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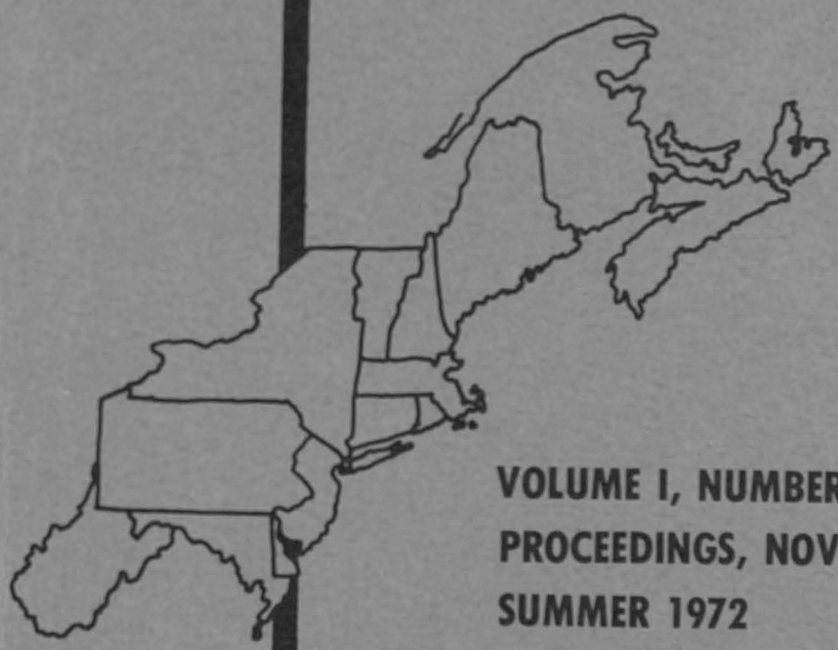

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TOWARDS A COORDINATED INFORMATION SYSTEM FOR NATURAL RESOURCE PLANNING*

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INTRODUCTION

From 1940 to 1970 the population of the United States and particularly the Northeast has increased rapidly.1/ The population of the United States has grown from approximately 132 to 203 million people, while the increase in the Northeast was from 36 to 49 million.2/ This constitutes a 54 percent increase in the United States' population and a change in density from 37 to 57 people per square mile. For the Northeast, which is already the most densely populated region of the United States (New Jersey having 953 people per square mile), the expansion was from 134 to 182 people per square mile, representing a 36 percent increase.3/

When these population statistics are coupled with the development of our highway network, improved transportation systems, rising incomes, increased leisure time, increased demand for recreation, and the decentralization of industry, a tremendous amount of pressure is placed upon the natural resource base to meet these needs. Planners and decision makers in rural areas as well as urban areas need relevant, accurate, up-to-date land and natural resource base data of sufficient quantity and quality to meet both private and governmental needs.4/

In recent years, policy at various levels of government has shifted its emphasis from the quantity or scarcity of various resources to the quality aspect, better known as "quality of the environment."

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*This paper is based upon current and future work at the New Jersey Agricultural Experiment Station (New Brunswick) under the Regional Research Project NE-78.

1/ As shown in the 1971 Statistical Abstract of the United States, the Northeast consists of Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, and Pennsylvania.

2/ Statistical Abstract of the United States, U.S. Department of Commerce, Bureau of the Census, 92nd Edition, 1971, pp. 8-18.

3/ Ibid.

4/ From this point on land and natural resource base data will be referred to as land data.

Governmental and private sectors of the economy both require land data to promote efficient planning and decision-making. The governmental sector is structured so that the municipality (township, borough, city, town, or village) is established as the controlling force in the planning process for the Northeast. As a result, land data collection is inconsistent from one municipality to another. The private sector, on the other hand, assembles only the land data required to meet a specific need, thus causing data gaps. A coordinated natural resource information system would provide consistent data, reduce data gaps, and provide a mechanism which could keep pace with our rapidly changing environment.

REVIEW OF LITERATURE

Certain aspects of information storage and retrieval systems have been examined in great detail, while other components have received little attention. Areas examined by engineers, lawyers, and economists include availability and value of hardware, parcel identification, costs, and the advantages and disadvantages of various information systems.5/

Clawson and Stewart initiated the interest in land information systems with the examination of the need for land data by Federal agencies.6/ The feasibility of establishing a land-use information system using utility, land location, relevant land characteristics, accuracy, and the system's relationship to other data as the basic criteria promoted extensive research on the formulation of information systems.

An area which encompassed most of the early efforts was that of real property records. Because of the physical fixity of land, Kessler noted that the identification of parcels and transactions consistutes a crucial component of any land information system.7/ He selected a grid coordinate system and a sequential numbering system for parcel identification and examined the advantages and disadvantages of each system. He concluded that the best identifier is denoted by its intended use. Many other parcel identification systems were proposed and examined since Kessler's only to state similar conclusions.

