

## COMMUNITY BASED OPEN SPACE PLANNING: APPLICATIONS OF A GIS

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**Abstract:** The purpose of this paper is to illustrate the usefulness of a GIS in community open space planning of undeveloped recreational opportunities. The study area is a small New England village in the western region of Massachusetts. Like most of the Northeast, Northampton is a rural community with a growing population. Proposals for public recreation lands compete for commercial development.

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### Introduction

In order to meet the future needs for recreation, proper land use planning must be addressed today. Land use planners employ the technique called a "build-out" in order to plan for future growth of communities. Geographic Information Systems (GIS) is the tool utilized in this build-out since the computer-based analyses are efficient in time and cost. For the scenario here, a build-out scenario of the existing open space is queried to show the impact of population demand on open-space in the study area. Highlighted in this paper will be an overview of the process including steps in data collection, data management and analysis. Data of these types are collected from remote sensed imagery, MassGIS databases and fieldwork. After these steps, data are entered in multiple spatial databases. From these data, open space and existing land use will be evaluated and one can create maps appropriate for analysis.

In order for GIS data to be useful for recreation resource decision-making, alternative scenarios are considered. Alternative scenarios could include a build-out scenario tied with passive public recreational demands or a "no-build" possibility, preserving current land use. Once the GIS analysis is prepared, decision-makers can then make informed choices to provide for growth in the community as well as provide for recreational opportunities.

The reader should be able to recognize the importance of a build-out analysis and the usefulness of a GIS. Through the research presented the reader will develop an understanding of the town of Northampton's open space issues and at the same time develop an understanding of what a build-out analysis can accomplish using GIS technologies.

### Background

A Build-Out Analysis illustrates the form and pattern that development can be expected to take under a continuation of current trends and the manner and degree to which this form and pattern are contrary to planning goals (Marriot, 1995). A description and illustration of the consequences of current trends help to identify the kinds of action that are needed and to build public support for these measures (MassGIS 2000). Like many other cities, Northampton will continue to experience more growth. Alternatives to build-out analysis can be time consuming, however, they help provide positive actions towards the recreation environment.

There are three alternatives that are used in mainstream build-out alternatives, 1. No Build – Avoiding development as a whole, 2. Designate open space for recreational purposes such as parks and trails, 3. Use existing resources such as renovated buildings, former hospital grounds and landfill property (known as Recycle & Facilities). These alternatives are vital in the development of build-out analysis.

GIS is very important in the development of alternative build-outs. A GIS can show what open space could possibly look like if development does come into a town. A GIS uses a system of computer software, hardware, data and personnel to help manipulate steps, analyze and present information that is tied to a spatial location or geographic location (ESRI, 2000). GIS are "smart maps" linking a database to maps and layers consisting of many different themes such as rivers, lakes, roads, greenways, landuse, open space, and buildings. Data sources provide documentation of GIS data at various scales. For example, data are available at the global scale and can show continents and watersheds, while at the local scale, one would like to study vegetation or trails (MassGIS 2000). This research analyzed existing open space that could possibly be developed into commercial properties and thus unavailable for passive recreation. Several sites were chosen for possible development based on the greatest amount of open space in Northampton.

### Case Study: Northampton, Massachusetts

The City of Northampton, Massachusetts contacted Westfield State College to provide an inventory of open-space properties within the City. The purpose of this study is to examine the open space areas to determine which are of high priority for purchase by the City. The purchased areas would be designated for conservation and recreation to prevent additional resource damage. Therefore, an inventory of vegetation, slope, topography, soil and wildlife was conducted. Three main sites were studied based on areas that the City of Northampton was interested in acquiring. See Figure 1 for the location of the case study area.

Fieldwork included several visits to the open space areas to conduct a natural resource inventory. This included a geographic survey of surrounding land, and adjoining

zoning, brook course, and tributaries; a sampling of vegetation using and a visual inventory of brook obstructions, natural or otherwise.

