Experience in GIS, remote sensing and image processing, GPS, cartography, metadata, & related technologies

Nature of my geospatial skills:

With undergraduate and graduate degrees in geography and ecology, I have strong grounding in spatial analysis, GIS, cartographic theory & practice, landscape analysis, etc.

Geospatial techniques have been important in my work, including landscape classification & analysis, vegetation surveys, ecological ordination, landscape classification & analysis, field site selection & navigation, data presentation, and mapping.

I have developed these skills in projects including acquisition, analysis, management, display, and dissemination of scientific and other geodata for use by a wide variety of audiences.

Applied skills:

- **GPS hardware use** (Trimble, Garmin, Magellan, etc.) in fieldwork for field navigation and site location, ground mapping with data dictionaries, and position and track recording. Includes work on foot, in aircraft, and on boats.
- **GPS software experience** including Trimble Pathfinder Office, Minnesota DNR's DNR GPS, and others. Used to correct, refine, edit, and export the data collected with GPS units for GIS and import tabular and other data into GPS units, including performing any necessary data transformations or other processing.
- **Data dictionary** creation and editing for project-specific feature documentation using Trimble GPS units and software, editing and correction of GPS data for use in GIS and mapping.
- Extensive experience using contemporary and historical aerial and satellite **imagery** for research planning, analysis, and cartography, including:

  1) **Aerial** imagery: NAIP 3 & 4 band imagery (CCMs and tiles), various USGS historical aerial imagery, USFS aerial imagery archive material including NHAP, various other federal; state; and county imagery products, and have scanned & processed printed aerial photographs into digital imagery.

  2) **Satellite** imagery: esp. Landsat 5-8, Worldview 1-3, Orbview, Ikonos, Spot 1-5, etc., in panchromatic, 'true color', and multispectral bands, and

  3) "**Non-optical**" (or non-visual) data such as **LiDAR**; (hereafter spelled 'Lidar'), Radar, Ifsar, etc.
- Proficient "**data-hound**" in geodata sourcing and acquisition from many sources common and obscure; both restricted access and public license.
- Applied **data stewardship** experience including classification & organization, metadata and other documentation, and quality control. I have worked hard to ensure that there is no ambiguity in the organization, content, quality, precision, history, or source of my data.
- Comfortable using, maintaining, and developing many geospatial data formats including raster; point; and vector files, shapefile; CSV; geodatabase; and other common 'GIS layer' file formats, spatial and relational databases, table- and file-linking, archival formats, many raw data formats, image stacking and raster band management, and other data formats integral to modern geospatial data.

- **Software** experience for acquisition, processing, manipulation, display, and documentation of GIS data including imagery; e.g., ArcGIS et al. (versions 3-10), Erdas Imagine, Envi, PCI Geomatica, Lastools; Fusion; MCC; and other Lidar tools, R, and other programs. Use, maintenance, and installation.
- I have instructed others in the use of GIS and geospatial software and consulted supervisors, coworkers, students, etc. for assistance and methodological questions related to GPS hardware & software setup, data sources, and techniques.
- I have built, selected, installed, maintained, and debugged various stand-alone and peripheral computer and scientific hardware including designing, building, and upgrading GIS & graphics workstation computers, and assured that software and hardware were compatible, optimized, secure, and up to date.
- Extensive use and creation of oblique aerial photography for the interpretation of landscape patterns, including impact assessment, wetland delineation, and vegetation mapping. I have done aerial photography from fixed wing and helicopter aircraft for use in vegetation mapping and classification, site and project documentation As a long-time photographer I understand light, optics, composition, and other aspects important to successful photography.
- Trained in cartography and map design and communication. In addition to GIS & other digital methods I also have used 'traditional' cartographic methods and techniques including map composition and communication, inking and drafting techniques, paste-up, lettering, and pen-and Mylar drawing on overlays of images (including stereopairs) to delineate vegetation and other landscape boundaries.
- Knowledge of color theory, typography, and other methods critical to effective mapmaking and other graphic communication whether digital or hand-drafted.