Problems in the storage and retrieval of land records first appeared local and unique, but were actually found to be worldwide in scope. With a knowledge of the importance of parcel identification and the scope of

5/ Extensive literature on data processing, storage, and retrieval is available. Only selected material is referred to in this literature review.

6/ Clawson, Marion and Charles L. Stewart, Land-Use Information, John Hopkins Press, Baltimore, Maryland, 1965, pp. 190-267.

7/ Kessler, James W., A Land Information and Recording System, Massachusetts Institute of Technology, Cambridge, Mass., Research Report R-66-38, August, 1966, p. 16.

land problems, Cook proposed a modern computerized system of land records.8/ The characteristics, possible components and a "basic and complete" system was presented by Cook in connection with the Tri-State Conference on a Comprehensive Unified Land Data System (CULDATA).9/

The advantages and disadvantages of land information systems applicable to real property records was explored.10/ Various advantages in the form of reduced costs to county offices and savings in time to users were identified. Counties with sparse populations are expected to have difficulty in justifying certain systems because of the low volume of use and high initial costs.

By 1971, the American Bar Foundation recommended that a single parcel identifier be established for use in land data systems throughout the United States. Moyer proposed an automated data system (Electronic County Cadastres) to be implemented on a county level.11/ The costs to local governments to convert parcels to a single standardized system based on experiences in Cincinnati, Madison, and Seattle varied from 10 to 50 cents per parcel provided suitable maps were available.12/

The development and implementation of data banks took place rapidly in urban areas. However, the feasibility of using unified land information systems in rural areas was yet to be explored.13/ As part of an investigation, data banks in Nassau County, New York, Washington, D.C., and Alexandria, Virginia, were reviewed with respect to their history of development, data requirements, and the uses made of distributed data. Results showed that: (1) Areas with populations as low as 30,000 people could benefit from present data banks containing property records; and (2) if the amount of land data in the banks was expanded to include more than just property records, smaller populations could benefit.

As evident in the examination of land information systems, computers can provide valuable savings in the manipulation and dissemination of stored data. An example of the effectiveness of computers was shown through an "input-output analysis" system used by five counties north of

8/ Cook, Robert N., "A Modern Computerized System of Land Records", University of Cincinnati Law Review, Vol. 38, No. 3, Summer, 1969.

9/ Cook, Robert N. and James L. Kennedy (ed.), Proceedings of the Tri-State Conference on a Comprehensive Unified Land Data System(Cincinnati: University of Cincinnati, 1967).

10/ White, James W. (ed.), Proceedings of a Workshop on Problems of Improving the United States' System of Land Titles and Records, Indiana State University, July 25-29, 1968.

11/ Moyer, D. David, County Cadastres and Compatible Parcel Identifier: Needs & Costs, ERS, USDA, Madison, Wisconsin, November, 1971, pp.1-44.

12/ Ibid. p. 43.

13/ Moyer, D. David, Three Automated Land Data Systems in the United States, Economic Research Service, USDA, Washington, D.C., p. 133.

California's San Francisco Bay.14/ In this system, the computer not only provides rapid data handling, but also aids in the economic decision-making process. As retired planner and designer of this system, John Fiske states, "The system can't tell you whether a subdivision will be an asset or a blight, but it can tell you the directions of the economic flow. The decision makers can look in advance at the gross economic results of proposed changes, and at least be more aware of some possible consequences before they make their final decision."15/

The full scale collection, use and exchange of land data on a statewide basis was developed by TRW Systems Group.16/ Results of the California Regional Land Use Information System (CRLUIS) will be realized in 1973. The principal conclusions of the TRW Systems Group reinforce the need for additional research in the area of the identification of collectors, users, and potential users of such land information systems. These conclusions show that: (1) There is real need for land-related data by both the governmental and private sectors of the economy, (2) significant benefits are possible through the use of comprehensive land data in the planning process, and (3) data users are aware of the needs and are highly cooperative.17/

Attention has also been devoted to methods of evaluating information systems. Hayami and Peterson proposed a method which estimated the social returns to governmental expenditures using the Statistical Reporting Service of the United States Department of Agriculture as an example.18/ Their results suggested that there is an under-investment in the provision of public information services, with respect to statistical reporting in agricultural production. Private expenditures should also be examined and this procedure provides a plausible method for such analysis.

Another aspect of information systems that is receiving attention is the invasion of privacy. Senator Ervin raises the question as to whether information systems infringe upon an individual's privacy.19/ Questions of this nature are concluded to arise with respect to personal questions involving one's private life and not information concerning land data.

14/ Smith, Ralph D., "Computer Aids Area's Decision-Making, Extension Service Review, USDA, Washington, D.C., February, 1972, pp. 8-9.

