

## Learning Objectives

1. Define a wildlife barrier.
2. Classify the landscape into land cover types.
3. Identify barriers restricting quail movement.

## Lesson Concept

Habitat fragmentation prevents the dispersal and movement of wildlife.

## TEKS

(4) Scientific Investigation & Reasoning (A) use appropriate tools to collect, record, and analyze information, including **journals/notebooks**, beakers, Petri dishes, **meter** sticks, graduated cylinders, hot plates, test tubes, triple beam balances, microscopes, thermometers, calculators, computers, timing devices, and **other equipment** as needed to teach the curriculum.

(12) Organisms and Environments (E) describe **biotic** and **abiotic parts** of an ecosystem in which organisms **interact**.

**Grade: 6**

**Subject: Science**

**Time Required: 1 hour**

**Group Size: 2**

**Approx. Cost: \$10\***

# Buildings, Rivers, and Roads...

## Barriers to Bird Movement

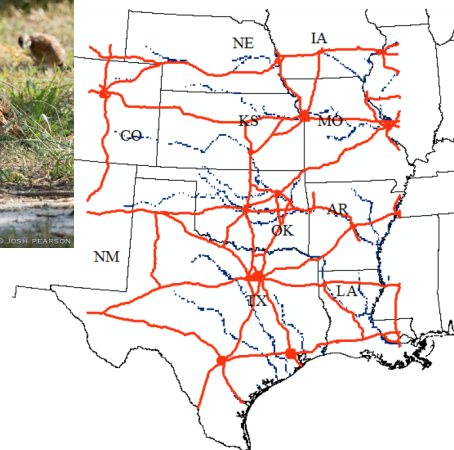
### Topic: Wildlife Research

Bird species, particularly those that seem to be more terrestrial can be affected by a changing landscape. Northern Bobwhite (*Colinus virginianus*) is one of these species in decline due to habitat fragmentation. Habitat fragmentation is defined as the alteration of the environment leading to isolated patches of habitat that were previously connected. The issue of habitat fragmentation has been a concern for conservationists due to the fact that many animals rely on moving place to place in search of food, shelter, and even mates.

The Northern Bobwhite is an important game species in much of Texas and because of habitat loss and fragmentation their numbers have decreased. Fragmentation can isolate bobwhite populations preventing dispersal, affecting genetic diversity, and population structure. For this reason, conservationists use a variety of tools including GIS (Geographic Information Systems) to gather more information about the landscape or environment in which bobwhites require.

GIS is a versatile tool used by many different fields including not only wildlife biologists, but city planners, water management, social scientists and many others. It is a computer software program that allows you to map the landscape, measure geographic features, map weather patterns, and a slew of other features.

In this activity, students will first learn a basic function of GIS using an aerial photo to classify the landscape into different habitat types. Habitat types include residential, water, roads/highways, etc. and will be color-coded just as they would in the program. Then using a bobwhite's home range they will identify barriers to that individual's movement.



Rivers (blue) and major highways (red) are potential barriers to dispersal of Bobwhite.

Map Credit: Katherine Miller

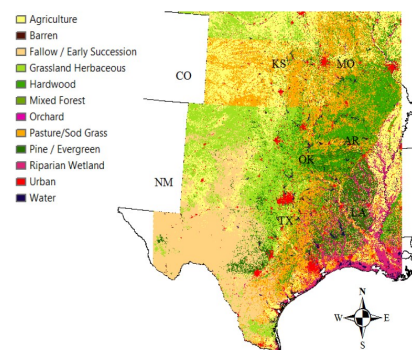
## Materials

### EXPLORE #1:

- "Maps" PowerPoint
- Aerial photos (1/2 students)
- 8.5"x11" Transparency Film (1/2 students)
- Whiteboard markers (various colors)

### EXPLORE #2:

- Same aerial photo used in Explore #1
- Transparency film w/ classified habitat types from Explore #1
- "Barriers to Bird Movement" Worksheet (1/2 students)
- Rulers (1/2 students)



Land cover categories from the National Bobwhite Conservation Initiative.

