Priority Conservation Area Evaluation

Upper and Lower Lakes Wildlife Management Area

INVASIVE SPECIES MANAGEMENT
SAINT LAWRENCE
EASTERN LAKE ONTARIO

May 2022

Contents

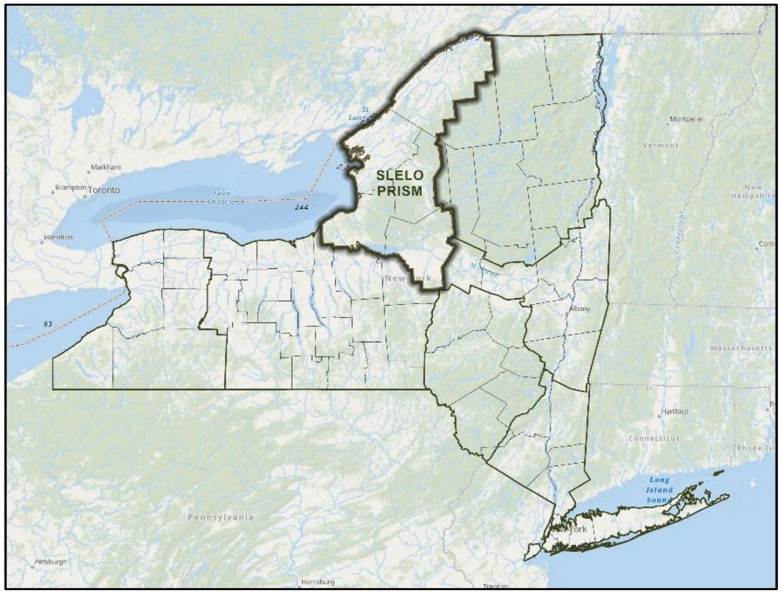
Introduction

The St. Lawrence Eastern Lake Ontario Partnership for Regional Invasive Species Management (SLELO PRISM) serves as one of New York State's eight PRISMs and is hosted by The Nature Conservancy. The SLELO PRISM region encompasses 7,600 square miles and includes all or part of five counties (Map 1).

The mission of the SLELO PRISM is to protect native habitats, biodiversity, natural areas, parks and refuges, habitats, waterbodies, farmland, and open space by using a collaborative and integrated approach to invasive species management. The emphasis of these activities is on prevention, early detection, rapid response, ecological restoration, and education.

Due to the expansive nature of the PRISM and the high number of invasive species present in the region, SLELO PRISM partners focus invasive species management efforts on sites that are ecologically significant or have a high conservation value. In addition, sites that are seed banks, vectors, or that pose a proximity threat to high-value sites are all factors involved in determining site-based management on both public and private lands. The SLELO partnership has named these sites **Priority Conservation Areas (PCAs).** Specifically, PCA's are viewed as "sites that have ecological importance such as unique habitat, grassland, Alvar, wetland, dune, freshwater spawning area, fen, bog, etc. and are often host to a rare, threatened or endangered species."

Invasive species survey and management work at PCAs is further refined to areas where human activities or site conditions increase the probability of an invasive species being introduced and/or becoming established – known as **Highly Probable Areas (HPAs).** Examples for HPAs in aquatic areas include boat launches, fishing access sites, and coves with shallow slow-moving waters, while HPAs in terrestrial areas include trailheads, parking areas, and campgrounds.



Map 1. Location of SLELO PRISM in New York State.

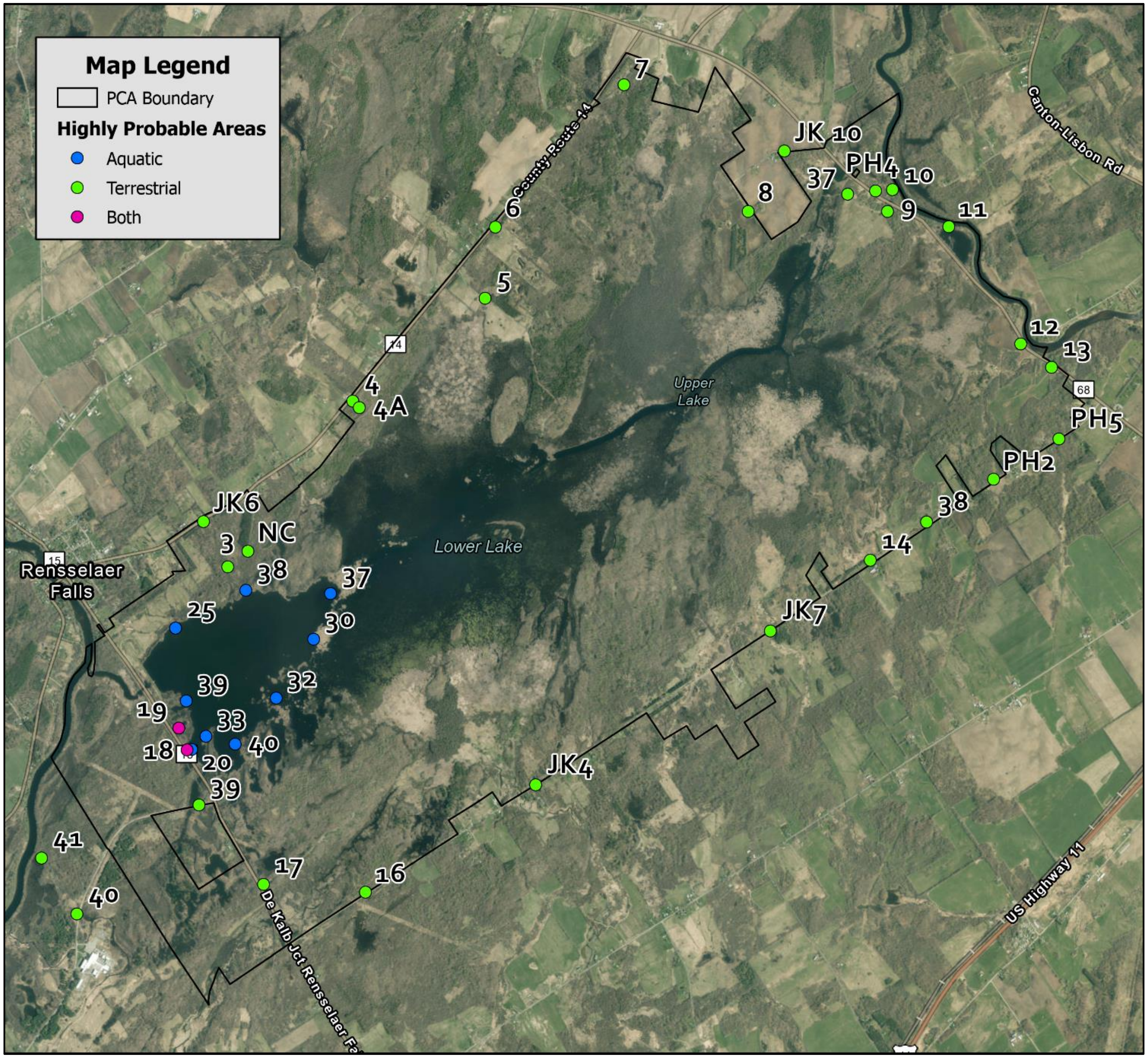
The purpose of this priority conservation area evaluation is to summarize select measures of conservation significance within the PCA and to objectively assess SLELO's progress toward invasive species prevention, survey, and management goals. The evaluation includes an overview of a respective PCA's conservation significance; a summary of invasive species distribution and abundance, including a quantitative analysis of management progress; and recommendations for future work. Summaries of invasive species distribution and management progress are compiled with data collected by SLELO PRISM staff and contractors, supplemented by public data from the iMapInvasives database. Survey and management activities conducted by partners and not reported to the iMapInvasives database are not included in this assessment.

