

# Spatiotemporal Distribution of Long-billed Curlew across North America

## Understanding annual migration patterns to improve habitat management practices.

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Fall 2016



### Background

The long billed curlew is the largest North American shorebird. An adult is approximately 19 – 26 inches tall and has a wingspan of 25 – 35 inches. As the name implies it has a very long and slender decurved bill. Overall the curlew has a mottled brown body with cinnamon colored wings. They typically spend their winters along the gulf coast in tide flats and marshes. They feed on marine animals such as crabs and shrimp. In the spring they migrate north toward the breeding grounds, stopping in grasslands and agricultural lands.

While there, they will prey on insects such as grasshoppers and earthworms. Once they make it to the breeding grounds in the grasslands of Canada around April they will mate and then tend to their young until they leave again to migrate back to the gulf coast. The adults will typically leave about a month before the young will.

Ducks Unlimited is a nonprofit organization dedicated to the conservation of waterfowl and countless other species of plants and animals. They were founded in 1937 by a group of sportsman who noticed a dramatic decrease in waterfowl populations. Along with the drought,

unethical resource management practices were killing ducks and their habitat. DU's mission is to protect and restore habitats such as wetlands, grasslands, and other areas important to waterfowl and their migrations across North America. So far they have been contributed to the conservation of over 13 million acres. Based on evaluations of previous projects DU has divided their conservation efforts into thirty-six different geographic regions, which is in DU's International Conservation Plan. Each region has a plan of action to restore and conserve habitat.

### Introduction/Purpose

The long billed curlew population was once very abundant in the United States but was crushed in the 1800s and early 1900s due to over hunting. There was a very high demand from restaurants for these birds. But in 1918, long billed curlews were protected due to the Migratory Bird Treaty. As a result of the treaty populations increased a little, but by this time grasslands they use for breeding had been converted to agriculture. The populations in the eastern United States was never able to recover because almost all of grasslands curlew needed for breeding were gone.

Since the treaty, the biggest threat to the long billed curlew population is habitat loss. More than 75 % of Canadian native grasslands are gone and from 1850 to 1950 over 2 billion acres of grassland in the United States was converted to cropland. Long billed curlews can inhabit croplands and they often stop in them during their migration, but the use of pesticides has dramatically indirectly impacted the long billed curlew. Long billed curlew's diet consist of insects such as grasshoppers and crickets. Without these insects present they do not survive during the migration. The purpose of this project is to understand the spatiotemporal distribution of the long billed curlew in

order to locate areas of interest for habitat conservation. With this information I can determine the land cover which they inhabit annually, as well as during the migration period. Also I can determine the region of the Ducks Unlimited's International Conservation Plan which they inhabit in order to determine the areas of the region that are important to the long billed curlew.

### Research Questions

- 1.) Where do long billed curlew's go during migration and how far do they travel?
- 2.) What type of land cover do they use and which Ducks Unlimited region do they fall into?

### Objectives

#### 1.) Research long billed curlews.

- a. Identify their physical characteristics.
- b. Determine what kind of habitat they prefer and diet.
- c. Gain an understanding of their migration and history.
- d. Identify factors affecting their populations and migration.

#### 2.) Research Ducks Unlimited

- a. Identify what they are and what they do.
- b. Determine how they can help or have helped habitat for long billed curlew.

#### 3.) Decide on an appropriate projection to conserve the most important property of the data.

#### 4.) Obtain long billed curlew migration data.

- a. GPS tracking data over the span of one year.
- i. Determine migration route and distance traveled.

#### 5.) Access land cover dataset covering curlew migration.

- a. Identify what type of land cover long billed curlew use annually.

- i. Determine what percentage of time they spend in each land cover type annually.
- b. Identify what type of land cover long billed curlew use during migration.

- i. Determine what percentage of time they spend in each land cover type during migration.

#### 6.) Obtain the Ducks Unlimited Conservation Regions dataset.

- a. Identify which regions long billed curlew use annually.

- i. Determine what percentage of time they spend in each region annually.

- b. Identify which regions long billed curlews use during migration.

- i. Determine what percentage of time they spend in each region during migration.

### Methods

Once research was finished, I located and downloaded necessary data. The first set of data I downloaded was a shapefile off of Movebank, an online database. This consisted of GPS data points for a long billed curlew with the ID number 141768. This data is part of the Migratory Connectivity Project and the principle investigators are Peter P. Marra and Autumn-Lynn Harrisso.