15/ Ibid., p. 9.

16/ TRW Systems Group, California Regional Land Use Information System, Redondo Beach, California, 1968.

17/ Ibid.

18/ Hayami, Yujiro and Willis Peterson, "Social Returns to Public Information Services: Statistical Reporting of U.S. Farm Commodities,", The American Economic Review, March, 1972, pp. 119-130.

19/ Interview - Senator Sam J. Ervin, Jr., "Invasion of Privacy - How Big a Threat?", U.S. News and World Report, 1972, pp. 38-45.

ANTICIPATED PROBLEMS IN THE IMPLEMENTATION OF A COORDINATED LAND INFORMATION SYSTEM

The Unit of Reference

Because of the physical fixity of land and land-related resources, data must be referred to a specific location (Table 1). This can be based upon:

(1) Parcel ownership (the legal entity as described by the deed or lease).
(2) Some type of grid coordinate system (longitude and latitude, the State Plane Coordinate System SPCS, Universal Transverse Mercator UTM, or Modified Transverse Mercator).
(3) A convenient geographic identifier (a square mile, an acre, or a kilometer).

After the unit of reference to be used has been defined, some type of identifier needs to be applied. Sequential numbering, grid coordinates, and lot and block have been examined. The best identifier tends to revolve around the intended use. The LUNR inventory has coded and referenced data to the Universal Transverse Mercator Grid. The state coordinate system has also been suggested because it can supply a parcel identifier and the boundaries of a parcel at the same time.20/

Autonomy of Units of Government

The problem is complicated for the Northeastern states in that the basic unit of government is the municipality. Currently, in New Jersey there are 567 municipalities (234 townships, 257 boroughs, 53 cities, 23 towns and villages). The Municipal Planning Enabling Act of 1953 and the Home Rule Act of 1917 give these municipalities control over land planning (master plans, building codes, zoning regulations), primary and secondary education, police and fire protection, and other local functions.

Within each municipality there are several officials dealing with various aspects of land data collection and use. Typically, there are about ten officials, five boards, three departments and several land-related commissions at the municipal level having a need to collect and/or use land data.21/ It is also estimated that there are today about 557 different municipal, county, and regional planning boards in the state.

20/ Taylor, James I., Thomas R. Ory, and Olin W. Mintzer, An Investigation of the Means to Establish Survey Control for Highway Engineering and Right-of-Way Acquisition, Report EES 217-2, Engineering Experiment Station, Columbus, Ohio, December, 1963, p. 102.

21/ A questionnaire survey of approximately 800 municipal, county, regional and state officials is being conducted by the Department of Agricultural Economics and Marketing, Rutgers University, New Brunswick, N.J., April 1972 to identify the collectors, users and potential users of land data in the Garden State.

The 23 county and regional planning boards are permitted by enabling legislation but generally serve in advisory capacities.

Table 1
Selected Aspects of Three Information
System Units of Reference
1972

Units of reference (selected aspects)	Parcel ownership	Grid coordinate system	Convenient geographic identifier
1. Easily established as a unit of reference	POSSIBLY	YES	YES
2. Requires the development or selection of guidelines before establishment	NO	YES	YES
3. Initial cost	LOW	HIGH	HIGH
4. Administration	REQUIRES CONTINUAL UP-DATING	PERMANENT	PERMANENT
5. Is flexible with respect to delineating sub-regions	NO	YES	SOMEWHAT
6. Current use	EXTENSIVE	LIMITED	LIMITED
7. Is most beneficial to local, county, regional or state planning	LOCAL	ALL	ALL
8. Can be effectively used in conjunction with the other units of reference	NO	YES	NO
9. Can be easily computerized	NO	YES	YES

Two bills have come before the State Legislature redefining responsibilities and powers under the Home Rule but have not received sufficient support for passage.

The Cost of a Coordinated System

Questions have arisen as to who should pay for such a system and how much. Should it come out of general revenue or should there be user charges? Perhaps the biggest deterrent is the large initial investment and the annual operating costs. Also, because of rapid technological advances taking place, communications and computer equipment become rapidly obsolete.

Data Duplication and Gaps

There tends to be a data "overkill" in some areas and data gaps for others. Duplication often exists because one source may not present data with sufficient detail for use by another. The lack of knowledge that certain data are available is another problem. A central receiving point perhaps would eliminate some of these inconsistencies.

OPPORTUNITIES FOR COORDINATED DATA COLLECTION AND USE

Improved Decision Making

People seeking information about a parcel of land can locate data pertaining to zoning ordinances, building codes, and other land-related data. However, few are familiar with or realize the importance of soil limitations for development purposes. The total impact of a housing development upon a rural community is not totally predictable until years after the improvement. An information system properly structured could, in part, supply some idea of the possible social and economic impact.

