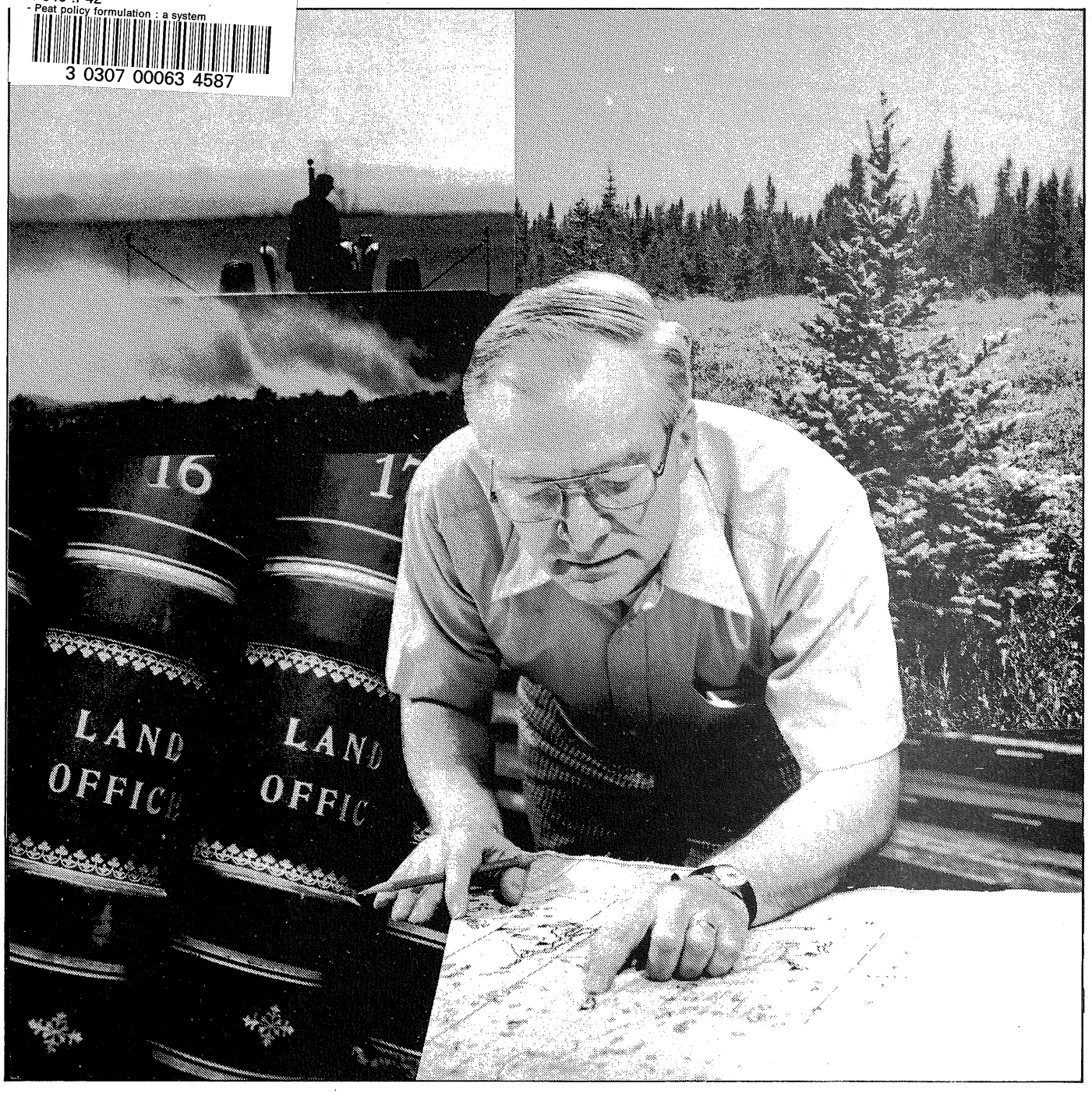

PEAT POLICY FORMULATION

A Systems Approach

Minnesota Department of Natural Resources Minerals Division April 1981

PEAT POLICY FORMULATION

A Systems Approach

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Minnesota Department of Natural Resources
Minerals Division

April 1981

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Introduction

The increasing demand for the development of peat in Minnesota has forced the state to develop a comprehensive peat management policy. The Minnesota Department of Natural Resources has been asked to recommend policy for legislative consideration in 1981. This enormous task is complicated by several things:

* Conflicting and competing demand for peat.
* Uncertainty about long-term peat demand.
* Uncertainty about the technological, environmental and socioeconomic feasibility of various uses, especially peat's use for energy.
* Conflicting local, state and federal goals.
* Conflicting opinions about the timing, scale and distribution of peat development.

Policy formulation is a problem facing many institutions in the United States today. Coal mining, water shortages

and nuclear power generation are but a few examples of the issues requiring policy formulation. Although sophisticated policy process models have been developed, few academicians commonly use them in "real world" situations. On the other hand, few field-trained analysts explore policy-formulation techniques available, even though the use of such tools would greatly assist the effort.

This study has two objectives:

* To recount how the Department of Natural Resources formulated peat policy, and

* To describe how sophisticated policy-formulation techniques were used in the making of policy.

This report provides background about the peat resource, summarizes the history of the peat program, discusses policy-formulation techniques and applies a method for developing policy.

Peat Background

Minnesota contains about 7.2 million acres of peatland (Figure 1), the equivalent of about 16.1 billion tons of air-dried peat or 195 quadrillion Btu's (Soil Conservation Service 1967, Farnham 1978). Based on this theoretical energy value, Minnesota's peat resources could meet the state's energy requirements for about 160 years (Farnham 1978). Minnesota's peatlands represent about 14 percent of the state's total land surface, about 28 percent of U.S. peat deposits excluding Alaska, and almost 50 percent of the peat reserves in the Upper Great Lakes Region (Figure 2).

Peat Types

There are three major types of peat in Minnesota: fibric, hemic and sapric.

Fibric (including sphagnum, hypnum and other moss peat) is

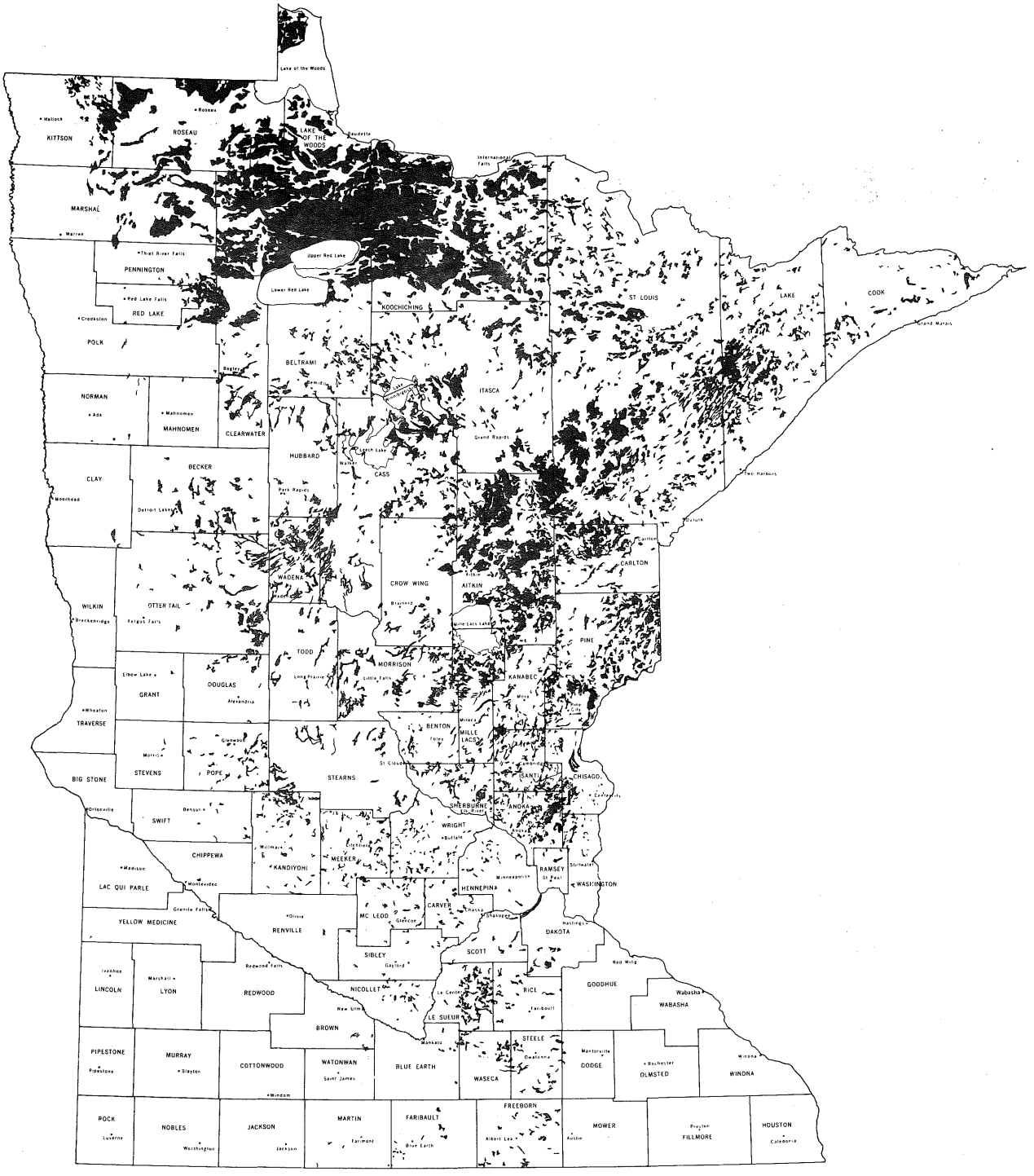


Figure 1. DISTRIBUTION OF PEAT IN MINNESOTA

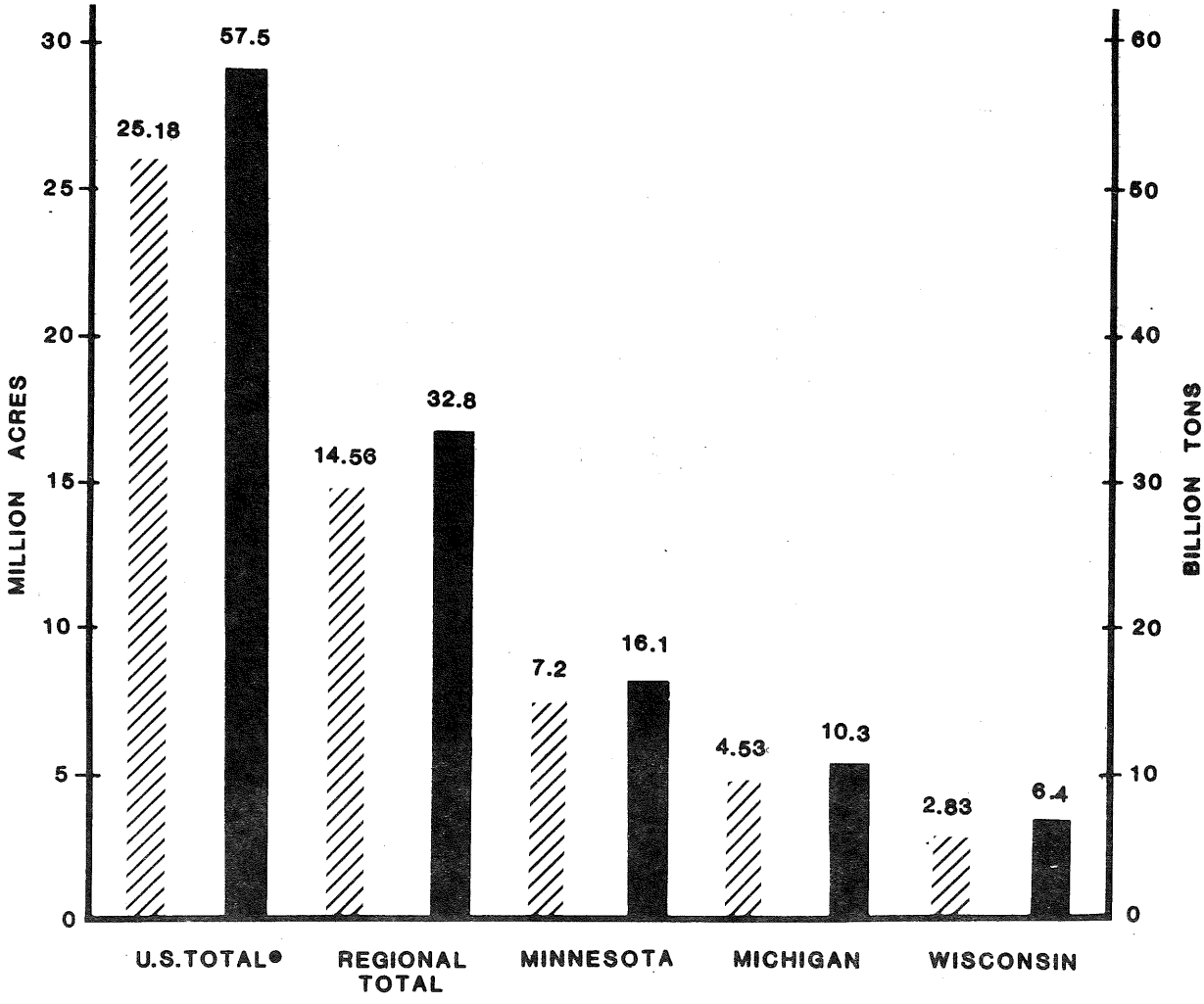


Figure 2.

ESTIMATED RESERVES OF PEAT IN THE UPPER GREAT LAKES REGION

the least decomposed of the three and the most suitable for horticultural applications. Sphagnum is of particular significance because most of the U.S. supply is in Minnesota. Current estimates indicate that sphagnum peat deposits represent about 2.1 percent of the state's peat. Only about 25,870 acres of sphagnum peat, or about 0.36 percent of the total peat resource, are considered to be of prime commercial value.

