WEB MAPPING FOR BIRD CONSERVATION: LEVERAGING THE AVIAN KNOWLEDGE NETWORK

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Rapidly expanding capabilities in web-based geospatial technology over the past five years provide significant opportunities to create map-based knowledge discovery tools and interfaces for environmental management. The Center for Environmental Informatics at Penn State University (CEI) has pioneered the application of advanced web-based geospatial technologies for a wide range of environmental and agricultural decision support tools through an approach that combines an interactive user-interface with the underlying geospatial capability of web map server technology.

The web map-based paradigm provides a rich user interface for a wide variety of applications, ranging from decision support tools at the land manager level to advanced spatial-temporal data exploration needs of the research community. This combination effectively provides easy access to spatial and temporal information for users who may have little, if any, familiarity with advanced geographic information systems (GIS) but who require a spatial and/or temporal view of the domain of interest to improve their understanding of the information needed in the context of a specific question or problem. For avian conservation applications the capability to visualize, explore, and ultimately understand the spatial and temporal relationships between migrating species and breeding/wintering habitats is absolutely critical if conservation efforts are to be targeted effectively.

CEI has worked since 2006 with Partners in Flight (PIF) and the Avian Knowledge Network (AKN) to create a prototype web application for exploring and visualizing AKN databases in conjunction with species range maps (wintering and breeding) for neotropical migrant land bird species in the Western Hemisphere (Fig. 1). A dynamic, query-driven system, as demonstrated in this prototype, allows custom creation of maps in response to a specific set of query functions as opposed to accessing pre-defined maps that may or may not meet user needs.

The prototype was built using existing species range maps maintained by NatureServe (NatureServe 2008). The interface has three main selection components: species selection, data selection, and an additional data layer selection button. The species selection drop down features a list of common names for birds found in North America (1850+ species). Selection of a species name invokes the display of the appropriate range map for that species with status categories including year round, breeding, wintering, passage migrant, and introduced.

The user may then tap the AKN and select from among the following databases: eBird, Hawk Count, Latin American and Caribbean, Land Bird Monitoring Program, or LAMNA Point Count. Due to the shear number of observations within eBird and associated databases, individual observations are summarized to a 100-km^2 grid cell. A unique feature of the interface is the capability to adjust the temporal bounds on the four seasonal categories presented (winter, spring, breeding, and fall). Upon modification by the user, the data are redisplayed using the newly requested seasonal boundaries. A transparency function, with a slider bar, is included in the map display to allow the user to view the bird observations more easily in the context of the range map layer. The user may also toggle both of these data layers on and off to display the desired map selection.

Standard web map functions are also included in the prototype interface: pan and roam, zoom, and extent functions as well as a help button. Double-clicking with the pointer tool within individual grid cells eventually

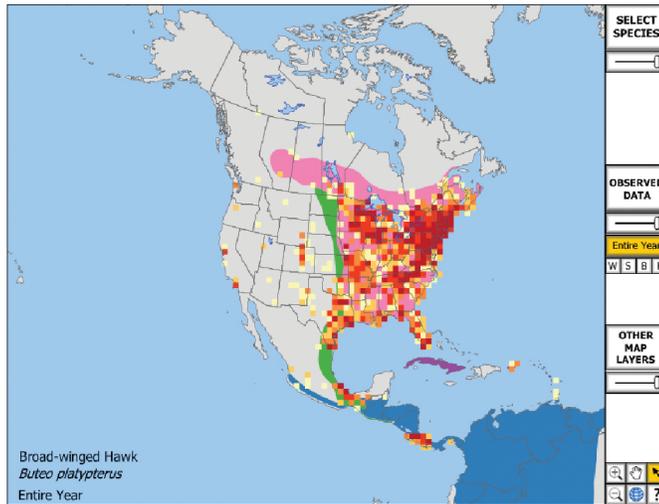[4] E-mail: miller@eesi.psu.edu

FIGURE 1. A screenshot of the PIF/AKN prototype web map-based interface.

leads to the display of individual observations with a mouse-over tag associated with each observation point—noting the date and specific time of the observation. Additional map layers including land ownership boundaries may be displayed as desired and are included to provide spatial context.

The initial prototype (www.cei.psu.edu/pif/akn.html) uses a Flash-based interface to a GeoServer web map server (http://geoserver.org/) that is, in turn, fed by a Postgres object-relational database management system (http://www.postgresql.org/). Flash enables creation of a highly interactive, easy-to-use and aesthetic interface that is quickly and easily mastered by the new user. GeoServer is a highly flexible and increasingly popular Open Source web server for geospatial information that is fully OGC (Open Geospatial Consortium) compliant. Postgres is the Open Source database engine used to store the AKN snapshot currently used for the tool. All of the components used to create the prototype are Open Source, meaning that others may freely use and adapt our code for their own applications development.

Feedback from users and reviewers of the initial PIF prototype has been favorable, with numerous suggestions for additional features and capabilities. Not unlike other environmental web map applications that we have developed, the PIF/AKN tool has opened a new realm of interactive mapping to the avian conservation community and highlights the power of the web map medium to convey the spatial and temporal dynamics of avian species. We envision web map applications that span the realm from global and hemispherical to the landscape scale, where land managers will ultimately be in a position to tap the power of these tools for making local conservation decisions. These capabilities will be particularly relevant to communities that typically do not currently have access to rigorous geospatial data management systems and linked visualization resources, such as individual resource managers, small non-governmental organizations, or land managers in Mexico, Central and South-America.

LITERATURE CITED

NATURESERVE. 2008. Digital Distribution Maps of the Birds of the Western Hemisphere. Version 3.0. [Online.] <http://www.natureserve.org/getData/birdMaps.jsp> (15 May 2009).