

Title: Data and code associated with “Supporting Adaptive Management with Ecological Forecasting: Chronic Wasting Disease in the Jackson Elk Herd”

Abstract: Adaptive management has emerged as the prevailing approach for combining environmental research and management to advance science and policy. Adaptive management, as originally formulated by Carl Walters in 1986, depends on the use of Bayesian models to provide a framework to accumulate knowledge. The emergence of ecological forecasting using the Bayesian framework has provided robust tools and supports a new approach to informing adaptive management, which can be particularly useful in developing policy for managing infectious disease in wildlife. We used the potential infection of elk populations with chronic wasting disease in the Jackson Valley of Wyoming and the National Elk Refuge as a model system to show how Bayesian forecasting can support adaptive management in anticipation of management challenges. The core of our approach resembles the sex- and age-structured, discrete time models used to support management decisions on elk harvest throughout western North America. Our model differs by including stages for CWD infected and unaffected animals. We used data on population counts, sex and age classification, and CWD testing, as well as results from prior research, in a Bayesian statistical framework to predict model parameters and the number of animals in each age, sex, and disease stage over time. Initial forecasts suggested CWD may reach a mean prevalence in the population of 12%, but uncertainty in this forecast is large and we cannot rule out a mean forecasted prevalence as high as 20%. Using recruitment rates observed during the last two decades, the model predicted that a CWD prevalence of 7% in females would cause the population growth rate (λ) to drop below 1, resulting in population declines even when female harvest was zero. The primary value of this ecological forecasting approach is to provide a framework to assimilate data with understanding of disease processes to enable continuous improvement in understanding the ecology of CWD and its management.

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Format of data files – .csv, R scripts

Location where data were collected

- Feedground_census.csv: Conducted on USFWS National Elk Refuge outside of Jackson, WY.

- Harvest_data_2016.csv: Includes hunt areas 70, 71, 72, 75, 77, 78, 79, 80, 81, 82, and 83 which comprise the Jackson herd unit as defined by the Wyoming Game and Fish Department.
- Hunt_area_census.csv: Includes hunt areas 70, 71, 72, 75, 77, 78, 79, 80, 81, 82, and 83 which comprise the Jackson herd unit as defined by the Wyoming Game and Fish Department.
- Jackson_tests_1998_2015.csv: From the National Elk Refuge outside of Jackson, WY.

Time period during which data were collected – 1997-2016

File Information

Final_Data.zip contains 7 .csv files representing data collected by both the Wyoming Game and Fish Department and the US Fish and Wildlife Service for elk management:

- Classification.csv
- Counts.csv
- Feedground_census.csv: Jackson feedground census, 1998-2016
- Harvest_data_2016.csv: Harvest data, 1997-2015
- Hunt_area_census.csv: Hunt area census, 1998-2016
- Jackson_tests_1998_2015.csv: Chronic wasting disease test results, 1998-2015
- JacksonElkHarv2000_2013.csv

Final_Code.zip contains 11 R scripts written for data analysis and model fitting as described in the full associated article:

- A_WorkFlow.R
- CWD_test_results_reduction.R
- lambda analysis with plotII.R
- NER_Call_v28_Final.R
- NER_JAGS_final.R
- NER_update_and_forecast.R
- NER_update_and_forecastJAGS.R
- Parameters from moments for priors II.R
- prior on beta transmission rate.R
- simulate initial conditions_v4.R
- TablePlottingCode.R

Definitions of acronyms, site abbreviations, or other project-specific designations used in the data file names or documentation files

GRTE: Grand Teton National Park; JFG: Jackson Feed Ground (at the USFWS National Elk Refuge); HA: Hunt area; Uncl: Unclear demographic category.

Software

RStudio Version 1.1.453

R version 3.5.0 (2018-04-23)