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Remote Sensing Analysis of the Nechako Plateau using Landsat, ASTER and SPOT Datasets

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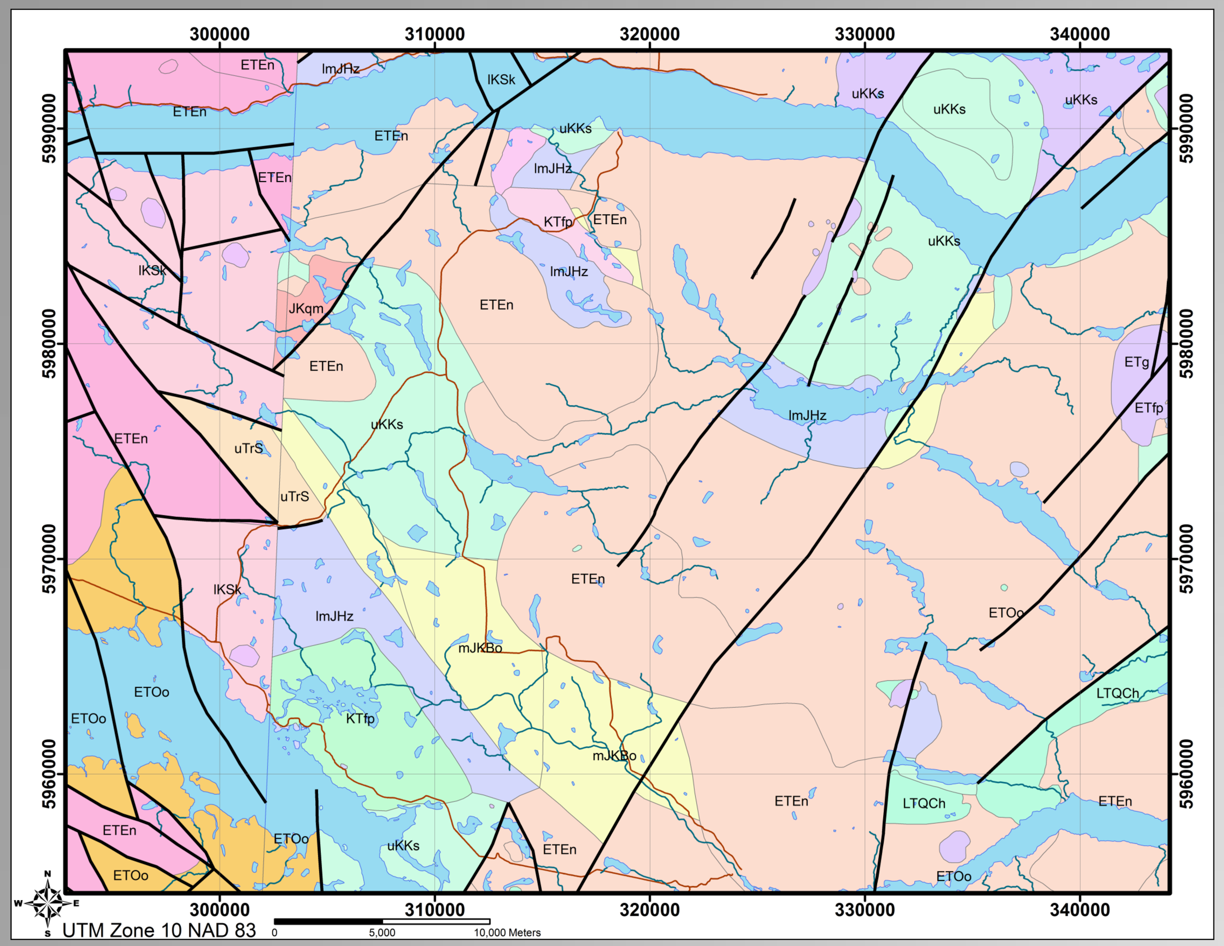
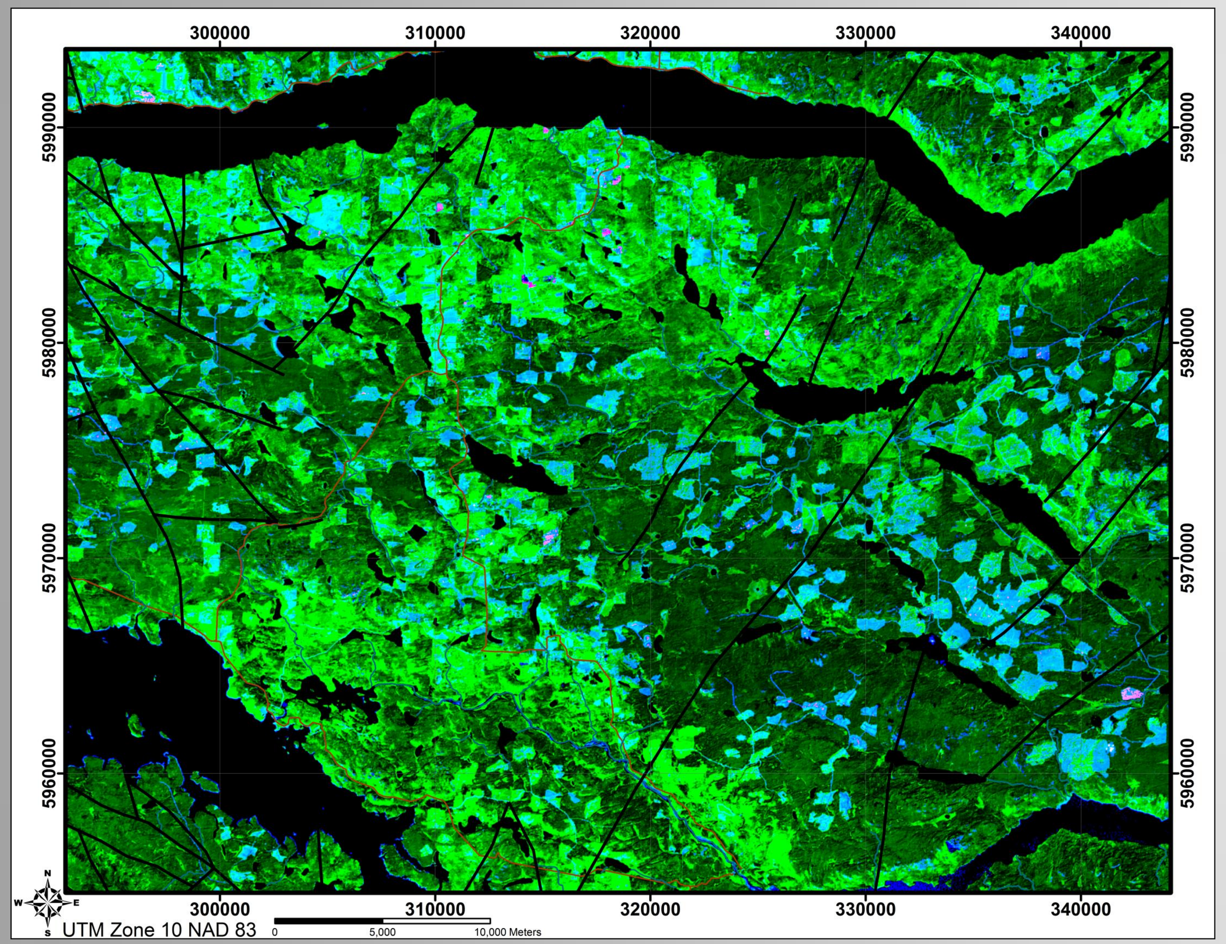
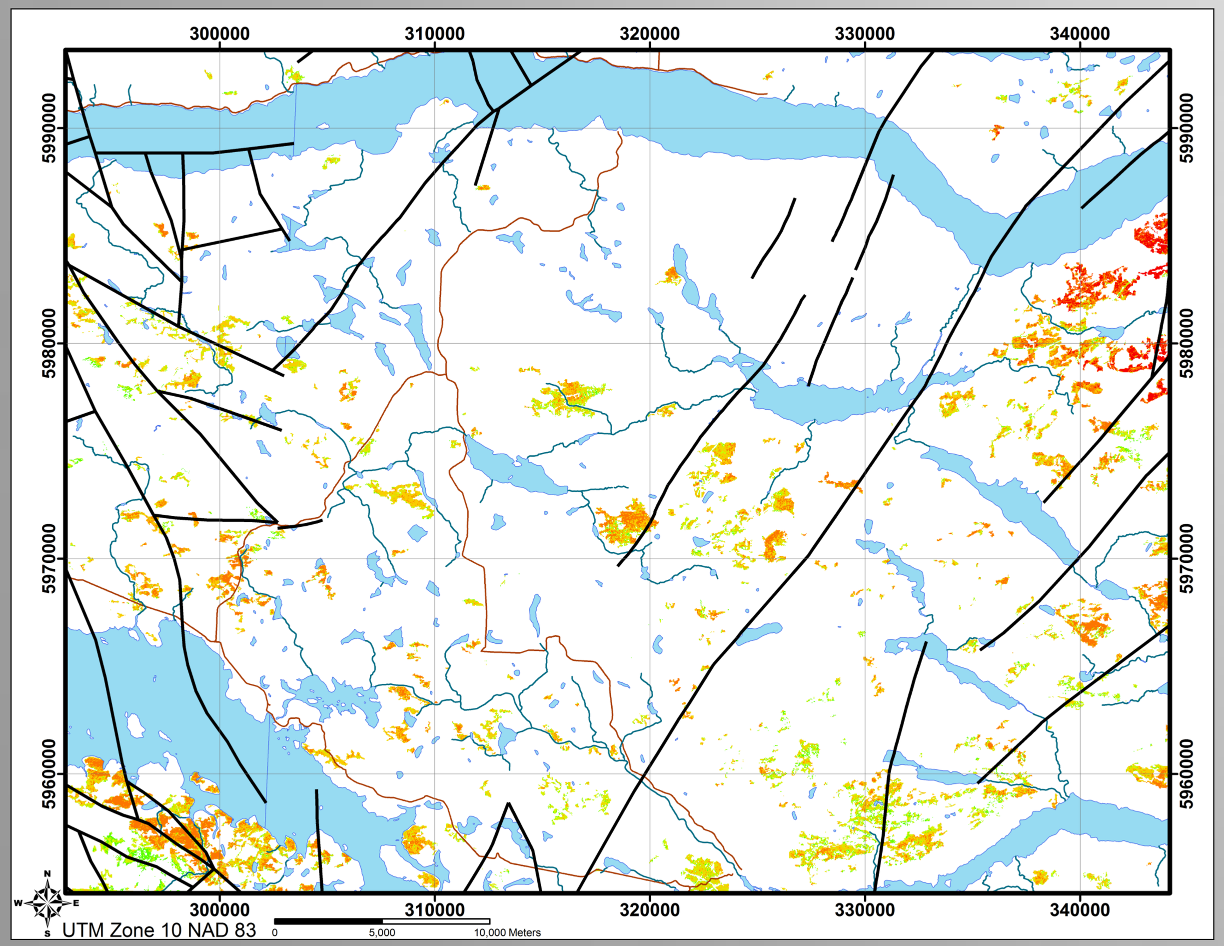


