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Rationale

Hydrologic response in small watersheds depends in part on the subsurface architecture of the soils and the soil/bedrock interface while in subsurface flow pathways and networks it is dependent on antecedent conditions and rainfall intensity. Currently there are few methodologies and measurement techniques available for characterizing this important subsurface architecture at the watershed scale. We demonstrate the use of 'soft' spatial data, collected using electromagnetic induction.

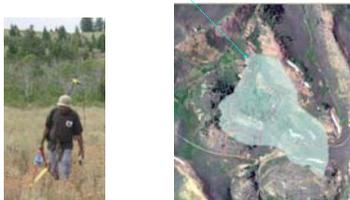
Introduction

Spatial pattern modeling of catchment hydrological processes is limited by the availability of time-sensitive high resolution maps of subsurface architecture. Electromagnetic induction (EMI) instruments are gaining wider use for this purpose due to their non-destructive nature, rapid response and ease of integration into mobile platforms. From EMI measurements the soil apparent electrical conductivity (ECa) can be calculated and calibrated to a number of soil properties including: soil salinity, moisture and clay content. The objective of the study is to infer the textural properties of a watershed through EMI mapping.

Study Area

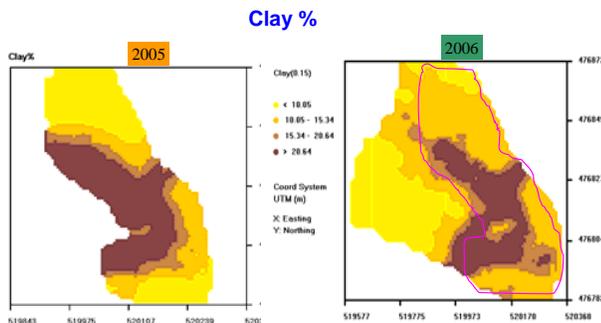
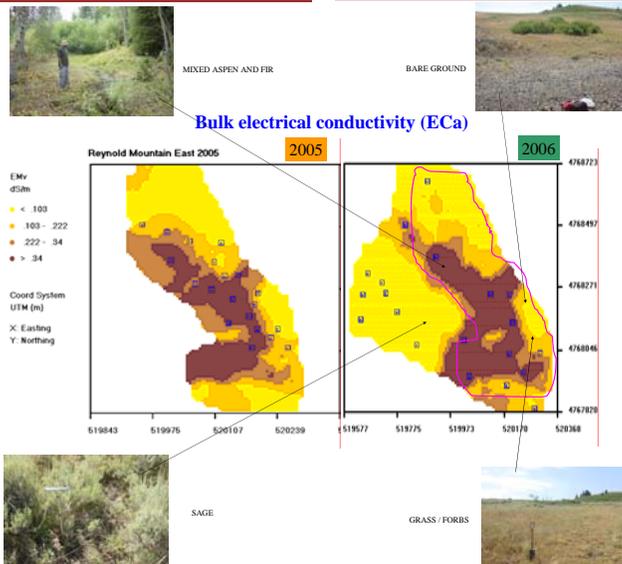
The study area, Reynolds Mountain East (RCE), encompassing 38 hectares is located on the south eastern tip of the larger Reynolds Creek Experimental Watershed (RCEW). RCEW is a 239 km² watershed located in the Owyhee Mountains of southwestern Idaho, approximately 80 km southwest of Boise. The watershed has been continuously monitored since the early 1960s.

Study Area



Methodology

The DUALEM 1-S ground conductivity meter along with a Trimble ProXT GPS unit were used to make non-invasive geo-referenced EMI measurements of the 38 ha Reynolds Mountain East watershed in southwestern Idaho in August 2005 and July 2006. The geo-referenced ECa readings were input into electrical-conductivity statistical analysis package (ESAP) in order to generate an optimal soil sampling plan. Based on this plan, 20 soil samples were obtained at two depths (0-0.3 and 0.3-0.6 m) and analyzed for soil moisture content, electrical conductivity of the saturation paste extract (ECe) and particle size for clay percentage determination.



Results

The maps on the left show the apparent electrical conductivity survey for summer 2005 and 2006. The outlined part of the 2006 ECa survey is comparable to the 2005 survey of part of the watershed. Multiple linear regression analysis in ESAP was used to find the strength of correlation between ECa and EMI survey location points and clay percentage of the top 0.3 m of the watershed.

	Clay%(2005)	Clay%(2006)
R ²	0.91	0.88
RMSE	2.7%	3.8%

Summary & Future Developments

- The apparent EC_a maps provide spatial patterns of subsurface architecture and with calibration provide spatial information on soil properties.
- A higher resolution texture map can be obtained if the watershed is divided into two sections improving the sampling design.
- Future work will synthesize the data to provide a conceptual model of soil-plant-hydrological interactions in the watershed.

References

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