

**Red Fox Road Accumulation: Prince George's, Montgomery, and Howard County
Maryland**

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Background

The Red Fox, *Vulpes vulpes*, are often in highly populated in urban areas. Even though they are often not seen, they thrive on anthropogenic resources (Campbell et al. 2020). Their diet consists of rabbit, birds, insects, mice, berries, and fruits (DNR, n.d.). Red foxes mating season runs from January to April. They tend to be very social animals, except during their breeding season. It is not advised to approach a fox or leave any food out for them, not cat nor dog food.

Due to their high population in Maryland (DNR, n.d.), it was thought to track the various locations close to roads in which they inhabit. This project will investigate the county Census Tracts, MDOT Maintained Roadways, and the red fox tracking from iNaturalist in the following counties: Montgomery, Howard, and Prince George's. SQL statement will be determined based on where the red foxes live in location to the various roadways.

Information on iNaturalist; it was originally created in 2008 as a Master's project of Ken-ichi Ueda, Nate Agrin, and Jessica Kline at the University of Berkely's School of Information. After some work, in 2014 it became an initiative of California Academy of Science and a joint initiative with the National Geographic Society in 2017. As of today, there are over 170 million observations worldwide, with more to come. Several organizations support its use (iNaturalist, 2023).

Questions

In this project, I will be looking the counties in Maryland: Montgomery, Howard, and Prince George's. Their specific maintained roads as well as the iNaturalist observation will be considered of the three counties. The following questions will be asked:

1. What is the count for each iNaturalist county: Howard, PG, Montgomery?
2. For the iNaturalist counties, where are there 1+ disagreements with the encounters of Red Foxes?
3. Since its creation in 2008, when are the first encounters with various Red Foxes?
4. From observing the data for maintained roads of the three counties, what would be the most observed road and what would the count be?
5. For the specific road encountered in the previous question in iNaturalist, does the actual road exist in the maintained roads data for the three counties?
6. How long are these given roads stated in the previous segment? What unit is it in?

Data Collection

Three sources of data were obtained through the three counties: Howard, Prince George's, and Montgomery.

1. iNaturalist Observations Obtained through CSV files:
 - a. https://www.inaturalist.org/observations?place_id=39&subview=map&taxon_id=42069
 - b. This video was watched to guarantee the correct items were obtained: <https://www.youtube.com/watch?v=Jbc-ZWdoi78>
2. Various Maintained Roads CSV and shapefile were obtained:
 - a. Montgomery: <https://data.imap.maryland.gov/datasets/maryland::montgomery-county-maintained-roads/explore?location=39.029704%2C-76.960166%2C10.26>

- b. Prince George's: <https://data-maryland.opendata.arcgis.com/datasets/c130c8db782c4b64aaa0beea45207def/explore?location=38.919497%2C-76.840493%2C10.64>
 - c. Howard: <https://data-maryland.opendata.arcgis.com/datasets/maryland::howard-county-maintained-roads/explore?location=39.187634%2C-76.931221%2C10.65>
- 3. Twenty-four counties in Maryland were obtained:
 - a. <https://data.imap.maryland.gov/datasets/2315ef0b071a4ec59420e3d342dbcf2/explore>
- 4. W3School for SQL was used as a resource:
 - a. <https://www.w3schools.com/sql/default.asp>

Database Design

PostgreSQL tool by pgAdmin 4v4 will be used. Three things were downloaded into pgAdmin 4v4: the three county-maintained-road files CSV and their shapefiles and the iNaturalist CSV.

iNaturalist Data

Observations in map view was looked at. Maryland was zoomed into, and a county was selected from places of interest. After the selection of the county was made, filters were selected next to the search bar. Then, download in the bottom right corner was chosen. *Id, observed_on, created_at, description, num_identification_agreements, captive_cultivated, place_guess, latitude, longitude, place_county_name, common_name*, were selected for the various attributes. Next export was chosen, then it was saved to the corresponding folder in association; iNaturalist_COUNTY_RF. To uploaded to PostgreSQL PGAdmin 4v4, it first needed to be uploaded to phpMyAdmin to see the correct organization type for the 12 attributes. After doing that, they were uploaded into PostgreSQL in *CREATE TABLE* in the correct type of formulation. After uploading the correct table, they were retrieved and imported through CSV into the database. All were saved as *iNaturalist_COUNTY_RF* into the PostgreSQL database.

