4/25/2017

Massachusetts Priority Parcels for Resilience (MAPPR 2.0): Technical Document

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Introduction

With the recent completion of parcel mapping for all of Massachusetts, it became possible to entertain a number of statewide projects with the parcel as the unit of analysis. With the Mapping and Prioritizing Parcels for Resilience (MAPPR) project, we have moved some key conservation resource layers directly into the level 3 parcels so that users can use the parcel as the "unit" of prioritization. Traditionally, we have identified priorities first and then overlaid parcels only afterwards.

This document describes how the following resource layers were manipulated in order to move their information into the MassGIS Level 3 parcels.

- BioMap2 Layers
    - BioMap2 Core Habitat
        - BioMap2 Priority Natural Communities
        - BioMap2 Forest Core
        - BioMap2 Vernal Pool Cores
        - BioMap2 Wetlands
        - BioMap2 Aquatic Core
        - BioMap2 Species of Conservation Concern
    - BioMap2 Critical Natural Landscape
        - BioMap2 Landscape Blocks
        - BioMap2 Coastal Adaptation
- The Phase II Critical Linkages data set produced by the Landscape Ecology Lab, Department of Environmental Conservation, UMass, Amherst.
- Fine scale resilience dataset produced by the Massachusetts chapter of The Nature Conservancy.
- Updating the under-represented settings analysis for just Massachusetts using the Massachusetts geophysical settings layer available from the Massachusetts chapter of The Nature Conservancy.

- Identification of large “roadless” blocks using the Level 3 parcels as the source and their relative protection
- The MassGIS Protected and Recreational Openspace Layer was migrated (to the extent possible) into the Level 3 parcels so that querying of the protected lands was rendered simpler.
- The NRCS Prime Farmland statewide datalayer (from MassGIS)
- The MassGIS Surface Water Supply Protection Areas (Zones A, B, and C)
- The MassGIS MassDEP Wellhead Protection Areas (Zone II, Zone I, IWPA)

All parcels with an area <1 acre, as calculated by GIS, were removed from this analysis. In addition, all of the public right of way polygons/roads were removed. When assigning values to the various resource types, all of the protected parcels were removed and were not assigned a value. The protected parcels, as described below, were moved from the MassGIS openspace layer into the level 3 parcels.

MAPPR 2.0 Update

The following things were completed as part of the MAPPR 2.0 update:

- Updated the parcel data to the current version at the outset of this project (September 2016). As is always the case with projects such as this, MassGIS has since updated the parcel data.
- Updated the open space data set and moved the open space information into the new level 3 parcels using the same technique described as part of the initial project.
- Moved all of the original data layers into the updated level 3 parcel geometry. This includes all BioMap2 data, the resilience data set, phase II critical linkages, under-represented settings analysis.
- Updated the roadless block analysis and any related analyses.
- Updated any tasks that flowed out of the level 3 data set such as parcel size and adjacency to protection.

We undertook several enhancements to MAPPR 2.0 that include:

- Moving the following data sets into the level 3 parcels:
    - The NRCS Prime Farmland statewide datalayer (from MassGIS)
    - The MassGIS Surface Water Supply Protection Areas (Zones A, B, and C)
    - The MassGIS MassDEP Wellhead Protection Areas (Zone II, Zone I, IWPA)
- All three of the above pieces of information can be included in the user’s customized models for any study area. The details of how parcels were scored for each of these models are found below.
- The aquatic model was updated to include both MassGIS water supply data sets.
- Additional study areas were added so that Regional Conservation non-profits can use their own areas of action as a study area. We also added the Mass DFW Districts as study areas. Note: Many of these study areas were much larger than the original study areas of towns, counties, and watersheds. As a result, the prioritization analysis is confined to parcels that are greater than 5 acres in size, and parcels between 1 and 5 acres are omitted from the calculations of these new study areas.

BioMap2 Layers

The following BioMap2 layers were incorporated into the analysis:

- BioMap2 Core Habitat
  - BioMap2 Priority Natural Communities
  - BioMap2 Forest Core
  - BioMap2 Vernal Pool Cores
  - BioMap2 Wetlands
  - BioMap2 Aquatic Core
  - BioMap2 Species of Conservation Concern
- BioMap2 Critical Natural Landscape
  - BioMap2 Landscape Blocks
  - BioMap2 Coastal Adaptation

All of the BioMap2 layers are polygon shapefiles that were produced with the 2010 BioMap2 project. In order to move this information into the level 3 parcels, we calculated two statistics for each parcel:

- Number of acres of the respective BioMap2 resource in each parcel
- Percent of the parcel that is occupied by the respective BioMap2 resource

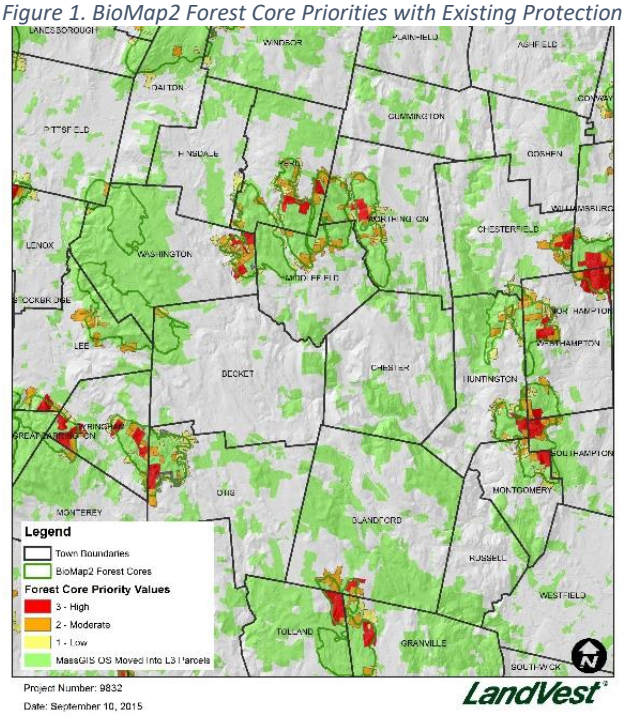
Using these two pieces of information, we were able to create bins for each of the resource that *evenly split the resources' acres into values of 3, 2, and 1*. In addition some of the parcels that included very small amounts of the resource in question were removed from the analysis. For example, the threshold of 107.5 and 34.5 acres evenly distributes the forest core acres between the three values, with a small minority (223 acres) that were removed because they made up insignificant portions of the parcels. The "Forest Core Parcel Acres" indicates the total acreage of the entire parcel that each resource falls in. This acreage is always larger because only part of many of the parcels includes the BioMap2 resource.

