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May 18, 2007

Ms. Kristen Andersen, Senior Planner
Tallahassee-Leon County Planning Department
300 S. Adams Street
Tallahassee, FL 32301

RE: Leon County Aquifer Vulnerability Assessment Progress Report #3: BC-06-21-06-53

Dear Ms. Andersen:

We are pleased to present you with the third progress report for the LAVA project detailing work we have completed during the fourth month of the project. An invoice for work completed to date is attached. Please refer to http://adgeo.net/lava.php for additional project information. Please call if you have any questions.

Best regards,

Alex Wood, President
Advanced GeoSpatial Inc.

AW/aw

attachments

LEON COUNTY AQUIFER VULNERABILITY ASSESSMENT PROJECT
PROGRESS REPORT #3 –MAY 19, 2007

As agreed upon between Leon County and Advanced GeoSpatial Inc., AGI will provide progress reports along with invoices and deliverables every month throughout the six-month project period. Each report is intended to detail the progress and metrics of the LAVA project. This third report details work completed between April 19 and May 19 per contract timeline. Work includes sensitivity analysis and test modeling for the fourth month.

Preliminary Sensitivity Analysis/Test Modeling

The model extent was developed based on the Leon County political boundary minus large water bodies. Water bodies are omitted from any aquifer vulnerability assessment to avoid bias in model areas which have no input data associated with them (i.e., no wells are drilled in water bodies and soils data is not typically available for lakes and rivers). Test modeling was initiated on evidential themes which were developed during the first three project months. This task is approximately 100% complete.

Training Point Testing

Test modeling and analysis of the training point datasets revealed an atypical trend in the distribution and values of dissolved oxygen across the Leon County study area when compared to similar hydrogeologic investigations (Marion County Aquifer Vulnerability Assessment, Florida Aquifer Vulnerability Assessment). Further, applying this dissolved oxygen training point dataset in the LAVA model process indicates that patterns in the evidential themes are not reasonable when compared with results of similar projects, and test modeling does not follow basic hydrogeologic principles and logic. Though it falls beyond the scope of the LAVA project, it is AGI's recommendation that this atypical dissolved oxygen trend be further investigated to determine its source or origin.

Previous aquifer vulnerability assessment projects have relied on nitrogen data as a primary training point theme. For example, dissolved nitrogen was used with success in the Florida Aquifer Vulnerability Assessment project to model the vulnerability of all three of Florida's major aquifer systems: the Floridan Aquifer System, the Surficial Aquifer System and the Intermediate Aquifer System (Arthur et al., 2005). Sensitivity analysis and test modeling have revealed that dissolved nitrogen values will serve as more statistically valid training point dataset for the LAVA project. The dissolved oxygen dataset will be reserved and considered as a validation parameter for the LAVA model.

From the same data sources listed in Progress Report 1, a database of wells measured for nitrogen was developed for analysis. Of these wells, 74 were measured for dissolved nitrogen and were extracted as potential candidates for inclusion in the training point theme. If multiple readings were available for a single well, the median value of the multiple sample results was chosen to represent each well as a single point. Statistical analyses completed on the median values revealed the following:

Parameter	Value (mg/L)
Upper Fence	1.06
Mean	0.44
Median	0.21
Q3 (upper 25^{th} percentile)	0.41

Based on this analysis, five median measured values occurred above the upper fence value and were omitted as statistical outliers. Applying the upper 25^{th} percentile to this dataset, results in a training point theme consisting of 18 wells. Figure 1 displays the distribution of wells for which the median dissolved nitrogen value falls above 0.41 milligrams per liter (mg/L) comprising the resulting training point theme.

Soil Hydraulic Conductivity and Soil Pedality Themes

As mentioned in a previous report, two parameters of soils have been tested for input into the LAVA model: *soil hydraulic conductivity* and *soil pedality.* As previously described, multiple empirical values may be reported for any given soil column underlying a particular soil polygon, and multiple columns may be reported for each polygon. From this data, a number of datasets were generated to test in model sensitivity: for soil hydraulic conductivity one each representing average, minimum, and maximum hydraulic conductivity; and for soil pedality, one each representing average, minimum, and maximum pedality.

