Estimating Biological Capacity for Grass-Based Ruminant Meat Production in New England and New York

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Introduction

Meat production is a minor agricultural enterprise in the Northeastern United States (Griffin et al. 2015). However, increasing interest in local food production and on-going challenges posed by drought and fire on Western rangelands give reason to believe that the importance of Northeastern grass-based ruminant meat could grow in the near future (Conrad et al. 2016). Possible barriers to expansion of ruminant meat production include access to slaughter facilities and the economics of raising grass-finished meat in the region (Gwin and Thiboumery 2013). The present study quantifies current and potential biological capacity for grass-based ruminant meat production in New York and New England – part of a project exploring supply chain barriers in the region.

Approach

Evaluating current land cover:

1) Cropland Data Layer (CDL) agricultural land cover data for 2009-2016 aggregated to broad categories: perennial grass (pasture + hay), alfalfa, other field crops, and specialty crops

2) Long agricultural term land cover summarized as percent use for dominant categories over the 8 year interval

3) Perennial grassland cover was summarized at county level and compared to NASS Agriculture Census 2012 land use

4) Regression trees—statistical models based on recursive partitioning of data into increasingly homogenous groups (De'ath and Fabricius 2000)—were used to model spatial distribution of farmland and perennial grassland within farmland as functions of National Commodity Crop Productivity Indices (NCCPI), Non-Irrigated Capability Class (NICC), slope, root zone depth (rootznemc), root zone available water holding capacity (rootznaws)

Modeling potential yield:

5) Pasture yield ordinary least squares model generated from gSSURGO nonirrigated component crop yield estimates for pasture as a function of NICC, NICC subclasses, drainage classes (drainagecl), and quintiles of depth to root zone restrictive layers (slope and air temperature were also considered as possible predictor variables)

Results

1) CDL pasture and hay land area correlate with NASS county-level land use data, but overestimate NASS by a factor of 2 (see Goslee 2011) (**Figure 1**)

2) More than half of CDL farmland cover is primarily in pasture or hay (**Figure 2**)

3) High NCCPI and higher quality NICC positively related farmland locations, and negatively related to perennial grassland locations within farmland (**Figure 3**)

4) NICC, NICC subclasses, drainage classes, and root zone depth explain 50% of variation in component crop yield, with $R^2 = 0.37$ when aggregated to map units, giving much better regional coverage than the database values (**Figure 4**)

5) Overlay of resulting raster with CDL pasture and hay distribution gives estimate of current biological production capacity at the county level (**Figure 5**)

Next steps

Future directions will include use of process-based modeling to evaluate the temporal dynamics of this production potential, which will serve as input for a supply chain model of the grass-finished beef sector.

References:

Conrad, Z., N. E. Tichenor, C. J. Peters, and T. S. Griffin. 2016. Regional self-reliance for livestock feed, meat, dairy and eggs in the Northeast USA. Renewable Agriculture and Food Systems:1–12.

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Gwin, L., and A. Thiboumery. 2013. From From Convenience to Commitment: Securing the Long-Term Viability of Local Meat and Poultry Processing. Niche Meat Processor Assistance Network, Oregon State University and Iowa State University. Available at Web site: http://www.nichemeatprocessing.org/nmpan-research (verified 19 October 2017).

