Selecting Field Sites for Grassland Bird Research using GIS ModelBuilder

Alexander C. Keyel
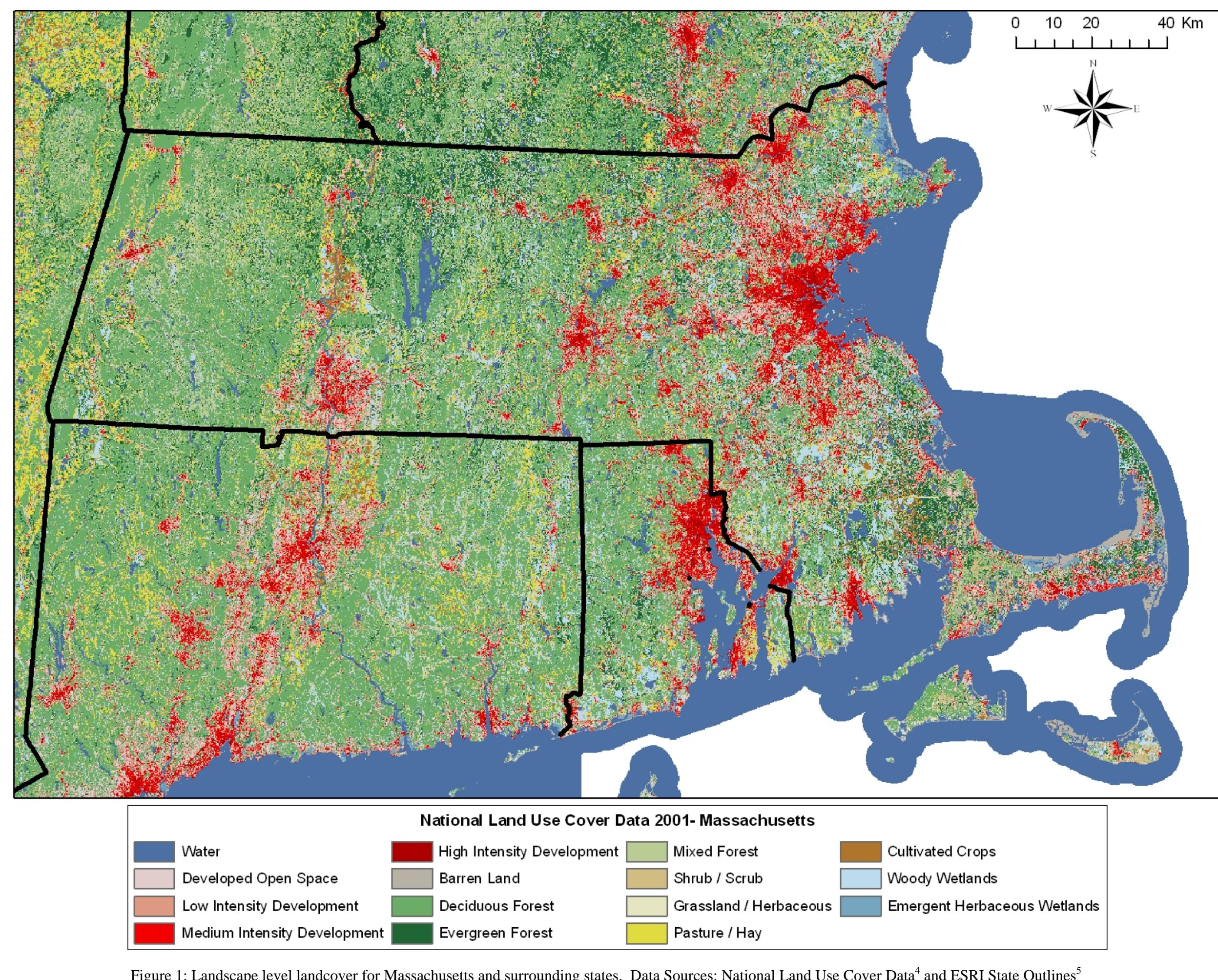### Department of Biology, Tufts University, Medford, MA 02155