Identification of Sub-regions

For certain community services, like education and solid waste management, it has become necessary to "regionalize" in order to meet standards and/or to provide the service at a reasonable cost. To identify these sub-regions on a state basis, it is desirable to carry out the groupings all at once rather than designing one region at a time. In order to adequately identify the sub-regions at one time, a large amount of data that is sufficient in quantity and quality is required.

A Data Base for Research

Once operational, there would be pay-offs to the researcher for input-output analysis, programming, and budgeting.22/ There would also be the advantage of reduced costs of data collection.

A Reduction of Duplication and Data Gaps

A key advantage will be the reduction in duplication of certain data and strengthening areas where there is a lack of data. Also, reducing the time lag between request and delivery of data hopefully would be reduced.

22/ Hearle, F.R. and Raymond F. Mason, A Data Processing System for State and Local Governments, 1963, pp. 1-109.

WHERE DO WE GO FROM HERE?

Identification of Collectors and Users

First, the existing offices or organizations collecting land data along with the existing data users need to be identified. Then the detail and frequency of collection have to be assessed.

An inventory of collectors, users, and potential users of land data was conducted in New Jersey. Individuals representing 100 percent of the state departments, 33 percent of the counties, 5 percent of the municipalities and selected private and regional groups were surveyed.

By analyzing the preliminary returns it has been estimated that 43 percent of those responding use sundry forms of land data in their decision-making processes (Table 2). Results also indicate that 58 percent use legislative data and only 37 percent use natural resource data. This implies that possible data gaps exist within the natural resource category. At the local level where the final decisions are made, the land-use activity, natural resource and related socio-economic data exhibit the lowest percentages of use.

The Potential Users

The data requirements and frequency of inquiry must be ascertained for potential users as well as for present users. Will there be daily inquiries made for certain data and once-a-year inquiries for other data? This is necessary, in part, to structure or organize the system so accessibility to data is not a limiting constraint.

If current land data were available to those surveyed in a form that would meet their specific requirements, approximately an additional 19 percent (above the 43 percent of current land data users) would use these data (Table 3).23/ The range of potential users is relatively constant for all categories. However, there exists an inverse relationship between the current users and potential users of land data at the governmental level.

The Organization of the System

Researchers who have examined this aspect can provide direction here. Some feel that a commission, a state land commission, would be required to oversee the operation. The Governor of Washington, on May 19, 1971, signed into law, a bill creating a 19-member State Land Planning Commission.24/

23/ The time factor associated with data collection is of prime concern to decision-makers.

24/ The Quiet Revolution in Land Use Control, prepared for the Council on Environmental Quality, U.S. Government Printing Office, Washington, D.C., December, 1971, p. 301.

Table 2
Current Land-Use Data Users, by User Categories, Selected Areas, New Jersey, 1972
(In percent)

Category of data	User category: Unit of government: Local	County	State	Other*	Total
Land use activity	35	38	39	60	42
Natural resource data	26	42	36	53	37
Land use legislation	61	46	56	69	58
Related socio economic data	31	41	56	60	45
Total	35	40	43	59	43

*Includes individuals, corporations, and inter/intra state groups.

Table 3
Potential Users of Land-Use Data, by User Categories, Selected Areas, New Jersey, 1972
(In percent)

Category of data	User category: Unit of government: Local	County	State	Other*	Total
Land use activity	23	22	9	16	18
Natural resource data	27	18	8	21	20
Land use legislation	23	27	10	22	21
Related socio economic data	23	21	14	15	19
Total	24	21	10	17	19

*Includes individuals, corporations and inter/intra state groups.

A major task of the Commission will be the development of a statewide land use data bank.25/ The Ohio Legislature, in 1967, passed enabling legislation that permits the creation of data processing districts and county automated data processing boards.26/ Centralization of data processing equipment was also permitted.

Who Will Pay What?

Will costs be assessed in proportion to benefits or use, or will the system be financed out of general governmental revenues? Estimates by

25/ Ibid.
26/ Revised Code, Section 307.84, Ohio, 1967.

Hearle and Mason indicate that expenditures will vary considerably for data processing systems from state to state, due primarily to economies of size.27/

SUMMARY

Exploration of information systems presents interesting opportunities and problems. The cost will be high, but so will the benefits considering the absorption and misuse of the natural resource base. Anticipated problems in implementing a coordinated system include: (1) The unit of reference; (2) autonomy of the various units of government; (3) the cost; and (4) elimination of duplication and gaps. Also, it will take years to construct basic formulation of the system. However, the cost of waiting will make it even more expensive in the future.

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27. Hearle, F.R. and Raymond J. Mason, A Data Processing System for State and Local Governments, Prentice Hall, Englewood Cliffs, New Jersey, 1963.