Credit: Terhune & Palmer (2011)

## Keywords

Habitat: place where a plant or animal lives and grows

GIS: Geographic Information Systems, a system designed to capture, store, manipulate, analyze, manage, and present all types of spatial or geographical data

Wildlife Barrier: object(s) in the habitat that prevent movement of wildlife

Wildlife Corridor: area of habitat for wildlife that allows the connection of isolated patches

## Teacher Background

The Northern Bobwhite is very sensitive to environmental changes whether they be within the habitat such as barriers or weather patterns such as rain or drought. This species is considered to have boom and bust years that are very reliant on weather, particularly rain. With heavy rain, this species generally spikes in numbers following the heavy rain. In drought conditions, the population numbers are generally poor. These weather patterns also have an effect on the size of their home range. A home range is the area in which an individual occupies, lives, and travels. In normal years of weather, bobwhite have home ranges of about 16 hectares. In drought, home ranges are about 14 hectares and in moist conditions home ranges decrease to about 12 hectares. With these values it is safe to assume that there must be enough food, shelter, and mates close by during moist times so they do not have to travel as far, however it is different during drought years. Drought years require them to travel further for necessities which requires more ground to be covered and this ground is often fragmented creating additional problems.

Changes in bobwhite home ranges and movement are not only affected by the weather, but as we have mentioned, habitat alteration also increases the difficulty these animals undergo to move through the landscape.

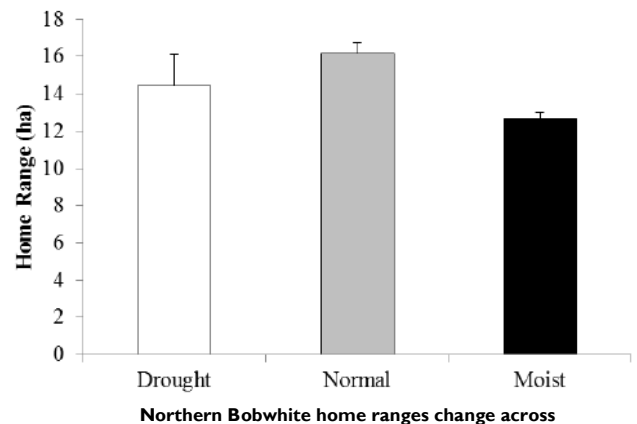
### Website(s):

"Reversing the Decline of Quail in Texas"

<http://wildlife.tamu.edu/quail/northern-bobwhites/>

"Habitat Fragmentation: A serious problem for bobwhites and other wildlife species"

<http://www.georgiawildlife.com/node/2250>



Northern Bobwhite home ranges change across drought, normal, and moist years.

Credit: Katherine Miller

## Engage

Teacher: "How many of you have used a map before or have seen your parents use one, maybe online or a paper copy?"

*Students raise hands.*

Teacher: "Well, maps not only tell you how to get places, but certain maps also show you what may be in a particular place. As in, is there water in this spot? What about buildings? How many roads cut through this spot?.....So when thinking about animals, what can a map show us that may be important when we are choosing for a specific animal to live?"

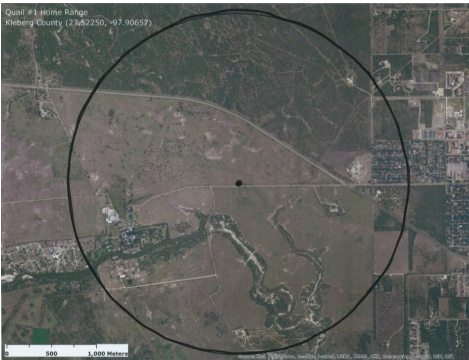

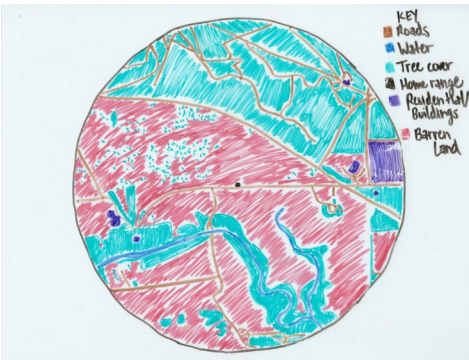
Student: "Trees for protection or food." "Where rivers are so they can drink."

