

Early Detection System

Introduction

The data warehouse and the Community Empowerment System previously described provide a large amount of quality data about the health of neighborhoods and put the power of that data in the hands of users, whether community organizations, government workers or researchers. This, the third part of Detroit's Neighborhood Indicators System, provides a way to identify trends citywide using a small amount of carefully selected data.

The goal of the Early Detection System is to identify the conditions of specific neighborhoods within the city—whether the neighborhoods are suffering from blight or enjoying growth and success—as a way to focus the attention of community-based organizations, government policy-makers and others. The EDS, for example, addresses the desire of the city of Detroit P&DD to identify blighted areas as a way to inform decisions about where resources should be directed. It could also help community-based organizations identify successful areas as a first step in understanding and building on that success.

This Early Detection System section is divided into two parts:

- **Part I: How to Build an EDS**
This defines an Early Detection System and explains what steps an organization could go through to build a quality system
- **Part II: A Pilot EDS**
This provides a sample EDS built using the process outlined in Part I and illustrates the problems and potential of such a system. This section illustrates the type of output an organization may see from an EDS. Technical details are included in appendices for users who want an in-depth look at the pilot system.

Part I: How to Build an EDS

Definition and Background

Early detection systems, often called early warning systems, are data-driven information analysis tools designed to provide insight into the health of neighborhoods. Neighborhood health can be defined as the overall quality of life in an area. Factors considered in the analysis of neighborhood health may include social connectedness, housing stock quality, economic strength and public safety.

Organizations around the country use early detection systems to identify potential areas of concern or opportunity. Those groups include community-based organizations, politicians, government employees, real estate developers and researchers. Web-based systems, such as one used by Neighborhood Knowledge Los Angeles, use indicators as warning signs of neighborhood decay.⁶³ Systems used in many cities, though, do not provide a clear early warning of neighborhood decline because they provide neighborhood data that describe rather than predict. Chicago's City News Chicago, for example, provides data on building code violations and vacant lots without interpreting what those numbers might mean for a neighborhood.⁶⁴

This EDS plan for Detroit differs from other systems by:

- Focusing on predicting both negative and positive neighborhood conditions, which is why the word “detection” rather than “warning” is used in its title.
- Providing predictive power to help policy-makers and others making key decisions know where to focus attention or resources.

This approach builds upon previous research and analyses to create a predictive detection model. A small pool of strong, representative indicators can create a predictive detection model as the basis for many early detection systems.⁶⁵ Reviewing trends through analyzing time-series data also adds to the predictive capabilities of an early detection system.⁶⁶

The EDS system will allow P&DD, neighborhood organizations and other actors to observe change in neighborhood conditions and assumes that decision-makers will use other methods (such as the Community Empowerment System) to gain a greater understanding of the situation in the neighborhood. It also assumes that people can take action that will prevent decline or

⁶³ Neighborhood Knowledge Los Angeles. <http://nkla.sppsr.ucla.edu>. Accessed January 25, 2004.

⁶⁴ City News Chicago. <http://www.newschicago.org/>. Accessed January 23, 2004.

⁶⁵ Galster, George, Chris Hayes, and Jennifer Johnson. 2004. *Identifying Robust, Parsimonious Neighborhood Indicators*. Working Paper.

⁶⁶ Temkin, Kenneth and William Rohe. 1998. *Social Capital and Neighborhood Stability*. Housing Policy Debate. Vol. 9 Issue 1.

encourage neighborhood success.

This plan outlines methods to construct an EDS and provides recommendations for the future development of a Detroit system. The sections below define indicators and then outline the steps that must be taken to construct a neighborhood indicator system.

Indicators Defined

This section explains three types of indicators and how they can work together as part of Detroit’s Early Detection System. The three types of indicators, which provide the foundation for the EDS are *supporting* indicators, *leading* indicators and *key* indicators. These indicators lay the foundation of a well-designed indicator system. (See Table 4).

One can collect several leading and/or supporting indicators and construct a model that speaks to key aspects of the health of neighborhoods. Table 5 provides sample key, leading and supporting indicators. In this plan, key indicators of blight

⁶⁷ Galster, George, Chris Hayes, and Jennifer Johnson. 2004. *Identifying Robust, Parsimonious Neighborhood Indicators*. Urban Institute. Working Paper.

Table 4
Types of Indicators

Indicator type	Description	Function	Example ⁶⁷
Supporting	These indicators are made up of directly measurable data.	To provide a foundation of data on which to build an EDS.	Education level attained.
Leading	These indicators seek to predict the future value of a key indicator. These indicators are, in essence, supporting indicators that best predict the key indicator. Leading indicators are determined by analyzing the relationship between supporting indicators.	To provide a predictive indicator that effectively represents a number of supporting indicators. Identifying leading indicators can produce an analytical tool while avoiding possible confusion caused by using a large number of indicators.	The number of home mortgage loan applications.
Key	These indicators support judgments about certain aspects of the future condition of a neighborhood. Key indicators are not directly measurable but provide a general category for a neighborhood characteristic. Key indicators are made up of supporting and leading indicators.	To allow observation of changes in a neighborhood, and raise awareness of the assets/growth and potential problems so that they can be addressed accordingly.	Housing Type & Tenure

Table 5

Sample Supporting and Leading Indicators Listed by Key Indicator

Sample Key Indicators of Neighborhood Conditions⁶⁸	Rationale	Commonly Used Leading Indicators⁶⁹	Commonly Used Supporting Indicators⁷⁰
Social Disadvantage	Social disadvantage accounts for the influence of unfavorable social or cultural conditions.	Mortgage approval rate	Teen birthrates
Status	Status accounts for status of an individual, household or neighborhood.	Mortgage approval rate	Educational attainment Median home values
Business and Employment	Business and Employment address the opportunities and services available in an area.	Number of businesses, number of jobs	Sales tax revenues per capita Unemployment rate
Housing Type and Tenure	Housing Type and Tenure address the feasibility and stability of residency.	Mortgage loan applications	Physical structure conditions
Crime	Crime accounts for the influence of perception and safety.	Mortgage loan applications and approval rate	Violent crime per capita
Housing Vacancy	Housing Vacancy accounts for land use quality and variation.	Mortgage loan applications and approval rate	Empty residential units per total residential units Empty lots per total residential lots
Place Attachment⁷¹	Place attachment addresses the psychological relationship between social and physical components of a neighborhood. High levels of attachment may mitigate the effects of otherwise disadvantageous physical factors.	Home ownership rates ⁷²	Years in residence Vacancy rates ⁷³
Social Capital⁷⁴	Social capital accounts for the resources associated with connections among individuals, resident involvement, social networks, trust, and mutual benefits.	Institutional infrastructure (such as schools, churches), social and cultural environments (the support institutions may provide) ⁷⁵	Home value Percentage of family households Vacancy rates ⁷⁶

^{68 - 70} Galster, George, Chris Hayes, and Jennifer Johnson. 2004. *Identifying Robust, Parsimonious Neighborhood Indicators*. Urban Institute. Working Paper.

