

**Environment and Natural Resources Trust Fund
2012-2013 Request for Proposals (RFP)**

Project Title:

ENRTF ID: 087-E1

Mapping Landscapes for Better Land and Water Quality

Topic Area: E1. NR Info Collection /Analysis - Statewide

Total Project Budget: \$ 360,000

Proposed Project Time Period for the Funding Requested: 2 yrs, July 2013 - June 2015

Other Non-State Funds: \$ 0

Summary:

This project will create up-to-date land cover data using existing LiDAR data and remote sensing technologies. Products will be extensively used for daily efforts by land and water conservation projects.

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Sponsoring Organization: MN Pollution Control Agency

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Location

Region: Statewide

County Name: Statewide

City / Township:

_____ Funding Priorities	_____ Multiple Benefits	_____ Outcomes	_____ Knowledge Base
_____ Extent of Impact	_____ Innovation	_____ Scientific/Tech Basis	_____ Urgency
_____ Capacity Readiness	_____ Leverage	_____ Employment	_____ TOTAL _____%



**Environment and Natural Resources Trust Fund (ENRTF)
2012-2013 Main Proposal**

PROJECT TITLE: Mapping Landscapes for Better Land and Water Quality

I. PROJECT STATEMENT

It can be difficult to remember changes in our landscapes – most sneak along escaping our ability to collectively register them over the years. Nonetheless, these land cover changes may have significant cumulative influences upon wildlife, their habitats and the nature of runoff reaching our streams and lakes. That is why we need to periodically measure statewide land cover changes that will become critically needed data, ‘the first step’ for most if not all, protection and restoration efforts.

This project will update the state’s computerized land cover information that will be used by just about every county, watershed management organization, city, basin and state agency for water and land conservation programs, as follows:

Region	Coverage	Products	Technology
Entire State	54 Million acres and 2,397 Cities, Townships	Digital/GIS maps of 7 land cover classes	New Landsat satellite data
Greater MN Cities	~100,000 acres	High resolution digital /GIS maps of 7 land cover classes + Hard Surfaces	High resolution satellites + Existing LiDAR
Twin Cities 7 Counties	~1.9 Million acres	High resolution digital /GIS maps of 7 land cover classes + Hard Surfaces	High resolution satellites + Existing LiDAR

This project will help track our progress with accurate data of Minnesota’s cities/growth zones, forests, and agricultural lands to pair with water quality/quantity and biological monitoring data. Otherwise, we risk making restoration and protection investments based on old and potentially incorrect information. The last Minnesota land cover data was produced in 2000 (and again nationally, in 2006 using less precise methods) and does not fully reflect land use changes (demographic and boom growth of the 2000’s) nor technology advances. We propose to integrate the existing LiDAR data collected for Minnesota and combine it with improved remote sensing to develop the ‘next generation’ of high quality data to produce new GIS data layers.

With the previous 1990 and 2000 data, we observed that hard surfaces (e.g., asphalt/cement parking lots + roads + roofs) increased much faster than population growth. Hard surfaces, that shed rain quickly, are the main factor causing decline in urban waters and habitats. We can do better, as new developments reduce hard surfaces by the use of best practices and plants that increase infiltration, improve water quality and long-term sustainability.

The project will provide freely available state-of-the-art Minnesota-wide land cover data for 2013-2014, with higher resolution data for select Greater Minnesota communities and the Twin Cities. Data will be consistent with the Minnesota Land Cover Classification System. The University of Minnesota will freely provide two training opportunities and distribute data via existing information portals including the MDNR’s Data Deli and the Minnesota Geospatial Information Office. Typical uses include linking land uses changes with water quality, assessing cumulative performance of geographically diverse urban and agricultural Best Management Practices, locating agricultural and urban regional treatment sites, targeting of stormwater treatment practices and tracking changes in our urban and Greater Minnesota forests. The new maps and statistics will provide greatly enhanced and more detailed information than is currently available.

