EPA's Smart Growth INDEX In 20 Pilot Communities:
Using GIS Sketch Modeling to Advance Smart Growth

EPA
United States
Environmental Protection
Agency

Acknowledgments

This report was prepared by the U.S. EPA's Development, Community, and Environment Division (DCED). Division staff Carlton Eley, Christopher Forinash, Adhir Kackar, Amber Levofsky, Ilana Preuss, Mary Kay Santore, and Eric Sprague contributed to this report. Thanks are extended to the communities who have participated in EPA's Smart Growth INDEX pilot program; their experiences have paved the way for future users.

For additional copies of this report, please call 202 566-2878 and ask for EPA's Smart Growth INDEX in 20 Pilot Communities (EPA 231-R-03-001). A PDF version of this report will be available online at >>http://www.epa.gov/smartgrowth/<<.

Office of Policy, Economics, and Innovation (1808T)

Development, Community, and Environment Division

EPA 231-R-03-001

www.epa.gov/smartgrowth

February 2003

Table of Contents

List of Tables

List of Figures

Appendices

Section I: Introduction

Smart growth offers localities a wide range of options for handling growth and development in ways that make positive contributions to communities. By making development decisions that reflect smart growth principles (see box) and community priorities, localities can approach growth-related problems with solutions that serve the economy, community quality of life, and the environment. Smart growth strategies make it possible to address problems such as traffic congestion and air pollution, maintain a sense of place, and minimize expenditures for infrastructure such as water and sewer lines, roads, and new schools in previously undeveloped locations.

As more communities seek smart growth solutions to growth-related problems, they need tools that can help them evaluate their options. Local officials and residents often find themselves trying to determine how different proposed developments and transportation improvements might meet their quality-of-life goals. They may ask themselves —

- "Does this project achieve our goal of increasing transit ridership?"
- "Will this development create more jobs in the downtown core?"
- "How will these changes affect our air and water quality?"

Local governments rely on past experience, case studies of similar places, professional judgement, and sometimes technical software tools to help answer these questions and to engage the public in planning discussions.

To help communities answer these kinds of questions, the U.S. Environmental Protection Agency (EPA) has developed the Smart Growth INDEX (SGI) model. SGI is a software tool that allows the user to benchmark existing environmental and community conditions, compare the impacts of multiple development and transportation scenarios, and monitor changes over time. The program provides clear graphics so that the public can understand comparable impacts. It allows the public visioning process to be integrated into the development planning and environmental protection process. Since July 2000, more than 35 communities have used SGI in various ways to enhance their planning processes.

Smart Growth Principles

1. Mix land uses
2. Take advantage of compact building design
3. Create a range of housing opportunities and choices
4. Create walkable neighborhoods.
5. Foster distinctive, attractive

   communities with a strong sense of place
6. Preserve open space, farmland, natural beauty, and critical environmental areas
7. Strengthen and direct development towards existing communities
8. Provide a variety of transportation choices
9. Make development decisions predictable, fair, and cost effective
10. Encourage community and stakeholder collaboration in development decisions

Source: Smart Growth Network
(For more information, see
>>http://www.smartgrowth.org/about/<<.)

This report describes the first version of the SGI model (in Section II) and summarizes the experiences of those pilot communities during the initial pilot phase of SGI. Seven are presented as case studies in Section III; another 13 pilot projects are briefly synopsized in Appendix B. Section IV discusses the successes achieved and lessons learned through the first 20 pilot applications, sums up conclusions, briefly discusses the Version 2 update of SGI, and names new partners who have signed on to use SGI Version 2 in 2003.

About the Smart Growth INDEX Pilot Program

Since 1996, EPA's Development, Community, and Environment Division (DCED), has been working with national organizations, state and local governments, universities, and the private sector to support smart growth — defined as development that serves the economy, the community, and the environment. EPA's initial approach focused on providing information, outreach, and policy analysis to constituencies looking to learn more about the principles (see box on previous page) and concepts of smart growth. As this knowledge base grew, so too did the demand for new tools to implement smart growth.

In conversations with stakeholders, many noted a need for analytic tools – tools that would quantitatively demonstrate the environmental, transportation, and quality-of-life benefits of smart growth projects. In particular, communities stressed a need for a quick-response tool that would allow them to estimate the impacts of different development scenarios and compare them to one another. The communities also sought a quantitative method to display information and to engage the public regarding future land use trade-offs. To respond to this interest, EPA developed the Smart Growth INDEX model. The Agency contracted with Criterion Planners and Engineers in Portland, Oregon, to develop the software.

In July 2000, after a limited beta-test (trial use) distribution of SGI, EPA's Development, Community, and Environment Division (DCED) initiated a 20-community pilot program to work with and evaluate the tool. DCED capped the number at 20 in order to provide substantial on-demand technical assistance to all pilot users.

Starting in February 2000, DCED gave presentations and sent written announcements to alert organizations about the SGI pilot program. To apply, candidates were asked to submit a 1- to 2-page proposal detailing their intended use for the SGI model, expected results, staff commitment to the project, and data availability to run SGI.

For this first phase of the pilot program, DCED looked for proposals that demonstrated:

- Strong prospects for better environmental, economic, and community outcomes as a result of using SGI
- Potential to achieve environmental benefits through smart growth approaches
- Significant contribution of staff time/resources by the local partner
- Potential to improve plans for federal facilities and/or lands through application of SGI
- Potential for SGI to facilitate win-win development outcomes (i.e., less controversial projects generally preferred)
- Adequate existing GIS[1] coverages — i.e., key areas with the data and resources available to run SGI, including GIS coverage in shapefile format (ArcView and ArcInfo format for storing data)
- A strong public participation process for review of SGI output and development of planning alternatives

1 GIS stands for Geographic Information System. A GIS is an organized collection of computer software and geographic data designed to display, analyze, and manipulate all forms of geographically referenced data.

More than 40 proposals were submitted. Working in partnership with EPA Regional offices, DCED selected pilot communities sequentially on a monthly basis until 20 were chosen. In evaluating proposals, headquarters and regional staff gave particular emphasis to the following criteria:

- Availability of data to input to SGI
- Commitment of staff time/resources to the project
- Demonstration that planned project could achieve environmental benefits through smart growth approaches
- Potential of SGI to inform a near-term decision
- Potential for a "win-win" development outcome

The pilot communities first received SGI at the end of July 2000. Each was provided with a license for the software, an initial training seminar, and ongoing remote and on-site technical support. No funding was provided to the pilots through this agreement, although many sites used the model to leverage monetary support elsewhere. Since then, the software has been modified to correct errors and improve user-friendliness. Updated versions and service packs have been posted to a secure website that all pilot users can access.

About the Pilot Communities

The 20 communities who took part in the first-phase pilot testing of SGI deserve recognition as bona fide pioneers on the frontier of smart growth. All new software tools, including SGI, have initial technical issues and bugs which need to be worked out through user experience. The SGI pilot users contributed extensive time and effort to this necessary process. Thanks to their participation, SGI is well on its way to becoming a highly practical tool for helping communities evaluate their development options and make informed, strategic decisions.

Section II: The Smart Growth INDEX Model

The purpose of EPA's Smart Growth INDEX (SGI) is to enable communities to do quick analyses of multiple "what if?" scenarios before running more sophisticated, data- and labor-intensive transportation and land use models. Additionally, SGI is intended to be a public visualization tool. Its easily understood readouts can help the general public visualize and compare alternative development scenarios during the decision-making process.

SGI is a GIS-based sketch model for analyzing alternative land-use and transportation scenarios and evaluating their outcomes, using environmental and quality-of-life indicators. As a sketch planning tool, SGI can demonstrate the direction and magnitude of change and calculate rough estimates of relative impacts; it is not intended to replace more technical and sophisticated tools used for regulatory purposes. SGI can be used to analyze:

- Regional growth management plans
- Environmental impact changes
- Comprehensive land-use plans
- Transportation plans
- Neighborhood plans
- Land development proposals
- Environmental impact reports
- Special projects — e.g., brownfields redevelopment, annexation proposals
- Proposed indicators of community quality of life and environmental assessment

For any analysis it performs, the SGI software provides a variety of readouts, including maps, bar charts, and tables that illustrate contrasting scenarios for easy public understanding.

The Forecast and Snapshot Modes of SGI

SGI operates in two distinct modes: the forecast sketch and the snapshot sketch. Although the software platform and several required data items are common to both modes, they function quite differently and are meant to answer very different questions.

The Forecast Mode:

The forecast mode addresses questions like, "Where might growth go in the future, given these conditions?" It applies population and employment projections provided by the user to spatially allocate total growth over a decided time horizon. Users, applying given population projections, can estimate how and where a community might grow over time by varying any of the following:

- The community's land use plan
- Environmental constraint areas

- Infrastructure service areas
- Development incentive areas
- Transportation system capabilities

The user sets various SGI parameters including: allowable densities for various land use categories; vehicle ownership rates; trip generation rates; transportation level of service standards, etc. Community-specific data can be used, or if unknown, SGI provides national-level defaults. All of the elements just mentioned influence the "growth attractiveness" of a given part of the sketch area. The base attractiveness of a "cell" (an area of 10 to 200 acres) is calculated by its travel accessibility and is increased or diminished according to development incentives or constraints and the presence or absence of infrastructure (water and sewer services). Given the relative attractiveness of each cell in the sketch area, SGI allocates housing and employment growth to appropriate locations.

In the forecast mode, SGI is unique in that it has an internal travel demand "submodel" that can estimate transportation outcomes from land-use changes without the use of a traditional four-step transportation model. This feature has made SGI a particularly valuable tool for communities because it fills an important niche – it allows the user to see rough estimates of transportation impacts from projects without needing to run a labor-intensive travel demand model. In addition, SGI in forecast mode can run in tandem with popular four-step transportation models, instead of relying on its internal travel submodel.

The Snapshot Mode:

The snapshot mode estimates the impacts of known, detailed alternative development plans. It takes a "snapshot" at a moment in time, whether current or future, generally applying the analysis to a smaller scale area than the forecast sketch. The "base case" scenario usually represents existing conditions on a site. The user can examine potential impacts by varying any of the following:

- Land use designations and densities
- Mix of housing types and job types
- Transportation system characteristics

The user enters various input parameters concerning land use, transportation, and other conditions. When future snapshot sketches are prepared, the user-specified baseline estimates of per-capita vehicle trips and vehicle miles of travel are adjusted to reflect impacts of changes in density, jobs/housing balance, and pedestrian design.

Data and Resource Requirements for SGI

Although SGI is less data-intensive than many models, the data requirements are nonetheless significant. In a setting where land and travel data are not routinely maintained in a GIS environment, first-time development of needed data can consume considerable resources. In localities which have already invested in such basic data, the accumulation of files and development of other inputs can and does occur quite quickly.

SGI Version 1 requires GIS coverages, including the following data, in "ESRI shapefile" format (an industry standard for data exchange):

- Existing land-use designations by class (parcel-based, for snapshot mode only)
- Planned land use designations by class (typically from comprehensive plans, not parcel level of detail)
- Existing housing (single family or multifamily) locations by point (note: point implies the address-specific location of a single residential structure) (forecast mode only)
- Existing employment by type (retail, service, or other) and job count in point format
- Existing and future street centerlines attributed by functional class, number of lanes, and sidewalk presence
- Transit routes (bus or rail) and transit stops for snapshot sketches

Once installed, SGI snapshot is suitable for non-technical users with moderate computer skills. Use of the forecast mode requires higher skill levels, both in model comprehension and GIS. Installation and maintenance require an experienced model steward with GIS and transportation modeling experience. At a minimum, SGI requires a 300- MHZ or higher PC with 128 MB of RAM, and Microsoft Windows 95 or later operating systems.