Hemic or reed-sedge peat deposits compose an estimated 81 percent of the total peat area. Hemic peat is the best peat for energy use and is also good for horticulture, agriculture and other uses.

Sapric or humus peat is the most decomposed and least fibrous peat. It has a wide variety of applications. The extent of recoverable sapric peat deposits is not now known.

Location

Most of the peat in the state is near the Red Lakes and Lake of the Woods. Because of this location, two political issues are particularly important to peat development. First, because waters from these peatlands flow northward to the international border, the Canadian government and people are intensely concerned about the effects that peat development might have on water quality. Second, much of the peat is on land owned by the Red Lake Indian Reservation, where the state has no jurisdiction over economic, social, legal and political issues (Walter Butler Co. 1978).

Ownership and Access

The ownership and access rights of the state to the resource are predicated on the statutory classification of peat as a surface interest. (The existing public and private ownership of peatlands in Minnesota is shown in Figure 3.) About 49 percent of all peat is on state-held or state-administered lands. But if the statutory classification of peat is changed from that of a surface interest to that of a mineral, the state's jurisdictional rights could change significantly.

Most of the federal holdings consist of the Red Lake Indian Reservation lands, national forest and wildlife management areas. Private holdings are widely dispersed, though some are sufficiently large and contiguous to support commercial development.

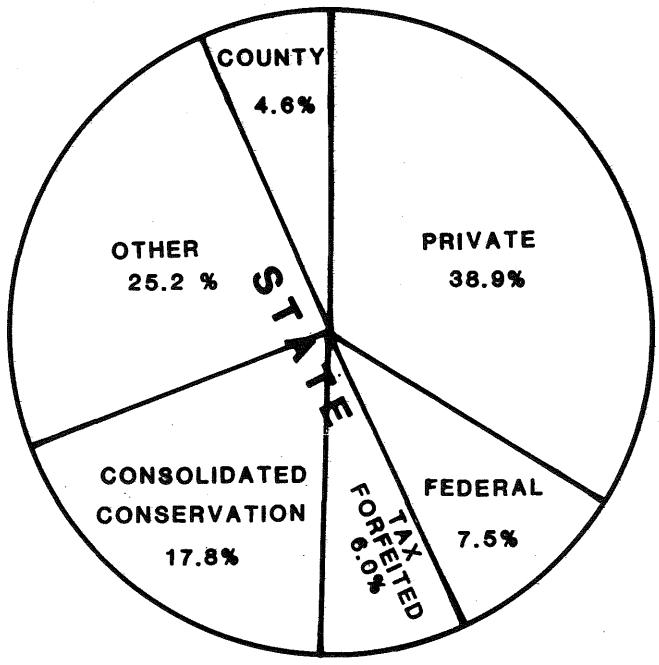
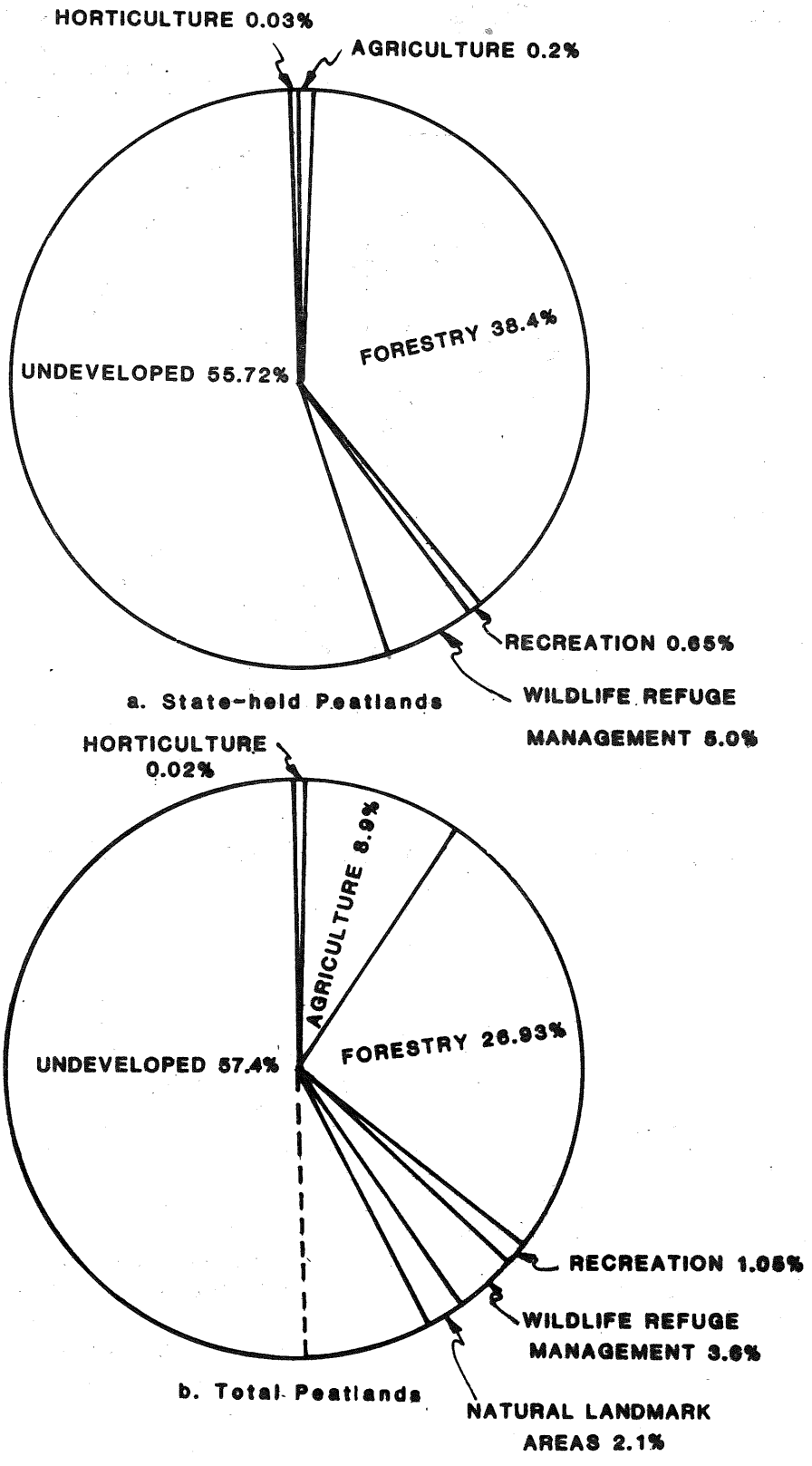


Figure 3.
OWNERSHIP OF PEATLANDS IN MINNESOTA

Current Use

Figure 4 illustrates the use of Minnesota's peat. About 57.4 percent of the resource is still undeveloped. The only major extractive development, horticultural peat production, affects only 0.02 percent of the total resource. Most horticultural peat is mined on state land.

Existing non-extractive uses are most commonly agriculture, forestry and preservation. About 8.9 percent of the state's peatland is farmed, and most of that is private land. The most common crop is hay, which is grown on 78 percent of the peatland under cultivation. Row crops are grown on about 13.5 percent of the peatland devoted to agriculture (Farnham 1978b). Other peatland crops include wild rice, turf grass, grain and vegetables. Commercial forests cover about 27 percent of Minnesota's peatlands. State forests are managed by the Department of Natural Resources, Forestry Division, and national forests are managed by the U.S. Department of Agriculture, Forest Service. Existing conservation practices on peatlands include wildlife management and the preservation of natural heritage areas and national natural landmarks.



Source of Data:
Farnham, R.S.
Status of Present
Peatland uses
for Agricultural
and Horticultural
Peat Production,
December 1978.

Figure 4.
DISTRIBUTION OF PEAT USE IN STATE

Potential Use

There are several potential uses for Minnesota's peatlands:

* Energy -- conversion of peat to various solid, liquid and gaseous fuels.
* Horticulture -- peat production for soil improvement, plant packaging and other horticultural applications.
* Industrial chemical -- chemical processing of peat for commercial production of coke, activated carbon, waxes, carbohydrates or other industrial chemicals and pharmaceutical substances.
* Agriculture -- cultivation of peatlands for vegetables, sod, forage or other crops.
* Forestry -- management of forests on peatlands for commercial production of timber.
* Preservation -- preservation of peatlands as virgin wilderness, natural landmarks or wildlife refuge and management areas, or use of peatlands for education or recreation.

Domestic Peat Production

The demand for peat products in the United States has always exceeded domestic production (Figure 5). The amount of imports has remained steady during the last 20 years. About 98 percent of U.S. imports come from Canada. Although Minnesota has more peat than any of the other contiguous 48 states, the state produces only about three percent of the total domestic production (Singleton 1979).

Demand for Minnesota Peatlands

The Department of Natural Resources has been asked to lease about 240,000 acres of peatland. The largest request, for 200,000 acres, is for peat gasification. Most other lease requests are for horticultural development.

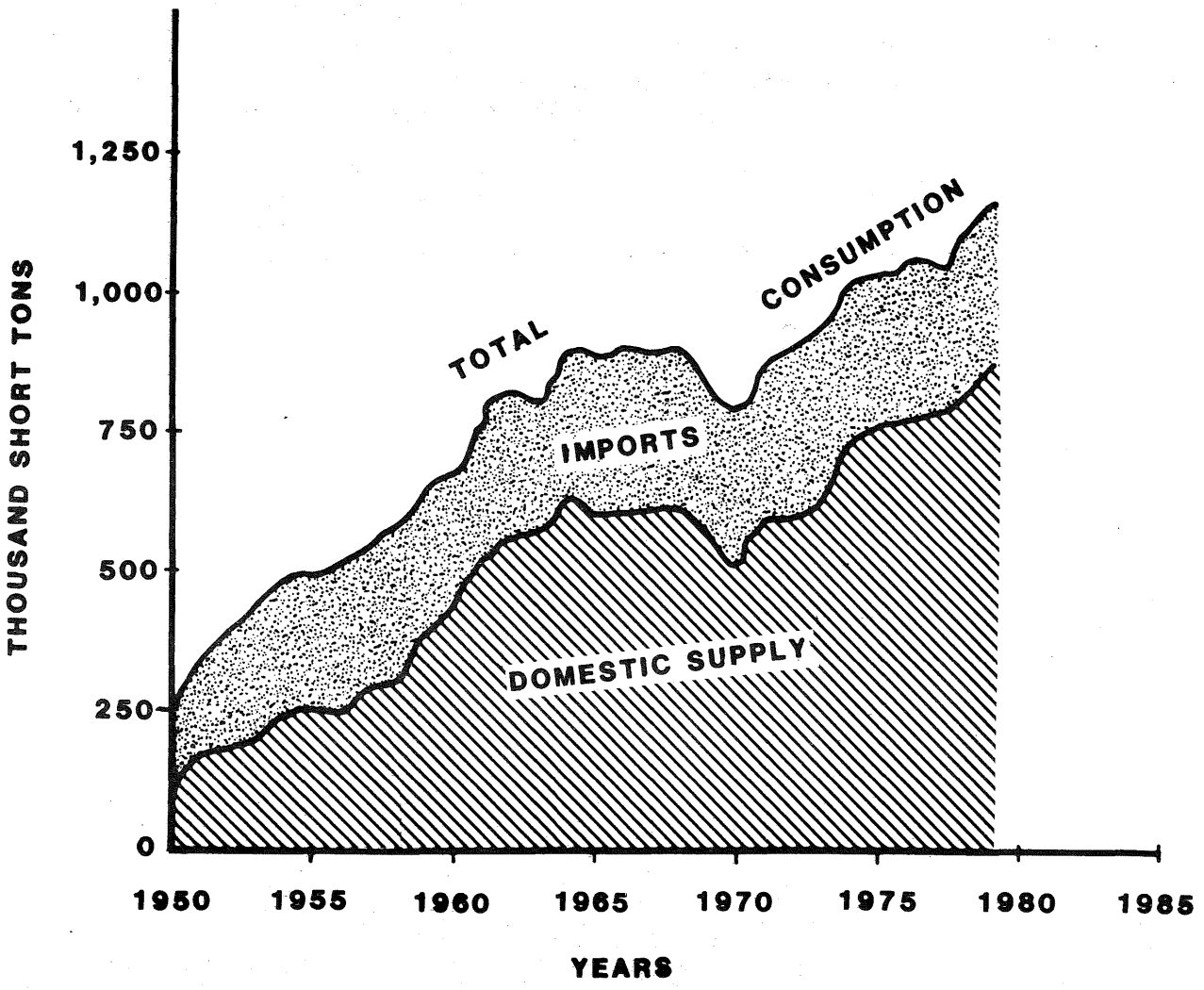


Figure 5.

TRADITIONAL SUPPLY OF PEAT IN THE UNITED STATES

History of the Peat Program

A major gas utility's request in 1975 for a 25-year lease on 200,000 acres of state-owned peatland to produce synthetic natural gas was the beginning of peat policy formulation in Minnesota. Since then, a peat policy has evolved through several phases characterized by ever-increasing organization and sophistication. During the initial phase, staff members identified issues. The second phase involved actual peat program planning. Execution of the program can be considered the third phase. The final phase was policy development.

Issue Definition

In 1975 there was no agency or organization in Minnesota equipped to respond to such a massive lease request. The Department of Natural Resources was responsible for leasing state-owned peatlands by prior statute but had leased only

about 4,000 acres since 1950. A consulting firm, Midwest Research Institute, actually initiated a peat program with the department's blessings by developing a grant proposal for the state and obtaining a grant from the Upper Great Lakes Regional Commission.

The grant, entitled "Peat Program Phase I: Environmental Effects and Preliminary Technology Assessments," resulted in the first identification of peat issues. The final report presented several conclusions and recommendations concerning policy, environment, technology, development and socioeconomic issues (Midwest Research Institute 1976). The report emphasized the need for a peat inventory.