Table 1. Forest core priority thresholds

Final Recommendations	**Three**	**Two**	**One**	**Zero**
Forest Core Thresholds	>107.5	>34.5 and <=107.5	<=34.5	<=34.5 acres and <=0.05 percent
Forest Core Acres	36,772	36,745	36,903	223
Forest Core Parcel Acres	47,642	53,512	74,268	13,125

Figure 1 below shows how the forest core prioritization focuses on only those *unprotected* parcels that touch Forest Core, placing them into the high, medium, or low priority bin based on the above thresholds.

Figure 1. BioMap2 Forest Core Priorities with Existing Protection



The table below shows the thresholds that were selected for each of the BioMap2 layers. Each of the thresholds was selected to balance the acres of the BioMap2 resource in the 3, 2, and 1 bins.

Table 2. Final priority threshold for all BioMap2 Resources

Final Recommendations	**Three**	**Two**	**One**	**Zero**
Forest Core Thresholds	>107.5	>34.5 and <=107.5	<=34.5	<=34.5 acres and <=0.05 percent
Forest Core Acres	36,772	36,745	36,903	223
Forest Core Parcel Acres	47,642	53,512	74,268	13,125
Core Habitat Thresholds	>58	>12.4 and <=58	<=12.4	<=12.4 acres and <=0.05 percent
Core Habitat Acres	195,828	195,688	195,351	2,464
Core Habitat Parcel Acres	241,724	323,045	407,417	144,282
Critical Natural Landscape Thresholds	>78	>19.5 and <=78	<=19.5	<=19.5 acres and <=0.05 percent
CNL Acres	292,948	292,072	291,221	1,549
CNL Parcel Acres	326,722	374,670	475,385	89,501
Vernal Pool Thresholds	>39.5	>13.5 and <=39.5	<=13.5	<=13.5 acres and <=0.05 percent

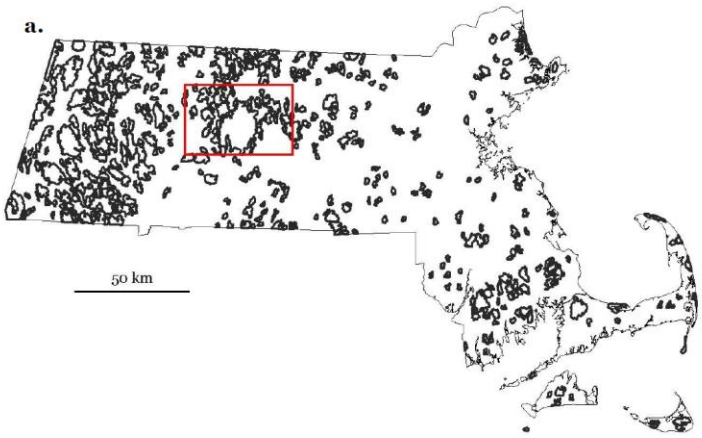
VP Acres	6,384	6,336	6,463	116
VP Parcel Acres	10,764	12,034	15,546	5,965
Priority Natural Community	>56.25	>11 and <=56.25	<=11	<=11 acres and <=0.05 percent
PNC Acres	9,083	9,057	8,929	549
PNC Parcel Acres	19,049	23,614	28,156	48,604
Wetland Core and Buffer	>40	>13 and <=40	<=13	<=13 acres and <=0.05 percent
Wetland Acres	34,653	34,436	33,536	716
Wetland Parcel Acres	77,428	76,234	82,698	43,600
Aquatic Core and Buffer	>60	>13 and <=60	<=13	<=13 acres and <=0.05 percent
Aquatic Core Acres	63,579	63,031	64,931	1,374
Aquatic Core Parcel Acres	91,732	144,124	163,054	90,654
Species of Conservation Concern	>50.5	>11 and <=50.5	<=11	<=11 acres and <=0.1 percent
SOCC - Acres	140,733	140,693	140,395	4,322
SOCC - Parcel Acres	179,059	224,699	223,656	157,043
Landscape Blocks	>86.75	>24.5 and <=86.75	<=24.5	<=24.5 acres and <=0.05 percent
LB - Acres	233,553	232,294	233,241	615
LB - Parcel Acres	255,086	277,617	324,654	36,113
Coastal Adaptation	>19.5	>5.4 and <=19.5	<=5.4	<=5.4 acres and <=0.1 percent
Coast Adapt - Acres	11,628	11,460	11,624	354
Coast Adapt - Parcel Acres	18,349	19,683	22,688	10,979

Phase II Critical Linkages data set produced by the Landscape Ecology Lab, Department of Environmental Conservation, UMass, Amherst.

The critical linkages project consists of spatially explicit tools, including models, maps and scenario-testing software, with the goal of helping to assess how to mitigate the impacts of roads, railroads, and dams on the environment. Within this project we used 2 of the components of the critical linkages set of data, the conductance index raster layer and the "nodes" of high quality habitat in between which it is important to maintain connectivity.

The conservation nodes are areas selected to represent existing or anticipated high-quality habitat. They were built from a combination of areas including BioMap2 cores and areas of permanently protected open space where the CAPS index of ecological integrity was > 0.7. The figures below are taken from the April 30, 2013 report entitled Critical Linkages Phase II (McGarigal et al., 2013).

Figure 2. Critical Linkages Nodes, pg 14, McGarigal et al. 2013.



The conductance index represents the probability that a dispersing animal might pass through a given point in the landscape.

Figure 3. Conductance index, pg 16, McGarigal et al. 2013.

