RESULTS OF A MODELING WORKSHOP CONCERNING PRESERVATION AND PROTECTION OF WETLANDS IN NORTH DAKOTA

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EXECUTIVE SUMMARY

In a recently signed letter, the Governor of North Dakota and the Assistant Secretary of the Interior for Fish and Wildlife and Parks charged a joint state-federal study group with examination of two separate questions: 1) mitigation for the Garrison Diversion Project; and 2) planning for long-range protection and preservation of fish and wildlife habitat in North Dakota. The cochair for this study group (the Secretary of the Interior's Field Representative, Denver, Colorado, and the Natural Resources Coordinator for North Dakota) further articulated the charge concerning the second of these two questions to include three steps: 1) development of a general plan for preservation and protection of migratory waterfowl and their associated wetland habitat; 2) a comprehensive analysis of alternative strategies, including opportunities and constraints, for achieving the goals articulated in Step 1; and 3) design of a coordinated state-federal public information program to assist in plan implementation.

In order to obtain input from a variety of interests, the joint study group initiated step 2 activities with a five-day workshop in Bismarck, N.D., December 8-12, 1980. The objectives of the workshop were: 1) to identify alternative strategies for preserving and enhancing waterfowl production habitat in North Dakota; 2) to identify opportunities and constraints associated with those alternatives; and 3) to promote communication and understanding of the implications of these alternatives for all affected parties. To achieve these objectives, the workshop utilized a group of concepts and techniques collectively known as Adaptive Environmental Assessment (AEA).

Developed by Dr. C. S. Holling and his co-workers at the University of British Columbia, the AEA process involves planners, managers, scientists, and other interested parties in a structured atmosphere whose focus is the construction and examination of a computerized simulation model of the resource system under consideration. The modeling process is used to promote communication, identify pertinent issues, identify key data gaps and uncertainties, direct research efforts to fill those gaps, and explore the possible consequences of various management alternatives.

The workshop, which was facilitated by the AEA Group of the U.S. Fish and Wildlife Service (FWS), was attended by approximately 25 invited participants representing a variety of interests concerned with the wetlands protection issue in North Dakota. During the week workshop participants conceptualized and constructed a computerized simulation model incorporating many of the hydrologic, agricultural, and wildlife aspects of the wetlands issue. During the process of constructing this model and examining its behavior, participants identified several interesting alternative strategies that may prove useful in an overall wetland protection program, along with a variety of constraints associated with each.

Perhaps the most interesting of these alternatives revolve around the idea that there may be a variety of cases in which water can be retained on the land, with concommitant benefits both for wildlife and flood control, without detriment to agricultural productivity. Examples of this kind of activity include flooding of previously drained Type I wetlands in summer fallow areas, installation of smaller drains in Type I and III wetlands to

reduce the rate at which water runs off in the spring, and use of strategically located gates in drainage channels associated with the state highway system to slow runoff and create wetland habitat.

Several other alternatives discussed at the workshop are related to the notion of using available, uncommitted water supplies to enhance or create wetlands. Several cases were cited in which more certain water supplies would be useful in increasing waterfowl production or reducing disease problems, especially in dry years. Water for such purposes might come from a variety of current or proposed water development projects, both large and small scale.

Finally, the potential for re-establishment of "unsuccessfully" drained (i.e., not consistently usable for agricultural purposes) wetlands was discussed at some length. There are apparently substantial acreages of such wetlands in North Dakota and a program to acquire and rehabilitate them might be of considerable utility.

The workshop was thus successful in accomplishing its first two objectives--identification of alternative strategies, opportunities, and constraints. However, it would be naive to suppose that any of the alternatives discussed offers a complete, simple solution to the wetlands issue in North Dakota. The most important result of the workshop may therefore be that which was accomplished relative to the third objective - promotion of communication and understanding. It was gratifying and encouraging to see the spirit of communication and cooperation that developed by the end of the workshop. The fact that representatives of many of the interests concerned with the wetlands issue participated in an open exchange of ideas and information marks

an important step forward. We believe that it is imperative that this cooperative attitude be maintained, and that there are a variety of ways in which this might be accomplished. Perhaps the simplest would be a small-scale pilot project and research effort to determine the effects of wetland maintenance on summer fallow areas. Such a research program would provide not only useful inform ation, but an opportunity for many of the affected interests to begin working toward mutually acceptable solutions to the overall wetlands issue.

