MAPPING THE AMERICAN DREAM

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in collaboration with
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Finding Lawns in Northeastern Massachusetts

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Why map lawns?

The goal of this research is to create a land-cover classification of 26 towns (Fig. 1) in Northeastern Massachusetts. There are few studies of suburban land-cover that utilize sub-meter remotely sensed imagery, particularly for large geographical extents.

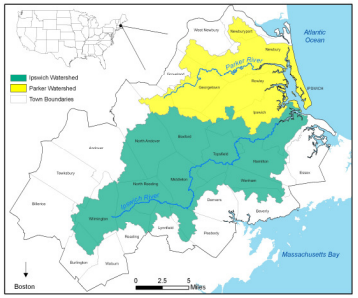

Figure 1: 26 town study area, with Ipswich and Parker River watersheds

The conventional methodology for land-cover classification lacks the spatial resolution, extent, and accuracy to describe the phenomena found in a suburban environment. Studies of the causes and consequences of suburban land-use would benefit from a land-cover classification depicting within-parcel heterogeneity, as well as the ability to match other data, such as the census, with land-use. Once all the towns are classified, a relational database will be built with multi-scale analyses of the landscape.

How did we classify the landscape?

Where do we get our data?

All the data used in this project is obtained for free from either MassGIS or the town to which the data applies. MassGIS provides aerial photographs, impervious surfaces, water and wetland boundaries, as well as town boundaries. Individual towns can but do not necessarily provide parcel boundaries, and building footprints.

How is our method different?

Segmentation refers to the process of dividing a digital image (Fig. 2a) into multiple image objects. Neighboring pixels are grouped in the same image object (Fig. 2b) if they are similar with respect to a series of characteristics such as color, brightness, and texture. Image objects are then classified (Fig 2c).

Figure 2a: aerial photograph of a house in Woburn, Ma, 2005

Figure 2b: segmentation of the same aerial photograph into image objects

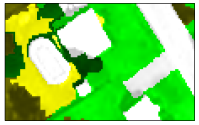

Figure 2c: classification of those image objects according to the classification hierarchy

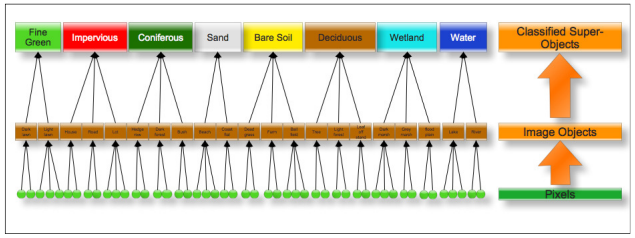

Figure 3: classification hierarchy from pixels to classified image objects

Finding Lawns

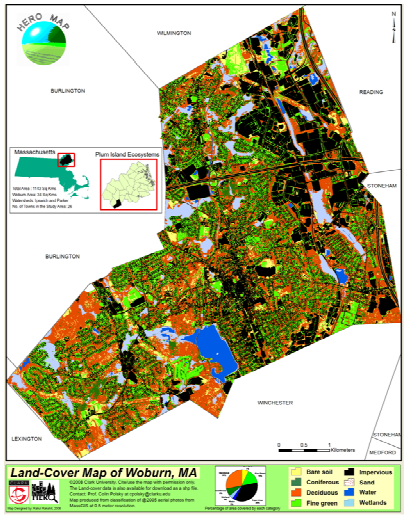

Figure 4: land-cover classification of Woburn MA, 2005

Classification was performed by applying a hierarchy of rules (Fig. 3). Some classes were defined by sampling, while others were determined by layers from MassGIS. A classified town (see Fig. 4) must be validated before it can be analyzed for land-cover proportions and lawn presence.

Figure 5: Microsoft Virtual Earth Bird's Eye View of 10 Myrtle Rd, Woburn, MA

Figure 6: Google Earth's Aerial View of 10 Myrtle Rd, Woburn, MA

Figure 7: Google Street View of 10 Myrtle Rd, Woburn, MA

How do we know how good our maps are?