II. DESCRIPTION OF PROJECT ACTIVITIES

Activity 1: For selected Greater Minnesota Cities and Twin Cities Metropolitan Area, acquire and process remote sensing data. Budget: \$ 175,000

Acquire, process and combine high resolution satellite data with existing LiDAR data for improved land cover determinations (~3 foot resolution). Land cover and impervious surfaces will be determined for select Greater Minnesota urban areas (St. Cloud, Rochester, Duluth, and others) and the seven county Twin Cities Metro Area by incorporating Metropolitan Council’s baseline work.

Outcome	Completion Date
1. Acquire high resolution GeoEye and RapidEye satellite data and integrate with existing LiDAR data covering ~1.9 million acres of Twin Cities Metro + ~100,000 acres of Greater Minnesota Cities.	November, 2013
2. Generate land cover maps (GIS) for ~2.0 million acres	August, 2014
3. Define impervious surfaces (GIS) for ~300 cities/townships	December, 2014

Activity 2: Update the statewide land cover data for 2013/2014. Budget: \$125,000

The State’s land cover maps will be updated consistent with the Minnesota Land Cover Classification System (cropland, forests, wetlands, grasslands, shrublands, wetlands, water and urban/developed + impervious surfaces) for 2013/2014.

Outcome	Completion Date
1. Acquire satellite data and process for all of Minnesota (54 million acres)	January, 2014
2. Generate land cover classification datasets for Minnesota	June, 2014
3. Map municipality/MN Civil Division impervious surface area for 2,367 MCDs.	December, 2014

Activity 3: Freely distribute updated land cover information and train users. Budget: \$60,000

The project will be freely distributed maps and statistics of land cover including percent impervious surface area, in an ArcGIS database and MapServer application for both metro and statewide. MapServer enables display and analysis of spatial maps and geographic data over the Internet. Maps and statistics summarizing the classifications by city, township, county, ecoregion, watershed and catchment will be generated and added to the current online database available at land.umn.edu and made available to users at no cost. Two training sessions will be conducted by the University of Minnesota in conjunction with the Minnesota Geospatial Information Office.

Outcome	Completion Date
1. Convert into GIS datasets and web-based maps, along with areas statistics by county, city/township, ecoregion, watershed, catchment, and by MCD, for Minnesota (54 million acres).	December, 2014
2. Two training sessions and distribute products freely on UM website (land.umn.edu) with the Minnesota Geospatial Information Office’s input.	June, 2015

III. PROJECT STRATEGY

A. Project Team/Partners

- \$ 10,000 to MPCA for administrative costs (contracts, fiscal, project management).
- \$ 350,000 contract with the University of Minnesota for work elements.
- In-kind support of \$30,000 provided by the Metropolitan Council for TCMA analyses.
- In-kind support provided by the Minnesota Department of Natural Resources (LiDAR data and technical support) and via guidance provided by the Minnesota Geospatial Information Office.

B. Timeline Requirements. The Project will be completed in two years.

C. Long-Term Strategy and Future Funding Needs. This project directly addresses LCCMR funding priority #3: ‘Collection and analysis of information that assists in developing the state’s environmental and natural resources policies.’ The proposed project’s state-of-the-art data will be used by most land and water management entities for a wide variety of daily needs for restoration, protection and scoping purposes. State agencies and the Minnesota Geospatial Office will establish a land cover updating plan.

2012-2013 Detailed Project Budget

Project Title: Mapping Landscapes for Better Land and Water Quality

IV. TOTAL ENRTF REQUEST BUDGET 2 years

<u>BUDGET ITEM</u>	<u>AMOUNT</u>
Personnel:	
Two year contract with the University of Minnesota for all work, including research assistant, research fellow, IT specialist, and undergraduate research assistant.	\$ 258,600
MPCA contracting, invoices and project management	\$ 10,000
Total Personnel	\$ 268,600
Equipment/Tools/Supplies: RapidEye image data, 9,263 sq km @ \$0.95 = \$8,800; GeoEye image data, 4,000 sq km @\$18 = \$72,000	\$ 80,800
Travel: Field/reference data collection, 2,909 miles @\$0.55 = \$1,600; per diem 25 days @\$120 = \$3,000	\$ 4,600
Additional Budget Items: Computer lab user fees. 3 users @ \$1,000 per year x 2 years	\$ 6,000
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND \$ REQUEST =	\$ 360,000