SGI Indicators

SGI helps communities assess development scenarios by scoring projects with indicators that measure a host of prospective impacts. These include: land consumption, pollutant emissions and other environmental consequences, housing and employment density, proximity to transit, and travel costs, among other things. The software can also produce maps to illustrate geographical variations in indicator outcomes; such maps are often useful as visualization aids for public forums. SGI Version 1 scores sketches using either 26 indicators (forecast sketch mode) or 29 indicators (snapshot sketch mode). Land allocations can be tabulated for land-use classes and local jurisdictions. The forecast and snapshot mode indicators are respectively given in Tables 1 and 2 below. Additional details regarding the indicators are available from the SGI Reference Guide at >>http://www.epa.gov/smartgrowth/<< (click on “Browse Smart Growth Topics,” then on “Smart Growth INDEX”).

Table 1. SGI Version 1 Forecast Sketch Indicators

Indicator	Expressed As
1. Population density	Persons/square mile
2. Growth compactness	Persons/square mile
3. Incentive area use for housing	Percent of total housing capacity utilized in incentive areas (as entered by user)
4. Incentive area use for employment	Percent of total employment capacity utilized in designated incentive areas (as entered by user)
5. Housing density	Dwelling units (DU)/gross acre
6. Housing transit proximity	Percent of all DU within 1/4 mile of transit route
7. Residential energy use	MMBtu/year/capita for housing and auto travel
8. Residential water use	Gallons/day/capita
9. Employment density	Employees/gross acre
10. Employment transit proximity	Percent of all employees within 1/4 mile of transit route
11. Jobs/housed workers balance	Ratio of total jobs to total housed workers, assuming a constant 1.4 workers per household
12. Vehicle trips	Vehicle trips taken/day/capita
13. Vehicle miles traveled	Miles driven/day/capita
14. Vehicle hours traveled	Hours driving time/day/capita
15. Vehicle hours of delay	Hours delayed in traffic/day/capita
16. Single-occupant vehicle mode share	Percent of total daily person trips by auto driver
17. Auto passenger mode share	Percent of total daily person trips by auto passengers
18. Transit mode share	Percent of total daily person trips by transit
19. Walk/bike mode share	Percent of total daily person trips on foot or bike
20. Auto travel cost	Dollars/year/capita
21. Nitrogen oxides vehicle emissions	Pounds/year/capita
22. Sulphur oxides vehicle emissions	Pounds/year/capita
23. Hydrocarbon vehicle emissions	Pounds/year/capita
24. Carbon monoxide vehicle emissions	Pounds/year/capita
25. Particulate matter vehicle emissions	Pounds/year/capita
26. Carbon dioxide vehicle emissions	Tons/year/capita

Table 2. SGI Version 1 Snapshot Sketch Indicators

Indicator	Expressed As
1. Population density	Persons/square mile
2. Use mix	INDEX of use dissimilarity among one-acre grid cells
3. Land-use diversity	INDEX of sketch area population/ employment mix in relation to region mix
4. Residential density	Dwellings per net acre of residential land
5. Single-family housing share	Percent of single-family units/total dwellings
6. Multi-family housing share	Percent of multi-family units/total dwellings
7. Housing proximity to transit	Percent of dwellings within 1/4 mile of transit stop
8. Housing proximity to recreation	Percent of dwellings within 1/4 mile of park
9. Residential energy consumption	MMBtu/year/capita for housing and auto travel
10. Residential water consumption	Gallons/day/capita
11. Jobs/housed workers balance	Ratio of total jobs to total housed workers, assuming a constant 1.4 workers per household
12. Employment density	Employees/net acre of employment land
13. Employment proximity to transit	Percent of employees within 1/4 mi. of transit stop
14. Park space availability	Park acres/1,000 persons
15. Open space	Percent of total sketch area in open space land-use classes (as designated by user)
16. Sidewalk completeness	Percent street frontage with sidewalks
17. Pedestrian route directness	Average ratio of walking distance from point of origin to central node, compared to straight line distance
18. Street network density	Street centerline miles/square mile
19. Street connectivity	Ratio of intersections to total intersections plus cul-de-sacs
20. Pedestrian environment design	Composite index of street network density, sidewalk completeness, and pedestrian route directness
21. Vehicle trips	Vehicle trips/day/capita
22. Vehicle miles traveled	Miles driven/day/capita
23. Auto travel cost	Dollars/year/capita
24. Carbon monoxide vehicle emissions	Pounds/year/capita
25. Hydrocarbon vehicle emissions	Pounds/year/capita
26. Sulphur oxides vehicle emissions	Pounds/year/capita
27. Particulate matter vehicle emissions	Pounds/year/capita
28. Carbon dioxide vehicle emissions	Tons/year/capita
29. Nitrogen oxides vehicle emissions	Pounds/year/capita

The SGI indicators can be displayed in multiple formats. SGI produces tables that list each indicator and its score for each modeled scenario. The indicator scores can be compared among scenarios to provide a direct contrast of outcomes for public facilitators and participants. Most indicators can also be mapped, as noted above, to illustrate geographical variations. Lastly, SGI produces bar charts that demonstrate, for a given scenario, how a set of indicators changes relative to the baseline score. Samples of these various readouts are given in Appendix A.

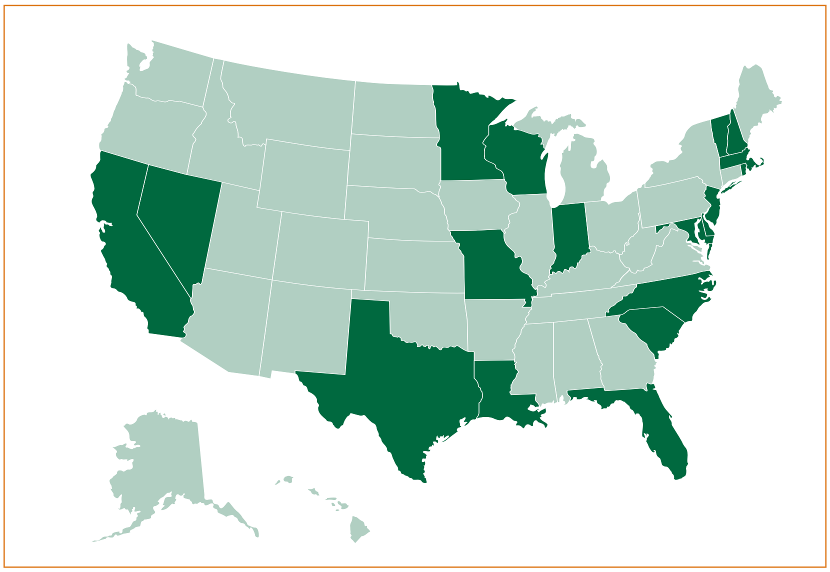
Section III: Smart Growth INDEX Pilot Projects

For the first pilot applications of the Smart Growth INDEX (SGI), EPA selected 20 pilot projects from the more than 40 pilot project proposals submitted, using the criteria discussed in the Introduction (Section I) of this report.

Overview Statistics

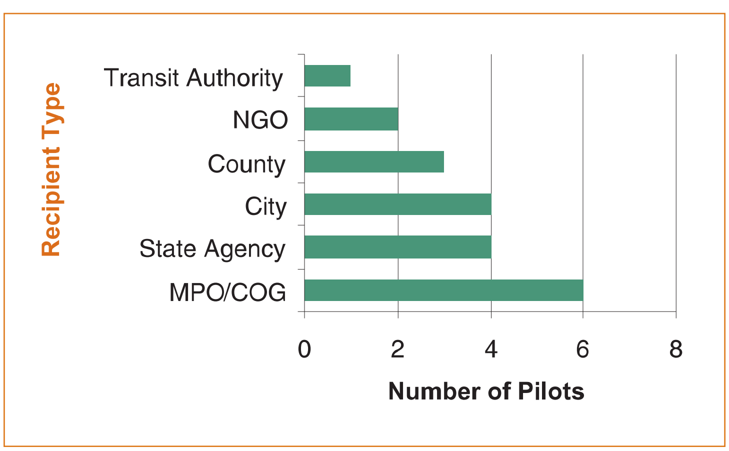
In the map shown in Figure 1, the states with shading have an SGI pilot. Of the shaded states, Maryland, North Carolina, and Texas each have 2 pilots.

Figure 1. Location of SGI Pilots, Phase 1



Interest in the pilot program has come from a variety of government entities and other organizations. Figure 2 below shows how the 20 pilot project sponsors are distributed among six categories: one transit authority, two non-governmental organizations, three counties, four cities, four state agencies, and six metropolitan planning organization/council of government entities.

Figure 2. Pilot Sites By Recipients Type



Abbreviations:

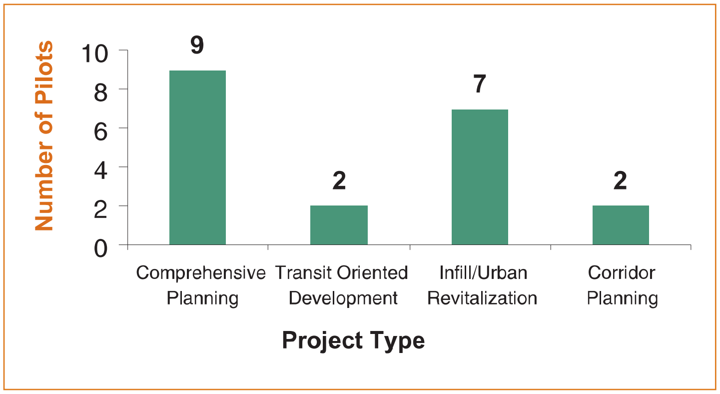
NGO: Non-Governmental Organization

MPO: Metropolitan Planning Organization

COG: Council of Governments

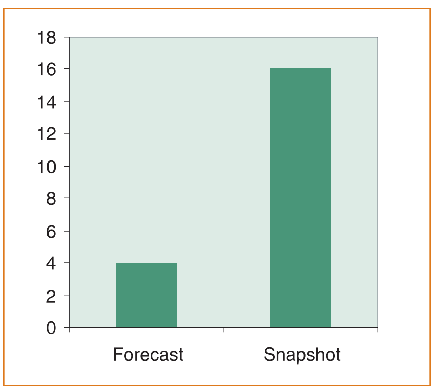
Pilot communities are using SGI for a variety of purposes. The bar graph in Figure 3 gives an overview of the basic types of projects that SGI is supporting.

Figure 3. SGI Pilots by Project Type



During the initial pilot testing of SGI, most pilot communities chose to work with the snapshot mode, primarily because it is simpler to run and has been subject to more testing than the forecast mode. (The differences between SGI's snapshot and forecast modes are discussed early in Section II.) As shown in Figure 4, 16 pilot communities used the snapshot mode; four used the forecast mode of SGI.

Figure 4. SGI Mode Used By Pilots



Profiles of Selected SGI Pilot Projects

Seven pilot projects are discussed below to illustrate applications of the model in different contexts. These examples represent state, regional, and local uses, and varying circumstances of resources and analysis. A number of sites used SGI output to develop public support for more extensive application in the locality's comprehensive plan. Others used the model to illustrate the potential air quality improvements with smart growth development. Nearly all of the pilot sites used SGI to instigate the planning process and/or to sketch — for public discussion — alternatives for future development. SGI makes it possible to increase community understanding of the effects of development alternatives on the local and regional quality of life, as well as to enhance public participation in the process of evaluating new development alternatives. Each of these pilot communities will continue its work with Smart Growth INDEX beyond the initial pilot phase reported here.

