Creating a Healthier Planet

From smart data-collection planning to effective analysis and implementation, regional planners in Southeast Michigan are enabling urban sustainability and green infrastructure.

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Urban sustainability involves a plethora of important issues confronting urban managers and planners, from climate change and air and water quality to stormwater management, flooding and many other interrelated social and environmental issues. Such issues force decision makers to balance the economic, environmental and societal outcomes of any action.

As a result, urban sustainability is prompting decision makers and planners to look more holistically at interrelated phenomena and focus on multiple goals instead of one outcome. Developing sustainable solutions to address complex urban issues requires urban managers to plan ahead to collect the right data, analyze the data to evaluate various scenarios, and implement policy and actions to make changes based on the analysis. The Southeast Michigan Council of Governments (SEMCOG) is using this framework to develop more sustainable solutions to create a healthier planet.

Grant Enables Urban Sustainability

SEMCOG is the regional planning agency for a 4,500-square-mile area, encompassing seven Michigan counties comprising 4.7 million people. As the designated regional water quality management agency under the Clean Water Act, SEMCOG has been engaged in environmental activities for more than 40 years.

The last comprehensive land cover update for the region was performed in the 1980s. With local implementation activities related to habitat restoration, low impact development and natural resource preservation on the rise, there was no doubt that an update of the land cover data was needed to assist in planning and implementation efforts. The venture was cost-prohibitive during an economic recession, but the problem was solved when SEMCOG secured a grant through the Housing and Urban Development (HUD) Sustainable Communities Regional Planning Grant (see *http://portal.hud.gov/hudportal/HUD?src=/program_offices/sustainable_housing_communities/sustainable_communities_regional_planning_grants program*).

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The purpose of SEMCOG's grant-funded project was to develop a green infrastructure vision to benchmark the agency's current level of land cover and envision a new region that includes greening as a critical element. Specific tasks included:

- Benchmarking green infrastructure by developing a green infrastructure coverage map based on existing 2010 aerial imagery.

• Envisioning the future through planning sessions with stakeholders, assessing green infrastructure benefits and opportunities, and setting targets/metrics.

• Developing recommendations on how to implement the vision.

The project involved collecting data, analyzing the data with tools such as American Forests' CITYgreen land-use planning software and Esri's ArcGIS geographic information system software, and implementing appropriate and best management practices based on data analysis.

Planning Efficient Data Collection

SEMCOG sought vendors to develop a land cover dataset that could meet the grant's requirements as well as the SEMCOG community's greater needs. The Sanborn Map Company won the project based on its expertise and past experience with similar data and analysis.

The land cover layers created through the project consisted of a suite of products/thematic layers:

• Land cover data
• Tree canopy data
• Building footprint data
• Composite data

For land cover data, the five-class classification of SEMCOG 2010 imagery—impervious surface, open space, trees, urban:bare and water—encompassed urban and rural areas. The urban areas were mapped with a 0.025-acre minimum mapping unit (MMU), and the rural areas were mapped with a 0.25-acre MMU.

The classification also covered 873 square miles of area previously mapped by Sanborn through separate contracts with the Alliance of Rouge Communities, the Alliance of Downriver Watersheds, the City of Detroit and Shelby Township. In these areas, a change detection methodology was used instead of reclassifying the full area. The two methodologies produced a consistent and seamless dataset. The approach leveraged previous work and provided the most cost-effective, efficient way to create the data.

Because the land cover data were derived using leaf-off imagery, the dataset didn't include the canopy's full extent. To delineate the entire canopy, 2010 National Agricultural Imagery Program (NAIP) imagery was used to classify a full canopy dataset comprised of binary data (canopy/noncanopy). Combining full-canopy and full-impervious data using the leaf-on and leaf-off imagery allows users to model full canopy over impervious or vice versa.

For building footprint data, vector polygons were captured through heads-up digitizing in a 2-D environment. Each polygon/footprint was tagged with an estimated height using light detection and ranging (LiDAR) data processed separately for each county. In addition, the building footprints were leveraged for the land cover data to prioritize impervious over canopy in that dataset.