Figure 1: Landscape level landcover for Massachusetts and surrounding states. Data Sources: National Land Use Cover Data[4] and ESRI State Outlines[5]
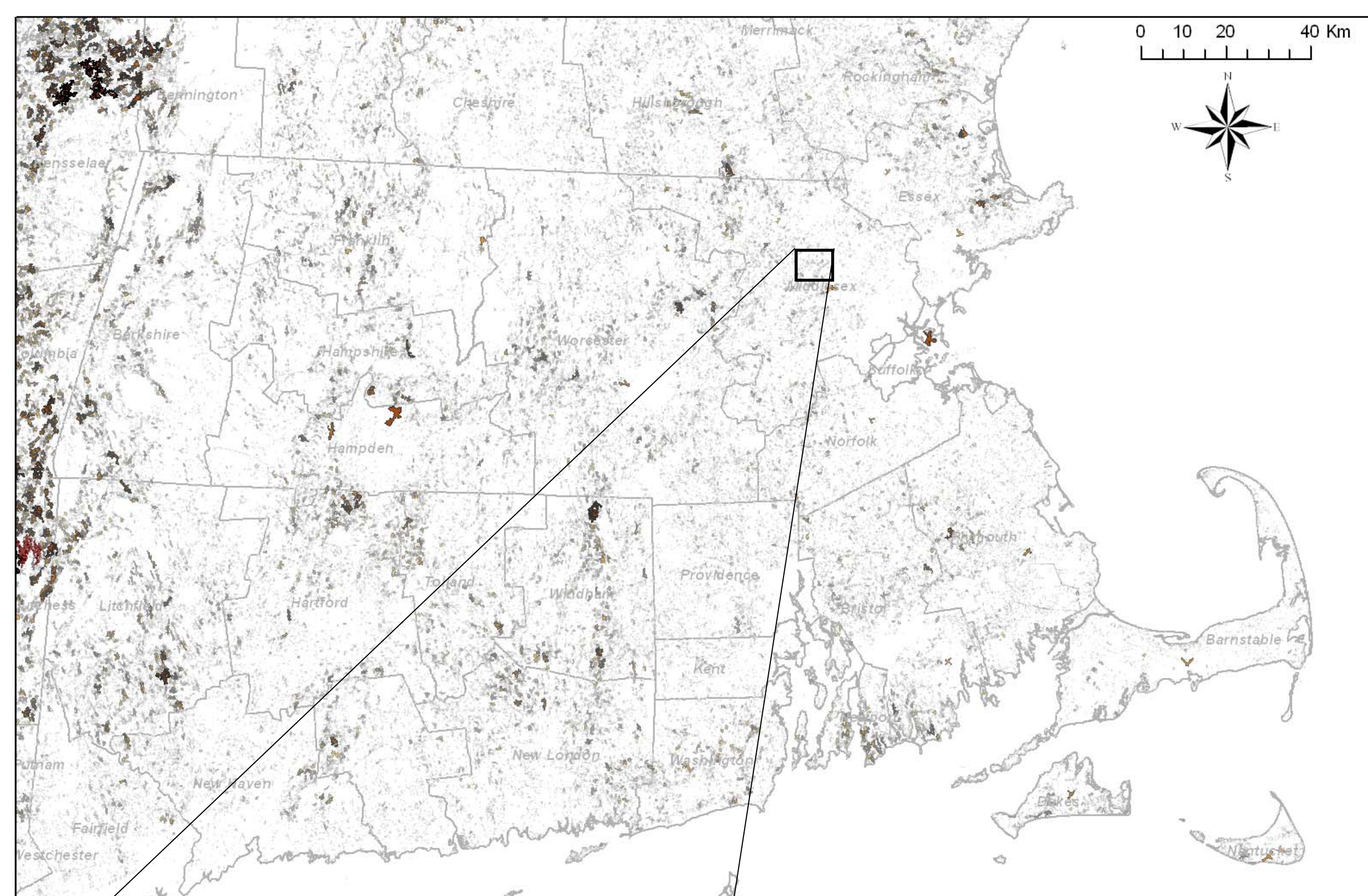