⁷¹⁻⁷³ Brown, B. et al. 2003. *Place attachment in a revitalizing neighborhood: Individual and block level of analysis*. Journal of Environmental Psychology 23. p. 259-271.

⁷⁴⁻⁷⁶ Temkin, Kenneth and William Rohe. 1998. *Social Capital and Neighborhood Stability*. Housing Policy Debate Fannie Mae Foundation. Vol. 9 Issue 1.

and physical improvement are examined. These are social disadvantage, housing type and tenure, and status, which are evaluated more in depth later in the plan.

Methods for Developing an EDS

Developing an EDS is a multi-step process. After gathering the appropriate data, spatial and statistical tests can help describe the relationships among indicators and judge how well the selected indicators measure the neighborhood condition that the system is being asked to detect (e.g. blight or physical improvement). On the following page, Figure 11 demonstrates the flow of the EDS process, which begins with defining the question one is trying to answer with the EDS, then moves on to selecting, collecting, manipulating and testing indicators, and ultimately producing results that identify neighborhoods and their conditions. A more complete explanation of the methods follows the flowchart.

The following methods description follows the flowchart from top to bottom and provides a general roadmap to building an EDS.

- 1. Define the question the system seeks to answer.**
The indicators selected depend on what the model developers have determined will be the focus for evaluating neighborhood conditions. This focus is critical in developing a system that works to address the users' goals. Based on the priorities of Detroit P&DD and SDBA, the pilot model focuses on gauging physical conditions to show deterioration or revitalization in neighborhoods.
- 2. Develop criteria for how specific indicators will be selected.**
This step allows users to spell out how indicators will be selected, based on their priorities. Key considerations at this stage are: What makes a good indicator? And, how many should be included in the system? Criteria can narrow the number of potential indicators from a great many to those that are most useful.
- 3. Gather additional data if necessary.**
Data already in the data warehouse can be used for the EDS. A team building an EDS, though, may find that promising data that fit the indicator selection criteria are not already available in the data warehouse. To the extent possible, "wish-list" data should be sought out and included in model testing.

Figure 11

Early Detection System Model: Development and Function

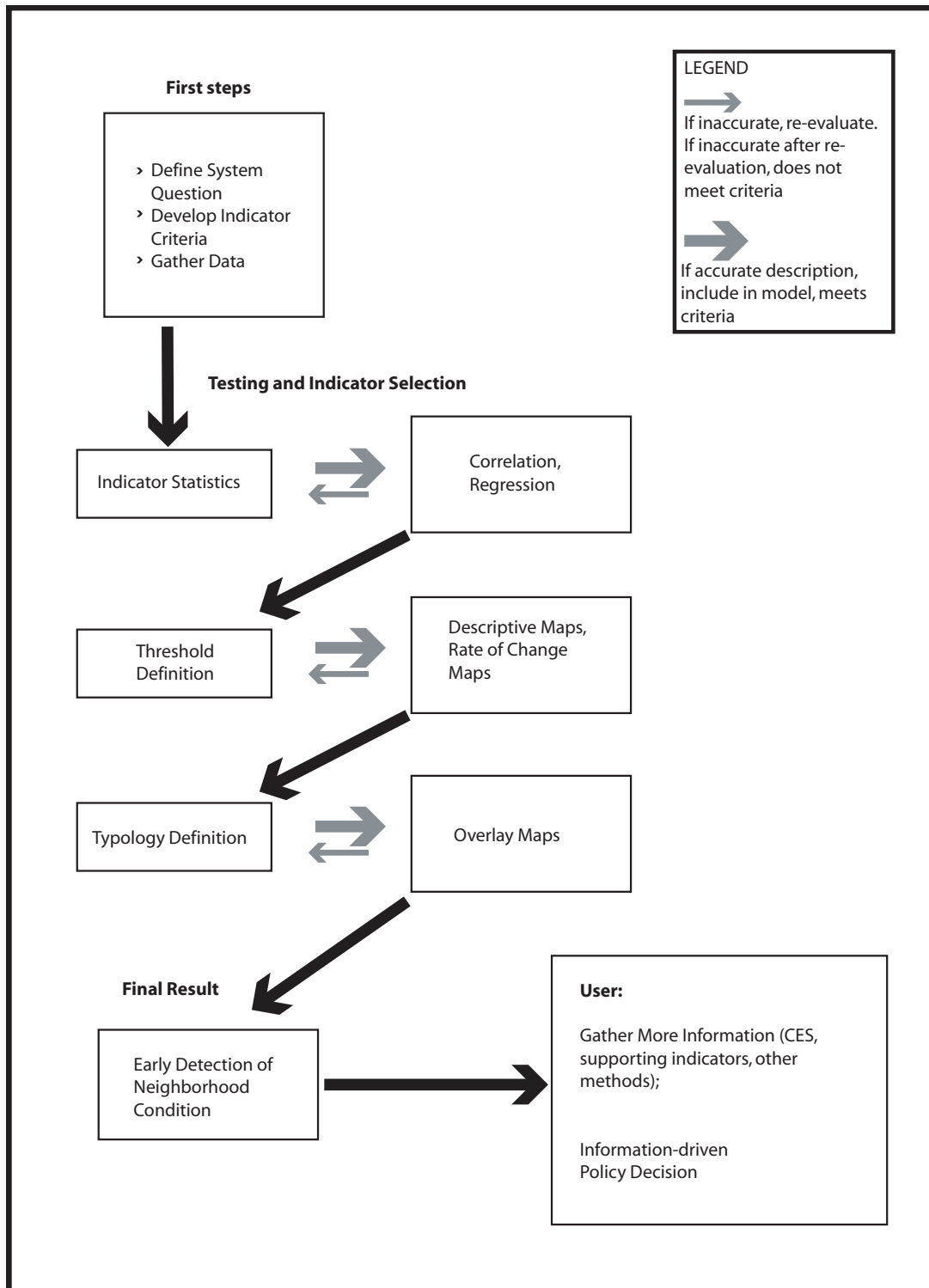


Figure 11: Illustrates the process of developing an EDS.

4. Establish a database.

Once different sets of data have been selected, the numbers require manipulation and organization to be tested or used in the model. This may require the aggregation of parcel-level data⁷⁷ to the census-tract level.⁷⁸ This might be necessary because some data, such as home mortgage applications or crimes committed, are available at the census-tract level but not at smaller geographic areas, such as by city block or address. This also addresses confidentiality issues, as individual sites cannot be identified at the tract level. However, alternate calculations may provide more meaningful trends or easier comparisons. For example, the percentage of renters in a census tract provides a better comparison among tracts than the total number of renters in a tract. This is because the number of available housing units varies widely among different census tracts. Where tract A might have 50 renters and tract B might have only 20, the percentage of renters in tract B could be higher if it has a smaller number of housing units than tract A.

5. Test the data for use in the EDS.

In the beginning, the relationships among a set of supporting indicators are unclear. A series of statistical and mapping tests provide a way to evaluate the role of each indicator, and how well it meets the criteria already established. The process of testing increases the likelihood that indicators will be useful in describing or predicting changes in neighborhood conditions.

a. Analyze the statistical relationships among indicators

Statistical tests help a model developer build relationships among indicators. Testing reveals the degree and direction of these relationships, and is useful in quantifying the relationships that may seem otherwise intuitive to local residents, community organizations, or city officials.

