Background

The Eurasian collared dove (Streptopelia decaocto) was accidentally introduced to North America in the 1980s. The first populations were established in Florida, after which the species spread north and west, establishing populations across the continent by 2004. This large dove now competes with native doves, such as the mourning dove and white wing dove, though its impact is not well studied.

As a postdoctoral fellow at the University of Tennessee, Knoxville, I worked with Erika Asano and Andrew Whittle to develop integro-difference equations that predict the rate of spread and ultimate northern limit of the population in North America. Our model incorporates biological parameters of population growth (i.e. length of reproductive period, number of offspring per brood, etc) as well as latitudinal variation in the population growth rate. The model provides a basis for testing a new theory for species invasions, which we call the Breeding Season Length theory. The project involved collaborations with several people, including, Dr. Louis Gross, and Dr. Suzanne Lenhart.

Shown at right (top) is the distribution of the Eurasian collared dove in the US, during the Summer and Winter of 2004. The small dots in the figure indicate survey locations. Colored areas represent dove sightings. The different colors represent different densities of doves (see legend). Notice that although there are more Summer (breeding bird) survey locations (black dots), the winter range is more extensive. For example, there are no Summer observations of breeding birds in North Dakota, Wyoming, or along the coast of California. This observation may have several causes, including reporter bias in the Christmas Bird Counts, and the fact that the doves aggregate in flocks during the winter, making them easier to detect. The lack of tree foliage may also make birds easier to detect in winter.

Model Projections

The next figure at right shows model projections (one-dimensional model) for the dove densities before and after the dispersal of young. Notable features of the prediction include the decline in population density with increasing northward distance, and stepped changes in density, which arise via the interaction between breeding season length and the time needed to reproduce.

The Eurasian collared dove has the capacity to raise multiple broods each year, but the actual number of broods they can produce is limited by the length of the breeding season. As the breeding season gets shorter with increasing latitude, there are specific points in latitude where one less brood can be produced relative to the previous interval. These points cause discreet density intervals to form along the continuous change in latitude, represented here as distance of northern spread away from an initial southern entry point.

The bottom figure compares model projections for how quickly the doves spread north to empirical data collected during annual censuses. The red points show records of new dove populations recorded each year, starting at the point of the first record for a given transect.

Two transects are shown, which represent northward invasions from Texas to North Dakota (top panel) and from Florida to Pennsylvania (bottom panel). The maps show the locations of annual dove sightings by birders, marking the distance the
The dove's geographic range moved northward each year.

Two model projections are shown for each transect: before (open squares) and after (closed squares) dispersal. The figure reveals that the general pattern and relative rate of spread of the doves is similar to that predicted by the model, especially for the FL-PA transect. For example, the expansion rate is slow at first, due to **Allee effects**, which are built into the model. However, the empirical data reveal that the dove invasion slowed when the doves encountered the Appalachia mountains. This difference between the model and observations suggests that the mountains suppressed the dove invasion, possibly because of suboptimal conditions or food availability (the doves prefer open, arid habitats).

The speed of the invasion increases with time, but eventually slows to an asymptote as the length of the breeding season declines. Eventually, the breeding season is too short for even one bout of reproduction, and the latitude at this point represents the predicted northern boundary of the species' range.

The locations of the transects were chosen at random, and the TX-ND transect contained only three collared dove records. Therefore, it's agreement with the model is more difficult to ascertain.