About this PCA – Upper and Lower Lakes WMA

The Upper and Lower Lakes Wildlife Management Area (WMA) PCA is an approximately 8,757-acre wetland complex located between the Grass and Oswegatchie Rivers in the Town of Canton, St. Lawrence County. This NYSDEC managed property is a popular destination for numerous recreational activities (NYSDEC).

Approximately 96% of the PCA is natural landcover (NLCD, 2019). The mean elevation of Upper and Lower Lakes WMA PCA is 315 feet and most common geophysical settings are very low elevation loam (57%), very low elevation calcareous (13%), and very low elevation silt/clay (13%).

Upper and Lower Lakes WMA was nominated as a SLELO PCA in 2012 and includes 28 terrestrial, nine aquatic, and two mixed habitat HPAs (Map 2). It was surveyed by SLELO staff/contractors in 2013, 2015, 2017, 2019, and 2021.

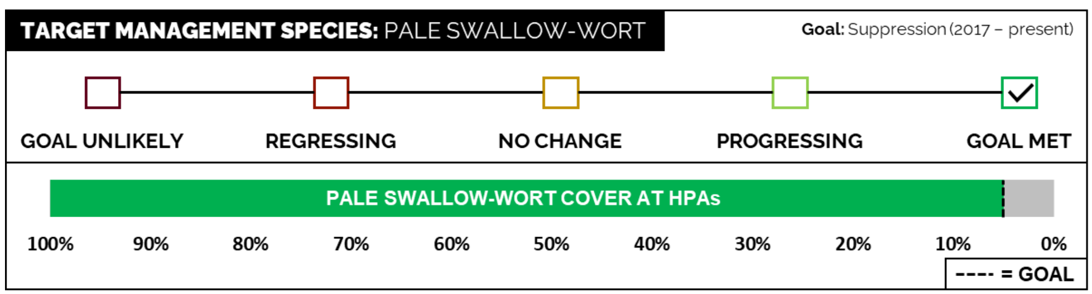


Map 2. Location of HPAs at Upper Lower Lakes WMA PCA (2021).

BY THE NUMBERS

PCA STATS	SURVEY STATS	MANAGEMENT STATS
8,757* ACRES IN THE PCA	**28 HPAs** 28 TERRESTRIAL, 9 AQUATIC, 2 MIXED	**2** TIER SPECIES UNDER MANAGEMENT
96% NATURAL LANDCOVER	**5.5** AVERAGE ACRES SURVEYED PER VISIT	**14** TOTAL SLELO MANAGEMENT ACTIONS SINCE 2017
83% OF PCA IN RCN*	**23** KNOWN INVASIVE SPECIES (5 AQUATIC + 18 TERRESTRIAL)	**2.8** AVERAGE ACRES MANAGED PER VISIT
724,295 mt OF STORED CARBON	**11** SLELO TIERED SPECIES (2 AQUATIC + 9 TERRESTRIAL)	**54%** REDUCTION IN EXTENT AT MANAGED SITES
13 KNOWN RARE SPECIES OR COMMUNITIES		

INVASIVE SPECIES MANAGEMENT PROGRESS



PCA SCORE	
A	Score is based on the PCA's ecological attributes and current progress towards invasive species management goals. Primary drivers influencing the score at this PCA include: (+) Swallow-wort management goal met (+) Slightly above average terrestrial resilience

** Current score subject to future discretionary restoration adjustment*

Conservation Significance and Natural Features

The following section provides an overview of select characteristics – such as terrestrial resilience, carbon storage, and rare species and communities – that lend to this PCA's conservation value.

Terrestrial Resilience

The Nature Conservancy has identified a network of lands with unique topographies, geologies, and other characteristics that can withstand the impacts of climate change. The **resilient and connected network (RCN)** identifies where plant and animal species have the best chance to adapt in a changing climate (Anderson et al., 2016). Multiple factors contribute to a location's overall resilience, including:

- **Landscape Diversity –** microhabitats and climate gradients available within a given area. The persistence of species increases in areas with high landscape diversity.
- **Local Connectedness –** the number of barriers and degree of fragmentation within a given area. A permeable (or connected) landscape promotes resilience by facilitating species movements.

The attributes of climate resilient lands can be degraded by invasive plants and/or forest pests and pathogens. Approximately **83%** of the terrestrial environment within Upper and Lower Lakes WMA is included in the resilient and connected land network (Figure 2). Upper and Lower Lakes WMA PCA has **slightly above average terrestrial resilience, above average local connectedness, and slightly above average landscape diversity,** indicating a slightly elevated capacity to maintain species diversity, movement, and ecological function as the climate changes (Figure 3). For background information on this data, see Appendix A.

