

Grazing In the Grass:

Assessing the Potential for Targeted Grazing as a Wildfire Fuel Management Technique in the Hudson Valley, NY

Project Overview

It is generally accepted that the practice of wildfire suppression over the past century has resulted in elevated fuel loads throughout the United States. This has contributed to higher intensity wildfires that are more likely to damage ecosystems and damage infrastructure. A number of methods are currently used to reduce fuel loads, the most common being prescribed burns and mechanical and chemical treatments. While these methods are generally effective they each have drawbacks. Prescribed burns are inherently risky and result in poor air quality. Mechanical methods require relatively gentle terrain and the required heavy equipment can damage soils and contribute to erosion. There is also mounting public concern with regard to the environmental and health risk associated with chemical treatments (Taylor, 2006).

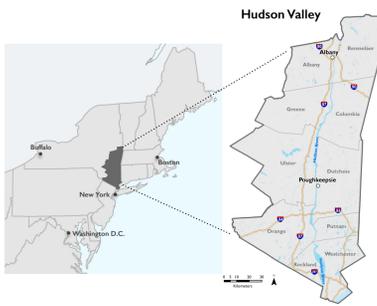
Targeted Grazing

An often overlooked alternative method of fuel-load reduction is targeted grazing - the controlled grazing of livestock to accomplish vegetation management objectives. Targeted grazing provides a unique and cost-effective solution for reducing fire fuel loads with the added economic benefit of meat production. Additionally, grazing animals can reduce fuel loads on steep terrain where it is difficult for humans to use mechanical and chemical methods, and, when grazing is properly controlled, it can have a positive effect on a variety of ecosystems including grasslands, scrublands, and forest (Taylor, 2006 & Longwell et al, 2000). While a variety of livestock can be utilized as part of a targeted grazing management plan, goats and sheep are often preferred for their versatility and tolerance of secondary plant compounds (FWS, 2015). In general, goats prefer woody vegetation while sheep tend to select fine herbaceous fuels (grasses and forbs). Therefore, depending on fuel type, one species may be preferred over the other, or there may be instances when grazing by both species is ideal (Taylor, 2006).

Study Area

The purpose of this pilot study is to assess the feasibility of using existing nation-wide datasets to identify areas in the Hudson Valley, NY, where targeted grazing by sheep and goats may help reduce the fuel load, and thus the fire risk, in the region.

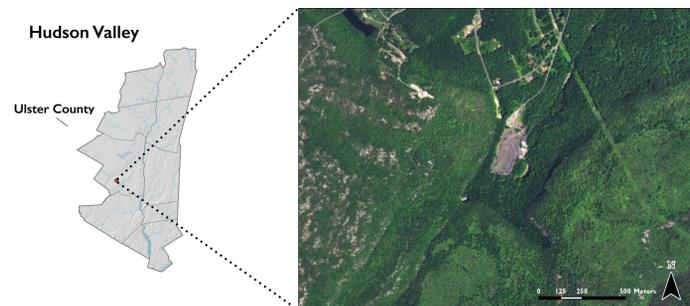
Selection of the Hudson Valley was based on the proximity to urban areas, the presence of existing agriculture, and the historic presence of wildfires.



Datasets: Fitness for Use

Important spatial and physical characteristics that determine the potential of targeted grazing as an effective wildfire fuel management technique include vegetation cover type, terrain and fire risk. These components were modeled using the following datasets.

- *Vegetation Grazability* was modeled using the LANDFIRE Existing Vegetation Type (EVT) nation-wide dataset. With a raster cell size of 30 meters, the EVT layer is appropriate for use at the regional-level. The dataset classifies vegetation cover into 130 categories using the terrestrial ecological systems classification developed by NatureServe.
- *Slope* is one of the primary terrain components that influences targeted grazing potential. Lyons & Machen note that sheep can effectively graze areas with up to 45% slope, and goats are known to excel at grazing steep terrain. The USGS National Elevation Dataset (NED) 1 arc-second was used to model slope.
- *Fire risk* was addressed using a combination of U.S. Drought Monitor (USDM) data the USDA Forest Service's Wildfire Hazard Potential (WHP) map. The USDM is a composite index produced on a weekly basis. The national map is based on climatic, hydrologic, and soil condition measurements in addition to reported observations from more than 350 contributors nation-wide. WHP is a 270-meter resolution raster meant to inform prioritization of fuel management needs and general assessment of risk posed by wildfire across very large landscapes.