Specific working experience and applied projects:

In my work for the **US Fish & Wildlife Service** Inventory & Monitoring branch 2012-present, I have used GIS data and remote sensing products for all aspects of project management and implementation from planning to reporting, including:

- GIS & image analysis to develop broad landscape classifications and to select potential field sites.
- As most sites had no record of previous visit, accurate interpretation of available data (mostly recent satellite imagery and older aerial photographs) was important to preparing for fieldwork and transport.
- GIS to weigh site restrictions & goals (land ownership & access limitations, aircraft & boat travel/fuel distance capabilities, radio communications, safety considerations, etc.).
- GIS to weigh sites that are safely accessible by our mode of transport (helicopter, fixed-wing plane, boat, foot), and that can be efficiently navigated on foot between desired vegetation types.
- I have made much use of project field maps for planning, information to field crew and pilots, field navigation, and in safety plans to clarify fieldwork location, possible travel routes, and where crew are in relation to base camp and/or transport in case of emergency.
- Spot 4-5 imagery has been particularly useful in this landscape-scale classification and interpretation, and higher resolution imagery (Worldview, Ikonos, etc.) for the field navigation maps, clarifying site configuration, and understanding potential navigation or access challenges.

- I have made maps to document fieldwork and sites in presentations and documents, illustrate trip and fieldwork reports, map species occurrences, etc.
- I have assisted others in FWS in acquisition of satellite and aerial imagery and other geodata for their projects, and made field maps for their use.

In my work at the **US Forest Service Rocky Mountain Research Station** (RMRS) 2010-2012, I worked primarily with remotely sensed geospatial data including Lidar-derived products, aerial and satellite imagery, etc. to detect and analyze ecological conditions and change, particularly forest structure modeling and fire-related conditions. Primary tasks included:

- Acquisition, management, processing, analysis, and documentation of remotely-sensed geospatial data (imagery, Lidar, vector), and conversation to and from other formats.
- Ecological and forestry field data collection.
- Preparation of imagery, maps, reports, presentations, and other research data communication.
- Computer & data assistance.
- Preparation of field research equipment and data.
- Data management including processing procedures and documentation, geospatial database management; metadata documentation and maintenance and accuracy checks.
- Preparation and dissemination of data to archive (on- and off-site).
- Assistance in various RMRS field station projects and planning.

Skills I developed at RMRS included:

- I dealt frequently with large Lidar datasets at RMRS, and I am familiar with software and methodology for scripting and processing and classification of large unclassified Lidar datasets in binary or .las format to derive surface models, forest stand metrics, and various GIS-ready raster and vector files for project-specific uses.
- I worked regularly with raster imagery at RMRS, including acquisition, processing, manipulation, and derived products. The most frequent products were satellite imagery (Geoeye, Spot, QuickBird, Ikonos, WorldView, Landsat) and NAIP and other contemporary and historical aerial imagery.
- I manipulated and processed imagery for various analytical and modeling purposes including detection of fire area and intensity (using NBR and NDVI indices), temporal comparisons of vegetation conditions (using imagery from multiple years and various methods), impacts from logging operations (using PCI and other methods), human-driven landscape change, comparison and standardization with Lidar data, as well as visual interpretation of ground features and conditions.
- I projected (or reprojected), orthorectified, and georeferenced unprojected and poorly-projected satellite imagery using Envi, Imagine, ArcGis and other software.
- I became adept at obtaining high-resolution and historical satellite and aerial imagery from diverse sources (military, state and federal government agencies, NGO and international bodies) to meet specific temporal, spatial, and data goals.

- In my work at RMRS I most commonly used ArcGIS versions 9 and 10; Envi versions 4 to 5; Imagine 9 to 11; Lidar applications including Fusion, MCC, Lastools, and BCAL Lidar; multiple geospatial data viewing applications, R for data manipulation and statistics, and various GPS software (Garmin MapSource et al., MDNR DNR Garmin, Trimble Pathfinder Office et al., and others as needed).

In my 2010 work for the **US National Park Service's Central Alaska Network** I used several geospatial methods in long-term ecological monitoring fieldwork and reporting:

- I used ArcGIS and other software to create maps and other cartographic products for use in backcountry navigation, field site assessment, and for use in project reports.
- I used Trimble and Garmin GPS units, as well as map & compass and aerial imagery to navigate in remote wilderness settings.
- I used Trimble GPS units and Trimble Pathfinder Office software to collect; process; and export project-specific field GPS data to GIS.
- I instructed my field crew in use of Trimble GPS use and other field techniques.

In my work as a geospatial contractor DBA **Vermillion Geographics** 2009-2010, I used my GIS and cartographic skills to locate, edit, and document GIS data and produce maps with these data as needed by individual project:

- I reconstructed GIS data and produced metadata for an NGO's Arctic research project, which had been shelved for several years following data acquisition and mapping, that they needed to revisit.
- This included 'reverse-designing' the GIS projects and maps, then repairing or editing corrupt files, deciding which of numerous versions of files were the most accurate or intended, tracing or estimating processing history, determining data sources and history, and writing documentation for files and projects. This was also a good applied lesson in the importance of sound data management and organization.
- Other projects included producing GIS files and maps for historical landscape mapping, forest fire mapping and analysis, and a project promoting bicycle touring in the Upper Peninsula of Michigan.