The Nechako Plateau is located within the Intermontane Belt and is comprised mainly of the Stikine, Quesnel and Cache Creek Terranes (Struik et al., 2001).



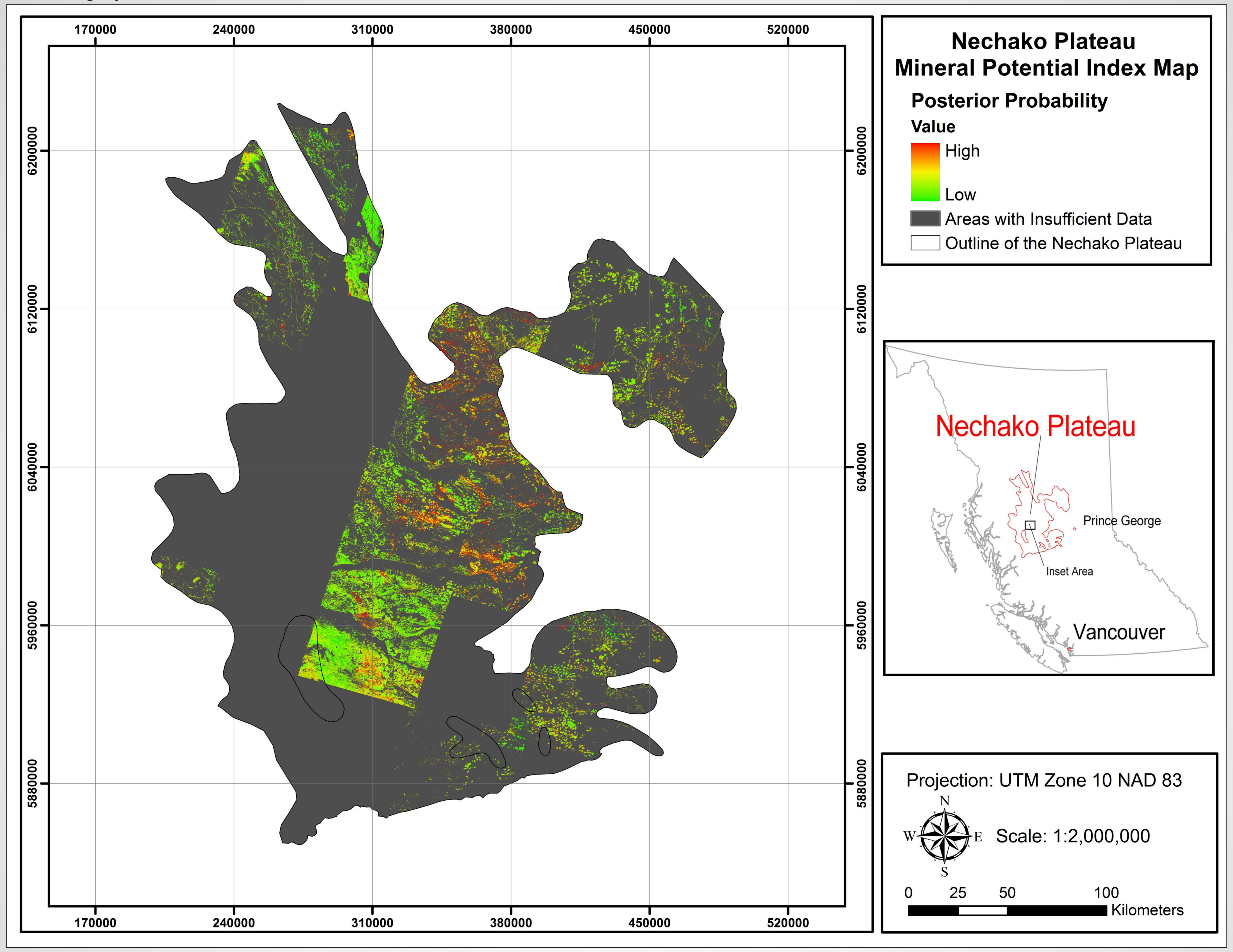
A Landsat ETM+ false colour composite (FCC) image of the inset area using bands 6, 4 and 1 (RGB). Vegetation is green, weathered soils are blue, and pink areas are granitoids (as per Kujjo, 2010).



An ASTER Principal Component Analysis (bands 1 to 9, PC3) image of the inset area showing potentially metal-stressed lodgepole pine trees highlighted in red.

Introduction:

Mineral exploration programs involve extensive sampling and surveying to determine the mineral potential of an area. Often, many areas are overlooked due to deep soil and thick vegetation covers (e.g. the Nechako Plateau). Using readily available data from Canadian agencies, the analysis of this information is used to pinpoint areas of potential mineral occurrences with an overall goal of facilitating exploration for minerals within the project area. The objective is to create a Mineral Potential Index Map using Landsat, ASTER and SPOT satellite imagery of the Nechako Plateau located in the Interior of British Columbia.



A Mineral Potential Index map of the Nechako Plateau using geology, clays, lineaments and metal-stressed trees as evidence layers and MINFILE locations, plus geochemistry data, as the training layer for ArcGIS 9.3 Grand Weights of Evidence tool.

Materials & Methods:

A spatial database was built to include Landsat, SPOT, ASTER, geology, MINFILE and geochemical data from the following sources: NRCan Geoscience Data Repository (geology and geochemistry), Geobase (Landsat and SPOT orthorectified images), and MapPlace Exploration Assistant (ASTER images). Data processing involved the reclassification and simplification of the spatial and satellite imagery. The metal-stressed vegetation maps underwent Principal Component Analysis, using all reflectance ASTER bands, and reclassification. PCI Geomatica LINE algorithm was used to extract lineaments from the SPOT panchromatic images. The integration of the data was accomplished via the ArcGIS 9.3 extension ArcSDM Grand Weights of Evidence tool. MINFILE locations and NGR plus RGS results were used as training sites. The tectonic units (geology NRCan), metal-stressed trees (ASTER PC3), kaolinite (ASTER FCC 8-1-1), alunite (ASTER FCC 9-0-0), geology (Landsat FCC 6-4-1) and SPOT lineaments were used as the evidence layers in the creation of the mineral index potential map.