Parsons Brook is located in south central Northampton, an area that is prime for open space protection. Throughout Parson's Brook's course, it varies in width and velocity. It starts out rather small and slow near the source, often spreading out into a small marshy area for a few yards before resurfacing. Further downstream, the brook begins to widen and pick up more velocity and depth as tributaries and runoff from the roads add to the brook.

There are few man-made obstructions in the stream. And aside from the beaver dam, there are no other major obstructions besides brush and fallen trees. The terrain varies around the stream from slightly sloping to slopes of 15% or more. The vegetation inventory includes various species of maples, ash, pine, ferns and mosses. Soil maps were reviewed to identify the different soil types that surround the stream are typically loams. Wildlife in the area consists of the usual array of birds, raccoons, deer, squirrels, chipmunks and skunks. Beavers are also in the area and have created an impressive system of terraced dams to form a fairly large pond.

#### Data Collection

In this section of the paper, the details of the resource will be discussed. Starting at the source, the transect moves downstream, section by section to complete the inventory.

Beginning in Parcel 1, the brook surfaces roughly 20 feet from the road and begins its southeasterly course. At this point, the brook is very shallow, often spreading out into a marshy area before collecting into a solid brook. The terrain is fairly flat, with a slight incline to the road on the north side. The soil characteristic of the area consists of PcB or Paxton very stony fine sandy loam with 3-8% slopes. After about 50 feet, the brook crosses Parcel 2. By this point, the brook has established itself into a single stream. The flow is slow and shallow. The lawns of Parcel numbers 3, 4 and 5 (south of the brook) come relatively close to the brook itself, within 10 feet. Lawn debris is piled up in spots along the brook. Fallen trees and old tree stumps block the stream in some places, causing the stream to form small pools. After another 20 feet the yards begin to slope upwards to about 3%.

The brook at Parcels 6, 7 and 8 becomes a bit wider and the velocity of the water picks up. The terrain becomes slightly more inclined on either side of the brook, with the greater slope on the southern side. The debris in the brook still consists of fallen trees, yet there is a picket fence gate thrown over the brook between Parcel 6 and 7. The soil composition has changed to ReB or Ridgebury very stony fine sandy loam 3-8% slopes. Within Parcel number 8, the terrain is increasingly steep with a slope of about 20%.

Parcel 9 is a transition point for the composition of the brook. There is a path running from Burts Pit Road across the brook to the road to the south. At the brook crossing,

there is a makeshift bridge made of an old door, some logs and old planks. There were many bicycle tracks observed on this path, indicating a popular route for local mountain bikers.

The vegetation for this area was relatively uniform, consisting of a few white pine trees, Red maples, Swamp Oak, and Yellow and American Beech trees. Cinnamon Fern as well as Crested and Sensitive were seen in the area as well. Common mosses also grow on the rocks in the stream. Scattered Birch trees are to be found downstream.

At this point, the brook has picked up speed and becomes deeper. The terrain is now steeply inclining on the north side of the brook, and the lawns are now up the hill and about 30 feet from the stream. The southern side of the brook is still slowly inclining, but not yet becoming steep. This area is also marshy in nature and the land surrounding the brook is saturated. The soil content is Ma or Maybid Silt Loam.

Vegetation is denser in this area. It still includes the White pine, Swamp Oak, Red Maple and Beech trees, but there are more Birch trees and several types of low brambles. The same types of ferns exist near the brook as above, and mosses are abundant. Mountain Laurel and Swamp Azalea are also found here. Small chutes of Princess Pine were also noted.

The southern side of the brook begins to slope upwards at a steeper angle when crossing Parcel 11. Tributaries begin to join the brook at different intervals on both the northern and southern sides. By the time the brook reaches Parcel 12, the topography is very steep on both sides and the vegetation consists of mainly White Pine and Hemlock trees. There are no nearby houses or lawns in this vicinity.

