

❖ Standard 8: Develop explicit abundance and distribution goals for conservation targets/biodiversity elements.

Case Study: Florida Game and Fresh Water Fish Commission's Goal for Florida's Wildlife

Summarized from: Cox, J. A., R. S. Kautz, et al. (1994). Closing the gaps in Florida's wildlife habitat conservation system. Tallahassee, Florida, Florida Game and Fresh Water Fish Commission: 246.

Purpose and region of analysis

The state of Florida set out to develop quantitative goals for the conservation of species far into the future in the face of continued human development pressure. This was part of a larger effort to conduct a statewide gap analysis of the current public lands system and the wildlife they do, or do not, support.

Criteria/Methods

As part of a gap analysis for the state of Florida, species distributions were determined for 44 focal species. This was followed by a population viability analysis to determine minimum requirements for adequate protection of a species. Out of this analysis a quantitative goal was set -- 10 populations, distributed broadly, with at least 200 individuals on publicly owned land or land under a public management agreement (e.g. conservation easements).

Species distributions

The 44 focal species were selected from the 542 vertebrates that occur in Florida. These species were selected if a species' habitat could be quantified using the available land cover data and geographic data (e.g. soils, field survey information, roads, etc.), if a species utilized a large home range, or if a species was strongly associated with a rare habitat type that contained other rare organisms. A group of birds were added to this list which included several endangered or declining birds and those with lots of available data.

Location data were collected from agencies and researchers for these focal species. Most data came in the form of point locations. Four methods were used to convert these point data to polygons derived from known or estimated characteristics of a given species. The ultimate goal of these conversions was to assist in the identification of remaining habitat within reach of a known species occurrence. First, circles were created around points with a radius determined by the known home-range of a species, or, when little information was available, a "small" or "large" circle with radii 250m or 1km, respectively. A second approach created Voronoi Tessellations (TYDAC 1991). In this method, polygons are created where the border of each polygon is equidistant from the

nearest neighboring point. What results is a large polygon created where occurrences of focal species are far apart. Where there are many occurrences of focal species concentrated in one area, the resulting polygon is small. A third approach was used for birds. Breeding bird atlas data reports locations of birds by a grid block which is 1/6 of a 7.5 minute quadrangle map, or 3,080 hectares. When a focal bird occurred within a grid block, that block was examined closely for remaining habitat for that species using the land cover data. This same approach was used for reptiles and amphibians but the size of the block used to locate habitat was reduced to 260 hectares (or a section in the township/section/range grid system). Finally, a fourth approach was used for wide-ranging mammals such as the Florida Panther. Habitat maps were created from models within areas these species are known to occur. Models considered availability of suitable land cover types as well as other factors such as road density, habitat patch size and distance to nearest population center. Each approach provided a unique way to look at the data providing insights to possible distributions and available habitat within those distributions of the species of interest.

Population viability analysis

Eleven species were selected for population viability analysis (PVA). Models were developed to test species persistence for 200 years based on fecundity and survival of females under normal ranges of environmental variability. Environmental stochasticity was also incorporated into the model to account for the potential for catastrophic events. Population viability was reported as a proportion of the 200 model iterations where species persisted in 200 years. The population extinction simulation model was written using BASIC programming language which can be found in the “tools” section of this document.

Summary of parameters used in population extinction simulation model, the values these parameters could hold and how these values were determined.

Parameter	Possible values	Determination of value for model input
Survival and Fecundity for various age classes	Values for each species grouped into “unfavorable”, “moderate” and “favorable” to cover the range of values found in the literature	From literature, species-specific and selected for model iterations by random draw from pseudo-normal distribution
Catastrophic event	15-25 year frequency	Species dependant and selected for model iterations by random draw from a uniform distribution
Population size	10-350 individuals	variable

Results of this analysis allowed the authors to determine those species with relatively high, or relatively low minimum thresholds for persistence, assisting in setting goals for initial population sizes necessary for a species to persist. One can also glean information on thresholds such as was the case with the red-cockaded woodpecker where substantial increases in population size (from 200 to 300 individuals) only resulted in slight increases in estimated persistence predictions (figure 1).