Teacher: "Yes, exactly, these specific maps can show us what is on the ground— trees, water, buildings, roads. So we all remember the Northern Bobwhite from our previous lesson right? The quail? So have any of you seen a quail outside of your house?"

*Students: "Yes/No"*

Teacher: "If no, that's because what? There's human activity— people walking, talking, driving around. And for those of you who have— could it be that there's a lot of land around you, and it's not used much by people?...Today we are going to focus on the bobwhite as an example. We are going to be looking at aerial photos or maps that show us what's on the ground and you get to tell me and show me reasons why quail may/may not be in the area. What may be stopping them from moving about in that area, what barriers are there to stop them? And what can we do to help them cross into habitat that they need? ((introduce terms of wildlife barrier versus wildlife corridor by providing examples))

## Procedure

TEACHER	STUDENT	CONCEPT
<p><b>EXPLORE #1 (30 minutes):</b></p> <ol style="list-style-type: none"> <li>Project "Maps" Powerpoint for students. Go through powerpoint explaining the different uses of maps: for us to learn the states of the U.S., show us the different counties within our state, show us the freeways and roads we can travel on to get from place to place, even finer details such as what is on the land in a particular spot.</li> <li>Have students pair up into groups of 2. For each group pass out 1 aerial photo, 1 transparency paper, and 4 different colored <b>whiteboard</b> markers.</li> <li>Explain that these aerial photos were created using a software program called GIS (Geographic Information Systems) which mapped out/gave us an aerial view of the home range of an individual bobwhite. The circle represents the area of its home range and the dot is the center of the home range. May want to ask what they think a home range is?</li> <li>Students will classify land cover types (ex: residential, water, industrial, roads, grass, tree cover, etc.) by using different colors for each type and creating a key on their map. They will place the transparency paper on top of their aerial photo and <b>ONLY COLOR</b> on the transparency.</li> <li>First, have students trace the outline and center of the home range on their transparency paper. Then using different colors have them outline and shade in the different land cover types (ex: water will be blue, industry will be black, etc.) within the home range. Have students create a key on the side of the transparency.</li> </ol> <p><b>EXPLORE #2 (30 minutes):</b></p> <ol style="list-style-type: none"> <li>Using their photo and transparency film, have students complete the "Barriers to Bird Movement" worksheet (1/2 students).</li> <li>Here students will identify the number and type of barriers/land cover types that may prevent their quail from moving within the habitat.</li> <li>Using the ruler, students will be able to measure how far various barriers are from their core area (center of home range, dot). They will convert this measurement into meters using the map scale at the bottom of the aerial photo.</li> </ol> <p><b>WRAP UP &amp; FOLLOW UP:</b></p> <ul style="list-style-type: none"> <li>Have students share the different types of barriers their quail encountered. Were there any similarities?</li> <li>Question students on the differences between a wildlife barrier and a wildlife corridor.</li> <li>Follow up in a few days by asking students what barriers have they encountered in their daily lives that would prevent animals from moving across the land.</li> </ul>	<p>"The area where it lives."</p>    <p>"My quail had the barriers: water and residential."          "A wildlife barrier stops the animal from moving to another place and a wildlife corridor provides a good habitat for the animal to move to and from different places."</p>	<p>Maps can help us visualize habitat fragmentation.</p> <p>Habitat fragmentation can limit the distance animals can move within their home range.</p>

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## Assessment

### Pre-Assessment

Discuss the ideas of maps, wildlife barriers, and corridors (differentiate the two terms). (Objective 1)

### Activity Embedded Assessment

Classify landscape into land cover types (Objective 2)

Identify barriers preventing quail movement (Objective 3)

### Post-Assessment

Discuss the number and types of barriers preventing movement of your quail individual (Objectives 2 & 3)

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## Activity Extensions

Download DIVA-GIS onto classroom computers for students to explore actual land cover data!