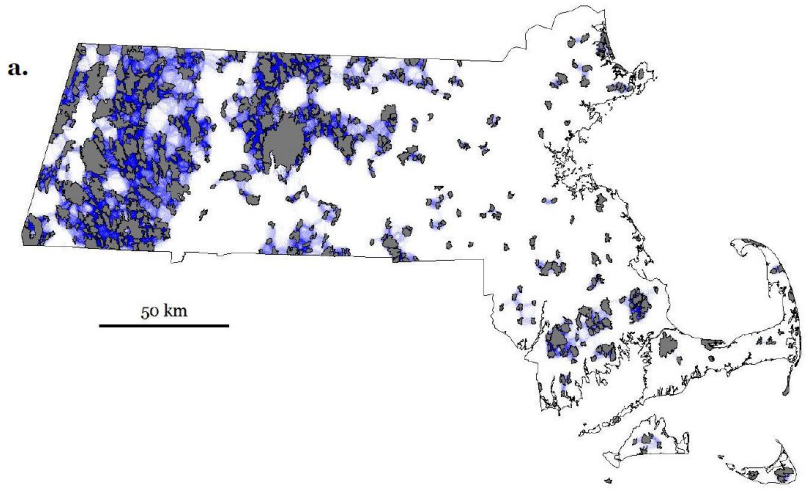
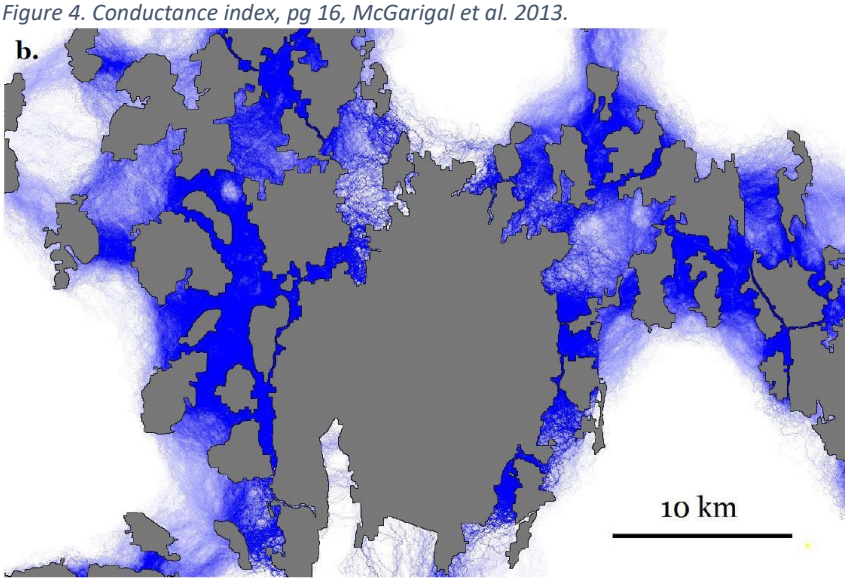


Figure 4. Conductance index, pg 16, McGarigal et al. 2013.



The above images show the conductance index at a statewide and more regional scale. We wanted to identify those parcels where the conductance values were high, while also including the nodes as important resources.

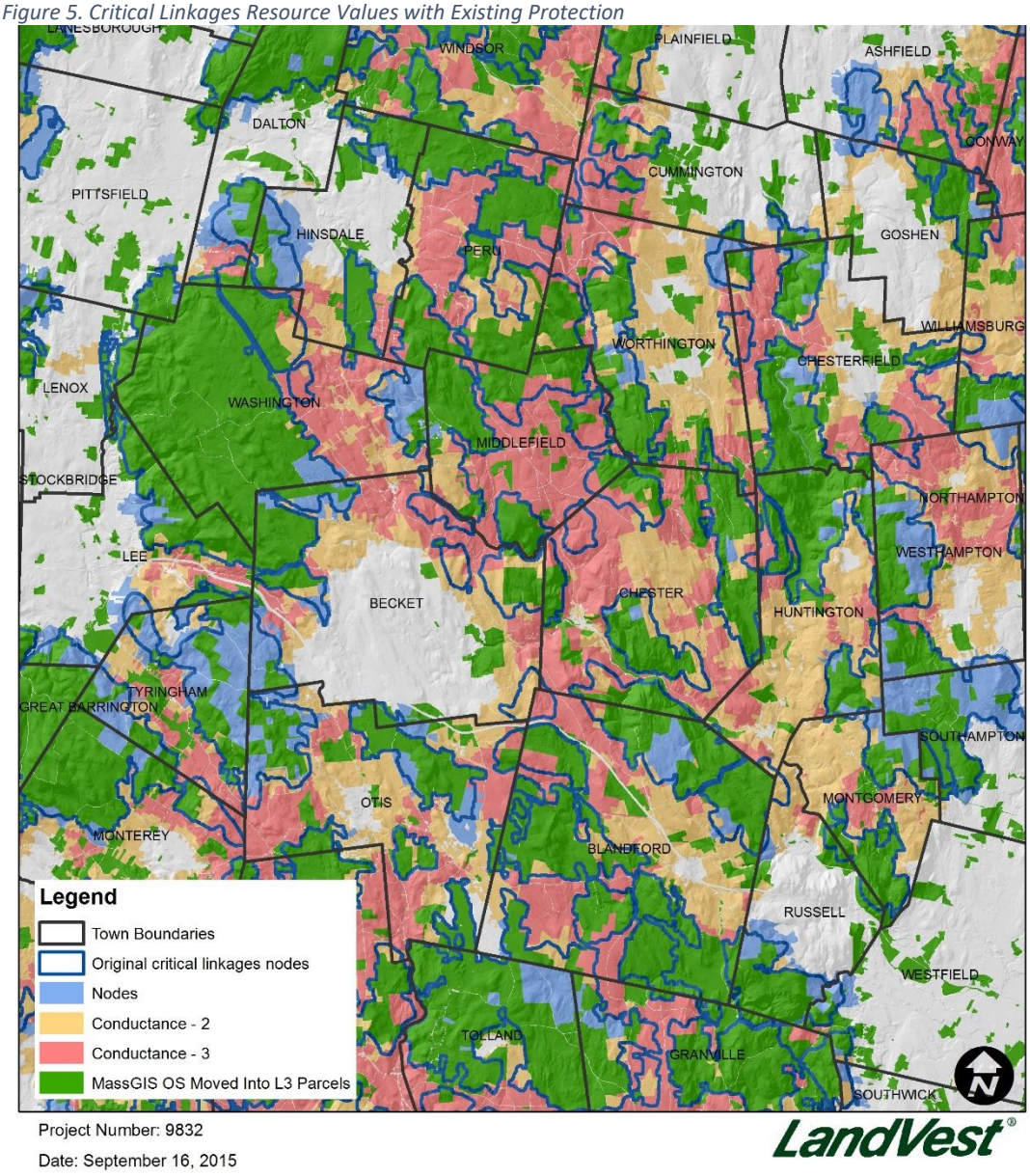
The conductance values were very small numbers that fell between 0 and 0.025. In order to make these values more usable, we log transformed the conductance values, multiplied them by -1, and then took the reciprocal of that value. These transformed values fell between 0.022 and 0.62.