The Peat Advisory Committee was created during phase I. This group was assembled to represent the broad and varied interests in the state. Included were members of state agencies, county officials, peat developers peat researchers. The Peat Advisory Committee met periodically to review Midwest Research Institute draft documents. The Department of Natural Resources coordinated these reviews, but no real program planning had yet begun. The problem was yet to be defined, and peat issues were floating about at random.

The 1976 Legislature responded to the increasing interest in peat by appropriating funds to the Department of Natural Resources for staff members and an inventory. Department staff members began informal discussions of issues and held meetings with the Peat Advisory Committee to identify peat issues. No formal techniques were used.

The department developed a grant proposal to the Upper Great Lakes Regional Commission for Peat Program Phase II to study the issues identified. The grant award resulted in nine studies on the following subjects:

1. Economic impact.
2. Agricultural and horticultural peat use.
3. Hydrological factors of peat harvesting.
4. Water-quality impacts of peat use.
5. Potential of industrial chemical uses.
6. U.S. and Canada peat policy review.
7. Forestry and plant communities.
8. Terrestrial wildlife.
9. Air-quality effects of peat development.

These studies were undertaken by the department to learn more about the identified issues. The reoccuring theme was, "We need to know more about..."

The Legislative Commission on Minnesota Resources also funded two peat studies. One was the feasibility of "Utilizing Peat as a Fuel" in power plants in northern Minnesota (Ekono Engineering Inc. 1977). The other study investigated the administrative questions of leasing and royalties (Pippo 1977).

Generally, the problem and issue definition phase of the peat program lacked organization. No real program planning had yet occurred.

Program Planning

In 1977, peat planners became more active than reactive. Two events caused this change. First, the National Science Foundation encouraged peat planners to develop a systematic approach to solving peat problems. Second, the governor announced in his budget proposal a greater effort to gather peat information. Because of these events, staff members began comprehensive program planning.

Peat program staff members for the first time framed the major problem in a question: "What is the prudent use of the peat resource?" This problem surfaced because of the potential competition among many peat uses and the many ways of managing the resource. The remaining steps in the program were: identification of key issues, the forming of objectives, the determination of alternative courses of action, evaluation of alternatives, and the formulation of policy recommendations for legislative consideration (Figure 6).

The goal of the program was "to provide for the wise management of the state's peat resources for both present and future generations." Six key steps were identified:

1. Inventory and classify the resource.
2. Analyze governmental institutional problems.
3. Analyze environmental, social and economic impacts.
4. Research the properties and uses of peat.
5. Evaluate potential commercial peat markets.
6. Develop and demonstrate the technological use of peat.

Issues 1 through 3 were considered most important to the peat program, whereas issues 4 through 6 were considered most important to private industry.

To address these issues, several activities were proposed for the short term (by 1979) and the long term (by 1981):

Short-term activities

1. Gather socioeconomic, environmental and resource

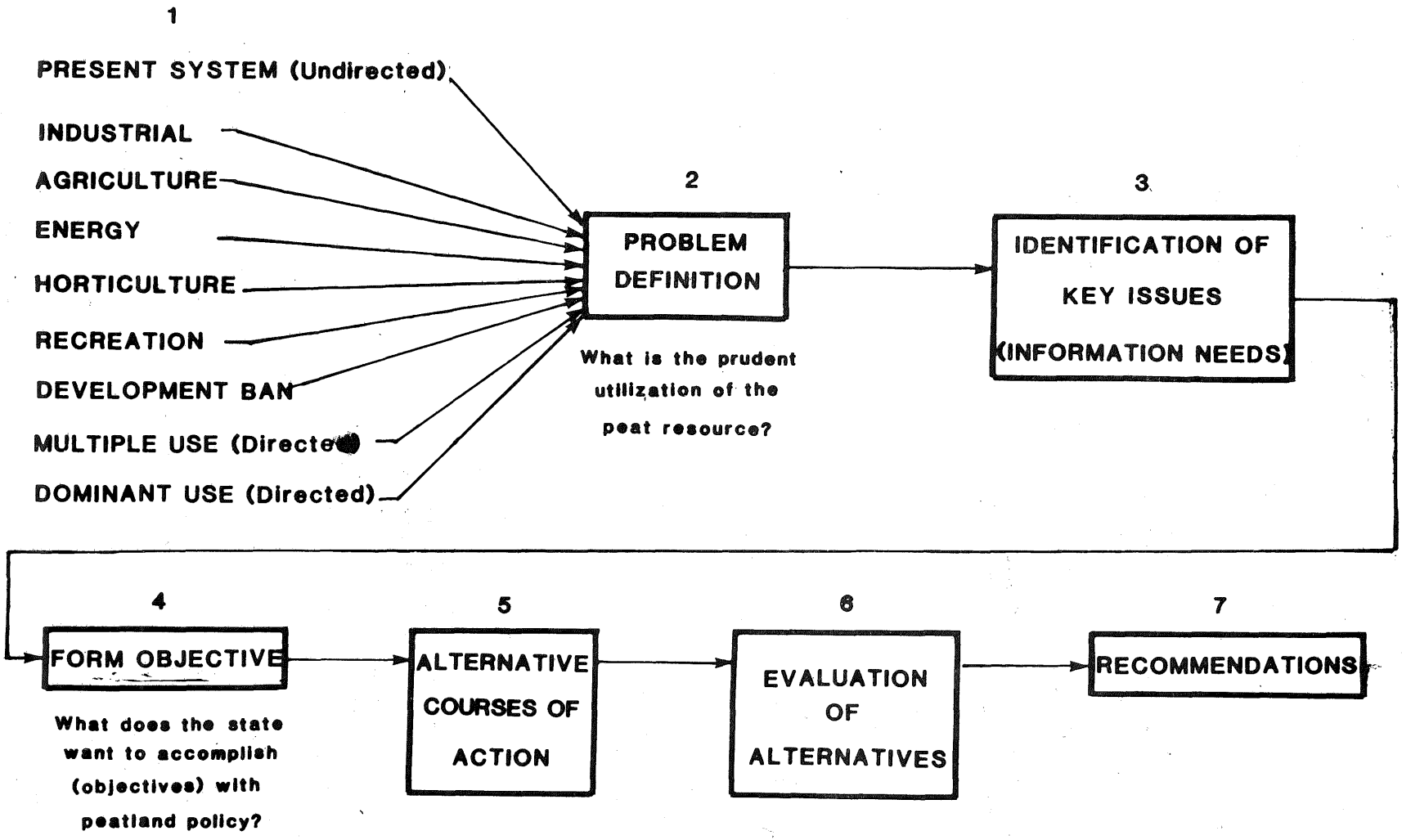


Figure 6. MINNESOTA PEAT PROGRAM PLANNING

data necessary to address small- and medium-scale requests for the use of state peatlands.

2. Complete the peat inventory project begun in July 1976.

3. Determine prices and pricing mechanisms for peat, including the identification and evaluation of alternatives for assessing royalties or taxes on the peat resource.

4. Identify and evaluate alternatives to state leasing of peatlands.

5. Formalize the lease application and review process.

6. Study and prepare recommendations for the legal classification of peat.

Long-term activities

1. Finish gathering the socioeconomic, environmental and resource information necessary to address large-scale peatland development requests.

2. Formulate long-term policy alternatives for state action.

3. Accelerate basic and applied research on topics specified by the Legislature.

Although peat program planning was underway, there still would be no formulation of planning techniques until the program execution phase.

Program Execution

Money for the first two years (1977-79) was provided by the Legislature and through the Legislative Commission on Minnesota Resources. Thirteen contracts were let to gather needed information. The Peat Advisory Committee helped determine what studies were needed. Peat leasing was halted until these studies were completed and policy recommendations were considered by the 1979 Legislature.

The policy recommendations presented to the Legislature in 1979 were developed primarily by peat program staff. Draft recommendations were reviewed by department officials and Peat Advisory Committee members. Policy recommendations were developed more by an ad hoc process than by any systematic technique. The completed contract studies and inventory results served as a basis for many recommendations. (A summary of the 1979 peat policy recommendations is given in Appendix A.)

While formulating policy, peat program staff members developed six management objectives:

1. Ensure the proper use of peat.

2. Define and develop peatland management units.

3. Control the rate of development.
4. Maintain environmental quality.
5. Ensure future land-use capabilities.
6. Maintain intergovernmental cooperation.

These objectives served as a basis for determining alternative courses of action. Policies were formulated to satisfy the management objectives.

After the policy recommendations were presented to the Legislature, additional funding for the second two years (1979-81) was received from the Legislature and the Legislative Commission on Minnesota Resources. The commission was designated as the legislative body overseeing the completion of the peat program. Peat program staff members met with Peat Advisory Committee members to determine new and continuing studies. A work program was approved by the Legislative Commission on Minnesota Resources. To ensure that the concerns of state agencies were being met, the Peat Interagency Task Force was created. This group comprised administrative officials from six state agencies and included several peat experts.

The National Science Foundation grant resulted in several events that were significant to policy formulation. First, a systems engineer was added to the peat program staff to give advice on systems engineering techniques available for policy formulation. Second, the engineer maintained frequent contact with systems engineering experts at the University of Virginia. Third, an impact analysis specialist was added to the staff to formalize impact assessment techniques. Because of these changes, the peat program staff began formulating policy through more formalized methods.

Summary

Policy formulation was ad hoc and inefficient until the department began program planning to apply for a National Science Foundation grant.

The timing of funding and legislative testimony sometimes did not coincide with the steps in the policy formulation process. For example, legislative funds were received before the phase II studies could be completed. Throughout the history of the peat program, new issues continually emerged as more information became available. Policy formulation was indeed a dynamic process.

Policy Formulation Methods

Techniques

For several years, peat program staff members--like many other policy makers--flew by the seats of their pants. Like a small group of soldiers who suddenly found themselves surrounded and outnumbered, staff members made decisions quickly, randomly and in ways intended to satisfy immediate objectives. There was little opportunity to consider the broad plan of attack. There only was time to react.

Only later did peat program workers have the chance to set up an orderly and more efficient way to formulate peat management policy. Since 1979, staff members have used four relatively sophisticated techniques to develop policy:

Brainwriting (idea writing): This technique was used both by peat program staff and during a Peat Advisory Committee meeting. The purpose was to generate ideas about an issue. An initial question generated the first idea for each

Policy Formulation Techniques

There are several techniques that can aid in the making of policy:

- Systems methodology
- Brainwriting (idea writing)*
- Charette
- Nominal group technique*
- DELPHI
- Interpretive structural modeling*
- Causal loop diagrams*
- Cross-impact analysis
- Workshop dynamic models
- Continuous time dynamic models
- Input-output analysis
- Econometrics
- Worth assessment
- Decision analysis
- Voting
- Network planning
- Gantt chart

An excellent description of these techniques is found in "A User's Guide to Public Systems Methodology" by Sage and Warfield (1981). The major advantage of most of these techniques is that the public is involved -- a frequently difficult task.

* Techniques used by the peat program staff.

individual. Ideas were shared to encourage other ideas. Ideas were aggregated at the end.

Nominal group technique: Nominal group technique was used by selected Peat Advisory Committee members in a meeting to generate the list of constraints mentioned later in this report. Ideas were generated individually and then discussed. Additional ideas were generated by a second round. A trained facilitator from the University of Virginia led the exercise. The ideas were ranked by individuals, and a final ranking was developed.

Causal loop diagram: The stakeholder causal loop diagram was developed by peat program staff to show the complex relationships among stakeholders with an interest in peat in Minnesota (Figure 7).

Interpretive structural modeling: Interpretive structural modeling is a computer-assisted system that develops a map showing relationships among ideas. Interpretive structural modeling was used by the peat program to organize the

constraints list generated in the nominal group technique exercise. Pairs of constraints were compared by the group to determine if one affected the other. Consensus was required. The results of the interpretive structural modeling session are given in Figure 8.

Procedure

In addition to these techniques, peat program staff members adopted a logical procedure to develop peat policy. The procedure included five steps:

Definition of problems and issues: Staff members determined the nature of a policy problem and defined related issues.

Value system design: Workers listed the needs of various stakeholders and the objectives those stakeholders sought. Objectives were labeled as short-term, mid-term and long-term. The short-term objectives were those that could be achieved by 1990, whereas the mid-term and long-term objectives could be achieved after 1990.

Development of policy alternatives: Staff members developed policy options that addressed issues and stakeholders' needs.

Evaluation of policy alternatives: The policy options were ranked according to their effectiveness in satisfying stakeholders' needs.

Implementation planning: Staff members identified ways to effect the selected policy alternatives. Each point of policy was designed to accommodate three possibilities: limited growth in the use of peat, moderate growth and accelerated growth.

These steps were developed largely from A.D. Hall's methodology (Hall 1969, Ahmad and Christakis 1979, Chen et al 1979, Warfield 1976, 1979).

Policy Stakeholders

Many groups have a stake or interest in the outcome of peat policy. Such groups may be called "stakeholders." Identifying these groups is important to successful policy formulation for several reasons: Identifying groups helps to explain how policy is established; groups that may impede policy implementation can be identified, and groups that can make valuable comments can be determined. Few of these groups, if any, operate in a vacuum; therefore, it is important to identify the interaction among groups.

Stakeholders can be grouped into four categories according to their role in policy formulation: policy and decision makers, policy analysts and managers, policy advisors, and the stakeholder public. These groups are identified in Table 1, which shows the great number of stakeholders that can complicate the task of making peat policy.

