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A SYSTEM TO EVALUATE PRIME FARMLAND RECLAMATION SUCCESS BASED ON SPATIAL SOIL PROPERTIES

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Project Description and Objectives:

A soil property based formula could relieve these financial burdens and ensure the most efficient process for evaluating and returning agricultural lands to the landowner.

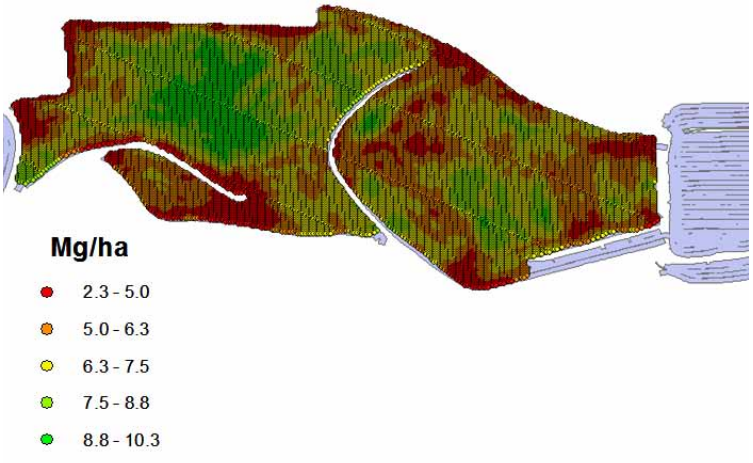
Specific Project Objectives:

- Expediate bond release process
- Save time and money required by bond release process and yield testing
- Increase precision over yield testing
- Provide detailed maps of reclamation efforts
- Provide recommendations for problematic field areas

ABOVE PHOTO: Collection of terrain and electrical conductivity measurements at the Lewis Mine site in Indiana.

Applicability to Mining and Reclamation:

Time required for productivity validation with yield tests over time may be ten times that required for extraction and reclamation. A soil based method of productivity validation will provide the shortest period of time that the land will be out of normal production. Today, after 30 years of reclamation research, the idea of a soils based productivity model for bond release could be a reality because of the large database on yield response to minesoil reclamation and new technology to accurately measure soil parameters on a spatial scale. This would result in reduced time and effort from all involved while not compromising the accuracy of productivity testing.



ABOVE PHOTO: Corn yield variability in 2006 at the Cedar Creek Mine site in Illinois.

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Applicability to Mining and Reclamation (continued):

Our soil-based approach uses measurable soil characteristics to determine if sub-field locations meet the requirements of restoration of field productivity as outlined in existing federal and state regulations.

Methodology:

Georeferenced corn (Zea mays L.), soybean [Glycine max (L.) Merr.], and wheat (Triticum aestivum L.) yield, cone penetrometer test (CPT), VIS-NIR spectrophotometer, apparent electrical conductivity (ECa), elevation and terrain derivatives, fertility, and other site characteristic data were collected on fields at the Lewis Mine site (39°28'N, 87°24'W) in southwestern IN , the Cedar Creek Mine site (40°13'N, 90°85'W) in western IL, and the Wildcat Hills Mine site (37°75'N, 88°35'W) in southern IL. A large database was constructed spanning multiple years of data collection including all sampled sites. Soil-based productivity models were developed using regression and multivariate techniques to assign probabilities of meeting crop yield standards at the partial-field level. Model validation between fields and among sites was conducted to evaluate model robustness across a range of soil types, land reclamation efforts, and farming practices.

Highlights:

Our research indicates that soil compaction and water availability primarily influence a field's ability (bonding area) to meet crop yield standards across time. From our work, we have been able to construct statistical models which predict future yield potential (meeting a bond release standard) at the sub-field level on mine fields in reclamation using only soil properties and weather information. Our models work very well for individual fields in which they were built upon. We have seen that certain measurements like compaction related variables (i.e. CTP tip strength, sleeve strength) consistently describe yield variation spatially and temporally. Model validation between fields and among sites has been encouraging, thus we propose modeling soil variability as a diagnostic tool to identify problematic field areas and to complement yield-based requirements.

Results/Findings:

Successful soil-based models have been developed that adequately predict bond release. Compaction and water related variables are important in describing yield variation across years. We believe our soil-based modeling approach has clear benefits over the current yield-based system, thus we propose modeling soil variability as a diagnostic tool to identify problematic field areas and to complement yield-based requirements.

ABOVE PHOTO: Collection of cone penetrometer test measurements at the Lewis Mine site in Indiana.

Website Information:

The final project report can be found at **http://www.techtransfer.osmre.gov/NTTMainSite/appliedscience/2008appscience/CompletedProjects/ILSpatialSoilPropLEmmons08FR.pdf**

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