

ATLSS PanTrack Tool Enables Visualization of Florida Panther Movements

PanTrack, a tool developed through the Across Trophic Level Systems Simulation (ATLSS) Program of the U.S. Geological Survey, is designed to display and analyze spatial movement data over georeferenced landscape maps. It has been customized for the display of radiotelemetry observations collected for the endangered species recovery project of the Florida panther (*Puma concolor coryi*).

South Florida is home to the last remaining population of endangered Florida panthers, estimated at about 60 individuals. Panther survival is threatened by habitat loss and degradation, inbreeding, insufficient numbers of large prey, and disease. Because the few remaining panthers have been so intensively studied, a detailed database is available for individuals in the population. The monitoring of Florida panthers by radiotelemetry began with the radio-collaring of two individuals in 1981 and has expanded to include forty-one panthers—a majority of the population. More than 50,000 telemetry locations have been available over the observation period.

PanTrack was originally developed to help define panther behavioral rules for the spatially explicit, individual-based ATLSS Deer/Panther model. The effectiveness of individual-based models depends on the availability of detailed observations about individuals on the landscape, and on the ability to find patterns in these observations that provide insight into key animal behaviors.

The PanTrack tool can be adapted to display and analyze any location coordinates over background map layers. In addition to its application to panther monitoring, it has been used to display annual field observation data for Cape Sable seaside sparrows (*Ammodramus maritimus mirabilis*) and telemetry observations for American alligators (*Alligator mississippiensis*). It could also be used to display movements of simulated animals generated by spatially explicit, individual-based models.

PanTrack Offers Many Features to Users

The run-time PanTrack screen consists of a PV-WAVE command window, a Landscape Map Window, and a menu board user-interface, all of which remain through the session. Zoom and Animation windows may be created and dismissed during the session.

PanTrack first reads in needed data files. After data have been loaded, the Landscape Map Window appears. This window remains throughout the PanTrack session, displaying a landscape map for South Florida. Telemetry observations are displayed in this window. The menu board then appears at the top of the monitor screen, displaying the user control panel.

Groups of related user option choices are organized into columns on the menu board. A help file describing each option is available for each column, accessed by clicking the HELP button at the top of a column. Paths for each panther are color-coded and identified in a sidebar. Telemetry data may be subset by individual, sex, genetic group, or age. The display options are draw, animate by time step, or movie animation. Time step may be set to year, season, month, or day. Telemetry locations may be displayed as points or connected in time sequence by vectors. Adult home range and activity area outlines may be computed and displayed. Telemetry locations are displayed over a habitat map (Florida Gap Analysis map version 6.6) with vector overlays for roads, canals, and public areas. A text window displays vital statistics information for each monitored individual. Selections may be made in any order. For unmodified options, default selections are used. After all subsetting selections have been made, click the DISPLAY button (in the PROGRAM CONTROLS column) to display observations in the landscape map window.

PanTrack Is Used to Study Panther Behavior

The following examples of inquiries into panther demography and behavior can be addressed by studying panther telemetry observations with a tool such as PanTrack.

*Track changes in panther activity ranges over time and space.

*Compare activity ranges of male and female panthers.

*Locate reproductive centers of the panther population and determine which habitat types are most heavily used by reproducing females.

*Study seasonal components to movement patterns.

*Compare dispersal strategies of subadult males and females.

*View geographic patterns of causes of panther deaths.

*Characterize interactions in which panthers have been killed by other panthers. (For example, the incursion of a subadult male into the range of an established male may lead to a violent confrontation resulting in death. (Telemetry animations can view sequential snapshots of movements that have led to panther deaths.)

Platform and System Requirements

PanTrack Version 1.0.1 presently operates only on Sun workstations or on PCs with a LINUX operating system installed. The installation of PV-WAVE Version 7.00 (Visual Data Analysis Software by Visual Numerics) is required. PanTrack data and program installation require 14MB of disk space.

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Figure 1. The activity ranges of all radio-collared Florida panthers from 1981 through 1998.
[IMAGE = allpan.jpg]

Figure 2. The ranges of Florida panther males seldom overlap those of other males, but generally include the ranges of several females. The ranges of females often overlap. The territory of dominant male #12 (border outlined with *solid line*) includes the territories of five female panthers (borders outlined with *dashed lines*.) Overlapping female ranges are often mother–daughter pairs, as females disperse close to their natal ranges. [IMAGE=homerange.jpg]

Figure 3. The locations of Florida panther females known to have reproduced. A histogram of habitat type represents their ranges. [IMAGE=ml.jpg]