Discussion of Model

Using ArcGIS, each of the datasets were reclassified, as necessary, and weighted to reflect their relevance to a targeted grazing assessment. The 130 categories in the nation-wide EVT layer were each assigned a score between zero and three based on their grazability by sheep and goats (0 = non-grazable, 3 = highest). Areas with a score of '0' were omitted from the final raster calculation. Slope was reclassified to reflect the competitive advantage sheep and goats have in reducing fuel loads on steep terrain: 20-50% slope was prioritized while anything >100% slope was omitted. The WHP layer was already classified and therefore did not require attention beyond assigning scores to each category. Drought risk was assessed by aggregating USDM drought data from mid-April over a 10-year period (2007-2016). April was selected because it is the month with the highest occurrence of wildfire in New York, historically (New York State DEC, 2015).

The above datasets were combined using ArcGIS's 'map algebra' function with the following weights:

Description	Weight
Drought Risk	15%
Wildfire Hazard Potential	30%
Vegetation Grazability	40%
Slope	15%

The 'Vegetation Grazability' component was modified depending on which species was being assessed: sheep, goats, or sheep/goats combined. The resulting layers were then converted using 'kernel density' to produce three separate maps depicting 'targeted grazing potential' in the Hudson Valley.

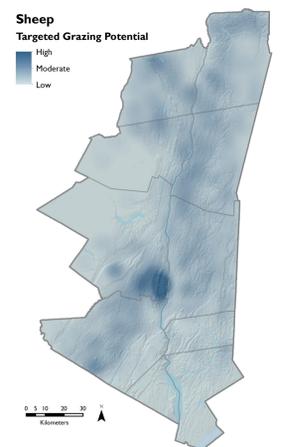
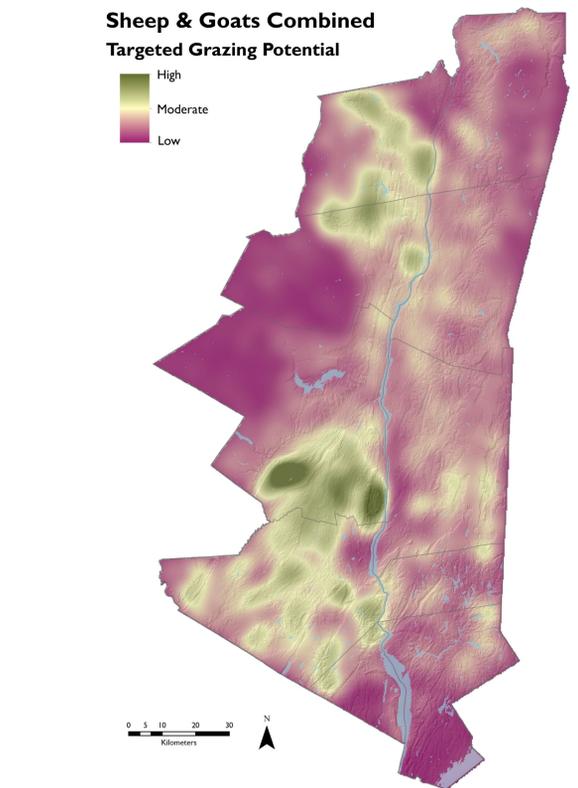
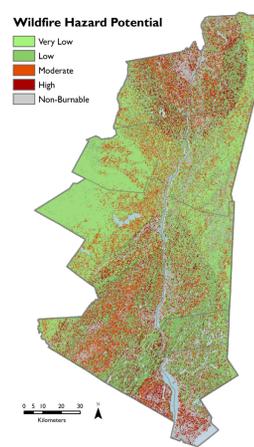
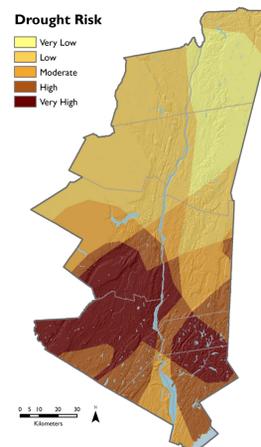
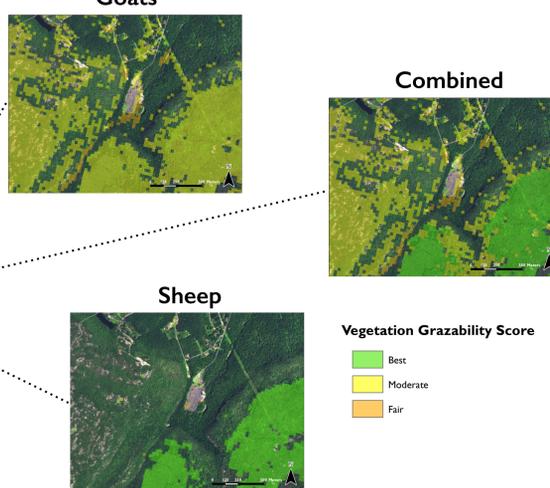