TABLE OF CONTENTS

	PAGE
EXECUTIVE SUMMARY	1
TABLE OF CONTENTS	5
LIST OF FIGURES	6
LIST OF TABLES	7
ACKNOWLEDGEMENTS	8
INTRODUCTION	11
MODELING WORKSHOPS	13
THE WORKSHOP STAFF	14
WORKSHOP ACTIVITIES	14
THE WORKSHOP MODEL	19
ACTIONS AND INDICATORS	20
SPACE AND TIME	23
MODEL COMPONENTS AND THE LOOKING OUTWARD MATRIX	24
MODEL STRUCTURE	27
Hydrology Submodel	27
Agriculture Submodel	33
Wetland Values Submodel	36
Land Use Changes Submodel	38
WORKSHOP RESULTS	41
MODEL RESULTS	43
OPPORTUNITIES AND CONSTRAINTS	47
General Considerations	47
Specific Alternatives	50
RESEARCH AND DATA NEEDS	53
LITERATURE CITED	54
APPENDICES	55
APPENDIX A. CHARGE TO SPECIAL STUDY GROUP ON ACQUISITION OF LANDS FOR WILDLIFE IN NORTH DAKOTA	55
APPENDIX B. LONG-RANGE PROTECTION AND PRESERVATION PLANNING FOR FISH AND WILDLIFE: CHARGE FROM THE COCHAIR	57

LIST OF FIGURES

Figure 1. Looking outward matrix for interactions among submodels.

Figure 2. Diagram illustrating basic subgroup responsibilities.

Figure 3. Model structure and order of calculations.

LIST OF TABLES

Table 1. Management actions identified at the workshop.

Table 2. Indicators (performance measures) identified at the workshop.

Table 3. Hypothetical watershed characteristics and initial conditions.

ACKNOWLEDGEMENTS

The success of the modeling workshop described herein is largely attributable to the support that we received from a variety of sources. We would like to take this opportunity to express our sincere thanks to the many individuals involved.

First and foremost, we wish to thank those who participated in the workshop. Their professional expertise, dedication, and hard work made our job as workshop facilitators immeasurably easier and more enjoyable. These individuals include:

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We apologize to anyone who was inadvertently omitted from this list.

Secondly, we wish to express our appreciation to R. J. Bruning and Nancy Rockwell for providing us the opportunity to conduct the workshop described herein. We can only hope that the results of the workshop justified their confidence in us. Additionally, their staffs, along with personnel from the U.S. Fish and Wildlife Service Bismarck Area Office, were very helpful in providing the logistical support so necessary for a successful workshop. Their assistance is gratefully acknowledged.

Finally, we wish to thank Pete McNamee of Environmental and Social Systems Analysts Ltd., Vancouver, British Columbia, Canada, for his assistance as a facilitator. His technical competence and good humor were of immeasurable value.

Despite the quality of the aforementioned support, errors of fact and interpretation may still remain. For these we take full responsibility. They are in no way the fault of any other persons who participated in this effort.

INTRODUCTION

On August 19, 1980, the Governor of North Dakota and the Assistant Secretary for Fish and Wildlife and Parks, Department of the Interior, jointly signed a letter (Appendix A) establishing a study group to address two separate questions: 1) mitigation for the Garrison Diversion Project, and 2) planning for long-range protection and preservation of fish and wildlife habitat in North Dakota. The cochair of the study group, the Interior Secretary's Field Representative, Denver, Colorado, and the Natural Resources Coordinator, Governor's Office, Bismarck, North Dakota, further articulated the charge for Long-Range Protection and Preservation Planning for Fish and Wildlife (Appendix B) into three steps:

Step 1. Develop a general plan for preservation and protection of migratory waterfowl and their associated wetland habitat.

Step 2. Conduct a comprehensive analysis of methods to successfully achieve the goals established in Step 1, including constraints and impediments to achieving those goals.

Step 3. Establish a coordinated state-federal public information program to assist in plan implementation.

The cochair anticipated the need for input from a broad range of interests to accomplish Step 2 because of the wide segment of the population of North Dakota that will be affected by any strategies for preservation and protection of wetlands. To assist the study group in beginning the identification and analysis of alternative strategies and constraints to implementation of those strategies (Step 2), the co-chair sponsored a five-day workshop concerning preservation of wetlands in North Dakota. The workshop was held in Bismarck, North Dakota, December 8-12, 1980, and involved approximately 25 invited participants. This multidisciplinary group included policy, managerial, and technical experts from the array of interests that will be affected by the strategies eventually selected.