1. Visit: [www.diva-gis.org](http://www.diva-gis.org),
2. Click “free spatial data”
3. Click “country level data”
4. Use the drop down menu to select the country: “United States” and subject: “Land Cover”
5. Click “Download” and save file in My Documents in a folder labeled “Land cover” for an easier find when it’s time for the activity.

On the day of the activity:

1. Open up DIVA-GIS.
2. Go to “Layer” > “+ Add Layer” > navigate to the land cover file you downloaded, highlight all of the files, and open.
3. Click on the magnifying glass with the + in it at the top. Use this to draw a square and zoom into South Texas.  
How would they classify those land cover types?

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## Activity Scaling

For younger students, only complete the explore #1 component. The use of rulers and math conversions may be too advanced for these students. You can download and set up the map described in “Activity Extensions” for them to get an idea of the program used behind the idea of land cover/ map making.

For older or advanced students, follow the directions above for “Activity Extensions.” Use the following website to allow students to explore the critical habitat of many different species (<http://ecos.fws.gov/crithab/>) by downloading the shapefile corresponding to the species of interest.

From the website you can navigate to download spatial data for a variety of endangered species. Have students select one by searching through the search bar by taxa or common name. Have them search through a find a species of interest and download its “Spatial Data” and again saving it in a folder within My Documents so it can be easily found. Return to DIVA-GIS and add another layer, this time it’ll be the critical habitat for your species of interest. In what states is the habitat located? Near any land cover features such as water?



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## Bring GIS into the Classroom!

Free version of DIVA-GIS is available online to download at: [www.diva-gis.org](http://www.diva-gis.org)

Click on free spatial data and you can download country level data, climate data, species occurrence data and much more!

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## Material Sources\*

Whiteboard markers can be found in packs of 4 at any dollar store.

Transparency paper is often a part of many school offices and classrooms, borrow some colleagues or administrators.

Other materials will need to be printed, the use of common office/school supplies will be used such as copy paper, a printer, and printer ink.

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## References

DIVA-GIS. [www.diva-gis.org](http://www.diva-gis.org). Accessed June 6 2015.

Miller, K.S. 2014. Landscape Genetics of Northern Bobwhite in Texas and the Great Plains. Ph.D. Dissertation, Texas A&M University-Kingsville.

Terhune and Palmer. 2011. The National Bobwhite Conservation Initiative: a range-wide plan for recovering bobwhites. National Bobwhite Technical Committee technical publication v. 2.0, Knoxville, Tennessee, USA.

U.S. FWS Critical Habitat Portal. <http://ecos.fws.gov/crithab/>. Accessed June 6 2015.