Figure 2: Shaded regions represent possible grassland sites. Color differentiates sites of different size classes, with deeper browns indicating larger sites.
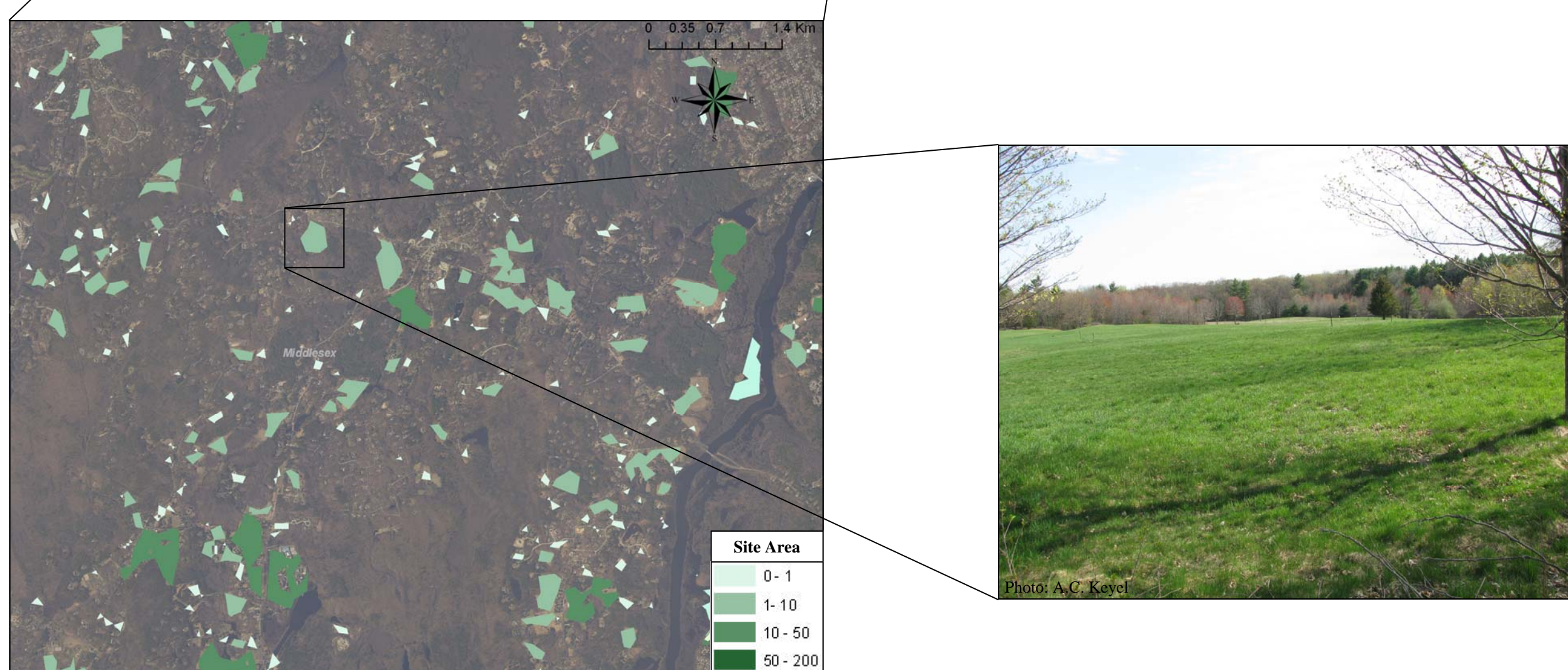Sources: ESRI County Outlines[5], Sites Identity layer

