

4-24-2020

Animaltracker: Streamlining Spatio-Temporal Analysis and Visualization of High Sampling Rate Animal Data

Thea Sukianto
Boise State University

Joe Champion
Boise State University

Sergio Arispe
Oregon State University

Dylan Mikesell
Boise State University

ANIMALTRACKER

STREAMLINING SPATIO-TEMPORAL ANALYSIS AND VISUALIZATION OF HIGH SAMPLING RATE ANIMAL DATA

¹THEA SUKianto, ¹JOE CHAMPION, ²SERGIO ARISPE, ¹DYLAN MIKESSELL
BOISE STATE UNIVERSITY¹, OREGON STATE UNIVERSITY²

OVERVIEW

Scientists studying animal behavior have begun using low-cost geolocation (GPS) trackers, but struggle to migrate large raw data files (100,000+ observations) using spreadsheet software. *Animaltracker* is a new R package to automate data cleaning and visualization of GPS logs. The package bundles R Shiny web applications with data processing functions to provide customizable data processing, interactive plots of animal locations over time, and statistical tools for augmenting, analyzing, and exporting the cleaned data.

DATA PROCESSING

The data workflow is summarized in a simple 4-step process:

1. Data Upload

- Upload archive of raw GPS data (.csv format)

2. Select Data

- 4 filtering options:
 - **Site** (data source), **Animal** (ID number), **Date** (min/max), **Time** (24h min/max)

3. Data Processing

- **Cleaning Options:**
 - **Discard erroneous data** (yes/no)
 - e.g. (0,0) coordinates
- **Elevation Append Options:**
 - **Latitude** (min/max), **Longitude** (min/max), **Zoom** (geodesic zoom 1-18), **Slope** (yes/no), **Aspect** (yes/no)
- Data selected in (2) with options in (3) is then processed automatically

4. Data Download

Select Site(s)
bannock, riverside

Select Animal(s)
1149, 2253, 8855, 9964

Date Range
2017-12-12 to 2017-12-14

Min Time
15:18:18

Max Time
23:47:34

Panel of options for Step 2.