The workshop was planned to provide an informal atmosphere for the participants to address the objectives of: 1) identifying alternative strategies for preserving and enhancing waterfowl production habitat; 2) identifying opportunities and constraints associated with these alternatives; and 3) promoting communication and understanding of the implications of the alternatives for all affected parties. The Adaptive Environmental Assessment (AEA) Group of the U.S. Fish and Wildlife Service (FWS) facilitated the workshop, whose focus was the construction and examination of a computer simulation model of the wetland protection issue.

MODELING WORKSHOPS

Developed at the Institute of Animal Resource Ecology, University of British Columbia, by Holling (1978) and his co-workers, Adaptive Environmental Assessment (AEA) modeling workshops evolved as a result of experience in environmental impact analysis in a vareity of international settings. Typical examples of these experiences include: renewable resource management and disease control in Venezuela and Argentina; range and wildlife management in the United States; developmental and oceanographic problems in Europe; ecological process studies in the USSR; and renewable resource and pest management systems in Canada.

Through the course of these experiences, Holling and his staff developed an approach that involves decisionmakers, planners, scientists, and other interested parties in a series of highly structured workshops. The focal point of these workshops is the construction and refinement of a simulation model of the resource system under consideration. In the process of constructing such a model, participants learn that not all components of the system are of equal importance, and that value judgements concerning what to incorporate and what to leave out of the analysis must be made. The press of time restrains scientists from their tendency to subdivide problems into increasingly finer concerns. Managers and administrators become familiar with some of the basic assumptions and limitations of analytical techniques being used, and provide the practical focus necessary to keep the analysis relevant to management issues. Finally, all participants are challenged to communicate clearly and concisely their ideas concerning function of the resource system. There is little room for ambiguity in the formulation of a simulation model,

into subgroups, the participants go through an exercise (Looking Outward) which defines how the components of the resource system interact with each other and, therefore, determines what each subgroup will require as input from the others and what part of the total system model each subgroup will provide as a product. This interdisciplinary exercise helps broaden participants' understanding of the resource system and lays the foundation for developing alternative management actions later in the workshop.

A member of the workshop staff convenes each subgroup meeting. Each subgroup has available to it a list of outputs that will be produced by the other subgroups as well as a list of management actions that it is responsible for representing in the model. Each subgroup must utilize these lists in developing the functional relationships, or rules for change, that describe the behavior of its own component. The outputs of these rules for change are a series of values required as inputs by the other subgroups, and a set of previously identified indicators that are used to measure system performance. The workshop staff member and a designated subgroup leader assist the participants in developing a consensus as to how these variables interact. When two competing perceptions cannot be resolved, both are recorded for later trials in the model. Upon completion of this exercise, the participants return to a meeting of the entire group, and the staff members retire to construct and link their submodels. While the staff is programming the model, the workshop participants consider courses of action (scenarios) that management agencies might take, and record qualitative guesses as to what the response of the model variables will be to these action scenarios.

Once the submodels have been programmed, examined for internal mathematical and conceptual consistency, and linked together by the staff, workshop participants begin a process of model testing. Some of the variable interactions agreed on by the subgroups usually cause the model to exhibit unrealistic behavior. The group may respond by suggesting changes in the forms of these interactions. The workshop staff attempts to incorporate these changes into the model and scenarios are rerun for examination by participants. Through this process, the participants begin to develop confidence that the model conforms to their perceptions of reasonable system behavior. The model that emerges thus represents a group concensus concerning assumptions and behavior. This does not mean, of course, that the model is scientifically accurate or precise, but rather that it represents the group's best estimate of how the resource system functions. The model, while only a caricature of the real world, often has a group perspective vastly superior to that of any individual.

Workshop participants often discover that the behavior of their model is greatly changed by small changes in assumptions about interactions of some variables. Confidence in model behavior is strongly dependent on confidence in those assumptions. Thus, the model-building process focuses attention on areas of uncertainty about the system and, by so doing, identifies priorities for further scientific investigation. Both the model building and testing processes provide an integrated perspective of the resource issue in which consequences of various actions to all interest groups are represented. Both of these processes thus generate interdisciplinary communication and understanding which often result in identification of new potential management

alternatives and opportunities. Typical results of modeling workshop therefore include identification of gaps in the available data and in our conceptual understanding of the resource system, shifting of research priorities to fill those gaps, definition of new variables and indicators for use in managerial decisions, identification of potential management alternatives, identification of monitoring needs, and improved understanding of system interactions through better communication among workshop participants.