1. Correlation

A correlation analysis measures the strength of the relationship between two indicators, such as home mortgage approval rate and a property's average true cash value for an area. This test gives an EDS development team an idea of not only how much the values between these two indicators are related,

⁷⁷ Parcel-level data refers to data collected at the parcel level. Parcels are often considered, "the basic administrative unit of local government" Source: East St. Louis Action Research Project. *Neighborhood Condition Survey*. <http://www.eslarp.uiuc.edu/gis/ncs/training/index99.htm>. Accessed April 13, 2004.

⁷⁸ A census tract is a small part of a county containing an average of 4,000 people. Source: U.S. Census Bureau. *Question and Answer Center: What is a Census Tract?* http://ask.census.gov/cgi-bin/askcensus.cfg/php/enduser/std_adp.php?p_sid=9yjbEC8h&p_lva=&p_faqid=245&p_created=1077122473&p_sp=cF9zcmNoPSZwX2dyaWRzb3J0PSZwX3Jvd19jbnQ9MjAmcF9jYXRfbHZsMT0xJnBfcGFnZT0x&p_li= Accessed April 5, 2004.

but the direction of this relationship. For example, do average true cash value rates increase or decrease as home mortgage approval rates increases? Identifying the direction of the relationships between indicators is important for understanding how different indicators influence specific neighborhood conditions.

2. Regression

A regression analysis is a tool that helps one further understand the relationships between two variables; in particular, how well the presence of one indicator explains the presence of another. In an EDS model, this test measures how well leading indicators predict key indicators. One way of determining which indicators to include in an EDS is to test the relationship between a possible leading indicator (such as median amount of home purchase loans) and all of the supporting indicators that make up a key indicator (property values and education help to make up the key indicator status). Repeating this test over multiple years increases one's confidence in the observed relationships.

Other data and local knowledge can help explain more fully why neighborhood conditions appear as they do in the EDS.

The results from such tests do not tell the whole story. They might reveal that neighborhoods that have high values in, for example, mortgage approval rates also have high values in properties' true cash value. However, the tests do not show that one causes the other or explain why their values tend to rise and fall together. Other data and local knowledge, such as that collected for the Community Empowerment System, can help explain more fully why neighborhood conditions appear as they do in the EDS. In addition, as the system developers collect more and new data over many years, the relationships among indicators should be re-evaluated and updated.

Test results also might show that data are not accurately reflecting neighborhood conditions.

For example, residents in some neighborhoods might rely on other forms of capital to finance home purchases rather than bank loans, making home mortgage loan data less useful because comparisons would be difficult between neighborhoods that use banks heavily, and those that do not. In the development of the pilot EDS, Detroit Planning & Development Department and University of Michigan Taubman College of Urban Planning Chair Margaret Dewar and Outreach Coordinator Eric Dueweke provided the local knowledge to begin to validate the findings. The Planning & Development Department also provided input about how various indicators might meet criteria.

b. Establish thresholds for neighborhood change.

Thresholds come into play once the model developer has started working with the data in a mapping program. In this context, a general definition of a threshold is: a point at which neighborhood conditions change enough to be considered different. If one crosses the threshold, the pattern on the map is noticeably different. Thresholds must be determined at the beginning stages of map-making in order to create descriptive maps.

"Descriptive" maps display one variable from a single year for one cluster. These maps visually and spatially represent different indicators. They show the values and patterns of distribution associated with each indicator, which offer a basis of comparison of existing conditions across neighborhoods. These patterns should be validated, or checked against local knowledge, to ensure that the chosen thresholds appropriately describe existing conditions. For example, if a map indicates blight in areas that local knowledge indicates are thriving, the thresholds will have to be adjusted. Care should be taken in defining thresholds, as the thresholds established at this stage will be used to predict future changes.

c. Set neighborhood types by showing different levels of neighborhood change.

Once thresholds are established, categories

of neighborhood condition can be defined. These categories can be combined to produce neighborhood typologies, or classifications. For example, some areas may be "good physical condition," whereas others could be "vulnerable." These labels describe the quality of an area, based on the selected indicators.

With mapping programs, using geographic information system (GIS) technology, different sets of data can be combined to show more than one single indicator could show by itself. For example, crime rates or mortgage loan approval rates from one year can be combined to provide a snapshot describing particular areas. Using the thresholds already established, mapping programs can show which areas fall above or below more than one threshold. For example, a map could show areas with high levels of crime and low mortgage approval rates results.

This kind of neighborhood classification helps EDS users identify neighborhoods that require action or further study. The map produced from this step is the basis of the final EDS map, described below.

d. Combine different indicators to produce a comprehensive typology.⁷⁹

In addition to showing a snapshot of the condition of neighborhoods, the EDS model should account for how each indicator changes over time. Such information allows EDS users to get a sense of the neighborhood areas where, for instance, crime and mortgage approval rates have increased, decreased or remained the same. By combining single-year and multi-year views of a specific indicator, the EDS application provides a historical perspective of where a neighborhood has been and also shows EDS users where a neighborhood may be headed. This "predictive" map accounts for a combination of indicators and more than one year of data. In this pilot EDS, the absence or presence of blight is predicted by the combination of all leading indicators, not just one. Because each map showing categories of neighborhoods and prediction shows only

⁷⁹ For an in-depth discussion about neighborhood typology, consult Brower, Sidney. 1996. *Good Neighborhoods*. Westport, CT.

those tracts that meet all conditions, not all areas will be highlighted on the final map. In addition, weighting variables within the model should be considered. By establishing a priority system and giving more value to indicators that play a more significant role in identifying neighborhood strength or decline, the model can provide a more accurate output.

e. Produce multiple outputs.

To generate meaningful analysis for the city, the EDS should produce a variety of outputs such as maps and summary spreadsheets that allow users to compare different areas of the city. Representing indicator information in different formats enables users to see the results from more than one perspective.

After these EDS methods are followed, the next step is for users to look at neighborhoods identified and decide the policy implications of those classifications. If a neighborhood is identified as blighted, for example, actors such as government agencies or community-based organizations could decide to collect more information (such as from the Community Empowerment System) and decide whether more resources should be directed toward that area.

This methods section described how to build an Early Detection System, from figuring out which question the system seeks to answer, to testing, to producing results that identify different types of neighborhoods. The next section describes how this plan followed the steps described above.

Part II: EDS Methods Applied

This plan was completed with the city of Detroit's P&DD and Detroit's community-based organizations in mind and this section shows how an early detection system can be created for use locally. It describes in general how the pilot EDS was created and is intended for a lay audience that wants to understand the methods more fully. A technical explanation of how the pilot EDS was completed can be found in the appendices referenced throughout this section, and can be used by those who wish to develop a quality EDS for Detroit.

This section will follow the organization in Part I, "Methods for Developing an EDS" above. The steps below describe how an

Early Detection System for changes in physical condition within Detroit's neighborhoods was constructed. By following the steps as described below and making different decisions, any sort of Early Detection System could be built by a system host.

