergii</i>	Japanese barberry	BETH
<i>Berberis vulgaris</i>	common barberry	BEVU
<i>Cardamine impatiens</i>	narrowleaf bittercress	CAIM
<i>Centaurea biebersteinii</i>	spotted knapweed	CEBI2
<i>Elaeagnus angustifolia</i>	Russian olive	ELAN
<i>Elaeagnus umbellata</i>	autumn olive	ELUM
<i>Euonymus alata</i>	burning bush	EUAL13
<i>Euphorbia cyparissias</i>	cypress spurge	EUCY2
<i>Glyceria maxima</i>	reed mannagrass	GLMA3
<i>Hesperis matronalis</i>	Dame's rocket	HEMA3
<i>Iris pseudacorus</i>	yellow iris	IRPS
<i>Ligustrum obtusifolium</i>	border privet	LIOB
<i>Lonicera xylosteum</i>	dwarf honeysuckle	LOXY

<i>Lysimachia vulgaris</i>	garden loosestrife	LYVU
<i>Microstegium vimineum</i>	Japanese stiltgrass	MIVI
<i>Paulownia tomentosa</i>	princess tree	PATO2
<i>Polygonum perfoliatum</i>	mile-a-minute vine	POPE10
<i>Polygonum sachalinense</i>	giant knotweed	POSA4
<i>Populus alba</i>	white poplar	POAL7
<i>Robinia pseudoacacia</i>	black locust	ROPS
<i>Rosa multiflora</i>	multiflora rose	ROMU

Invasive Insect Survey: Protocol

1. Survey is to take place approximately from mid-May to Labor Day 2010, which is following the same time frame as the invasive plant survey. It would be advantageous to survey certain parks last-during the last couple weeks of August. These parks have the highest probability for Asian longhorned beetle to be found, and this is the time of highest beetle activity.
2. The survey will be focused on looking for three major non-native invasive insects: 1. *Asian Longhorned Beetle*, 2. *Emerald Ash Borer*, 3. *Hemlock Woolly Adelgid*.
3. It will be conducted on developed and dispersed US Forest Service campgrounds, and on developed Vermont State Parks campgrounds.
4. No destructive sampling will be done, except hand removal of dead bark.
5. The results may be recorded on a data sheet or recorder. However, a paper copy of the Recreation Site Data sheet will be completed for each site.
6. The area to survey will be primarily campsite based, but will also include the buffer around campsites. Buffer distance will be 33 feet around the perimeter of each campsite. The hemlock woolly adelgid survey will focus on areas of greatest risk: planted hemlocks, stream banks and lake shores, near bird feeders and bird baths, and along hiking trails.
7. At each campsite:
 - a. Each maple, ash, and hemlock >1" DBH around the perimeter and buffer of the campsite, will be included in the survey, to a maximum of 50 of each per campsite. These trees will be examined, from all sides to the top of the tree, for the presence of Asian longhorned beetle, emerald ash borer, and hemlock woolly adelgid. Binoculars should be used as necessary. The total number examined will be recorded.
 - b. If any maple, ash or hemlock trees have damage signs or decline symptoms, this will be noted.

- c. The presence of white pine and other pines, birch, beech, aspen/poplar, oak, spruce and fir within the buffer will be noted.

8. For each campground as a whole:

- a. Fifteen suspicious ash and maple (or other Asian longhorned beetle host) trees will be selected for a more intensive survey. These should be distributed through the campground. Priority will be trees located in campsite buffers. Only if there are no host trees in the campsites will the trees be selected from elsewhere in the campground. *Using binoculars*, crews will take a more in-depth look at the entire tree for the presence of exit holes, frass or other beetle signs. Diameter at Breast Height (DBH), crown class, overall health, and other symptoms will be recorded.
- b. If hemlock is present in the campground, a total of 200 branches will be looked at from at least 10 hemlocks. Branches are 39 inches long extending back from the tip, and must be within reach. No more than 20 per tree will be examined.

9. If a signs are detected which could indicate that Asian longhorned beetle, emerald ash borer, or hemlock woolly adelgid are present:

- a. Any samples collected should be double-bagged. Bags should be clearly labeled with the location, date collected, host species, and the name of the collector. Any information which would assist in making an identification should also be included. Samples which are not delivered within 24 hours should be refrigerated.
- b. Record the location of any trees with symptoms of concern or where samples were collected. Ensure that these trees, and the exact location of symptoms, can be relocated using flagging or other means.
- c. Report on follow-up needed and convey samples to the project coordinator, Jeff Briggs, as soon as possible. If unavailable, report should be made to other designated staff from the Department of Forests, Parks, and Recreation.

10. Any survey areas, outside of the campsite buffers, and the location of trees requiring follow-up will be sketched on a campground map.

11. Equipment

- a. Needed: Binoculars, flagging, data sheets and clipboards, plastic bags, markers, 50' tape, GPS, outreach materials.
- b. Optional: Data recorder, hand lens, tally counters, digital camera.