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## Contact Information

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**Project Funded By:**

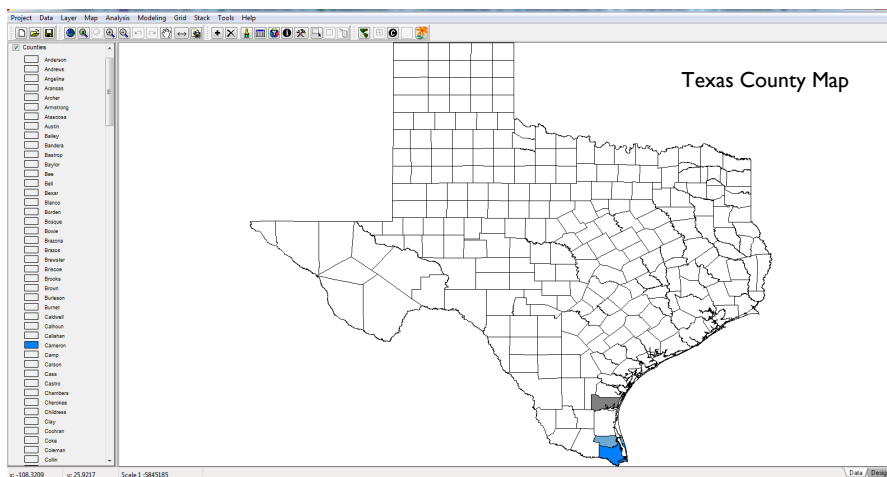
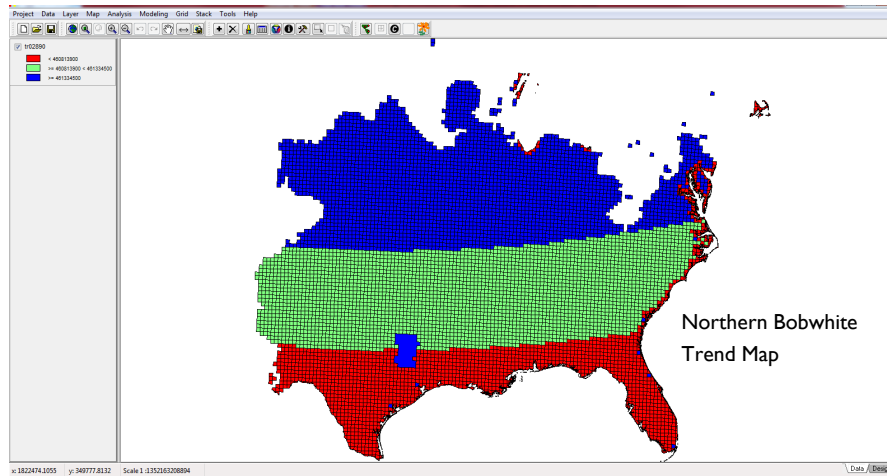
**Elizabeth Huth Coates Charitable Foundation of 1992**

**[[www.ckwri.tamuk.edu](http://www.ckwri.tamuk.edu)]**

## DivaGIS Activity Extension

- 1) Download the latest version of DivaGIS at [diva-gis.org](http://diva-gis.org) and other files as you see fit, potential sources listed to the right.
- 2) Once installed, open the program and click the “+” icon to begin adding layers.

**Add in: state and county layer, land cover, if possible city names, and bird’s range/distribution. (Files ending in .shp)**



**Modify the symbols (colors) by double-clicking on the layer added. You can change to solid fill, outlined, or cross-hatched, etc. depending on your preference.**

- 3) In an excel spreadsheet, you will need to begin adding your GPS points from your bird locations in this format and save as **.XLS**.

**Here are some examples shown in decimal degrees:**

**X= LONGITUDE (North to South, vertical, Prime Meridian)**

**Y= LATITUDE (West to East, horizontal, Equator)**

**((Image references on the next page))**

### Land Cover Data Sources\*:

<http://gapanalysis.usgs.gov/gaplandcover/data/download/>

Or simply search: “your state” land cover spatial data.

### Bird Trend Map Data:

Sauer, J. R., J. E. Hines, J. E. Fallon, K. L. Pardieck, D. J. Ziolkowski, Jr., and W. A. Link. 2014. *The North American Breeding Bird Survey, Results and Analysis 1966 - 2012. Version 02.19.2014* [USGS Patuxent Wildlife Research Center](http://www.mbr-pwrc.usgs.gov/bbs/), Laurel, MD