At the **USDA Natural Resources Conservation Service** in 2007-2009 I was responsible for various GIS and cartographic tasks related to soil and landscape mapping in interior and southern Alaska, including:

- Compiling existing ecological data (soil, topography, vegetation association, geology, etc.) for field planning and project management.
- Identification, interpretation, and tracing of landscape-soil unit polygons to Mylar overlays using photography stereopairs and viewer ("pre-mapping" in NRCS terminology).
- GIS & imagery analysis and interpretation of field data for development and classification of landscape-ecological units.
- GPS field data collection and navigation.

At the **World Wildlife Fund**, I compiled existing scientific data from disparate international sources in order to evaluate conservation status and facilitate long-term priority planning of WWF projects in the greater Bering Sea ecoregion of Alaska and Russia:

- Data were in various formats including text summaries and reports, databases, and geospatial/GIS files; my work was to collect and compile these data into a comparably formatted comprehensive database of easily accessed and understood information that facilitates easy future refinement so that the data will remain viable and accurate.
- To accomplish this, I created database, GIS, and written documentation of the data to precisely document the data and metadata (spatial and temporal coverage and accuracy, sources, limitations, manipulation records, etc.) so that others after me can add updated information.

As a vegetation ecologist at **Denali National Park** & Preserve 2004-2007, proficiency in geospatial and other data acquisition, management, and presentation facilitated my contribution to an environmental assessment project (EA), Park management planning, law enforcement investigations, and resource management projects; for example:

- I collected extensive field data on vegetation, soils, hydrology, and environmental degradation from off-road vehicle use. My primary field data recording tools were Trimble GPS units with project-specific data dictionaries that I wrote, photography, field notebooks, and data recording forms. With GPS I spatially documented site conditions (e.g., linear ORV impacts, degraded wetlands) and defined the location or extent of other data (e.g., plant collections, photography sites, plot markers) with point, linear, and area features.
- I transferred GPS data to GIS using Trimble Pathfinder Office. These data were then edited in ArcGIS to integrate non-digital field data (datasheets, notebooks, etc.); for example, adding additional photo data or hyperlinked photos to the GPS-collected photo points. I also created new GIS layers (for example, creation of project research area borders and extent of areas visually investigated).
- These GIS data were used extensively throughout my time at Denali to produce maps (including a large scale vegetation landscape map), tables, and other outputs to disseminate and summarize the data, as well as to add information to the NPS Alaska Region GIS dataset (for example, ORV and foot trails that I mapped for the first time, historical mining claim stake locations, and significant species locations).
- I performed GIS analyses using my field data with other geospatial data including aerial photography and Ikonos satellite imagery, NRCS soils data, digital elevation models, digital orthoquads, and other data to provide additional contextual data and extend the usefulness of my field data beyond areas that had been investigated on the ground.
- I used the results to determine impact areas, intensity, landscape characteristics, and boundaries to document sensitive sites, to model probable impacts and severity of ORV use by landscape, to review fieldwork progress, and to create maps for reference during fieldwork.
- I trained a variety of "borrowed" field crews in the GPS, GIS, and field techniques used in my fieldwork.

At **Glacier Bay National Park** & Preserve 2002-2004, I worked on several projects that combined field data collection, data management, database, analysis, and GIS components.

This included extensive GIS-based vegetation and habitat delineation and mapping, fisheries-related gear and vessel monitoring and location mapping, and development of field and data manipulation techniques to support fisheries and habitat research. My supervisor, Chad Soiseth, was appreciative of my work, and stated on my performance review:

> "The final results for a project of this magnitude employed a relatively novel and untested approach with few guidelines and no existing protocol. Ultimately, Rob's continued dedication, expertise and attention to detail have benefited the NPS through a vastly superior product. Rob's previous work on this project two years ago along with his botanical knowledge and geography background proved to be the best possible fit for this project and we applaud his contribution!"

A complex project that I led during several steps was landscape mapping of temporal change resulting from isostatic rebound and vegetation, soil, and hydrological development in a recently deglaciated (early 20th century) outwash plain in the Dry Bay area of Glacier Bay NP. The product of this work was four discrete sets of orthorectified geospatial imagery (1948, 1966, 1978, 1996) and four vegetation landscape maps for the same dates of the area.