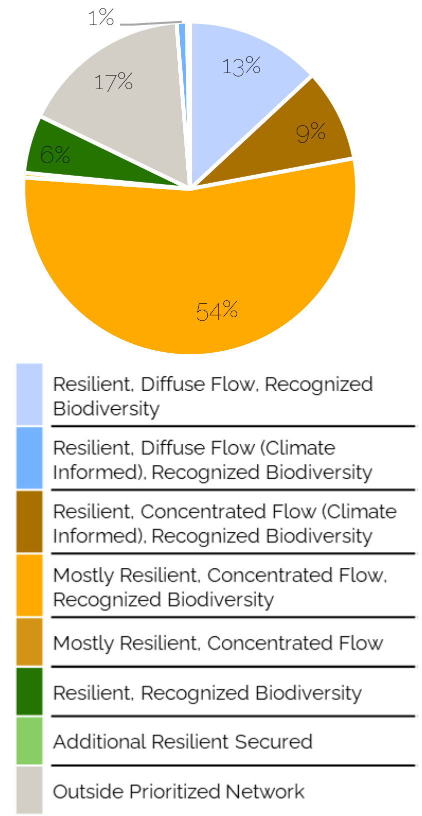


Figure 2. Percent of Upper Lower Lakes WMA located in The Nature Conservancy's resilient and connected land network.

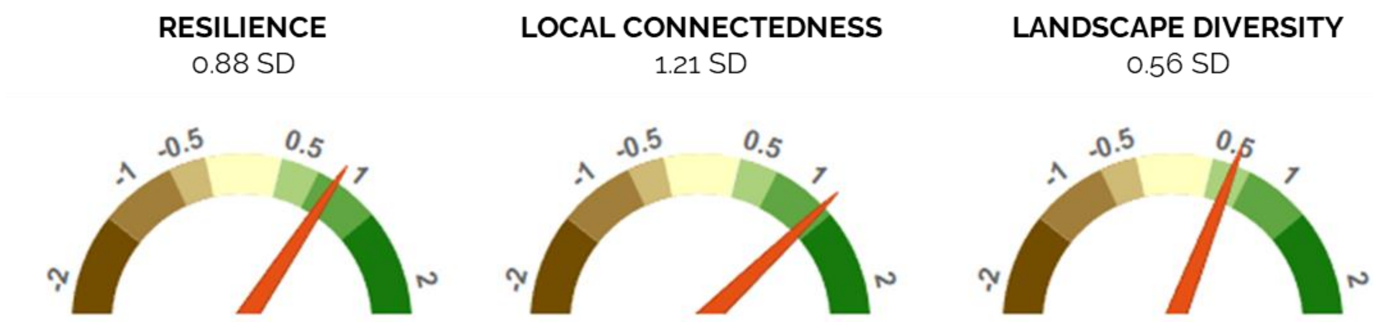
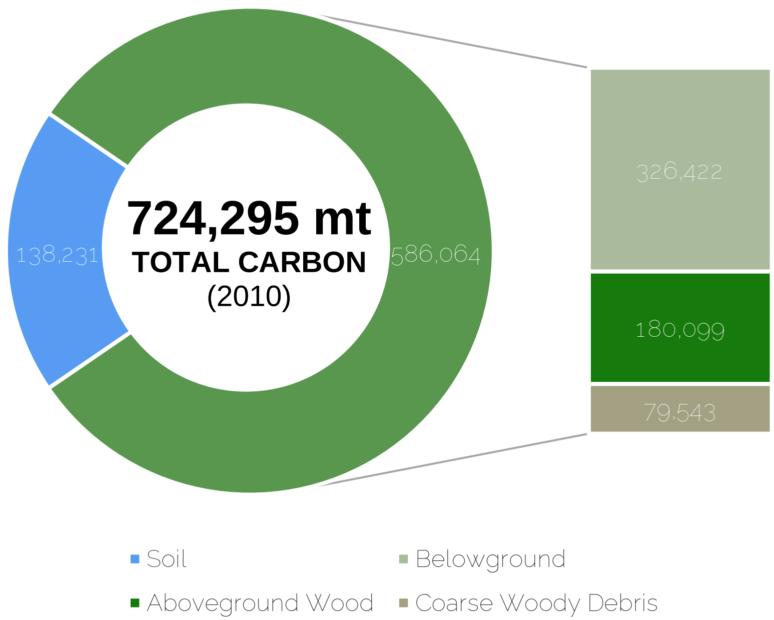


Figure 3. Site resilience, local connectedness, and landscape diversity scores for Upper Lower Lakes WMA PCA. Scores are expressed as the standard deviation above or below the average score.

Carbon Benefits

Climate change is driven, in part, by increased carbon dioxide in the atmosphere from human sources. Forests are an effective means to sequester (i.e. store) carbon. Through the process of photosynthesis, trees pull CO^2 from the air and bind it in their tissues as branches, roots, etc. Forests also sequester and store carbon through their soil. Conservation or improved management actions that aim to increase carbon storage and/or avoid carbon release are an important component of a natural climate solutions strategy. It's estimated that in the United States, conservation, restoration, and management could support sequestration of 21% of net annual emissions (Fargione et al., 2018). Unfortunately, tree damage or death caused by invasive forest pests or diseases can reduce sequestration and storage capacity. Based on an analysis of National Forest Inventory Plots, forests impacted by insect disturbances sequestered 69% less carbon than trees with no disturbance (Quirion et al., 2021). In addition, the presence of terrestrial invasive plants has been documented to reduce forest regeneration success, which can lead to long-term reductions in forest carbon storage (Magdalena & Katharina, 2020).

Models of forest and soil carbon data indicate Upper and Lower Lakes WMA PCA stores an estimated 724,295 metric tonnes (mt) of carbon, including 586,064 mt forest carbon (Williams et al., 2021) and 138,231 mt of soil carbon (Guevara et al., 2020) (Figure 4).



