SuAsCo Regional Prioritization Plan Process Documentation
Compiled by Dan Stimson, Assistant Director of Stewardship, Sudbury Valley Trustees
September, 2022 (updated May, 2023)

Project Summary
Sudbury Valley Trustees (SVT) received funding through the 2021 Land and Climate Program, which provides tools, resources, and training to help land trusts adopt climate adaptation and mitigation practices into their conservation work. The program is administered by the Land Trust Alliance and includes technical assistance from the Open Space Institute.

Through a working group of SVT's Regional Conservation Partnership—the Metrowest Conservation Alliance (MCA)—we sought to bring a collaborative approach to the work of developing updated regional priorities for conservation. A survey of the MCA and SVT members helped to guide the values that would be included in the prioritization work. Based on the results of this survey, the working group identified four themes of focus: Natural Services, Habitat for Biodiversity, Community Conservation, and Farmland.

The following documentation details the Geographic Information System (GIS) processes and datasets used to map the priorities in each of these themes. We acquired data to support the values identified for the prioritization work. Tables identifying each individual dataset, the source of the data, and the scoring system we used are found below. Each table is followed by a description (and link for more information when available) for each dataset.

GIS Process
The project area is the 36-town region of the Sudbury, Assabet, and Concord Rivers watershed. To consider context near the outer boundaries of the region, our study area included a ring of additional towns adjacent to the perimeter of the project area.

- We created each thematic map by combining multiple datasets.
- Scoring: Features in each dataset were assigned a score of 0 through 5, with 5 being the highest value and 1 being the lowest present value. Areas lacking data were given a score of 0.
- All datasets were converted to raster datasets with a cell (or pixel) size of 30 x 30 meters.
- Weighting: We assigned a multiplier weight to each dataset to further emphasize datasets of higher perceived value in the analysis. This weight, either 1 or 2, was used to multiply the cell score of an individual dataset.
- We used the Spatial Analyst Tool "Weighted Sum" to combine all input datasets in each thematic map. This tool uses each cell's score value and the weight multiplier in each dataset to sum all the values of every cell in the study area.
- The resulting raster for each thematic map includes a score for every cell in the study area, ranging from 0 to the maximum value in each thematic map. Maximum values can be found at the end of each section below.

Natural Services

This theme focuses on carbon storage, connecting core habitats for biodiversity, protection of water quality, and flood storage capacity.

Dataset	Source	Scoring	Weight
Active River Area	TNC	5: input water cells	
		4: Material Contribution Zone (3cell), wetflat	
		3: Material Contribution Zone (3cell), non-wetflat	
		2: Base Zone, wetflat	
		1: Base Zone, non-wetflat	1
Habitat Fragments, Parcels with 10+ acres	ESRI	5: Presence/Absence	1
Potential Carbon Sequestration	TNC	5: 18-27 metric tons/acre	
		4: 14.929412 - 18 metric tons/acre	
		3: 11.964706 - 14.929412 metric tons/acre	
		2: 7.941176 - 11.964706 metric tons/acre	
		1: 2.964706 - 7.941176 metric tons/acre	2
Aquifers	MassGIS	5: High Yield	
		3: Medium Yield	
		1: Low Yield	1
Outstanding Resource Waters	MassGIS	5: Presence/Absence	1
Public Water Supply Protection Zones	MassGIS	5: Zone 1	
		3: Zone 2	
		1: Zone 3 (IWPA)	1
Surface Water Protection Zones	MassGIS	5: Zone A	
		3: Zone B	
		1: Zone C	1
Conserve for Inland Flood Resilience	TNC	5: Presence/Absence	1

Active River Area - The active river area framework offers a more holistic vision of a river than solely considering the river channel as it exists in one place at one particular point in time. Rather, the river becomes those lands within which the river interacts both frequently and occasionally. (April 2015)

Habitat Fragments - This layer represents modeled habitat fragments, or small minimally disturbed natural areas. It was created as part of ESRI's Green Infrastructure Initiative and is one of five companion layers that can be used for Green Infrastructure Planning. We further limited these data by removing any fragments with an area of less than 10 acres contained within a single Tax Parcel. (July 7, 2017)

Potential Carbon Sequestration - Estimates of 2010 forest carbon stock and components (above ground, 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.