Table 1: Major Stakeholder Groups in Peat Policy Formulation

POLICY AND DECISION MAKERS	POLICY ANALYSTS AND MANAGERS
EXECUTIVE GROUP Governor State Executive Council LEGISLATIVE GROUP Legislature Legislative Commission on Minnesota Resources	STATE REGULATORY GROUP Dept. of Natural Resources Energy Agency Pollution Control Agency Environmental Quality Board Dept. of Public Service Dept. of Revenue OTHER STATE AGENCIES Dept. of Agriculture Dept. of Economic Development Iron Range Resources and Rehabilitation Board State Planning Agency
POLICY ADVISORS Peat Advisory Committee Interagency Task Force Peat research community and other support groups	FEDERAL REGULATORY GROUP Environmental Protection Agency Energy Regulatory Commission Federal Trade Commission Dept. of Labor (OSHA) Dept. of Energy Dept. of the Interior Dept. of Treasury (IRS)
STAKEHOLDER PUBLIC INDUSTRIAL GROUP Energy industry and utilities Peat developers Other peat-based industry Competing industries Financial institutions CITIZEN GROUP Environmental groups Other citizen groups LOCAL PUBLIC GROUP Community officials Local citizens Employees Local consumers of peat and other products Local peatland owners	OTHER FEDERAL AGENCIES Dept. of Agriculture Upper Great Lakes Regional Commission LOCAL GOVERNMENT County and municipal gov't. Regional development commissions INTERNATIONAL GROUP International Joint Commission Canadian government

Policy and Decision Makers

These groups have the primary responsibility in deciding the policy for the state.

Executive group: According to Minnesota law, the state Executive Council -- composed of the governor, lieutenant governor, secretary of state, attorney general, state auditor and state treasurer -- must approve any peat lease whose term exceeds 10 years (Minnesota Statutes, Section 92.50, Subdivision 1). Since the lease terms for most peat

developments exceed 10 years, the Executive Council plays a decisive role in peat leasing. The governor's constitutional responsibility provides him a special role in peat policy decisions.

Legislative group: Ultimate specification of peat policy is a prerogative of the Legislature. The House and Senate committees on natural resources play a particularly important role. The Legislative Commission on Minnesota Resources provides the information necessary for legislative evaluation of the Department of Natural Resources' peat policy recommendations and other related programs (Minnesota Statutes, Section 86.02), and oversees most of the department's peat-related activities. The commission traditionally comprises 14 legislators -- seven representatives and seven senators (Minnesota Statutes, Section 86.07).

Policy Analysts and Managers

These groups either analyze all available information and develop policy recommendations for the Legislature, or they are responsible for implementing a policy through regulations.

State regulatory group: By virtue of its central authority and control over the peat resource, the Department of Natural Resources plays a primary role in the formulation and implementation of peat policy. Other state, federal and local government agencies, however, also have responsibilities in peat policy implementation. The Environmental Quality Board comprises the heads of seven state agencies: Agriculture, Energy, Health, Natural Resources, Pollution Control, State Planning and Transportation. In addition, a representative from the governor's office and four state citizens appointed by the governor sit on the board. The Environmental Quality Board is responsible for the implementation of the Minnesota Environmental Policy Act. The Minnesota Energy Agency is authorized under the Minnesota Energy Act (Minnesota Statutes, Section 116H.07) to approve a certificate of need before the construction of a major energy facility, such as a peat gasification plant. The agency is also primarily responsible for proposing state energy policies and programs to the governor and the Legislature. Regulation of air and water pollution, solid-waste disposal, noise pollution, and toxic- and hazardous-waste disposal is the primary responsibility of the Pollution Control Agency (Minnesota

Statutes, chapters 115 and 116). Should peat be developed for energy on a commercial scale in Minnesota, the Public Service Commission of the Minnesota Department of Public Service would regulate peat-based gas and electric utilities. The Department of Revenue plays a vital role in enforcing tax policy and other financial measures for peat development and use.

Other state agencies: Other major state agencies whose broader responsibilities and interests can affect or be affected by peat policy directives include the Minnesota Department of Agriculture, the Minnesota Department of Economic Development, the Iron Range Resources and Rehabilitation Board, and the State Planning Agency. The Department of Agriculture is responsible for the enforcement of laws designed to protect the public health and for promulgation of rules to prevent fraud and deception in the manufacture and distribution of items that include several peat-based products (Minnesota Statutes, chapters 17-34). The Department of Economic Development promotes economic development in the state. The Iron Range Resources and Rehabilitation Board has long shown considerable interest in various aspects of peat research and development. The board is now involved in experimental demonstration of the feasibility of low-Btu peat gasification. The State Planning Agency traditionally addresses planning issues and problems that are too broad in scope to be assigned to other agencies. In addition, it guides planning by the state and local units of government and stimulates public interest and participation in state development programs (Minnesota Statutes, sections 4.10-4.18). Because the director of the State Planning Agency is also the permanent chairman of the Environmental Quality Board, the agency plays a major role in promoting cooperation between state agencies on environmental issues.

Federal regulatory group: Federal agencies whose responsibilities could transcend state peat-management regulations include the U.S. Environmental Protection Agency, the Federal Energy Regulatory Commission, the Federal Trade Commission, the U.S. Department of Labor (Occupational Safety and Health Administration), the U.S. Department of the Interior, the U.S. Department of Energy and the U.S. Department of the Treasury (Internal Revenue Service).

Other federal agencies: Other federal agencies whose

broad responsibilities and interests have been affected by the Minnesota peat policy process include the U.S. Department of Agriculture and the Department of Commerce (Upper Great Lakes Regional Commission). Both agencies, as well as the Department of Energy and the Department of the Interior, have sponsored or are conducting detailed studies on various aspects of peat development and use in Minnesota. The Upper Great Lakes Regional Commission has dispersed funds for economic development programs for the Upper Great Lakes region, which comprises 119 counties in Michigan, Minnesota and Wisconsin.

Local government agencies: Various local government agencies are responsible for planning the local economies, and establishing and enforcing local zoning ordinances and other land-use controls. These agencies include county boards and regional development commissions in the areas where peatlands may be developed. The county auditor is authorized, with the approval of the county board and the commissioner of natural resources, to award peat leases on tax-forfeited peatland in the county.

International group: The International Joint Commission and several Canadian agencies are included in the international group of stakeholders. The commission and Canadian environmental agencies have expressed concern about water-resource impacts that may be caused by Minnesota peat developments.

Policy Advisors

Stakeholders that advise in the making of policy include the Peat Advisory Committee, the Peat Interagency Task Force, the peat research community and other groups. The 40-member Peat Advisory Committee guides the Department of Natural Resources on peat policy issues and problems and includes legislators, state, federal and local officials, and members of the research community, industry, citizen groups and local community groups.

The Peat Interagency Task Force, formed more recently than the Peat Advisory Committee, was designed for more efficient discussion of peat policy issues. This committee is composed of officials from the Department of Natural Resources, the Pollution Control Agency, the Department of Agriculture, the Department of Economic Development, the Minnesota Energy Agency, the Iron Range Resources and Rehabilitation Board, the Upper Great Lakes Regional

Commission and a peat expert from the University of Minnesota. The executive director of the Legislative Commission on Minnesota Resources usually attends meetings.

The peat research community includes individuals or organizations responsible for investigating scientific issues relevant to policy planning and formulation. The University of Minnesota and other state universities have conducted extensive research for the peat program. Other agencies grant money or give other support to the peat policy process. Such sources include the National Science Foundation and the University of Virginia.

Stakeholder Public

Social and economic interests that could be affected by peat policy have been divided into three groups: industrial, citizen and local public. People with these interests have responded or probably will respond to the peat policy process. Some of these stakeholders have sat on the Peat Advisory Committee.

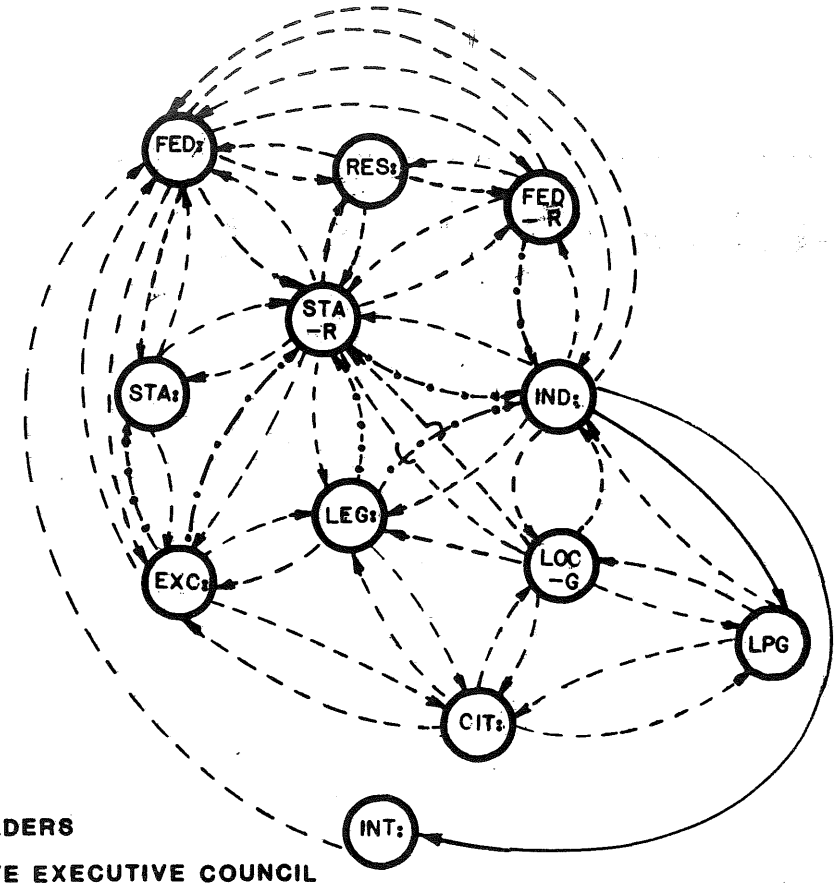
Industrial group: Some major energy utilities, existing and potential horticultural developers, and other firms have expressed interest in developing state peatlands. Since the final development decisions will depend largely on peat policy, interested developers have a major stake in that policy. Financial institutions, transportation firms and other service industries could also be affected by peat policy.

Citizen group: Several environmental groups, particularly the Sierra Club, Audubon Society and the Minnesota Public Interest Research Group, have expressed concern over the potential environmental implications of commercial-scale energy development and other activities. Citizen groups with other than environmental interests have occasionally taken part in peat policy planning.

Local public group: The local public group includes stakeholders who are likely to be immediately affected by the impacts of peat development. Local residents near major peat deposits and employees in peat-based operations are likely to be especially susceptible to the environmental and sociological effects of peat development. Local community leaders -- the Red Lake Indian Tribal Council or labor union leaders, for example -- may try to influence peat policy to benefit the interests they represent.

Stakeholder Interaction

The interrelationships among stakeholders cannot be fully defined because some of these groups are so disorganized. Nonetheless, an attempt has been made to identify existing and potential patterns of causal relationships between stakeholder groups. Figure 7 illustrates that political pressures on the executive and legislative groups could readily translate into policy directives.



STAKEHOLDERS

EXC: STATE EXECUTIVE COUNCIL

LEG: STATE LEGISLATIVE BODIES

STA-R: STATE REGULATORY AGENCIES

STA: OTHER STATE AGENCIES

FED-R: FEDERAL REGULATORY AGENCIES

FED: OTHER FEDERAL AGENCIES

LOC-G: LOCAL GOVERNMENT AGENCIES

RES: RESEARCH,SUPPORT AND ADVISORY GROUP

IND: PEAT- BASED ECONOMIC ACTIVITY

CIT: CITIZEN GROUPS

LPG:LOCAL PUBLIC GROUP

INT: INTERNATIONAL GROUP

RELATIONSHIP

——► ECONOMIC IMPACT

—o—o► AUTHORITATIVE STIMULI

– – –► PERSUASIVE OR OTHER STIMULI

Figure 7. STAKEHOLDER CAUSAL RELATIONSHIPS

Policy Problems and Issues

Development of issues began when the peat program was started in 1975 and has continued ever since. Ideally, defining the problem and associated issues should occur from the beginning of any policy-making effort. Issues continually emerge as policy is developed, frequently because addressing one issue creates other issues. This dynamic feature of policy formulation often frustrates sophisticated systems approaches that are static.

Information used to develop issues was sought from stakeholders and from relevant literature. Among the major stakeholders groups that actively participated in identifying policy issues were the various state and local land-use departments and other regulatory agencies, public and special-interest groups, peat developers and peat researchers. Frequently, issues that first surfaced in contracted studies were included in final report recommendations.

Stakeholders voiced issues in several ways. Many issues were identified by the peat program staff. Other forms of participation included regular meetings with the Peat Advisory Committee and the Peat Interagency Task Force. Public meetings held throughout northern Minnesota served as another important source of issues. One of the formal approaches was an idea-writing session by the Peat Advisory Committee. The committee was asked to discuss interim peat policy proposed by the Department of Natural Resources in 1979.

It would be very difficult to present all the issues defined during the course of this project; however, the four major kinds of problems in policy formulation are administrative-institutional, alternative uses, leasing and environmental.

Administrative-Institutional

Problem: Greater public participation and intergovernmental cooperation are needed to aid peat policy formulation and implementation.

Issues: The key administrative and institutional issues in peat policy formulation are outlined in Table 2. To aid discussion, these key issues have been partitioned into three sets: public participation, intergovernmental cooperation, and legal and jurisdictional conflicts.

Public participation in the peat policy process is frequently characterized by suspicion and distrust. Such fears arise, in part, because the public doesn't understand the peat program and the policy process. Meaningful public participation is crucial to acceptance of a peat policy, and adequate forums are needed to aid that process.

Insufficient coordination of peat programs and goals supported by various local, state and federal agencies frustrates the implementation of peat policy. Agency jurisdictions overlap because of existing legislation and because conflicting goals exist among agencies.