Define the Question

The question for the pilot developed from discussions with the Detroit's P&DD and SDBA. The P&DD requested an early detection system that would identify areas that were blighted or in danger of being blighted. This would help provide focus for new or continued revitalization efforts and programs. SDBA requested that neighborhood assets and progress be easily identifiable. Neighborhoods could then use that information to attract additional investment. These objectives led to the pilot EDS having the ability to identify both declining and improving physical conditions in neighborhoods. Defining the question helped focus the pilot EDS on certain key indicators (status and housing type and tenure) and clarified which data should be used to address questions about blight and neighborhood success.

Develop Indicator Selection Criteria

The pilot EDS established criteria with which to choose leading indicators that predict neighborhood conditions. The criteria were chosen to select sound indicators that can compare neighborhoods. Table 6 shows criteria used in the pilot EDS. Ideas and explanations for selecting leading indicators have been modified from the following sources:

- Brown, B. et al. 2003. *Place attachment in a revitalizing neighborhood: Individual and block level of analysis*. Journal of Environmental Psychology 23. p. 259-271.
- Galster, George, Chris Hayes, and Jennifer Johnson. 2004. *Identifying Robust, Parsimonious Neighborhood Indicators*. Urban Institute. Working Paper.
- International Institute for Sustainable Development. *General Criteria for the Selection of Performance Indicators in the Context of Sustainable Development* <http://www.iisd.org/casl/CASLGuide/Criteria.htm>. Accessed February 10, 2004.
- Kingsley, G. Thomas, (ed). 1999. *Building and Operating Neighborhood Indicator Systems: A Guidebook*. National Neighborhood Indicators Partnership.
- United Nations Human Settlements Programme. *Global Urban Observatory Toolkit*. p. 7. http://www.unchs.org/programmes/guo/guo_guide.asp Accessed February 21, 2004.
- Sociology Central. *Reliability*. <http://www.sociology.org.uk/p1mc5n1a.htm>. Accessed February 10, 2004.
- Taylor, Ralph B. 2001. *Breaking Away from Broken Windows: Baltimore Neighborhoods and the Nationwide Fight against Crime, Grime, Fear, and Decline*. Boulder, Colo.: Westview Press.

Table 6
Criteria for Selecting Leading Indicators (in alphabetical order)

Criteria	Definition	Purpose	Source (see previous page for full citations)
Discrete	The selected indicator best explains the desired aspect of neighborhood condition.	Some indicators are more accurate descriptions or more predictive than others. Using these key indicators saves time and effort and provides a clear picture of neighborhood condition.	Modified from Galster
Inexpensive	Data are free or inexpensive to obtain.	This facilitates acquisition of data even when resources are limited.	National Neighborhood Indicators Partnership (NNIP)
Reliable	Data are consistently gathered year after year, using a method that allows for consistent results if conditions do not change.	Longitudinal data are essential for year-to-year comparisons and trends. Such data can also be used to test the applicability of key indicators (whether they continue to meet the criteria over time).	<i>Longitudinal</i> : Modified from Taylor <i>Reliable</i> : Modified from NNIP; definition from http://www.sociology.org.uk/plmc5n1a.htm
Relevant	Data reflect neighborhood realities and histories.	Data that may show some statistical relationship to other indicators might not be relevant for Detroit.	NNIP
Timely	Data are available at least annually.	Up-to-date information is necessary to draw conclusions that reflect recent developments in a neighborhood. Old data can give an outdated or inaccurate portrayal of neighborhood conditions.	NNIP
Useful	The data reflect change. The indicator implies a way issues can be addressed. The indicator applies across neighborhoods.	Indicators need to measure a characteristic or condition that policy-makers at the local or neighborhood level can change. Does the leading indicator relate to policy issues? Comparison among similar neighborhoods is important to Detroit. One neighborhood's experience could be a lesson to others.	NNIP <i>Policy Relevance</i> : http://www.iisd.org/cas/CASLGuide/Criteria.htm Modified from Taylor
Valid	The extent to which the data give a true measurement or description of reality.	The indicator needs to have broad applicability—does it accurately represent a larger issue?	Modified from NNIP; <i>definition of "valid"</i> from http://www.sociology.org.uk/plmc5n1a.htm
Simple	The data are easy to understand.	Information is most useful when the intended audience has access to it. Complex issues need to be distilled to allow clear presentation to the general public.	<i>Definition</i> : http://www.iisd.org/cas/CASLGuide/Criteria.htm

Gather Additional Data

Although Detroit's Planning & Development Department provided data for this project, more data were needed to complete the pilot. We collected Home Mortgage Disclosure Act from the HMDA web site and City of Detroit Police Department crime data from the Wayne State University College of Urban, Labor and Metropolitan Affairs (CULMA) web site after research showed that those data might add to the model's abilities and meet the selection criteria.

Establish a Database

This step involved creating a database for indicators that could be used in the pilot for Clusters 3 and 5 in Detroit. Because some data were only available for census tracts, all the data were aggregated to the census tract level. This means that the database included all census tracts in Clusters 3 and 5 and various data about those census tracts. The database was revised as testing determined which indicators to use in the final pilot EDS.

Test the Data

Indicator statistics

In choosing a set of indicators to measure changes in the health of a neighborhood, a model developer should perform various types of statistical analyses to understand the relationship among indicators. For this pilot model, we analyzed indicators that relate to physical conditions to demonstrate how statistical tests can be useful in evaluating indicators. The lack of a comprehensive dataset prevented us from conducting a full statistical analysis on the indicators.

The tests used Clusters 3 and 5 in Detroit as a proxy for the entire city. As mentioned, all data values were aggregated to the census tract level. Data sources include federal Home Mortgage Disclosure Act (HMDA) data from 1997 to 2002, City of Detroit Assessor's data from 2002, City of Detroit Police Department crime data for 2002 collected from the Wayne State University College of Urban, Labor and Metropolitan Affairs (CULMA) web site, geographic boundary shapefiles from the City of Detroit's P&DD, and U.S. Census data from 2000.

a. Correlation

Before explaining the results of these tests, here is some basic information about correlation:

- Correlation tells about the relationships between indicators by providing numbers between 0 and 1.

The closer to 1, the stronger the relationship between two variables.

- The numbers are accompanied by “+” and “-” signs. A positive (+) relationship between indicators means that as one indicator goes up, the other one goes up also. A negative (-) relationship means that as one indicator increases, the other goes down.

The correlation results show a strong relationship between many of the indicators. Of particular interest, the leading (independent) and supporting (dependent)⁸⁰ indicators with strong relationships were:

- Mortgage Approval Rate – Property value
 - Median Amount of Home Purchase Loan
 - Education

Both mortgage approval rate and average true cash value, and median amount of home purchase loan and education had positive relationships. Because of these strong relationships, the results suggest that these indicators may be useful in an EDS model. (See Appendix 3 for a more detailed description).

b. Regression

The idea behind doing a regression analysis is to build a model that can predict the value for the supporting indicator, which is used as a proxy for the key indicator. For example, if the EDS team has information on the number of mortgage loan applications, then the team can build a model that predicts the home ownership rates for a particular neighborhood. In doing regression, a model developer will need to address questions like: What changed when? And, how much variation from the predicted value is acceptable? If a leading indicator explains well the presence of all supporting indicators over multiple years, it can be said to predict the key indicator and could be used to predict future, unknown values.