Critical Linkages Resource Values

- 1 - All parcels that had any acreage that fell within a node were assigned a value of 1.
- 2 – All parcels with conductance values that were >0.25 and <= 0.3 were assigned a value of 2
- 3 – All parcels with conductance values that were > 0.3 were assigned a value of 3
- Any “node” parcels that also had conductance values > 0.25 were assigned the appropriate higher resource value.

The resource values were applied only to those parcels that were unprotected. The result is shown for a portion of the state in Figure 5 below.

Figure 5. Critical Linkages Resource Values with Existing Protection



Fine scale resilience dataset produced by the Massachusetts chapter of The Nature Conservancy.

The Nature Conservancy mapped Resilient Sites for Conservation in 2012. Lasting conservation depends on identifying and protecting places where the effects of climate change are buffered by the natural properties of the site. Conserving these places is vital to maintaining a diversity of species and natural processes regardless of changes in the climate.

These “natural strongholds” are places where the direct effects of climate change are moderated by complex topography and connected natural cover. In these sites, species can find areas of suitable moisture and temperature within their local neighborhood. These “micro-climates“ buffer the impacts of change by providing species with a variety of options. This allows resident species populations to remain strong and helps ensure that changes in the composition and structure of natural communities will be more gradual. Natural strongholds can serve as a bridge to grant safe passage into the future for thousands of species.

The Nature Conservancy developed data representing complex and connected landscapes, then selected the most resilient examples of each “geophysical setting”, unique combinations of geology, elevation, and landforms. These diverse places have supported a full suite of biodiversity in our region over millennia, and if protected will do so into the future.

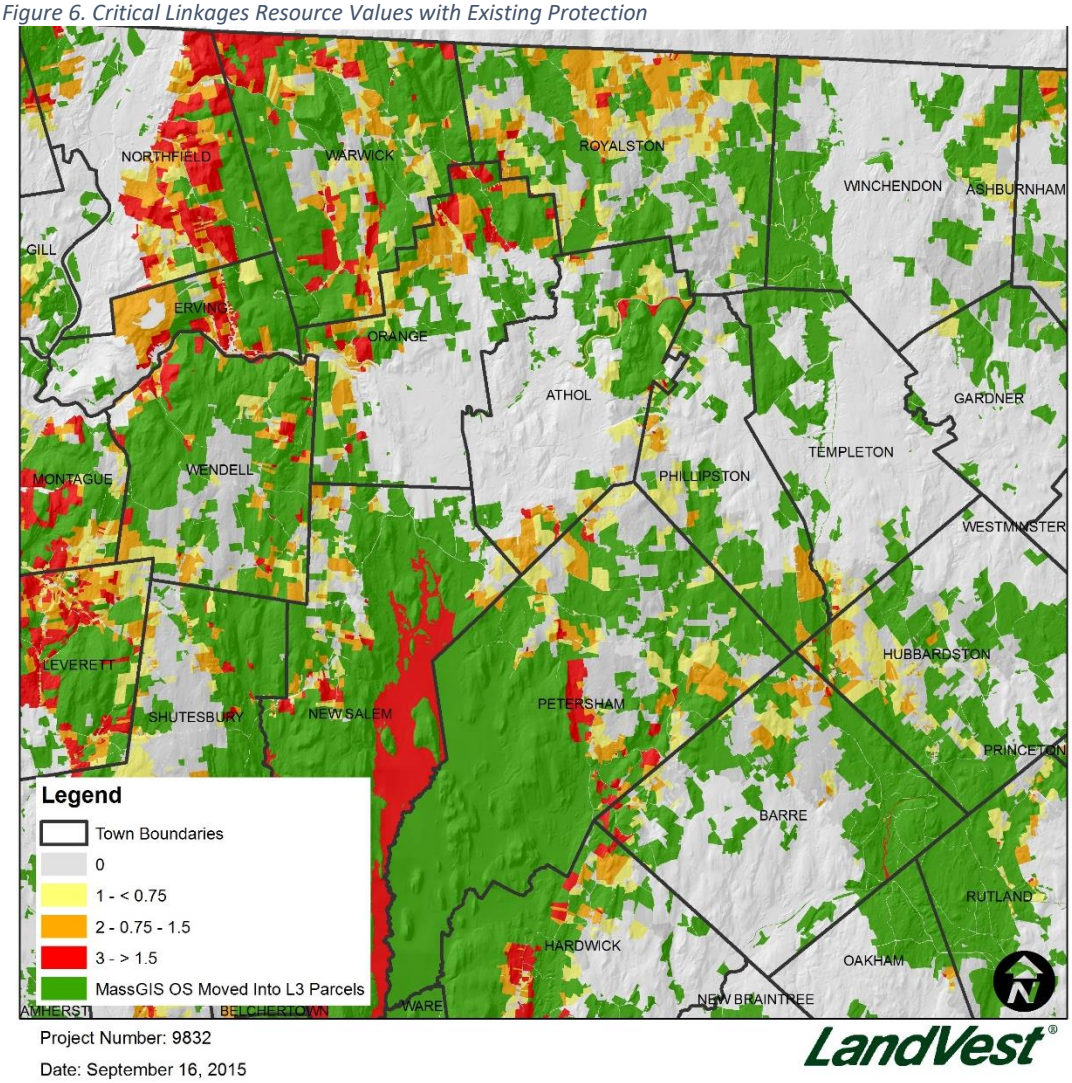
A Resilient Sites summary report, interactive map, data downloads, articles and maps are available at the Resilient Sites website: https://www.conservationgateway.org/ConservationByGeography/NorthAmerica/UnitedStates/edc/reportsdata/terrestrial/resilience/Pages/default.aspx.