Cleaning Options

Elevation Options

Latitude Range:
43.27409 to 43.628948

Longitude Range:
-117.194107 to -116.204277

Zoom:
13

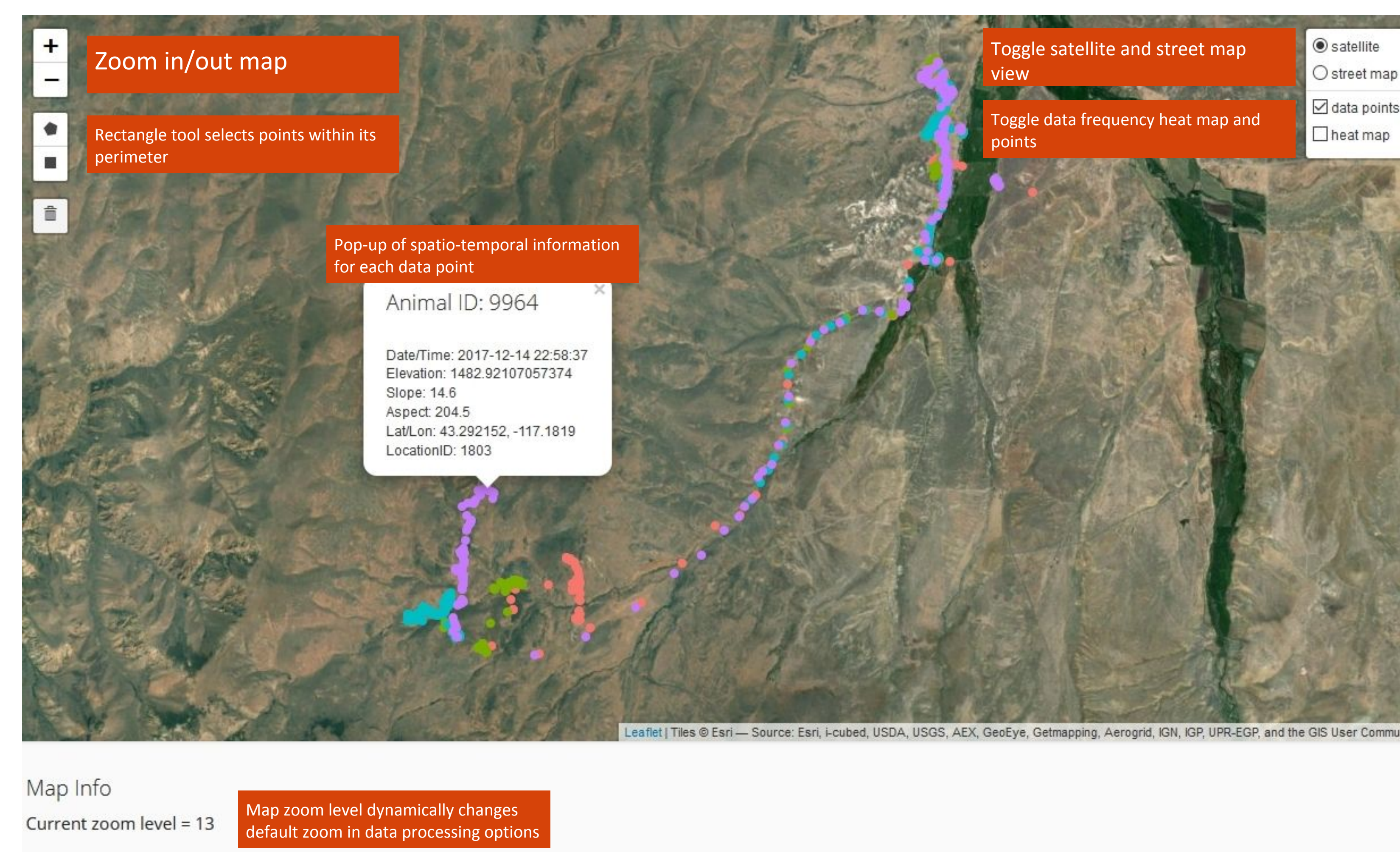
Include slope
 Include aspect

Process All Process Selected

Panel of options for Step 3.