Pilot Case #1

Site: **Fells Point - Baltimore (Digital) Harbor, Baltimore, Maryland**

Sponsor: **Maryland Department of Planning**

Features: The Maryland Department of Planning (MDP) decided to use SGI in its study regarding redevelopment in the Baltimore Inner Harbor, also known as Digital Harbor. The redevelopment involves a series of large-scale, mixed-use developments surrounding an ongoing hi-tech business expansion. The state wanted to quantify air quality benefits for the Digital Harbor project at two levels:

- At the macro level, a regional transportation model was used to evaluate travel and air quality impacts of the concentration of projects at a central location
- At the micro level, the Smart Growth INDEX model was used to quantify travel effects and air quality benefits associated with density, diversity, and design for a sample sub-area

Context: In 2001, the EPA released guidance on how states and regions could incorporate land-use activities in developing state implementation plans (SIPs) for meeting federal air quality standards. The state of Maryland has been an innovator in employing land-use activity to improve air quality and chose to apply SGI to help illustrate the potential benefits of redevelopment in the Digital Harbor. In aggregate, development of the Digital Harbor area is expected to result in an additional 26,400 jobs and 5,900 households by 2005, and 37,600 jobs and 10,400 households by 2020 in the City of Baltimore.

Approach: Given resource challenges associated with the quantification of all projects within Digital Harbor, MDP officials chose to focus on a representative study area: greater Fells Point. Projects within greater Fells Point area include residential, office/commercial, retail/entertainment, and hotel developments. Maryland officials estimated that these projects would generate 14,800 new jobs and 1,100 new housing units.

Using SGI's snapshot mode, planning officials were able to estimate air quality impacts resulting from different mixes of housing and employment in the greater Fells Point area.

EPA's Development, Community, and Environment Division (DCED) staff provided assistance through on-site visits, on-call phone and e-mail support, and review of data quality. EPA staff also assisted the users in the process of focusing the project on a smaller site area within Digital Harbor for estimate analysis.

Results and Future plans: Several SGI indicators of environmental performance stood out as especially germane to travel behavior and air pollutant emissions. Using SGI, Planning Department officials estimated that smart growth development in the Fells Point area would reduce daily vehicle miles travelled (VMT) per capita, and annual per capita emissions of nitrogen oxides, volatile organic compounds, and greenhouse gases by 14 percent, as compared to the baseline/no build scenario for the site. As shown in Figure 5, the study compared indicators of "ideal values" for the future with the planned scenario for Fells Point.

Figure 5. Sample Readout from Fells Point SGI Pilot Project (Baltimore, Maryland)

Indicator	Description	Ideal Scenario*	Fells Point Scenario
Persons/sq. mi	Persons (residents and employees) per sq. mi.	100,000	75,570
Jobs/housing balance	Ratio of total jobs to total housed workers	1.0	6.93
Land use mix	Proportion of dissimilar land uses among a grid of one-acre cells.	1.0	0.63
Street network density	Length of street in miles divided by areas of neighborhood in square miles (miles per sq. mile.)	10	34.6
Sidewalk completeness	Percent street frontage with sidewalks	100	100
Route directness	Ratio of shortest walking distance from outlying nodes to neighborhood center vs. straight-line distance	1.3	0.9
Street connectivity	Ratio of intersections vs. intersections and cul-de-sacs	1.0	0.67
Average distance to transit stop	Average distance from dwellings to closest transit stop in feet	600 **	229
Housing near transit	Percent of dwellings within 1/4 mi. of transit stops	100	90

* Ideal scenario generated by MDP from SGI support information and other published sources.
** Maximum ideal distance

Results from these analyses have been included in Maryland's current SIP revision, as an illustration of the potential effects of smart growth on regional air quality. In addition, Maryland officials have used the results from SGI to communicate with other public officials in the Baltimore region and colleagues nationwide on the prospective advantages associated with smart growth and infill development. These communications included briefings to the American Planning Association and the Baltimore Metropolitan Council.

For Maryland officials, Smart Growth INDEX filled a gap in their tool box by helping to determine the emissions reductions associated with micro-scale improvements in development design. The tool also contributed to the department's capacity to share its experiences with public officials in a quantified and illustrated manner. In the future, the Maryland Department of Planning intends to increase its use of Smart Growth INDEX. Having employed the snapshot mode of SGI, officials anticipate employing the forecast mode to examine future development in the state.

Pilot Case #2
Site: Broadway Corridor, San Antonio, Texas
Sponsor: VIA Metropolitan Transit

Features: San Antonio planning groups worked with a broad coalition of stakeholders to analyze future development opportunities in the Broadway corridor. The group identified existing assets to leverage in conjunction with new redevelopment patterns, as part of a smart growth strategy for the neighborhood.

Context: The San Antonio City Planning Department worked with EPA regional and headquarters staff to bring together representatives from the City Public Works Department, the Alamo Area Council of Governments, and local residents and business leaders to discuss a new vision for the future development of the Broadway corridor. The corridor is a prime reuse area with numerous historical buildings and community assets such as a zoo, gardens, museums, and a university.

The group recognized four major goals for their discussions of redevelopment alternatives in this corridor:

- Fully identify all of the reuse capacity in the area
- Test new provisions of San Antonio's Uniform Development Code, which encourages redevelopment of existing neighborhoods
- Look at the potential transit uses for underused roadway capacity along Broadway Street
- Improve the stakeholders' understanding of the connection between land use, transportation, and the environment

Approach: The coalition of community members came together to envision development alternatives for the corridor, given existing assets and the four major goals described above. The group applied SGI to evaluate the effects of different scenarios on the local environment and quality of life.

Three main alternatives were modeled:

- The existing conditions along Broadway Street
- A compilation of the existing proposed land plans that predominantly focused on auto- oriented development
- A new development plan, created by the coalition of stakeholders involved in this process, that focused on mixed use, reuse, and transit-oriented development

A sequence of public forums was convened to review and discuss SGI indicator outputs from all three alternatives. Thereafter, the group repeatedly improved upon the third alternative — a new development plan — which enabled them to develop a final proposal with "optimum" indicator outputs.

Staff from EPA's Development, Community, and Environment Division provided extensive assistance throughout the modeling and stakeholder participation process for San

Antonio. EPA staff helped plan and convene the charrette for stakeholders to develop the alternative scenarios. The staff met with other partners to describe the software and present its capacity to help local planning. Technical support was provided to integrate the alternatives into the model as well as convert necessary data for model inputs. Criterion Planners and Engineers — the Portland, Oregon, contractor involved in developing SGI — delivered a post-charrette presentation of the indicator outputs for the three alternatives. EPA provided further assistance in reviewing the locality's development code for existing policies that would help the area reach its pre-defined goals of improved air quality, reduced water consumption, and enhanced community livability.

Results and Future Plans: The team compared outputs from the three scenarios to examine the necessary steps for corridor revitalization and improvement. The land use indicators that differed most significantly between the modeled scenarios included:

- Land use balance
- Developed footprint
- Multi-family dwelling density
- Employment density
- Transit-oriented residential development

These land use changes were reflected in a number of environmental outcome measures as well. For instance, the community-recommended plan showed a six percent decrease in greenhouse gases and air pollutant emissions. This same plan also forecasted a 55 percent decrease in imperviousness (in terms of impervious acres per capita). Additional indicator outcomes are shown in Figure 6.

Results such as those shown in Figure 6 were used in the consensus-building community process to create a new vision for San Antonio's Broadway Corridor. SGI readouts were also used for agency coordination purposes during the redevelopment efforts for the corridor. Findings were published in the *ESRI magazine* as well as numerous local newspaper articles. The City and stakeholder team expect to continue to use SGI to refine the development plan for the corridor. Additionally, the city's VIA Metropolitan Transit Agency will use the SGI forecast mode to examine how the existing transit system assists (or hinders) smart growth development. City planners are considering use of SGI for the city's neighborhood planning process as well.

Figure 6. SGI Indicator Scores: Broadway Coridor Project (San Antonio, Texas)

Element	Indicator	Units	Existing Conditions	CoSA Future	Scheme 4 Future
Demographics	Population	residents	11,934	18,027	27,117
	Employment	employees	13,274	15,644	30,173
Land-Use	Land Area	acres	2,364	2,364	2,364
	Block Size	acres	4.76	4.76	4.76
	Parcel Size	sq ft.	22,536	22,373	22,356
	Parking Lot Size	acres	no data		
	Use Mix	0 to 1 index	0.42	0.38	0.43
	Use Balance	0 to 1 index	0.62	0.66	0.69
	Developed Footprint	acres/1000 residents	97	66	44
	Vacant Land	acres	135	48	45
	Redevelopable Land	acres	no data		
Housing	Single-Family Parcel Size	sq ft.	9,116	9,692	9,537
	Single-Family Dwelling Density	DU/acre	4.78	4.49	4.57
	Multi-Family Dwelling Density	DU/acre	16.96	16.78	22.77
	Single-Family Dwelling Share	% total DU	43	26	17
	Multi-Family Dwelling Share	% total DU	57	74	83
	Amenities Proximity	walk ft. to closest grocery	1,702	1,700	1,613
	Transit Proximity	walk ft. to closest stop	988	876	745
	Water Consumption	gal/day/capita	129	132	131
Employment	Jobs to Housing Balance	jobs/DU	3.56	2.85	3.49
	Employment Density	emps/acre	17.97	21.31	36.98
	Transit Proximity	walk ft. to closest stop	550	502	495
	Commercial Building Density	floor area/land area ratio	no data		
	Commercial Building Setback	ft.	no data		
Recreation	Park Space Supply	acres/1000 res.	24	16	11
	Park Proximity	walk ft. to closest park	2,422	2,371	2,325
Travel	Internal Street Connectivity	intersections/node ratio	0.93	0.93	0.93
	External Street Connectivity	ft. between access points	545	545	545
	Street Network Density	miles/sq. mi.	17.53	17.53	17.53
	Street Network Extent	miles/1000 residents	5.54	3.59	2.39
	Transit-Oriented Residential Density	DU/acre w/i 1/4 mi.	8.41	9.69	13.10
	Transit-Oriented Employment Density	emps/acre w/i 1/4 mi.	16.40	18.10	33.62
	Transit Service Coverage	stops/sq mi	44	44	44
	Transit Service Density	tran. veh-mi/day/acre	9.50	12.52	12.52
	Pedestrian Network Coverage	% tot. centerline dist.	100	100	100
	Pedestrian Crossing Distance	curb to curb ft.	30	30	30
	Pedestrian Route Directness	route ft./direct ft. ratio	1.29	1.29	1.29
	Bicycle Network Coverage	% tot. centerline dist.	9	9	12
	Vehicle Miles Traveled	veh-mi/day/capita	19	18.54	17.92
Environment	Air Pollutant Emissions	lbs/capita/year	254	250	239
	Greenhouse Gas Emissions	lbs/capita/year	6,935	6,833	6,534
	Open Space Share	% total area	18	18	18
	Open Space Connectivity	0 to 1 index	0.8	0.89	0.89
	Imperviousness	acres/capita	0.09	0.06	0.04

Favorable
Marginal
Unfavorable

* Ratings were determined by the stakeholder group
** CoSA Future: Existing Future Land Use Plans
*** Scheme 4 Future: Charrette-developed scenario

Source: Smart Growth Indicators Modeling of the Broadway Corridor, 2001

Project Case #3

Site: New Castle County, Delaware, and Cecil County, Maryland

Sponsor: The Wilmington Area Planning Council

Features: The Wilmington Area Planning Council (WILMAPCO) used SGI in the snapshot mode to evaluate alternative brownfield redevelopment scenarios and in the forecast mode to help inform its long-range planning activities. The results helped to garner public support for future uses of the model.