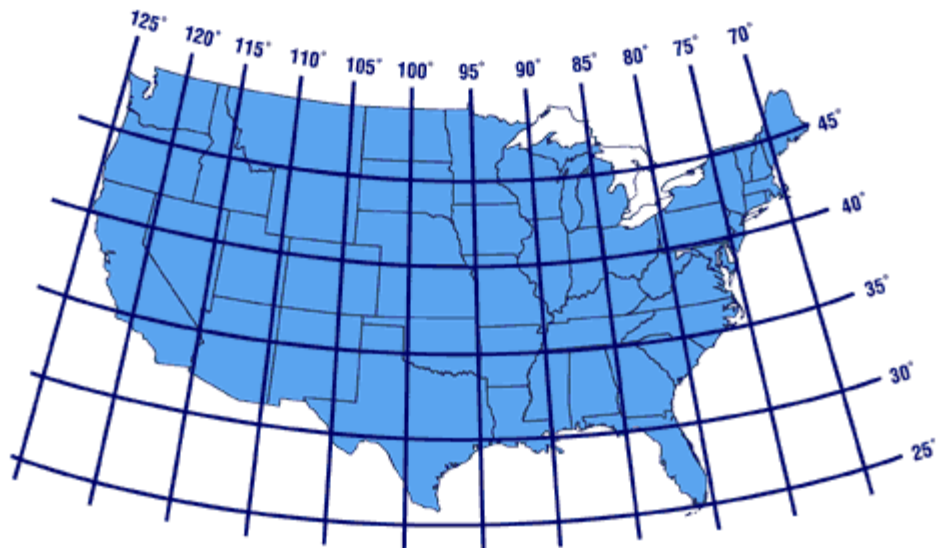
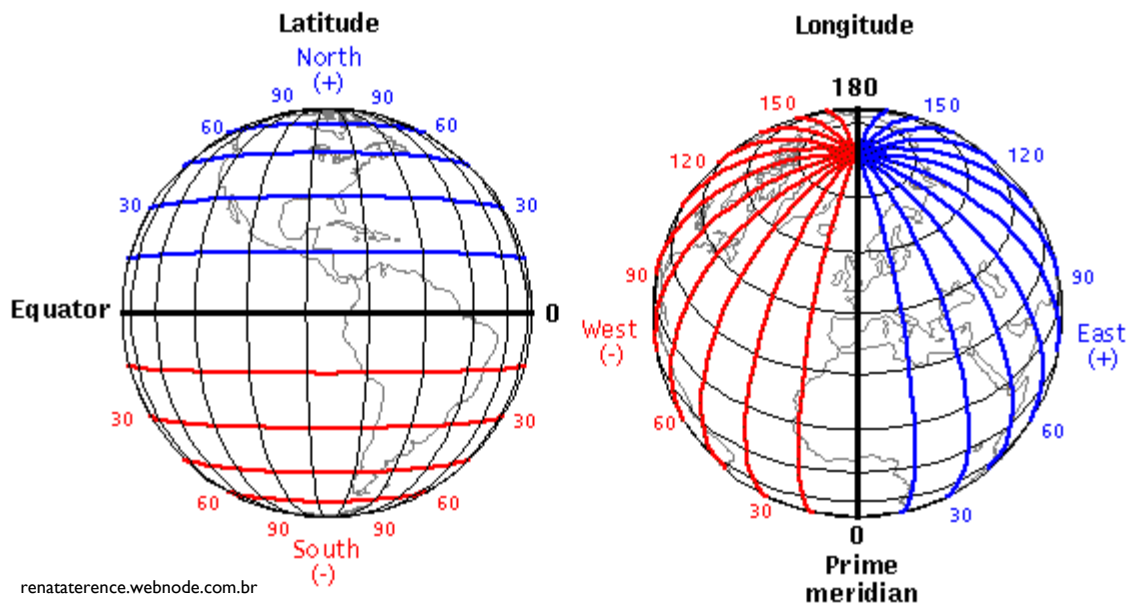
<http://www.mbr-pwrc.usgs.gov/bbs/>

\*Best to search for GIS or spatial data with government or state agencies.