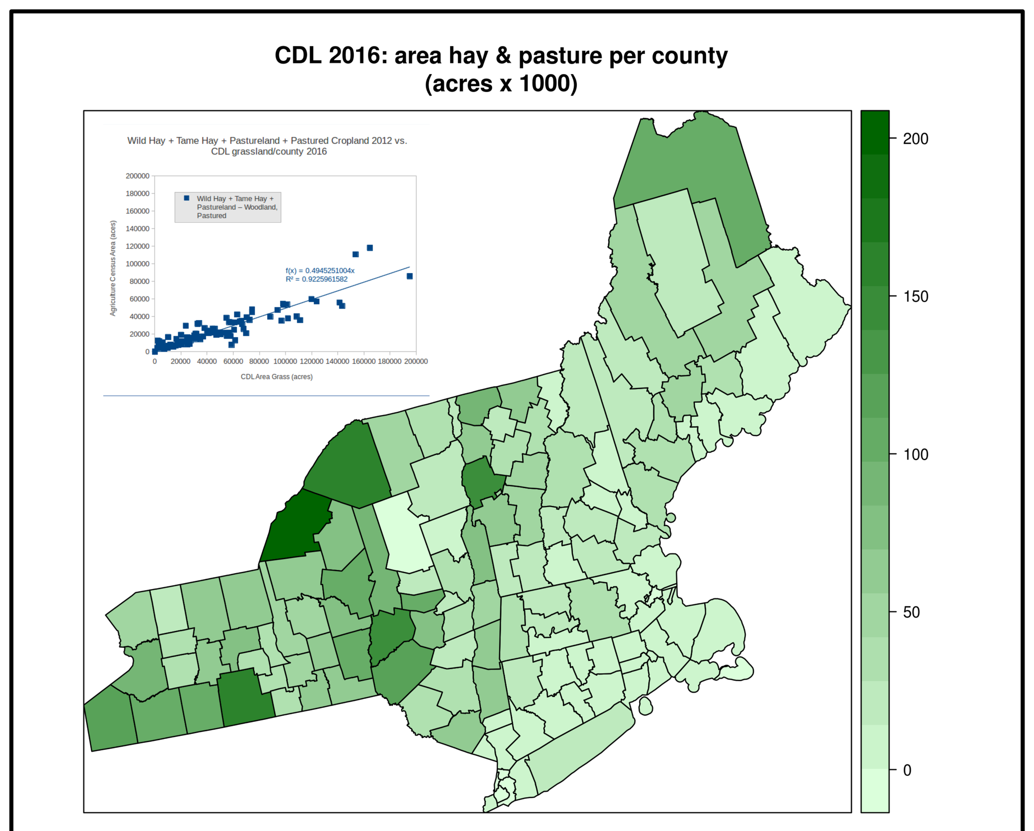

Figure 1. Pasture + hay area per county based on the 2016 CDL. The inset shows the regression of hay and pasture land area reported to the Census of Agriculture in 2012 versus CDL grassland categories for 2016.

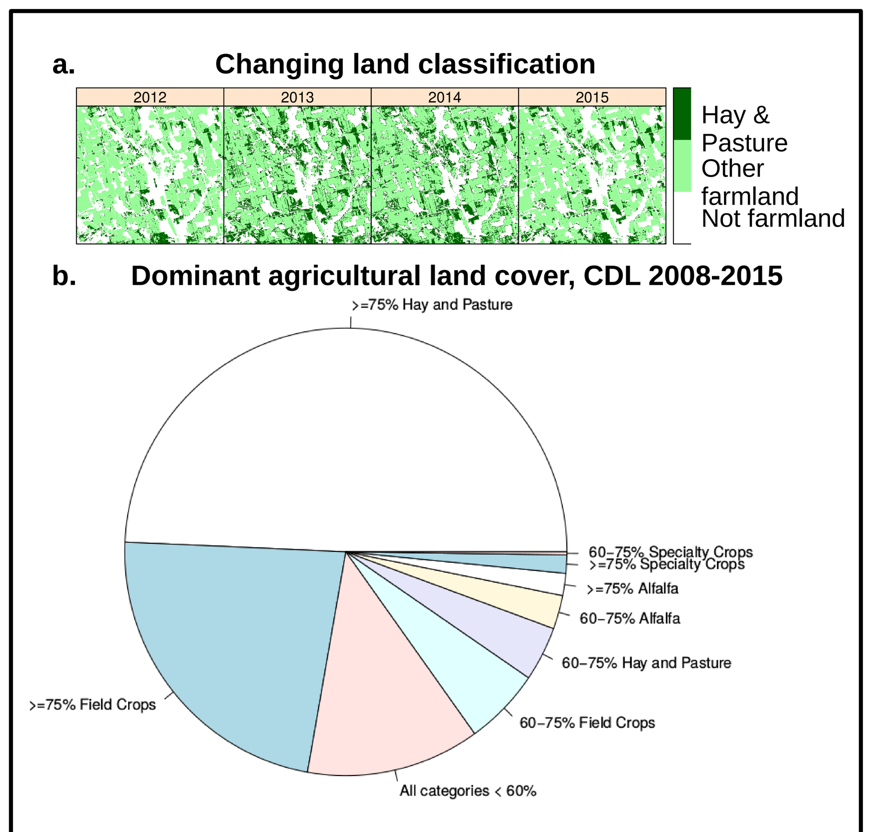

Figure 2. Example of year-to-year changes in land classification in the CDL (**a**), and dominant agricultural land-cover types, as percentage of years in each category for 2008-2015 (**b**).