At the center of the legal conflicts is the lack of consensus on the most appropriate classification of peat. Peat is now treated as a surface interest. A change in the classification of peat to that of a mineral would likely have significant legal implications with respect to ownership and access. There are other questions, too. For example, should peat policy address all peatlands or just state-owned peatlands? The existing statutes fail

Table 2: Administrative and Institutional Issues

Public participation
Concern for public acceptability of peat policy
Understanding of peat policy problems
Forum for public participation
Intergovernmental coordination
Overlapping political jurisdictions
Conflicting goals
Legal and jurisdictional conflicts
Classification of peat
Regulation of private peat resources
Resource ownership and access rights
Conflicting state and federal laws regulating peat development

Table 3: Alternative-Use Issues

Site selection
Scheduling of peatlands for development
Peatland speculation
Land capabilities
Threat to adjacent peat deposits
Peatland reclamation
Extension of peat development to special areas
Conflicts with local land-use controls

to specify the responsibilities of various governmental agencies in management of the peat resource.

Alternative Uses

Problem: There are numerous ways to use Minnesota's peatlands, many of which conflict. Policy should address how selections will be made from among these competing interests.

Issues: Table 3 summarizes the issues related to uses. One major issue is selecting peatlands for preservation or development. Criteria must be developed for this selection process. There is significant pressure to preserve large tracts of peatlands. There is considerable political resistance to immediate large-scale peatland development.

Many of the early peat lease requests are considered speculative. Large portions of peatlands could be tied up

for a long time to prevent competing development. Certain peatland uses will limit future uses of the land. Peatland drainage, necessary for many uses, may affect adjacent peatlands. Reclamation of the peatland is a primary concern since the environmental consequences of inadequate reclamation can be serious. There is public concern that development of state-owned peatlands may extend to private peatlands and, conversely, that peat development may extend to public lands that have potential for recreation, education or preservation. The issue depends on the compatability of local land-use controls with state peatland policy.

Peat Leasing

Problem: A sound peat-leasing policy is needed to guide the orderly and timely development of the resource.

Issues: The key issues in formulating a sound policy for peat leasing are summarized in Table 4. Before the imposition of a moratorium on the leasing of state-owned peatlands in 1977, the issuance of peat leases had not been competitive. The state also did not demand as much money for its leases as it could have. Peatland rental should be related to the assessed land value, and royalties should reflect the fair market return for the peat resource. Nonetheless, more is at stake than money. Leasing policy must address many technological, environmental and socioeconomic issues.

Environmental

Problem: Successful peat management requires the protection of environmental quality. There has been considerable public concern over the effect of peat development on air and water quality, the local hydrologic balance, peatland vegetation, wildlife and the reclamation of peatlands.

Issues: The key environmental issues associated with peat development are listed in Table 5.

A major issue has been the lack of baseline data with which to make decisions regarding management of the resource and control of environmental effects. There is also insufficient information regarding the cost of effective pollution control. The potential effect of drainage on water quality is of great concern to the Red Lake Indians and the International Joint Commission. There are many adverse environmental effects associated with peat

Table 4: Peat-Leasing Issues

Maintaining competitiveness among peat lessees
Peat-lease sales procedures
Determination of equitable rents and royalties
Appropriate size of peat leases

Table 5: Environmental Issues

Natural
Inadequate environmental baseline data
Cost of pollution control
Effectiveness of existing pollution-control regulations
Unavoidable environmental impacts
Human
Degradation of existing quality of life
Overload of local services
Employment of local labor force
Local cash-flow and investment problems
Possibility of boom-bust cycle

development that cannot be prevented or mitigated.

Peat development could pose health and safety hazards that could impair the quality of life. Population increases could overload available housing and community services in small towns. Local officials fear that an imported rather than local labor force would be used for a large-scale peat development. Local investment in additional services could create revenue shortfalls, and there is great fear of a boom-bust economy. The needs and objectives of various stakeholders with respect to these issues is disclosed in the following section.

Policy Objectives

The second step of policy formulation involved identifying the needs of various stakeholders.

To determine these needs, the peat program staff arranged a nominal group technique session with members of the Peat Advisory Committee. Members of the group were asked, "What need do you want peat policy to satisfy?"

Committee members then listed 25 needs (Table 6). The list was difficult to work with since many responses overlapped. Nonetheless, these needs were combined and relisted as follows:

* Effective management of peat.
* Efficient use of the resource.
* Adequate and stable supply of peat products.
* Stable real economic growth related to peat.
* Adequate protection of the environment.
* New and stable sources of energy.

Table 6: Peat Policy Needs

1. Maintenance of high quality of life.
2. Competitive horticultural peat industry.
3. Adequate supply of peat for large-scale energy uses.
4. Development of peat as an alternative energy form.
5. Allowance for the equitable multiple-use of peatlands.
6. Environmentally and socially acceptable long-term policy concerning peatland development for energy.
7. Flexible, well-defined policy responsive to environmental, social and economic interests for present and future uses.
8. Designation of specific peatlands according to highest and best single or multiple use.
9. Provide for competitively produced peat products that reduce import dependence and generate local income.
10. Maintenance of existing environmental quality.
11. Emphasize the development potential of peat.
12. Development for the public good and to ensure local revenue.
13. Recognize the energy dependency of the state.
14. Determine if policy applies to development on both private and public peatland.
15. Specify management procedures and agency roles, including the role of soil and water conservation districts.
16. Emphasize using peat for renewable energy sources.
17. Address growth rates of peat.
18. Consider short-term versus long-term impacts of land reclamation.
19. Provide for the protection of local socioeconomic values.
20. Adequate solid- or liquid-waste disposal.
21. To promote development, a lease period must be sufficiently long to attract the necessary capital investment.
22. Provide for a broad-based public information program during the development of the peat policy.
23. Establishment of peatland preserves of sufficient size to protect patterns of vegetation.
24. Equitable leasing for agricultural use--vegetables, grass seed, hay and other products.
25. Ensure sufficient land to provide softwood pulp for the pulp and paper industry in Minnesota.

* Adequate reclamation of peatlands.
* Adequate peat resource information.
* Preservation of peat resources.
* Flexible, clear and well-defined policy.
* A public-information program.

Once the stakeholders' needs were determined, staff members developed closely related objectives that would meet those needs. They then developed ways to determine whether the objectives were being met. These objectives and measures of effectiveness are listed by the four major policy problem areas: administrative-institutional, alternative uses, leasing and environmental.

Administrative-Institutional

Objectives

* To provide ways to coordinate activities related to Minnesota peat planning, development and management.
* To enhance the stakeholders' understanding of policy issues and options.
* To determine the feasibility of different kinds of peat developments of various sizes.

Measures of effectiveness: The extent to which these objectives are met is difficult to gauge. In regard to the first, there is nothing much the peat program staff can do except to see where problems arise and to try to remedy them on a case-by-case basis. Success in attaining the second objective can be roughly determined by how well policy recommendations fare with the Legislature, industry, special-interest groups and other stakeholders. Peat program staff members also can watch for any major shifts in public opinion over peat issues. The success of the peat program staff in meeting the third objective can only be determined by various kinds of projects proving effective in economic, environmental and sociological terms. Staff members will have to wait to see what finally works.

Alternative Uses

Short-term objectives (to be met before 1990)

* To provide a rational, fair, effective method of selecting peatlands for various uses.
* To encourage efficient use of peat.
* To protect peatlands of special interest.

Other objectives (to be met after 1990)

* To ensure a sustained supply of commercial peat.
* To minimize land-use conflicts.

Measures of effectiveness: The degree to which peat-use objectives are attained can be gauged by the following measures:

* Marginal rates of peatland development and reclamation (acres/year). This ratio compares the number of acres developed with those restored and expresses the net gain or loss during a year.
* Index of peat supply (percentage). This number indicates the likelihood of meeting current and projected demand for peat.
* Land-use conflict resolution index (percentage). This percentage indicates the success with which land-use conflicts are resolved.

Leasing

Short-term objectives

* To maintain competition among peat users.
* To charge as much for leases as the market will bear.

Other objectives

* To encourage steady, gradual development of peat, free from speculation and a boom-bust cycle.
* To allow peat to supply a share of the state's energy requirements, if such a demand for peat develops.

Measures of effectiveness: The degree to which these objectives are met can be measured by the following indicators:

* Net cash flow from peat lease sales (dollars/acre/year). This ratio is a measure of the state's income from a peat lease, which can be compared to the real market value of the property.
* Mean absolute deviation from the peat lease holding index (acres/holder/year). This figure is an indication of competitiveness in lease holding. The magnitude of deviation is inversely related to the effectiveness of policy implementation.

Environmental

Short-term objective: To ensure that peat development is orderly and environmentally acceptable.

Other objective: To minimize hazards to public health, safety and welfare.

Measures of effectiveness

* Marginal contribution of peat development to environmental pollution (appropriate units/year). This ratio indicates the additional air and water pollution that can be attributed to peat development and use.
* Annual change in hydrologic balance (appropriate units/year). This statistic measures peat development's disruption of the local hydrologic system.

Summary

Now that the policy objectives and their measures of effectiveness have been determined, the next step is to evaluate policy alternatives.

Policy Alternatives

The next step in developing specific policies is to decide how objectives can best be met. The peat program staff began this task by asking the question: "What can be modified to achieve the objectives?" The answer was the following list of "alterables," which once refined, become the tools of policy:

* Ordinances, rules, regulations and statutes.
* The quality of peat data and information.
* The amount of peat developed.
* Research into technological and environmental issues.
* The level of intergovernmental cooperation.
* Public information programs.
* Uses for peat.
* Rents and royalties
* Environmental mitigation.
* The size of peat operations.

Table 7: Constraints on Achieving Peat Policy Needs

No.	Rank	Constraint
1	1	Citizen opposition.
2	1	Lack of technical information.
3	2	Political realities, such as funding for data acquisition, energy needs and environmental controls.
4	2	Insufficient state agency cooperation due to conflicting goals.
5	3	Energy-use conflicts with other peat uses.
6	3	Bureaucratic inefficiency in the permit process.
7	3	Disagreement over taxes and royalties for use of land.
8	3	Public pressure for small-scale leases.
9	4	Policy clarity.
10	4	Market demand.
11	5	Multiple land ownership.
12	6	Acceptance of policy by all groups.
13	6	Energy development pressure.
14	7	Available time and manpower.
15	7	Development-related monetary costs--for example, transportation costs.
16	8	Environmental data needs after policy decisions.
17	8	Lack of local government input.
18	8	Uninformed public.

The next step is to determine the possible "constraints" to satisfying the needs or varying the alterables. For policy to work, these constraints must be overcome. The peat program used two techniques to determine constraints. Nominal group technique was used to obtain a list of constraints. Eight members of the Peat Advisory Committee participated in the session. Each member was asked the question: "What is a constraint or barrier to achieving your needs?" Responses were given individually by each participant and then discussed. After each member gave one response, other answers were requested. After the list was obtained, members were asked to rank the constraints in terms of importance. (The 18 constraints and their rank are given in Table 7.) Both citizen opposition and the lack of technical information were found by members to be constraints of high importance.

The second technique used to evaluate constraints was interpretive structural modeling. Interpretive structural modeling is a computer-based technique that prioritizes elements in a list. Because some constraints influence others, it was desirable to understand constraint interrelationships. Interpretive structural modeling was used by the eight Peat Advisory Committee members following the nominal group technique session. For various

pairs of constraints, members were asked: "Does constraint A make constraint B worse?" Ultimately, all constraints were considered by the end of the session. The results, shown in Figure 8, show that certain constraints-- lack of technical information and environmental data and local government input-- must be overcome first to achieve satisfaction of peat policy needs. Moreover, Figure 8 shows that to overcome citizen opposition, 10 constraints must be overcome. This structure of constraints is very useful in planning program activities. First-priority activities should be those that overcome constraints at the bottom of Figure 8.

The peat program staff then listed several policy options that relied on the various alterables and constraints. Many options were discarded almost immediately. The most promising were kept and, in some cases, have already been put into effect.

To make this selection of options easier to understand, this chapter has been divided into the four familiar problem areas: administrative-institutional, alternative uses, leasing and environmental. In some cases, groups have been broken down even further. In each case, however, several options are listed. A subsequent discussion of each group of options separates the wheat from the chaff.

Administrative-Institutional

Options

1. Establish an interagency task force including the state, federal and local government agencies that shoulder major management responsibilities. The task force should be used to harmonize the goals pursued at different governmental levels.
2. Promote informal discussions between the Department of Natural Resources staff and other public officials. Informal relations between the department and the peat industry, public groups and other interested parties also should be fostered.
3. Develop public educational programs concerning peat resource development, use and management. The programs can be used to inform people from other agencies, public and special-interest groups, schools, the news media and others.
4. Continue to consult with the attorney general for advice on the appropriate legal definition of peat as well as on other procedural and substantive elements of peat policy.