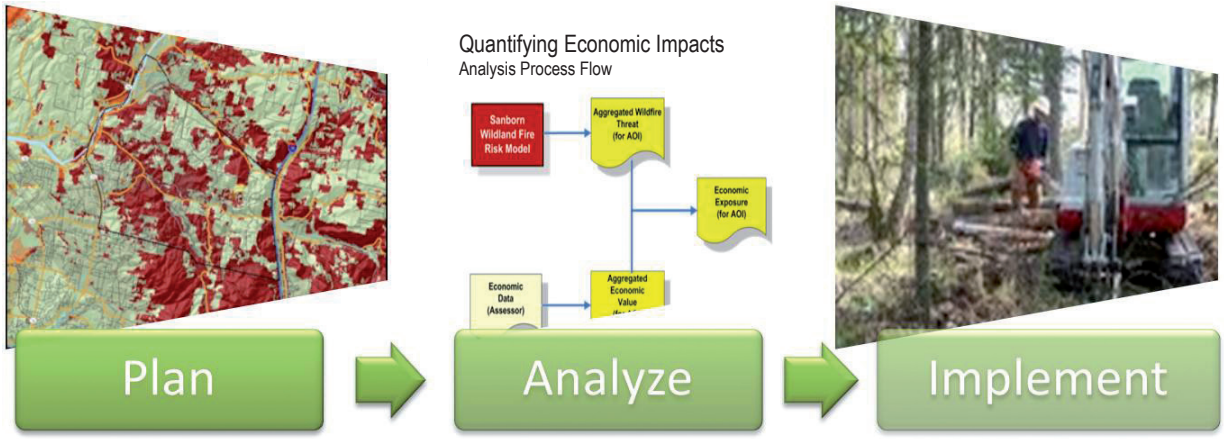
Testimonials Confirm SEMCOG Data's Value

Multiple stakeholders are benefitting from SEMCOG's land cover data development efforts.

"In our work at the Clinton River Watershed Council, we're using SEMCOG's new land cover data to help us bring landscape-level green infrastructure concepts down to the neighborhood and site level. The data allow us to assist communities to quantify green infrastructure, model runoff and set realistic, site-specific goals and targets into local communities in a way that wasn't possible before the data became available."
— Nina Ignaczak, watershed planner, Clinton River Watershed Council

"St. Clair County has used the SEMCOG data to identify driveway locations to improve address location tools. The ability to cross reference existing buildings with driveway locations is extremely beneficial in finding areas where field crews and first responders may have difficulty. The process to collect address points was already in progress; spatial queries against the new datasets have been great timesavers. The building footprints have been used to assist local fire departments when looking to validate mutual aid contracts and adjust service areas. With the ability to quickly count and quantify building characteristics, first responders have been able to better estimate the impact of changing districts. As we continue to strive to achieve more results on a shrinking budget, baseline datasets such as these are extremely valuable."
— Trevor Floyd, GIS analyst, St. Clair County

"We've used the building footprints with several applications. We just received preliminary Digital Flood Insurance Rate Maps (DFIRMS) from the Federal Emergency Management Agency. Having the building footprints enabled us to measure the impact on the community. There are several factors that determine whether a house is in or out of a flood hazard area, location only being one of them. However, being able to compare the current DFIRMS with the preliminary DFIRMS, using the building footprints, we were able to notify the municipalities of a negative or a positive impact and highlight areas of concern that might receive an extreme impact from the preliminary study."
— Jeffrey S. Boudrie, GIS specialist, Monroe County Planning Department



The project involved planning data collection, analyzing the data, and implementing appropriate and best management practices based on data analysis.