Future Forest Carbon Stock & Potential Sequestration: The method used to calculate the 2050 carbon stocks was the samPote, except that the model assumed no disturbances to the forests after year 2010. Because the modeled forests grow undisturbed from 2010 onward, the results can be used to estimate the potential carbon sequestration if the forest were free of harvest, fire, or conversion. While conservation efforts can limit harvest and conversion, it is difficult to predict future disturbances and users should be aware that the actual sequestration may be less than predicted. The Total Potential Sequestration is estimated as: (2050 stock - 2010 stock). (Based on 2010 data)

Aquifers - Underground water sources of high, medium, and low yield are in this layer. (July 2007)

Outstanding Resource Waters - This datalayer delineates areas in which certain waters are afforded Outstanding Resource Water (ORW) protection under the Massachusetts Surface Water Quality Standards, 314 CMR 4.00 (WQS). According to 314 CMR 4.04(3). (March 2010)

Public Water Supply Protection Zones - Wellhead protection areas are important for protecting the recharge area around public water supply (PWS) groundwater sources. (March 2022)

Surface Water Protection Zones - These Surface Water Supply Protection Areas delineate those areas included in 310 CMR 22.00, the Massachusetts Drinking Water Regulations, as Surface Water Supply Protection Zones. (April 2017)

Conserve for Inland Flood Resilience - Part of TNC's Nature Based Solutions datasets, this layer identifies as conservation opportunities the remaining undeveloped and unprotected lands >5 acres within the floodplains and adjacent areas mapped in an "inland flood hazard" layer. Natural cover slows, spreads, and dampens inland flood hazards. (2020)

The highest possible score for a cell on this map is 45. The maximum score received for a cell on this map is 45.

Habitat for Biodiversity
This theme focuses on significant blocks of aquatic, wetland, vernal pool, and forest habitat; areas of uninterrupted interior forest; priority natural communities; natural communities that are under-

represented in preserved lands; rare and endangered species habitat; migration corridors; and climate resiliency.

Dataset	Source	Scoring	Weight
Habitat Cores	ESRI	5: Better (3.31 - 4.12)	
		1: Good (1.599999 - 3.31)	1
BioMap2 Aquatic Cores	MassGIS	5: Presence/Absence	1
BioMap2 Wetlands Cores	MassGIS	5: Presence/Absence	1
BioMap2 Forest Cores	MassGIS	5: Presence/Absence	1
BioMap 2 Priority Natural Communities Cores	MassGIS	5: Presence/Absence	1
BioMap2 Species of Conservation Concern Cores	MassGIS	5: Presence/Absence	1
BioMap2 Vernal Pool Cores	MassGIS	5: Presence/Absence	1
Interior Forests	MassGIS	5: (3)Interior Forest	
		3: (4)Adjacent Non-forested Wetland	
		1: (20)Adjacent Open Water	1
Under-represented Settings	Mass Audubon	5: 3 (Grid code)	
		3: 2 (Grid code)	
		1: 1 (Grid code)	2
Priority Habitats of Rare Species	MassGIS	5: Presence/Absence	1
Resilient Sites	TNC	5: Most resilient	
		3: More resilient	
		1: Slightly more resilient	2
Active River Area	TNC	5: input water cells	
		4: Material Contribution Zone (3cell), wetflat	
		3: Material Contribution Zone (3cell), non-wetflat	
		2: Base Zone, wetflat	
		1: Base Zone, non-wetflat	1
Climate Flow	TNC	5: 2,000.000001 - 9,999,999 (permeability)	
		3: 1,000.000001 - 2,000 (permeability)	
		1: 500.0000001 - 1,000 (permeability)	2

