No Farms, No Food

Two Scenarios for Prioritizing Farmland for Agricultural Conservation Easements in Berkshire County, MA

Background

Massachusetts (MA) has seen a 20% decline in farmland since 1987, making it critical that the remaining farmland in MA is protected against long-term trends of farms lost to development (USDA, 2019a). Berkshire County, located in western MA, has experienced a 5% decline in farmland between 2012 and 2017(USDA, 2018b). 36% of farmers in Berkshire County are 65 years old or older (USDA, 2019b). Retiring farmers must decide what to do with farmland and many choose to sell their land to developers to finance their retirement. The Massachusetts Department of Agricultural Resources developed the Agriculture Preservation Restriction (APR) program in 1977 to offer non-development alternatives to owners of agricultural land with the goal of protecting productive agricultural land from development for non-agricultural purposes, increasing access to farmland for beginning farmers, and assisting aging farmers with estate and retirement planning (MDAR, 2019).

Agricultural conservation easements are deed restrictions placed on property to protect resources, such as productive farmland, and limit non-farm development in the future. Easements are a critical tool for farmland protection and can be flexible to meet the needs of individual farmers. Criteria considered for identifying farmland to put under agricultural easement differs based on local priorities. One criteria that is consistently considered high priority is whether the farm is considered to be Prime Farmland, defined by the USDA as having a combination of physical and chemical characteristics that make it a highly productive area (USDA, 2000). Some conservation programs focus their efforts on areas with a high level of development threat. Factors that contribute to high development threat include growing population density and high land value, which attract developers to purchase land for non-agricultural uses. In contrast, other conservation programs prioritize maintaining larger regions, or clusters, of agricultural land. For example, the state of Connecticut's conservation program prioritizes farms with greater agricultural production value and farms in proximity to other agricultural land, currently conserved land, or farm services (Bassani, Coffin and Mittasch, 2015).

The goal for this project is to offer two scenarios for how MA state and local government and non-profits could go about identifying farmland to prioritize for agricultural conservation easements in Berkshire County. These two scenarios are based on criteria from state and local government conservation programs in the Northeast region. These scenarios reflect different goals for farmland conservation in MA, one that aims to protect farms under high threat of development and the other to protect farms in regions with larger areas of ongoing agricultural land use and lower threat of development. Based on these two scenarios, this project aims to identify geographic areas of priority for farmland conservation efforts in Berkshire County which can be used to guide local conservation groups for future easement decision-making.

Data

Data acquired for this project includes vector data for MA's counties and towns from MassGIS. Raster data for current agricultural land use and change in agricultural land use comes from the USDA-National Agricultural Statistics Service Cropland Data Layers for 2008 and 2018. Farmland quality is assessed based on the USDA's Prime Farmland data from the USDA-NRCS Certified Soils vector layer available from MassGIS. Population vector data comes from the 2010 Census data by block group published by MassGIS. Total land values for each parcel is obtained from Standardized Assessor's Parcel vector data from MassGIS. Data for land currently under APR conservation easement is found in the Protected and Recreational Open Space vector data available from MassGIS.

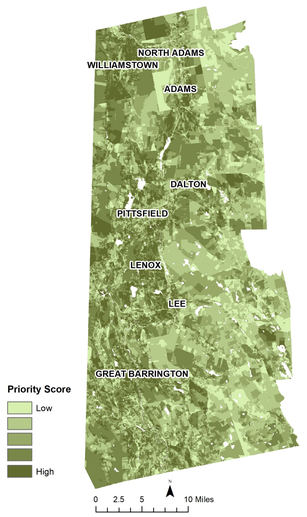

Figure 6. Weighted Score for Scenario 1: In Scenario 1, priority is determined by high threat of development.

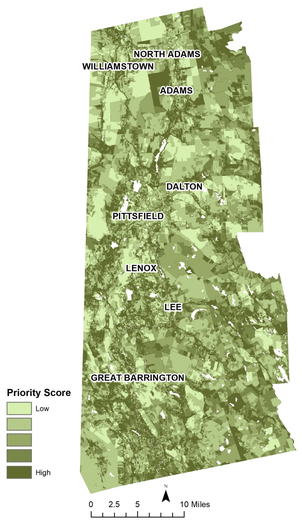

Figure 7. Weighted Score for Scenario 2: In Scenario 2, priority is determined by lower threat of development and maintaining regions of ongoing agricultural production.

Criteria	Weight
% Agricultural Land 2018	12.5%
% Change in Agricultural Land 2008-2018	12.5%
Farmland Type	25%
Population	25%
Property Value	25%

Table 1. Criteria and Weights

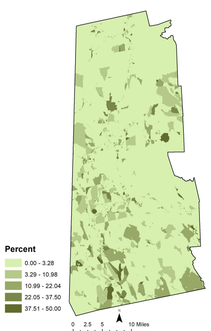

Figure 1. Percent Agricultural Land 2018 Percent of land within each census block group in agricultural use in 2018.