- A first step for the vegetation mapping was creation of suitable geospatial imagery (this was before much aerial or satellite imagery was easily available for Government work, particularly in Alaska).
- I processed four sets of printed aerial photographs and converted to geospatial raster imagery upon which later vegetation delineation would be done.
- I developed workflow and techniques for efficient and high quality processing of all steps using a very large number of printed aerial photographs of varying scale, type, quality, and condition; and adapted accordingly for consistency between data sets.
- Starting from the photographic prints (some of which were in states of advanced degradation) I scanned the photographs, performed various digital image adjustment; color; and tonal balance, and other processing to maximize clarity.
- I then located ground control point selection (for point features that could be identified on all photographs from 1948 to 1996 to ensure full-temporal comparability), the performed image georeferencing, orthorectification, and photomosaicking the final output data into conveniently-sized image tiles.
- The result of this work was a set of four discrete georeferenced aerial photography layers with metadata for use in the next step (landscape mapping) and in future projects.
- Following production of the geospatial imagery sets, work commenced on mapping vegetation based on the imagery. I used GIS analysis and mapping the aerial imagery, mylar interpretive aerial photography overlays of vegetation data co-developed with the Alaska Natural Heritage Program, site vegetation data I collected in the field, and post-field data interpretation to map long-term vegetation and landscape change.
- The data were produced as GIS shapefile and geodatabase beginning with on-screen polygon drawing over imagery diaplays, through several stages of editing for topological and other quality control, to final review and metadata and project directory documentation.
- Programs used for the combined projects included PCI Geomatica georeferencing and photomosaicing software, ESRI ArcView and Arc/Info, Adobe Photoshop, MS Excel and Access to log image and processing data and to organize work progress, several photo databasing programs, and other common software such as word processors, data converters, text editors, etc.
- During summer 2016 I have been in discussion with my old colleagues on continuing this work toward a publication on the landscape succession of Dry Bay.

In my first summer at **Glacier Bay National Park** (2002) I worked on two projects at for which I assumed responsibility; 1) long-term fisheries gear distribution data and surveys, which occupied about 30% of my time, and 2) vessel distribution and activity surveys and mapping in the coastal areas of the Park, which occupied the other 70%.

These projects were split approximately half and half between field surveys and office tasks, and compilation, analysis, and management of field data and the presentation of results required intensive data management skills.

The first project was to reorganize and standardize disparate data on fisheries gear location surveys that had been collected by various field workers over 10 years, to determine changes in resource use in Park waters. This project was a good example of important historical resource use data that were nearly lost in the "digital dump" of computer evolution, which I resurrected it by careful and creative data management.

- The project data had been collected and stored in MS Access, MS Excel, FoxPro, Delta Graph, GIS shapefile, and field notebook format; often existing in more than one of the formats but with differences in date and/or data and often with little or no metadata of field methodology information.
- During this work it was frequently necessary to extrapolate or infer data history facts from other sources so that data collected in previous seasons would compare to that collected in the current and future seasons in quality, quantity, and reliability – thus a great deal of interpretive, intuitive, and creative ability (and patience!) was needed.
- I combined and standardized the data into a single MS Access database with GIS data layers to show the spatial components. This was an early and very good lesson in the importance of data management.
- For the same project, I made monthly field surveys to collect new data, and developed and documented standard field protocols for future fieldwork.
- In field surveys I collected data on distribution and registration onto project-specific field data forms and collection of GPS position data. These data were later combined and transferred to GIS and the project database.
- The output products of this project work were an improved, updated, and verified survey database for all years; a set of data collection protocols and methods for future data collection; and a set of standardized GIS data and maps showing existing data and other project information such as survey areas and paths.

The second project I worked on that summer was documenting fisheries activity in Park waters using airplane surveys to identify vessel fishing type (e.g., longliner, troller, seiner, etc.) and use intensity.

- Because the original lead for the 2002 fieldwork on this project left soon after the beginning of the season, I took over as project lead, assuming responsibilities including flight survey scheduling and safety equipment and documentation, data management and manipulation, field methodology protocol writing, and project status reporting.
- Field methods involved extensive flight surveys including aerial photography, GPS, and data collection (often while in rough air or making sharp turns).

- Post-field work involved integration of the field data from GPS, photos, and field sheets to GIS, film scanning, image processing and databasing, vessel identification from vessel ID numbers in the Alaska DFG database or matching features to other photographs when a vessel number was not visible or legible, and GIS mapping of vessel locations, survey paths, and other project data.
- The product of this work was a set of GIS and spreadsheet data of vessel locations; identities; and activities, a series of maps and cartographic analyses of vessel use patterns, an updated field methodology protocol, a photographic database of known vessels and their identifying features, and a project report.
- This project continued the following year after my fieldwork, and results for the entire project were published in 2007 (see Soiseth et al. on my resume publications section).

Updated: December 2016