Context: WILMAPCO is the metropolitan planning organization for New Castle County, Delaware, and Cecil County, Maryland. The region is a diverse mix of an older industrial port city (Wilmington), fast growing suburban areas, and traditionally rural land.

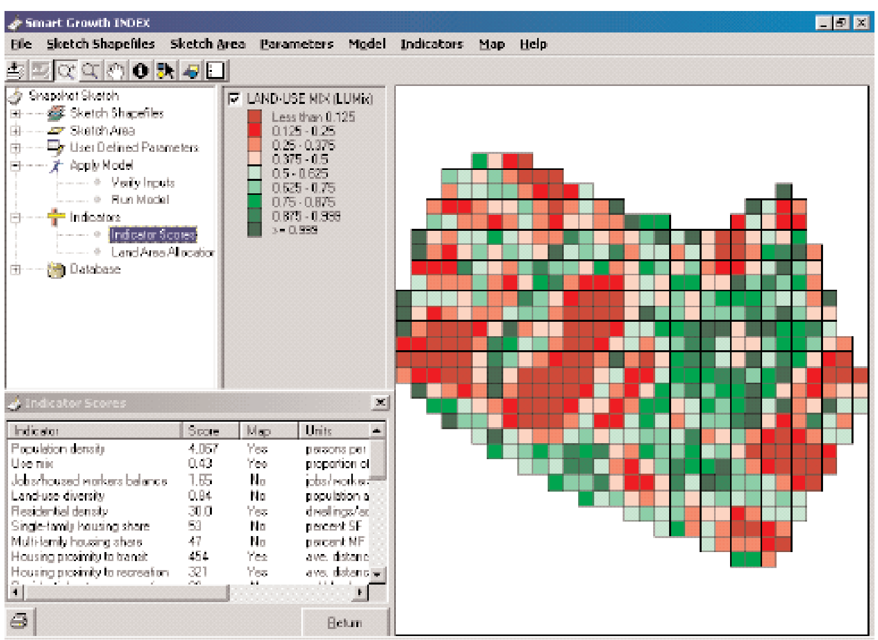
In 2001, WILMAPCO used SGI's snapshot mode to compare alternative brownfield redevelopment scenarios for the City of Wilmington, Delaware, the region's most populous city at 72,000 people. In addition to those snapshot applications, WILMAPCO is using the forecast mode option to help inform its long-range planning activities. The long range transportation plan looks forward at least 20 years and lays out policy, action, and transportation investment initiatives.

Approach: The snapshot mode was used to compare three brownfield redevelopment scenarios. The "base condition" focused on a vacant property targeted by the City and State for future economic development activity. The alternative scenarios tested a variety of options at each site, including high density residential, intense commercial, and industrial. Each of these options was modeled as a separate scenario. The results were compared with the base case to determine the relative impacts of each option. (See Figure 7 for a "use mix" readout for the base scenario.)

The forecast mode is being applied to the area's long-range plan. This mode will help the partners engage the public on issues of environmental protection, land use, and transportation. They engaged diverse partners, including the City's Planning and Economic Development departments, the Delaware Department of Natural Resources and Environmental Control, the State Office of Planning Coordination, and EPA to select specific brownfield sites in the City to model with SGI.

Staff from EPA's Development, Community, and Environment Division (DCED) provided support initially through a two-day onsite working group to help prepare existing regional data for the model. Staff provided

Figure 7. "Use-Mix" Indicator Readout for Base Scenario*: Wilmington Area Project (New Castle and Cecil Counties)



*Note on color code: Green indicates greater mix of uses; red indicates less mix.

regular on-call support via phone and email. Additionally, EPA provided the users with presentation materials for the MPO Technical Committee and public forums. Staff assisted in a panel presentation for the Transaction 2002 conference that highlighted SGI application in WILMAPCO's planning process.

Results and Future Plans: WILMAPCO staff made presentations about the SGI model to the following groups: the WILMAPCO Technical Advisory Committee, Delaware Geographic Data Committee, a designated SGI model development stakeholder group, and the New Castle County Council. In each case, SGI received very favorable comments. In an upcoming series of public outreach meetings for its long range planning process, WILMACO will use SGI to illustrate how environmental impacts relate to issues of land use and transportation. By visually illustrating the impacts of the land use and transportation changes and quantifying the effects of the long-range plan at public meetings, SGI can help build stronger public participation.

> "The EPA Smart Growth INDEX model provides an extremely useful tool to allow a small agency with limited resources . . . to more effectively engage the public and decision makers in an informed debate regarding transportation and land use options for the future."
>
> *– Mr. Ted M. Matley*
> *Executive Director, WILMAPCO*

Dan Blevins, the model steward at WILMAPCO, has commented that SGI is very useful because it allows metropolitan planning organizations to test many scenarios quickly. For instance, Blevins used SGI to run various scenarios involving transit service and fare changes in relatively little time compared to other model options. What's more, SGI is easy to understand, he said, and therefore useful when communicating to the public.

WILMAPCO plans to continue using SGI to inform its long-range planning process in the future.

Pilot Case #4

Site: Berkeley-Charleston-Dorchester Counties, Charleston, South Carolina region

Sponsor: Berkeley-Charleston-Dorchester Council of Governments

Features: The Berkeley-Charleston-Dorchester Council of Governments (BCDCOG) used SGI to project future growth patterns based on current policies and planned infrastructure improvements. The Council then compared these to alternative investment patterns and development choices, and examined the environmental quality and transportation capacity impacts of each scenario.

Context: The Berkeley-Charleston-Dorchester region is home to more than 500,000 residents, and its growth patterns indicate that land development is outpacing population growth by six to one. In response to this challenge, the region's Council of Governments has begun to develop regional strategies and models to link transportation and infrastructure planning to land use planning.

> "[SGI] has expanded our potential land use modeling capacity far beyond what is typically feasible for a smaller metropolitan area such as ours."
>
> *– Ron Mitchum, Executive Director*

Approach: The BCDCOG is using the SGI model to analyze development options for the region's future land use and zoning plans. The model is particularly valuable for the region's Growth Options Program because of its capacity to illustrate how different land use, transportation, and infrastructure policies can affect growth patterns. Data were collected for the three-county area, including the regional municipalities. The staff is currently revising the zoning data for Charleston and Berkeley Counties for their recently updated zoning ordinances. BCDCOG staff has run the model for Berkeley County's future land use and zoning data for preliminary results. Currently, the users are concentrating on the analysis of three primary indicators: housing, population, and employment densities.

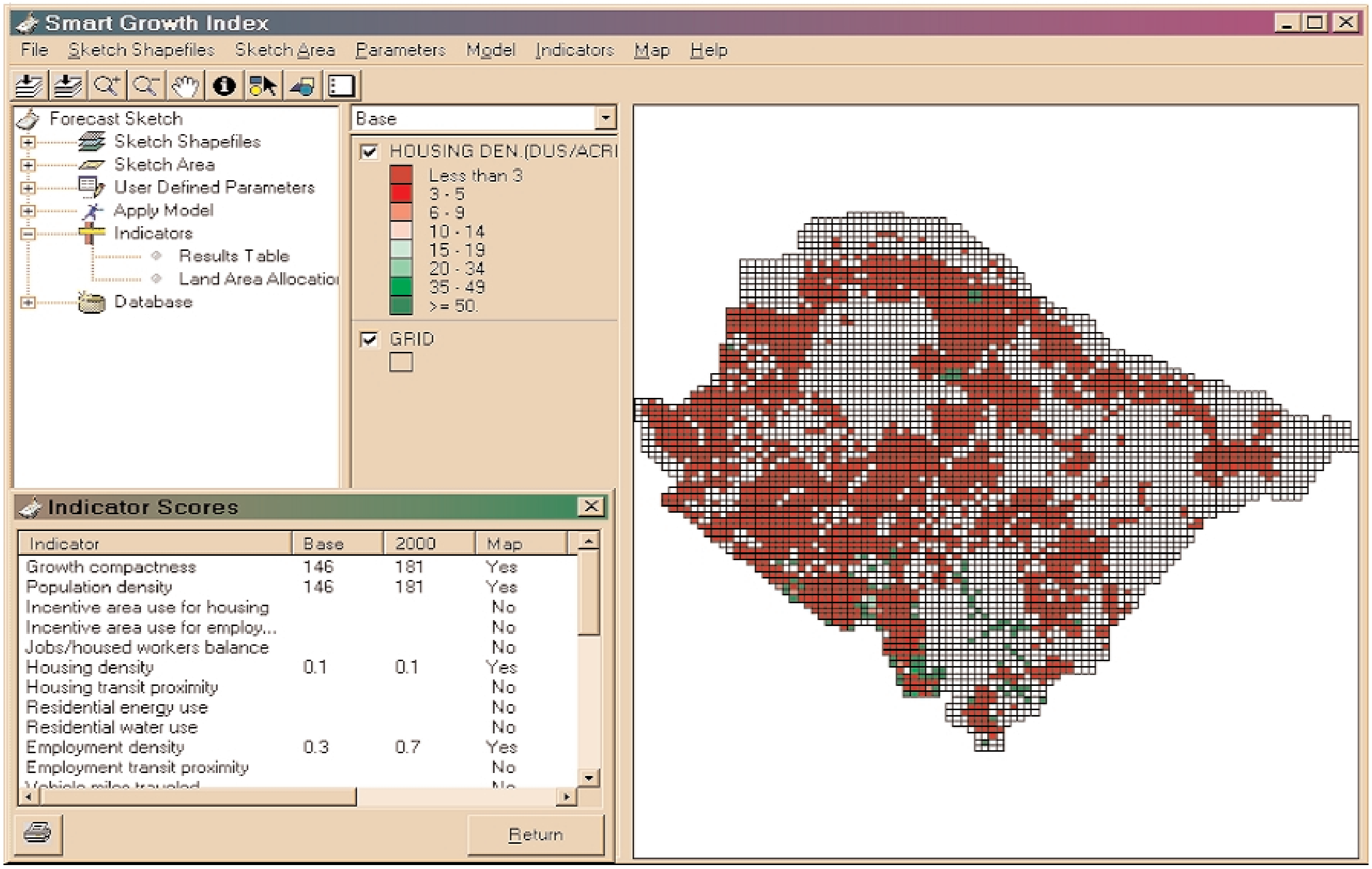
EPA's Development, Community, and Environment Division staff provided assistance through on-call support and technical data review. Staff also helped the Council of Governments create consistent land use definitions across the county jurisdictions and improve the street network coverage used in the model.

Results and Future Plans: The results from the model will be used to aid regional discussions concerning growth patterns. It is expected that the SGI forecast module will provide a sophisticated analysis and projection of future growth patterns that will lead to increased interest by policy makers about the impacts of regional land use policies. It is also expected that the SGI model will increase understanding about the link between land use and infrastructure demands for the public.

The BCDCOG hopes that the results can be used by their economic and environmental consultants on the Growth Options project to feed into fiscal and environmental cost models. This in turn can provide the region with estimated costs associated with growth alternatives. Considered together, these outputs will help the region more fully understand the long-term impacts of different development and infrastructure scenarios on its economy and environment.