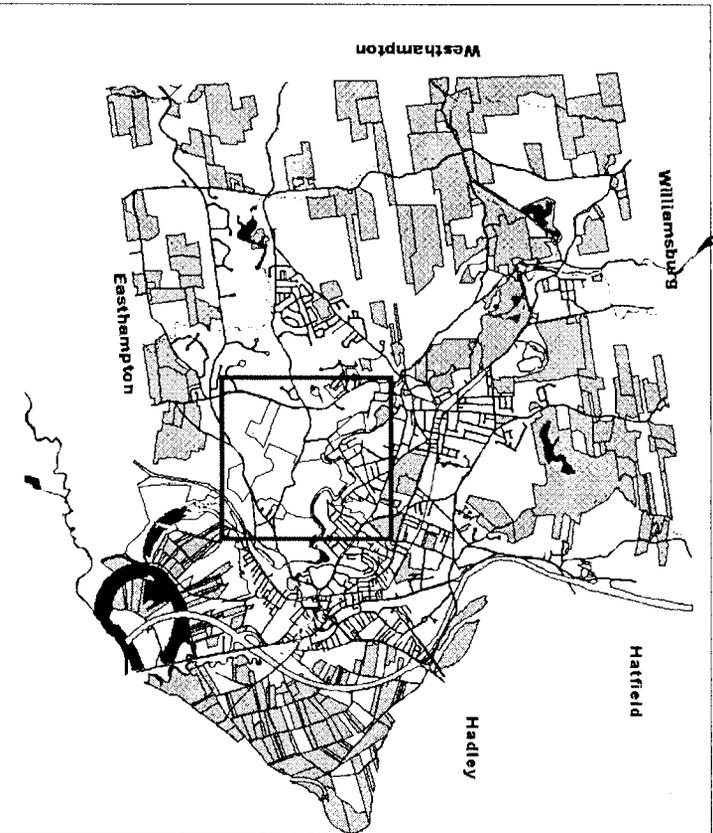
Now the brook empties out into a beaver pond. Surrounded on all sides by steep slopes, this pond looks to be several years in the making, with an active network of beavers adding to it. The pond covers approximately an acre and a half of Parcel 12. There are felled trees all around the pond yielding evidence of beaver intervention. It is here that the brook turns south. In the southwestern corner of the pond, lies a very large beaver dam of about 100-150 feet in length. Another 2 dams and what looks to be the making of a third follow this main dam.

The house on Parcel 13 has a network of paths that lead down past the pond and along the brook. After the dams, the brook then widens to about 10-20 feet across and deepens to 1 or 2 feet. It moves fairly swiftly. Topography in this area is still steeply inclined on either side, but gradually decreases downstream. The houses on the western side of the brook are very close to Parsons Brook. The house on Parcel 14 sits on the edge of the incline overlooking the brook. There are no further obstructions until Parcel 16. There is a bridge made out of telephone poles that connects a network of trails between Parcel 15 and 16.

The soil here becomes visibly sandy and increasingly darker while the vegetation consists of an abundance of White Pine, Eastern Hemlock and Oak. As the terrain