Habitat Cores - This layer represents modeled Intact Habitat Cores, or minimally disturbed natural areas. It was created as part of ESRI's Green Infrastructure Initiative and is one of five companion layers that can be used for Green Infrastructure Planning. (July 7, 2017)

BioMap2 Aquatic Cores - Aquatic core contains integrated and functional ecosystems for fish species and other aquatic Species of Conservation Concern. (Feb. 2011)

BioMap2 Wetlands Cores - BioMap2 Wetlands identifies important wetland habitat. It is a combination of the Wetland Core analysis that identified the most intact wetlands in Massachusetts, the wetlands

present within the Priority Natural Communities data layer, and several Oxbows identified as important wetland habitat. A detailed description can be found in the summary document. Wetland Cores and Priority Natural Community wetlands sometimes overlap. (Feb. 2011)

[BioMap2 Forest Cores](#) - Forest Core identifies the best examples of large, intact forests that are least impacted by roads and development, providing critical habitat for numerous woodland species. (Feb. 2011)

[BioMap 2 Priority Natural Communities Cores](#) - This data set is maintained by MassWildlife's Natural Heritage and Endangered Species Program (NHESP). It consists of polygons that represent the extent of various natural communities of biodiversity conservation interest. Scientists classify and delineate natural community polygons by analyzing "on-the-ground" field data and available information about the landscape (particularly topographic maps and aerial photographs). (Feb. 2011)

[BioMap2 Species of Conservation Concern Cores](#) - This layer contains the combined BioMap2 footprint of all species listed under the Massachusetts Endangered Species Act in combination with all non-listed species present in the State Wildlife Action Plan that were mapped. Individual species information is not identified in this layer. (Feb. 2011)

[BioMap2 Vernal Pool Cores](#) - The BioMap2 team used a GIS model developed by the University of Massachusetts Landscape Ecology Program to identify the top 5 percent most interconnected clusters of Potential Vernal Pools within each ecoregion. Each cluster of pools was then buffered to create vernal pool habitat areas to target for conservation that include the pools themselves and the surrounding habitat to allow for successful breeding, dispersal, overwintering, foraging, and migration. (Feb. 2011)

[Interior Forests](#) - This Massachusetts Division of Fisheries and Wildlife interior forest GIS dataset identifies extensively forested portions of the Massachusetts landscape where forest cover is relatively un-fragmented by human development. (Oct. 2009)

[Under-represented Settings](#) - In 2013, the Open Space Institute identified a set of landscapes/settings (i.e., unique combinations of geology and topography, each of which supports unique and important biodiversity over long time frames) in the Northeast US that were under-represented in the portfolio of protected lands regionally.

The under-represented geophysical settings that were part of The Nature Conservancy's Resilient Sites for Terrestrial Landscape Conservation were assessed and prioritized regionally. MassAudubon analysts were interested in conducting an equivalent search restricted to Massachusetts. To do this, they used the geophysical settings layer that the Massachusetts chapter of TNC maintains to identify the distribution of these settings throughout the state. They then overlaid protection onto these settings to identify those settings that are under-represented in the network of protected lands in Massachusetts. (Based on 2016 open space data)

[Priority Habitats of Rare Species](#) - Areas delineated as Priority Habitats by NHESP are protected and can include wetlands, uplands, and marine habitats. (Aug. 2021)

[Resilient Sites](#) - 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. (Oct. 2016)

[Active River Area](#) - The active river area framework offers a more holistic vision of a river than solely considering the river channel as it exists in one place at one particular point in time. Rather, the river becomes those lands within which the river interacts both frequently and occasionally. (April 2015)

[Climate Flow](#) - Corridors or flow zones that facilitate plant and animal movement for climate adaptation. (Oct. 2016)

The highest possible score for a cell on this map is 80. The maximum score received for a cell on this map is 52.