Illustration of 'Vegetation Grazability' Mechanism

For the purposes of this assessment, the primary limiting component is whether or not the vegetation-to-be-removed is edible by sheep and goats. Below is an illustration of the 'vegetation grazability score' assessment for an area in Ulster County identified as having a 'high potential' for targeted grazing. The underlying aerial photo reveals a variety of terrain and vegetation type. The resulting 'grazability scores' illustrate the more-versatile grazing capabilities of goats as compared to sheep. The model also appears to have properly identified some areas where targeted grazing can potentially be employed (e.g. recently logged and/or cleared areas). However, the model also identified non-grazable areas, such as the perimeter of an apparent gravel pit, highlighting a shortcoming of the EVT dataset. That being said, it appears that the resulting layer can be useful at least for an initial assessment at a regional-scale.

Vegetation Grazability Overlay Ulster County



Evaluation of Model & Next Steps

While the model takes into account some of the important spatial and physical characteristics relevant to targeted grazing, it fails to address some other contributing factors such as vehicle accessibility (in order to deploy sheep and/or goats), current land use, land ownership, and proximity to valuable infrastructure susceptible to wildfire damage. Despite these shortcomings, it appears that the model has use at a regional level for highlighting areas where the potential for targeted grazing as a wildfire fuel reduction method can be further investigated. However, in using this model to examine areas for further action, it is important to consider that targeted grazing takes place at a very local scale. For example, an area may seem ideal for targeted grazing when in reality there is a feature such as an existing fence that poses challenges to actually implementing the method. Therefore, before developing a more comprehensive targeted grazing management scheme, the model should be fine-tuned to account for spatial relationships and mechanisms at a more-localized level. Albany, Ulster and Orange counties appear to be prime candidates for a more-detailed GIS assessment of this sort.

Sources

References:

- Longwell, T., Miller, N., Schreweis, M. "Weed Control and Fire Hazard Reduction in Forest Ecosystems with Sheep Grazing." Purdue University (2000).
- Lyons, Robert K. and Richard V. Machen. "Livestock Grazing Distribution: Considerations and Management." Texas Cooperative Extension.
- New York State: Department of Environmental Conservation. "Wildfire in New York State." Available at www.dec.ny.gov/lands/42378.html. Accessed 23 December 2016.
- Taylor Jr, Charles A. "Targeted grazing to manage fire risk." Targeted grazing: A natural approach to vegetation management and landscape enhancement (2006): 107-112.
- U.S. Fish and Wildlife Service. "Prescribed Grazing." Available at www.fws.gov/invasives/stafftrainingmodule/methods/grazing/review.html. Accessed 23 December 2016.

Images:

- Header clipart: http://www.freeclipart.com/clipart_images/grass-clipart-94037-freeclipart.pw.com/a/
- Footer image: <https://pixabay.com/en/sheep-goats-flock-quadruped-1563110/>

Data Sources:

- LANDFIRE, 2008. Existing Vegetation Type Layer, LANDFIRE 1.1.0. U.S. Department of the Interior, Geological Survey. Accessed November 17 2016.
- National Elevation Dataset (1 Arc Second), 2015. U.S. Geological Survey. Accessed December 2016.
- NYS Office of Information Technology Services GIS Program Office (GISPO): City and Town Boundaries, County Boundaries, Linear Hydrology, Polygon Hydrology, Simplified Streets
- U.S. Drought Monitor, November 2016, National Drought Mitigation Center (NDMC), the U.S. Department of Agriculture (USDA) and the National Oceanic and Atmospheric Administration (NOAA). Accessed November 17 2016.
- Wildfire Hazard Potential map, 2014. USDA Forest Service, Fire Modeling Institute. Accessed November 17 2016.
- Map Projection: NAD 1983 UTM Zone 18N
- NUTR 0231, Fundamentals of GIS, Fall 2016
- Poster Produced On: 23 December 2016

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