The development of the pilot EDS used the supporting and leading indicators education, income, poverty, crime rate, and property value to show the beginning stages of physical decline. We selected these indicators because of the strong relationships shown in the correlation tables and the indicator selection criteria identified above. Using the research of Professor George Galster of Wayne State University on neighborhood indicators, we were able

⁸⁰ The independent variable (x-axis) explains the value of the dependent variable (y-axis).

to develop a basis to understand the functioning of an EDS. In order to demonstrate how the testing process can work, we adopted some of Galster's findings—primarily, that median home purchase loan amount, number of loan applications, and mortgage loan approval rate are valid leading indicators of the key indicators: social disadvantage, status and housing type & tenure.⁸¹ This model includes the indicators from Galster's findings that relate to physical condition.

To simplify the pilot, we limited our regression analysis to two variables. One variable was a leading indicator (the dependent variable), and one was a supporting indicator (the independent variable). The results showed a positive relationship between the average value of property in 2002 and the median value of home purchase loans in 2001, as well as between percent of the census tract population with an associate's degree or higher in 2000 and the median value of home purchase loans in 1999. (See Appendix 3 for a more detailed description).

Thresholds for neighborhood change.

As represented in Figures 12 and 13 on the next two pages, the process of creating useful descriptive maps required multiple iterations of spatial analysis (making maps and then thinking about what they say) and data interpretation in order to develop accurate representations of the study areas. This is because the patterns shown in the descriptive maps change dramatically as the model developer adjusts the thresholds in data. Overall, the process involved producing descriptive maps, observing patterns, and validating these patterns using working knowledge of existing conditions in Detroit. We determined thresholds (or classifications) by analyzing simple summary statistics (e.g. mean, minimum, and maximum), tracts distribution across the range of data values, and system output (initial "descriptive" maps). The mapping software provides summary statistics which help in map development and refinement. (See Appendix 3).

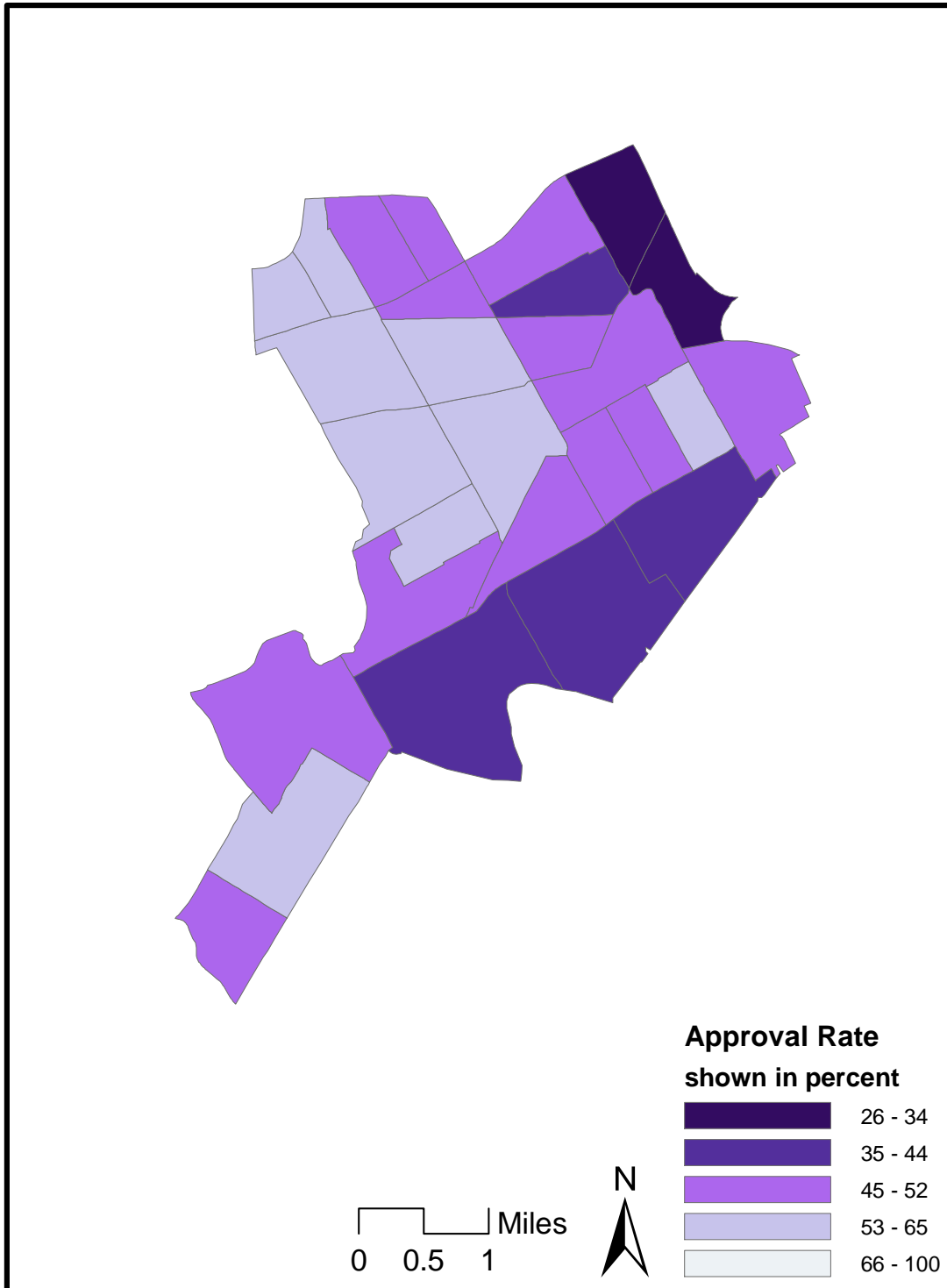
Descriptive Maps

The following two figures illustrate the type of descriptive maps generated for each indicator tested. The legend represents the thresholds assigned to each indicator. In both clusters, mortgage approval rates may reflect the economic stability of applicants. Rate equals the total number of loan applications approved (accepted and not accepted) divided by the total number of loan applications submitted. (See Appendix 4 for descriptive maps of the other indicators tested).

⁸¹ Galster, George, Chris Hayes and Jennifer Johnson. 2004. *Identifying Robust, Parsimonious Neighborhood Indicators*. The Urban Institute. Working Paper.

Figure 12

Mortgage Approval Rate, Cluster 5



Source: U.S. Census 2000; City of Detroit Planning & Development Department; HMDA 2002

Figures 12 and 13: Mortgage approval rates may reflect the economic stability of applicants. The rate equals the total number of loan applications approved (accepted and not accepted) divided by the total number of loan applications submitted.

Figure 13
Mortgage Approval Rate, Cluster 3



Source: U.S. Census 2000; City of Detroit Planning & Development Department; HMDA 2002

If the EDS developer determines that the patterns represented by the descriptive maps are accurate, the indicators can be considered relevant and valid. In developing this pilot model, indicators were evaluated according to the criteria throughout the testing process. Table 7 explains the rationale behind the selection and use of the five indicators initially included in the model.

