A repository for:

Murray et al. A multi-state occupancy model to non-invasively monitor visible signs of wildlife health with camera traps that accounts for image quality. Journal of Animal Ecology.

This repository contains seven folders. In alphabetical order they are:

./assets/

Contains two images used to make `README.md`. This includes:

`./assets/coyote.png`: A line drawing of a coyote.

`./assets/coyote_mange.png`: A line drawing of a mangy coyote.

./data/

This folder contains the data to fit the model and a set of gridpoints as a shapefile used to generate figure 5 in the manuscript.

`./data/coydata_merged_sites.csv`: A csv file with 3971 rows and 11 columns that contains all of the image data used in the analysis.

Column header	Data type	Description
new_file_name	character	The name of the coyote image, which generally uses a site code.
blur	numeric	The blur value calculated by the python script. Higher values indicate increased clarity.
File_name_order	integer	The numeric order of images at a site.
Mange_signs_present	boolean	Takes a value of 1 if mange was detected in an image, otherwise it is 0.
In_color	boolean	Takes a value of 1 if the image is in color, otherwise it is 0 (i.e., greyscale).
Season	categorical	The season the photo was collected. Either Spring, Summer, Fall, or Winter.
Year	integer	The year the photo was collected.
propbodyvis	proportion	The proportion a coyote was visible in an image, ranges from 0 to 0.55
surveyid	character	The survey code for a photo. Combines seasonal, year, and site information.
site	character	The site the image occured at.
date	date	The date the image was taken

`coyote_detection_data.csv`: A csv with 54656 rows and 8 columns that contains all of the coyote detection / non-detection data used in the analysis.

Column header	Data type	Description
Season	categorical	A seasonal code for the season the data comes from. It combines the first two letters of the season and the last two digits of the year. Seasonal codes are SP = Spring, SU = Summer, FA = Fall, WI = Winter. Data collection started in 2010.
Week	categorical	The week of a given primary sampling period. Week 1 through Week 4.
Date	date	The date of the coyote detection / non-detection data. In `yyyy/mm/dd` format.
SeasonWeek	categorical	Just a combination of Season and Week columns.
StationID	categorical	The site code for the detection / non-detection data. Can be joined to the `site` column in `coydata_merged_sites.csv`
SurveyID	categorical	The survey code for the detection / non-detection data. Can be joined to the `surveyid` column in `coydata_merged_sites.csv`
IDWeek	categorical	Just a combination of the StationID and the Date
Coyote	Integer	Can take three values. `NA` if a camera was not active, `0` if the camera was active and coyote were not detected, and `1` if the camera was active and coyote were detected.

`./data/gridpoint.shp`: A shapefile of the gridpoints used to predict coyote and coyote with mange throughout the greater Chicagoland area (figure 5). The utm coordinate reference system for this file is `26916`.

`./data/map_data/coyote_mange_hu10.csv`: The housing density calculated at each of the gridpoints for figure 5. This csv is 28329 rows by 2 columns.

Column header	Data type	Description
LocationName	integer	The site code from the gridpoints shapefile.
HU10	numeric	The housing density (houses per km squared) in a 1 km buffer around each gridpoint. Data comes from http://silvis.forest.wisc.edu/data/housing-block-change/

`./data/map_data/tree_imperv_mapdata.csv`: The tree cover and impervious cover calculated at each of the gridpoints for figure 5. This csv is 28329 by 3 columns.

Column header	Data type	Description

LocationName	integer	The site code from the gridpoints shapefile.
tree	percent	Percent tree cover in a 1 km buffer around each gridpoint. Data comes from https://datahub.cmap.illinois.gov/dataset/high-resolution-land-cover-ne-illinois-and-nw-indiana-2010
imperv	percent	Percent impervious cover in a 1 km buffer around each gridpoint. Data comes from https://datahub.cmap.illinois.gov/dataset/high-resolution-land-cover-ne-illinois-and-nw-indiana-2010

`./data/model_covariates.csv`: The covariates used to generate the two urbanization metrics via Principal Components Analysis. This csv has 113 rows and 4 columns.

Column header	Data type	Description
site	categorical	The site code where data was collected.
house	numeric	The housing density (houses per km squared) in a 1 km buffer around each site. Data comes from http://silvis.forest.wisc.edu/data/housing-block-change/
tree	percent	Percent tree cover in a 1 km buffer around each site. Data comes from https://datahub.cmap.illinois.gov/dataset/high-resolution-land-cover-ne-illinois-and-nw-indiana-2010
imperv	percent	Percent impervious cover in a 1 km buffer around each site. Data comes from https://datahub.cmap.illinois.gov/dataset/high-resolution-land-cover-ne-illinois-and-nw-indiana-2010

`./data/raw_site_coords.csv`: The UTMs of the camera trapping sites. These sites are in zone 16N.

Column header	Data type	Description
site	categorical	The site code where data was collected
utmEast	numeric	The easting coordinate
utmNorth	numeric	The northing coordinate

./im_calls/

This folder just contains one script, titled `figure_3_calls.txt`. I used imagemagick to combine the two subplots for figure 2 and add in the a) and b) symbols. These are just the notes I took in a text file so I could remember what to call from the console.

./jags_script/

This folder contains three JAGS scripts, all of which are different parameterizations of the model we developed in the manuscript.

`./jags_script/conditional_model.R`: This is the multi-season model without an autologistic term (i.e., assumes samples are independent among seasons).

`./jags_script/conditional_model_autologistic.R`: The is the multi-season model with an autologistic term, and the one we fit to our coyote data. All of the scripts (e.g., plotting) assume this is the model that is fit.

`./jags_script/conditional_model_single_season.R`: This isthe single season model we used for our simulated example.

./plots/

Contains plots 3, 4, and 5 of the manuscript, as well as the model evaluation plots for the supplemental material (within it's own subfolder).

./python/

Contains a single script, `blur_detection.py`, which is what we used to calculate the blur metric for all of the coyote images in our analysis.

./R/

Contains the seven R scripts for this analysis. If you were to run them in order they would go.

`./R/prep_data.R`: A script that prepares all of the coyote data for analysis.

`./R/fit_conditional_mange_model.R`: This fits the autologistic conditional mange model.

`./R/evaluate_mange_model.R`: This calculates some model diagnostics.

`./R/summarize_conditional_mange_model.R`: This summarizes the model and plots out some of the results.

`./R/mange_map.R`: This plots out the distribution of coyote, mangy or otherwise, and mangy coyote throughout Chicago, based on our model.

`./R/model_simulation_example.Rmd`: A markdown file that generates one of the supplemental files, which walks through a single season example.

`./R/simulate_conditional_data.R`: This is the script I initially wrote, which the above markdown file is based on. Keeping it here for folks that just want to work through the R script instead.

./results/

It contains just one file, which is a summary of the conditional mange model with an autologistic term, fit to the coyote data, and is generated in `./R/summarisze_conditional_mange_model.R`. The row names of the file are informative (i.e., contain parameter names), while the rest of the columns are the median

estimates of a parameter, associated 95% credible interval, and whether or not the 95% credibible interval excludes zero.