CRITICAL TRENDS ASSESSMENT:

THE ILLINOIS
ENVIRONMENT

PAST, PRESENT
AND FUTURE

ENR
Illinois Department of
Energy and Natural Resources

John S. Moore
Director

Natural History Survey Library

NOTICE: Return or renew all Library Materials! The Minimum Fee for each Lost Book is \$50.00.

The person charging this material is responsible for its return to the library from which it was withdrawn on or before the **Latest Date** stamped below.

Theft, mutilation, and underlining of books are reasons for disciplinary action and may result in dismissal from the University.
To renew call Telephone Center, 333-8400

UNIVERSITY OF ILLINOIS LIBRARY AT URBANA-CHAMPAIGN

UNIVERSITY OF
ILLINOIS LIBRARY
AT URBANA - CHAMPAIGN
NAT. HIST. SURV.

L161—O-1096

Integrated Critical Trends Database

Critical Trends is an environmental initiative that will take a comprehensive look at the state's environment. It will:

- ♦ assess environmental trends and conditions**
- ♦ graphically illustrate those trends**
- ♦ provide a measure of environmental progress**
- ♦ forecast future conditions under various scenarios**
- ♦ use computer technology to advance environmental and natural resource management into the next century**

Digitized by the Internet Archive
in 2010 with funding from
University of Illinois Urbana-Champaign

Integrated Environmental Database

The project will develop a database for the Geographic Information System that will:

- ♦ coordinate large data sets
- ♦ integrate economic, social, and natural resource data
- ♦ present data spatially and over time
- ♦ provide the information needed to make complex decisions
- ♦ allow for regional analyses
- ♦ allow for a statewide exposure assessment based on the spatial relationships of sources, environmental agents, and receptors.

The database, which will be GIS-compatible, will be delivered to the participating state agencies.

The State of the State Report

The project will analyze and synthesize the data into a report on the state of the state's environment. The report will:

- ♦ be written for the general public, in non-technical language
- ♦ illustrate, with GIS-generated graphics, complex environmental, economic and social relationships
- ♦ provide an overview of the state's environment and the impacts on human health, ecological health, and welfare
- ♦ summarize trends and forecast future conditions based on varying scenarios

The Geographic Information System

The GIS is a computer technology that has three components: the relational database, graphics, and most importantly, the user.

With the GIS, users can analyze *spatial* geographic data and graphically display their findings.

The GIS can display:

- ♦ location -- what is at...? (i.e., place name, street address, zip code, latitude and longitude, etc.)
- ♦ conditions -- where do they occur? (location where certain features are present and certain criteria are met, such as soils suitable for mining)
- ♦ trends -- what has changed since...?
- ♦ patterns -- what spatial patterns exist...?
- ♦ modeling -- what if...?

The GIS and Critical Trends

To develop the integrated environmental database and conduct the statewide assessment, GIS professionals will:

- 1. Build the database**
 - a. Design the database**
 - b. Input spatial data**
 - c. Edit and create topology**
 - d. Input attribute data (i.e., water temperature or soil type)**
- 2. Analyze the data (determine relationships, patterns)**
- 3. Present the results of the analysis narratively and graphically**

Source-based Assessment Model

The environmental assessment model will be based on a source-agent-receptor flow which will estimate exposure and assess a range of impacts.

- ♦ The *source* is the point of origin, such as manufacturing or mining, of an agent.
- ♦ The *agent* is an element or action that presents a hazard or ecological stress.
- ♦ *vector*
- ♦ The *receptor* is the human or ecological unit exposed to the agent.

The characteristics of the sources, agents and receptors will be defined during Phase I of the project. The level of detail will depend on the availability of the data.

EXAMPLE OF SOURCE-BASED ASSESSMENT

Copyright © 1998 by John Wiley & Sons, Inc.

Example

The GIS will be used to operate the source-based assessment model. For example, to analyze the impacts of coal mining on prime farmland:

- ♦ the source is mining
- ♦ the agent is the physical dispersal of soil
- ♦ the receptor is the land

The GIS coverages (topologically linked geographic features and their descriptive data) would be:

- ♦ the mine locations
- ♦ soil identification and distribution
- ♦ land cover

The final products would be ^{maps} ~~graphic illustrations~~ and an analysis conducted by the user to support the agency's decision-making process.