V. OTHER FUNDS

<u>SOURCE OF FUNDS</u>	<u>AMOUNT</u>	<u>Status</u>
Other State \$ Being Applied to Project During Project Period:		
The University of Minnesota has a University funded research project that will develop and test procedures for use in the proposed ENRTF project. The amount of funding when they are concurrent is:	\$ 56,481	Secured
In-kind Services During Project Period:		
UM: Salaries and fringe benefits (\$36,000) for two faculty at an average of 10% time will be provided by University. Computer and image processing facilities will be provided by the University (estimated value, (\$25,000).	\$ 61,000	Secured
Metropolitan Council: In-kind contribution of processing of imagery for Twin Cities Seven County Area under contract with University of Minnesota (\$30,000)	\$ 30,000	Pending
Funding History: LCMR funding (2003-2005, \$235,000) Remote sensing of lake and stream water quality (served as the basis for MPCA routine use of satellites for determining lake quality of all lakes greater than 5 acres). NASA Regional Earth Science Applications Center grant (1999) to develop technology for use of satellites to define statewide land uses and (2003) eForest grant for refining forest land cover (total grants of \$250,000).	\$ 235,000	Completed

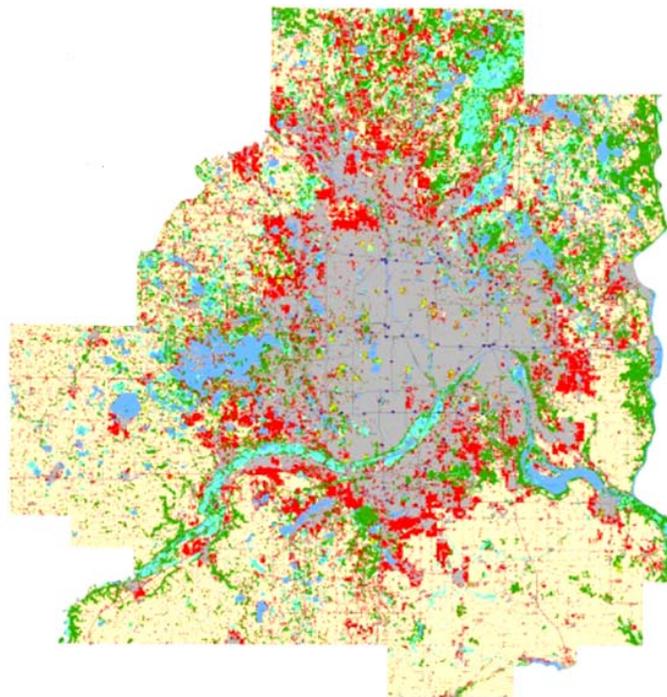


Figure 1. Land cover-use change from 1986 to 2002 for the Twin Cities Metropolitan Area. Red is conversion from agriculture, forest or wetland to urban/developed.