Soil hydraulic conductivity

Sensitivity analysis indicated that the evidential theme representing average values of the sum of the harmonic weighted averages of hydraulic conductivity values is the most statistically significant theme. These values range from 1.8 to 20.74 inches per hour (in/hr) across the study area. Test modeling indicates that areas underlain by 20.74 to 12.72 in/hr are more associated with the training points, and are therefore associated with higher aquifer vulnerability. Conversely, areas underlain by 12.72 to 1.8 in/hr soil permeability are less associated with the training points, and therefore lower aquifer vulnerability. Based on this analysis, the evidential theme was generalized into two classes as displayed in Figure 2.

Soil pedality

Sensitivity analysis indicated that the evidential theme representing average values of the sum of the harmonic weighted averages of soil pedality values is the most statistically significant theme. These values range from 0.167 to 0.477 (unitless) across the study area. Test modeling indicates that areas underlain by 0.453 to 0.477 soil pedality are more associated with the training points, and are therefore associated with higher aquifer vulnerability. Conversely, areas underlain by 0.167 to 0.452 soil pedality are less associated with the training points, and therefore lower aquifer vulnerability. Based on this analysis, the evidential theme was generalized into two classes as displayed in Figure 3.

To represent the weight soils has on aquifer vulnerability in the final aquifer vulnerability assessment, only one of the two soils evidential themes will serve as final input. They are both presented herein to display the results of the sensitivity analysis.

Thickness of Intermediate Confining Unit

The Intermediate Confining Unit ranges from absent to 124 feet thick across the study area. Test modeling indicates that areas underlain by zero to 50 feet of ICU are more associated with the training points, and are therefore associated with higher aquifer vulnerability. Areas underlain by 51 to 124 feet ICU thickness are less associated with the training points, and therefore lower aquifer vulnerability. Based on this analysis, the evidential theme was generalized into two classes as displayed in Figure 4.

Thickness of Overburden on the Floridan Aquifer System

Overburden on the Floridan Aquifer System ranges from absent to 212 feet thick across the study area. Test modeling indicates that areas underlain by zero to 58 feet of overburden are more associated with the training points, and are therefore associated with higher aquifer vulnerability. Areas underlain by 59 to 212 feet overburden thickness are less associated with the training points, and therefore lower aquifer vulnerability. Based on this analysis, the evidential theme was generalized into two classes as displayed in Figure 5.

To represent aquifer confinement in the final aquifer vulnerability assessment, only one of the above two evidential themes will serve as final input. They are both presented herein to display the results of the sensitivity analysis.

Karst features

As described in the previous report, Leon County staff has participated in the development of a karst layer for the LAVA model. A layer representing all closed topographic depressions in the study area was submitted to intensive shape and size analysis to develop an ‘effective karst’ layer. Based on the results of this effort, numerous effective karst layers were analyzed for input into the model. Effective karst features were buffered into 20-ft zones to allow for a proximity analysis. Test modeling indicates that areas within 1,120 ft of a karst feature are more associated with the training points, and are associated with higher aquifer vulnerability. Conversely, areas greater than 1,120 ft from a karst feature are less associated with the training points, and therefore lower aquifer vulnerability. Based on this analysis, the evidential theme was generalized into two classes as displayed in Figure 6.

Remaining tasks

Overall, the LAVA project is on schedule. The upcoming fifth progress report is due June 19, 2007, and will detail the final modeling results task. The next and final TAC meeting is planned for June of 2007; the results of the sensitivity analysis and the final modeling phase will be presented in this meeting. For reference, the task schedule as in the scope of work is included below.

Table 1. Task schedule for the LAVA project.