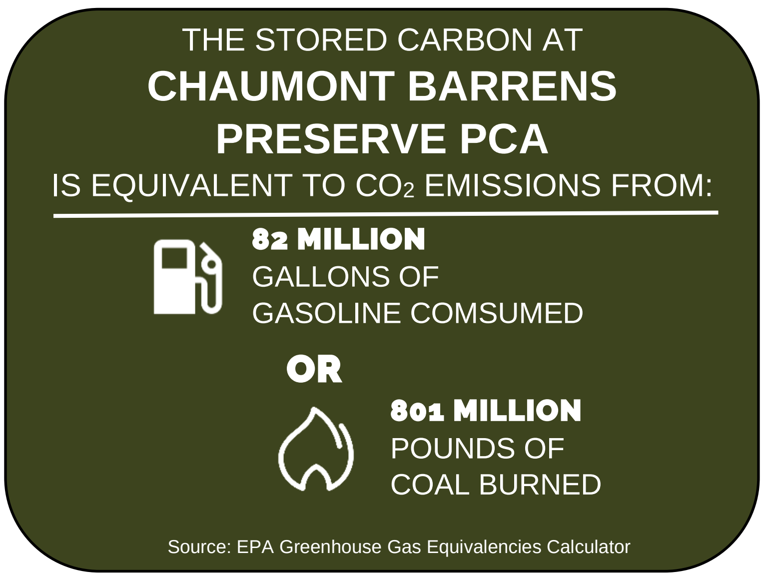


Figure 4. Sources and quantities of stored carbon at Upper and Lower Lakes WMA PCA.

Rare Native Species and Communities

Approximately 42% of threatened or endangered species are at risk due to invasive species. Invasive species are generally considered one of the greatest causes of endangerment, second only to habitat loss (Pimental et al., 2005). Invasives may impact endangered species through direct predation, disease or competition for space and resources, and more (Duenas, et al., 2021).

Upper and Lower Lakes WMA CONTAINS:

1 RARE COMMUNITIES

12 RARE SPECIES

Species and communities in New York are assigned a state rank by the NY Natural Heritage Program (NYNHP) to reflect their rarity. Conservation status ranks include:

- **S1 –** Typically 5 or fewer occurrences, very few remaining individuals, acres, or miles of stream, or some factor of its biology making it especially vulnerable in NY.
- **S2 –** Typically 6 to 20 occurrences, few remaining individuals, acres, or miles of stream, or factors demonstrably making it very vulnerable in New York State.
- **S3 –** Typically 21 to 100 occurrences, limited acreage, or miles of stream in New York State.
- **S4 –** Apparently secure in New York State
- **S5 –** Demonstrably secure in New York State

Surveys by NYNHP and other conservation partners have identified **one rare community** and **12 rare species** at Upper and Lower Lakes WMA PCA (Table 1). Note that some species documented historically may no longer be extant.

Table 1. Number of rare species and communities documented at Upper and Lower Lakes WMA PCA.

State Rank	Functional Group	Count
Critically Imperiled (S1)	Dragonflies and Damselflies	1
	Fish	1
	Vascular Plants	1
Imperiled (S2)	Birds	2
	Fish	3
	Northern White Cedar Swamp	1
Vulnerable (S3)	Birds	4

Invasive Species Abundance and Management

Invasive Species Surveys

Upper and Lower Lakes WMA PCA was surveyed by SLELO staff in 2013, 2015, 2017, 2019, and 2021. Staff focus early detection surveys on tier-ranked species at 28 terrestrial, nine aquatic, and two mixed habitat highly probable areas (HPAs). For more information on the ranking system, see Appendix B. Additional incidental invasive species observations throughout the PCA are submitted by community scientists and other practitioners. According to the iMapInvasives database, the first invasive species observation at Upper and Lower Lakes WMA was reported in 2002. As of June 2021, 18 terrestrial and five aquatic invasive species are known to be present in Upper and Lower Lakes WMA (Figures 5a). Twelve are low to moderate impact species and not tier ranked in the SLELO PRISM. Four known species are ranked as tier 3 and seven are ranked as tier 4 (Figure 5b). The total number of known species at each HPA ranges from one to nine with an average of 3.4 species per HPA. The total number of SLELO tier species at each HPA ranges from one to six with an average of three species per HPA. For a full list of species known at the PCA, see Appendix C.

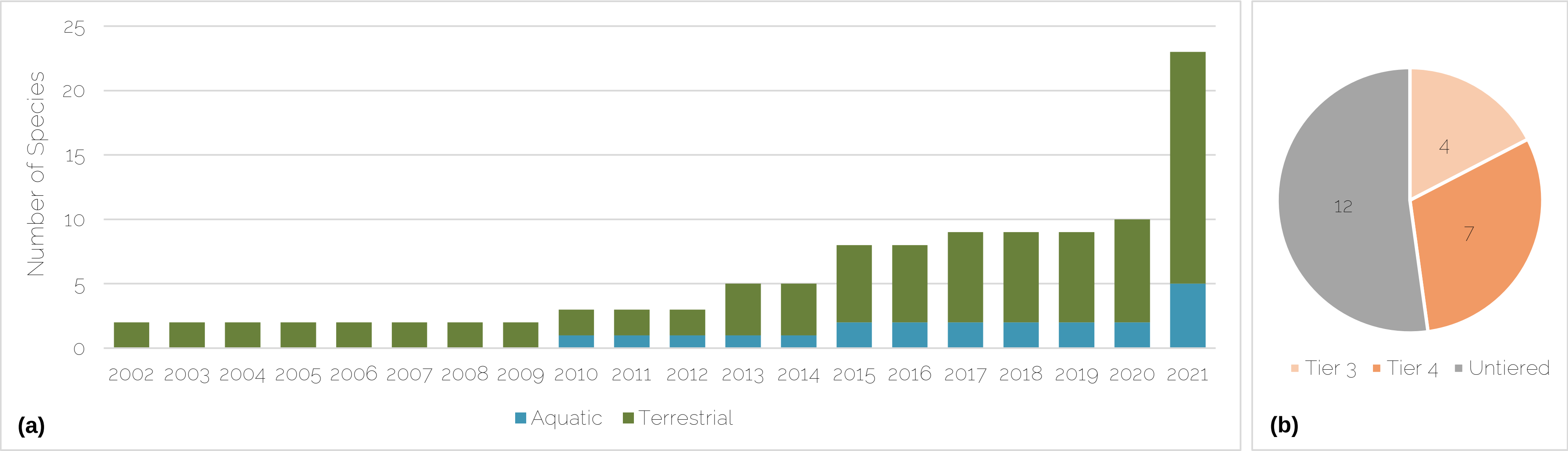


Figure 5. (a) cumulative number of aquatic and terrestrial invasive species documented at Upper Lower Lakes WMA PCA 2002-2021 (source: SLELO and iMapInvasives). (b) Distribution of known invasive species by SLELO tier classification.