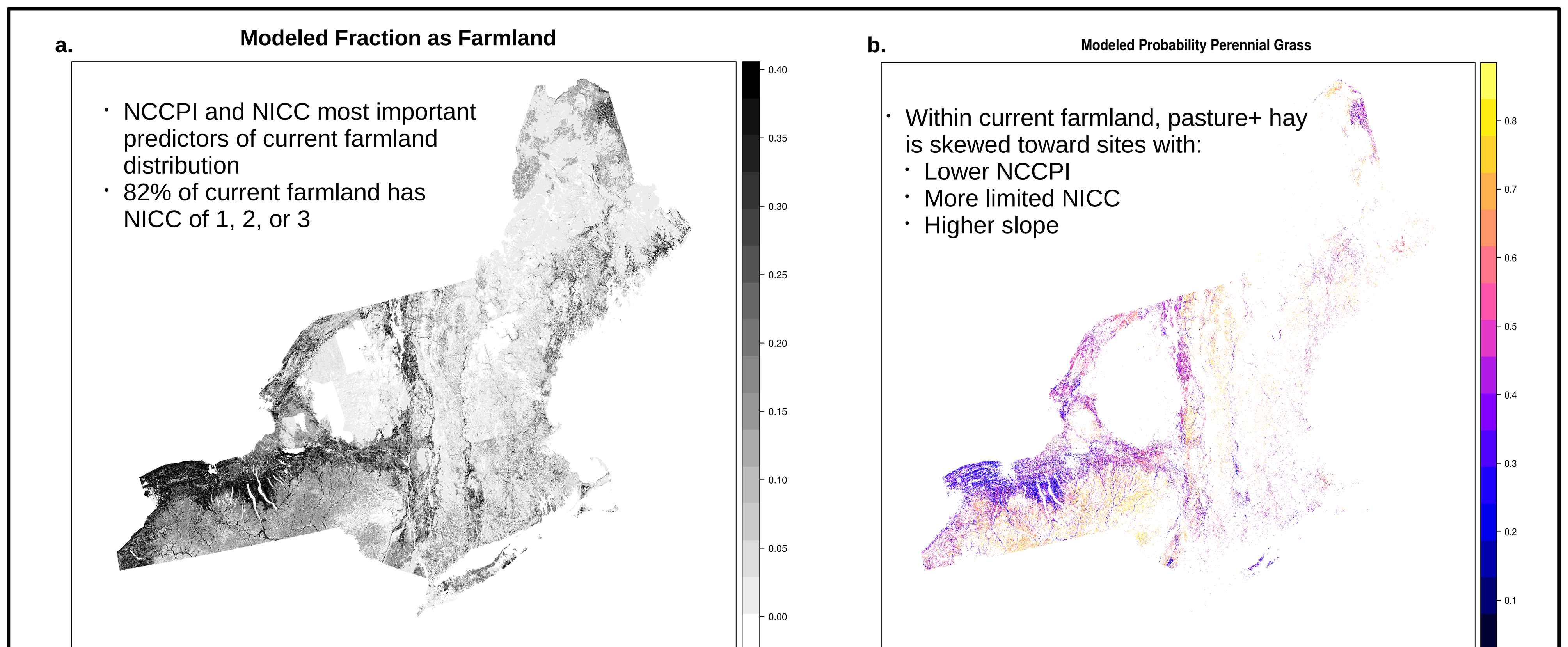

Figure 3. Probability surfaces generated from regression trees predicting: the probability of farmland existing at each location in the region (**a**), and the probability that farmland will be hay or pasture for land classified as farmland in 2016 (**b**). Key patterns in regression trees are also shown.

