**Coal Mine Reclamation Performance Assessment using Time-Series Landsat Data**

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**ABSTRACT**

The Alberta Energy Regulator (AER) is reviewing the current audit system for coal mine reclamation. The AER/Alberta Geological Survey (AGS) is investigating the potential of Earth Observation (EO) data to enhance the auditing process by identifying sites-at-risk for ground assessment and tracking reclamation progression over time. The criteria for evaluating site-at-risk include vegetation type and vegetation health considering the surrounding land cover type as well as the pre-disturbance condition. Vegetation health is considered as a key site-at-risk indicator as it reflects if the soil is capable of sustaining life. Landsat time series datasets were tested to assess the coal mine reclamation with the extraction of pre- and post-disturbance conditions from 1972 to 2016. The study area includes Gregg River, Luscar, and Cheviot coal mines located south of Hinton, Alberta. Chronology of coal mining disturbances and vegetation recoveries were extracted based on multi-temporal changes in the Normalized Difference Vegetation Index (NDVI). Maximum Likelihood classification was applied to produce time-series land cover maps using training data from the Alberta Ground Cover Classification (AGCC) map. Vegetation recovery was observed on 59 %, 27 %, and 8 % areas of the Gregg River, Luscar, and Cheviot coal mines, respectively. For the Gregg River coal mine, the highest disturbance occurred in 1995 - 2000 (37 %) and the highest recovery occurred in 2000 - 2005 (43 %). For the Luscar coal mine, the highest disturbance occurred in 1995 - 2000 (26 %) and the highest recovery occurred in 1985 - 1990 (23 %). For the Cheviot coal mine, the highest disturbance occurred in 2010 - 2015 (34 %) and the highest recovery occurred in 2010 - 2015 (78 %). For all three coal mines, 90 % vegetation recovery includes grass/shrub/short vegetation and the remaining includes trees/coniferous forest. An average accuracy of 78 % was observed for disturbance, recovery, and land cover classification results. This type of study helps improving the auditing process including validation of industry submitted information to obtain the reclamation certificate.