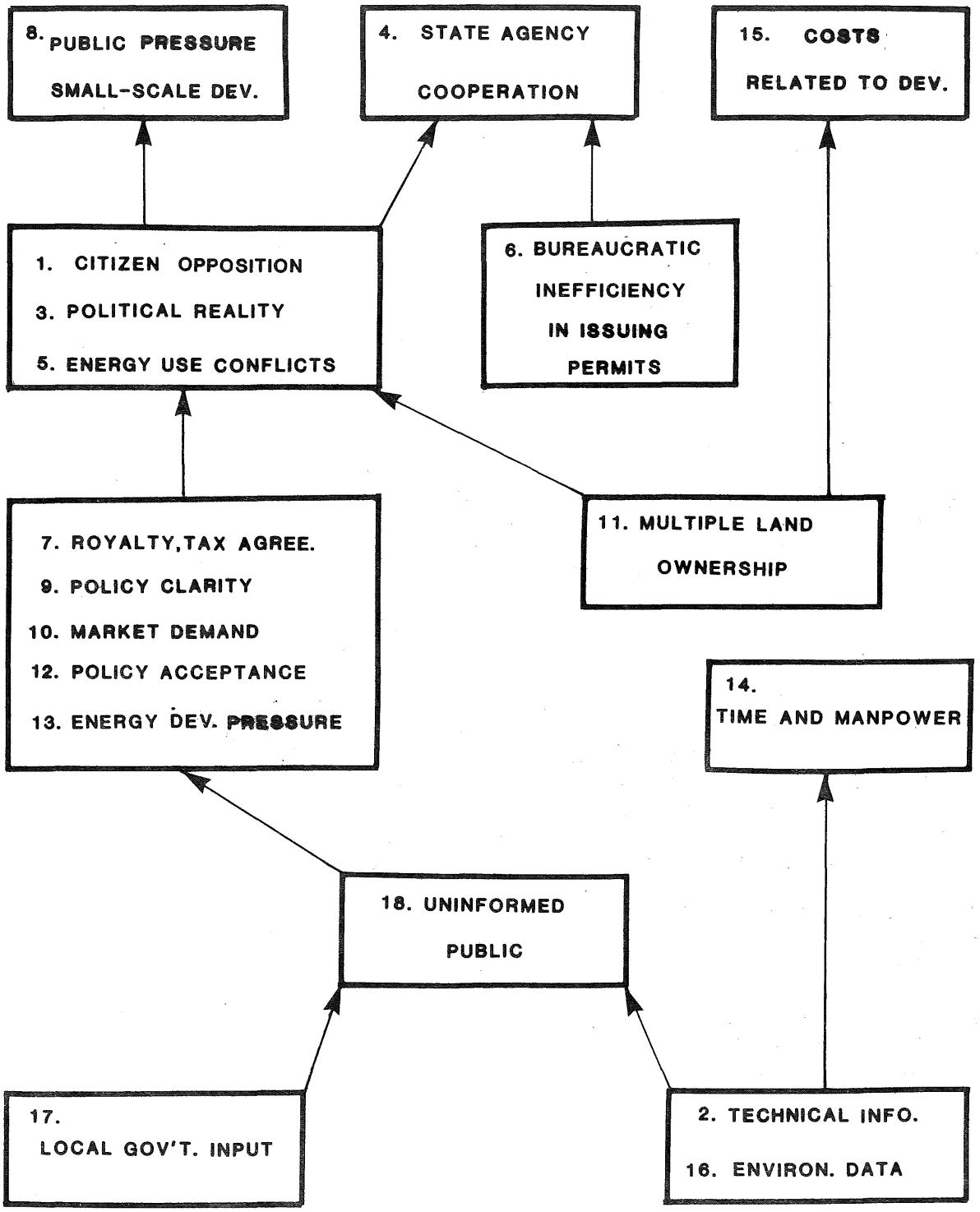


Figure 8. STRUCTURE AND INTERRELATIONS OF CONSTRAINTS TO SATISFACTION OF PEAT POLICY NEEDS

5. Monitor and directly participate in ongoing national and international efforts related to peat resources, conferences, meetings and publications.

Evaluation of administrative options

All options have been implemented to some extent, especially 1 and 2 through the Peat Advisory Committee and the Interagency Task Force. Public education programs (option 3) could be greatly improved.

Alternative Uses

Site-selection options

1. Selections could be based on identification of areas of special environmental concern and areas that could be developed. The selection would be made by state, federal and local agencies, industry and the general public.
2. Recommend areas of the resource to be preserved or developed on the basis of available data, and then seek industry's and the public's opinions before making final decisions.
3. Determine areas of the resource to be preserved or developed on the basis of valid criteria, and require the development industry to respond only to the designated developable peat tracts.
4. Maintain the existing system of site selection, and respond to interests for preservation or development as they occur.

Evaluation of site-selection options

While 2 and 3 permit some level of participation by the public or other stakeholders, only 1 requires direct and purposeful participation by all interested parties in nomination and selection of peat tracts for preservation or development. Such direct participation could enhance the political feasibility of final policy measures. The likelihood of polarized or enduring conflicts of interest could be significantly reduced. Furthermore, the adoption of 1 could reduce the chance for error in peat preservation or lease-site selection, as various stakeholder opinions become known early in the selection process. A major drawback of 1, however, is that it could prove more cumbersome than the other options. Option 1 would be the most effective in the accelerated-growth scenario.

None of the other options provides as much flexibility in site selection as 1 does. In particular, option 2 would restrict the choices of industry and other stakeholders.

Option 2 is compatible with any future peat development scenario.

Adoption of 3 would not permit reasonable stakeholder participation in site selection. The difficulty with insufficient participation is that land-use conflicts may not be adequately resolved.

Adoption of option 4 will leave the peat leasing system in a reactive state. Though reactive leasing has few advantages, it has several major disadvantages. Such disadvantages include insufficient competition and other inequities. Option 4 will not adequately meet stakeholders' needs in the accelerated-growth scenario.

Scheduling options

5. Establish a comprehensive schedule for development of acceptable sites by working with local governments, the industry, the stakeholder public and other interested parties. Clearly indicate the acceptable size and timing of development in the schedule.

6. Lease acceptable sites according to development interest and not according to a specific schedule.

Evaluation of scheduling options

A major advantage of 5 is that it fosters competition, as the state would not have to react to individual development interests. Option 5 is also administratively easier than 6 is, and provides greater flexibility and opportunity for the state to prioritize areas of development and to allocate the resource to competing interests. With 5, the state can better manage peat resource development in all future scenarios. Conversely, with the adoption of 6, there will be a higher probability of serious errors in peat allocation in the accelerated-growth scenario because sufficient orderliness in resource management might not be maintained, especially in the regulation of the rate of development.

Development size options

7. Permit all sizes of development for all acceptable uses, as long as such developments conform to existing environmental regulations and are compatible with the people who are directly affected.

8. Permit only select sizes of development for specific resource uses and specific types of peat. In particular, favor small-scale and low-intensity development of sphagnum peat.

9. Maintain the present system of limited scales of peat leases.

Evaluation of development size options

Adoption of 7 will provide substantial benefits to the state in that equality of opportunity will be maintained and the market forces will be given a free hand in resource allocation. This option provides the state adequate flexibility to effectively deal with all demand scenarios. However, adoption of 7 could pose some problems in respect to equitable distribution of the scarce sphagnum peat. Moreover, the environmental effects of some large-scale options are yet unknown.

While the implementation of 8 will ensure the long-term supply of sphagnum or other peat, it could impose severe limitations on the state's ability to adequately respond to peat development requests in the accelerated-growth scenario. However, adoption of the option could prove effective in the status-quo or limited-growth scenarios.

A major advantage of 9 is that it allows a cautious approach to peat development until the technological, socioeconomic and environmental issues can be addressed.

Peatland reclamation options

10. To the extent feasible, require the reclamation of some land as other land is developed.

11. Permit developers to initiate land reclamation activities at their convenience but within a prescribed schedule.

12. Maintain the existing system: Do not require, but encourage, post-development land reclamation.

Evaluation of reclamation options

Adoption of 10 will allow the state to more effectively monitor and control peatland reclamation programs while development progresses. Among the benefits of adopting the option is the certainty that land will be reclaimed. It is likely, however, that 10 will demand heavy investment at the early stage of peat development. But given the mining industry's long history of noncompliance with reclamation requirements and the severe land-use conflicts and other environmental problems that could result from inadequate reclamation in the accelerated-growth scenario, the social benefits would likely exceed the inconvenience to developers.

Unlike 10, option 11 will not impose a heavy burden on investment capital at the early stage of development since developers will tend to initiate reclamation activities later in the process, when the effects on profit will be

minimal. A major difficulty with implementation of 11 is that, without proper management, developers might not meet the prescribed schedules for reclamation.

Adoption of 12 will not meet objectives, especially in the accelerated-growth scenario, because many developers may not invest in reclamation if they are not required to.

Leasing

Lease-tenure options

1. Adopt a flexible lease-tenure system in which the tenure for each scale of peat development is adjusted to the time period for amortization of required capital investment, the time period for optimal development of the lease tract, and relevant equity considerations.

2. Maintain the maximum lease tenure of 25 years in all cases of peat leasing (see Appendix A for a discussion of the existing lease-tenure system).

Evaluation of lease-tenure options

Although option 1 imposes additional administrative burdens on the state, it has received significant support from industry, several local planning agencies, the Peat Advisory Committee and many communities. The chances of it working are good.

Implementation of 1 will permit the state to maintain adequate flexibility in satisfying stakeholders' needs in any development scenario. Furthermore, adjusting lease terms could provide a stable climate for capital investment and economic growth.

Proper implementation of 1 will facilitate timely and orderly development of the resource in any future scenario.

Though option 2 is already in effect, its continued use could engender significant political risks in the accelerated-growth scenario. Political pressure for extension of lease terms for agriculture, energy and other peat uses will likely intensify in the accelerated-growth scenario.

Option 2 will not provide the state adequate flexibility in adjusting lease terms to meet needs in the accelerated-growth scenario. The current maximum lease terms may not allow the developer enough time to turn a profit. Provisions for the renewal of successful leases, however, will improve the effectiveness of 2 in the accelerated-growth scenario.

Bidding-for-lease options

3. Include bonus payments in peat leasing and require competitive

bidding on rental, royalty and bonus payments, as well as on reclamation and other management surcharges. Establish reasonable minimum bids for all required payments.

4. Introduce bonus payments to peat leasing and require competitive bidding on rental, royalty and bonus payments. Establish minimum bids for all required payments.

5. Do not require bonus payments in peat leasing, restrict competitive bidding to only royalty payments, and adopt a uniform rental scheme. Establish a minimum royalty bid.

6. Maintain the existing system, and do not require competitive bidding and bonus payments in peat leasing.

Evaluation of bidding options

Except for 6, all other options have some political support. Option 5 is the most compatible with the existing system.

Because both 3 and 4 require the inclusion of bonus payments, either will yield increased revenue to the state and to the counties where the peat leases are located. Either option will foster competition in leasing and serve to capture the fair market value of peat. Reasonably high minimum bids on bonus, rental and royalty payments will earn more revenue and help capture the fair market value of the peat.

In the limited-growth scenario, however, the introduction of bonus payments and high minimum bids could deter many operations that would otherwise have been successful. That is to say, option 5 may work better than either 3 or 4 in the limited-growth scenario. But the adoption of a uniform annual rent as called for in option 5 may be inefficient or inequitable since the royalty alone may not fully capture the different values of peat tracts. Extension of competitive bidding to rental payments will likely correct the situation.

Since option 6 is non-competitive and inequitable in virtually every respect, to keep it will reinforce that which the state intends to change. Stakeholders' needs could be thwarted in all three development scenarios if the state retains noncompetitive leasing.

Environmental

Peatland drainage options

1. Establish drainage directions and outflow points for each lease tract, and strictly enforce drainage requirements.

2. Recommend acceptable drainage channels for each lease tract.

Evaluation of drainage options

Option 1 is increasingly attracting the support of various

stakeholders. In particular, many environmental groups, agencies and the stakeholder public support the option, and some have expressed desire to directly participate in the establishment of drainage channels for specific sites. Given the compatibility of option 1 with development scenarios, it could be adopted and successfully used.

Adoption of 1 will meet stakeholders' needs better than 2 will. It will permit the state and interested stakeholders to directly influence the management of drainage activity in sensitive basins.

If effectively implemented, 1 would aid orderly and environmentally acceptable development and would reduce environmental or political risks related to peat development in all future scenarios.

Option 2 has been rejected by many stakeholder groups, including various environmental groups, the Peat Advisory Committee, local government agencies and interested citizens. It might not receive sufficient political support to be used in some areas of the state, especially in the status-quo or limited-growth scenario, because the goal would be to remove peat rather than protect the environment.

Pollution control options

3. Require regular monitoring of effluents and emissions associated with peat development, and strictly enforce full compliance with all applicable pollution control rules and regulations (including federal and local regulations).

4. Maintain the status quo--no system for peat-related pollution monitoring and control.

Evaluation of pollution control options

Many stakeholders support option 3. Implementation of 3 will promote orderly development of peat and reduce the environmental risks of peat development. The stringent requirements of option 3 could affect the level of peat production in the accelerated-growth scenario.

It is not likely that 4 will satisfy stakeholders in any peat development scenario.

Socioeconomic options

5. To the extent necessary, require the developer to pay for additional local services needed because of development. Furthermore, when necessary, establish or recommend quotas for local labor force participation in all phases of peat development.

6. Give the lessee maximum freedom in social conduct.

Evaluation of socioeconomic options

While option 5 could receive significant political support in the accelerated-growth scenario, its popularity in other development scenarios is questionable. Since the extent of political support for either option is not known, we cannot predict the political feasibility of either option.

Adoption of 5 will mitigate the adverse socioeconomic impacts of peat development. Implementation of 5 also could reduce political risks related to peat development.

The extent to which option 6 would satisfy stakeholders in the scenarios is difficult to determine since we cannot anticipate the social conduct of prospective developers.

Summary

A summary of the final peat policy recommendations presented to the Legislature in 1981 is provided in Appendix C. A summary of peat program planning, displayed according to procedures developed by Hill and Warfield (1977), is provided in Figure 9. Such an analysis would have been very useful during the early stages of the peat program. The following explanation of Figure 9 will serve as a summary of policy formulation.

The definition of problems is shown in the interactions of constraints, alterables, needs and stakeholder groups. Constraints are the barriers to meeting the needs of stakeholders. The alterables are what can be modified to achieve the needs. Two types of matrices are given: The self-interaction matrix displays the relationships among a set of variables, and the cross-interaction matrix shows the interactions between sets of elements. Figure 9 shows that major constraints to peat policy include citizen opposition, the lack of information, political realities and

an uninformed public. Among the major alterables are laws of various types. The effective and efficient management of the peat resource is a major need shared by most stakeholders. Stakeholders are highly interrelated, which complicates policy formulation. Although Figure 9 is complex and difficult to follow, it allows a thorough understanding of the problem in developing policy. A stakeholder can be traced through the matrices to determine his needs as well as what can be modified or what may prevent attaining those needs. These linkages also serve as a basis for determining policy objectives, the second step in the process.

Objectives combine the constraints with needs as a value system. Objective interactions can be used to develop an objectives tree, which is a hierarchical structure of the objectives (Figure 10). The highest-level objective is "to ensure the effective management of peat." The objectives can also be related to constraints, alterables and needs, which serves to justify objectives. The objectives must be achieved within the constraints by modifying the alterables to meet various needs. Objective measures are also provided to demonstrate how and when an objective is attained.