Maintained Roads

Three maintained roads were received for the three counties, as to correspond with the iNaturalist data. The same process was done as the iNaturalist data such that a CSV was downloaded, phpMyAdmin was looked at for the correct organization type, next a table was created in PostgreSQL, and then they were uploaded into PostgreSQL and saved as *COUNTY_county_maintained_roads*.

Skills

Skills in various systems were used. phpMyAdmin was used to access the correct execution of the iNaturalist data's CSV file into PGAdmin 4v4 PostgreSQL. PGAdmin 4v4 PostgreSQL database on VMWare was be used to execute the SQL statements that were be asked. Six questions total or 18 SQL statements, one for each county, were processed. ArcGIS Online was processed to create a map of each of the maintained roads and the iNaturalist data.

System Architecture

The software that was used is PostgreSQL, phpMyAdmin, iNaturalist, Maryland.gov, and W3Schools. Each is listed in the references. A map was created of the three roads and counties

used. Below is a map of the Montgomery, Prince George's, and Howard counties CSV files of iNaturalist as well as the maintained roads created in ArcGIS Online.

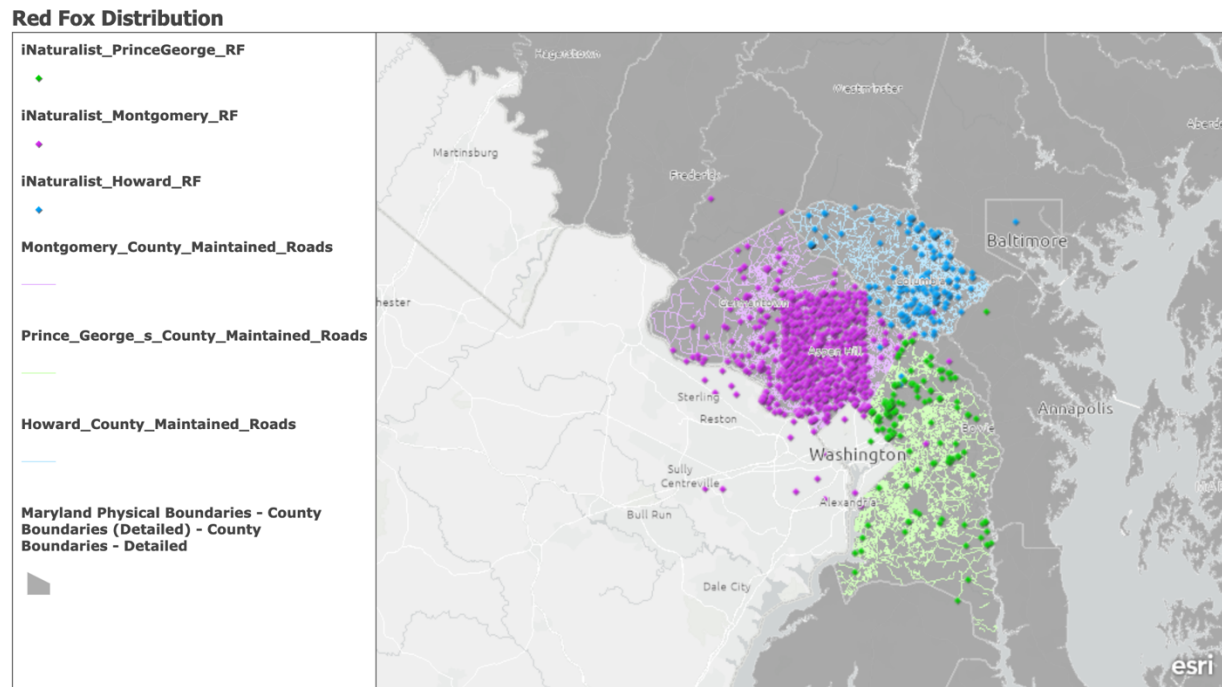


Figure 1. Map of Red Fox Distribution in Three Counties in Maryland

System Implementation

Several questions were asked in PGAdmin 4v4 PostgreSQL and several answers were given. Below I will state the following questions that were asked. Results will be where I display the answers to these questions:

- What is the count for each iNaturalist county: Howard, PG, Montgomery?
 - SELECT count(id)
FROM public."iNaturalist_Howard_RF";
 - SELECT count(id)
FROM public."iNaturalist_PrinceGeorge_RF";
 - SELECT count(id)
FROM public."iNaturalist_Montgomery_RF";
- For the iNaturalist counties, where are there 1+ disagreements with the encounters of Red Foxes?
 - SELECT "id", "num_identification_disagreement", "place_county_name",
"place_guess"
FROM public."iNaturalist_Howard_RF"
WHERE "num_identification_disagreement"=1 OR
"num_identification_disagreement">1;

- b.

```
SELECT "id", "num_identification_disagreement", "place_county_name",  
"place_guess"  
FROM public."iNaturalist_PrinceGeorge_RF"  
WHERE "num_identification_disagreement"=1 OR  
"num_identification_disagreement">1;
```
 - c.

```
SELECT "id", "num_identification_disagreement", "place_county_name",  
"place_guess"  
FROM public."iNaturalist_Montgomery_RF"  
WHERE "num_identification_disagreement"=1 OR  
"num_identification_disagreement">1;
```
3. Since its creation in 2008, when are the first encounters with various Red Foxes?
 - a.

```
SELECT "id", "observed_on"  
FROM public. "iNaturalist_Howard_RF"  
WHERE "observed_on" LIKE '%2006'
```
 - b.

```
SELECT "id", "observed_on"  
FROM public. "iNaturalist_PrinceGeorge_RF"  
WHERE "observed_on" LIKE '%2009'
```
 - c.

```
SELECT "id", "observed_on"  
FROM public. "iNaturalist_Montgomery_RF"  
WHERE "observed_on" LIKE '%2010'
```
4. From observing the data for maintained roads of the three counties, what would be the most observed road and what would the count be?
 - a.

```
SELECT COUNT(place_guess)  
FROM public. "iNaturalist_Howard_RF"  
WHERE "place_guess" LIKE '%Woodbine Rd%'
```
 - b.

```
SELECT COUNT(place_guess)  
FROM public. "iNaturalist_PrinceGeorge_RF"  
WHERE "place_guess" LIKE '%Colmar Manor%'
```
 - c.

```
SELECT COUNT(place_guess)  
FROM public. "iNaturalist_Montgomery_RF"  
WHERE "place_guess" LIKE 'Forest Glen%'
```
5. For the specific road encountered in the previous question in iNaturalist, does the actual road exist in the maintained roads data for the three counties?
 - a.

```
SELECT "ROAD_NAME"  
FROM public.howard_county_maintained_roads  
WHERE "ROAD_NAME" LIKE "WOODBINE RD%"
```
 - b.

```
SELECT "ROAD_NAME"  
FROM public.prince_george_s_county_maintained_roads  
WHERE "ROAD_NAME" LIKE "COLMAR MANOR%"
```
 - c.

```
SELECT "ROAD_NAME"  
FROM public.montgomery_county_maintained_roads  
WHERE "ROAD_NAME" LIKE "FOREST GLEN%"
```
6. How long are these given roads stated in the previous segment? What unit is it in?
 - a.

```
SELECT SHAPE_Length  
FROM public.howard_county_maintained_roads  
WHERE "ROAD_NAME" LIKE "WOODBINE RD%"
```

- b. `SELECT SHAPE_Length`
`FROM public.prince_george_s_county_maintained_roads`
`WHERE "ROAD_NAME" LIKE "COLMAR MANOR%"`
- c. `SELECT SHAPE_Length`
`FROM public.montgomery_county_maintained_roads`
`WHERE "ROAD_NAME" LIKE "FOREST GLEN CT%"`

These questions were asked.

Results

The following are the answers to the SQL questions stated above:

1. What is the count for each iNaturalist county: Howard, PG, Montgomery?
 - a. iNaturalist_Howard_RF: 233 results
 - b. iNaturalist_PrinceGeorge_RF: 168 results
 - c. iNaturalist_Montgomery_RF: 1250 results
2. For the iNaturalist counties, where are there 1+ disagreements with the encounters of Red Foxes?