In addition, the workshop process contributes greatly to the following aspects of environmental analysis.

a) Problem Definition - Environmental analyses are usually constrained by time and funding. The scope of the impacts to be addressed must be comprehensive in scale, yet prudent in detail. The modeling workshop demands a workable compromise between breadth and depth, resulting in a crisp problem definition.

b) Interdisciplinary Coordination - Explicit in the organization of the workshop and the model is a clear definition of the interdisciplinary data requirements. The model ensures that each investigator knows what information about his discipline is required by other investigators in order to evalute impacts.

c) Dynamics - Environmental studies rarely are carried out over a time span such that a wide range of natural environmental conditions is observed. Therefore, it is generally difficult to differentiate natural changes from environmental impacts of a development.

Modeling is a useful tool to explore different types of natural and development-related changes and to examine the differences between them. Resulting analyses are dynamic and predictive rather than static and descriptive.

d) Uncertainty - Environmental assessments always involve the risk that a fundamental assumption (on which predictions are based) is wrong. The modeling process forces the participants to state and evaluate all assumptions about the system's dynamics. The workshop and the model address alternatives in those cases where assumptions are based on little or no information and potential consequences under different assumptions can be explored.

e) Synthesis - Through enhanced communication and ongoing data integration, synthesis of project(s) results can be done at regular intervals. From the model, the connections between disciplines are well established. Results of each agency's program can be neatly placed within the context of an overall assessment. The final product is a well organized document on which sound recommendations can be based.

The modeling workshop thus provides a good beginning to environmental analysis. Scientists and policymakers from federal, state, and local agencies, as well as affected publics, may participate in and contribute to an integrated systems approach to the assessment process. The interdisciplinary model building approach helps insure that data collection and analysis address relevant issues, focus on key questions and variables, and provide information

responsive to policymaker's needs. Although the first version of the model may be incomplete, it serves to identify relevant information gaps and to provide a framework for the integration of existing and proposed studies. Ideally, additional workshops follow as new information becomes available. The periods between workshops are used for research, data collection, and model refinement. Each subsequent workshop produces a more credible model that is more useful in evaluating management alternatives. At all times, the model is used as a focal point for discussion, as a mechanism for integrating research results, and as a tool for testing the probable consequences of various management alternatives.

THE WORKSHOP MODEL

Simulation modeling must begin with an attempt to bound the system being modeled. Decisions must be made concerning the components that need to be represented in the model and the spatial and temporal scales relevant to those components. The AEA modeling process approaches the bounding problem through a group discussion of actions (those activities that management can undertake to manipulate the system toward some desired end) and indicators (those performance measures used to evaluate response of the system). The discussion subsequently turns to consideration of the spatial and temporal resolution necessary to represent the components and processes implied by this set of actions and indicators. Spatial resolution concerns the geograhic extent to be covered by the model, as well as the degree to which that geographic area needs to be subdivided into smaller units in order to capture the dynamics of the processes involved. Temporal resolution refers to the basic time-step of model calculations and the number of iterations needed to cover the time horizon of interest.

ACTIONS AND INDICATORS

The actions and indicators initially identified at the workshop are shown in Tables 1 and 2. For the purposes of this report they are organized into the groups that became major components (submodels) of the simulation model. Organized in this fashion, the actions and indicators represent the participants' initial definition of the system and its primary components. The items in these lists have been edited and combined in order to avoid the duplication and confusion that inevitably occur during a workshop. Hopefully, all the ideas expressed during the workshop have been retained.

Table 1. Management actions identified at the workshop.

