How to deal with all that GPS data?
Tools and techniques for managing and analyzing large GPS datasets

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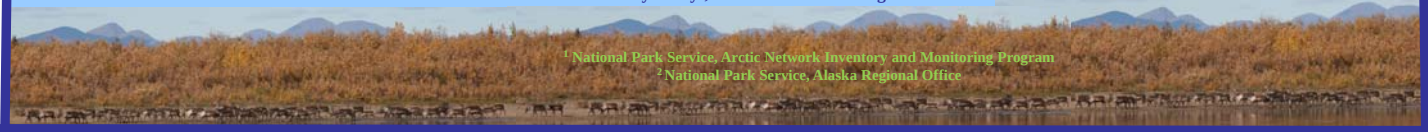
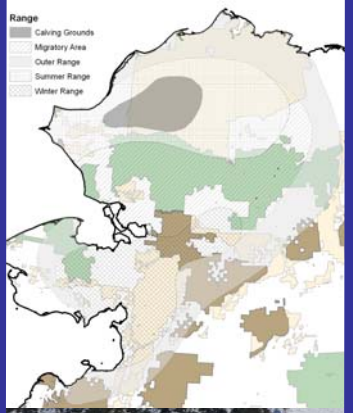
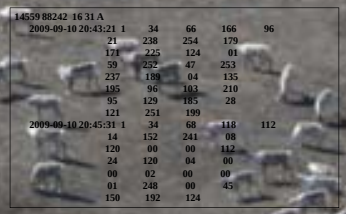
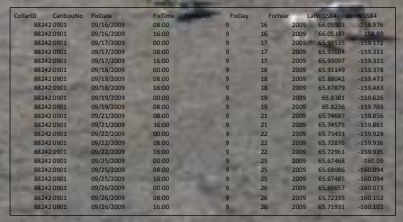
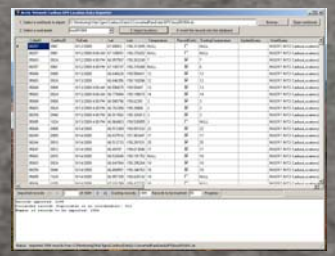
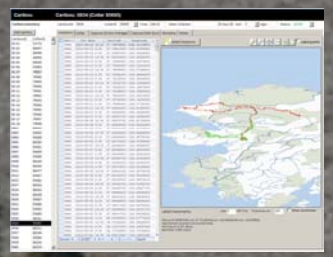


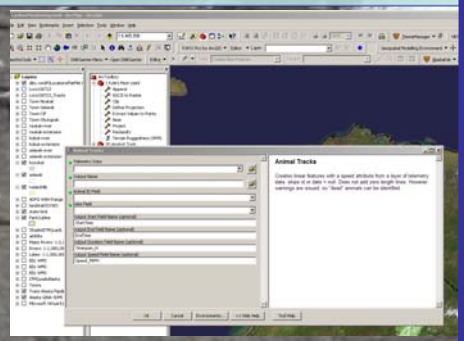


Step	Example	Details
Raw Data from ARGOS		Raw data coming in from ARGOS needs to be processed in order for it to be useful..
Data Processing Webpage		We partnered with the University of Alaska Fairbanks to develop an internet-based data processor that is user-friendly. The page features easy to use drop-down menus and allows users to select the boundary of the locations being imported as a first level data quality check.
Webpage Output		The webpage output is an Excel (.xls) spreadsheet that can be easily used or imported into GIS software..
Data Importer		Excel is limited in its capabilities so our data is stored in a Microsoft SQL Server database. We wrote a Visual Basic .NET data importer tool to perform basic data quality checks, remove any duplicates and write SQL insert queries to transfer the data to our database. Julian Day and local time are also inserted.
Database		Our database application consists of a Microsoft Access 2007 Project (.adp) with an embedded MapWinGIS ActiveX GIS control to visualize the data and perform quality control.

Abstract

Tracking movements of large mammals collared with Global Positioning System (GPS) collars provides biologists with a wealth of information about the spatial distribution of animals over time but presents special challenges to scientists due to the large volume of data and the many processing and quality assurance steps that are required to ensure a high quality dataset. We met these challenges while developing a system to monitor movements of Alaska's Western Arctic Herd caribou. While mammal tracking data tend to be simple, consisting of animal identifiers and simple spatial coordinates, building a system to collect, manage and analyze the spatial data and ancillary information required a complex range of skills. We engaged the expertise of a wildlife biologist to develop the program and write the sampling protocols, a data manager to design our database and application and a Geographic Information Systems (GIS) programmer to build the spatial analysis tools that we needed but could not find in off-the-shelf GIS software. We present an overview of our caribou monitoring program, our research protocols and our data management system as well as a summary of the difficulties we encountered and how we solved them.

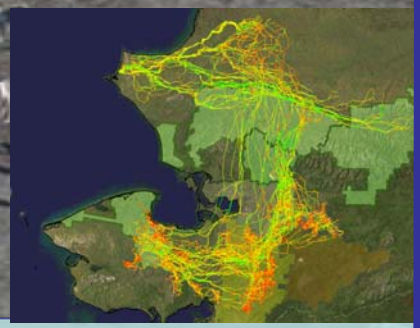
ArcGIS Scripts



Analysis is done using ESRI ArcGIS custom tools accessing the data through a database connection. Distance and time between relocations is calculated, as well as speed (km/h). Additional tools are pending.

Products

End products include maps and geodatabases suitable for statistical analyses. The map, at right, pictures the movements of caribou with the color scheme based on movement rates (green for fast and red for slow).



Preliminary Results

Using a team consisting of a wildlife biologist, data manager, GIS specialist and web manager, we have begun to develop of suite of tools to make the handling, storage, and analysis of very large GPS databases easier for the wildlife biologist. Our project using Western Arctic Herd has collected approximately 40,000 relocations from 35 caribou in just 1 year. Our goal is to reduce the time being spent on data management, augmentation and quality control so more time can be spent in the field and on analyses. Since most projects will not have the luxury of developing a team such as ours, we will be working to make our tools more generic and available to other interested wildlife biologists. -- For more information, email Kyle_Joly@nps.gov