Approaching Species

The following species are not found within the PCA geography but are within five-miles of the PCA boundary and approaching the area. They should be considered for early detection efforts by staff and partners.

Table 2. Species approaching Upper Lower Lakes WMA PCA (iMapInvasives, 2022).

Scientific Name	Common Name	SLELO Tier	Observations in Buffer
Frangula alnus	Glossy Buckthorn, European Buckthorn	4	1
Cyprinus carpio	Common Carp	No Tier	3
Petromyzon marinus	Sea Lamprey	No Tier	1

Invasive Species Management

Known invasive species within the PCA are prioritized for management based on their current or future impacts and the availability of effective control measures and management resources. Because resources are limited, all known invasive species cannot be targeted for management. Some HPAs are not surveyed and/or managed annually. In addition, if a species is present in high abundance within the PCA, only a sub-set of HPAs may be prioritized for management.

Two tier 3 species are targeted for management by SLELO staff and contractors at select HPAs within this PCA: pale swallow-wort and invasive bittersweet (Table 3). The following section provides an overview of invasive species control efforts conducted by SLELO staff and contractors. Additional management actions conducted by partners or volunteers and reported to iMapInvasives are summarized under the sub-section "*Partner Management Efforts".*

Table 3. Simplified invasive species management plan overview for Upper Lower Lakes WMA PCA.

Management Goal(s):	
Suppress known infestations of target invasive species where they occur at HPAs within Upper Lower Lakes WMA PCA to minimize their spread to uninvaded, interior portions of the property; protect rare, threatened, or endangered species and communities; maintain climate resilience; and promote the establishment and recovery of native species.	
Monitoring Plan:	
Outcome monitoring will be conducted annually by SLELO staff and/or contractors. Measurements of extent (acres) and invasive plant percent cover will be collected for each infestation to evaluate management progress. To validate current management goals and objectives, staff will conduct strategic monitoring of interior portions of the PCA at least every there-years to assess the extent of target invasive species outside HPAs. The location and size of all infestations will be recorded.	
Restoration Needs:	
As part of the annual monitoring process, SLELO staff will evaluate the need for active restoration at each management site. Restoration will be prioritized first for sites that have reached their management objective. Active restoration will utilize a selection of native species appropriate for the PCA and specific site.	
Management Objective(s):	
Pale Swallow-wort	Contain swallow-wort at HPA 7 and density to 5% or less by 2028.
Invasive Bittersweet	Reduce invasive bittersweet density at current HPAs to 25% or less by 2028.

Pale Swallow-wort

A single swallow-wort was documented at the PCA in 2017 and annual management efforts began the same year (Figure 7).

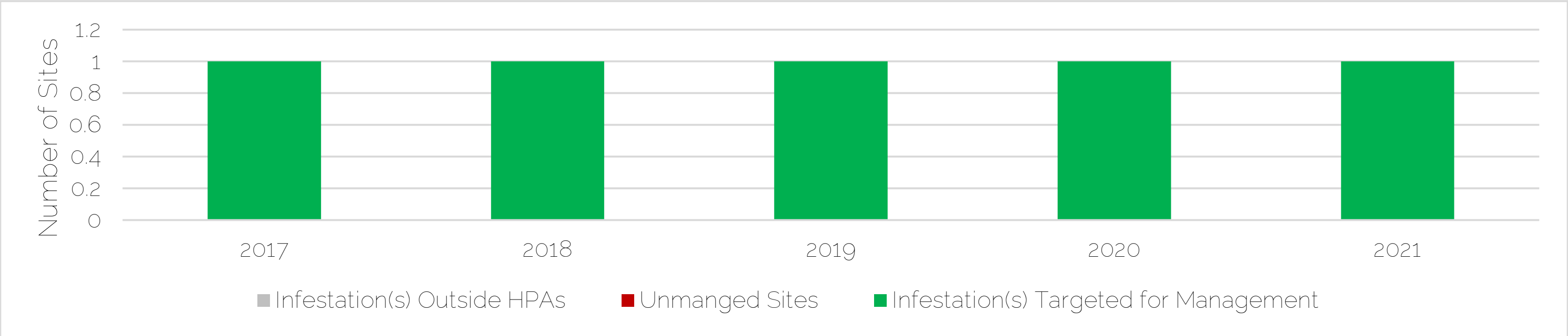


Figure 6. Number of known pale swallow-wort infestations at Upper Lower Lakes WMA PCA from 2017-2021 by management status.

From 2017-2019, invasive species distribution and management data was collected using handheld GPS and manually transcribed to paper-based maps. The relatively fixed presence and treated area measurements observed from 2012-2019 (Figure 8) reflect this data collection technique and do not indicate unchanging conditions on the ground. Beginning in 2020, SLELO staff and contractors adopted a mobile GIS data collection system to allow for increased spatial mapping detail and accuracy. Based on the best available data, after five years of chemical control, overall swallow-wort extent at HPAs reached a peak of 0.89 acres in 2019 and declined by approximately 54% to 0.41 acres in 2021. For an overview of site-specific management progress, see Appendix D.

