

The Gap Analysis Program's Approach to Mapping National Species Ranges and Distribution Models

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GAP is embarking on an effort to create species distribution models across entire species ranges for a large number of species that occur in the continental US. We started with creating a species list for the US. Our list is based on the species lists that were developed for the Southwest, Southeast and Northwest GAP projects. We then compiled species lists from all the remaining states (e.g., California, Midwestern and Northeastern states). Once a comprehensive list was assembled, each species was verified using the most current information regarding that species. For amphibians and reptiles, we used Crother (2008) to verify species and subspecies inclusions as well as the most current scientific and common names. For mammals, we used Wilson and Reeder (2005); and, for birds, we used the American Ornithological Union's 2008 checklist.

We define a species range as a coarse representation of the total areal extent of a species or the geographic limits within which a species can be found (Morrison & Hall 2002). Our intent is to build a national database of standardized HUC-based range maps. We are currently compiling species range maps, based on 12-digit hydrological units (HUCs), and information. We are using information from NatureServe, Southwest ReGAP and Southeast GAP to create our species ranges. The Northwest GAP species ranges will be incorporated as soon as they are finalized.

Our species range maps will be overlaid to create species richness maps, which will then be used in a national gap analysis of US species. Furthermore, we intend to use each species range to provide the biological context within which to build our species distribution models.

We define a species distribution as the spatial arrangement of environments suitable for occupation by a species. In other words, a species distribution is created using a model to predict areas suitable for occupation within a species range. Once the species ranges are complete, we will begin building species distribution models across each species' entire range. Our distribution maps, which are the result of our distribution models, will be created at a 30m resolution. We will be using deductive approaches based on habitat associations and expert input. We will also be starting to collect species point observations to begin including inductive modeling as well. However, the modeling approach used for creating a species' distribution model will be applied consistently across that species' range.

For those species that have ranges entirely within the regional extents of one of our Southwest, Southeast, or Northwest GAP projects, we will use the existing distribution models as our national distribution models for that species.

Goals

Our goal in this effort is to build species models with the best available data as well as to apply the best available modeling approaches for the spatial extent and resolution we need. This will be our first attempt to build species models across the entirety of a species' ranges rather than stopping at state or regional boundaries. These models will provide a base from which we can iteratively improve the model when new data become available. They will provide the basis of a national biodiversity assessment.

Since we are shifting our focus to creating national species distribution models, we are making strategic decisions regarding how to complete distribution models for as many species as possible within the next year. We are initially determining for which species we currently have national distribution models (i.e., models that encompass an entire species' range). And we are deciding how to complete national distribution models over the next year for additional species. Since we only have point observation data for NWGAP and it will take time to expand that database to other regions of the US, we are focusing our initial efforts on building, expanding or updating our deductive species models. Currently, we are focusing on species ($n = 208$) that have ranges completely contained within the boundaries of our Southwest and Southeast projects because they represent national species distributions, which are deductive models.

To build on our existing national distribution models, we are identifying a subset of birds to be modeled by a contractor who will work closely with GAP personnel to complete deductive models within 1 one year. We focused on bird species that are important to Partners in Flight, USFWS, and that have been identified as Species of Greatest Conservation Need by one or more states. We included birds that had existing deductive models from either or both the Southwest and Southeast projects.

For many amphibians, reptiles and small mammals, an inductive modeling approach may help us create more predictive distribution models. We will focus our efforts on gathering point observations for these species as well as birds. However, deductive modeling will still be an important modeling approach for many species especially as we work to build up our point observation database.

GAP’s modeling strategy is aimed towards our new national level vision. We believe our strategy over the next one to two years will position us well for conducting nationwide biodiversity assessments while also building and expanding our species modeling data, models and expertise.

Accomplishments

As mentioned above, we have species ranges and distribution models for all species that occur entirely within the boundaries of the Southwest and Southeast Gap Analysis Projects. The Northwest Gap Analysis Project is currently developing inductive and deductive models for about 690 species.

Our challenges include making sure all species models are consistently built across an entire species range even if it has a disjunct range as well as compiling habitat association data, point observation data and spatial variable data across the country.

Goals for the Coming Year

We are focusing on bird species for this year and plan to have deductive models completed for many bird species upon which biodiversity assessments can be conducted. We will also focus on Western species for amphibians, birds, mammals and reptiles. And we will incorporate the NWGAP species models into our national effort.