Submodel	Action
Hydrology	- Weather modification (increase rainfall) - Maintain water level in wetlands during drought*
Agriculture	- Increase total agricultural acres and yield per acre - Modify agricultural practices 1) increase irrigated acres 2) shift to continuous cropping 3) alter crops 4) organic and no-till farming* 5) delay tilling* 6) manipulate timing of drainage*
Wetland Values	- Increase wildlife production per acre - Regulate wildlife harvest* - Control predators*
Land Use Changes	- Wetland ownership/protection programs 1) fee acquisition 2) water bank* 3) easement 4) soil bank* 5) tax credit* - Wetland drainage 1) drain additional wetlands 2) drain wetlands into wetlands* 3) regulate and enforce drainage restrictions* - Form wetland conservation districts* - Stop section line farming* - Institute public information and awareness program* - Increase wetland acreage 1) create artificial wetlands 2) reclaim drained wetlands 3) reclaim mining areas to wetlands

* Asterisk indicates that the action was identified, but not incorporated into the model due to lack of time or information.

Table 2. Indicators (performance measures) identified at the workshop.

Submodel	Indicator
Hydrology	- Degree of flooding and flood losses - Flood storage capacity - Condition of wetlands including depth of water - Siltation - Evapotranspiration - Ground water recharge* - Water quality (nutrient and heavy metal removal by wetlands, salinity)
Agriculture	- Agricultural yields, costs, and returns - Noxious weed diversities* - Levels of crop surpluses* - Depredation losses*
Wetland Values	- Waterfowl population levels - Waterfowl breeding habitat and migratory habitat - Dollar value of ducks and wetland recreation* - Wildlife harvest and number of hunters* - Nesting success of waterfowl species* - Other wildlife population levels*
Land Use Changes	- Costs of ownership/protection programs - Acres of wetland drained by land type - Acres of wetland remaining by land type - Number of wetlands drained by land type* - Agricultural suitability of acquired lands* - Other variables identified: 1) vulnerability of wetlands to drainage* 2) spatial complexity and the location of wetlands on farms and ranches* 3) world food demand* 4) salt-affected acreage* 5) energy development effects*

* Asterisk indicates that the variables was identified, but not incorporated into the model due to lack of time or information.

SPACE AND TIME

There was considerable discussion about the proper spatial scale for addressing the actions and indicators in the context of workshop objectives. Three basic levels were identified: 1) a series of small, coupled farms in which relative locations and hydrologic relations among various wetlands and agricultural fields could be specified; 2) a hypothetical watershed representing a composite of regionally "typical" conditions in the Drift Plain; and 3) a whole state level, composed of the Red River Valley, the Drift Plain, the Missouri Coteau and the Southwestern Slope Region, which could directly address state-wide waterfowl population goals in relationship to Flyway objectives. The hypothetical watershed level was selected as a compromise by the workshop participants. As a result of selecting this level of spatial resolution many aspects of the system's dynamics and a number of management actions dependent on specific spatial relationships were "averaged out" and could not be effectively incorporated in the model. A coupled series of small, detailed farms or watershed units would have allowed a more effective treatment of these aspects. However, it sould have been less conveniently related to state-wide planning goals and regional data bases.

The hypothetical 1,000,000 acre watershed was divided into the following five land types based on Circular 39 (Shaw and Fredine, 1956) wetlands classification criteria: Type I wetlands (seasonally flooded basins or Flats), Type II wetlands (shallow, inland, freshwater marshes), Type IV wetlands (deep, inland, freshwater marshes), Type V wetlands (open, inland, freshwater, shallow ponds and reservoirs), and other (including agricultural and idle land).

Six agricultural activities were identified which could take place on land in the "other" type or in some cases on wetland types during dry conditions. These classes of agricultural activity were row crops (sunflowers), small grains (wheat), tame hay (as a crop), summer fallow (as part of a crop rotation scheme), grazing, and idle.

Five ownership/protection programs were defined: private, public (including refuges, waterfowl production areas, and state lands), long-term (in perpetuity) easement, short-term (3-10 years) easement, and water bank. The hypothetical watershed was defined (Table 3) in terms of the initial conditions for the various land types and ownership/protection programs. The initial model parameter values were based on "typical" conditions in the drift plain.

The time horizon for the model was set at fifty years with a time step of one year. Several of the Hydrology Submodel variables (such as precipitation) were separated by season (November-March, April-May, June-August, September-October) within the annual time unit used by the overall model.

MODEL COMPONENTS AND THE LOOKING OUTWARD MATRIX

The next step in the workshop process was to identify the linkages between the general components or submodels shown in Tables 1 and 2. The mechanism for identifying these linkages is known as a Looking Outward Matrix. The submodels or components are arrayed as both the row and column headings of a matrix. For each of the matrix elements representing an interaction between

Table 3. Hypothetical watershed characteristics and initial conditions.