Figure 1. Northampton, Massachusetts Build-out Scenario

# Northampton, Massachusetts Build-Out Scenario



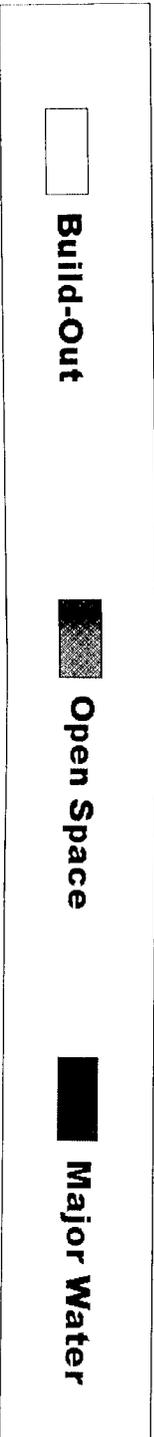
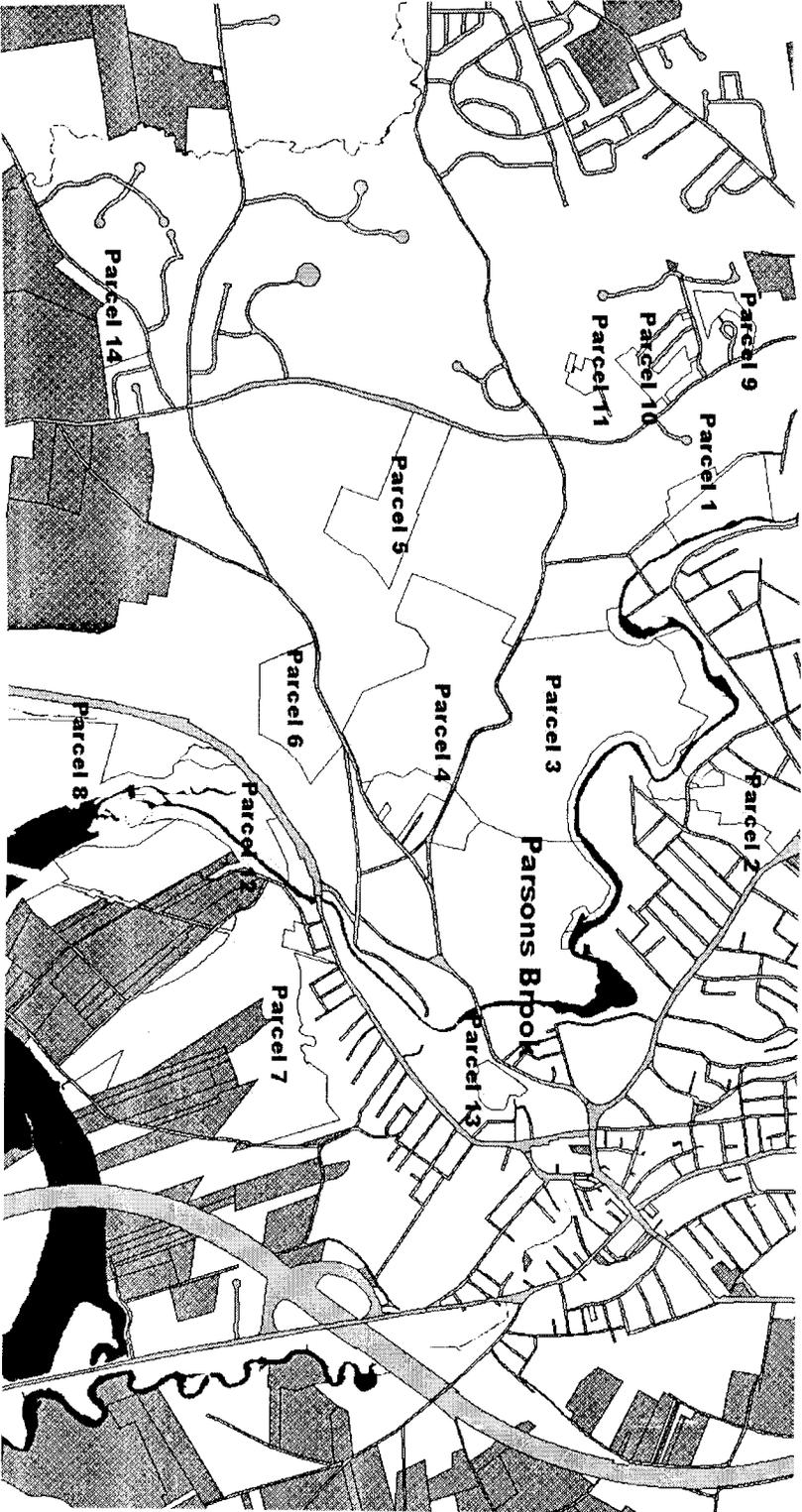
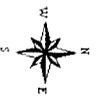
**This Build-Out represents an illustration of the consequences of a continuation of current growth trends in Northampton, Massachusetts.**

-  Major Water
-  Open Space
-  Build-Out

Figure 2.