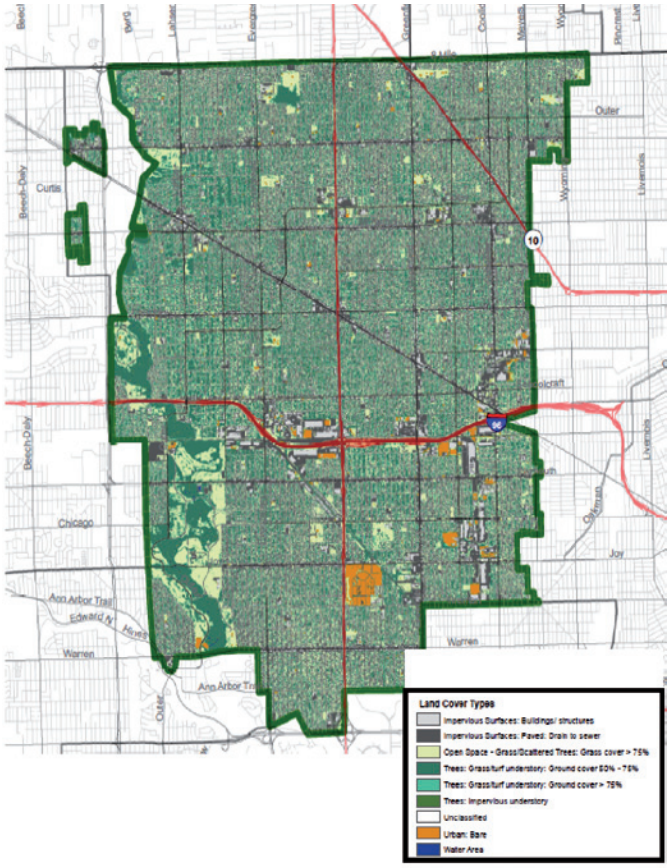
Land Cover Type	Tributary Area (acres)
Impervious Cover: Buildings	3,112
Impervious Cover – Paved: Drains to Sewer	8,778
Open Space – Grass/Scattered Trees	4,706
Trees with Grass/Turf Understory > 75%	647
Trees with Grass/Turf Understory 50-75%	5,230
Trees with Impervious Understory	1,212
Urban: Bare (dirt)	301
Water	24

	Acreage	% of total acreage in the Tributary Area	Runoff volume (2-yr; 24-hr) MG	% of total runoff in the Tributary Area
Residential	10,813	90%	391	88%
Roads	6,684		283	
City Parks (open and closed)	2,639		78	
City Vacant (TE)	300		8	
State and Wayne County Vacant Land	267		7	
Vacant Non-Tax Exempt	820		22	
Commercial	883	10%	41	12%
Industrial	992		47	
Institutional (Churches/ Universities)	354		14	
Hospital and Medical	42		2	
Civic	17		1	
State and Federal Buildings	7		0	
Totals	**23,818**		**893**	

The aforementioned datasets were combined to create a composite dataset that could be input into the CITYgreen software to provide the most suitable green infrastructure assessments. All work for the land-cover data was performed in a raster environment, but final deliverables included raster and vector data. The vector data were created from raster data through a raster-to-vector conversion process using smoothing algorithms. Work for building footprint data was done in a vector environment.

Analysis Benefits Multiple Stakeholders

The collected data already have been used for several analyses at SEMCOG and the Detroit Water and Sewerage Department (DWSD). Additional analyses are highlighted in "Testimonials Confirm SEMCOG Data's Value," page 41.



Land use was overlaid with land cover to help DWSD determine the land uses with the most opportunity to increase green infrastructure.

DWSD Stormwater Goals

SEMCOG used the land cover data to develop a green infrastructure strategy to help DWSD meet its combined sewer overflow permit requirements. The plan sets the stage for a 2.8 million gallon reduction in stormwater volume into the city's sanitary sewer system through the use of green infrastructure.

SEMCOG used the land cover data to determine the stormwater runoff benchmark for DWSD's 37-square-mile tributary area. The tables above summarize the acreage of land cover based on the area's SEMCOG Composite Dataset.

