Environment and Natural Resources Trust Fund (ENRTF)
M.L. 2014 Work Plan

Date of Report: January 15, 2014

Date of Next Status Update Report: December, 2014

Date of Work Plan Approval:

Project Completion Date: June 30, 2016

Does this submission include an amendment request? No

PROJECT TITLE: Update Statewide Land Cover Use Map

Project Manager: Joseph Knight

Organization: University of Minnesota

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Location: Statewide

Total ENRTF Project Budget:		**ENRTF Appropriation:**	$300,000
		Amount Spent:	$0
		Balance:	$300,000

Legal Citation: M.L. 2014, Chp. 226, Sec. 2, Subd. 05a

Appropriation Language:
$300,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to update Minnesota's land cover data at moderate spatial resolution statewide and at high resolution for selected areas, distribute products, and provide training. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

I. PROJECT TITLE: Update Statewide Land Cover Use Map

II. PROJECT STATEMENT: Conservation and management of Minnesota's natural resources require significant investments of time and money by many state/local agencies and stakeholder groups. For example, in FY 2013, Clean Water Funding for restoration and protection watershed projects is over $95 million.

The three components of success in such projects (define problem sources, target and track changes) begin with accurate quantification of land cover via Geographic Information System (GIS) or geospatial data. Land cover data shows the composition of a landscape, such as forest, water, impervious surface, agriculture, etc. Examples of uses for land cover data in Minnesota are:

1. The Metropolitan Council uses land cover data to plan many critical infrastructure projects. Updated land cover data is required to base infrastructure decisions on current information.
2. The Pollution Control Agency (PCA) uses land cover data as input to models describing water flow over the landscape (among other uses). These models are important for projecting where and how water will flow in response to rainfall events of various strengths. Correct land cover data is required because different cover types influence the flow of water in different ways (for example, impervious versus grassy areas). Updated land cover data is required so that limited state resources can be used in the most effective ways.
3. The MN Department of Natural Resources (DNR) Community Forestry group would use updated land cover data to estimate urban tree canopy (UTC) cover for various areas of interest. Information about current UTC is important for estimating the effects of temperature regulation, shading, water flow, and leaf deposition. As UTC changes due to the effects of climate change and pests like the Emerald Ash Borer, models based on older land cover data will increasingly produce incorrect results. Therefore, updated land cover data is required for optimal decision making.

However, the existing statewide land cover data is badly out-of-date (2000) and does not include the effects of the boom growth period, changes in agricultural production, or changing forests. Alternative datasets (e.g. the National Land Cover Data) are inadequate for many of Minnesota's needs. Thus, this project is driven directly by the needs of local, county, state agencies and other stakeholders.

This project will update the statewide land cover data and freely distribute it to all stakeholders. We will produce statewide geospatial data for 2013-2014, with higher resolution data for selected parts of the state. Statewide 1/4-acre (30-meter) spatial resolution products will allow us to identify current land uses as well as track changes from 2000 to today that are applicable to diverse conservation goals. Higher resolution 1-2 meter geospatial data products will be developed for selected urban areas. We are currently planning high resolution mapping for the Twin Cities Metropolitan Area, Duluth, and Rochester. Depending on our progress with the complexities of mapping at such high resolutions, we may modify the list to remove or add areas (if funding and time allow). Any additional areas would be those deemed especially sensitive that would benefit from higher resolution. The University of Minnesota will distribute all of the data and statistics in easily displayed GIS-compatible format through existing information websites including the DNR's Data Deli and MnGeo and the University of Minnesota's (UMN) Remote Sensing website (www.land.umn.edu) as well as provide website tutorials. Three data use workshops will be conducted for project stakeholders at appropriate locations.

III. PROJECT STATUS UPDATES:

Project Status as of *December, 2014*:

Project Status as of *June, 2015*:

Project Status as of *December, 2015*:

2

Overall Project Outcomes and Results:

IV. PROJECT ACTIVITIES AND OUTCOMES:

ACTIVITY 1: Update the statewide land cover map for 2013/2014

Description: The State's land cover data will be updated consistent with existing classifications. We anticipate that the main classes will be: cropland, forest, wetland, grassland, shrubland, water, and urban/developed + impervious surfaces. The classes will be subdivided into more thematic detail where possible. We will search the Landsat imagery archive for data appropriate for an updated Minnesota classification. We hope to be able to use only images from the newly-launched Landsat 8 satellite, as the data quality is better than previous versions of the satellite. However, cloud or haze cover may make complete coverage for the state impossible. In that case, we will use Landsat 5 or 7 images where necessary. The mapping will be done using a combination of Landsat optical imagery and the statewide lidar dataset in an object-based image analysis (OBIA) environment. Unlike previously used pixel-based classification systems, using OBIA allows for a more accurate and aesthetically pleasing map.

