

2009 Progress Report: Reality Check Plus: Envisioning a Sustainable Maryland

EPA Grant Number: RD-83334601

Title: Reality Check Plus: Envisioning a Sustainable Maryland

Investigators: Gerrit Knaap, Matthias Ruth, Glenn Moglen

Institution: University of Maryland

EPA Project Officer: Dale Manty

Project Period: April 11, 2007 through April 30, 2010

Project Period Covered by this Report: April 11, 2007 through September 21, 2009

Project Amount: \$274, 060

RFA: [Collaborative Science & Technology Network for Sustainability \(2007\)](#)

Research Category: [Pollution Prevention/Sustainable Development](#)

(1) Brief statements covering work status, work progress, preliminary data, results, and evaluations made during the reporting period, including a comparison of actual accomplishments with the goals and objectives (outputs/outcomes) for the period. Address difficulties you have encountered (or might encounter) in carrying out this project and remedial actions (to be) taken. If the aims of the project have not changed from the original application, state this. If these have been modified, provide the revised aims and discuss the reason for the modification.

Activities during Years 1 and 2 focused on data collection, resolution of methodological issues, model development and model integration. This includes models developed with funding from non-EPA sources. Highlights of progress to date include. (1) with funding from the Maryland State Highway Administration we constructed statewide transportation and land use models; (2) with funding from the Maryland Department of Planning we constructed a fiscal impact model; (3) with funding from the EPA CNS program we constructed residential energy and nutrient loading models (4) to operationalize all these models we collected social economic and land use data from a wide variety of sources; (5) we conducted preliminary experiments with two test scenarios: Business as Usual and High Energy Prices; (6) we presented a paper at the regional science association meetings in Brooklyn, NY, and at the meetings of the Association of Collegiate Schools of Planning in Crystal City, VA; and (7) we gave many presentations to local planning directors, state agency staff, and the Scenario Advisory Group.

Preliminary results from the nutrient loading model produced surprising results. In some cases, sprawl development produced less nutrient loadings than compact development. This occurred because some farms contribute more nutrients than some residential developments. The results, however, depend critically on the type of land being developed and the extent to which developments use low impact techniques. Preliminary results from the residential energy model provided expected results: sprawl development results in greater residential energy consumption than compact development. The reasons are that compact growth contains smaller housing units and more shared walls.

In the coming year we will conduct additional experiments and refine the nutrient loading model to ascertain why and under what conditions it produced counterintuitive results. We will also try to fine tune and calibrate the residential energy model.

(2) A discussion of any absence or changes of key personnel involved in the project.

Glenn Mogen has moved to Virginia Tech University but remains active on the project. John Frece left UMD to head the EPA's smart growth office. He has been replaced by Marty Bierbaum.

(3) A discussion of expenditures to date along with a comparison of the percentage of the project completed to the project schedule, and an explanation of any costs which are higher than originally estimated. Revised budget information will be required under this agreement if any significant changes in the size or scope of the project or in the originally-negotiated total estimated costs are anticipated for the project period.

Spending is consistent with the grant's timing and our progress toward completion. See table below:

September 31, 2009 Budget	Total - UMD Budget \$274,060.00	5-29165 - Moglan 75,090.00	5-29148 - Knaap 120,540.00	5-29166 - Ruth 78,430.00	Total Expenses	Balance
Salary	113,891.00	39,685.00	44,211.00	18,379.00	102,275.00	11,616.00
Benefit	48,362.00	6,489.00	10,557.00	4,883.00	21,929.00	26,433.00
Tuition Waiver	-	8,302.00	3,203.00	2,220.00	13,725.00	(13,725.00)
Travel	5,000.00	-	-	-	-	5,000.00
Supplies	8,000.00	-	-	-	-	8,000.00
Contractual	17,000.00	-	-	4,160.00	4,160.00	12,840.00
TDC	192,253.00	54,476.00	57,971.00	29,642.00	142,089.00	50,164.00
IDC 48.5% UMD	81,807.00	22,395.00	26,563.00	11,282.00	60,240.00	21,567.00
Total - UMD	274,060.00	76,871.00	84,534.00	40,924.00	202,329.00	71,731.00

(4) Statements addressing how the quality assurance requirements of 40 C.F.R. 30.54 and the agreement are being met, especially focusing on the assurance of data quality relevant to environmental measurements and data generation.

The project combines statistical analysis of time series, engineering analyses, scenario-based assumptions, and dynamic modeling. Secondary data are used for these analyses, including census data, and data provided by the Maryland Department of Planning and US Geological Survey. The quality of each type of analysis is assured as follows:

Statistical Analysis

The choice between different functional forms and the choice which variables to include as regressors are guided in part by conventional hypothesis test statistics such as t and F statistics as well as the R^2 . The general Lagrange multiplier test (Godfrey 1978, Breusch 1978) was used to test for serial correlation. The presence of heteroscedasticity was examined by using the Lagrange multiplier test (Breusch and Pagan 1979). Multicollinearity was examined by closely inspecting the error associated with each regressor and by inspecting the variance decomposition matrix (Belsley et al 1980). Structural instability was examined by employing the Chow test (Chow 1960) or the Hendry forecast test (Cuthbertson et al. 1992). To examine the presence of spurious regressions (Granger and Newbold, 1974), the autocorrelation function (ACF) of the regression residuals was examined with the Dickey-Fuller test (Dickey and Fuller 1981)

Scenario-based Model Assumptions

The length of the time series used in the econometric analyses and the adequacy of data bases for engineering analyses of this project decrease in their ability to generate meaningful future scenarios the longer the time frame over which the model is run. These scenarios were based, in part, on alternative futures identified in collaboration with the advisory committee and participating stakeholders, and on assumptions about future materials and technologies and the rates at which they

are adopted by industry and by consumers. The latter involve expert judgment of the engineers and economists involved in this project.

Evaluation of Results

Frequent interaction with the stakeholder and project advisory groups, presentations at scientific conferences, publications in the public and peer-reviewed press, and continued literature research throughout the project has helped us evaluate model results and assess consistency of the results with existing theory and findings from other studies.

(5) Results (outputs/outcomes) to date, emphasizing findings and their significance to the field, their relationship to the general goals of the award, their relevance to the Agency's mission, and their potential practical applications.

Considerable progress has been made to date. We now have several models operational and successfully linked. Analyses of preliminary scenarios reveal that all the models produce plausible results and connect well. Preliminary results suggest that development patterns are sensitive to economic and policy parameters and that differences in development patterns are manifest in measurable differences in nutrient loading, residential energy consumption, vehicle miles traveled, impervious surface, and other environmental variables. Combined the results reveal that managing land use and urban development patterns can serve as an effective tool for environmental conservation and improvement.

A Paper written on the basis of the project is attached.

(6) Planned activity for the subsequent reporting period, including a description of equipment, techniques, and materials to be used or evaluated.

Major activities for the next year include additional model development and calibration, new scenario development, scenario evaluation, and public engagement. In particular, we will work with the Maryland Department of Planning to integrate our public outreach efforts with their efforts to roll out the state development plan. This will likely involve workshops with local government and environmental advocacy groups.

(7) Publications arising from this project. Copies of publications and reprints which have not previously been submitted to the Agency should be enclosed with the report.

Attached.

(8) Annual Report Summaries with each annual progress report. These will be placed on the EPA/NCER HomePage. NCER will not alter the content of a summary without consultation with the Principal Investigator. The summary should be submitted in the following format:

NCER Assistance Agreement Annual Report Summary (1-2 pages)