Resilience scores were stratified by the 20 geophysical settings defined for Massachusetts. Zonal statistics were used to find the mean and standard deviation of the estimated resilience scores for each setting. These statistics were then used to z-score each setting, so that final resilience scores are in z-score units around the mean for that particular setting. The final stratified scores are shown in figure 6.

The resilience layer contains values that are above and below the average values for the entire state. For this analysis, we used only those values that were above the mean of all cells in the state.

- 3 – Values > 1.5
- 2 – Values > 0.75 and <=1.5
- 1 – Values > 0 and <= 0.75
- All other parcels were assigned a value of 0

Figure 6. Critical Linkages Resource Values with Existing Protection



Updating the under-represented settings analysis for Massachusetts

Intro/Background: In 2013, the Open Space Institute identified a set of landscapes/settings in the Northeast US that were under-represented in the portfolio of protected lands regionally. The geophysical settings that were part of the The Nature Conservancy's *Resilient Sites for Terrestrial Landscape Conservation* were used regionally. We were interested in conducting an equivalent search but in only Massachusetts. In order to do this, we used the geophysical settings layer that the Massachusetts chapter of TNC maintains to identify the distribution of these settings throughout the state. We then overlaid protection onto these settings to identify those settings that are under-represented in Massachusetts.

We updated an Underrepresented Settings Analysis to identify areas of the state that are most in need of conservation effort. The state was first divided into areas of similar ecological characteristics, based

on bedrock or surficial geology, elevation, and slope. These areas, termed 'geophysical settings' by The Nature Conservancy, are identified under the assumption that only through adequately protecting the full complement of these settings will we be conserving the stage for the future shifting of species and natural communities in the face of climate change. Staff in TNC's Massachusetts office refined a regional geophysical setting map with finer-scale bedrock geology data and with surficial geology data where we felt that surficial geology plays a bigger role in driving ecological conditions than bedrock.

We then used the MassGIS Open Space data to identify permanently protected land in each of these geophysical settings. We selected parcels that are permanently protected (LEV_PROT = 'P') and where the conservation purpose is for habitat, conservation, conservation and recreation, or water protection. We deliberately excluded land permanently protected for agriculture as our focus is on land providing wildlife habitat.

Finally, we used Spatial Analyst in ArcGIS to calculate the percent of each geophysical setting that is permanently protected for habitat. Percent protection ranges from 10.6% in the 'Low elevation moderately calcarous' setting to 71.4% in the 'High elevation bedrock settings'. The project team selected the thresholds between the various categories of conservation representation based on clusters of percentages in the final analysis while seeking to balance the amount of land in the four categories and using meaningful, whole number percentages for ease of communication.

Our final categories are split between three tiers.

- Tier 1: <15% protected – poorly represented/greatest conservation focus – Value of 3
- Tier 2: 15-20% protected – not well represented/greater conservation focus – Value of 2
- Tier 3: 20%-25% protected – fairly well represented/some conservation focus – Value of 1
- No value assigned: >25% protected – well represented

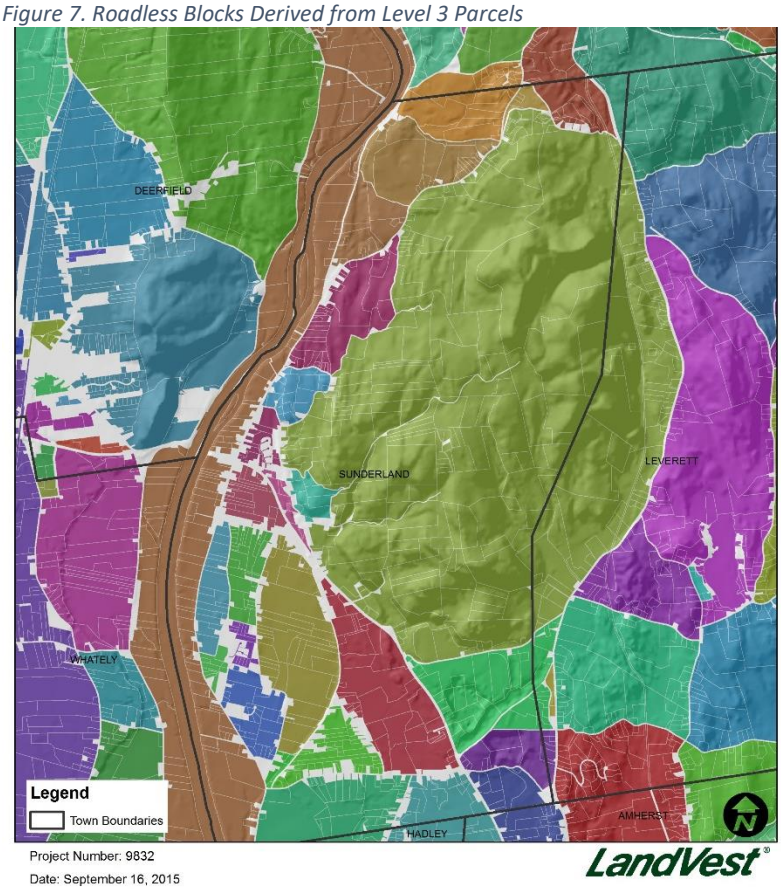
Table 3. Tier 1, 2, and 3 Under-represented Settings

GeoPhysical Setting	Percent Protected - For Biological Purposes	Percent Protected - For other purposes	Acres	Cumulative Percent of State	Final Tiers	Resource Value
Low Elevation Moderately Calcareous	11%	3.8%	206,975	4.0%	Tier 1	3
Low Elevation Calcareous	11%	7.2%	13,137	4.3%	Tier 1	3
Mid Elevation Calcareous	12%	3.3%	111,719	6.4%	Tier 1	3
Low Elevation Acidic Sedimentary	14%	2.2%	467,638	15.5%	Tier 1	3
Low Elevation Coarse Sand	17%	1.8%	1,436,414	43.3%	Tier 2	2
Low Elevation Granitic	20%	1.5%	559,357	54.1%	Tier 2	2
Low Elevation Mafic	21%	2.2%	312,564	60.2%	Tier 3	1
Coastal Bedrock Settings	22%	2.3%	30,068	60.8%	Tier 3	1
Low Elevation Fine Silt	22%	4.3%	422,159	69.0%	Tier 3	1
Mid Elevation Moderately Calcareous	24%	2.8%	201,034	72.9%	Tier 3	1
Coastal Coarse Sand	24%	2.4%	125,350	75.3%	Tier 3	1
Mid Elevation Coarse Sediments	25%	1.6%	96,323	77.1%	Tier 3	1