Summary Budget Information for Activity 1: **ENRTF Budget:** $ 91,370
Amount Spent: $ 0
Balance: $ 91,370

Activity Completion Date: December, 2015

Outcome	Completion Date	Budget
1. *Acquire satellite data and process for 54 million acres*	January, 2015	$ 10,000
2. *Generate land cover classification datasets for Minnesota*	June, 2015	$ 70,000
3. *Map municipality/MCD impervious surface area for 2,367 MCDs*	December, 2015	$ 11,370

Activity Status as of *December, 2014*:

Activity Status as of *June, 2015*:

Activity Status as of *December, 2015*:

Final Report Summary:

ACTIVITY 2: Generate high resolution land cover/use products for selected Greater Minnesota areas and Twin Cities Metropolitan Area (TCMA)

Description: We will acquire, process and combine high resolution satellite data with existing lidar data for improved land cover classification (2-4 meters). We are currently planning high resolution mapping for the Twin Cities Metropolitan Area, Duluth, and Rochester. Depending on our progress with the complexities of mapping at such high resolutions, we may modify the list to remove or add areas (if funding and time allow). Any additional areas would be those deemed especially sensitive that would benefit from higher resolution. We anticipate having access to sufficient high resolution imagery to perform this mapping. The imagery, which comes from the DigitalGlobe archive, will be acquired via an agreement with NASA (National Aeronautics and Space Administration) and the National Geospatial-Intelligence Agency (NGA) and will be free of charge. An OBIA system, as described above, will be used to classify the

Summary Budget Information for Activity 2: **ENRTF Budget:** $ 86,600
Amount Spent: $ 0
Balance: $ 86,600

3

Activity Completion Date: December, 2015

Outcome	Completion Date	Budget
1. *1. Acquire state-of-the-art satellite data and integrate with existing lidar data covering selected TCMA and Greater MN areas*	November, 2014	$ 10,000
2. *Generate land cover products for selected areas*	August, 2015	$ 60,000
3. *Define impervious surfaces for selected areas*	December, 2015	$ 16,600

Activity Status as of *December, 2014*:

Activity Status as of *June, 2015*:

Activity Status as of *December, 2015*:

Final Report Summary:

ACTIVITY 3: Distribute updated land cover and train users
Description: The project will freely distribute data and statistics of seven standard land covers and percent impervious surface area, in an ArcGIS database and MapServer application (or similar technology) for both metro and statewide areas for updating of watershed computer modeling efforts. MapServer enables display and analysis of spatial data over the Internet. Products and statistics summarizing the classifications by city, township, county, ecoregion, watershed and catchment may be generated and added to the online database available at land.umn.edu, as funds and time allow. Three training sessions will be conducted by the University of Minnesota using existing Board of Water and Soil Resources (BWSR), Minnesota Association of Watershed Districts (MAWD), and Soil and Water Conservation District (SWCD) venues for cities, counties and professional engineering services.

Summary Budget Information for Activity 3:	**ENRTF Budget:**	**$ 122,030**
	Amount Spent:	**$ 0**
	Balance:	**$ 122,030**

Activity Completion Date: June, 2016

Outcome	Completion Date	Budget
1. *Convert into GIS datasets and web-based maps, along with area statistics by county, city/township, ecoregion, watershed and catchment for 54 million acres*	December, 2015	$ 102,030
2. *User training and distribution of map and GIS products on UM website*	June, 2016	$20,000

Activity Status as of *December, 2014*:

Activity Status as of *June, 2015*:

Activity Status as of *December, 2015*:

Final Report Summary:

V. DISSEMINATION:

Description: Dissemination will be largely as described in Activity 3, above. We will ensure that awareness of the dataset among stakeholders is as great as possible, through training workshops, email announcements, social media, and other appropriate outreach efforts. All data products, reports, and methods will be available at no cost via the land.umn.edu website and other outlets such as the DNR Data Deli.