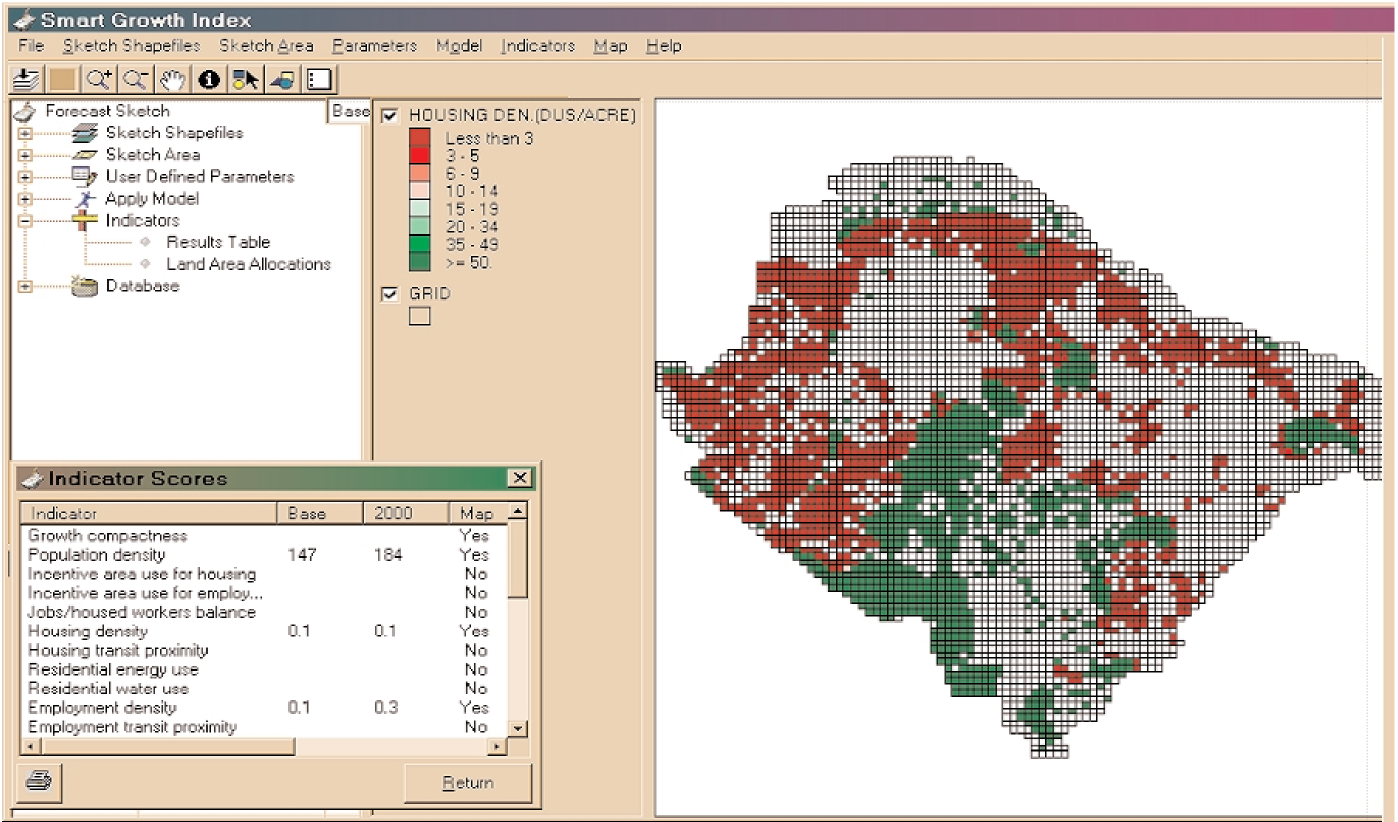
Housing Density Map Outputs: The housing density maps reproduced below illustrate growth being redirected in the study area by pursuing more compact building design, more housing types, and higher densities. Note how under existing conditions (Figure 8), most of the region is scattered with lower density housing at less than 3 dwelling units per acre (red areas). Then compare Figure 9, which shows a scenario in which more compact design and higher densities are redirecting the region's housing growth.

Figure 8. Map Illustrating Existing Housing Density: Berkeley-Charleston-Dorchester Counties, Charleston, South Carolina, Project



Note on color code: Red/pink indicates low density; deepening shades of green indicate higher densities.

Figure 9. Map Showing Future Housing Density Scenario: Berkeley-Charleston-Dorchester Project



Pilot Case #5
Site: Two Harbors, Minnesota
Sponsor: Minnesota Department of Planning

Features: The Minnesota town of Two Harbors is using SGI for a twofold purpose: (1) to analyze how its comprehensive plan supports smart growth principles and (2) to check for any internal inconsistencies within the plan.

Context: A town of approximately 4,000 people, Two Harbors is in the northeastern part of the state, along the northern shores of Lake Superior. The town itself is located on two natural bays along the North Shore of Lake Superior; it is bisected by Highway 61. Highway 61 is known as the North Shore Scenic drive, long recognized as an extraordinary scenic drive.

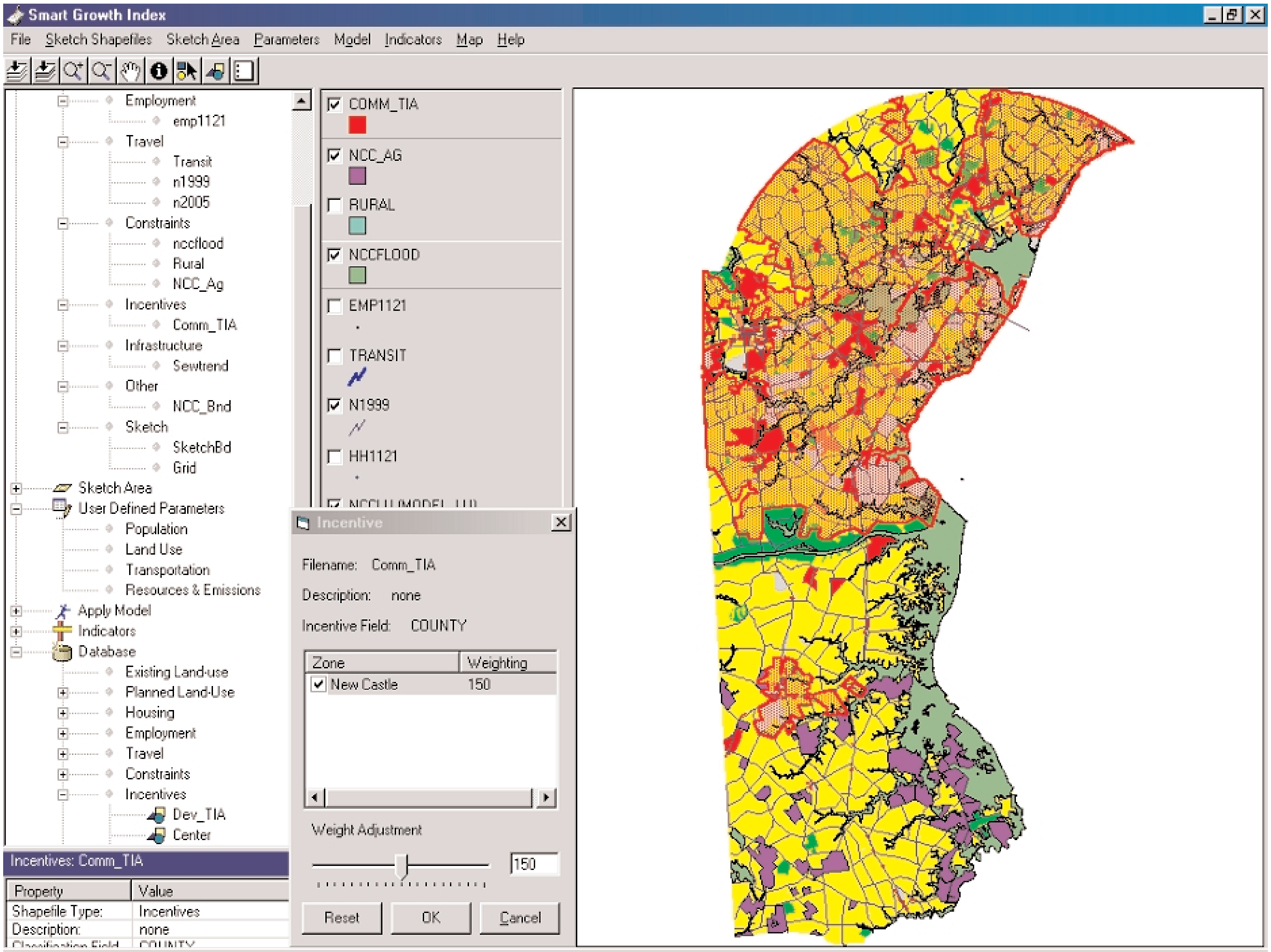
Two Harbors lost 18 percent of its population between 1970 and 2000. In an effort to spur revitalization, the city and its residents have been exploring and discussing planning directions and overall city improvements. Projects under consideration include a new high school, a trail head for the North Shore Trail, a safe harbor, a context-sensitive design for the reconstruction of Highway 61, and a new focus on the historic downtown area in conjunction with Lake Superior.

Approach: The modeling effort is being carried out through a collaboration of the State of Minnesota Planning Department's Local Planning Assistance Team with the Arrowhead Regional Development Commission and the town of Two Harbors. Since mid-2000, this team has put together a comprehensive collection of geo-spatial data for both the town of Two Harbors and Lake County. Data developed for the town include: sewer and water lines, home locations by type, employment points, park locations, a zoning map, and an existing land use map. A town- and county-wide planning GIS support system for planners and the community has been developed using these sources and other current state datasets. (See Figure 10, which illustrates existing land uses in Two Harbors.)

Results and Future Plans: Initial meetings on the use of the Smart Growth INDEX and how it relates to comprehensive planning and various city opportunities took place on March 11, 2002. Smart Growth INDEX is being used to create a benchmark of conditions for evaluating future alternatives for city projects and build-out scenarios. The next step: Forecasting will be used to address several viable options related to housing development, recreational access, and opportunities, downtown revitalization, and the redesign of Highway 61. The City Council will then examine the Smart Growth INDEX results for planning consideration and general information about various spatial relationships in the community.

The cooperation between the state, region, and locality to evaluate development alternatives endows this process with enhanced capacity. By working with the state, Two Harbors puts concentrated effort into the development of the local and county GIS databases, and it will have greater long-term ability to examine future land use changes.

Figure 10. Existing Land Uses in Study Area: Two Harbors, Minnesota



Pilot Case #6
Site: Hudson, Massachusetts (Boston Area)
Sponsor: Boston Metropolitan Area Planning Council

Features: Located 40 miles from Boston, along the I-495 corridor, Hudson, Massachusetts, has recently experienced rapid residential and high-tech commercial growth, along with increased traffic congestion. SGI was used to evaluate impacts of further growth in jobs and housing on the region's worsening traffic congestion and air quality.