Community Conservation
This theme focuses on smaller minimally disturbed natural areas, designated Environmental Justice Areas, access points to regional trail links and areas connecting them, access points to existing preserved lands, areas in and around the most severe summer heat, protection of water quality, and flood storage capacity.

Dataset	Source	Scoring	Weight
Habitat Fragments	ESRI	5: Presence/Absence	2
Environmental Justice Communities	MassGIS	5: MIE (Minority, Income, and English Iso.)	2
		3: MI (Minority and Income)	
		3: ME (Minority and English Isolation)	
		1: M (Minority)	
		1: I (Income)	
		1: E (English Isolation)	
Regional Trail Links and Buffers	SVT	5: 200'	2
		4: 400'	
		3: 600'	
		2: 800'	
		1: 1000'	
Access to Open Space, Frontage Parcels	SVT	5: Presence/Absence	2
Heat Severity	ESRI	5: 83.81176472 – 137 (relative heat severity)	
		4: 52.6509804 - 83.81176471	
		3: 28.47450981 - 52.65098039	

		2: 8.596078432 - 28.4745098	
		1: 0 - 8.596078431 (relative heat severity)	2
Heat Severity Adjacency	SVT	5: 500'	
		1: 1000'	2
Aquifers	MassGIS	5: High Yield	
		1: Medium Yield	1
Outstanding Resource Waters	MassGIS	5: Presence/Absence	1
Public Water Supply Protection Zones	MassGIS	5: Zone 1	
		3: Zone 2	
		1: Zone 3 (IWPA)	1
Surface Water Protection Zones	MassGIS	5: Zone A	
		3: Zone B	
		1: Zone C	1
Conserve for Inland Flood Resilience	TNC	5: Presence/Absence	1

Habitat Fragments - This layer represents modeled habitat fragments, or small minimally disturbed natural areas. It was created as part of ESRI's Green Infrastructure Initiative and is one of five companion layers that can be used for Green Infrastructure Planning. (Jul. 7, 2017)

Environmental Justice Communities - Environmental Justice Population Data, based upon three demographic criteria developed by the state's Executive Office of Energy and Environmental Affairs (EEA). (June 2021, based on 2020 census)

Regional Trail Links and Buffers - We started with MAPC's 2021 Shared Use Pathway Inventory from their LandLine Greenway Network Map. This includes existing, under-construction, and envisioned significant trails. We then created buffers of distances from 200'-1000', with the highest score being assigned to the tightest buffers. (July 2022)

Access to Open Space, Frontage Parcels - We identified Tax Parcels with 2 acres or more of undeveloped area, with frontage (on public roadways and waterways) adjacent to existing Protected Lands. (July 2022)

Heat Severity - This map contains the relative heat severity for every pixel for every city in the United States. This 30-meter pixel raster was derived from Landsat 8 imagery band 10 (ground-level thermal sensor) from the summers of 2019 and 2020. (March 28, 2022)

Heat Severity Adjacency - We started with the ESRI Heat Severity data and applied buffers of 500' and 1000', assigning more points to the closer areas. (March 28, 2022)

Aquifers - Underground water sources of high, medium, and low yield are in this layer. (July 2007)

Outstanding Resource Waters - This datalayer delineates areas in which certain waters are afforded Outstanding Resource Water (ORW) protection under the Massachusetts Surface Water Quality Standards, 314 CMR 4.00 (WQS). According to 314 CMR 4.04(3). (March 2010)

Public Water Supply Protection Zones - Wellhead protection areas are important for protecting the recharge area around public water supply (PWS) groundwater sources. (March 2022)

Surface Water Protection Zones - These Surface Water Supply Protection Areas delineate those areas included in 310 CMR 22.00, the Massachusetts Drinking Water Regulations, as Surface Water Supply Protection Zones. (April 2017)

Conserve for Inland Flood Resilience - Part of TNC's Nature Based Soultions datasets, this layer identifies as conservation opportunities the remaining undeveloped and unprotected lands >5 acres within the floodplains and adjacent areas mapped in an "inland flood hazard" layer. Natural cover slows, spreads, and dampens inland flood hazards. (2020)

The highest possible score for a cell on this map is 85. The maximum score received for a cell on this map is 60.