Figure 3: Close-up of sites layer. Source: Mass GIS Digital Orthophotos[6], ESRI County Outlines[5], Sites Identity
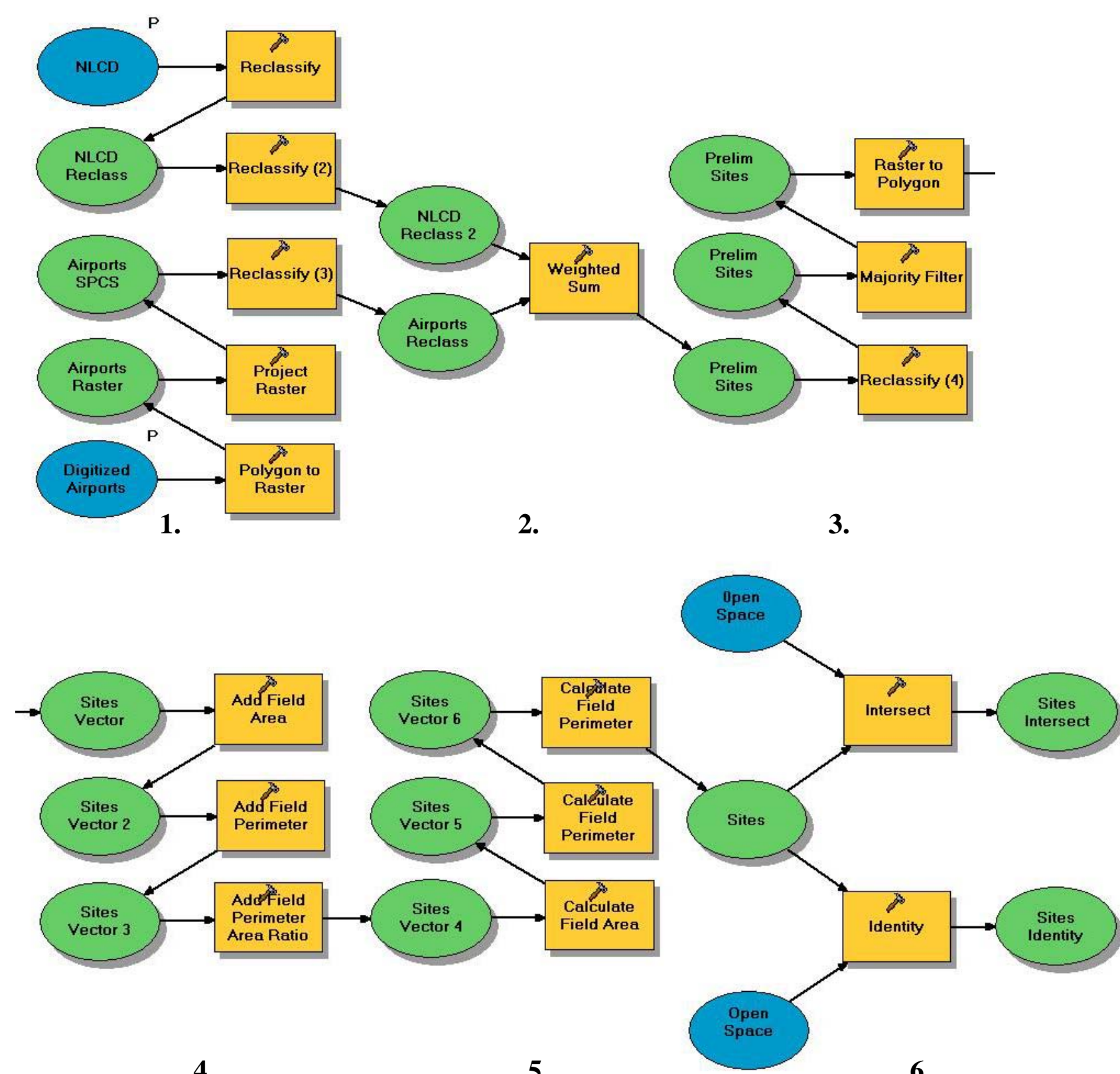

Figure 4: This ModelBuilder model can be used for field site selection. Three inputs are converted to two outputs that can be selected in ArcGIS to choose sites, or exported to Google Earth for display. Numbers correspond to description in Methods section.