4

Status as of *December, 2014*:

Status as of June, 2015:

Status as of *December, 2015*:

Final Report Summary:

VI. PROJECT BUDGET SUMMARY:

A. ENRTF Budget Overview:

Budget Category	$ Amount	Explanation
Personnel:	$ 295,230	Project supervisor (20% FTE, 2 years), research associate (100% FTE, 2 years), graduate research assistant (50% FTE, 2 years), graduate research assistant (25% FTE, 2 years) and IT specialist (20% FTE, 2 years). Project work, dissemination, and supervision
Travel Expenses in MN:	$ 4,770	Mileage, lodging, and meals for UMN project personnel to travel to/from field validation sites throughout Minnesota. Estimate of 3,000 miles @ $0.56 per mile plus loding and food for 25 days at $123 per day
TOTAL ENRTF BUDGET:	**$ 300,000**	

Explanation of Use of Classified Staff: N/A

Explanation of Capital Expenditures Greater Than $5,000: N/A

Number of Full-time Equivalents (FTE) Directly Funded with this ENRTF Appropriation: 4.3

Number of Full-time Equivalents (FTE) Estimated to Be Funded through Contracts with this ENRTF Appropriation: N/A

B. Other Funds: N/A

VII. PROJECT STRATEGY:

A. Project Partners: Marvin Bauer (UMN), stakeholders (e.g. state agencies, SWCDs, etc.) will be involved through periodic advisory meetings.

B. Project Impact and Long-term Strategy: This project is the latest in a series of efforts to describe Minnesota's changing land cover. The data products developed will follow the most recent mapping, done in 2000. Monitoring Minnesota's land cover is critical for many reasons, as described in the Project Statement above. Our long term strategy will involve attempting to obtain stakeholder funding to perform future mapping. Maintenance of the data distribution tools is a continuing function of the Remote Sensing and Geospatial Analysis, which will continue regardless of funding for future mapping.

C. Spending History: N/A

VIII. ACQUISITION/RESTORATION LIST: N/A

IX. VISUAL ELEMENT or MAP(S): See attached maps

X. ACQUISITION/RESTORATION REQUIREMENTS WORKSHEET: N/A

XI. RESEARCH ADDENDUM: N/A

XII. REPORTING REQUIREMENTS:
Periodic work plan status update reports will be submitted no later than December 2014, June 2015, and December 2015. A final report and associated products will be submitted between June 30 and August 15, 2016.
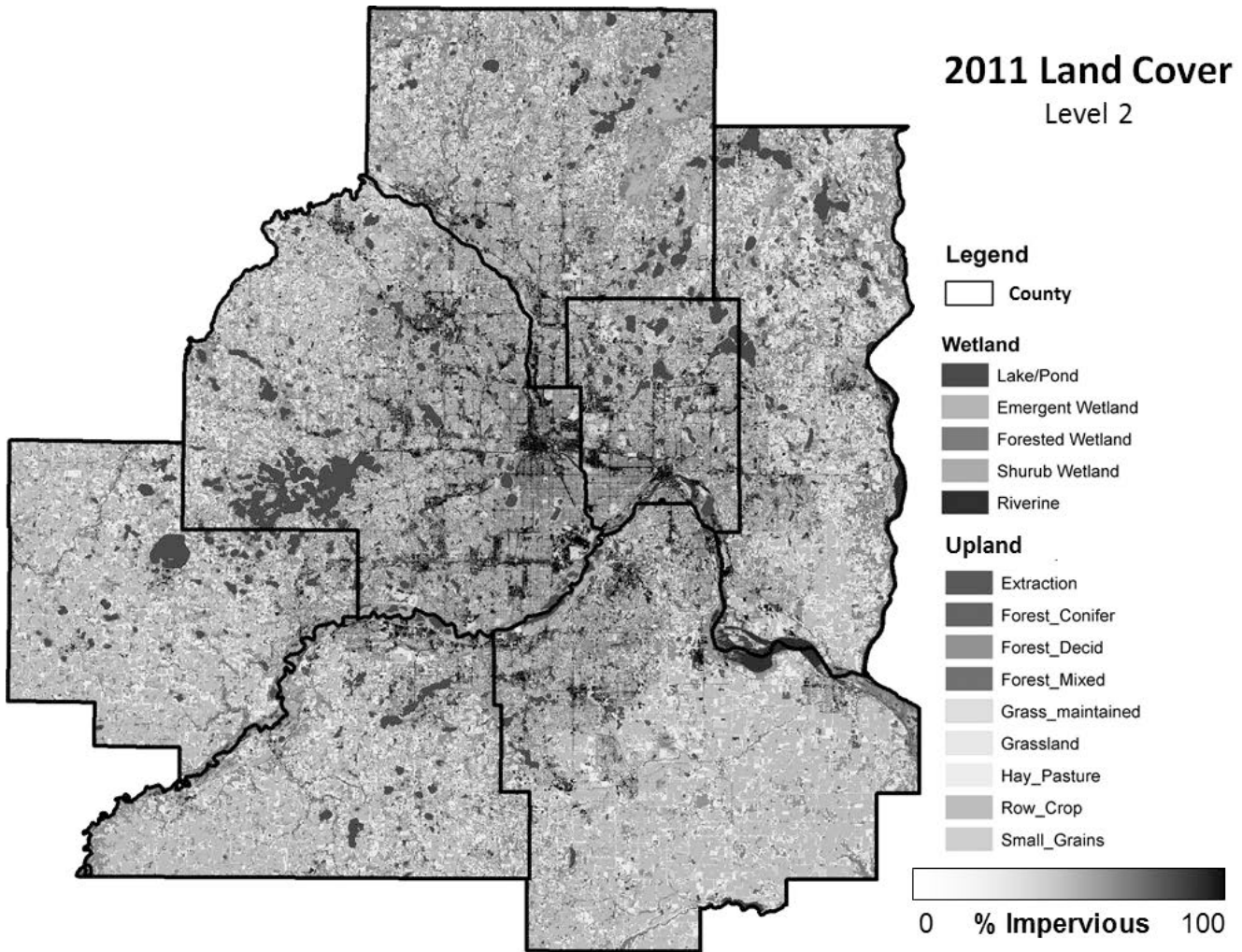
6