To check the accuracy of our maps we compare our land-cover classification with imagery seen in a virtual globe like Google Earth or Microsoft Virtual Earth. We place points randomly across the map, grouped by strata, and determine which land-cover they are characterized by in the virtual globe (Figures 5-8). We then compare the land-cover provided by our map with the land-cover determined using the virtual globe. We create strata because we want to know how well each of our land-cover categories correctly characterizes the landscape, as well as how often privately managed lawns can be observed in the virtual globe (Figures 9 & 10).

What's Virtual Field Work?

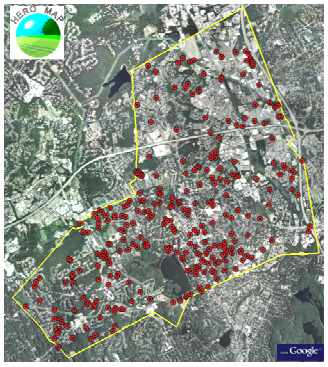

Figure 8: sample points for validating the town of Woburn, MA as seen on Google Earth

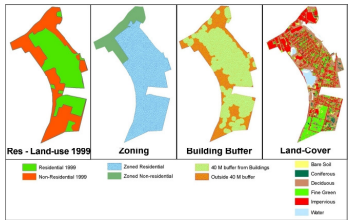

Figure 9: strata for validation, some of which are created using ancillary data

Stratum	Fine Green	Near Buildings	Zoned Residential	Residential Use
1	TRUE	TRUE	TRUE	TRUE
2	TRUE	TRUE	TRUE	FALSE
3	TRUE	TRUE	FALSE	Not Used
4	TRUE	FALSE	Not Used	Not Used
5	FALSE	Not Used	Not Used	Not Used

Figure 10: rules for the creation of strata which use ancillary data

How much lawn?

The HERO MAP project will continue to add towns to its 0.5m resolution land-cover database, which will be searchable at the town, census block, and parcel scale (Figures 11 & 12). For each of these scales we derive data such as area of fine green cover, greenness for fine green areas, and proportions of each land-cover (Figures 13 & 14). We also break the study area into strata and determine the likelihood of the presence of privately managed lawns for each stratum. This database will be available to the public and will serve as a useful tool for studying the effects of suburbanization.

Figure 11: 7 Roman Rd., Woburn MA Google Earth streetview

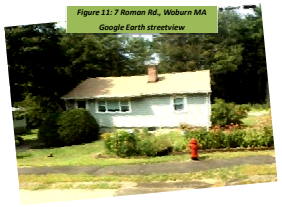

Figure 12: 9 Roman Rd., Woburn MA Google Earth streetview

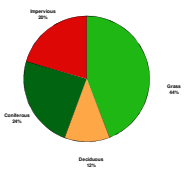

Figure 13: Proportions of land-cover categories found for the parcel located at 7 Roman Rd, Woburn, Ma 2005

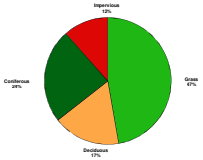

Figure 14: proportions of land-cover categories found for the parcel located at 9 Roman Rd, Woburn, MA 2005

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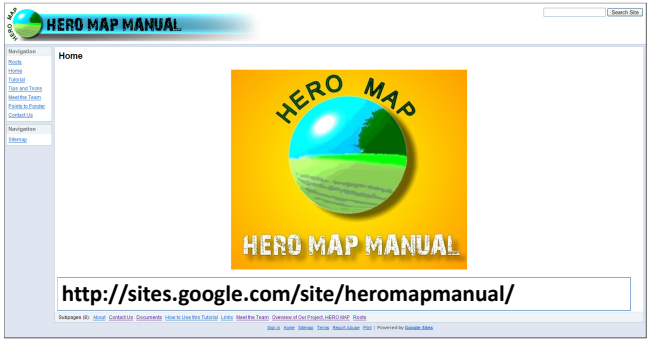

Reference:

[1]W. Zhou, and A. Troy. (In press). An Object-oriented Approach for Analyzing and Characterizing Urban Landscape at the Parcel Level. *International Journal of Remote Sensing.*

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