Month 1: January 19 – February 19	***Percent Complete***
Project Kickoff Meeting	100
LAVA Scientific Advisory Committee Meeting #1	100
LiDAR implementation and conversion	100
Training Point Theme and Statistical Analyses	100
Invoice amount	$ 7,871
Month 2: February 19 – March 19	
Intermediate Aquifer System/Overburden Thickness Theme	100
Invoice amount	$ 9,850
Month 3: March 19 – April 19	
LAVA Scientific Advisory Committee Meeting #2	100
Other Evidential Themes under Consideration and Testing	100
Soil Permeability Theme	100
Karst Features Theme (to be completed by Client)	100
Invoice amount	$ 7,963
Month 4: April 19 – May 19	
Preliminary Modeling/Sensitivity Analysis	100
Invoice amount	$ 12,428
Month 5: May 19 – June 19	
Final Modeling	100
Board of County Commissioners Meeting	
Invoice amount	$ 13,347
Month 6: June 19 – July 19	
Model Validation	100
Map and Report Development	100
LAVA Scientific Advisory Committee Meeting #3	100
QA/QC of input data and model output	100
Project Results Presentation and Meeting	100
Training Session #1 and 2[1]	100
Invoice amount	$ 21,541
	$ 73,000

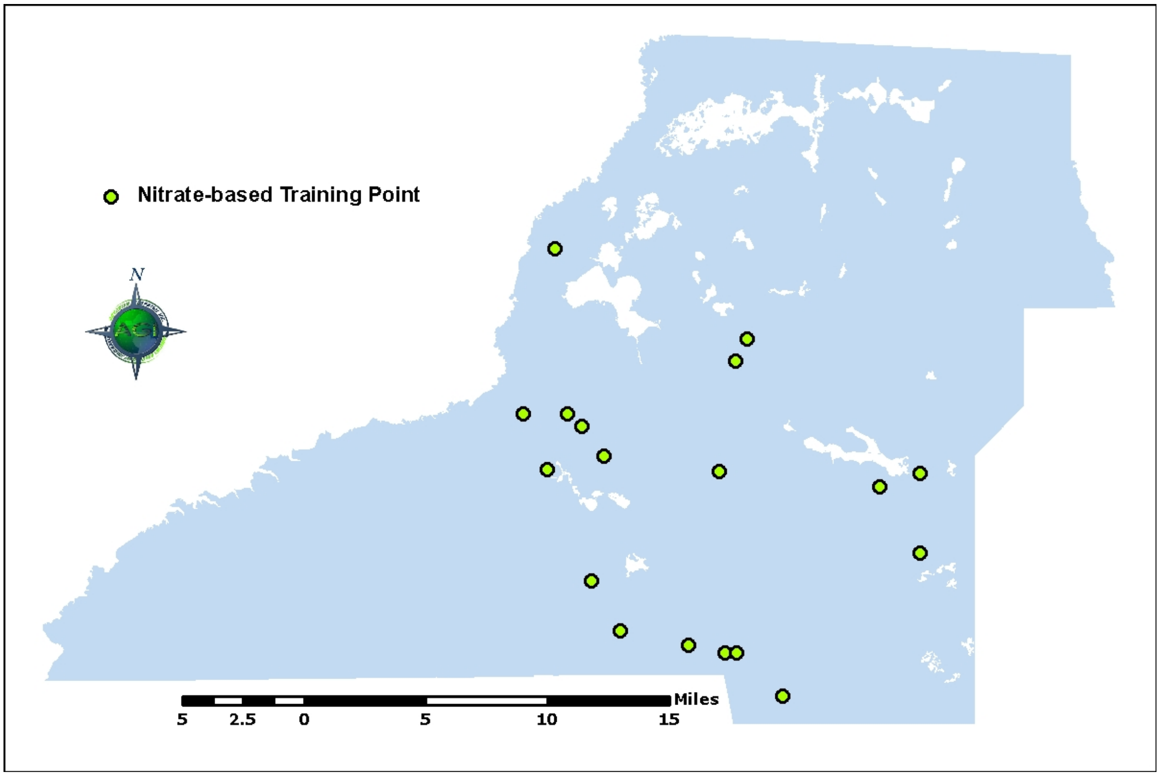

Figure 1. Dissolved nitrogen training point dataset.

