

LAB 11 Cartographic Modeling

INTRODUCTION

Cartographic modeling operations such as vector polygon overlay, raster analysis and combination, and tabular database processing are among the distinguishing functional characteristics of a geographic information system. In order to gain an understanding of the potential of cartographic modeling using a GIS, familiarity with both the conceptual and logical aspects of cartographic modeling is required. To this end, we have prepared a *multi-part* lab exercise to demonstrate both concepts and operations related to cartographic modeling.

We will be using the Sierra Vista Ranger District (SVRD) database that was developed for the Coronado National Forest. A ranger district is an administrative subset of a Forest. The lab will be approached in sections, with the first section dealing with conceptual spatial modeling, using flow charts and the second part will deal with actual GIS programming steps to implement the model. In lab 12, the output of this data modeling will be used for data visualization and interpretation.

SCENARIO

You have been hired as an *ecologist* (GS-7) for the Coronado National Forest and work on the Sierra Vista Ranger District. You have received the attached memo from the District Range regarding the experimental use of some of the range allotments on your district for the production of a genetically-engineered new species of mammal (read below). The idea is to establish some groups of the new species on the SVRD to initiate a long-term study (which could mean additional funding).

Since the Forest Supervisor's Office in Tucson has been pressuring the District for some demonstration of the GIS database that was developed at The University of Arizona, the District Ranger has asked you to make use of the system for some decision support in the allotment selection process. Although the Ranger is unfamiliar with the specifics of GIS operation, she has left it to you to develop and implement the cartographic model in support of the decision as to which allotments will be reassigned to the new species.

PROBLEM STATEMENT

Using a geodatabase that will be provided to you, you will need to provide information to support a habitat suitability analysis on the District could be used for management of the species. This information will be derived from an analysis that you conduct and will ultimately take the form of maps, tables, and graphics necessary to present your findings.

By the end of the process, **you will develop one or more maps** that concisely illustrate your findings by indicating those areas that you would recommend for the species. Your map will need to indicate those areas, preferably with some *ordinal ranking* of the potential allotments.

You will need to begin by deriving a schematic for the conceptual model that will be required to run the model in the GIS. Fortunately, the instructor will act as an overpaid GIS consultant that has been retained to assist you in the development of the model and the GIS programming sequence. You will work on this project for the next three to four weeks. The project will be the subject of the cartographic design work in Lab 12.

DATA FILES

This cartographic modeling exercise will utilize some ArcGIS feature classes and imagery that have been developed for the Sierra Vista Ranger District of the Coronado National Forest. The Coronado geodatabase contains the following feature classes:

Feature class	Description	Feature Type
streams	network of perennial and intermittent streams	line
swater	perennial and ephemeral surface water	poly
admin	USDA FS administrative areas	poly
gapveg	USFWS GAP vegetation	poly
allots	range allotments	poly
predator	known predator locations	point

In addition to these data, the workspace also contains a couple of **look-up tables** that provide support information for the codes that are contained in the above feature classes attribute tables. You should create a folder called *lab11*, and at some point **copying the lab11 data** from the class data folder into your workspace.

This geodatabase will hold all of the feature classes and tabular data that you need to complete the project.

MEMO

TO: Range and Wildlife Staff

FROM: Joan Weed, District Ranger

SUBJECT: Decision Support for Upcoming *Lepus octopedis* Meeting

As you may be aware, the District, through the Forest Supervisor's Office, has been asked to host a trial for production of an environmentally-friendly land mammal that was developed at Columbia University. This mammal, known as *Lepus octopedis*, is the result of years of research to develop a genetically engineered species that, among other things:

- improves range condition
- improves wildlife habitat
- reduces soil erosion
- provides economic opportunity on semiarid rangelands

Apparently, the mammal's physiology is such that the production of this species on semiarid range site actually improves the condition of the site. Its multi-footed design supplies just enough "trampling action" to improve soil condition and permeability. Although the animal prefers grasses, it readily ingests the developing shoots of many shrub species and retards the spread of shrubs. (Evidently, the animal also secretes a mild phytotoxin in its feces that is specific to shrubs and some forbs.)

Pilot studies have shown that areas where the mammal has been produced actually have improved wildlife habitat value. One study found that the range condition improved to the point that riparian areas were regenerating, and general ecosystem "health" was improving, both of which favor wildlife development.

We have been asked by Columbia and the National Science Foundation (NSF) to be host to a full-scale long-term study of the animal's effect on semiarid range resources. The study will require the identification of suitable areas that can be used as habitat for *L. octopedis*.

With respect to the habitat analysis, prime considerations include: there must be perennial water supply within the home range of the animal; that water supply must be on public land (not any of the private inholdings in the district). Additionally, the species dietary preferences have been studied to the point that habitat value for plant communities on the SVRD can be assigned.

Thank you for your cooperation in this matter. I will be looking forward to reviewing your approach and results. Please review the attached Fact Sheet for more information. **This information is to be treated as sensitive and confidential.**

FACT SHEET

Lepus octopedis



image by Randy Post

HABITAT

Ground-dwelling, burrowing mammal associated with moderate to high productivity ecosystems. The potential distribution of the animal ranges from semi-arid grasslands and shrublands to coniferous forest types. The animal must have reliable perennial water supply in semi-arid locations. Preferred primary habitat includes mixed grass types; secondary habitat includes oak shrublands with grass understory; tertiary habitat includes mixed pine, pinyon-juniper and ponderosa pine. The species is susceptible to volatile gases from pine and juniper litter. Home range has been estimated to be up to 3 square kilometers in semiarid environments.

PHYSICAL

Weighing 1.5 to as much as 3.0 kg, the species is multi-pedal variation on the common jackrabbit, mixed in with some DNA from several multi-pedal invertebrates. An obligate herbivore, *L. octopedis* thrives on grasses and forbs found in semi-arid areas. The gestation period is 10 weeks, with litters of 8 to 10 common. Fur colors include white, black, honey, and parti-colored.

PRODUCTION VALUE

The species is known to have an excellent feed-conversion ratio, be incredibly prolific, improve ecosystem health, and provide quality recreational value for wildlife viewers. In initial studies, the antics entertained recreational enthusiasts at a level similar to the river otter. At the present time, there are markets for the meat, milk, and fur being investigated by market research firms.

PREDATION

Though the species is prolific, local populations can be devastated by predation in the open areas that *L. octopedis* prefers. The Forest Service has mapped the locations of the various predator species.