Identification of large “roadless” blocks using the Level 3 parcels as the source and their relative protection

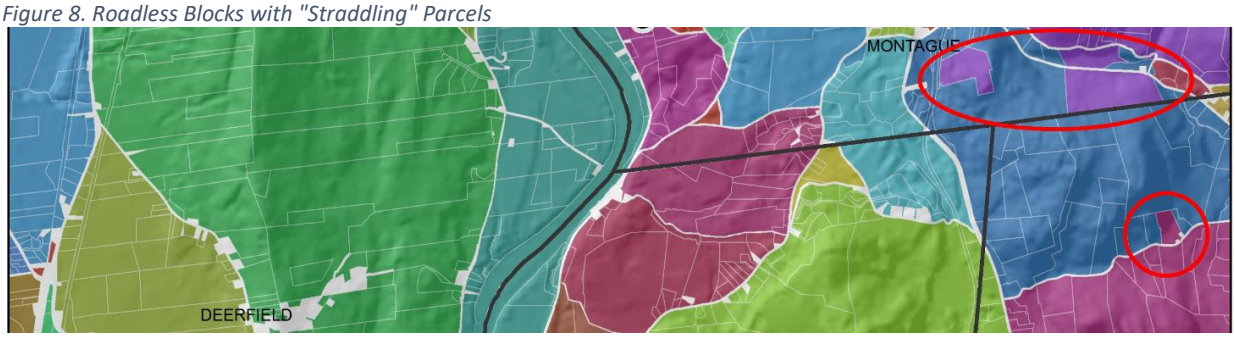
In order to identify the large blocks of contiguous parcels, all public right of ways were removed from the statewide level 3 parcel database. Then all multipart polygons were exploded so that parcels did not jump across the roads. A dissolve was then executed on that layer to create blocks of parcels that share contiguous sides and fall within a roadless block. All blocks that were less than 5 acres were dropped from the analysis.

Figure 7. Roadless Blocks Derived from Level 3 Parcels



The final step in this analysis was to rejoin those parcels that had portions on both sides of a road. The figure below shows how some parcels straddled the road. We placed such parcels into the block that held the majority of the area of the parcel. Although this makes for some disjunct blocks, the parcels are allowed to maintain their integrity as a unit.

Figure 8. Roadless Blocks with "Straddling" Parcels



We added the block information as a criteria that can be incorporated into the model. A user can limit the model to run only for blocks of unprotected parcels that are greater than a selected limit. In addition, we also added “Block Size” as a model value that can be added to any of the custom models. We assigned the following values to parcels that were part of blocks of unprotected parcels of the following sizes:

- Value 0: < 200 acres (145,836 parcels): BAnalTotArea <= 200
- Value 1: 200 – 1000 acres (185,166 parcels): BAnalTotArea > 200 and BAnalTotArea <= 1000
- Value 2: 1000 – 5,000 acres (103,290): BAnalTotArea > 1000 and BAnalTotArea <= 5000
- Value 3: >5,000 acres (27198): BAnalTotArea > 5000

Migration of the MassGIS Protected and Recreational Openspace Layer into the Level 3 parcels

The MassGIS protected and recreational openspace layer has parcels that were delineated separately from the level 3 parcel database. As a result, there are many places where the parcel boundaries do not line up. For the purposes of this analysis, it was necessary to move the protected parcels into the level 3 parcel fabric so that these parcels could be removed from prioritization.

In order to do this we intersected the MassGIS openspace layer with the level 3 parcels used for this project. This had the effect of splitting all of the level 3 parcels up using the openspace boundaries so that we could determine those level 3 parcels that had very high percentages that fell within the openspace layer. We were able to calculate 2 key statistics. The first statistic (Inter_L3_A) calculated the percentage of the original level 3 parcel acreage that fell within the intersected polygon. For instance, if a level 3 parcel and the openspace polygon overlapped quite well, but not completely, then this statistic would have a high percentage, such as 85%. Additional smaller polygons that were part of the original one level 3 parcels, would have very low percentages for these areas with smaller overlaps. The second statistic (Inter_Op_A) calculated the percentage of the original openspace polygon that fell within the intersected polygon.

We also preserved the attributes that distinguished between Fee (INTSYM = ' ') and CR/APR ("INTSYM" = 'CR/APR' OR "INTSYM" = 'CR' or "INTSYM" = 'APR' or "INTSYM" = 'OINT') polygons as well as those that had a level of protection = “P”, for protection in perpetuity (LEV_PROT = 'P').

In addition, we determined all of the level 3 parcels that had a centroid within an openspace layer polygon (Centroid = 'Yes'). The final statistic we used was simply the acreage of each polygon after the intersect was performed (Inter_Ac).

