Pollinator Habitat around Kensington, Minnesota

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Introduction:

Much of Minnesota was once covered by tallgrass prairies. The prairie's fostered a huge diversity of plant and animal life that has often been overlooked by conservationists and politicians. Early settlers discovered that the prairie's had deep fertile top soil that they found to be good for growing crops. As the population of our nation increased we began to need more land for the cultivation of staple crops. With such a large range of fertile soil at their disposal, Americans began to tear up the prairies and plant staple crops such as corn, wheat, and soybeans.

The Echinacea project has been studying the wildflower *Echinacea angustifolia* in prairie fragments around Kensington, Minnesota and using it as a model organism for long lived prairie plants. The Echinacea Project is not only studying how and where this flower is growing but it is also studying the pollination strategies of different types of bees on Echinacea. Without the bees to pollinate Echinacea and similar wildflowers it would be impossible for them to reproduce and sustain their current populations. Therefore it is important to know the amount of pollinator habitat around the study site. But bees are not only necessary for the reproduction of wild flowers; bees are a necessary for many profitable agricultural crops such as almonds, apples, citrus, and most fresh vegetables. With limited populations of pollinators these crops would experience low quality and low quantity yields (Klein et al., 2007).

Procedures:

Planning:

I chose to describe pollinator habitat as grass/pasture or as herbaceous wetlands. Grass/pasture generally has a higher level of diversity than other farmlands which would promote the settlement of pollinators in these habitats. Grass/pasture's higher level of diversity would lend itself to a higher density of food for the pollinators. Herbaceous wetlands were included in this study for that similar reason that they would provide food, shelter, and water for species of wild pollinators. I decided that the most efficient way to obtain this data was through crop coverage data provided by the state of Minnesota. I found crop coverage data for the state of Minnesota from the Minnesota Geo Spatial Commons (MGSC) website. I obtained crop coverage data for 2006 and 2014. The MGSC provided me with a road map of Minnesota that was helpful for orientating myself during the map making process.

Data manipulation:

All data was originally downloaded and manipulated with the NAD 1983 UTM Zone 15N geographic coordinate system. The crop coverage data was a raster data set. I reduced the crop coverage data to the size of the Echinacea Project's study area through the clipping tool. I created a polygon that was encapsulated the study area of 104,393 Km^2, most of which was just north of Kensington, Minnesota. This polygon was used as template to which I would clip all layers that were to be used in the final product. I clipped crop coverage data form 2006 and 2014 along with a road map down to the size of this polygon. All three datasets were originally the size of the entire state of Minnesota.

The ArcGIS package that I was using did not include tools that analyzed raster data efficiently. Therefore it was beneficial to convert the raster data to polygon format. I performed

this conversion with the raster to polygon tool. In the newly created polygon data I selected those polygons with gridcode values of 176 and 195. These gridcode values corresponded to grass/pasture and herbaceous wetland respectively. I exported these selected polygons as a shapefile. This procedure was done to the crop coverage data from both 2006 and 2014. The exported polygon shape files were then referred to as pollinator habitat data. After creating my map I added metadata for all layers that I created in ArcCatalog.

Analysis:

The intersect tool was used to find where pollinator habitat from 2006 and 2014 overlapped. I intersected the data from the 2006 crop coverage shapefile with that of the 2014 crop coverage shapefile and obtained a shapefile which showed the intersection of pollinator habitat between 2006 and 2014. I added the field square_meters to the attribute tables of 2006 and 2014 pollinator habitat data and to the intersection of both those years. I then used the square_meters field to calculate the geometry of all three layers. From the square_meters field I was able to obtain the total area of pollinator habitat for 2006, 2014, and the intersection of those two years.

Results/problems:

In 2006 the pollinator habitat in the Echinacea Project's study area was 26,821,253 square meters. By 2014 the pollinator habitat had been reduced to 20,021,841 square meters. In eight years the pollinator habitat in the Echinacea Project's study site was reduced by 6,799,412 square meters. Only 12,777,592 square meters of pollinator habitat overlapped between the two years.

Only about 12,778 km^2 of the combined total 46,843 km^2 of pollinator habitat was conserved between 2006 and 2014. This signifies that 14,043 km^2 of pollinator habitat was

destroyed between 2006 and 2012. But, 7,244 km^2 of pollinator habitat was created in the same eight years. In 2014 a national record for soybean acreage was reached which may have contributed to the decline of pollinator habitat around the study site (Woteki, 2015).

The biggest problem I encountered was that I was unable to intersect both pollinator habitat coverage datasets. Every time I would attempt to use the intersect tool, ArcMap would crash and give me an error. I then tried dissolving the layer to create fewer polygons and make it easier for the computer to analyze. This still did not work. Originally I had saved this pollinator habitat data in a geodatabase format; this format did not allow me to intersect the two datasets. I went back to the polygon data that had been converted from raster data and exported the polygons of grass/pasture and herbaceous wetland as a shapefile. I did this for both 2006 and 2014. I was then able to successfully intersect the two data sets and have my results.

Future work:

This data can be used at the Echinacea Project to help analyze pollinator abundance and behavior data that has been collected over the past decade. Both data sets can be used in conjunction to see whether the reduction in overall pollinator habitat is detrimental to populations of native wildflowers and other plants which rely on pollinators to reproduce. It can also be used to determine if the change in demography of pollinator habitat would change what populations of wildflowers would be easily pollinated and therefore the ability of pollinators to find food. The reduction in pollinator habitat could cause a reduction in the number of pollinators within the study area. The combination of a smaller habitat and the need to travel farther to forage for food may put excess stress on the populations of pollinators around Kensington, Minnesota. This analysis can be performed in similar situations across the country to determine if the lack of pollinator habitat is reducing the effective pollinating abilities of native bees.

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