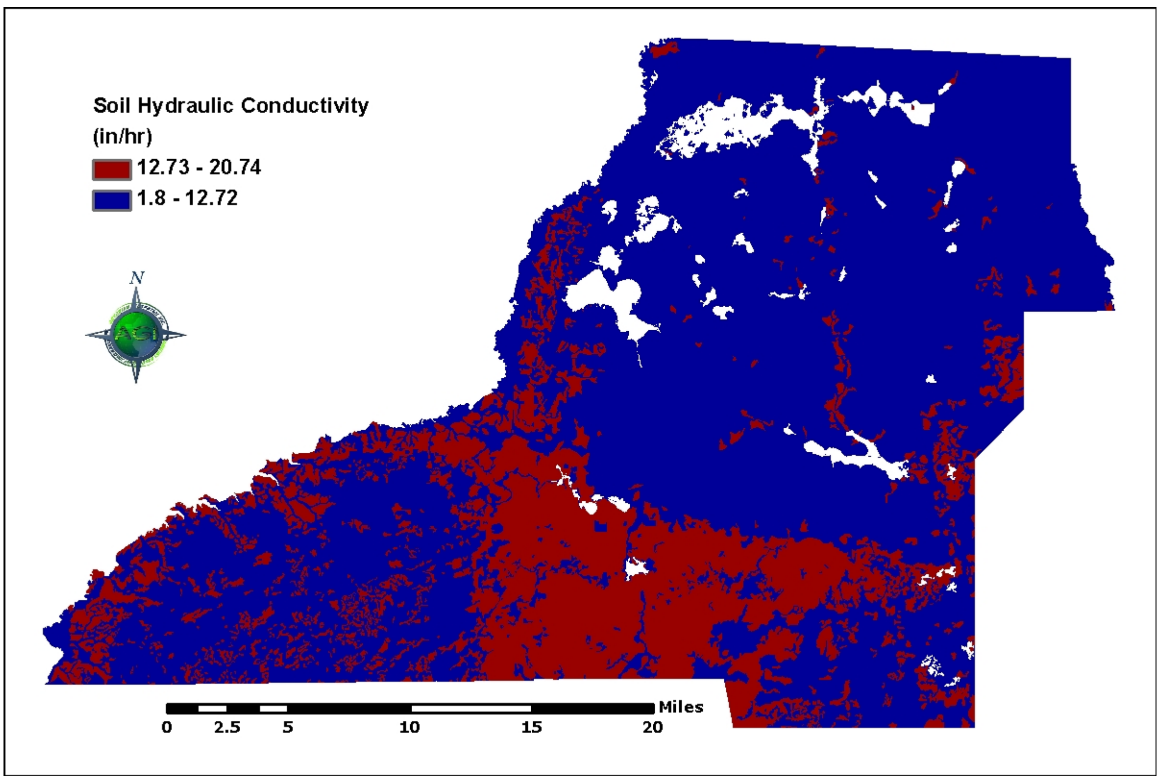

Figure 2. Generalized average hydraulic conductivity values of sum of harmonic weighted averages for soil.