The pilot model aggregated parcel-level data to the census-tract level to allow comparison among variables from different sources (e.g. HMDA and City Assessor's data). This aggregation resulted in a loss of information and occasional misleading results. While the EDS is best used for directing attention to an area of the city, analysis of the parcel-level conditions helps to understand the specific conditions and concerns of an area. Appendix 5 demonstrates how the parcel-level data can reveal otherwise misleading census tract values.

Neighborhood types showing different levels of change.

The spatial testing process also involved combining indicators by "overlying" tracts that meet a certain classification setting. The result is a typology map. Figure 14 shows an overlay (the technical term for combining indicators in a mapping program like ArcGIS) of the following indicators: Mortgage Loan Approval Rate, Number of Mortgage Loan Applications, Median Home Purchase Loan Amount, and Delinquent Property Tax/True Cash Value. These indicators represent data available for the same year (2002).⁸² See Appendix 6 for a chart showing the neighborhood classifications used to generate this map.

The four indicators used above demonstrated a strong ability to identify neighborhood strength and weakness, especially in relation to physical housing conditions. For reasons explained in Appendix 7, crime data failed to meet the criteria "discrete" or "valid" and were not included in the final pilot EDS. The other four indicators met all of the criteria and therefore remained a part of the model.

An EDS model developer can determine the degree to which areas are included in the final map. Changing how the neighborhoods are categorized (changing the typologies) dramatically affects the number of tracts the model captures. Figure 15 illustrates this point.

The map in Figure 15 shows an overlay of the following indicators: Mortgage Loan Approval Rate, Number of Mortgage

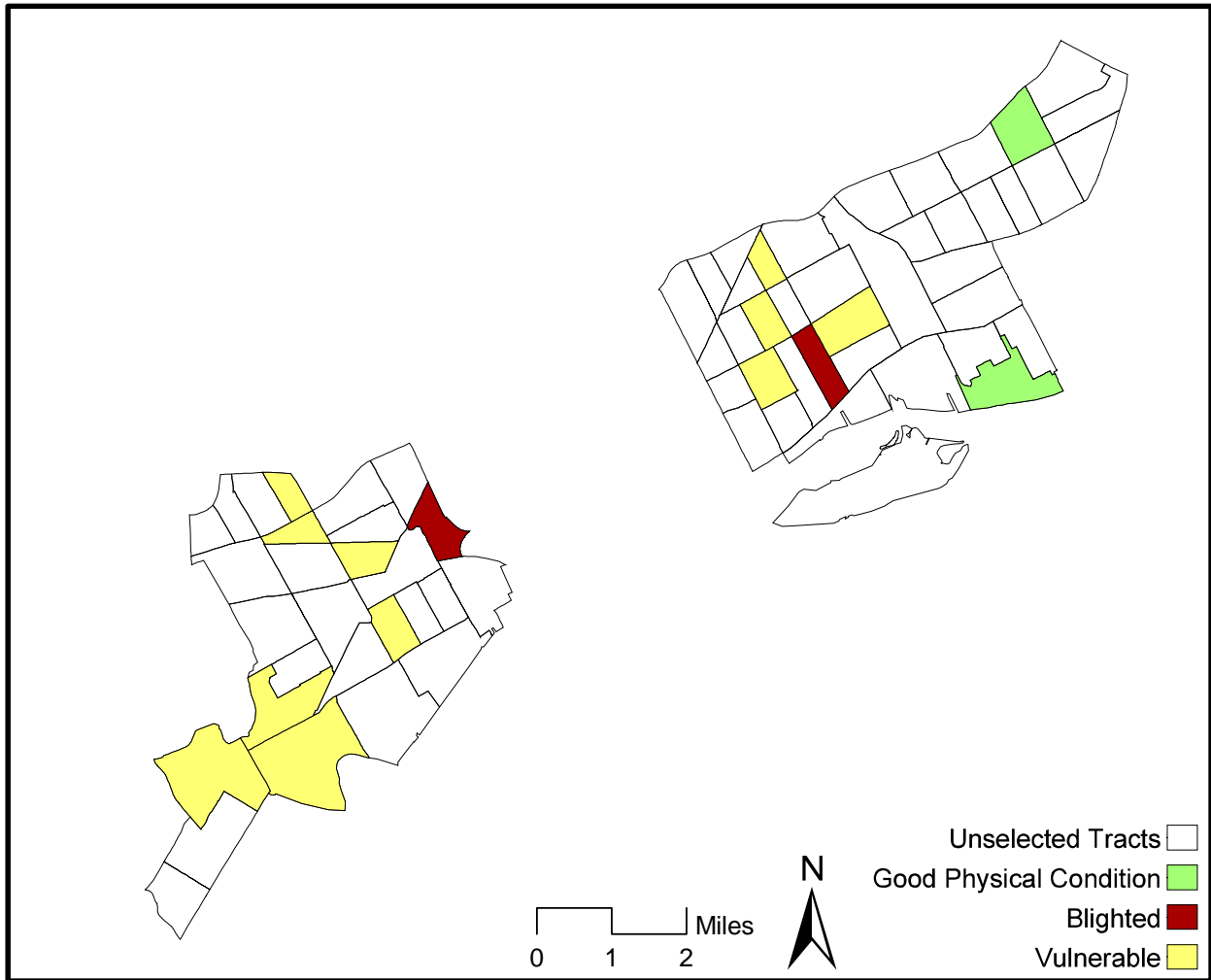
⁸² Primary data sources include: City of Detroit Planning & Development Department; City of Detroit, Finance Department - Assessments Division Data 2002; HMDA 2002; and, City of Detroit Police Department from Wayne State University College of Urban, Labor and Metropolitan Affairs (CULMA)

Table 7
Leading Indicators Tested: Definitions and Interpretations

Leading Indicator	Definition	Possible Interpretation	Comments
Ratio of delinquent property tax to true cash value	Delinquent tax divided by properties' true cash value.	Not paying property taxes can represent disinvestment. This may show how serious property abandonment may become in an area.	True Cash Value is nearest to the market value of a property and readily understandable as a measure of value.
Median home purchase loan originated	The median dollar amount of home purchase loans originated (approved and accepted).	The median loan value reflects cost and value of a home. It may also represent economic stability via home buyers' ability to borrow.	Number of loans originated should be considered when assessing investment in an area. Median value might be high because one large loan was originated, which would give a deceptive picture of loan activity in that area. Considering total value of homes in the tract (home purchase loan/value of homes in the tract) might give a better picture of neighborhood investment.
Percent mortgage approval	The number of mortgage approvals per the total number of mortgage applications.	This may reflect the credit-worthiness or economic stability of applicants.	Mortgage approval cannot be used to assess economic stability in isolation because low values may reflect that some banks do not approve loans in certain areas regardless of candidates' qualifications.
Number of mortgage loan applications	The number of mortgage loan applications submitted.	This variable can be used to understand potential investment as a reflection of whether people want to purchase homes in the area.	A decreasing number of loan applications may not indicate less investment and consequently more blight if the number of properties available for purchase or needing improvement decreases. Observing the real estate market is necessary to understand how many properties are available and the rate of turnover. The number of mortgage loan applications per the number of available residential parcels could also address this concern.
Serious crime rate (violent and property crime)	The amount of serious crime (sum of violent and property crime) per capita.	This variable shows areas with more or less serious crime.	Crime can be both a key and supporting indicator. It can influence decisions about whether to invest in or leave an area. One should consider, however, the actual crime rate or people's perception of crime has more influence on decisions. Crime should also be considered along with other factors for stability. For example, a strongly organized community may work to decrease criminal activity.