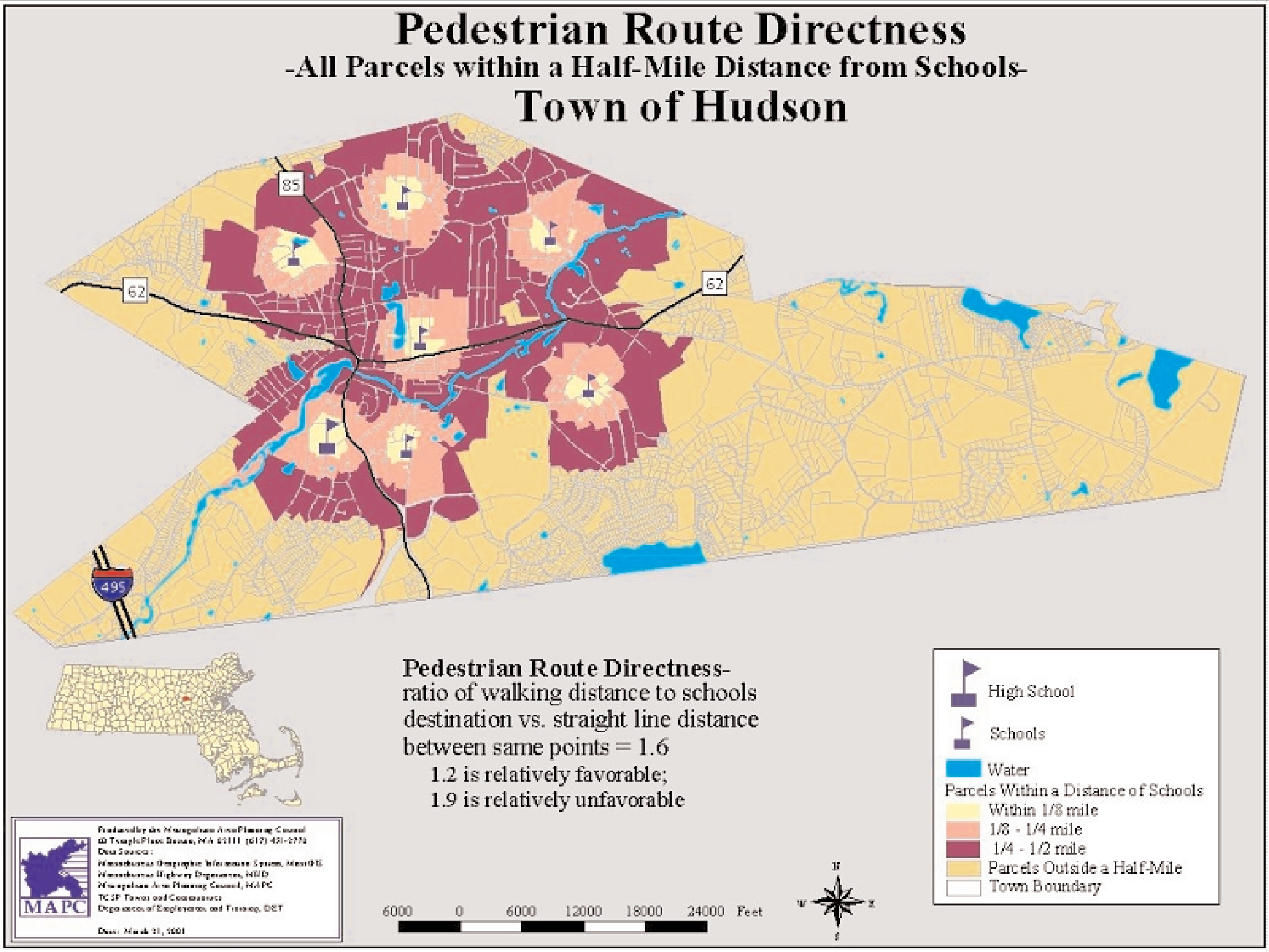
Context: Through an FY 1999 Transportation and Community and System Preservation (TCSP) grant from the US Department of Transportation, the Metropolitan Area Planning Council (MAPC) and a large number of area stakeholders launched a project called the "I-495 Technology Corridor Initiative/Campaign for Shared Solutions." Desiring to balance economic vitality and community preservation, MAPC is working with residents of the community to compare their goals for the future with a build-out scenario that would be allowed under current zoning practices. As part of this process, SGI is being applied to the town of Hudson along this corridor.

Approach: In addition to depicting the impacts of the build-out case, SGI will be used with community residents to develop alternative visions of transportation investments and land use scenarios. In Hudson, SGI was used to analyze two potential development projects. The first was an expansion of an Intel Corporation campus, slated to the number of employees from 2,000 to 2,500. The second was a proposed condominium development of 150 units that required changing the current zoning from commercial to residential. The snapshot sketch provided a useful level of analysis of the impacts of each of these projects. During the project development phase, staff from EPA's Development, Community, and Environment Division helped the planning council determine the best application of the model for regional goals and select an initial site.

Results and Future Plans: Addition of the proposed jobs and housing showed slight incremental effects on the indicators modeled in SGI. These relatively small impacts may be the result of the locations of the developments within the pattern seen in Hudson, or may reflect the comparative size of the projects in relation to overall development in the region. However, a series of developments of this type and size would likely have a much larger effect on the environment.

Although the initial SGI analysis results were not dramatic, the public gained a greater understanding of land use and transportation interplay through this analysis. Visual representation of these interrelationships, such as pedestrian route directness seen in Figure 11, allowed the community to participate more fully in the long-term corridor analysis than would otherwise be the case. This information is now being considered by County and planning officials, who will decide whether to allow these projects to proceed. Within the scope of the TCSP grant, SGI will be used for impact review of other development proposals as well.

Figure 11. Map Illustrating Pedestrian Route Directness in Hudson, Massachusetts



Pilot Case #7
Site: Indianapolis and Marion County, Indiana
Sponsor: City of Indianapolis

Features: The city of Indianapolis is using the SGI model in its comprehensive planning process. It will also integrate the model into its natural resources management program as a tool to assess the impacts of development and other land use changes on the city's natural environment. In addition, Marion County will also be using SGI in its county-wide comprehensive planning process, although that process has been temporarily postponed. The intent is to use SGI to forecast changes in large areas of the county where significant growth and development are anticipated.

Context: Two main Indianapolis city agencies are using the model: the Department of Metropolitan Development (in particular, its Division of Planning), and the Department of Public Works (specifically, its Environmental Resources Management Division).

The two agencies are working collaboratively. The Planning Division of the Department of Metropolitan Development devoted staff to ensure the model would be installed correctly and run effectively. The Department of Public Works dedicated staff members from a variety of disciplines to participate in the project.

Approach: For Indianapolis' comprehensive plan, the first application of the model was running scenarios of land use options. These included applying various growth boundaries in and around the city, preserving significant open spaces, making adjustments in development density in certain areas of the city, framing policies promoting infill development, and other options. Subsequent applications include sub-area planning, and comparing transportation-related alternatives in the context of long-range planning.

The city also intends to use the SGI program in conjunction with the Long-Term Hydrologic Impact Analysis (L-THIA) model, developed by Purdue University and EPA's Region 5 (Chicago) office, to examine changes in forest cover, watershed impacts, air quality impacts, brownfield redevelopment issues, development impacts in wellhead protection areas, and habitat changes under various land use scenarios.

Results and Future Plans: Indianapolis has arranged three "town hall" meetings for citizen participation in Franklin Township, which has a good deal of undeveloped land. The meetings consist of citizen participation workshops to plan land use scenarios in their areas. These proposed land use maps will then be incorporated into the model. At follow-up meetings, the results of the land use scenarios in SGI will be publicly presented.

EPA was pleased to learn that planning staff from Louisville, Kentucky – eager to learn about SGI's capabilities – contacted Indianapolis' SGI project manager, who was able to run the model for them. EPA strongly supports the sharing of information and experiences among current and potential future SGI users, and was impressed to see this kind of collaboration across state boundaries.

Section IV: Performance Highlights and Lessons Learned: Launching SGI Version 2

From the experiences of the first 20 Smart Growth INDEX pilot projects, EPA has documented the performance strengths of SGI Version 1 together with difficulties users encountered, for the purpose of strategically improving the program in Version 2. Highlighted below are the demonstrated strengths of Version 1, followed by a discussion of user-recommended areas for improvement. Taking this feedback into account, EPA has already moved forward with Version 2 of SGI, as described toward the end of this section. In the future, EPA will work to continually improve subsequent versions of SGI – both the technical performance of the software and the support provided to users.

Strengths of SGI Version 1

In field use, many pilot sponsors found SGI a strong tool for illustrating the environmental and community benefits of smart growth development patterns because it vividly illustrates the impacts of development alternatives and quickly presents scenario comparisons. Wherever it was used — in public forums, in city council discussions, to illustrate State Implementation Plans – SGI effectively helped both the public and local decision-makers understand land use impacts. It helped decision-makers engage the public in discussing links between land use and transportation alternatives, and overall implications for community quality of life. For many pilot sites, the resulting process provided a new opportunity for the public to contribute to local and regional land use planning decisions.

As a case in point, the Executive Director of WILMAPCO (Pilot Case #3), Ted Matley, noted that SGI helped educate a wide audience about the effects of transportation and land use options, while his organization was working with limited resources. Ron Mitchum, the Executive Director of the Berkeley-Charleston-Dorchester Council of Government, South Carolina (Pilot Case #4), recognized the success of SGI in engaging the public in policy decision-making. The pilot project in San Antonio, Texas (Pilot Case #2) used SGI to instigate a public forum discussion about the future redevelopment of the Broadway corridor. From this collaboration of community members, city staff, and local businesses developed an alternative plan deemed a great improvement over existing plans, much more closely reflecting the environmental goals and ideas of smart growth.

In addition to helping people understand planning decisions before investing major capital into any particular plan, SGI expands the GIS and modeling capacity of the user organization without extensive monetary investment (other than development of necessary GIS data). Through its use of specific indicators, it provides quantifiable measures of smart growth advantages that can be used in day-to-day planning decisions. The bottom line: SGI provided users with valuable information to help inform planning decisions that better protect the environment and community quality of life.

Recommended Improvements to SGI Version 1

The pilot users of SGI Version 1 suggested that improvements in the following categories could enhance the efficiency and effectiveness of SGI applications in the field: software ease of use, data availability, personnel resources required, and technical assistance, as discussed below.

Software Upgrades

After the initial release of SGI to the pilot groups in July 2000, a number of revisions to the software were posted on the website of the software developer (Criterion Planners and Engineers) for downloading. Pilot users were able to download these changes at their convenience and load them into the existing software. Some upgrades were necessary because of modeling errors found by the users (and by Criterion) as the program was tested in the field. Other program changes were made in order to provide specific new capabilities requested by users.

Many users understandably found the interaction with error messages frustrating during this revision process. Some pilots did not successfully run the model because of glitches they encountered with these early versions and/or because of incompatible data formats (discussed below). Also understandably, users experienced the frequent updating of the program as setbacks to their attempts to get a project initiated.

To help minimize software problems, EPA's Development, Community, and Environment Division agreed to all of the following improvements, which are reflected in Version 2 of SGI:

- Work with Criterion on minimizing software glitches in the updated version of SGI (i.e., SGI Version 2)
- Discuss in detail the nature of the modeling software with new pilot users and explain that it will regularly be upgraded and improved
- Develop a more complete list of frequently asked questions (FAQs) and answers for SGI users to quickly access known remedies to previously experienced problems
- Maintain frequent technical support communications with users to supplement the "Frequently Asked Questions" list – e.g., conduct "kick-off" user training and site visits, hold periodic technical support conference calls, and set up an e-mail listserver.

Data Availability

Many pilot groups had difficulties finding or creating the necessary data layers to run SGI. In instances where the local or regional planning organization did not have employment or housing point data readily available, pilots were slowed or stopped for that reason. Also frequently difficult data for pilot users to find: sewer and utility infrastructure information and road network data. Some pilot sponsors found that their available databases were not in the format required by SGI and needed extensive investments of time to be converted.