Within this dataset there were twelve total curlews. The reason I only picked one was because it would be less confusing to use one, and the other 11 flight patterns seemed to be identical. I am not sure how often the GPS timestamps are recorded because they differ from day to day. Some days there will be 10 timestamps per day and other days their will only be one. I also downloaded the DU International Conservation Planning Regions (ICP) dataset off of the Ducks Unlimited website. This dataset contains vector data of the different Ducks Unlimited planning regions across North America. The final dataset that I downloaded was a 2010 raster land cover dataset off of the Commission for Environmental Cooperation website. This dataset contains thirteen different land cover types. Once the data was downloaded I created a geodatabase (Capstone.gdb) and then created a feature dataset (capstone\_fd) for that geodatabase. I set the projection to be the North America Equidistant Conic. I chose this projection system because I am measuring distance over time and my data points are contained within North America. Since I did not need the entire area of this dataset I clipped it down to an approximate extent of what I needed. To do this I first created a new feature class in the capstone\_fd feature dataset. I then used the editor tool to digitize a polygon encompassing the extent of the GPS points, this became my Study\_Area. In order to answer my questions, I followed the steps in figure 1. The end results are four features

classes which I will use to analyze the data. These feature classes are "Curlew\_2015\_LC"; "2015\_LC\_Migration"; "DU\_Curlew\_2015"; and "DU\_Migration\_2015". For each feature class I created a table by summarizing the Class\_Name. Also in order to determine distances I just used the measure tool to measure the linear distance between two points.

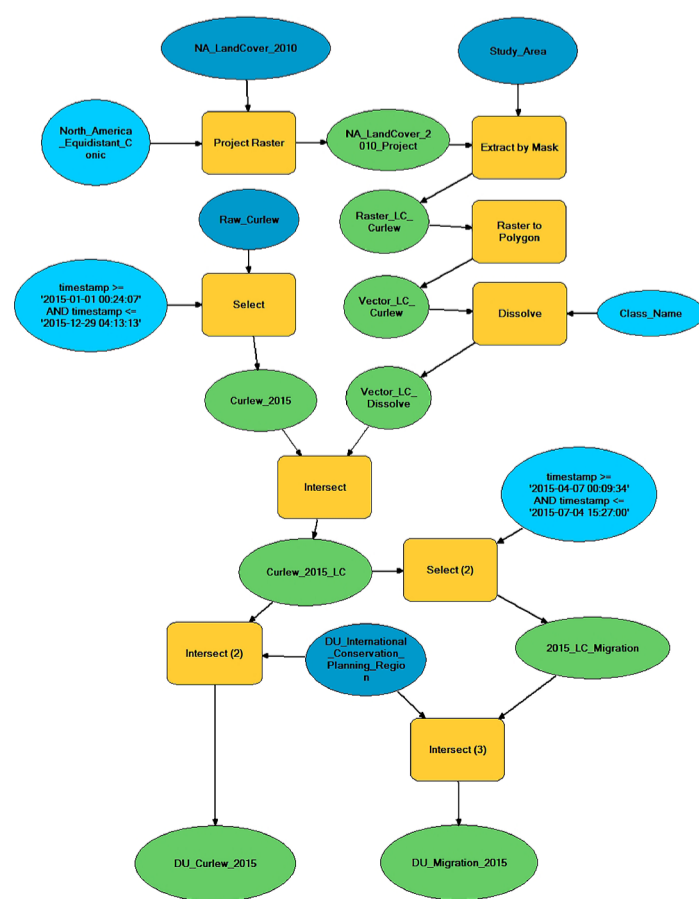


Figure:1 Cartographic model displaying the process used to answer the research questions.

### Data

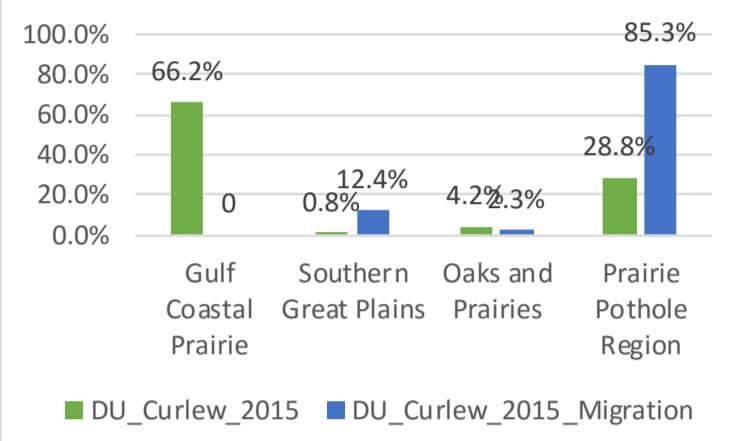


Figure:2 Percentage of time the long billed curlew spent in the major land covers in 2015, and during their migration period.