Figure 14

Neighborhood Categories, Clusters 3 and 5



Sources: U.S. Census 2000;
 City of Detroit Planning & Development Department;
 City of Detroit, Finance Department - Assessments Division data 2002; HMDA 2002;
 City of Detroit Police Department 2002, from
 Wayne State University College of Urban, Labor and Metropolitan Affairs (CULMA)

Figure 14: Illustrates that the condition of neighborhoods can be assessed using typologies, in this case good physical condition, vulnerable and blighted. The output varies depending on the classifications (or thresholds) defined for each typology. This is a static view of neighborhood condition, useful for comparing tracts spatially (to each other). Compared to a map of change over time, this map would indicate areas where revitalization efforts may be most beneficial or needed (in this instance, tracts shown as "vulnerable").

Figure 15

Different Definitions of the Category “Blighted”



Sources: U.S. Census 2000;
 City of Detroit Planning & Development Department;
 City of Detroit, Finance Department - Assessments Division data 2002; HMDA 2002;
 City of Detroit Police Department. 2002. from
 Wayne State University College of Urban, Labor and Metropolitan Affairs (CULMA)

Figure 15: Illustrates that changing the manner in which neighborhoods are categorized (changing the typologies) dramatically affects the number of tracts the model captures. The broad overlay generally defined blighted as a tract having the mean value of a variable and below, while the narrower definition identified as blighted only those tracts with lower than mean values. For an understanding of how this relates to neighborhood categories, see Table A5 Neighborhood Typology Classification in Appendix 6. (An EDS model developer can determine the degree to which areas are included in the final map).

Loan Applications, Median Home Purchase Loan Amount, Delinquent Property Tax/True Cash Value, and Serious Crime per Capita. A broader overlay of indicator thresholds identified the tracts highlighted in yellow. A narrower one produced those marked with orange stripes. All tracts highlighted in the "Narrow Estimate" also fall within the "Broad Estimate."

That the model is highly sensitive to how the developer defines the thresholds and typologies for each indicator can be considered a drawback and calls for caution on the part of the model developer. At the same time, an advantage to the model's sensitivity is its flexibility. That is, the model can respond to the goals of the model's developer. If the user's desire is to understand the subtle differences among a broader array of areas, the developer can use broad classifications to select the most tracts.

Combine Indicators to Produce a Typology

After defining the system, developing criteria, gathering data and some initial evaluation, four leading indicators were identified as promising for the pilot EDS. In order to create a predictive map, we evaluated data from more than one year. This identified census tracts that were improving or declining (had increased or decreased in value). More than one year of data were needed for all four indicators, however, and multiple years of assessor's data were not readily available. As a result, the remaining explanation and development of a pilot EDS include only the HMDA data.

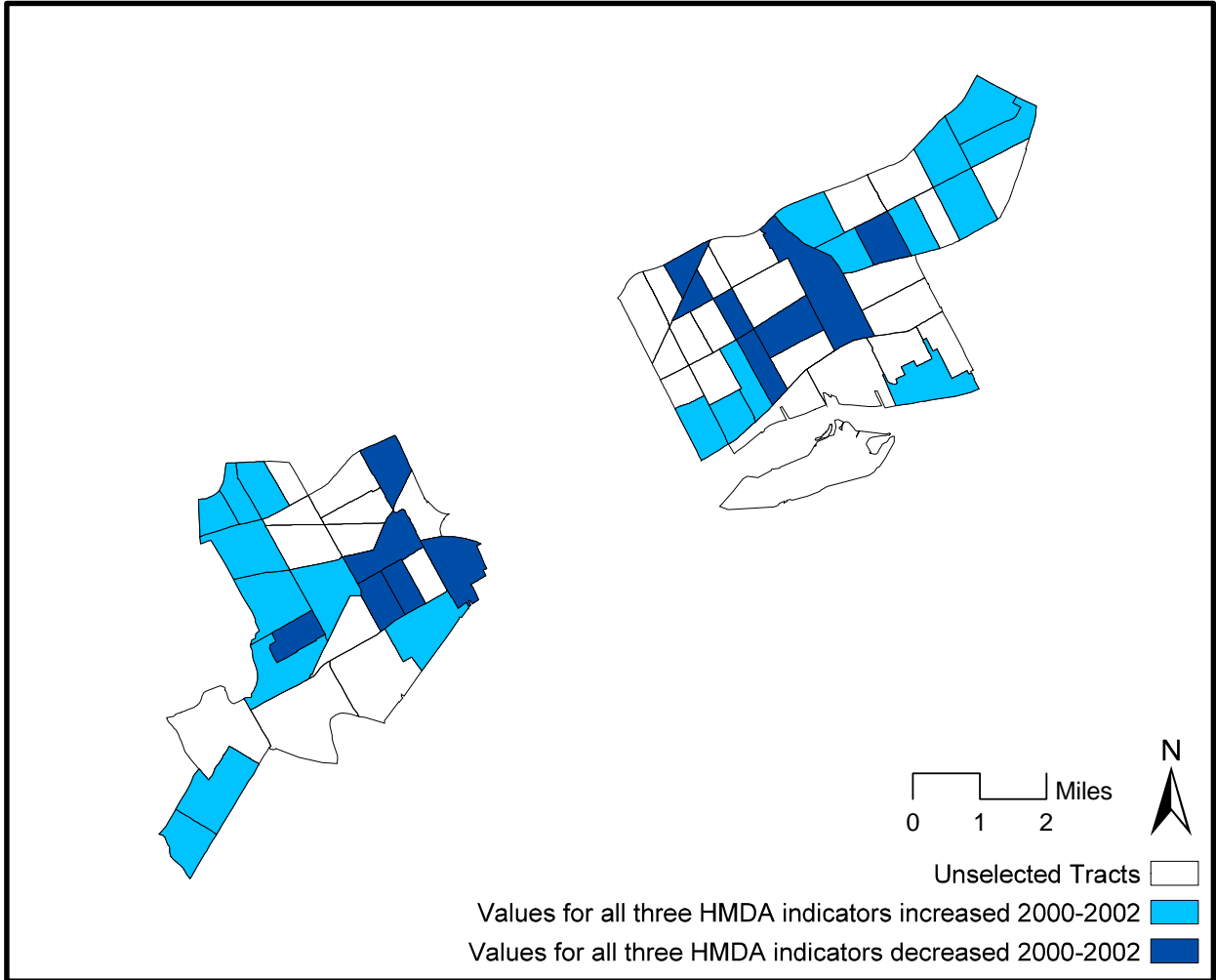
On the following page, Figure 16 shows those tracts that increased or decreased for all three indicators: Mortgage Loan Approval Rate, Number of Mortgage Loan Applications, and Median Home Purchase Loan Amount. Tracts highlighted in turquoise had a positive percent change, while those in dark blue had a negative percent change. See Appendix 8 for descriptive maps that show change over time for individual indicators.

