Wiscland-2 Quarterly Project Update 3

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Executive Summary

The objective of the Wiscland-2 project is to update the Wisconsin statewide land cover map to show the land cover of the state. During this quarter (June-September 2015), the Project Team has been primarily involved in assisting with and monitoring field collection, finalizing the training/validation sample database, establishing protocols and methods for the classification process, and performing Level 1 cross-validation and initial map classification. In the upcoming quarter, planned tasks are largely focused on continuing the Level 1 classification process and moving into the creation of higher level (2-4) maps.

Introduction

The purpose of this document is to update the Wiscland-2 Land Cover Guidance Team on the progress of the project in the previous quarter. Since issuing the previous quarterly report in June 2015, all of the tasks outlined in the "Current Tasks" section have been completed:

- Assisted with training and monitoring of DNR staff during the summer field collection season.
- Monitored, processed, and integrated field collected data submitted via the Land cover Field Reporter (LCFR).
- Began iterative classification process for Level 1 map categories to develop classification model and supply feedback to the DNR.
- Identifying problematic classes and working with the Guidance Team to evaluate options for those classes if needed.

Results

Results related to field collection:

1) Provided ongoing monitoring and inventory of field-collected data.

We supplied weekly reports to the Project Coordinator and DNR to assist in monitoring the efforts of the field technicians and progress toward their collection goals. The weekly reports detailed information on the number and quality of the submitted field polygons and the number of sample points generated. After the three month collection season, 16,092 points were added to the sample database via LCFR submissions, successfully fulfilling 90% of the field requests.

2) Implemented process to submit corrections to existing sample points from field via LCFR

With the DNR field crews acting as 'boots on the ground', they were in the unique and useful position of being able to note any errors or land cover changes in the existing dataset. If a field technician found a previously forested area that had been harvested in the past several years, for example, that area may no longer be an appropriate training site due to forest composition changes. A process was added to the LCFR application that allowed the field technician to indicate an area of existing training points that were mislabeled and submit those updates to the database as part of the weekly field collection data process. This helped to improve the quality of the database. Approximately 100 individual data points across the state were updated or removed from the dataset through this process.

3) Provide recommendations and supporting data to assess classification scheme.

For the remaining 10% of cases where field collection was not successful, the project team identified the issues and provided decision support to the Guidance Team for determining the appropriate action. This included information on where deficiencies in the samples database persist and a summary of field comments to help shed light on why the collection was unsuccessful for those classes. We also provided preliminary accuracy estimates for these problematic classes and put forth additional classes we identified as problematic from the image classification in order to facilitate further discussion between DNR program experts. Cumulative accuracy for the level 3 cross-validations ranged from 64.9% for the upland deciduous forest level 3 classes to 96.2% for the lowland scrub/shrub classes. Level 4 accuracy ranged from 62.9% for the bottomland hardwoods to 92.4% for the central hardwood classes.

4) Designed quality assurance process for two-week field season extension.

After the regular field season was complete, we had the opportunity to implement a quality assurance process to assess the sample data through site visits. With the help of DNR staff, we designed protocols to be carried out by two field technicians over two weeks based on time projections provided by the field staff and analysis of the misclassified sample data from the initial cross-validations.

Results related to <u>image classification:</u>

1) Develop image classification model for statewide classification.

Cross-validation was used for a subset of the state to test the performance of different classification models and optimize model parameters. Over 20 trials varying the sampling technique, sample size, and number of features (images) have been conducted for Level 1 categories and accompanying maps were produced for all models with adequate performance. Statistical and qualitative assessments were used to tweak the model for future runs and successful models were applied elsewhere in the state to reproduce results. These cross-validation results were also used to identify issues with the reference data, leading to a 3% increase in overall accuracy thus far.

2) Digitized cranberry bogs throughout state

Cranberry bogs are listed in the classification scheme for Wiscland 2 as a Level 2 class under the Agriculture category. As an agricultural class, cranberries are not classified using training data, but are to be 'burned' into the final map product along with the crop rotation data. Because the existing digital cranberry data was incomplete, the Project Team digitized the visible cranberry bogs for the creation of the cranberry 'mask' in the final map products by reviewing NAIP aerial imagery for counties identified by the Wisconsin State Cranberry Growers Association (http://www.wiscran.org/cranberries).

3) Automated classification and post-classification procedures.

Throughout the quarter we continued to make progress on automating the classification and post-classification workflow. Notable accomplishments include building a new implementation of the classifier to automatically generate a binary image as well as confidences associated with the predictions, and codes to apply the crop rotation mask, generate confusion matrices from the classified maps and test data, and calculate accuracy statistics.

Conclusions

During this quarter, the SCO has completed tasks in continued support of the field collection necessary for mapping statewide land cover. With the algorithm selection finalized to the C5 decision tree algorithm and feature selection moving forward, Level 1 classification has begun while the Guidance Team finalizes the recommendations for higher-level classes that were not able to be fully collected during the field season.

Current

The Project Team is currently focusing efforts on:

- Creating Level 1 map classifications for each footprint.
- Continuing research to determine features and variables for classification.
- Developing post-classification workflows for segmenting, mosaicking, and refining map classifications.
- Digitize areas of nursery/Christmas tree farms to create a mask of these classes (similar to the agricultural crop and cranberry masks).

Upcoming

There are several priority tasks currently being worked on for the next quarter:

- Creating level 2, 3, and 4 classification maps for each footprint.
- Creating draft versions of the User's Guide and documentation that will be included in the final product delivery.
- Continuing outreach and coordination with other land cover mapping projects.