For example: Texas Parks & Wildlife

<http://tpwd.texas.gov/gis/data>

Column 1	Column 2
X	Y
-97.5113	26.50194
-98.8787	26.96108
-98.2576	26.90344
-97.8935	27.5335
-97.8465	27.39881
-98.3515	29.64979
-98.0406	29.89059
-98.0891	29.93561
-97.7576	26.79781



musica-numeris.com

You don't need a GPS unit for your students to collect GPS data. If students have access to smartphones, many apps are available for download such as:

GPS Coordinates 

My GPS Coordinates 

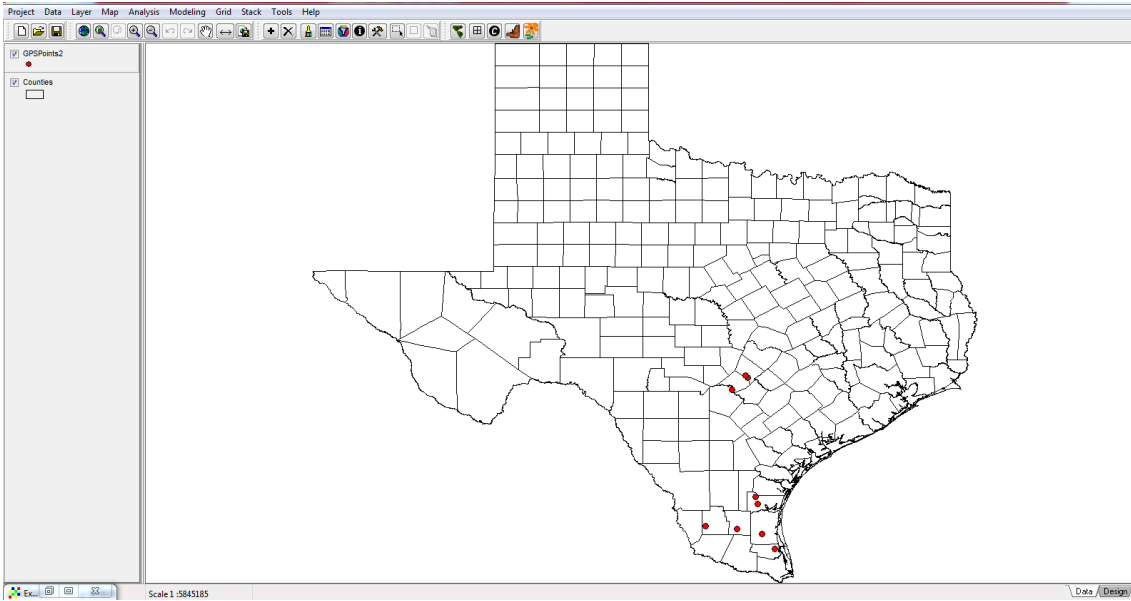
Map Coordinates 

...and many others! Try some out before you get started.

4) With DivaGIS opened and your preferred layer added (counties or bird range), go to "Data >> Import Points to Shapefile >> From Excel (.XLS)"

5) Click "Excel spreadsheet" and navigate to where your file is saved. Click OK.

- 6) From the drop down menu, select the proper “Worksheet” where all of your points appear in the bottom insert.
- 7) Click “Save to Shapefile” with a unique name and close out the box. The new file with your points should appear on the left side under your layers. Double-click the icon for your points to modify the size, shape, and color of your bird locations/GPS locations.



### ESRI ArcGIS Special Programs for Education:

<http://www.esri.com/esri-special-programs/Programs?category=Education#Program>

\*The Caesar Kleberg Wildlife Research Institute is not affiliated with DivaGIS or ESRI ArcGIS software. These activities are for K-12 and undergraduate educational purposes only. Please consult individual software guidelines in regards to publications and scientific study using the software mentioned.