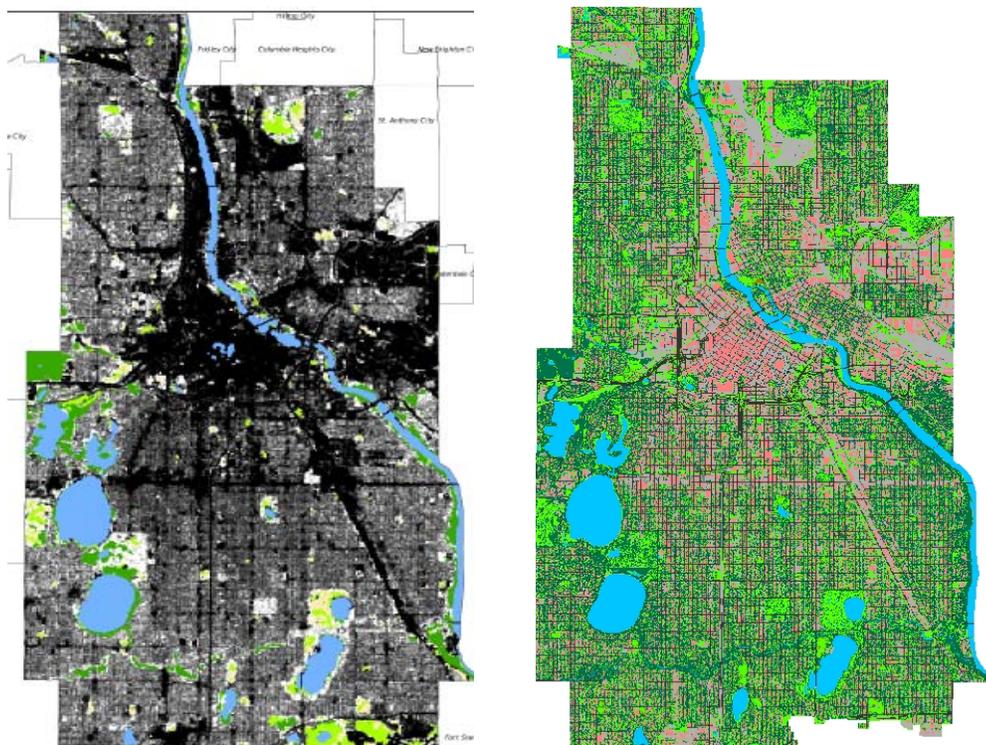


Figure 2. City of Minneapolis: Comparison of 2000 (left) at 100 foot resolution vs. next generation high resolution (3-foot) classifications.

Project Manager Qualifications/Organization Description

Project Manager:

Bruce Wilson has been a lake and stream scientist in various Minnesota Pollution Control Agency water programs. Past efforts have included technical support for more than 50 lake and river protection/restoration projects (including Minneapolis Chain of Lakes, Mille Lacs, Lake of the Woods, Red Lake, Upper Mississippi (Lake Bemidji to Winnibigoshish), Whitefish Chain, Gull Lake Chain, Vadnais Lake (St. Paul Regional Water Services), Big Birch (Todd), Sauk River Chain of Lakes, Crow River, Miller Creek (Duluth), Zumbro Lake), Environmental Trust Funded satellite remote sensing of lake/river water quality, developing new thermal runoff practices for Minnesota's trout streams, co-author of Minnesota lake nutrient standards, establishing river and stream monitoring (Upper Mississippi, Sauk, Crow, Pine, Long Prairie, Rainy, Red River Basin and North Shore tributaries) and stormwater management. He is now project manager for the Minimal Impact Design Standards (MIDS) Project with 24 partnering groups, to develop innovative stormwater management approaches. He can be contacted at bruce.wilson@state.mn.us or at the MPCA, 520 Lafayette Road, St. Paul, MN 55155-4194 and 651-757-2828.

Project Partners:

The **Metropolitan Council** will be a contributing partner providing support for Landsat remote sensing of the Twin Cities area via a contract with the University of Minnesota and supervised by Judy Sventek.

The **Minnesota Department of Natural Resources** will provide LiDAR data and GIS support under the supervision of Tim Loesch.

The **Minnesota Geospatial Information Office** will provide technical support and training opportunities under the guidance of Chris Cialek and Susanne Maeder.

The **University of Minnesota's** project team includes two Department of Forest Resources faculty, Marvin Bauer and Joseph Knight, who will direct the remote sensing data processing. They will be assisted by two research staff supported by Environment and Natural Resources Trust Funds. Bauer is professor of remote sensing and director of the Remote Sensing and Geospatial Analysis Laboratory (rsl.gis.umn.edu) at the University of Minnesota. He has extensive experience in research to develop applications of satellite remote sensing to inventory and monitor land and water resources. His current research emphasizes the development of satellite remote sensing for land cover classification and change detection, impervious surface mapping, and monitoring lake water quality. He has been principal investigator of several NASA grants, as well as State of Minnesota contracts for mapping and monitoring land cover, impervious surface area and lake quality. Knight is an assistant professor and conducts research characterizing natural and anthropogenic landscape change using multispectral and multitemporal image data to assess impacts on natural resources, wetlands mapping and characterization, and thematic accuracy assessment methods development.