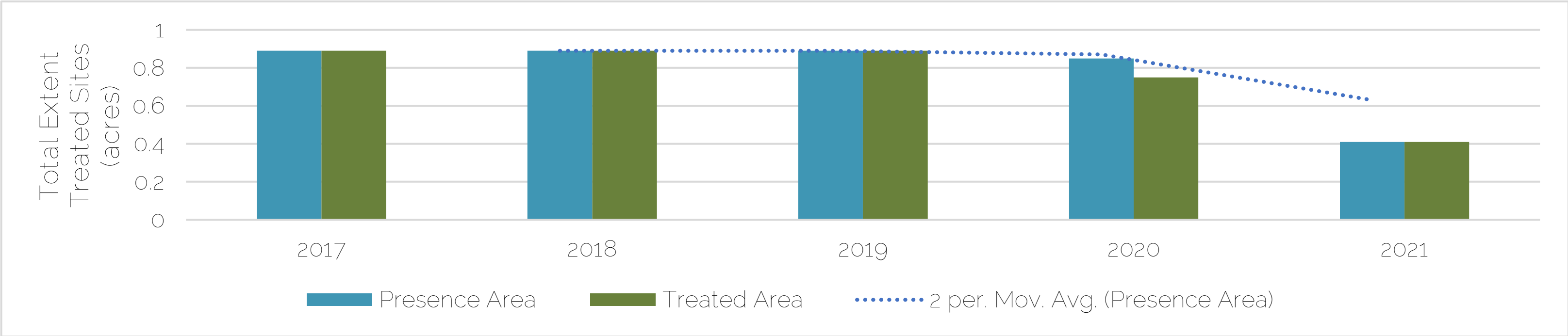


Figure 7. Changes in pale swallow-wort extent (presence area) and total area treated at all HPAs 2017-2021. Trendline represents two-year rolling average of presence area.

Invasive Bittersweet

Invasive bittersweet was first documented at the PCA in 2020 via iMapInvasives. Surveys by SLELO staff in 2021 identified additional infestations at eight HPAs. Management began in 2021 for two infestations. Approximately 3.7 acres were managed using herbicide. Management objectives were established in 2022 as part of the PCA evaluation process (Table 3). An evaluation of bittersweet management progress will be conducted after the 2022 field season.

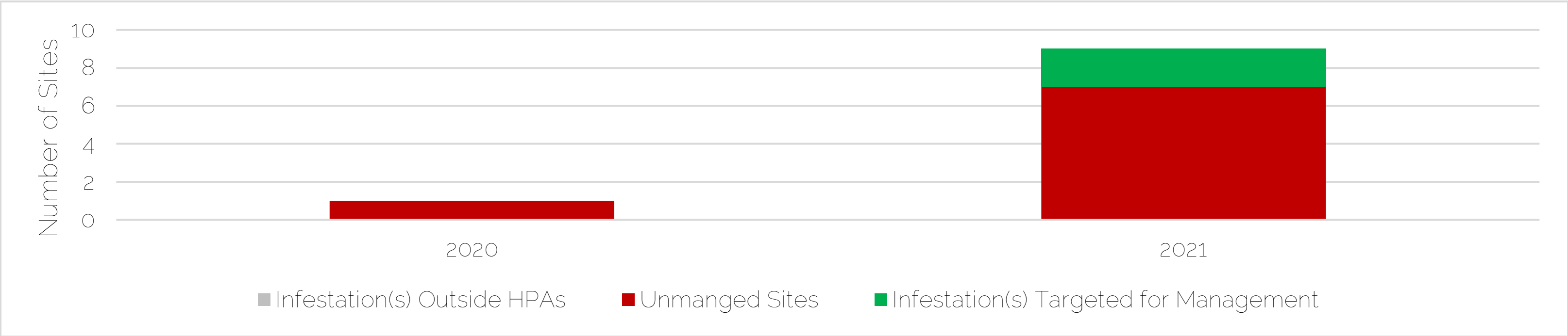


Figure 8. Number of known invasive bittersweet infestations at Upper Lower Lakes WMA PCA from 2020-2021 by management status.

Partner Management Efforts

The following sub-section provides an overview of management actions performed by partners and/or volunteers reported to iMapInvasives. Due to data reporting and sharing limitations, a quantitative assessment of management progress cannot be completed for each species. When possible, a summary of acres treated annually is provided. Trends charts are not provided for species managed sporadically.

June 2022: No partner management efforts were recorded in iMapinvasives.

Recommendations & Future Work

- **Conduct strategic monitoring outside of HPAs to validate current invasive species management goals.** SLELO staff and/or contractors will explore opportunities to survey interior portions of the PCA to better understand the extent of target management species outside of HPAs. Management actions that aim to suppress or contain invasive species at HPAs could be undermined if target species are more widely distributed throughout the PCA.

References

Anderson, M.G., Barnett, A., Clark, M., Prince, J., Olivero Sheldon, A. and Vickery B. 2016. Resilient and Connected Landscapes for Terrestrial Conservation. The Nature Conservancy, Eastern Conservation Science, Eastern Regional Office. Boston, MA. https://easterndivision.s3.amazonaws.com/Resilient_and_Connected_Landscapes_For_Terrestial_Conservation.pdf

Dewitz, J., and U.S. Geological Survey, 2021, National Land Cover Database (NLCD) 2019 Products (ver. 2.0, June 2021): U.S. Geological Survey data release, https://doi.org/10.5066/P9KZCM54

Fargione, J. E., Bassett, S., Boucher, T., Bridgham, S. D., Conant, R. T., Cook-Patton, S. C., et al. (2018). Natural climate solutions for the United States. Sci. Adv. 4:eaat1869. https://www.science.org/doi/epdf/10.1126/sciadv.aat1869

Guevara, M., C.E. Arroyo-cruz, N. Brunsell, C.O. Cruz-gaistardo, G.M. Domke, J. Equihua, J. Etchevers, D.J. Hayes, T. Hengl, A. Ibelles, K. Johnson, B. de Jong, Z. Libohova, R. Llamas, L. Nave, J.L. Ornelas, F. Paz, R. Ressl, A. Schwartz, S. Wills, and R. Vargas. 2020. Soil Organic Carbon Estimates for 30-cm Depth, Mexico and Conterminous USA, 1991-2011. ORNL DAAC, Oak Ridge, Tennessee, USA. https://doi.org/10.3334/ORNLDAAC/1737

Langmaier, M., & Lapin, K. (2020). A Systematic Review of the Impact of Invasive Alien Plants on Forest Regeneration in European Temperate Forests. *Frontiers in Plant Science*, 11. https://doi.org/10.3389/fpls.2020.524969

NYSDEC. (n.d.). Upper and Lower Lakes Wildlife Management Area. Upper and Lower Lakes Wildlife Management Area - NYS Dept. of Environmental Conservation. Retrieved March 18, 2022, from https://www.dec.ny.gov/outdoor/9325.html

Pimentel, D., Zuniga, R., and D. Morrison. 2005. Update on the environmental and economic cost associated with alien-invasive species in the United States. *Ecological Economics,* 52. pp 273-288. doi: https://doi.org/10.1016/j.ecolecon.2004.10.002.