2011 Land Cover
Level 2

Legend

☐ County

Wetland

■ Lake/Pond
■ Emergent Wetland
■ Forested Wetland
■ Shurub Wetland
■ Riverine

Upland

■ Extraction
■ Forest_Conifer
■ Forest_Decid
■ Forest_Mixed
☐ Grass_maintained
☐ Grassland
☐ Hay_Pasture
■ Row_Crop
■ Small_Grains

0   **% Impervious**   100

Figure 1: Land cover for the Twin Cities Metropolitan Area, 2011

7

Environment and Natural Resources Trust Fund

M.L. 2014 Project Budget

Project Title: *Update Statewide Land Cover Use Map*

Legal Citation: M.L. 2014, Chp. 226, Sec. 2, Subd. 05a

Project Manager: *Joseph F. Knight*

Organization: *University of Minnesota*

M.L. 2014 ENRTF Appropriation: $ *300,000*

Project Length and Completion Date: *2 Years, June 30, 2016*

Date of Report: *Jan. 15, 2014*

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET	Activity 1 Budget	Amount Spent	Activity 1 Balance	Activity 2 Budget	Amount Spent	Activity 2 Balance	Activity 3 Budget	Amount Spent	Activity 3 Balance	TOTAL BUDGET	TOTAL BALANCE
BUDGET ITEM	*Update the statewide land cover map*			*Generate high resolution land cover maps*			*Distribute land cover and train users*				
Personnel (Wages and Benefits)	$86,600	$0	$86,600	$86,600	$0	$86,600	$122,029	$0	$122,029	$295,230	$295,230
Lian Rampi, Reseach Associate: $47,000 (33.8% fringe); 100% FTE for 2 years											
Graduate Research Assistant: $18,500 (74% fringe); 50% FTE for 2 years											
Graduate Research Assistant: $18,500 (74% fringe); 25% FTE for 2 years											
Trent Erickson, IT Specialist: $20,430 (33.8% fringe); 20% FTE for 2 years											
Joe Knight, Project Manager: $83,500 (33.8% fringe); 20% FTW for two years											
Travel expenses in Minnesota Mileage, lodging, and meals for UMN project personnel to travel to/from field validation sites throughout Minnesota. Estimate of 3,000 miles @ $0.56 per mile plus loding and food for 25 days at $123 per day	$4,770	$0	$4,770	$0	$0	$0	$0	$0	$0	$4,770	$4,770
Other											
COLUMN TOTAL	**$4,770**	**$0**	**$4,770**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$4,770**	**$300,000**