Next, as shown in the figure at left, land use was overlaid with land cover to determine the land uses with the most opportunity to increase green infrastructure. This process illustrated that land use areas with the most opportunity for runoff reduction included vacant land (public and private), roadways, and residential and municipal properties (municipal buildings, parks and schools).

This set of activities is just one example of how geographic data and tools are being used by successfully by decision makers to enable a more sustainable world.

This information, along with priority sewersheds and vacancy rates, was used to develop scenarios for the top land use opportunities. For example, vacant land was identified at the parcel level, along with local roadways. A total volume reduction was quantified based on implementing the scenario over a 20-year timeframe and a pilot implementation to meet the 2.8 million gallon reduction requirement by 2017.

SEMCOG Long-Range Transportation Plan

As part of the development of a 2040 Long-Range Transportation Plan, SEMCOG used tree canopy information as an input

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into the federal requirement to analyze potential impacts of proposed transportation projects on environmentally sensitive areas. This analysis is shared with transportation agencies along with suggested guidelines to mitigate the project's impacts on environmental resources.

Implementation and the Road Ahead

Because SEMCOG's three-year HUD grant extends until 2014, several policies and implementation-related activities are still in the works. For example, SEMCOG is in the process of developing a green Infrastructure vision for Southeast Michigan.

To date, the land cover information has been benchmarked by region, counties and watershed, as shown in the chart below. The benchmarking also included the amount of land cover included in each land use category. SEMCOG will use the information to identify areas where green infrastructure opportunities can be increased. Similarly, using CITYgreen software, the region's stormwater runoff and air quality carbon sequestration has been benchmarked.

This summer, visioning sessions will be held to gather additional input beyond the program's 50- person task force to determine where green infrastructure should be added and what kind it should be. For example, green infrastructure can range from additional buffers around highly sensitive areas to adding bioswales along high-volume roadways.

In addition, these sessions will set the stage for developing recommendations on how to implement the vision. The recommendations will contain metrics and actions to achieve the metrics. For example, the regional tree canopy is 33 percent. A metric could be to raise this to 40 percent as a region. Actions could include continued funding of street tree plantings through state grants and private donations as well as from regional utility companies.

The vision will be completed and set for adoption by the SEMCOG General Assembly in the spring of 2014. This set of activities, which started with data collection, moved to data analysis and culminated with data-based action, is just one example of how geographic data and tools are being used successfully by decision makers to enable a more sustainable world.

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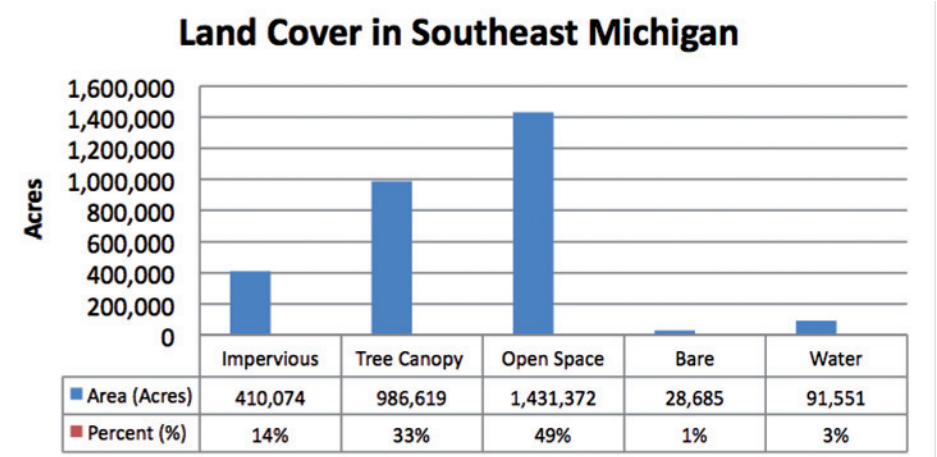

	Impervious	Tree Canopy	Open Space	Bare	Water
Area (Acres)	410,074	986,619	1,431,372	28,685	91,551
Percent (%)	14%	33%	49%	1%	3%