Results:

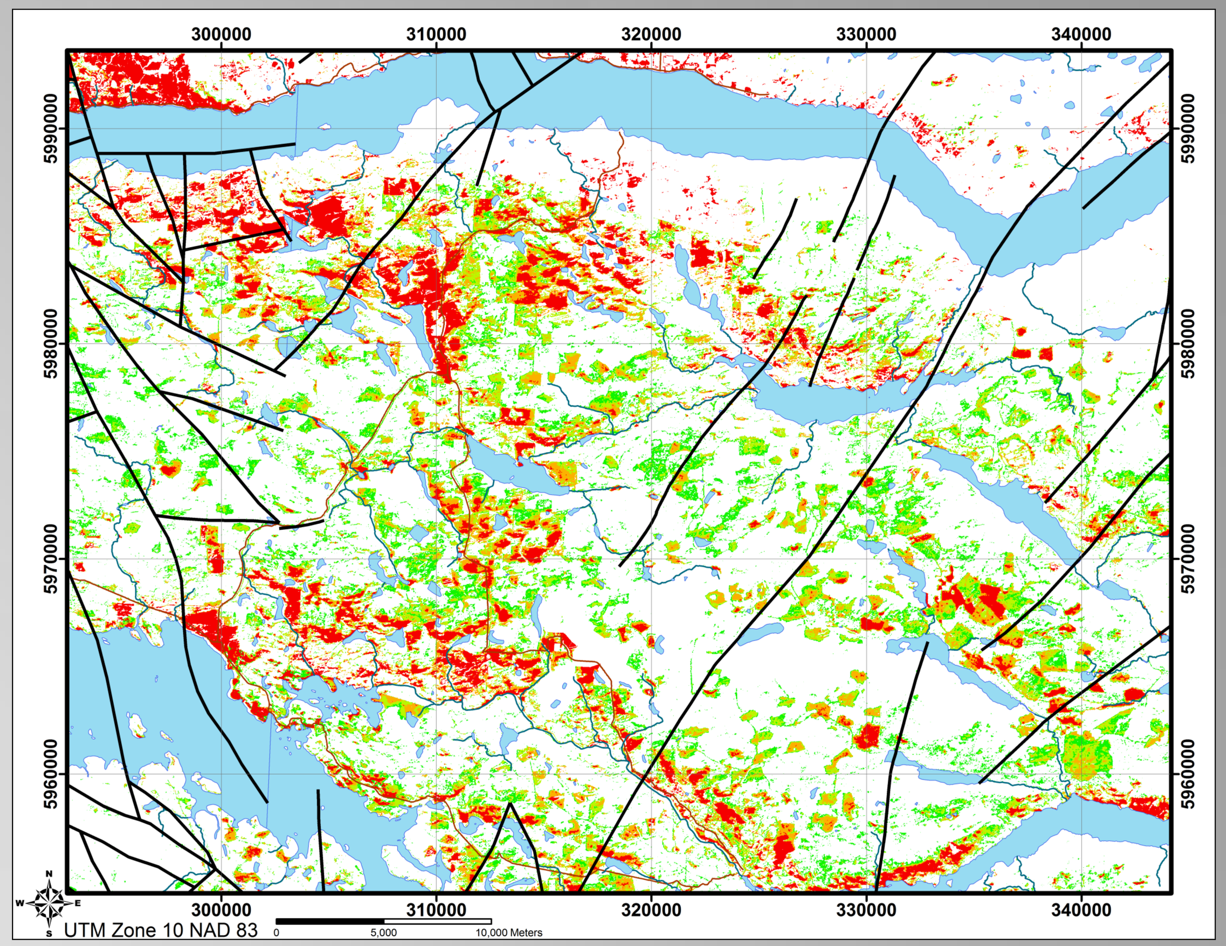
A Mineral Potential Index map was created depicting the areas with an increased probability for mineral occurrences based on the known locations of previous mine workings, showings and prospects; as well as regionally anomalous geochemical results. The evidence layers, used for the prediction of the mineral occurrences, include tectonic units, rock compositions, clay speciation, metal-stressed lodgepole pine and lineament proximity, resulting in an index map for the mineral occurrence potential within the Nechako Plateau.