RED-COCKADED WOODPECKER

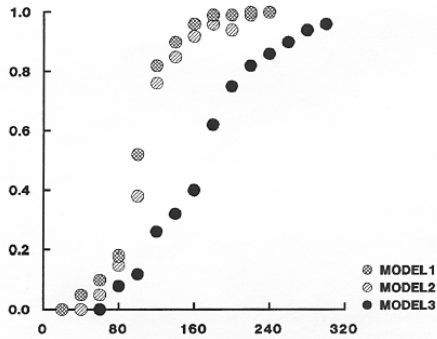


Figure 1 An example of the output from PVA models conducted for 11 of the focal species. The figure below illustrates the relationships between initial population size and the chances of persisting for 200 years for model populations of red-cockaded woodpecker (Model 1 =favorable environmental conditions; Model 2 = moderate environmental conditions; Model 3 = unfavorable environmental conditions).

Interpretation of results requires caution due to the apparent sensitivity of the minimum viable population value determined by the models. Values ranged dramatically depending on the parameters entered into the model. The authors assert that this is an indication that protecting the land which a population occupies is not enough. Populations require management that fosters an environment in which survival and fecundity rates are maximized.

Results of an analysis of the effects of inbreeding on species populations were also considered prior to setting quantitative goals for species conservation. A detailed review of the literature revealed that an effective population size, of approximately 50 individuals is sufficiently large enough to withstand the negative impacts of inbreeding for extended periods of time. A technique described by Reed et al. (1988) was used to translate effective population size to breeding population size for several of the selected focal species. The analysis revealed that the effective population size was approximately 20-45% of the censused population size. For other vertebrates, Ballou et al. (1989) found a censused population size of 100-250 individuals has an effective population size of about 50 individuals.

Based on the results of the population viability analyses, three categories of viability were defined for individual populations.

1. **Imperiled Population:** census population size estimated to be smaller than 100. Single populations of this size face a risk of extinction even under favorable management conditions. Populations of this size also may lose a significant portion of their genetic variability over the course of several generations.
2. **Insecure Population:** census population size estimated to be 100-200. Single populations of this size may be susceptible to annual environmental perturbations over an extended period and may lose a portion of their genetic variability over many generations. The prosperity of populations of this size will rely heavily on appropriate management regimes.

3. Potentially Secure Population: census population size estimated to be larger than 200. If habitat and population management are appropriate, the security of populations of this size will likely depend on the frequency and nature of catastrophic events rather than other environmental and genetical threats.

Products/Outcomes

Recognizing that one potentially secure population is inadequate to protect against environmental variability and inbreeding depression, the team set the minimum desired goal of protecting *10 potentially secure populations (at least 200 individuals) for a given species*. These 10 populations should be widely distributed to protect against catastrophic events.

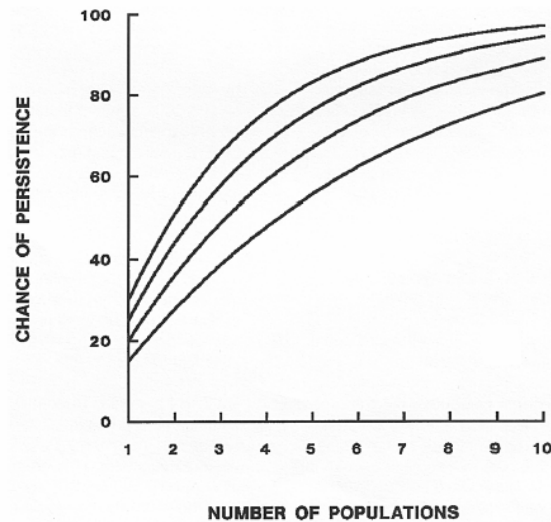


Figure 26. Relationship between the number of managed populations and population persistence. Several different values for estimated chances of persistence are shown. For example, the lowest curve represents the situation where each population has a 15% chance of survival. Two such populations would have out a 28% chance of at least one population surviving, and 10 populations would have >80% chance of at least one population surviving. The starting point on the Y axis indicates the estimated chance of survival for a single population (e.g., 15%, 20%, 25%, and 30%).

Tools

The population simulation model used to measure threat to populations by environmental variability and infrequent catastrophes is available in [appendix four](#) of Cox et al (1994).

SPANS (TYDAC 1991) is a Voronoi Tessellations software that can convert point data into polygons.

References

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