Phase	Time Period (2015)	Number of Days	Percent of Year	Distance Traveled (miles)	DU Region
Migration to Breeding Grounds	April 7- April 23	16	4%	1737	Southern Great Plains
Breeding Grounds	April 23- June 30	69	19%	n/a	Prairie Pothole Region
Migration From Breeding Grounds	June 30 - July 4	5	2%	1830	Oaks and Prairies Region
Winter Grounds	January 1 - April 7 and July 4 -December 29	274	74%	n/a	Gulf Coast Prairie Region
Totals	January 1 - December 29	364	99%	3567	n/a

Figure:4 Movement phases of the long billed curlew and associated attributes.

### Results

April 23. Traveling a total of approximately 1737 miles to get there. The breeding grounds are covered with water, grasslands and croplands. The breeding grounds are located in the Prairie Pothole DU region. The curlew spent 69 days there and left for its journey home on June 30. The curlew was wasting no time getting home and flew approximately 1540 miles in two days until it reached Texas on July 2. It hung out in the Oaks and Prairies region of DU consisting of mostly grassland and some cropland for two days until it decided to make the 290-mile journey home to the winter grounds. Putting the

finishing touch on it's approximate 3,567-mile migration. The curlew spends approximately 74 % of its life in the winter grounds. It is located in the Gulf Coast Prairie DU region and consist of water, barren land, grasslands, and wetlands. By creating a summarized table for the feature classes Curlew\_2015\_LC; Curlew\_2015\_LC\_Migration; DU\_Curlew\_2015; and DU\_Curlew\_2015\_Migration I can represent the percentage of time spent in land covers, as well as DU regions by using a graph (figure2) (figures).

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Figure:5 GPS points in 2015 on the long-billed curlew with associated Ducks Unlimited conservation regions and land cover data.

### Discussion

By locating GPS points of the long billed curlew, associated with the land cover and DU regions we can identify where conservation efforts can be emphasized. As well as what the conservations efforts should be based upon. The wintering grounds are located on Mustang Island. And is centered in Mustang State Park. This is a safe location for the curlew to be in terms of habitat because the park's land cover is suited for the curlew and is not going to change anytime soon. During the migration to the breeding

grounds, the curlew stopped in a few locations along the way, but spent 13 days in a particular area located in Kansas. The primary land cover in Kansas was cropland. Long-billed curlew rely on insects such as grasshoppers and crickets as food. With farmers spraying pesticides the insects are killed, having an indirect effect on the curlew. The GPS points allow the DU conservation region to focus their attention on curlew locations and work with the farmers to decrease the amount of pesticide they use in a particular area. Long-billed curlew need water and grasslands for breeding. The Prairie

Pothole region could use these points to focus their conservation plan to protect grasslands where the curlew spent it's time during breeding. On the way home the curlew traveled approximately 1540 miles in two days until it reached Texas. The curlew may not have stopped to rest along the way due to insufficient habitat. Knowing the flight path, DU could focus their attention on areas between the points where they stop to rest. They could restore grasslands, or croplands with pesticide regulations to serve as stepping stones along the way, relieving the stress of migration from the curlew.

### Conclusion

The GPS data from 2015 displayed that the curlew spent it's winter along the Texas Gulf coast and migrated to Saskatchewan in April, stopping in Kansas along the way. It spent 69 days in Saskatchewan before it started its journey home at the end of June. On the journey home the curlew

stopped in northern Texas for 2 days before traveling the remaining distance home. During the course of the migration, the curlew traveled approximately 3,567 miles. In 2015, the long-billed curlew mainly inhabited cropland, barren, water, and grassland land covers. It also spent time in the Southern Great Plains, Prairie Pothole, Oaks and Prairie, and the Gulf Coast Prairie

regions. By identifying locations associated with land cover types conservations efforts provided by DU could be improved. Before this project I had no idea what a long-billed curlew was so now I have an understanding of what they are and where they go. The biggest lesson I learned from this lab is that if you don't have data, you don't have a project.

### Citations

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