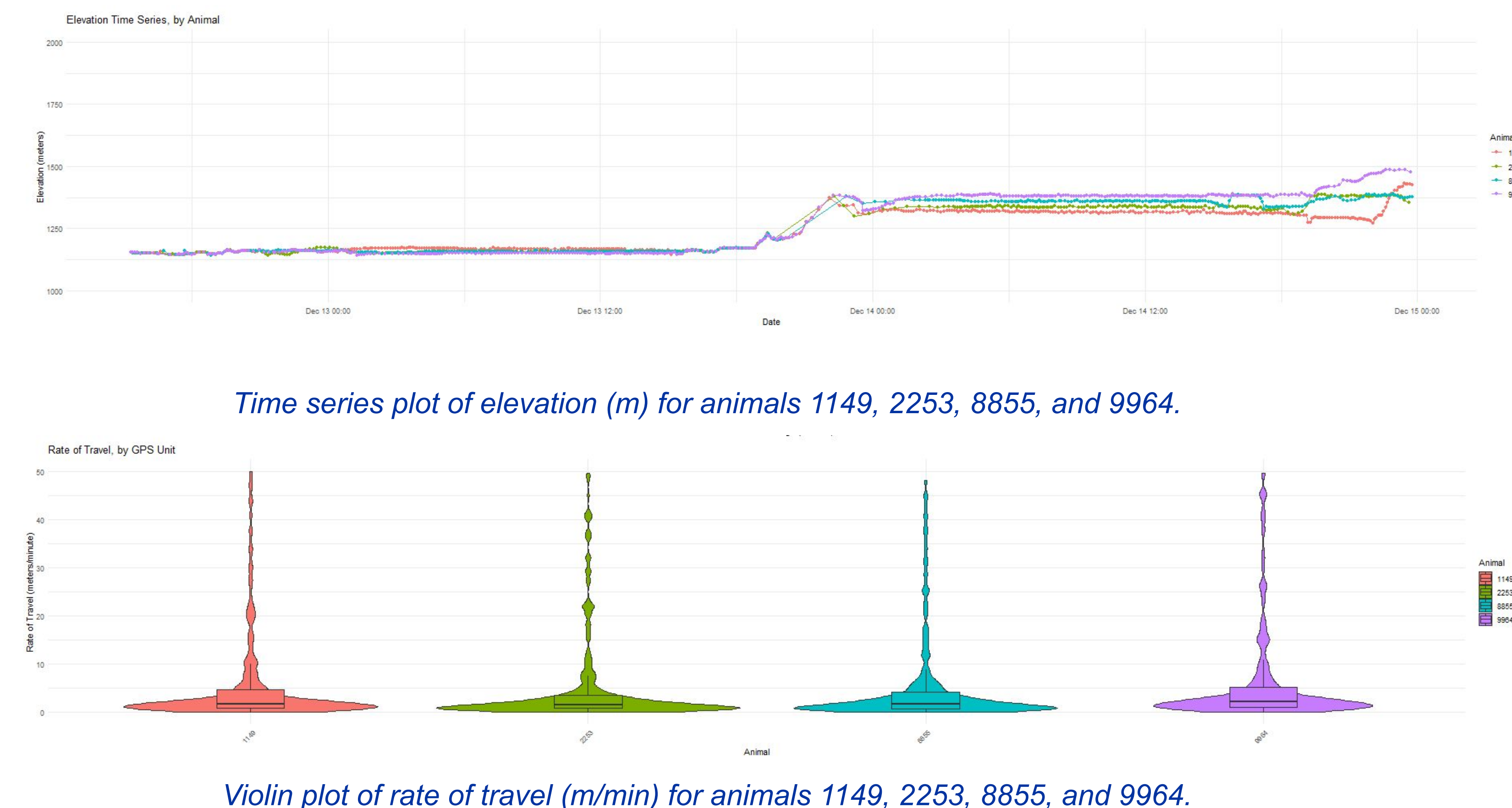
MAPPING

The data selected in (2) of processing is displayed on an interactive map.



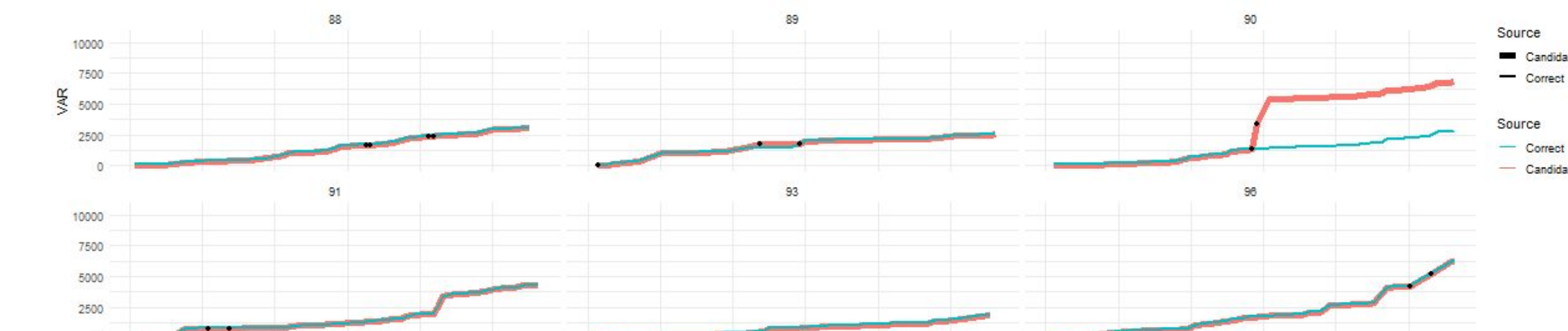
DATA ANALYSIS

After the raw data is uploaded, plots and statistical summaries are generated by the app. As the data is processed, the plots and summaries change to reflect the new data.



DATA VALIDATION

- Compare animal GPS data processed by different methods
 - Flag system
 - Flag distance, rate, and course when above a user-defined threshold
 - Extreme value detection
 - Modified z-score method
 - Time series plots of variables for each animal



ADDITIONAL FEATURES

R functions bundled in the animaltracker R package

- Data Visualization
 - Measurement intervals
 - Quantile-quantile (Q-Q) plots
 - Histograms
 - Boxplots for altitude distribution by animal ID
 - Comparison
 - Side-by-side violin plots
 - Faceted time series plots
- App functionality from R CMD

FUTURE DEVELOPMENT

- Optimize RAM consumption of elevation lookup
- .kmz, .kml, and .shp file support
 - Visualize fencing
 - Visualize water sources
 - Calculate distance to closest water source from fixed point
- More advanced time series analysis