- Using a combination of the above information we identified thresholds that identified those portions of the intersect layer that “captured” the openspace boundaries, but moved them into the level 3 parcels. Once we were satisfied that we were capturing enough of the openspace polygons, without adding extraneous level 3 parcels that were not protected, we created two attributes, one for the fee parcels and one for the CR/APR parcels. Below are the sets of queries that we used to identify the fee and CR/APR parcels:
  Query1 – Intersect – Fee only – Centroid Yes – Both high
    - "LEV_PROT" = 'P' AND ("INTSYM" = ' ') AND ("Inter_Ac" > 0.05) AND ("Centroid" = 'Yes') AND ("Inter_Op_A" > 0.6 OR "Inter_L3_A" > 0.6)
- Query2 – Intersect – Fee only – Centroid No – Both High
    - "LEV_PROT" = 'P' AND ("INTSYM" = ' ') and ("Inter_Ac" > 0.05) and ("Centroid" = 'No') AND ("Inter_Op_A" > 0.6 OR "Inter_L3_A" > 0.6)
- Query3 – Intersect – Fee only - >0.99L3
    - "LEV_PROT" = 'P' AND ("INTSYM" = ' ') AND ("Inter_Ac" > 0.05) AND ("Inter_L3_A" > 0.99)
- Query4 - Query4 - Intersect - Fee only - Water - Both High
    - "LEV_PROT" = 'P' AND ("INTSYM" = ' ') AND ("Inter_Ac" > 0.05) and ("POLY_TYPE" = 'WATER') and ("Inter_Op_A" > 0.6 OR "Inter_L3_A" > 0.6)
- Query5 - Query5 - Intersect - CR only - Centroid Yes - Both High
    - "LEV_PROT" = 'P' AND ("INTSYM" = 'CR/APR' OR "INTSYM" = 'CR' or "INTSYM" = 'APR' or "INTSYM" = 'OINT') and "Inter_Ac" > 0.05 AND ("Centroid" = 'Yes') AND ("Inter_Op_A" > 0.6 OR "Inter_L3_A" > 0.6)
- Query6 - Intersect - CR only - Centroid No - Both High
    - "LEV_PROT" = 'P'AND ("INTSYM" = 'CR/APR' OR "INTSYM" = 'CR' or "INTSYM" = 'APR' or "INTSYM" = 'OINT') and "Inter_Ac" > 0.05 AND ("Centroid" = 'No') AND ("Inter_Op_A" > 0.6 OR "Inter_L3_A" > 0.6)
- Query7 - Intersect - CR only - Water - Both High
    - "LEV_PROT" = 'P'AND ("INTSYM" = 'CR/APR' OR "INTSYM" = 'CR' or "INTSYM" = 'APR' or "INTSYM" = 'OINT') AND ("Inter_Ac" > 0.05) and ("POLY_TYPE" = 'WATER') and ("Inter_Op_A" > 0.6 OR "Inter_L3_A" > 0.6)

Additional Variables Added to the Custom Model Section

We added some additional values that can be used when building the custom models. We assigned values based on the size of the parcel using the following thresholds:

- Value 0: < 50 acres (474,311 parcels)
- Value 1: 50 – 200 acres (12,839 parcels)
- Value 2: 200 – 500 acres (1,237 parcels)
- Value 3: > 500 acres (371 parcels)

We also assigned a value of 2 to all parcels that were located directly adjacent to protected parcels from the MassGIS openspace layer.

NRCS Prime Farmland Data Set

We worked with the MassGIS NRCS SSURGO-Certified soils data set to move prime farmland information into all of the level 3 parcels. We initially broke out the acres and percent of each parcel that fell in one of the three prime farmland classes:

- All areas are prime farmland
- Farmland of statewide importance
- Farmland of unique importance

We combined all three of these mutually exclusive designations together to determine the amount of the prime/important soils within each parcel. We then ranked all of the parcels using acreage of prime/important soils and split all of the parcels into 3 roughly equal bins as follows:

- >17.07 acres of prime/important soils identified 325,669 acres of parcels to which we assigned a value of 3
- >3.9 acres and <= 17.07 acres of prime/important soils identified 325,626 acres of parcels to which we assigned a value of 2
- <= 3.9 acres and >0.05 acres of prime/important soils identified 325,803 acres of parcels to which we assigned a value of 1.

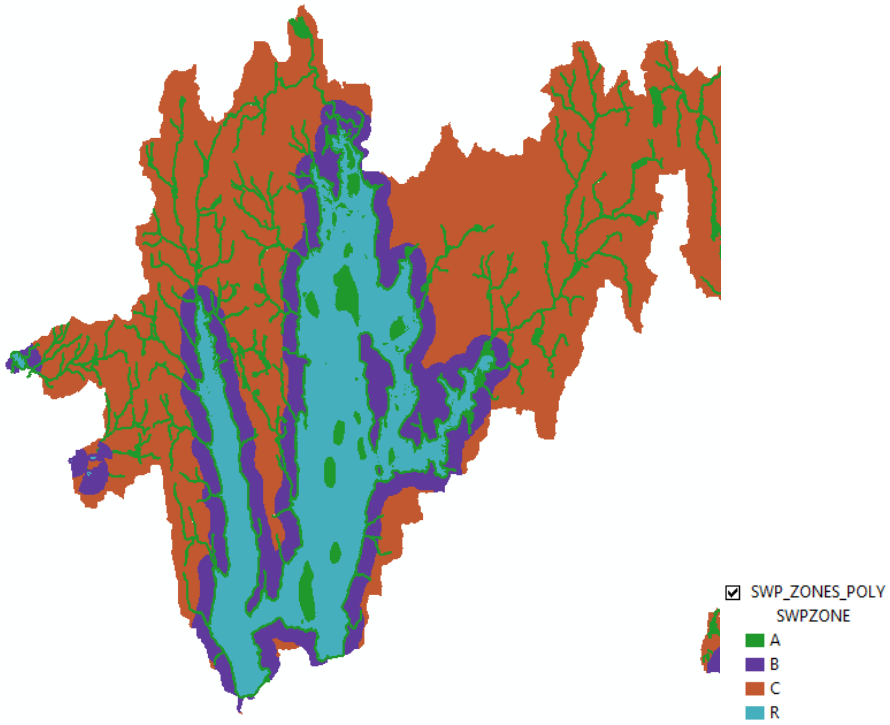
The above values for each parcel are what are used when selected the radio button to us

Surface Water Supply Protection Areas (Zones A, B, and C)

The Surface water supply protection areas are divided into zone A, zone B, zone C and reservoir areas are denoted by R.

- Zone A represents a) the land area between the surface water source and the upper boundary of the bank; b) the land area within a 400 foot lateral distance from the upper boundary of the bank of a Class A surface water source, as defined in 314 CMR 4.05(3)(a); and c) the land area within a 200 foot lateral distance from the upper boundary of the bank of a tributary or associated surface water body.
- Zone B represents the land area within one-half mile of the upper boundary of the bank of a Class A surface water source, as defined in 314 CMR 4.05(3)(a), or edge of watershed, whichever is less. Zone B always includes the land area within a 400 ft lateral distance from the upper boundary of the bank of a Class A surface water source.
- Zone C represents the land area not designated as Zone A or B within the watershed of a Class A surface water source, as defined in 314 CMR 4.05(3)(a).

