International Cartographic Association
Association Cartographique Internationale

Experience and technologies in animal mapping

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Keywords: animal mapping, spatial data cubes, spatial data extraction

Abstract:

The most common animal maps show polygons of their intended habitats. Usually, the initial data is the coordinates of the spot where the meeting with the animal was recorded. It is less often possible to record a track of its movement or to take a picture from a UAV. Still, in GIS-terms an animal map starts with a list of points coordinates. In this paper, we want to consider interconnection of cartography and biology using the example of several cases.

If it is needed to make a map of a single habitat, for example, a of seagull or a seal, a UAV images can be used. Then manually or with image detection methods coordinates of every animal or nest could be defined. In the case of seagull nests was it possible to apply a geostatistical analysis of the point process which revealed that seagulls nest regularly, increasing density towards the edges of the nesting area.

In nature reserves animal records are kept by employees along the so-called accounting routes. Based on the results of their long-term observations, it is possible to outline the habitats. Using other thematic maps and overlay operation the geographical conditions of their habitat can be determined (Goncharuk et al. (2020)).

Working with text sources is the most time-consuming. There are three types of spatial data recording in them: a. coordinates in numerical form; b. schematic maps; c. text description of the location. We tried several techniques of automated text recognition, but none of them were as accurate as manual extraction of location data. The resulting maps for the case of the polar mushrooms showed for the first time that a significant part of species are cosmopolitan and only a smaller part are endemic to both poles. (Grum-Grzhimaylo et al. (2024)).

Nevertheless, animal mapping could be more technological. Spatial data cubes offer a tool for mapping and analyzing animal habitats. These cubes are essentially grids of homogeneous cells, each containing environmental and geographic characteristics. Successful examples of this approach include Bio-ORACLE (Assis et al. (2024)) and MARSPEC (Sbrocco, Barber (2013)). While these rely on raster data models, the use of discrete global grid systems, as exemplified by Eco-ISEA3H (Mechenich, Žliobaitė (2023)), holds promise for future advancements.

Applications of data cubes for mapping animal habitats can be based on occurrence locations (analyzing the environmental correlates of animal sightings), species ranges (identifying areas with environmental conditions similar to known species ranges) or species habitat conditions (predicting suitable habitats based on species' ecological requirements). An example of spatial data cube for marine animals' habitats mapping was obtained for Arctic Ocean waters. The information incorporated into the cube may be referred to as analysis ready data since it is suitable for various purposes such as machine learning algorithms, expert evaluations, and interactive online tools without requiring extensive further processing by users. This approach establishes a standardized structure that harmonizes diverse geospatial datasets while separating analytical tasks from preparatory steps, thereby reducing geographical intricacies inherent in the dataset under examination (Titov, Kargashin (2024)).

Acknowledgements

The research was carried out within the state budgetary theme 121051400061-9.

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Abstracts of the International Cartographic Association, 10, 265, 2025
32nd International Cartographic Conference (ICC 2025), 17–22 August 2025, Vancouver, Canada.
https://doi.org/10.5194/ica-abs-10-265-2025