Outreach/Stakeholders/Data Distribution

We continually conduct outreach by attending conferences and connecting with other people doing or interested in species modeling (e.g. Terry Rich; USFWS/PIF, Steve Kelling, Cornell Lab of Ornithology). Furthermore, we have engaged zoologists at Natural Heritage Programs in the Northwest in our NWGAP species modeling.

Our stakeholders include USFWS and other federal agencies charged with managing and conserving species across the country as well as State Natural Heritage Programs and State Wildlife agencies.

All species ranges, distributions and associated data will be available for viewing and downloading through the USGS Gap Analysis web page (gapanalysis.nhii.gov).

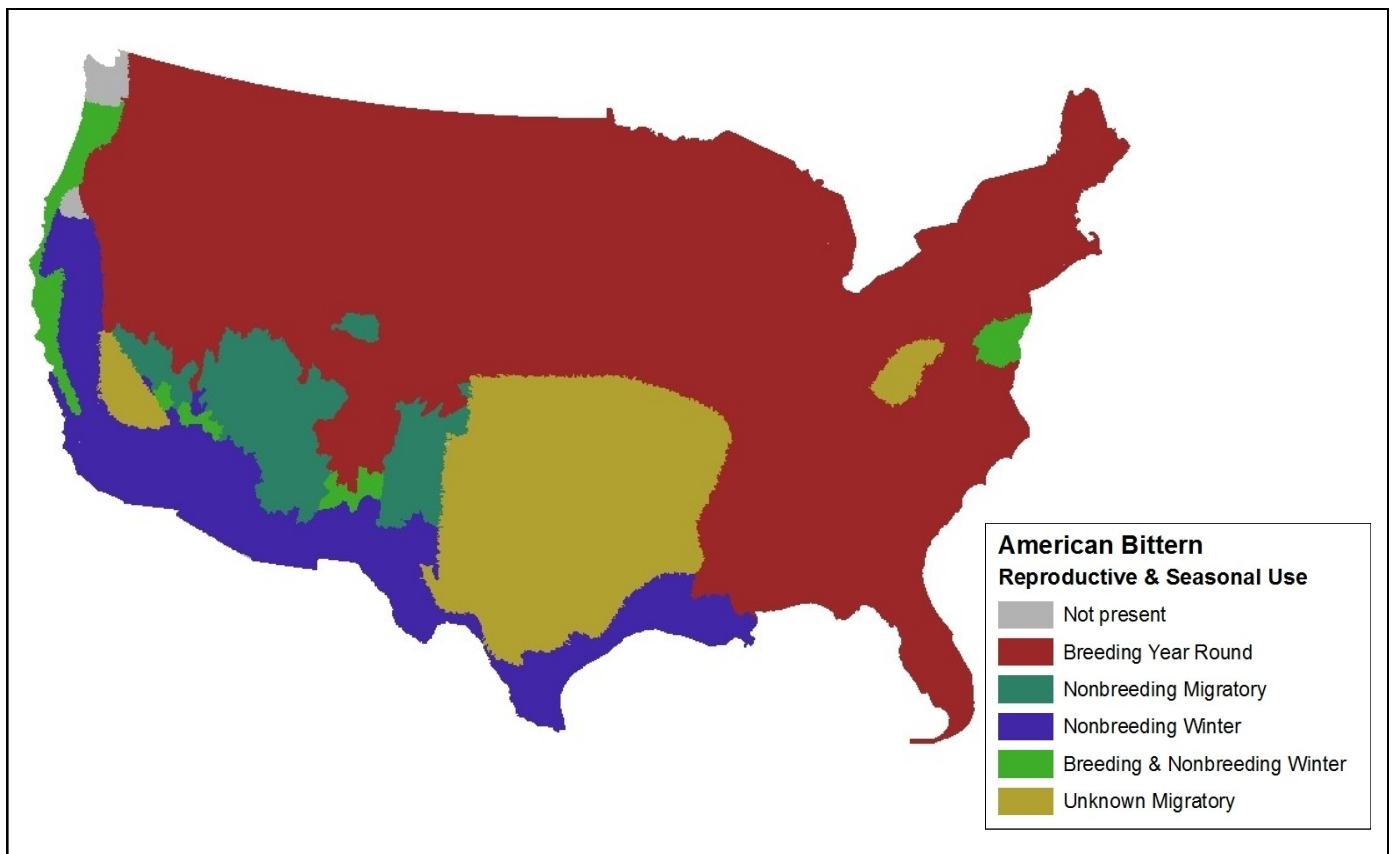


Figure 1. National range map for the American Bittern (*Botaurus lentiginosus*)

Literature Cited

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