Figure 9. Zones A, B, C, and R surrounding the Quabbin Reservoir



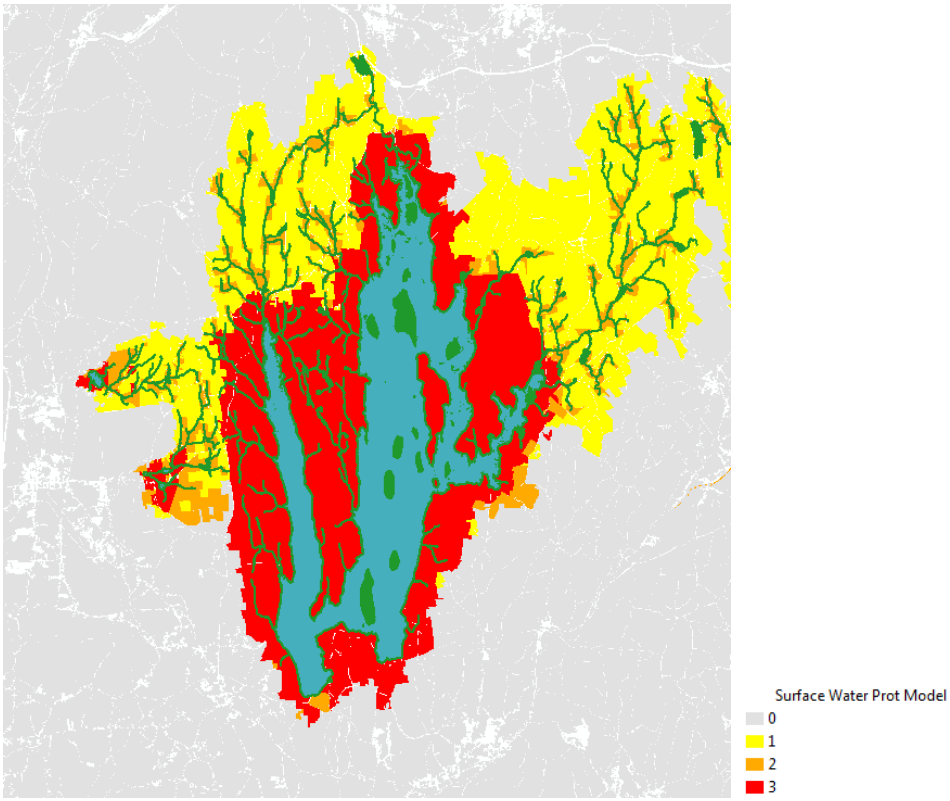
The acreage and percentage of each parcel falling in Zones B and R was calculated. The acreage and percentage of each parcel falling in Zone A was calculated. And the acreage and percentage of each parcel falling in zone C was calculated.

The following queries were used to assign values of 3, 2, 1, and zero to all parcels based on the surface water acreages/percents. The queries below result in a model where we have a watershed full of 1s, the tributaries ringed by 2s (with 1s for the edge parcels), and the surface waters ringed by 3s (with 2s for the edge parcels).

- Parcels where >= 25% was made up of Zone B or Zone R were assigned a 3
    - SurfWatRB_Perc >= 25, 8141 parcels selected, 207465.108445 acres
- Parcels where (<25% was made up of Zone B or Zone R and >0% was made up of Zone B or Zone R) and (Parcels where >=25% was made up of Zone A) and (Parcel was not already designated a 3 in step above) were assigned a 2
    - 10959 parcels selected, 184452.623519 acres
- Parcels where (<25% was made up of Zone A) OR (>=25% was made up of Zone C) and (Parcel was not already designated a 3) and (Parcel was not already designated a 2).

The following set of queries resulted in a model where parcels were designated 3, 2, 1, or 0. The model applied to the above region of the state near Quabbin is shown below:

Figure 10. Surface water model applied to Quabbin Reservoir region



MassDEP Wellhead Protection Areas (Zone II, Zone I, IWPA)

The wellhead protection areas are broken into Zone II areas (EPA designated wellhead protection areas based on hydraulic studies), Zone I areas (buffers surrounding wellheads based on flow rate per day), and IWPA (interim wellhead protection areas buffering wells that have smaller or larger circular buffers depending on the estimated amount of water withdrawal).

The model broke all parcels in the state into 3, 2, 1, or zero based on the following queries:

- WSProt_Z1_Acres > 0 OR WSProt_Z2_Perc >= 100 were assigned a value of 3
    - All of the parcel falls within a Zone II boundary and at least some acreage falls within a Zone I boundary
    - 47,869 parcels and 463,286.79 acres
- (Wellhead123 <> 3) AND ((WSProt_Z2_Perc >= 25 and WSProt_Z2_Perc < 100) or (WSProt_IWPA_Perc >=25 and WSProt_IWPA_Perc < 75)) were assigned a value of 2
    - (Greater than 25% of the parcel falls within a zone II boundary and less than 100% of the parcel falls within a zone II boundary) OR (Greater than 25% of the parcel falls within an IWPA and < 75% falls within an IWPA) and the parcel is not already assigned a value of 3.
    - 17,245 parcels and 182,345.69 acres
- ((WSProt_Z2_Perc < 25) OR ((WSProt_IWPA_Perc < 25) and (WSProt_IWPA_Perc > 5))) AND (Wellhead123 <> 3) AND (Wellhead123 <> 2) were assigned a value of 1

- (Less than 25% of the parcel falls within a zone II boundary) or ((Less than 25% of the parcel falls within IWPA) and (Greater than 5% of the parcel falls within an IWPA)) and the parcel is not already assigned a value of 3 or 2.
- 9818 parcels and 186,971.59 acres

Pre-calculated Models

Balanced Model - This model combines the TNC Resilience, UMass Critical Linkages, BioMap2 Core Habitat, BioMap2 Critical Natural Landscape, Parcel size, Block size, Adjacency to existing protection, and Under-represented settings values together. They are all equally weighted.

Resilience Model – This model combines the TNC Resilience and the BioMap2 Coastal Adaptation values together.

Aquatic Model – This model combines the BioMap2 Wetlands, BioMap2 Aquatic Cores, BioMap2 Vernal Pool Cores, Surface water supplies, and wellhead protection together.

Biological Model – This models combines the BioMap2 Species of Conservation Concern, BioMap2 Priority Natural Communities, BioMap2 Aquatic Cores, and BioMap2 Vernal Pool Cores together.

References

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