The third step in the process involved determining the alternatives for achieving objectives. These alternatives are expressed as activities in Figure 9. From the self-interaction matrix, it is evident that the critical activities are obtaining funds, hiring staff members, studying impacts and developing policy recommendations. These activities are also linked to objectives and constraints to illustrate how the activities met the objectives and to formulate the barriers to the activities. For example, energy development pressure and time and manpower are major constraints to the activities. The activities-objectives interactions indicate that most activities are aimed at ensuring the effective management of peat. Activity measures serve as standards of performance for completing activities, a guide for management. Finally, the interaction matrix between objective measures and activity measures indicates how well activities address the objectives of the program. Empty columns or rows indicate activities have been inadequate.

Figure 9 provides a visual description of the complex elements involved in peat planning. Developing this figure at the start of the peat program would have greatly increased the efficiency and effectiveness of planning.

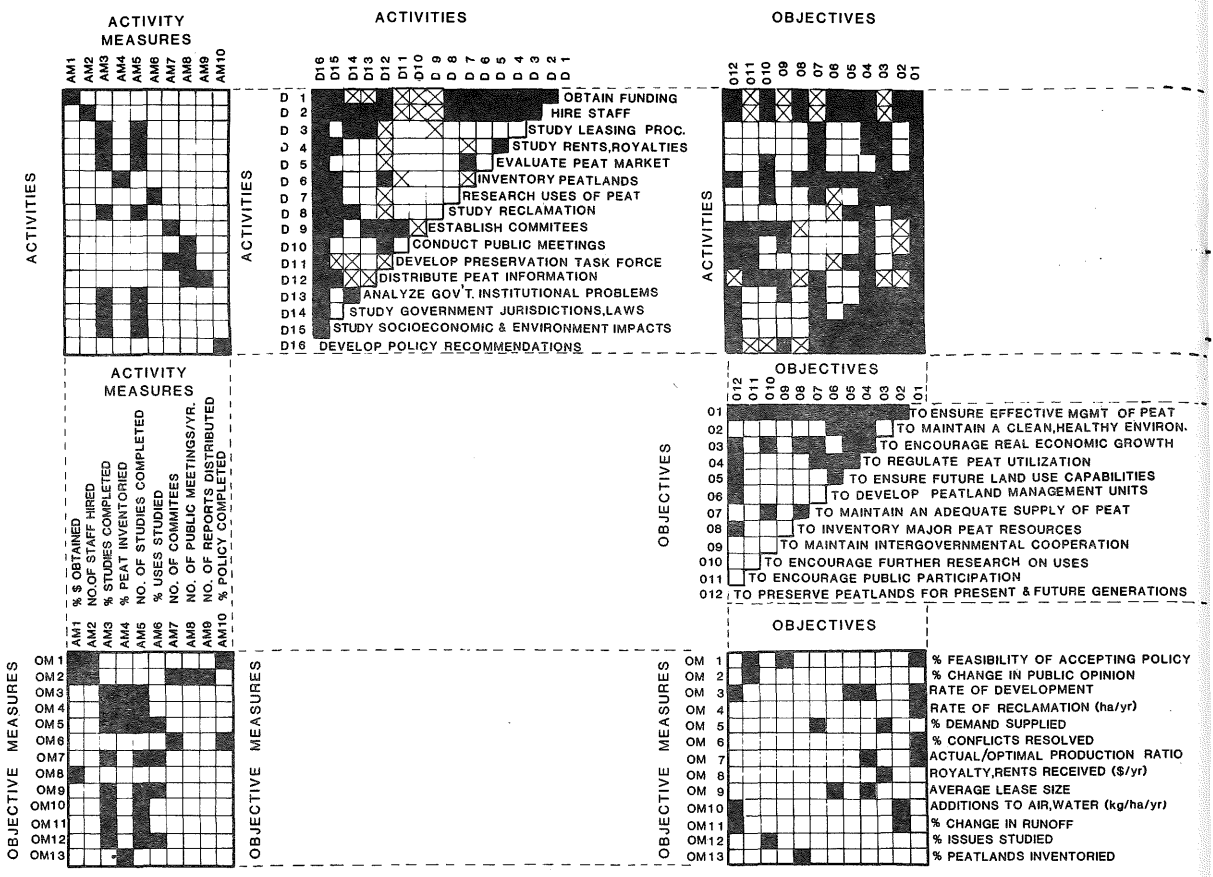
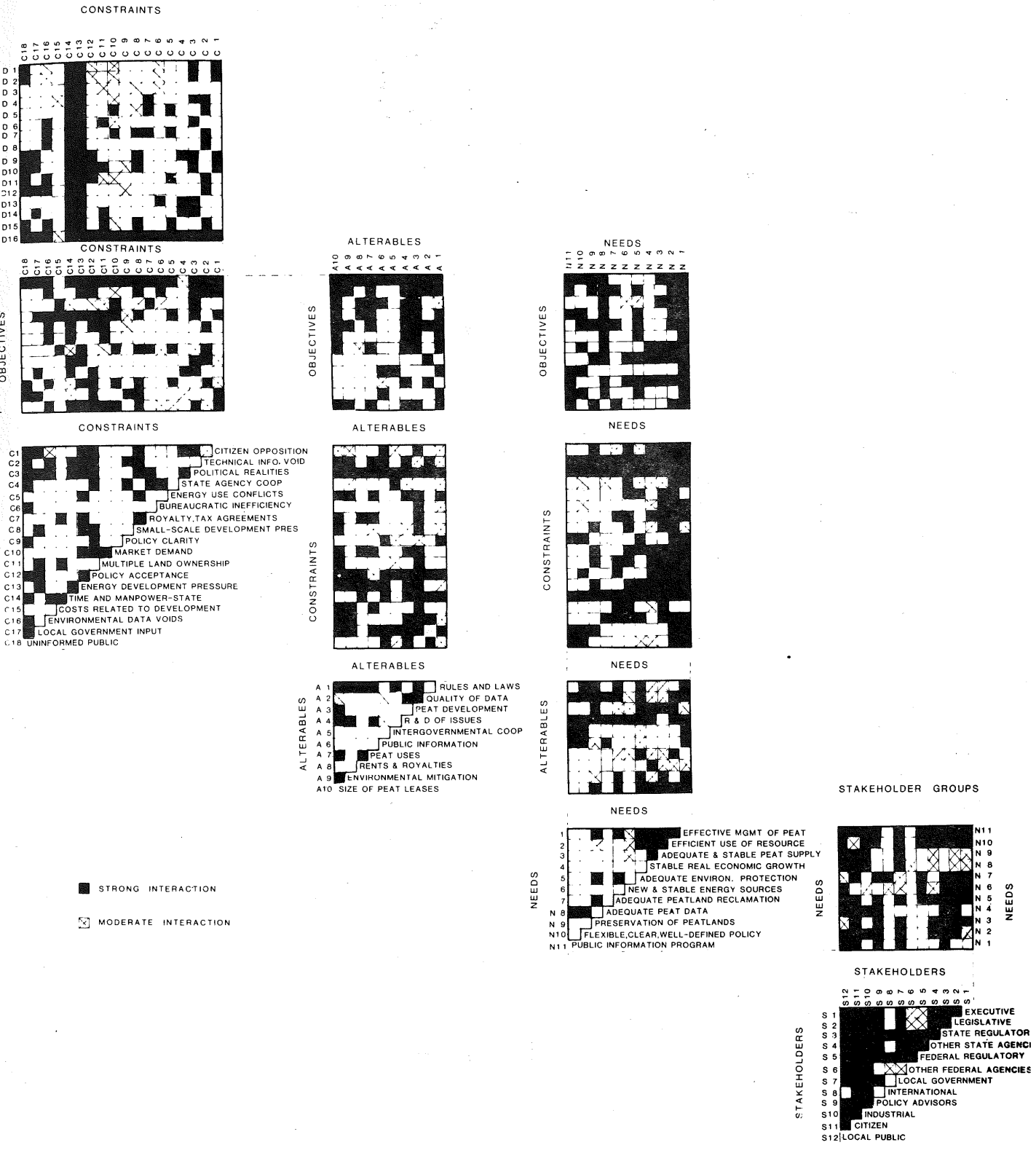


Figure 9. PEAT PROGRAM PLANNING LINKAGES


CONSTRAINTS
OBJECTIVES
ALTERABLES
NEEDS
C1 CITIZEN OPPOSITION
C2 TECHNICAL INFO. VOID
C3 POLITICAL REALITIES
C4 STATE AGENCY COOP
C5 ENERGY USE CONFLICTS
C6 BUREAUCRATIC INEFFICIENCY
C7 ROYALTY,TAX AGREEMENTS
C8 SMALL-SCALE DEVELOPMENT PRES
C9 POLICY CLARITY
C10 MARKET DEMAND
C11 MULTIPLE LAND OWNERSHIP
C12 POLICY ACCEPTANCE
C13 ENERGY DEVELOPMENT PRESSURE
C14 TIME AND MANPOWER-STATE
C15 COSTS RELATED TO DEVELOPMENT
C16 ENVIRONMENTAL DATA VOIDS
C17 LOCAL GOVERNMENT INPUT
C18 UNINFORMED PUBLIC
A 1 RULES AND LAWS
A 2 QUALITY OF DATA
A 3 PEAT DEVELOPMENT
A 4 R & D OF ISSUES
A 5 INTERGOVERNMENTAL COOP
A 6 PUBLIC INFORMATION
A 7 PEAT USES
A 8 RENTS & ROYALTIES
A 9 ENVIRONMENTAL MITIGATION
A10 SIZE OF PEAT LEASES
1 EFFECTIVE MGMT OF PEAT
2 EFFICIENT USE OF RESOURCE
3 ADEQUATE & STABLE PEAT SUPPLY
4 STABLE REAL ECONOMIC GROWTH
5 ADEQUATE ENVIRON. PROTECTION
6 NEW & STABLE ENERGY SOURCES
7 ADEQUATE PEATLAND RECLAMATION
N 8 ADEQUATE PEAT DATA
N 9 PRESERVATION OF PEATLANDS
N10 FLEXIBLE,CLEAR,WELL-DEFINED POLICY
N11 PUBLIC INFORMATION PROGRAM
STRONG INTERACTION
MODERATE INTERACTION
STAKEHOLDER GROUPS
STAKEHOLDERS
S 1 EXECUTIVE
S 2 LEGISLATIVE
S 3 STATE REGULATOR
S 4 OTHER STATE AGENCI
S 5 FEDERAL REGULATORY
S 6 OTHER FEDERAL AGENCIES
S 7 LOCAL GOVERNMENT
S 8 INTERNATIONAL
S 9 POLICY ADVISORS
S10 INDUSTRIAL
S11 CITIZEN
S12 LOCAL PUBLIC

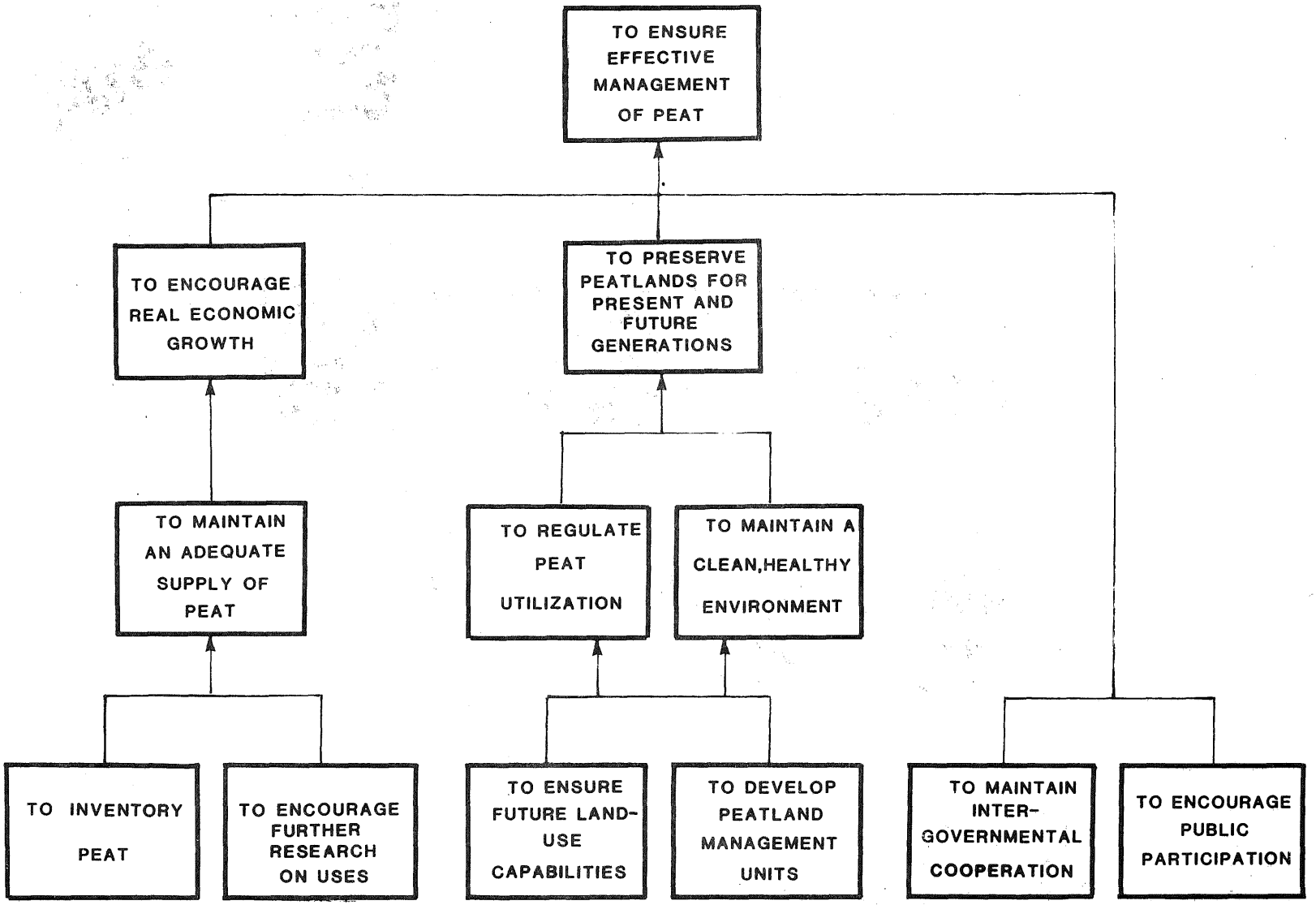


Figure 10. PEAT PROGRAM OBJECTIVES TREE

Conclusions

There is little doubt that a more structured planning effort would have greatly assisted peat program policy formulation. Public participation by relevant stakeholder groups is typically difficult to achieve in most public policy matters. The authors found that many of the policy formulation techniques enhance meaningful public participation. Nominal group technique was extremely useful in generating issues and encouraging discussion among participants. Nominal group technique should have been used in early planning. Interpretive structural modeling was impressive in its ability to prioritize elements and to identify topics for further discussion. It is unfortunate that interpretive structural modeling was not applied at all stages of the policy formulation effort to assist in decision making.