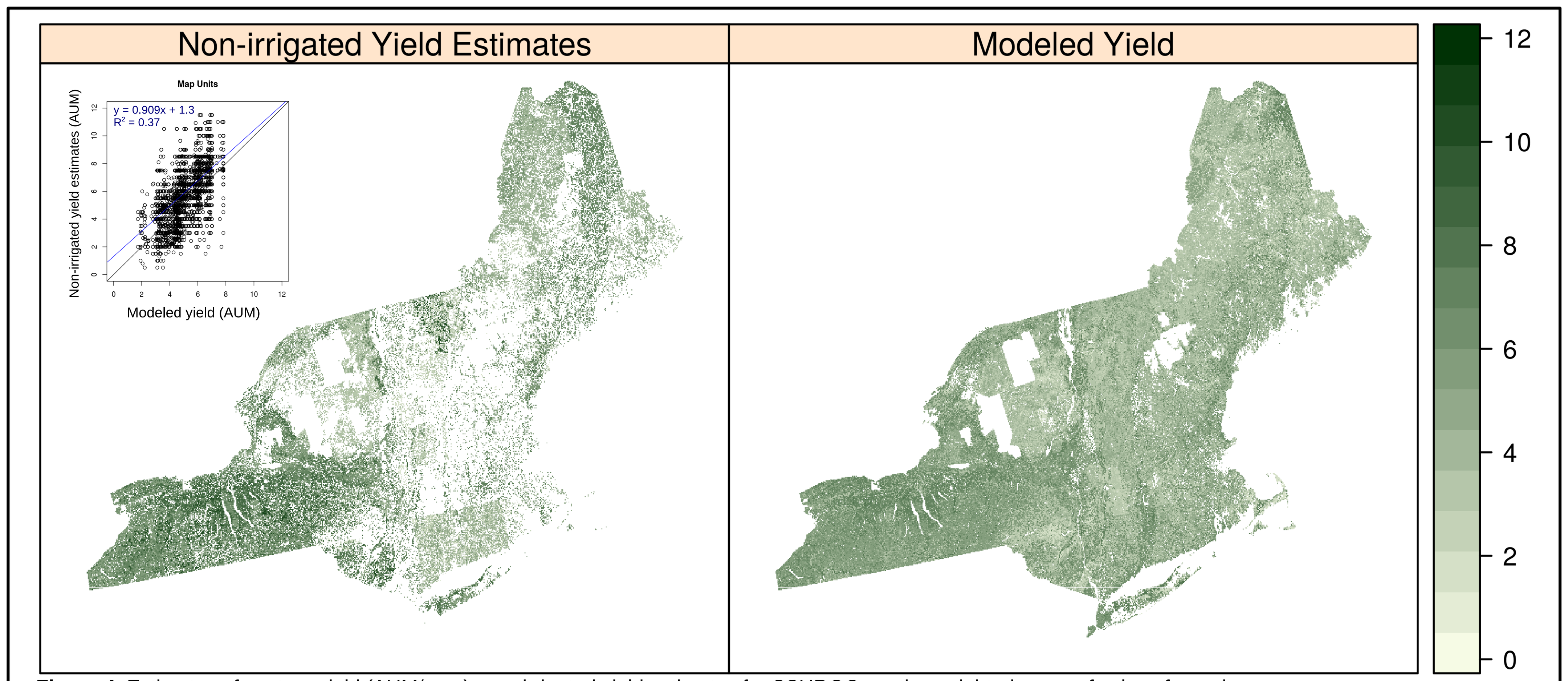

Figure 4. Estimates of pasture yield (AUM/acre): non-irrigated yield estimates for SSURGO, as the weighted mean of values for major components of each map unit (left panel), and yield modeled by ordinary least squares regression (right panel).

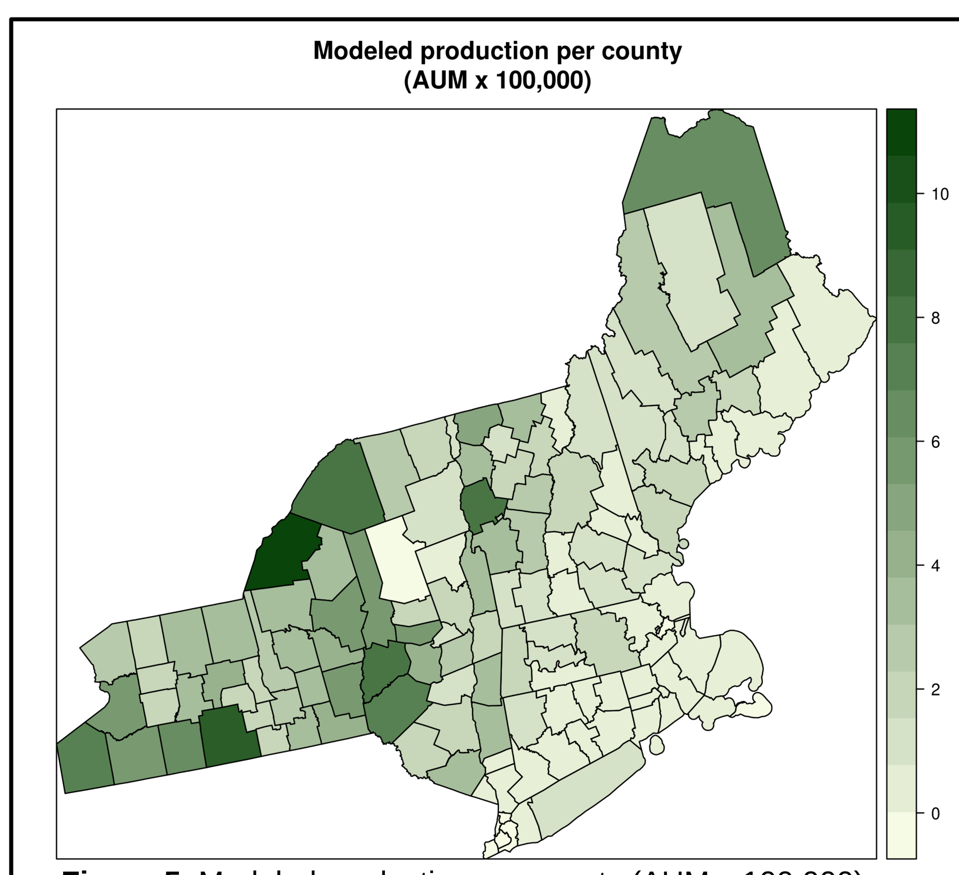

Figure 5. Modeled production per county (AUM x 100,000).

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