Pilot users made the following recommendations for alleviating data availability problems:

- Provide a universal database for selected layers needed in SGI. In particular, these may include housing, employment, or street centerline data. Package this data with SGI when distributing to users
- Present precise data structure and fields necessary for SGI application
- Provide a list of external data sources for necessary layers to facilitate community database compilation
- Review pilot sponsor databases before model use

In launching Version 2 of SGI, EPA accommodated all but one of the above suggestions. The Agency was not able to provide a universal database for packaging with SGI — mainly because of the cost to provide each locality with detailed data.

Resources—Personnel and Hardware

A number of pilot sponsors cited limited local staff resources as a problem that hindered the application of SGI to the proposed project. In some instances, local staff turnover was the primary issue. In others, pilot users noted that they did not adequately anticipate the demands of using the product. Another SGI Version 1 pilot was limited by the age and speed of hardware available in the office. A related problem: Different iterations of the software encountered errors with the Windows environment and other software present on the user's somewhat older computer.

Acting on pilot users' suggestions on resource issues, EPA did all of the following before launching SGI Version 2:

- Provide more detailed explanations of the time commitment and staff knowledge needed to install and maintain SGI during the launch of SGI Version 2
- Discuss staff responsibilities required for participation in SGI Version 2 pilot projects
- Solve compatibility issues of SGI with other software
- Provide detailed requirements for users regarding necessary computer systems, and software that may conflict
- Install Version 2 software on the user's computer to ensure compatibility

Technical Assistance

Pilot groups working to successfully run the software and install the necessary databases faced numerous technical difficulties along the way. Assistance was provided both by EPA staff and by Criterion personnel. Some pilots received on-site assistance, while most others received help by phone or e-mail. Even with these various kinds of support, many pilot users found that they needed more focused help, especially at the start of their SGI use.

To improve technical assistance for SGI Version 2, EPA accommodated all of the following suggestions from Version 1 pilot users:

- Provide a more detailed guidebook, along with the Version 2 software, that discusses technical issues faced by SGI Version 1 users
- Prepare guidebook appendices regarding the database requirements for each data layer, with visual examples of necessary fields
- Integrate more screen "captures" into the guidebook to help on-site users with first time scenario creation
- Provide several regional training programs, and train interested EPA regional staff on SGI so that they may provide assistance to pilot users in their region
- Support a SGI listserver where users may request help from other users
- Establish a monthly conference call where users may ask technical questions of other users or EPA staff

- Distribute contact information for all the pilot leads so that groups may contact each other more easily
- Develop an interactive database of technical errors and corresponding solutions found to date to review with pilots who call for assistance

SGI Version 2: Program Improvements and Phase 2 Partner Selection

Based on valuable feedback from pilot users of SGI Version 1, Version 2 of SGI has been upgraded and expanded to take into account user needs and recommendations, which are spelled out above. In fact, all recommendations were implemented prior to launching Version 2, with the exception of providing a universal database for selected SGI data layers.

The strengths of SGI Version 1 as a tool for vividly depicting comparative development scenarios and their impacts, and thereby illustrating the environmental and community benefits of smart growth, have been preserved and enhanced in Version 2. To sum up, the key changes to SGI Version 2 are the following:

- Snapshot mode provided only
- More GIS data layers to integrate additional planning and environmental analysis
- Nearly 30 additional indicators for public review
- A rating and weighting indicator interface that allows audiences to combine selected indicators into one major comparative index
- An expanded user manual
- Data preparation tools and review services to smooth upfront setup
- Onsite software installation and user training to ensure immediate productivity
- Increased contact between new (Phase 2) and continuing partner communities to exchange experiences and successes

The Next Round of SGI Partner Projects

In mid-2002, EPA requested applications from communities interested in using Smart Growth INDEX, Version 2, to evaluate local development alternatives. Each of 32 applicants provided detailed information on local issues, data availability, and staff capabilities, to help identify potentially successful local projects.

In August 2002, EPA announced the selection of fourteen new partner communities to receive the SGI Version 2 software, documentation, technical assistance, and other support. These new partner sponsors are using an improved SGI Version 2 tool, as described above and will benefit from a new community process workshop. The workshop will help new partners learn how to apply SGI in several typical settings, including public forums, with lessons from experienced contractor and continuing partner staff.

The new partners for 2003 are: Montgomery Township, New York; Cornell University; Municipality of Murrysville, Pennsylvania; Prince George's County Planning Department, Maryland; Voices and Choices of the Central Carolinas; Newton County Planning & Zoning Department, Georgia; Austin Transportation Planning and Sustainability Department, Texas; Twin Cities Metropolitan Council, Minnesota; Hamilton County Regional Planning Commission, Ohio; North Central Wisconsin Regional Planning Commission, Wisconsin; Ohio-Kentucky-Indiana Regional Council of Governments, Ohio; Hawaii State Office of Planning, Hawaii; Community Planning Association of Idaho, Idaho; Maui County Planning Department, Hawaii.

For More Information on SGI

For more detailed information about the SGI model (Version 2) and how it works, please visit: <http://www.epa.gov/smartgrowth/> (click on "Browse Smart Growth Topics," then on "Smart Growth INDEX"). In the future, EPA plans to continually improve material available at this Web site includes:

- *The SGI Reference Guide* (a lengthy technical manual that documents the model's methodologies)
- *The SGI Getting Started Guide* (a user manual)
- *The SGI Process Guide* (guidance on using SGI in the planning process)

Appendices

Appendix A:	Sample SGI Readouts Example of Indicator "Score" Table Example of Bar Chart Example of Indicator Mapping
Appendix B:	Summaries of Additional 13 SGI Pilot Projects Burlington-Essex, Vermont Concord, New Hampshire Burlington County, New Jersey St. Mary's County, Maryland Wilmington, North Carolina Hendersonville, North Carolina Gainesville, Florida Milwaukee, Wisconsin St. Tammany Parish, Louisiana Houston, Texas Wildwood, Missouri Clark County, Nevada Merced, California

Appendix A: Sample SGI Readouts

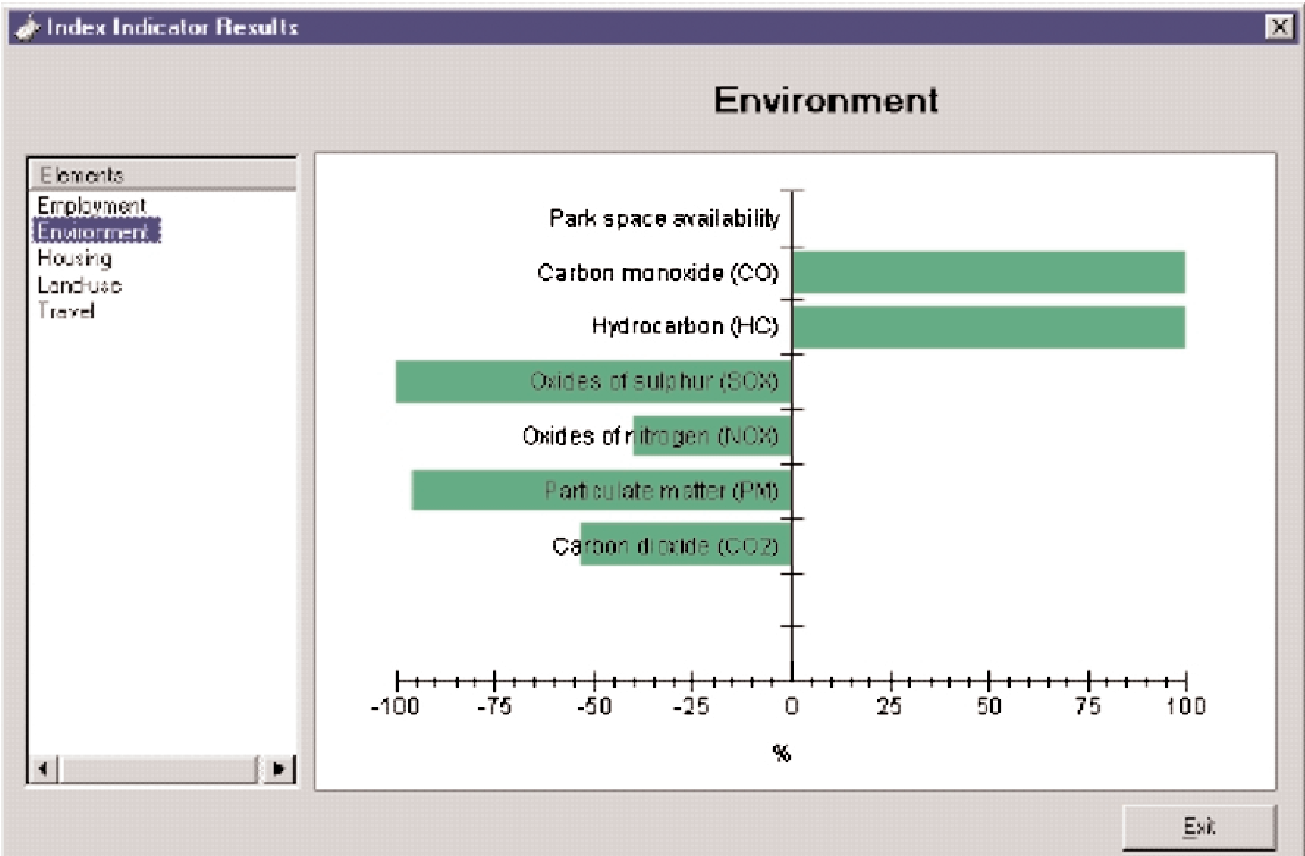
Example of Indicator "Score" Table: Illustrates how a scenario scores on each SGI indicator