Quirion B.R., Domke G.M., Walters B.F., Lovett G.M., Fargione J.E., Greenwood L, Serbesoff-King K., Randall J.M., Fei S. (2021). Insect and Disease Disturbances Correlate With Reduced Carbon Sequestration in Forests of the Contiguous United States. *Frontiers in Forests and Global Change*. 4, XX-XX. doi: https://10.3389/ffgc.2021.716582

Williams, C.A., N. Hasler, H. Gu, and Y. Zhou. 2020. Forest Carbon Stocks and Fluxes from the NFCMS, Conterminous USA, 1990-2010. ORNL DAAC, Oak Ridge, Tennessee, USA. https://doi.org/10.3334/ORNLDAAC/1829

Appendix A: Resilience Definitions

Resilience Score: A site's Resilience Score estimates its capacity to maintain species diversity and ecological function as the climate changes. It was determined by evaluating and quantifying physical characteristics that foster resilience, particularly the site's landscape diversity and local connectedness. The score is calculated within ecoregions based on all cells of the same geophysical setting and is described on a relative basis as above or below the average. For example, cells of granite bedrock were compared with all other cells of granite bedrock, and coastal plain sands were compared with other coastal plain sands. Our goal was to identify the places most resilient to climate change for each geophysical setting within each ecoregion.

Local Connectedness: Refers to the degree of fragmentation and strength of barriers that create resistance to movement within a landscape. A highly connected landscape promotes resilience by allowing species to move through the landscape and find suitable microclimates where they can persist. In this study, we calculate local connectedness by measuring the amount and configuration of human-created barriers like major roads, development, energy infrastructure, and industrial farming and forestry land. Read the methods for your region:

Landscape Diversity: Refers to the microhabitats and climatic gradients available in the immediate neighborhood surrounding any 30-m cell of land. The persistence of species in an area increases in landscapes with a wide variety of microclimates created by the topography (topo-climates), elevation and hydrology. In this study, we measure microclimates by counting the variety of small-scale landforms, measuring elevation range, and evaluating the density and configuration of wetlands in a 100-acre neighborhood around every point on the landscape.

Forest Carbon: Estimates of 2010 forest carbon stock and components (aboveground, coarse woody debris, and soil/other) are from Williams et al. (2021b) following methods described for the Southeast US in Gu et al. (2019). To estimate carbon stock, attributes were determined for all forested 30-m pixels in the continental United States. A forest carbon cycle model trained to match Forest Inventory and Analysis (FIA) data was used to predict carbon stocks for 2010 based on site-level attributes of forest type group, years since disturbance, and site productivity class. Results were iterated backward in time to provide continuous, annual reporting of forest carbon dynamics for each pixel. Most prior studies lacked spatial detail on the age of forest stands that persisted in a forested condition during the satellite data era, but this study used remotely sensed biomass to estimate the stand age condition of these persisting, intact forests, distinguishing relatively young stands (e.g., 30 to 50 years old) from older stands.

Soil Carbon: Estimates of soil organic carbon (SOC) for 0-30 cm topsoil layer at 250-m resolution for the conterminous USA (CONUS) are from Oak Ridge Lab (Guevara et al. 2020). The estimates are for the period 1991-2010 and were derived using the USDA Rapid Carbon Assessment (RaCA), which used over 6000 field soil samples and multiple environmental variables representative of the soil-forming environment coupled with a machine learning approach (i.e., simulated annealing) and regression tree ensemble modeling for optimized SOC prediction. Across the continental US, nearly 31% of SOC was found in forests, 28% in croplands, and 35% in grasslands and shrublands respectively.

Total Carbon: Estimates for total carbon in the carbon calculator use Forest Carbon 2010 for all cells with forest cover and Soil Carbon 2010 for all cells with non-forest cover. To combine the two datasets, we resampled the SOC data to a 30-m resolution to align with our other data products, and then removed developed lands using the 2016 National Land Cover Dataset (NLCD). Please note that resampling to a higher 30-m resolution introduces false accuracy as the original SOC data was at a lower 250-m resolution.

For more information, visit:
https://www.conservationgateway.org/ConservationByGeography/NorthAmerica/UnitedStates/edc/reportsdata/terrestrial/resilience/Pages/default.aspx

Appendix B: Invasive Species Tier Ranking

In 2017 the PRISM network, state agencies and the New York Natural Heritage Program (NYNHP) formalized official definitions for invasive species tiers based on an invasive species impacts and abundance. The ranking system included four primary tiers (Figure 10):

- **Tier 1 – Early Detection/Prevention**: Highly invasive species located in a buffer around region but not in region itself, targeted for early detection and prevention activities
- **Tier 2 – Eradication:** Highly invasive species with low abundance in the region, management goal of eradication
- **Tier 3 – Containment:** Highly invasive species with medium abundance in the region, management goal of containment
- **Tier 4 – Local Control:** Highly invasive species with great abundance in the region, management goal of local control

SLELO PRISM further prioritizes certain invasive species on the tiers list for management. These species are selected through nomination and agreement with PRISM partners. The SLELO tiered species list is a sub-selection of species ranked at the NYS scale.