Farmland
This theme focuses on existing farmland identified through local knowledge and land cover analysis, and designated Prime Farmland Soils.

Dataset	Source	Scoring	Weight
SVT Agricultural Priorities (2016)	SVT	5: Presence/Absence	1
Agricultural Land Cover	MassGIS	5: Presence/Absence	1
		5: Prime	
		3: Statewide	
Prime Farmland Soils	MassGIS	1: Unique	1

SVT Agricultural Priorities (2016) - Parcels identified by SVT in our 2014-2016 priorities work. Parcels were identified by land cover, identifications made by municipal open space plans, and conversations with conservation partners. (2016)

Agricultural Land Cover - Selections from the 2016 Land Cover/Land Use data based on the following land cover - land use categories: 6 (Cultivated Crops) - ALL, 7 (Pasture/Hay) - ALL, and 8 (Grassland/Herbaceous) - 7 (Agriculture). Identified areas were further limited by selecting only features over 5 acres. (May 2019, based on 2016 land cover analysis)

Prime Farmland Soils - The layer comprises three important farmland categories. Urban built-up land and water are excluded from all three categories, but forested lands are included in all three categories if they meet the appropriate criteria. (Nov. 2021)

- *Prime Farmland*: Land that has the best combination of physical and chemical characteristics for economically producing sustained high yields of food, feed, forage, fiber, and oilseed crops, when treated and managed according to acceptable farming methods.
- *Farmland of Statewide Importance*: This is land, in addition to prime and unique farmlands, that is of statewide importance for the production of food, feed, fiber, forage, and oil seed crops, as determined by the appropriate state agency or agencies. Generally, these include lands that are nearly prime farmland and that economically produce high yields of crops when treated and managed according to acceptable farming methods.
- *Farmland of Unique Importance*: Land other than prime farmland or farmland of statewide importance that might be used for the production of specific high-value food and fiber crops. Examples of such crops are tree nuts, cranberries, fruit, and vegetables. In Massachusetts, Unique soils are confined to mucks, peats, and coarse sands. Cranberries are the primary commercial crop grown on these soils. The presence of other crops on these soils is usually, possibly always, limited to small, incidental areas.

The highest possible score for a cell on this map is 15. The maximum score received for a cell on this map is 15.

Visualizing the Data in the StoryMap

For communicating the results of the project, a data viewer for each of the four thematic maps is provided in an ESRI Story Map. These data viewers allow a user to zoom and pan to an area of interest and identify the score of a particular cell on the map, as well as an ownership parcel's average score. Values are broken into standard deviations and a color ramp is applied to allow for visual analysis of the differing scores. Darker colors indicate higher scores, lighter colors indicate lower scores.

When a user clicks on an area of the map, a singular 30x30 meter pixel/cell is identified and a table of values is returned at the left of the map. This data includes identification of the ownership parcel that contains the identified cell, the overall score of the identified cell (0-Max), the average overall score of all cells within that highlighted ownership parcel, and the individual score of every component dataset that contributed to the overall score (0-5). The weight of the component dataset (1 or 2) is noted in the table. The parcel that contains the identified cell is also highlighted on the map.

A user can also view the results as parcels ranked by average score. To turn on this layer, select the "Layers" icon on the left of your computer screen or bottom of mobile device screen (a series of stacked diamonds). Tap the item "MassGIS SVT Parcels with Model Symbology" to turn on the layer. This layer will be visible when you zoom in to approximately a town-wide view (or closer). Darker colors indicate parcels with higher average scores, lighter colors indicate parcels that have lower average scores.

Questions and comments

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