Indicator Scores

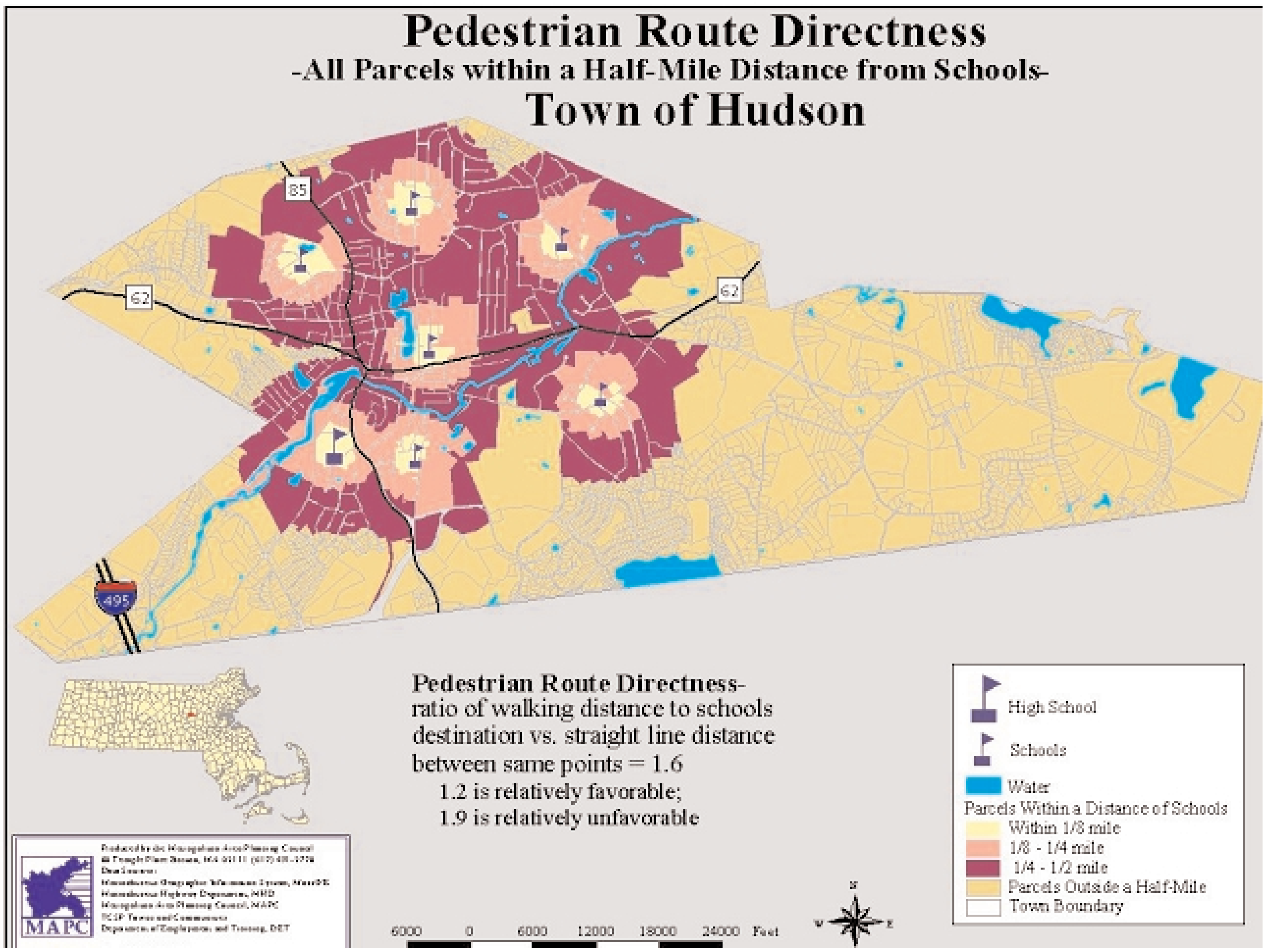
Indicator	Score	Map	Units
Population density	354	Yes	persons per sq.mi.
Use mix	0.20	Yes	proportion of dissimilar uses among 1 acre grid cells
Jobs/housed workers balance	0.44	No	jobs/workers (1.4 workers per household)
Land-use diversity	0.52	No	population and employment balance
Residential density	4.8	Yes	dwellings/acre
Single-family housing share	30	No	percent SF
Multi-family housing share	70	No	percent MF
Housing proximity to transit	911	Yes	ave. distance to a stop (ft.)
Housing proximity to recreation	828	Yes	ave. distance to a park (ft.)
Residential water consumption	88	No	gal/day/capita
Employment density	8.2	Yes	employees/acre
Employment proximity to transit	1,149	Yes	ave. distance to a stop (ft.)
Sidewalk completeness	39.3	Yes	percent of street frontage w/ sidewalk
Pedestrian route directness	1.5	Yes	network distance/airline distance
Pedestrian design index	3.0	No	pedestrian walkability
Street network density	7.7	No	street centerline mi. / sq. mi.
Street connectivity	0.72	No	ratio of intersections vs. intersections plus cul-de-sacs
Vehicle miles travel	21.0	No	VMT/day/capita
Vehicle trips	4.5	No	VT/day/capita
Auto travel costs	3,603	No	$/yr/capita
Residential energy consumption	98	No	MMBtu/yr/capita (housing & travel)
Open space	1.2	Yes	percent total land area
Park space availability	5.5	Yes	acres/1,000 persons
Carbon monoxide (CO)	432.5	No	lbs/yr/capita
Hydrocarbon (HC)	55.8	No	lbs/yr/capita
Oxides of sulphur (SOX)	11.9	No	lbs/yr/capita
Oxides of nitrogen (NOX)	41.1	No	lbs/yr/capita
Particulate matter (PM)	1.3	No	lbs/yr/capita
Carbon dioxide (CO2)	7.0	No	tons/yr/capita

Return

Example of Bar Chart: Depicts how much a scenario varies from its environmental baseline score, in either a positive or negative percentage value



Example of Indicator Mapping: Map depicting a single indicator (pedestrian route directness) for a given scenario (existing conditions, Hudson, MA)



Appendix B: Short Summaries of Additional 13 SGI Pilot Projects

In EPA Region 1 (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont):

Burlington-Essex, Vermont

The Chittenden County Metropolitan Planning Organization (CCMPO) is planning an 8-mile transit corridor between Burlington and Essex under the Federal Transit Administration's New Starts program. Under this program, participants are required to develop plans for transit-supportive land use that include measures to contain sprawl and supportive zoning regulations. SGI's role in this project is to analyze various transit-oriented developments and design scenarios, and to provide a much needed quantitative estimate of the effects of these different options.

Concord, New Hampshire

Responding to a controversial widening of Interstate 93, a group of concerned Concord citizens launched "the Initiative for a 20/20 Concord." Their goal: to create a long-range plan for growth and development that will preserve the thriving downtown area, revitalize old rail yards, and improve the region's air quality and water quality in the Merrimack River watershed, using smart growth strategies. The initiative involves an extensive public participation process that includes residents; state, regional and local government entities; and business interests. As various vision and policy scenarios are considered, SGI helps advance the public process by depicting the environmental and transportation impacts of those different scenarios.

In EPA Region 2 (New Jersey, New York, Puerto Rico, and the Virgin Islands):

Burlington County, New Jersey

The Delaware Valley Regional Planning Commission and the New Jersey Office of State Planning are taking a community-driven approach to examining how transit-oriented development scenarios will impact municipalities within the boundaries of the Delaware Estuary Project, along a major transportation corridor. SGI was chosen as the tool to be used to compare the effects of three scenarios: developing the corridor in an auto-oriented fashion; developing improved transit service without supportive land use changes; and developing the corridor with improved transit and transit-oriented developments. This comparative analysis will lead to further investigation of redeveloping abandoned shopping centers based on new-urbanist principles and creating improved linkages to transit for bicyclists, pedestrians, and feeder buses.

In EPA Region 3 (Delaware, Maryland, Pennsylvania, Virginia, West Virginia, and Washington, District of Columbia):

St. Mary's County, Maryland

Southern Maryland is the fastest growing area in the state. In order to guide growth into priority areas, St. Mary's County has developed a comprehensive plan that seeks to protect sensitive areas and the Chesapeake Bay watershed, diversify economic growth, and reduce resource consumption. SGI is being used to assist the county in assessing the effectiveness of various policies such as density bonuses, agricultural preservation strategies, mixed use planning districts, and infill development, which may ultimately be incorporated in the updated comprehensive plan.

In EPA Region 4 (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee):

Wilmington, North Carolina

In 1999, the City of Wilmington and New Hanover County developed a Comprehensive Plan that will be implemented through a "Unified Development Ordinance" (UDO). The UDO provides the county with an opportunity to implement various Smart Growth initiatives, such as open space preservation and increased housing densities. Working with the Wilmington Urban Area Metropolitan Planning Organization, the city and county are using SGI to model alternative land use scenarios to inform the implementation of the UDO and examining the impacts of an expanded transit network in the region. The project involves students at the University of North Carolina at Wilmington in the modeling effort.

Hendersonville, North Carolina

A rapidly growing community in western North Carolina, Hendersonville is looking to create a more walkable and livable downtown. The North Carolina Department of Transportation and the City of Hendersonville are working jointly on developing the city's land use plan and the state's Transportation Improvement Plan. As part of this working partnership, both entities are using SGI to examine the impacts of proposed land use designations and transportation improvements.

Gainesville, Florida

The City of Gainesville and Alachua County are working with the University of Florida, Center for Construction and Environment, to examine a series of revitalization strategies for the Depot Avenue corridor, located in Gainesville's downtown core. SGI is being used to model locations for a multi-modal transportation hub and an urban rail-trail network, and to examine options for the redevelopment of Depot Avenue and the surrounding commercial and industrial areas. This work helps support EPA Brownfields and Sustainable Development Challenge Grant efforts underway in the corridor.

In EPA Region 5 (Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin):

Milwaukee, Wisconsin

The Menomonee Valley, a 1500-acre industrial brownfield area, is undergoing large-scale redevelopment spearheaded by the City of Milwaukee. The site provides a significant opportunity for urban manufacturing infill in the Milwaukee area, which has been experiencing significant development pressures on surrounding open space and farmland. SGI is being used to analyze the effects of various transportation options within the site. The Valley stakeholders, representing over 30 public, private, and non-profit organizations, are examining scenarios to assess how site improvements affect vehicle miles traveled, transportation access for the workforce, and air quality impacts.

In EPA Region 6 (Arkansas, Louisiana, New Mexico, Oklahoma, and Texas):

St. Tammany Parish, Louisiana

St. Tammany Parish is developing a 10-element Comprehensive Plan, consistent with the American Planning Association's "Growing Smart" guidance, to manage growth throughout the parish. As part of the comprehensive planning process, the parish is examining a range of densities, development types (linear patterns, radial corridors, spread cities, and clusters), and transportation options, using SGI to visualize the impacts of these various land use and transportation scenarios.

Houston, Texas

The Gulf Coast Institute (GCI), a non-profit organization serving as the principal leader of smart growth in Houston, is using SGI as a bridge between community organizations and planning agencies in the Houston region. Working with the City of Houston Planning Department, GCI is examining development codes for ways to reduce air emissions; in addition, the institute is assisting with scenarios for a Master Plan for a 10-block area in a low-income neighborhood in the City's Third Ward. Assisted by the GIS Program Manager at Houston-Galveston Area Council and the Scarcella Science and Technology Center of Houston Community College, GCI is using SGI to evaluate the redevelopment of the neighborhood with mixed-use development and pedestrian-enhanced transit access and resulting effects on vehicle miles of travel and air quality.

In EPA Region 7 (Iowa, Kansas, Missouri, and Nebraska):

Wildwood, Missouri

Located in the path of St. Louis' impending development, the City of Wildwood has adopted a Master Plan and various development ordinances to advance compact and sustainable development. In this context, SGI is being used to compare alternative park locations in terms of pedestrian access, vehicle miles traveled, land use mix, and open space needs. In addition, SGI results will inform a pending decision on amending the Master Plan to shift two parcels that are zoned for suburban-area densities and designs to town-center level densities and designs.

In EPA Region 9 (Arizona, California, Hawaii, Nevada, Guam, and American Samoa):

Clark County, Nevada

Under the Southern Nevada Public Lands Management Act, more than 27,000 acres of Federal land within Clark County will be privatized by auction. In order to determine which properties to nominate for disposal, the county and affected city governments are using the SGI model to examine the impacts from alternative development scenarios and assist with potential re-zonings. The county's goal is to support developments that will provide environmental benefits through smart growth approaches.

Merced, California

The Merced County Association of Governments (MCAG), Caltrans, the Federal Highway Administration, and EPA have formed the "Partnership for Integrated Planning"—a multi-agency approach for improving regional planning efforts by integrating land use planning with environmental and transportation planning. The steering committee has developed an extensive workplan detailing specific tasks. All stakeholders will participate in developing population and housing projections, land use and transportation scenarios, and impact evaluations as steps toward selecting a preferred transportation system, along with financial plans and environmental mitigation strategies. SGI is part of a compendium of tools to help MCAG and Caltrans evaluate the impacts of alternative transportation system scenarios.

EPA
United States
Environmental Protection Agency
(1808T)
1200 Pennsylvania Avenue, NW.
Washington, DC 20460