Trends Analysis

The GIS, using temporal databases such as state land cover, allows the user to analyze conditions over time (e.g., 1970, 1980, 1990)

For example, with satellite imagery it can take current or historical data for a large area and show:

- ♦ extent and degree of recent development
- ♦ changes in farmland acreages over time
- ♦ forest cover changes
- ♦ loss of natural resources

With Census data it can show trends in demographics such as:

- ♦ population
- ♦ nationality
- ♦ housing
- ♦ age intervals

A GIS user can display such data to define relationships among the variables.

Forecasting

The Critical Trends project will take the data developed in the trends analysis to forecast future conditions under varying scenarios.

Possible variables include:

- ♦ environmental factors, such as climate scenarios**
- ♦ demographics, such as population growth and distribution, housing and commuting patterns**
- ♦ economics, such as industrial growth, natural resource use, and economic incentives or disincentives**
- ♦ social attitudes and behavior, such as conservation practices and laws and regulations**

Human Health Time Construct

Project Team

In cooperation with the Governor's Science Advisory Committee (GSAC), the Department of Energy and Natural Resources will be the lead agency for project management and technical analysis.

The GSAC will establish and coordinate two committees that will provide broad-based input to the project:

- ♦ an Advisory Committee will be composed of GSAC members, environmental representatives, technical experts and the public.**
- ♦ an interagency technical committee will be composed of state natural resource agencies and other appropriate agencies.**

Both committees will review and comment on working papers, the final report and other aspects of the project.

Project Management

The Department of Energy and Natural Resources will provide project management and technical analysis. Divisions participating in the project include:

Office of Research and Planning

State Water Survey

State Geological Survey

Natural History Survey

State Museum

Hazardous Waste Research and Information Center

Technical Assistance will also be provided by state research universities, and by consultants with expertise in computer modeling and human health and ecological impact analysis.

Interagency Technical Committee

The committee will be composed of a technical representative from each of the following agencies:

- ♦ Department of Agriculture**
- ♦ Department of Conservation**
- ♦ Emergency Services and Disaster Agency**
- ♦ Department of Energy and Natural Resources**
- ♦ Environmental Protection Agency**
- ♦ Department of Mines and Minerals**
- ♦ Department of Nuclear Safety**
- ♦ Department of Public Health**
- ♦ Department of Transportation**
- ♦ Office of the State Fire Marshall**

Interagency Committee Responsibilities

Initially, the Interagency Technical Committee will review, comment on and refine the Phase I work products. The committee will also:

- ♦ assist in refining the project work plan**
- ♦ provide technical input**
- ♦ coordinate data sharing and evaluation**
- ♦ participate in work group meetings**
- ♦ review and comment on working papers, final report and other aspects of the project**

Project Work Plan

FY '92 & '93

PHASE I

- ♦ **characterize source, agents and receptors**
- ♦ **inventory and acquire existing data**
- ♦ **review source-based exposure models and forecasting models**

PHASE II

- ♦ **evaluate data acquired in Phase I**
- ♦ **develop exposure model**
- ♦ **develop forecasting model**

PHASE III

- ♦ **estimate exposure**
- ♦ **conduct trend analysis of environmental conditions**
- ♦ **forecast environmental scenarios**

PHASE IV

- ♦ **synthesize data and analyses for final report**

This project will be co-funded by ENR and USEPA.

Lake County Landfill Screening

This figure illustrates how a number of physical and cultural site screening criteria were evaluated simultaneously by the Department of Energy and Natural Resources' Geographic Information System in order to locate areas of suitability for a new regional landfill in Lake County. Siting Criteria were selected by the Lake County Joint Action Solid Waste Planning Agency, and fall into four categories: 1) Natural Features, 2) Cultural Features, 3) Development, and 4) Highway Proximity. In some cases, buffers were constructed around features. The shaded areas in the Composite Map represent areas of potential suitability. None of the features mapped on the left fall within the shaded region of the composite.

Potential for Aquifer Recharge in Illinois

Appropriate Recharge Areas

Donald A. Keefer

Appropriate recharge as determined as part of the State's effort to assess the groundwater resources of Illinois (P.A. 85-863, Section 7 (b)(2)). Appropriate recharge areas, undelineated by the Act, have been defined by the Illinois State Geological Survey on a regional basis as the relative potential for recharge to aquifers.