Parsons Brook Outdoor Recreation and Open Space Opportunities

# Parsons Brook Outdoor Recreation & Open Space



which is a poorly drained soil. The survey of the brook ended near the southern edge of Parcel 16.

The ultimate conservation of Parson's Brook in the City of Northampton would provide a small yet important habitat for local wildlife. The brook provides a drinking source for many woodland animals, a habitat various species, and a very aesthetically pleasing area for the surrounding community. Purchasing some of the land buffering the brook may prove to be a worthwhile investment. Some parcels may be easier to come by than others and some owners may not agree to the idea, but an overall effort should be made to protect the brook and to preserve the natural character of the area.

## Results

The parcels that may be of some interest to the city are as follows. Parcel 1 contains the area where Parsons Brook originates. The area is wooded and vacant. It would be an excellent area to preserve. The brook crosses Parcels 2 and

3 near the edge of the property and could be considered a priority. Parcels 4, 5 and 6 may be a little more difficult to acquire because there is no direct public access to the property. Secondly, adjoining residential landowners may oppose open-space purchase in their back yard for fear of crime. An easement in this case may be the best option. Parcel number 7 is oddly shaped, and Parsons Brook crosses it in an area that is uninhabited to the viewer. This parcel contains the path used by mountain bikers, and may be of importance for erosion prevention purposes. Parcel 8 is cut in half by the brook, but is also an area where an easement could be procured. The back land on this property is fairly wooded and would be very beneficial in preserving as well. Parsons Brook cuts across Parcel 9 at the very edge, and could be considered a priority spot, whereas parcel 10 is bisected by it and may be harder to obtain. Parcel 11 houses a great length of the brook and is heavily wooded. This spot would be a wonderful piece to preserve, even though it is bisected by the brook and may be met with some difficulty in obtainment. Table 1. illustrates this priority.

**Table 1. Priority of open-space land in Northampton**

Parcel Number	Priority	Parcel Number	Priority
1	Hi	8	Hi
2	Hi	9	Hi
3	Hi	10	Lo
4	Lo	11	Hi
5	Lo	12	Hi
6	Lo	13	Hi
7	Hi	14	Lo

From this point Parsons Brook enters the gravel pit area and then forms the boundaries between several different parcels. This is a very aesthetically pleasing area and one that should be of high priority. The only area that may be of some concern is along the edge of Parcel 14 because the house on that property is very close to the brook. The rest of the parcels have the brook as a border between them and should be considered a high priority as well.

## Discussion

The build-out is a very useful tool for land use planners. GIS, with accurate and complete data, can be used to inventory these resources with the ease and precision of a computer. Alternative scenarios can be created and compared with a click of a mouse button.

The field work part of this project was more extensive than originally thought, but following the old adage "garbage in - garbage out", it is a necessary component in any GIS application. One cannot skimp on data collection. And available data in digital form is often not readily available for municipalities. Data may amount to as much as 75% of the total expense of the project, so one must recognize the importance of complete data collection.

This study may have over emphasized the need for soil data. For example, open space lands are less dependent on

soil type, then would agricultural lands. But it was felt that complete data would be preferred since it is easier to not include something instead of having to build the geographic layers after the fact. It is recommended that future studies in open space planning consider specifically their data needs before conducting the inventory.

## Bibliography

- Environmental Systems Research Institute Website.  
[www.esri.com](http://www.esri.com)
- Lynch, John. 1970. *Site Analysis*. , New York, New York: W.M. Norton.
- Tiner, Ralph. 1988. *Field Guide to Nontidal Wetland Identification*. Newton Corner, Massachusetts. Maryland Department of Natural Resources & U.S. Fish & Wildlife Services.
- Petrides, George. 1986. *Trees and Shrubs*. Boston: Houghton Mifflin.
- Marriott, Bowers Betty. 1997. *Environmental Impact Assessment*. New York: McGraw-Hill.
- Massachusetts GIS Website.  
[www.Magnet.state.Ma.us/mgis/massgis/htm](http://www.Magnet.state.Ma.us/mgis/massgis/htm)