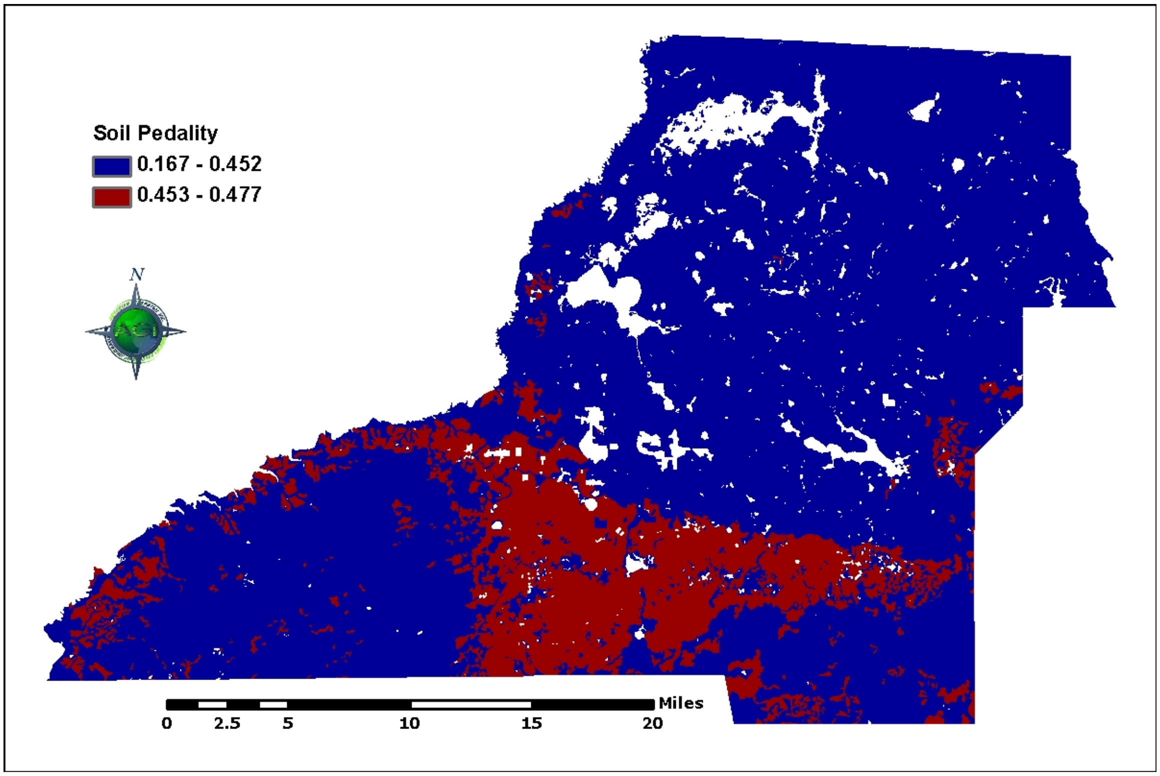

Figure 3. Generalized average soil pedality values of sum of harmonic weighted averages (unitless parameter).