- a. iNaturalist_Howard_RF: 2 results

	id [PK] integer	num_identification_disagreements integer	place_county_name character varying (6)	place_guess character varying (63)
1	109002178		Howard	Phillip Dorsey Way, Columbia, MD 21045, USA
i. 2	188854130		Howard	Stonecrest Dr, Ellicott City, MD, US

- b. iNaturalist_PrinceGeorge_RF: 2 results

	id [PK] integer	num_identification_disagreements integer	place_county_name character varying (15)	place_guess character varying (88)
1	152641723		Prince George's	Colmar Manor, MD 20722, USA
i. 2	178873995		Prince George's	Metzerott Rd, College Park, MD, US

- c. iNaturalist_Montgomery_RF: 4 results

	id [PK] integer	num_identification_disagreements integer	place_county_name character varying (10)	place_guess character varying (87)
1	34690540		Montgomery	New Mark Commons, Rockville, MD 20850, USA
2	67308313		Montgomery	Maryland, US
3	80259156		Montgomery	Burtonsville, MD, USA
i. 4	119557155		Montgomery	Rock Creek Regional Park, Derwood, MD, US

3. Since its creation in 2008, when are the first encounters with various Red Foxes?
 - a. iNaturalist_Howard_RF:
 - i. 2 results; 6/13/2006 and 6/23/2006
 - b. iNaturalist_PrinceGeorge_RF:
 - i. 1 result; 4/17/2009
 - c. iNaturalist_Montgomery_RF:
 - i. 2 results; 9/11/2010 and 9/17/2010
4. From observing the data for maintained roads of the three counties, what would be the most observed road and what would the count be?
 - a. iNaturalist_Howard_RF: 43/233 found at Woodbine Rd
 - b. iNaturalist_PrinceGeorge_RF: 8/168 found at Colmar Manor
 - c. iNaturalist_Montgomery_RF: 31/1250 found at Forest Glen
5. For the specific road encountered in the previous question in iNaturalist, does the actual road exist in the maintained roads data for the three counties?

- a. howard_county_maintained_roads: Road name exist with 1 entry in ROAD_NAME
 - b. prince_george_s_county_maintained_roads: Road name exists with 1 entry in ROAD_NAME
 - c. montgomery_county_maintained_roads: Road exists with 4 entries in ROAD_NAME
 - i. Forest Glenn Rd
 - ii. Forest Glenn Rd
 - iii. Forest Glen Ct
 - iv. Forest Glenn Rd (WB/L)
6. How long are these given roads stated in the previous segment? What unit is it in?
- a. howard_county_maintained_roads: 1855.6865 meters as stated by ArcGIS Online where the map is in WGS1984 Web Mercator
 - b. prince_george_s_county_maintained_roads: 515.8828 meters as stated by ArcGIS Online where the map is in WGS1984 Web Mercator
 - c. montgomery_county_maintained_roads: 58.8318 meters as stated by ArcGIS Online where the map is in WGS1984 Web Mercator

These are the answers to the questions asked above.

Timeline

Below is the timeline for this project:

Date	To Be Completed	Completion
1/9/2024	Final Project Proposal	Y
2/4/2024	CSV Files Gained: <i>Three Counties in iNaturalist and Maintained Roads</i>	Y
2/4/2024	Guarantee Fit in PGAdmin 4v4 PostgreSQL: <i>Three Counties in iNaturalist and Maintained Roads</i>	Y
2/4/2024	Form 6 Question, 3 for each county, for SQL	Y
2/5/2023	Insert iNaturalist and Maintained Roads into ArcGIS Online	Y
2/7/2024	Answer All Questions in SQL	Y
2/9/2024	Rough Draft of Final Project	Y
2/11/2023	Final Project Completion	Y

Discussion

Based on various knowledge acquired through SQL in this project I have learned several things. First is that my iNaturalist and Maintained Roads Data did not coordinate together, or work with one another. Given that I was trying to learn about what roads were a frequent viewing for Red Foxes, I was going to join the two tables together. After trying it several times, I noticed that there was no geometry or id's that coincided together. That is what I think did not allow me to join them together.

After further research into these foxes, Fish and Wildlife Services should mark off location where red foxes may be present with a road sign specifically at the three locations, Colmar Manor, Forest Glen, and Woodbine Rd, to note that there is a high population of Red Foxes. Another note, as stated in the proposal, would to be not leaving out any food more the

foxes, as they are urbanized foxes, and they can receive all their food from the nature around them, NOT from humans being involved in their lives. That is one thing that irritates me: leaving food out for various animals. It just draws them farther into urbanized areas. I was unaware if I asked too many or not enough questions. In the proposal, 15-20 questions were stated to be asked; in this project, 18 questions were asked.

The overall idea of this project, to investigate more information about Red Foxes and their location on and around roads was accomplished.

References

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