Policy formulation was found to be dynamic. Issues

frequently surfaced overnight, and often so did their associated policies. It is uncertain whether mathematical systems techniques could adapt to such a rapidly changing process.

Using the steps in the Hall activity matrix was very useful in developing policy alternatives. Without such guidance, the policy could have been developed before the problem was defined, a frequent occurrence (Hall 1969).

A major handicap to effective peat policy planning was the timing of funding and the political reality that most dollars are committed biennially. Efforts aimed at developing policy should begin with about a one-year planning stage. This often overlooked stage could save institutions vast amounts of time and money.

APPENDICES

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Appendix A: Policy Summary--1979

The following statements summarize the Department of Natural Resources' evaluation of policy alternatives for peatland management.

I. LEASING

The Department of Natural Resources will determine which peatlands are available for lease based on development interests and site-specific information on the resource.

Leases will be awarded on the basis of a bid-proposal mechanism.

II. UTILIZATION ALTERNATIVES FOR PEATLANDS

A. Horticultural Leasing

General

During the next biennium, the department will guide the development of horticultural uses of

peatlands through its leasing program. Specific peatlands will be identified by the department for horticultural lease.

Size

Horticultural leases for individual operations will be limited to 3,000 acres during the next biennium and will be managed in 1,000-acre units.

Rents

Rents will be charged on a per-acre basis. Rents will be bid beyond an established minimum.

Royalties

Royalties for horticultural peat leases will be calculated as a percentage of the gross price of the product shipped f.o.b. plant site, or a flat rate per bale, whichever is greater. The standard six-cubic-foot bale will be used as the basis for calculations. Royalty rates will be determined by bidding above a fixed minimum.

B. Agricultural Leasing

General

The department intends to allow the limited development of agricultural uses of peatlands during the next biennium.

Size

For the next biennium, agricultural leases for individual operations will be limited to 640 acres.

Lease Term

The department will seek legislation that amends Minnesota Statutes, Section 92.50, to allow extending the maximum lease term for agricultural uses from 10 years to 25 years.

Rents

Rents will be charged on a per-acre basis with actual amounts above an established minimum to be negotiated with individual lease applicants. Rents will be escalated or renegotiated periodically over the term of the lease.

Royalties

No royalties will be charged for agricultural peat leases as long as the peat is not extracted. Sod farming would be considered extractive and royalties would be assessed.

C. Conservation of Peatlands

The Task Force on Peatland Preservation, formed to establish selection criteria and recommend areas of special interest, will continue its activities over the next biennium. Selection criteria developed by the task force will be used to identify peatlands for preservation. The department will give consideration to any rare, unique or special characteristics of a peatland before making a leasing decision.

Until further studies are concluded, no peat leases will be approved within the Upper Red Lakes and Lake Agassiz Peatlands national natural landmarks.

D. Chemical and Industrial Uses

Although there are no proposals before the department to lease peat for chemical or industrial uses, the department would consider the small-scale use of peatland (640-acre maximum) for this purpose.

Until more is known about chemical and industrial uses of peat, a large-scale project (greater than 640 acres) will not be supported.

The department will encourage additional study of chemical and industrial uses of peat during the next biennium.

E. Forestry Utilization

Forest uses will be considered when peat lease applications for other purposes are evaluated. A peat lease for other uses will not be granted in cases where there is high potential for forest management.

Where a commercial forest occurs on lands to be leased for a non-forest use, the lessee shall pay stumpage prices and remove the timber.

F. Small-Scale Fuel Development

At present, there are no lease applications for small-scale utilization of peat as a fuel (direct burning or gasification) or for the production of biomass. The department would consider a small-scale demonstration project if proposed. Small-scale is defined as the production of 25 megawatts or less of electricity or an equivalent amount of steam heat. Peatlands leased for a demonstration project will be limited to 640 acres.

G. Large-Scale Fuel Development

The department will hold proposals to develop large tracts of peatlands for fuel purposes in abeyance during the coming biennium. Completion of studies proposed by the U.S. Department of Energy, the Department of Natural Resources and Minnegasco for the next biennium will provide better direction for managing large-scale peat extraction activities.

III. SPECULATION

Peatland speculation will be discouraged through the use of "diligent development" requirements contained in state peat leases. A set amount of development would have to occur within specified time periods.

IV. ENVIRONMENTAL MONITORING

Environmental monitoring of peat operations, including but not restricted to permit and lease conditions, will be required. Monitoring will include air, biological and water-quality parameters. Costs of monitoring will be the responsibility of the lessee. Long-term, post-project monitoring may be required as part of a reclamation plan.

All developments of peatlands authorized by state lease shall be conducted in an environmentally sound manner, and pollutants shall be controlled or contained on the site.

V. DRAINAGE OF PEATLANDS

Any proposal to drain peatlands is subject to the permit requirements of Minnesota Statutes, Section 105.41, and related laws.

VI. RECLAMATION

Reclamation of peatlands will be required of all lessees who

disturb state-owned peatlands by their actions. No lease will be granted unless there is a reclamation plan.

To ensure compliance with the reclamation plan, a surcharge, bond or other mechanism will be required in the lease agreement.

VII. CLASSIFICATION OF PEAT

During the next biennium (July 1979 to June 1981) the department will continue its policy of leasing peat as a surface interest and not as a mineral interest.

VIII. SALE OF PEATLANDS

Consistent with Minnesota Statutes, Section 92.461, no peatlands of commercial value will be offered for sale.

IX. BURNING OF PEATLANDS

All leased use of peatlands will prohibit the practice of burning the peat resource for land preparation.

Appendix B: Minnesota Peat Program Publications

Program and Policy Reports

Midwest Research Institute. 1976. Final report on peat program phase I: Environmental effects and preliminary technology assessment. Minnesota Department of Natural Resources, 184 pp.

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Meagher, P. D., W. R. Maki and L. A. Laulainen, Jr. 1979. Economic effects of Minnesota peatland development. Minnesota Department of Natural Resources, 40 pp.

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Pippo, P. F. 1977. Potential of peat as a power plant fuel: Present perspective for peat decision making. Minnesota Department of Natural Resources, 273 pp.**

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Industrial Chemicals

Fuchsman, C. H. 1978. The industrial chemical technology of peat. Minnesota Department of Natural Resources, 190 pp.

Fuchsman, C. H., E. E. Lundberg and E. A. Dreyer. 1979. Preliminary analytical survey of Minnesota peats for possible industrial chemical utilization. Minnesota Department of Natural Resources, 59 pp.

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Farnham, R. S. 1978. Status of present peatland uses of agricultural and horticultural peat production. Minnesota Department of Natural Resources, 50 pp.**

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Appendix C: Policy Summary--1981

Rationale

Peatlands are a valuable resource, capable of serving many uses, including horticulture, agriculture, forestry, energy, industrial chemicals, sewage treatment, recreation, scientific study, wildlife habitat, water filtration and preservation. Accordingly, the Department of Natural Resources recommends that peatlands be managed cautiously so that the resource can be used by both present and future generations, and that the management of this resource be flexible to allow for changing needs and expanded knowledge.

Peatland Uses

Department of Natural Resources: At present, peatlands that have high potential for forestry, wildlife management or natural-area preservation should not be offered for lease, so that peatlands will be preserved for such uses.

Peatlands that are highly valuable for forestry should be managed for that purpose. The department should consider the present and future potential of peatlands for forestry when evaluating lease proposals.

Peatlands that have significant value for wildlife habitat should be managed for that purpose. The department recommends protecting existing and proposed wildlife management areas from incompatible development. The value of peatlands as wildlife habitat should be one of the criteria used in the evaluation of proposals to lease peatlands outside of existing or proposed wildlife management areas.

Peatlands should be set aside that will preserve endangered, threatened and rare peatland fauna and flora, representative types of peatlands, unique geomorphic features and peatlands having significant scientific value. Candidate peatlands of such distinction are now under study by the Peatlands of Special Interest Task Force. These peatlands should not be leased until the department determines the appropriate management of these areas.

Leasing: Peatlands available for leasing should be allocated for many uses so that the needs of a variety of developers can be met and particular uses can be demonstrated.

Development siting: To guide the wise development of the state's peat resources, the department should determine the peatlands available for lease through the use of several site-selection criteria, including development interest, existing and potential use, available resource information, availability of transportation and utilities, existing disturbances, location in the state, location in the peatland and watershed, and potential environmental effects.

Conflicting uses: Certain uses of peat could preclude other uses. At present, the need to prioritize extractive uses does not exist, given the current supply and demand. Should major use conflicts arise, the department will study and recommend the appropriate use.

Size: As a guideline, leases should not exceed approximately 3,000 acres (approximately five square miles) of peatland. The size of each lease should be determined on the basis of the peatland, the watershed and the mining method.

Leases for larger-scale development should not be

granted until the technological, economic and environmental feasibility is well documented both conceptually and by demonstration.

Environmental Management

Rules: The department recommends that the rules of the Environmental Quality Board be amended to require a mandatory environmental assessment worksheet for conversion of 640 or more acres of peatland to an alternative use, for the construction of a facility using 5,000 dry tons or more of peat per year to produce a fuel, and for the construction of a peat mining operation which will use 160 or more acres of land. The department also recommends that an environmental impact statement be required for the construction of a facility using 250,000 dry tons or more of peat per year to produce a fuel and for the construction of a peat mining operation that will occupy 320 acres or more.

Permits: Drainage of all peatlands should be subject to water permit rules promulgated under Minnesota Statutes, Chapter 105, and other applicable legislation and the water quality rules of the Pollution Control Agency, in order to protect the resource and the public health, safety and welfare of the people of Minnesota. The department has promulgated rules for appropriation of waters of the state that pertain to peatlands.

Peatland development projects should also be subject to other applicable rules of the Pollution Control Agency regarding air quality.

Mitigation: Mitigation of potential adverse environmental effects should be required to protect water, wildlife and air and the public's health, safety and welfare.

Monitoring: Monitoring of the air, water and land should be required in all leases.

Before a lease is granted, an approved monitoring plan should be required. The lessee should be responsible for conducting or providing all required monitoring.

Reclamation: To ensure the future land-use capability of peatlands and to protect downstream and adjacent resources, reclamation should be required on lands disturbed by peat development activities.

To ensure adequate reclamation, a bond, security or other assurance should be required when the department has reasonable doubts as to the operator's financial and technical ability to comply with the reclamation plan.

Reclamation should be staged over the term of a lease to enhance the process of reclamation and to reduce the environmental effects of unused disturbed peatlands.

Legislation

The department recommends that Minnesota Statutes, Section 92.50, be amended to extend the maximum lease term for agricultural uses from 10 to 25 years so that potential developers may receive fair returns on their investments.

The department recommends that the Legislature consider requiring reclamation on all mined or otherwise altered peatlands by amending Minnesota Statutes, sections 93.44-93.51, which concern the reclamation of lands, to include peat.

Administration

Program focus: As stated in the department budget requests, the department recommends that the major focus of the peat program be altered from the past activities of research and policy formulation to peat management and program administration.

Future activities should include leasing, lease monitoring, inventory, site evaluation and expanding knowledge as needs require. Additional studies may be needed in response to technological advances in such areas as industrial chemical production, liquid fuel conversions and other applications.

Resource consolidation: To efficiently manage peatlands, the department should consider peatland ownership consolidation by exchange.

Jurisdiction: The department recommends that environmental laws and rules pertaining to peatlands be applied to all peatlands in the state to provide for uniform environmental control.

Both county and state peatlands should be managed with similar controls so that development is consistent and uniform throughout the state.

Local units of government should address peatland development in their planning and zoning activities so that local concerns are met. The department should consider local concerns before granting leases.

Federal, state and local units of government should maintain intergovernmental cooperation so that uniform guidelines are followed.

Classification: To identify various peat products, peat should be classified according to the American Society for Testing Materials Code No. D 2607-69 for peats, mosses, humus and related products.

The department recommends that peat continue to be managed as a surface interest rather than as a mineral.

Leasing

Rents and royalties: Both rents and royalties should be charged for extractive uses, and only rents should be charged for nonextractive uses so that the state receives an adequate return for the resource.

Royalties should be price indexed to fluctuate with the rate of inflation so that the return to the state is commensurate with current dollars.

Competitive bidding: Leases greater than 160 acres should be awarded through competitive bids for rents and royalties above an established minimum so that the state receives the maximum return for the use of the resource. Negotiated sales may be employed for lease expansions and when only singular interest or use is documented.

Expansion: Peatland parcels offered for lease should be chosen with consideration of adjacent peat resources for potential development, consistent with the goals and policies of the department.

Speculation: Peatland speculation should be discouraged by requiring a certain amount of development to be performed on a leased area within a prescribed time.