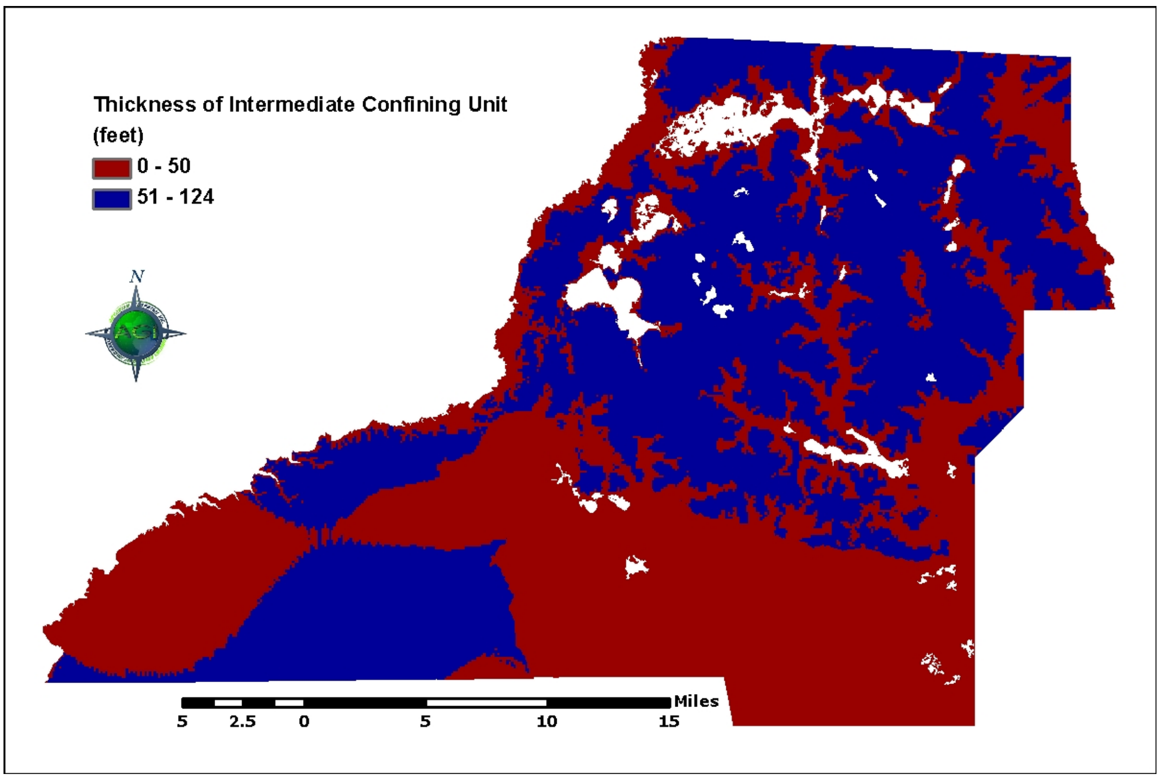

Figure 4. Generalized thickness of the Intermediate Confining Unit thickness.