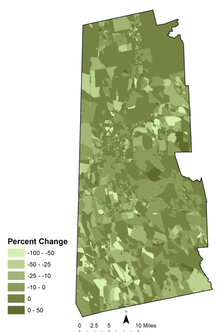

Figure 2. Percent Change in Agricultural Land Use 2008-2018 Percent change in agricultural land with negative values indicating loss of farmland and positive values indicating farmland gain.

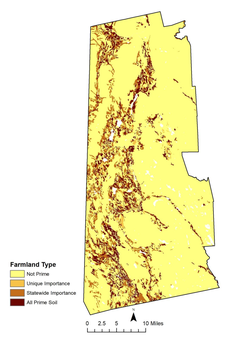

Figure 3. Farmland Type Based on USDA-NRCS farmland categories. Prime farmland is most productive land, followed by Farmland of Statewide Importance which is considered nearly prime. Farmland of Unique Importance indicates importance for a specific crop.

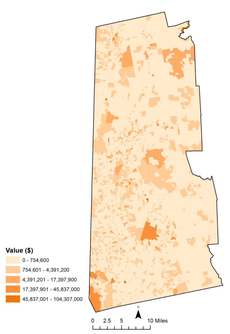

Figure 4. Property Value Total value, including land and structures, for each parcel in Berkshire County.

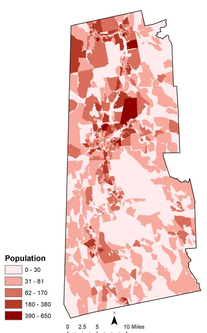

Figure 5. Population 2010 Census data for population by block group.

Methods

Based on the eligibility criteria for APR conservation easements and additional criteria for easement prioritization from government and non-profit groups referenced for this study, I developed two scenarios for prioritization of farmland for conservation in Berkshire County. Scenario 1 prioritizes conservation activity on areas of land more vulnerable to development and aims to maintain open space in more densely populated areas. Scenario 2 prioritizes farmland under a lower threat of development and thus more likely to remain as working land in the future. Here I am identifying land under low threat as areas of ongoing agricultural activity and gains in farmland, lower real estate values and areas of lower population density. This second scenario works under the assumption that it is more effective in the long term to keep farmland clustered, protecting larger agricultural areas that allow for resource sharing and proximity to farm services. Both scenarios are based on 5 criteria: the percent of land in agricultural use in 2018, the percent change in agricultural land from 2008 to 2018, farmland type, land value, and population density.

All analysis for this study was completed in ArcMap 10.7.1. For both scenarios I downloaded the USDA Cropland layers for 2008 and 2018 to use as a basis for identifying land currently in agricultural use and recent change in farmland. For both layers I reclassified the land use data for different agricultural uses, such as hay production or specific crop types, as either "agricultural" or "non-agricultural". I then used zonal statistics to find the percent agricultural land by Census block group for 2008 and 2018. Figure 1 shows the percent agricultural land in 2018. Based on these percentages, I then used the field calculator to find the percent change in agricultural land from 2008 to 2018, seen in Figure 2.

To identify the prime agricultural areas, I used the NRCS-SSURGO soil map, selected by location for the polygons within Berkshire County, and exported this layer. I then joined this Soils Poly layer with the Soils Poly Mapunit table on the MUKEY field to identify areas of Prime Farmland, Farmland of Unique Importance and Farmland of Statewide Importance, Figure 3. For land value, I used Standardized Assessors' Parcels data, downloading the parcel polygon layer for each town and the corresponding Extract from Assessor table. I joined each table to its corresponding polygon layer on the OBJECTID field to display total property value. Then I exported and merged these layers together into one polygon layer for the county, Figure 4. To assess population density I downloaded 2010 Census population data by block group, Figure 5. Because the population is so low in most parts of this county, the data is displayed as population counts rather than by population density based on area.

To find a weighted score for each scenario, I took these 5 criteria layers and converted all vector data to raster data. I completed the analysis in the Albers Conic Equal Area projection, based on the original projection for the Cropland data layer which is the basis of the analysis. I then reclassified each layer with scores from 0-3 based on each scenario. For Scenario 1, areas with the least current farmland and the highest percent of farmland loss were given the highest score of 3. High population and high total land value got a 3, lowest population and land value got a score of 0. For Scenario 2, areas with the highest percent of farmland and areas with either consistent farmland or farmland gain were given the highest score of 3. Areas of low population and low land value got a 3, and areas of highest population and high land value were given 0. In both scenarios Farmland Type was reclassified the same way, with Prime as 3, Statewide Importance as 2, Unique Importance as 1, and Not Prime as 0. The reclassified layers for each scenario were then added together using the weighting in Table 1, based on the importance of criteria from my research and using the Analytic Hierarchy Priority Calculator (Goepel, 2019). Figures 6 and 7 show the resulting weighted scores based on each scenario's criteria, using an SQL Query to display labels for towns with a population greater than 5,000.