Literature Cited:

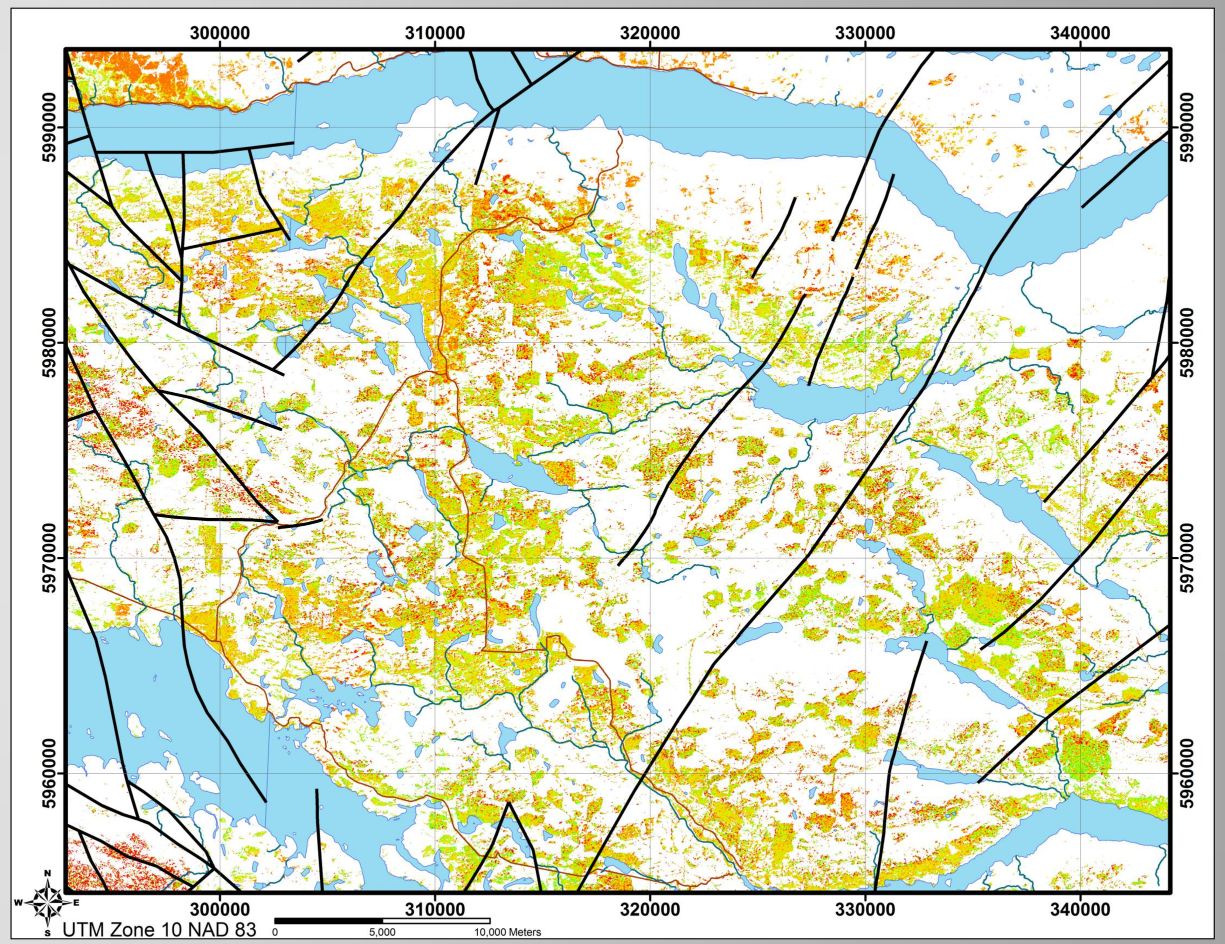
Struik, et al. (2001). Nechako NATMAP Project: A digital Suite of Geoscience Information for Central British Columbia. GSC open File 5623.

Kujjo, 2010. Application for Remote Sensing for Gold Exploration in the Nuba Mountains, Sudan. Unpublished M.Sc. Thesis, Bowling Green, Ohio, Bowling Green State University.

Kalinknowski, et al. (2004). ASTER Mineral Index Processing Manual, Remote Sensing Applications, Geoscience Australia.



An ASTER False Colour Composite image (bands 8-1-1, RGB) of the inset area highlighting the presence of kaolinite (as per Kujjo, 2010).



An ASTER ratio image highlighting the presence of sericite and illite within the inset area (bands (5+7)/6); as per Kalinknowski et al., 2004).

Conclusions and Recommendations:

This non-invasive, remote sensing method may decrease the costs of mineral exploration and has the potential to facilitate the discovery of yet-uncovered ore deposits. This methodology may also open up areas that are difficult to access or contain less than ideal sampling mediums (e.g., heavily forested areas and areas with thick till cover). Future work will include developing ore models for use with other spatial data modelers (e.g., Fuzzy Logic), extrapolating the evidence layers for a more comprehensive overview, enhancing the remote sensing determination of metal-stressed vegetation and developing methods for use in smaller-scale applications.

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