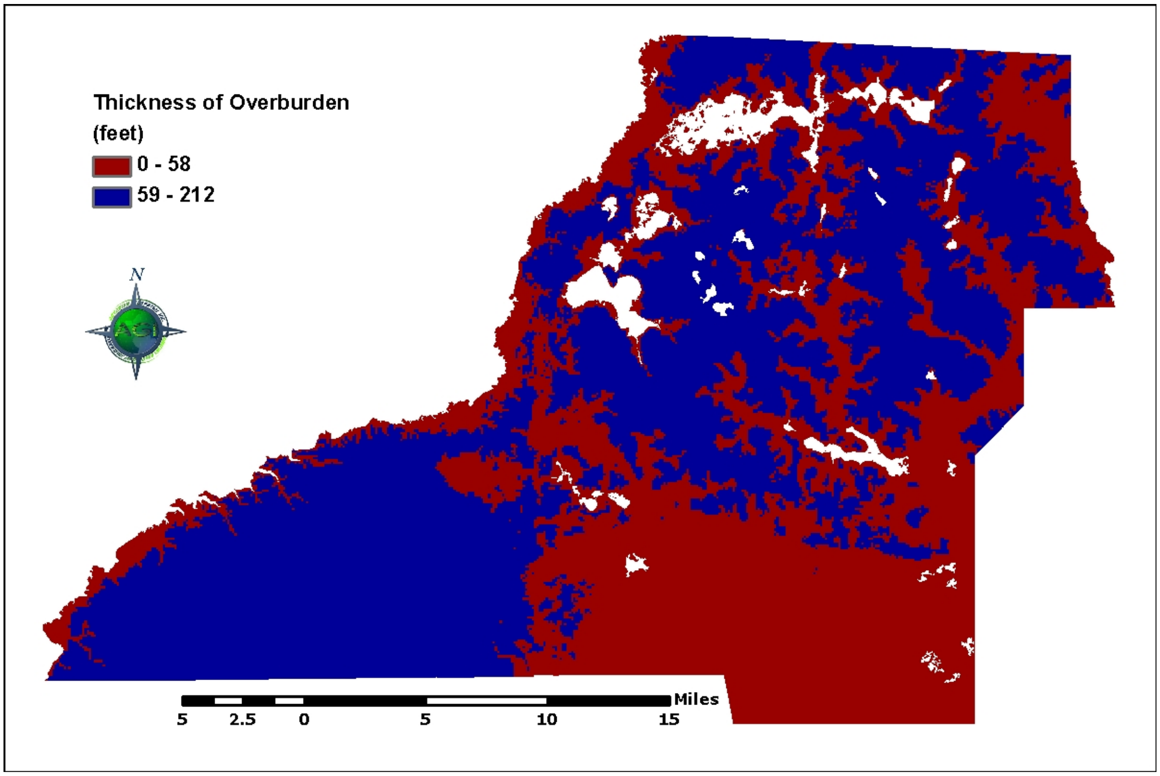

Figure 5. Generalized thickness of the overburden thickness overlying the FAS.

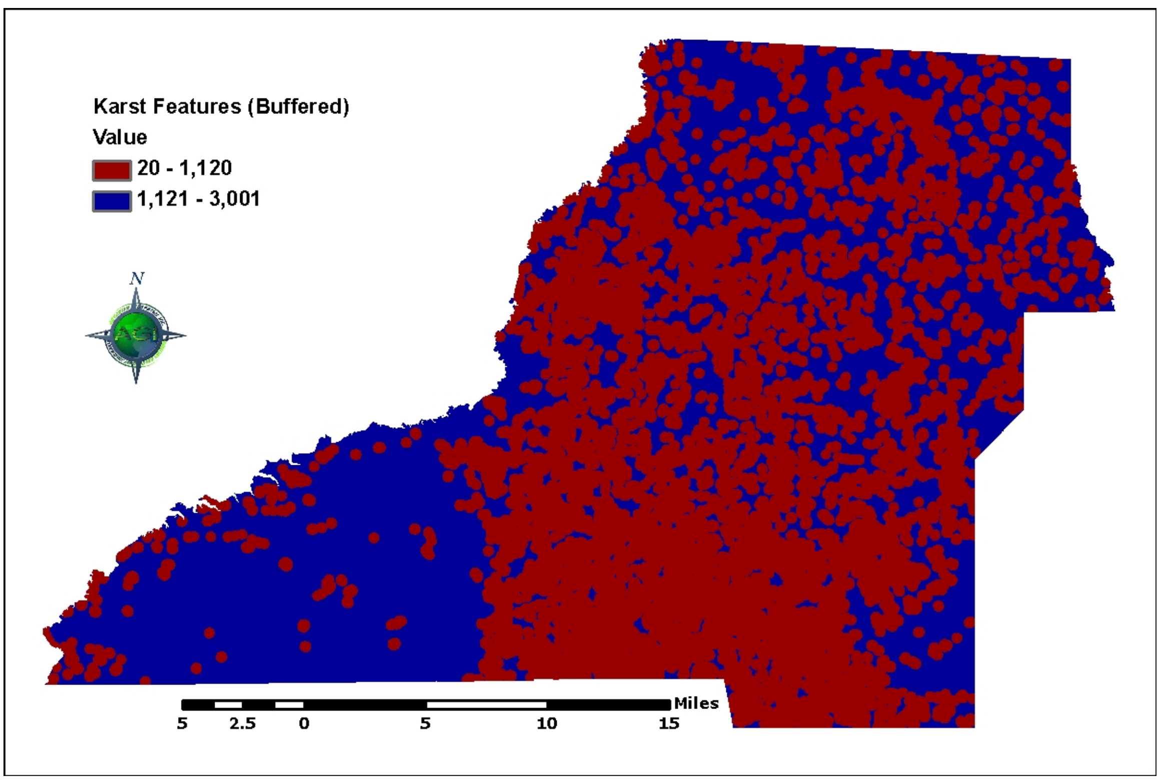

Figure 6. Generalized effective karst features theme.