Introduction

Grassland bird populations are declining nationally.[1] For example, Bobolinks, one species of grassland bird, have declined by 50% since 1966. Many grassland bird species are area sensitive, which means they are less likely to occur, or do not occur at all, on small habitat patches compared to large habitat patches. For example, Eastern Meadowlarks in Maine >20% of patches 100 ha or larger[2]. However, area sensitivity varies with time and space– Meadowlarks in Illinois were found on 5 ha plots[3], thus, *it is probable that the causes of area sensitivity are not area per se, but some factor correlated with area.*

In order to study area sensitivity, field sites of different sizes must identified. Furthermore, to understand patterns of occupancy, both sites with and without breeding grassland birds must be compared in order to identify what features make these grasslands suitable or unsuitable. These sites must be selected without bias towards sites already containing the species of interest. National Land Use Cover Data (NLCD) provides a means of identifying suitable sites in an unbiased manner. ArcGIS (ESRI) provides a toolset for examining and processing the NLCD data in an effective and efficient manner.

Furthermore, by using ModelBuilder, my process is *repeatable, transparent*, and *can be adapted* to selecting field sites in other locations.

GIS Methods

- NLCD layer[4] was reduced in extent and reprojected into Massachusetts State Plane Coordinate System (SPCS) prior to being input in the model.
1. This layer was then reclassified so that Grasslands and Pastures (coded 71 and 81 respectively) were coded 1, and all other data was coded as 0.
   - Airports, a significant habitat for grassland birds, were misclassified by NLCD, so were digitized manually from orthophotos[6] and an airports point layer[7].
   - The digitized airport shape file was converted to raster and reprojected into the Massachusetts SPCS. It was then reclassified so that airports were coded 1, and all other data was coded 0.
2. The airports layer and NLCD layer were merged into one using a weighted sum
3. These data were reclassified such that potential grassland habitat was coded 1 and all other data was coded NoData.
   - A majority filter was used to simplify the data
   - The resulting data was converted into vector to allow the use of select by location and select by attribute tools
4. Fields for Area, Perimeter and Perimeter to Area ratio were added
5. Area, Perimeter, and Perimeter to Area ratio were calculated
6. The resulting layer was combined with the Protected and Recreational OpenSpace layer[8] in two ways
   - Identity was used to add the attribute information to the grassland patches. This resulted in a file that had all potential grasslands, with the ability to select particular grasslands based on ownership data and was used for visualization.
   - Intersect provided a layer with only those parts of grasslands that were listed as openspace.
- Select by attribute and select by location were used to identify habitat patches of various sizes within the range of the Bobolink in Massachusetts (not in model)
- 43 high potential field sites were identified using this approach.

Discussion

GIS provides a powerful tool for selecting field sites, however, the quality of the input data must be carefully monitored. Accuracy assessment for NLCD 2001 is still underway[9], however accuracy of the National Land Cover Data 1992 was fairly low accuracy for grasslands (coded 71) with ~58% classified correctly[10]. However, the misclassification was generally between pasture (coded 81) and crops (coded 82). Pasture is used by grassland birds and was included in the above model. Crops, especially intensively grown crops are less suitable, but can be easily distinguished from pasture by ground-truthing. Ground truthing (verifying the data is accurately mapped by physically visiting the site) is essential[11], especially as land use may have changed in the 7 years since the NLCD 2001 data were obtained.

Ideally, a more accurate, locally digitized data set would be used in place of the NLCD, however, none exists to my knowledge (the MassGIS Landuse/Landcover data layer did not code grasslands as a unique layer), and it is beyond my time and budget to generate such a dataset prior to staring this summer's field season.

In conclusion, GIS provided an unbiased approach to selecting field sites for my summer research that can be repeated and documented.

Data Sources and Works Cited
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