		Difficulty of Eradication / Cost of Control Abundance (In PRISM plus Buffer)			
		None in PRISM	**Low** **(Eradication/ Full containment may be feasible)**	**Medium** **(Strategic management to contain infestations and slow spread in PRISM)**	**High** **(Established/widespread in PRISM; only strategic localized management)**
Impact (current and future)	**Very High or High**	**TIER 1** *Early Detection/Prevention* Highest level of early detection survey efforts. Should conduct delineation surveys and assign to appropriate Tier if detected. a) Inside buffer, but not in PRISM b) Outside PRISM and Buffer, but close (eastern North America) c) Far outside PRISM and buffer (not in east NA), but introduction pathway exists	**TIER 2** *Eradication* Highest level of early detection response efforts. High impact species with low enough abundance and suitable treatment method available to make eradication feasible within the PRISM. Need delineation surveys to determine extent.	**TIER 3** *Containment* Target strategic management to slow the spread, as likely too widespread for eradication, but many surrounding regions could be at risk if left unattended. For plants, use the IPMDAT. Possible eradication candidate only if adequate resources and effective control methods available.	**TIER 4** *Local Control* Eradication from PRISM not feasible; focus on localized management over time to contain, exclude, or suppress to protect high-priority resources like rare species or recreation assets. Be strategic when deciding if / where to control.
	Medium	*Evaluate (Medium Impact)* Further evaluate impacts and PRISM resources to see if the species should be assigned to one of the other lists. If this species could feasibly become high impact with climatic or other environmental changes, consider moving to the appropriate High Impact row based on abundance. If too little is known, consider moving to "Monitor".			
	Unknown	**X**	**TIER 5** *Monitor* Species that need more research, mapping, and monitoring to understand their invasiveness. This includes naturalized species and cultivated-only species that are known to be invasive in other regions but are not yet invasive here. Invasiveness may change with environmental or genetic changes. Should monitor populations on a regular basis to see if they are starting to become invasive and assign to appropriate Tier if invasive infestations detected.		

Tier definitions were formalized in 2017 by the NYS invasive species network of PRISMs, state agencies, and NYNHP.

Buffer: An area chosen by the PRISM that surrounds the PRISM and takes in certain counties, states and provinces. Most PRISMs are using about 100 miles as the buffer.

Impact: Use the PRISM-specific invasiveness rankings if available, or use NYS ranks (see nyis.info for existing ranks). For species that are not ranked yet, or PRISM-specific adjustments of state ranks are deemed necessary, use expert opinion and document justification. Low-impact species not included since cannot justify spending resources to control these.

Abundance: This is left as a qualitative metric, since assigning standardized values to categories is not feasible due to the diversity of species dispersal strategies and data gaps.

This ranking system takes into account populations that have escaped into natural areas, but not intentionally (and legally) distributed individuals. For example, a landscape planting would not be counted.

Figure 9. Invasive species tier table developed by the PRISMs, state agencies, and New York Natural Heritage Program.

Appendix C: Upper Lower Lakes WMA Full Invasive Species Lists

Terrestrial Species	SLELO Tier	Source	First Detected
Common reed grass	3	iMapInvasives	2013
Invasive Bittersweet	3	iMapInvasives	2020
Japanese Knotweed	3	iMapInvasives	2013
Pale Swallowwort	3	iMapInvasives	2017
Common Buckthorn	4	iMMA	2021
Honeysuckle species	4	iMMA	2021
Purple Loosestrife	4	iMapInvasives	2015
Spotted Knapweed	4	iMMA	2021
Wild Parsnip	4	iMapInvasives	2015
Black Locust	No Tier	iMMA	2021
Climbing Nightshade	No Tier	iMMA	2021
Common mullein	No Tier	iMMA	2021
Common Speedwell	No Tier	iMapInvasives	2002
Common Valerian	No Tier	iMMA	2021
Garlic Mustard	No Tier	iMMA	2021
St. Johnswort	No Tier	iMapInvasives	2002
Tufted Vetch	No Tier	iMMA	2021
White Poplar	No Tier	iMMA	2021

Aquatic Species	SLELO Tier	Source	First Detected
Eurasian Water-milfoil	4	SAS	2021
European Frogbit	4	iMapInvasives	2015
Banded Mysterysnail	No Tier	SAS	2021
Chinese Mysterysnail	No Tier	SAS	2021
Sea Lamprey	No Tier	iMapInvasives	2010

Appendix D: Site Specific Management Progress

Pale Swallow-wort				
HPA	**Peak Area (Net Invaded Acres)**	**Current Area - (Net Invaded Acres)**	**Date Range**	**Percent Change**
ULL 7	0.89	0.41	2017 - 2021	**54% ▼**

Appendix E: PCA Total Score Formula

The total score for PCA's is calculated as follows:

$$\boldsymbol{Total\ Score = Average(RCD + IS) + DRA}$$

- $\boldsymbol{RCD = Average(Resilience + Local\ Connectedness + Landscape\ Diversity\ Scores)}$
  - Terrestrial resilience data from Anderson et al. (2016) – accessible here.

- $\boldsymbol{IS = Average(Invaisve\ Species\ Management\ Progress\ Scores)}$
  - Invasive species management scores are calculated based on progress achieved toward established PCA and species-specific objectives. Objectives are set using extent or density-based metrics
    - Extent Based Metrics
      - *Example: Reduce net invaded area of all pale swallow-wort infestations at HPAs by 80% by 2025.*
        - "Score" is measured as progress achieved toward the set objective
          - If the objective is 80% and invaded area has currently been reduced to:
            - 55% → 55/80 = 0.69 (69% or D+)
            - 65% → 65/80 = 0.81 (81% or B-)
            - 75% → 75/80 = 0.94 (94% or A)
    - Density Based Metrics
      - *Ex: Reduce swallow-wort density at current HPAs to 5% or less by 2028.*
        - "Score" is measured as the amount change needed between current average invasive species density and goal
          - If the objective is 5% density of less, and current density is:
            - 76-100 – needs to move 4 cover classes = F
            - 51-75 –needs to move 3 cover classes = D
            - 26-50 – needs to move 2 cover classes = C
            - 5-25 – needs to move 1 cover class = B
            - <5% - at goal = A

- $\boldsymbol{DRA = Discretionary\ Restoration\ Adjustment}$
  - A discretionary adjustment applied to the total score that reflects restoration progress and/or native species recovery at the PCA
    - Add (+) to Total Score
      - Based on visual field observation, the majority of management sites exhibit an increase in native/desirable vegetation richness or cover
    - No Adjustment
      - Based on visual field observation, the majority of management sites exhibit an increase in native/desirable vegetation richness or cover
    - Add (-) to Total Score
      - Based on visual field observation, the majority of management sites exhibit an increase in non-native or invasive vegetation richness and/or cover