Potential for Aquifer Recharge Water that moves into the saturated zone and flows downward, away from the water table, is *recharge*. Generally, only a portion of recharge will reach an aquifer. The probability of precipitation reaching the uppermost aquifer is the potential for aquifer recharge.

The *Potential for Aquifer Recharge in Illinois* map combines information regarding the distribution, thickness, texture, and hydraulic conductivity of mapped sequences of shallow geologic materials, the distribution of major sand and gravel aquifers, the distribution of major bedrock aquifers within 91.2 meters (300 feet) of ground surface, and the regional variability of the potential for infiltration throughout the state.

Mapping the depth to the uppermost aquifer has been used in Illinois to evaluate the potential for aquifer contamination by municipal landfills and by agricultural chemicals. Any generalized map of the potential for aquifer contamination can also be used as a map of the potential for aquifer recharge because the procedures for generating these maps are similar. However, previous mapping of aquifer vulnerability only included information on the upper 15 meters of geologic materials and excluded the delineation of major aquifers (particularly at depth) and soil infiltration data.

Constraints of scale and data required the generalization and extrapolation of geologic and soils information; thus this map is not accurate enough to be used for site-specific purposes. Selection of specific sites for surficial waste storage or disposal facilities requires detailed geologic mapping and hydrogeologic evaluation.

Priority groundwater protection planning regions will be established, partly on the basis of this map, by the Illinois Environmental Protection Agency in cooperation with the Illinois Department of Energy and Natural Resources. Within each planning region, a committee will identify and evaluate issues of groundwater protection and potential contamination.

Potential for Aquifer Recharge in Illinois

Appropriate Recharge Areas

Donald A. Keeler
and
Richard C. Berg

Mandate The Illinois Groundwater Protection Act (IGPA) has specified that areas of appropriate recharge be identified as part of the State's effort to assess the groundwater resources of Illinois (P.A. 85-863, Section 7. (b)(2)). Appropriate recharge areas, undefined by the Act, have been defined by the Illinois State Geological Survey on a regional basis as the relative potential for recharge to aquifers.

Potential for Aquifer Recharge Water that moves into the saturated zone and flows downward, away from the water table, is recharge. Generally, only a portion of recharge will reach an aquifer. The probability of precipitation reaching the uppermost aquifer is the potential for aquifer recharge.

The Potential for Aquifer Recharge in Illinois map combines information regarding the distribution, thickness, texture, and hydraulic conductivity of mapped sequences of shallow geologic materials, the distribution of major sand and gravel aquifers, the distribution of major bedrock aquifers within 91.2 meters (300 feet) of ground surface, and the regional variability of the potential for infiltration throughout the state.

Mapping the depth to the uppermost aquifer has been used in Illinois to evaluate the potential for aquifer contamination by municipal landfills and by agricultural chemicals. Any generalized map of the potential for aquifer contamination can also be used as a map of the potential for aquifer recharge because the procedures for generating these maps are similar. However, previous mapping of aquifer vulnerability only included information on the upper 15 meters of geologic materials and excluded the delineation of major aquifers (particularly at depth) and soil infiltration data.

Constraints of scale and data required the generalization and extrapolation of geologic and soils information; thus this map is not accurate enough to be used for site-specific purposes. Selection of specific sites for surficial waste storage or disposal facilities requires detailed geologic mapping and hydrogeologic evaluation.

Priority groundwater protection planning regions will be established, partly on the basis of this map, by the Illinois Environmental Protection Agency in cooperation with the Illinois Department of Energy and Natural Resources. Within each planning region, a committee will identify and evaluate issues of groundwater protection and potential contamination.

Figure 3

County

Mobile Sources Roads

Transportation
MOBILE IV MODEL
Natural Resources, October 1990

Figure 3

Kane County

VOC Emissions from Mobile Sources County and City Roads

Estimated Emissions (lbs/day)

county/city road

Data Sources Traffic Data - Illinois Department of Transportation
Emission data estimated from USEPA's MOBILE IV MODEL
Prepared by Illinois Department of Energy and Natural Resources, October 1990

UNIVERSITY OF ILLINOIS-URBANA

3 0112 065447945