The next step combined the outputs from the previous two maps (neighborhood typology and change over time (HMDA) in order to create the final map for the pilot EDS (See Figure 17). Comparing the conditions of neighborhoods with how indicators have changed over time allows a more comprehensive analysis. Decision-makers can assess whether an area indicated as "vulnerable" may be improving or declining and possibly study the area further to see whether policy changes or more resources are needed in that area.

Identifying different types of tracts and whether they are

Figure 16

Change Over Time: 2000-2002, Percent Change in Home Mortgage Disclosure Act Data

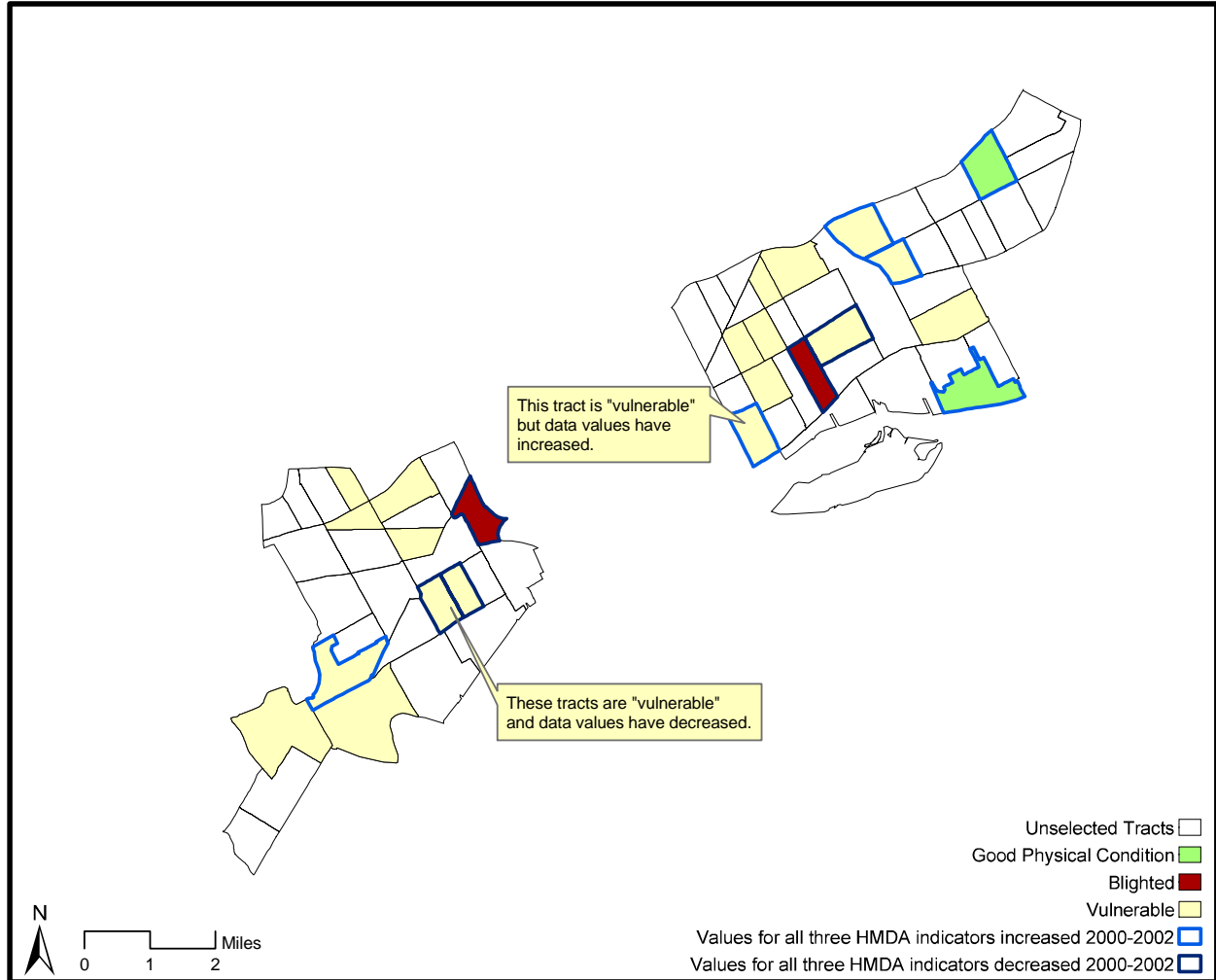


Sources: U.S. Census 2000;
City of Detroit Planning & Development Department;
HMDA 2002

Figure 16: This map shows the percent change in mortgage loan approval rate, number of loan applications, and median home purchase loans from 2000 and 2002. Tracts highlighted in turquoise had a positive percent change, while those in dark blue had a negative percent change.

Figure 17

Neighborhood Categories and Change Over Time, Clusters 3 and 5



Sources: U.S. Census 2000;
City of Detroit Planning & Development Department;
HMDA 2002

Figure 17: This map combines the outputs from the neighborhood category and change over time maps. Decision-makers can use this map to assess whether an area indicated as “vulnerable” may be improving or declining (having increased or decreased, respectively), and determine where to focus their revitalization efforts. Note: Due to data limitations, this map used HMDA data only (Mortgage Loan Approval Rate, Number of Mortgage Loan Applications, Median Home Purchase Loan Amount).

improving or declining is only the first step. EDS administrators, community organizations and policy-makers can use the map to identify areas of concern or opportunity, but a more detailed understanding of the forces affecting the neighborhood is necessary before action can be taken. The Community Empowerment System will provide a wealth of information about a community's assets and deficits and what forces might be at work. Because the CES focuses on collecting and presenting data for the purpose of community change, it will enhance interpretation and action once vulnerable, good physical condition, and blighted neighborhoods are identified.

This pilot EDS model illustrates some of the outputs and capabilities of such a system and includes a preliminary evaluation of indicators and indicator selection. However, the pilot shows an example of a model. Re-evaluating the criteria could result in different indicators for testing. A thorough analysis would involve a comprehensive and iterative process of testing those indicators—combining different indicators at different times to assess the relationship both among them and on the desired conditions of neighborhood strength and blight.

Conclusion

Part I: How to Build an EDS defined an early detection system and explained the methods an organization can use to build a quality system. The methods involved setting a goal for the system, selecting and testing data and providing outputs that predict neighborhood conditions. *Part II: EDS Method Applied* described how the methods were used in creating the pilot EDS and gave a general description of the results.

Using this approach, city of Detroit departments can create and use an EDS to identify trends and conditions in city neighborhoods. They then can further study the neighborhoods to understand the situation and consider how to act in response.

Appendices 3 through 8 describe more technical details about the pilot EDS.