

Introduction

Miami Valley Land Suitability Assessment - Natural Environment Factors

Purpose

The Miami Valley Regional Planning Commission (MVRPC) conducted the Miami Valley Land Suitability Assessment - Natural Environment Factors - as part of the existing conditions assessment phase of “Going Places - An Integrated Land Use Vision for the Miami Valley Region.” The main purpose of this assessment is to identify locations within the Region that are better suited for physical development than others. Additional goals of this assessment include:

- Compiling regional natural resource data into one regional dataset
- Developing a systematic approach to combining this data into a meaningful single variable
- Using this single variable to create a Natural Environment Factors Composite Map.

The natural environment factors analyzed in this assessment, such as soil, slope, vegetation, and hydrology, were included because of their significance in the context of land use planning. Technical analyses of each factor were conducted separately in order to determine the presence and conditions of each within a spatial context. This portion of the assessment not only comprises an important first step toward a land suitability evaluation process, but also provides geographically referenced information about opportunities and constraints for future land development. The Natural Environment Suitability Measure is the result of overlaying maps of these opportunities and constraints in order to generate overall suitability scores within the planning area.

This assessment alone is not meant to be a comprehensive land suitability assessment as it only focuses on natural environment factors. An assessment of built environment factors must be completed in order to have a complete understanding of the Region’s physical landscape.

Study Area

The study area covers an eight county Region in the Dayton metropolitan area located in the southwest Ohio as illustrated in the map. The study area covers approximately 3,600 square miles with the Great Miami River being the major north-south river corridor.

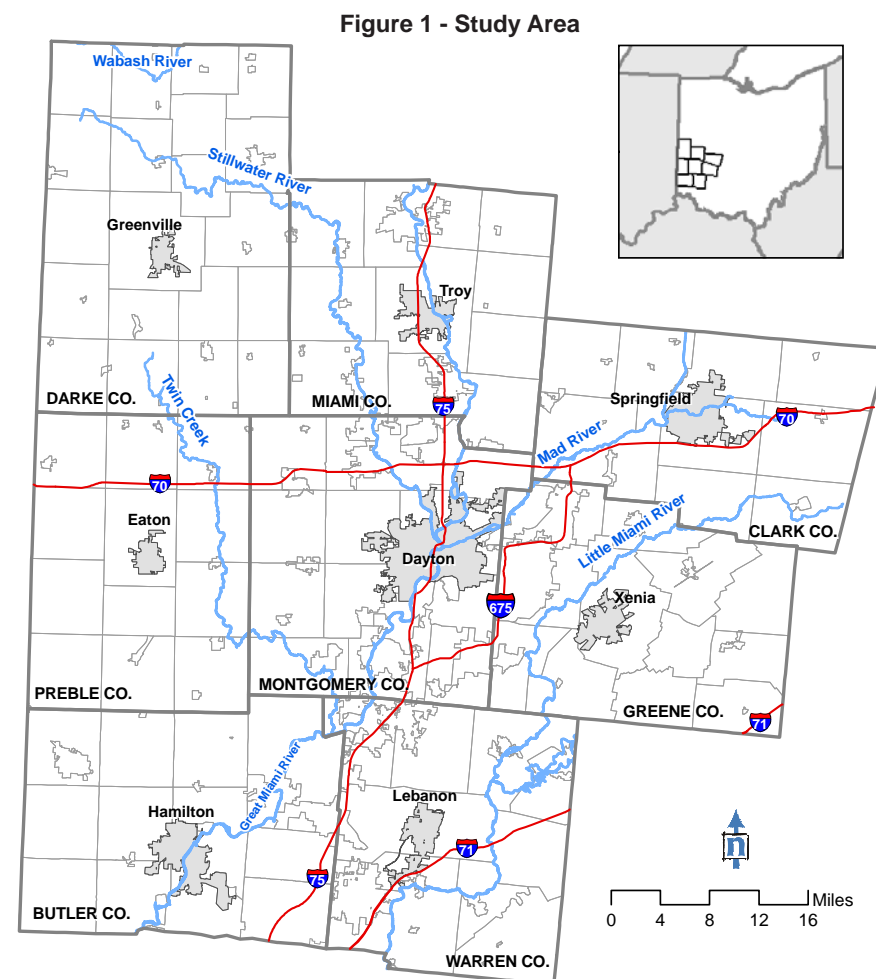


Figure 1 - Study Area

Natural Environment Factors Considered

The 15 natural environment factors analyzed in this study are:

- Depth to Bedrock
- Floodplain
- Forested Areas
- Ground Water Pollution Potential
- Ground Water Yield
- Inundation Areas
- Load Bearing Strength
- Mineral Resources
- Prime Farmland
- Slope
- Soil Drainage
- Sole Source Aquifer
- Surface Water
- Well Field Protection Areas
- Wetlands

Report Structure

This report is a summary of the study and it is structured in five separate sections:

1. The Introduction section provides a brief overview of the study, which includes the purpose, the study area, factors included in the study, and contact information.
2. The Methodology section provides detailed information on how the study was implemented. Further, this section describes the methods used to generate the land suitability score from all 15 environmental factors.
3. The third section presents the individual natural environmental factors. Each page represents one factor and presents the definition, data sources, and data findings.
4. The last section is the presentation of the Natural Environment Factors Composite Map and a summary of the findings that was developed based on the land suitability score from all 15 factors.
5. The Conclusion is a summary of the findings from the factor analyses and the analysis of the Natural Environment Suitability Measure.

Acknowledgements

The study was made possible by datasets that were made available by various agencies listed throughout the report. MVRPC is grateful for this data and would like to thank those Federal, State, and local agencies for making the data available.

Miami Valley Land Suitability Assessment - Natural Environment Factors

This assessment was carried out in four phases. The first phase was to identify the natural environmental factors to be included in the assessment, followed by the development of a regional dataset. The second phase focused on the development of a suitability score for each factor. The third phase of the assessment was to develop a land suitability composite map based on the aggregated total suitability score. The last phase includes a technical analysis of the 15 natural environment factors and a summary of data findings from the composite map.

A Geographic Information System (GIS) was used to carry out the assessment due to its unique capacity of spatial database management and analysis. The data developed and acquired for individual environmental factors were all brought into the GIS environment for spatial overlay and analysis and the conceptual framework for combining suitability scores from all 15 factors into a single aggregated suitability score was implemented through GIS.

Regional Dataset Development

The first step was to identify the natural environment factors to be included in the assessment and to develop a regional dataset for each factor. An extensive literature search was conducted to identify natural environment factors that are commonly used in land suitability assessments. The 15 factors selected for this assessment encompass three dimensions of natural environment considerations: resources, hazards, and physical impediments.

The 15 factors in the study can be grouped into these three dimensions as following:

- | | | |
|---|--|---|
| <p><u>Resources</u></p> <ul style="list-style-type: none"> • Forested Areas • Ground Water Pollution Potential • Ground Water Yield • Mineral Resources • Prime Farmland • Sole Source Aquifer • Well Field Protection Areas • Wetlands | <p><u>Hazards</u></p> <ul style="list-style-type: none"> • Floodplain • Inundation Areas | <p><u>Physical Impediments</u></p> <ul style="list-style-type: none"> • Depth to Bedrock • Load Bearing Strength • Slope • Soil Drainage • Surface Water |
|---|--|---|

Two considerations were prominent during the search for reliable data sources - the availability of consistent data for all eight counties and the availability of data in a GIS format.

Individual county data was aggregated into an eight county regional dataset and was stored in the GIS format for technical analysis and mapping purposes.

Suitability Score Development

A three-step process was developed for calculating the Suitability Score for each of the 15 factors. First, the data attributes for each factor were classified into a Suitability Measure. Second, a numeric Attribute Score was assigned for each Suitability Measure. Third, a Weight Factor was applied to each Attribute Score to generate the final Suitability Score. (See Appendix for detailed table)

The *Suitability Measures* indicate whether certain data attributes are more or less suited to accommodate land development. The data attributes were classified into one of four general Suitability Measures: Suitable, Somewhat Suitable, Not Suitable, or Not Applicable. For most factors it was only necessary to use two or three of the Suitability

Measure categories. For example, the data attributes for the Depth to Bedrock factor were classified simply as either Suitable, Not Suitable, or Not Applicable.

