Industrial Hemp Expansion in Kentucky: A land suitability analysis

Introduction

Industrial hemp (Cannabis sativa L.) was legalized to be grown in the United States upon the passage of the 2018 Farm Bill. Hemp is a crop that can grow in a variety of climates and conditions suitable for agriculture, and can be cultivated for its fiber, seed or as a dual-purpose crop (i.e. cover crop, biofuel). Since Kentucky was one of the states that paved the way for industrial hemp’s legalization, I was interested in exploring the state’s open, arable land to support industrial hemp expansion. I ran a preliminary state-wide suitability analysis using land use and land capability class data. I then used this analysis to assess which county appears to have the greatest potential for industrial hemp expansion according to my model. I zoomed into Hardin County to examine the feasibility of my model against more granular parcel data.

Methodology

To create the hemp suitability score, I utilized the most recent land use data for Kentucky (2005) as well as the Land Capability Class data layer from the Natural Resources Conservation Service’s National Cooperative Soil Survey from 2012. Both layers were reclassified to produce a score from 0-3, with 3 being the “best” condition and 0 being “out of the question.” For land use, I ranked “grassland/herbaceous” as 3, “pasture/hay” and “shrub/scrub” as 2, “barren land” as 1 and everything else as 0. The Land Capability Class (LCC) dataset distinguishes 8 classes of land suitability, I-IV considered for cultivation and V-VIII not deemed suitable for cultivation. A total of 20 soil attributes are considered to determine land class (see LCC 1 detailed below). I reclassified this dataset by marking classes I-IV as 3, 2, 1, 0, respectively and “NoData” for classes V-VIII. While the LCC is useful to suggest the general suitability of land for agricultural use, it doesn’t necessarily take into consideration the specific soil attributes required for hemp production.

Exhibit A: Model Accuracy

This image shows an example where the model inaccurately scored land suitability. A score of 3, “good” was given to a section of a developed subdivision.

Statewide Results and Limitations

The output of the hemp suitability score model was a raster with 98x98 ft cells. From a broad level, it appeared to narrow the potential arable land in Kentucky: few areas were reported as “most suitable” and “out of the question,” with more designated as “okay” and “good.” However, upon closer analysis of particular land parcels, it appears that the model, in general, overpredicted the extent of suitable land. There appeared to be two key causes for this: one, since the model did not control for contiguous land parcels, high-scoring parcels were sometimes scattered or nestled amongst a mass of low-scoring parcels. In reality, these would not be conducive to industrial-scale production and therefore not receive a high suitability score. Secondly, examining potential suitable areas atop satellite imagery revealed inconsistencies between the hemp suitability score and actual land use (see exhibit B). This could be due to the outdated land use data and/or a product of the large cell size. Additionally, the large cell size is likely contributing to other limitations in accurately portraying soil/land conditions. For instance, aspects such as clusters of rock fragments on land surface, small holes/mounds and detailed slope attributes.

Conclusions/Next Steps

This model showed moderately good ability to suggest potential areas to explore for industrial hemp expansion. It was useful in analyzing and narrowing down a vast amount of land to be considered, but more precise methods could be employed to better classify land quality and fitness to support industrial-scale production. Improvements would be made with updated land use data as well as a customized land/soil classification model based on the specific needs of hemp (for example, considering ideal precipitation, temperature, soil type and slope factors). The model showed usefulness at the county-level when supported by parcel data, and could be utilized in the future to help suggest potential parcels to evaluate for a new industrial hemp operation.

References


Tufts

Jessica Hall

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