I then took these weighted raster layers and used zonal statistics to find average priority scores by town under each scenario. For both figures I used an SQL Query to display labels only for towns that had a high weighted score, above 2.5, on the scale from 0-3. Finally I overlaid this with polygons for land currently under APR easement in order to see where land is currently being conserved in relationship to these identified high priority areas, Figures 8 and 9.

Results

Towns to Prioritize for Agricultural Conservation Easements in Berkshire County, MA

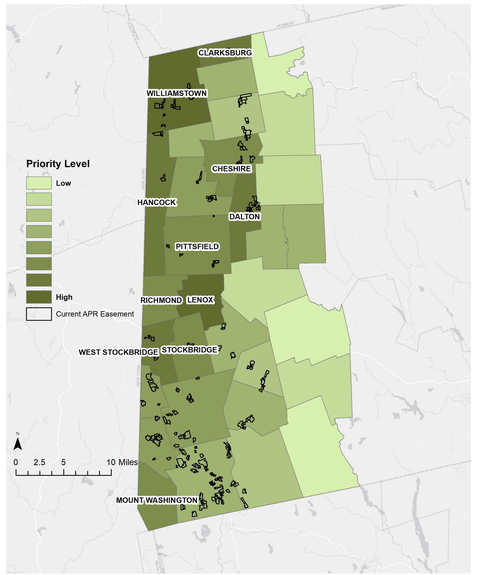

Figure 8. Priority Towns Under Scenario 1

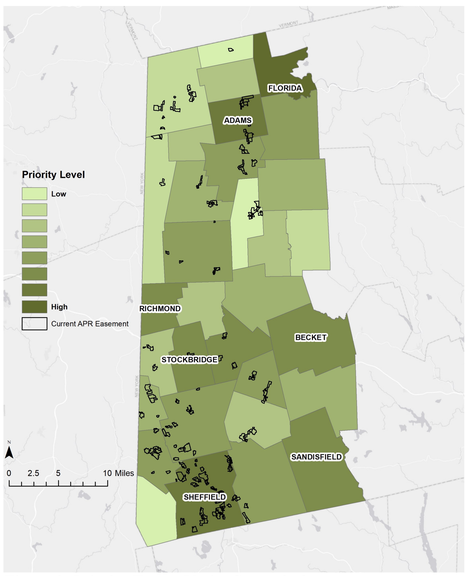

Figure 9. Priority Towns Under Scenario 2

Figures 8 and 9 show the results for identifying towns to prioritize for agricultural conservation easement in each scenario. Scenario 1 identifies the towns of Mount Washington, Stockbridge, West Stockbridge, Hancock, Richmond, Lenox, Pittsfield, Dalton, Cheshire, Williamstown, and Clarksburg as high priority for agricultural easement activity. Scenario 2 identifies Sheffield, Sandisfield, Stockbridge, Becket, Richmond, Adams and Florida as high priority. While Scenarios 1 and 2 have different goals, there are areas of overlap. In both cases Richmond and Stockbridge are identified as high priority areas.

Conclusions

The scenarios for prioritization of farmland for conservation easements presented here offer two paths forward. The results in Figures 8 and 9 can be used by decision-makers at MA Department of Agricultural Resources and local conservation groups to make funding decisions to continue their work of farmland protection in Berkshire County.

While Figures 8 and 9 may be helpful for decision-makers to initially identify towns to prioritize for funding, easements are made at the individual parcel level. In this case, Figures 6 and 7 may be equally useful for decision-makers. Parcels can be located within these maps and a more localized priority score can be used to assess and compare individual parcels. Additionally, to qualify for an APR conservation easement, a farm must be at least 5 acres in size. The maps in Figures 6 and 7 can also be used to select for parcels at least 5 acres in size that have a high priority score at the parcel level to evaluate individual farms.

A limitation of this project is the fact that the results, based on the criteria for the two scenarios, offer somewhat opposing models for conservation. To further this research, and develop a usable model to evaluate the priority for easement at the town or individual farm level, one scenario must be chosen to use in practice. If decision-makers in MA clearly define their priorities for farmland protection going forward, one of these scenarios could be further developed specific to the goals for farm and farmer support in Berkshire County. Assuming the priorities are consistent across the state, this model could then be applied to all of MA. For example, in some conservation programs land stewardship practices, farm production value, and age of the current farmer are important criteria for identifying farms for easements. Feedback is needed from local conservation groups to select and further develop the best model.

Another limitation of this project that would benefit from further research, is the usage of the USDA Cropland data layer as the basis for the analysis of change in farmland and percentage of current land in agricultural use in this study. The Cropland layer shows change in land use at a very detailed level, showing specific fields coming in or out of production, or change in the edges of agricultural fields. More useful for further study would be a land use data layer that shows change in land use at a parcel level instead. This way the percent of land in agricultural use and the percent change in agricultural land would be representing full changes in land usage at the parcel level, rather than specific changes at the farm crop plan level that may be less significant.

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NUTR231: Fundamentals of GIS, Fall 2019
Projection: Albers Conic Equal Area

References

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Data Sources

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