The Attribute Score translates the qualitative Suitability Measure into a quantitative measure ranging from one to five, with five representing the most suitable. This is a relative score within each factor, meaning that an Attribute Score of five does not mean that the attribute is five times more suitable than an attribute with a score of one.

The purpose of the *Weight Factor* is to weight the 15 factors against one another according to their importance in determining development potential. The Weight Factor ranges from one to four, with four indicating the highest degree of importance. As with the Attribute Score, the Weight Factor is a relative measure.

The *Suitability Score* is the final score that takes into account both of the measurements at the individual factor level and the relative importance of each factor among all 15 factors. It is derived by multiplying the Attribute Score by the Weight Factor. For example, for a data attribute from the Depth to Bedrock factor classified as Suitable, the Attribute Score would be five. Multiply that by a Weight Factor of two and the Suitability Score would be 10.

Natural Environment Suitability Measure Development

Conceptually, the Natural Environment Suitability Measure was generated by overlaying spatial data representing the Suitability Scores of all 15 factors, as illustrated in the figure to the right.

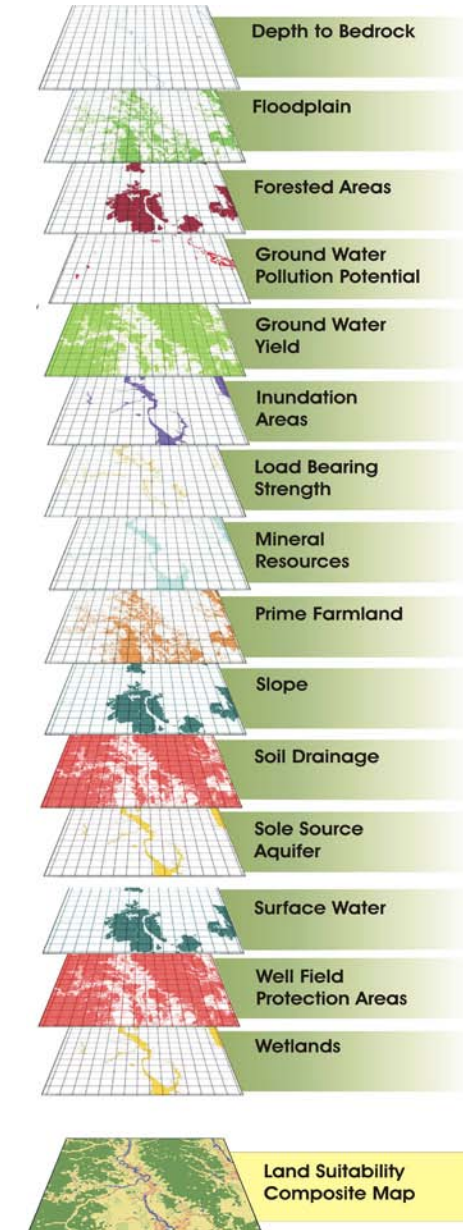
To make this possible, the entire study area was divided into a grid with cells measuring 2,500 square feet (50 feet by 50 feet).

This grid was then applied to the GIS data layers representing the Suitability Scores for each factor. Finally, the grids were overlaid and the Suitability Scores in each grid cell were summed to create the Natural Environment Suitability Measure, as illustrated in Figure 3.

Figure 3 - Summing Suitability Scores

Variable1			Variable2			Sum of Variables				
2	1	1	+	3	1	1	=	5	2	2
2	2	1		3	3	1		5	5	2
1	1	1		1	1	1		2	2	2

Figure 2 - Natural Environment Factors



Technical Analysis

Analyses at the regional and county levels were conducted for each of the natural environment factors with special emphasis on presenting the analysis results in a spatial context. A similar analysis was conducted for the Natural Environment Factors Composite Map.