AREA: 1,000,000 acres

REGION: Typical of North Dakota drift plain.

LAND TYPE	INITIAL ACRES IN VARIOUS OWNERSHIP/PROTECTION PROGRAMS				
	Private	Public	Long-term easement	Short-term easement	Water bank
Type I Wetland	5,568	670	22,400	0	0
Type III Wetland	63,744	4,168	5,600	0	4,000
Type IV Wetland	10,208	242	0	0	0
Type V Wetland	9,280	130	0	0	0
Other	822,846	39,144	0	0	12,000

two components the following question is asked; "In order to represent the dynamics of the submodel in this column, what information is required from the submodel in this row?" In addition to identifying linkages between the model components, the process of constructing such a matrix is extremely useful in promoting interdisciplinary communication and understanding. Workshop participants are forced to look carefully at the kinds of information that they can reasonably expect to obtain from other disciplines (i.e., how their submodel dynamics are influenced by other submodels), and the kinds of information other disciplines expect from them (i.e., how their submodel influences the dynamics of other submodels).

The Looking Outward Matrix constructed at the workshop is shown in Figure 1. For purposes of this report, the matrix has been edited to avoid duplication. Most of the variables transferred among submodels concern acres of various land types, in various agricultural activities, in various ownership/protection programs subject to specific hydrologic conditions (covered with water).

Following the Looking Outward exercise, the workshop participants met in smaller "subgroups," one for each of the major components, to construct a conceptual model representing the internal dynamics of that component. The basic charge of each of these subgroups is summarized in Figure 2, which is interpreted as follows: given a set of actions that you must represent in the model, and a set of inputs from other subgroups, describe the mechanisms and processes that occur in your component to produce the set of indicators that you must represent and the outputs required from you by other subgroups. The structure of the model resulting from these subgroup meetings is summarized in the following section.

MODEL STRUCTURE

The overall structure and order of calculation of the model is summarized in Figure 3. For each annual iteration the Hydrology Submodel calculated seasonal precipitation inputs, soil moisture, acreage covered with water by land type, and runoff. The Agriculture Submodel used these inputs to calculate acres in various agricultural activities, yields per acre, desired wetland drainage, and desired participation in various ownership/protection programs. The Wetland Values Submodel next calculated breeding waterfowl population levels, migratory waterfowl habitat, priorit of participation in various ownership/protection programs, determined goals for acres of wetland acquisition, and priorities for wetland types. Finally, the Land Use Changes Submodel modified the acreage in various land types and ownership/protection programs and calculated the cost of acquisition and protection programs based on desired wetland drainage, desired participation in ownership/protection programs, and available funds. The entire sequence was then repeated for the desired number of annual time steps.

Hydrology Submodel

Responsibilities. The Hydrology Submodel was responsible for generating the rules describing seasonal changes in precipitation, soil moisture, runoff, siltation, and corresponding changes in the number of acres of each wetland type actually covered by water. It was recognized that the size of wetlands varies both seasonally and annually as a result of differences in precipitation. This means that wetlands probably have a maximum potential size, which results when rainfall is extremely high, but that at most times only part of that

Figure 1. Looking outward matrix for interactions among submodels.

FROM THIS SUBMODEL:	THIS SUBMODEL NEEDS INFORMATION CONCERNING: Hydrology	Agriculture	Wetland Values	Land Use Changes
Hydrology		Acres not covered with water (by land type and season) Precipitation and soil moisture (by season)	Acres covered with water (by land type and season) *Number of wetlands	*Long-term climate *Short-term climate
Agriculture	Acres in various agricultural activities (by land type)		Acres in various agricultural activities (by (land type)	Private acres available for various ownership/protection programs (by land type) Additional drainage acres desired (by land type) *Profit potential (by land type) *Grain prices *"Nuisance" costs (by land type)
Wetland Values		*Depredatory bird population levels *Noxious weed population levels *Non-agricultural revenues (hunting leases)		Acres of wetlands desired (by land type)
Land Use Changes	Acres of various land types	Acres of various land types (by ownership/protection program) *Dollars received from acquisitions and easements (by land type and ownership/protection program)	Acres of various land types	

* Asterisk indicates the variable was not explicitly incorporated due to lack of time or information.

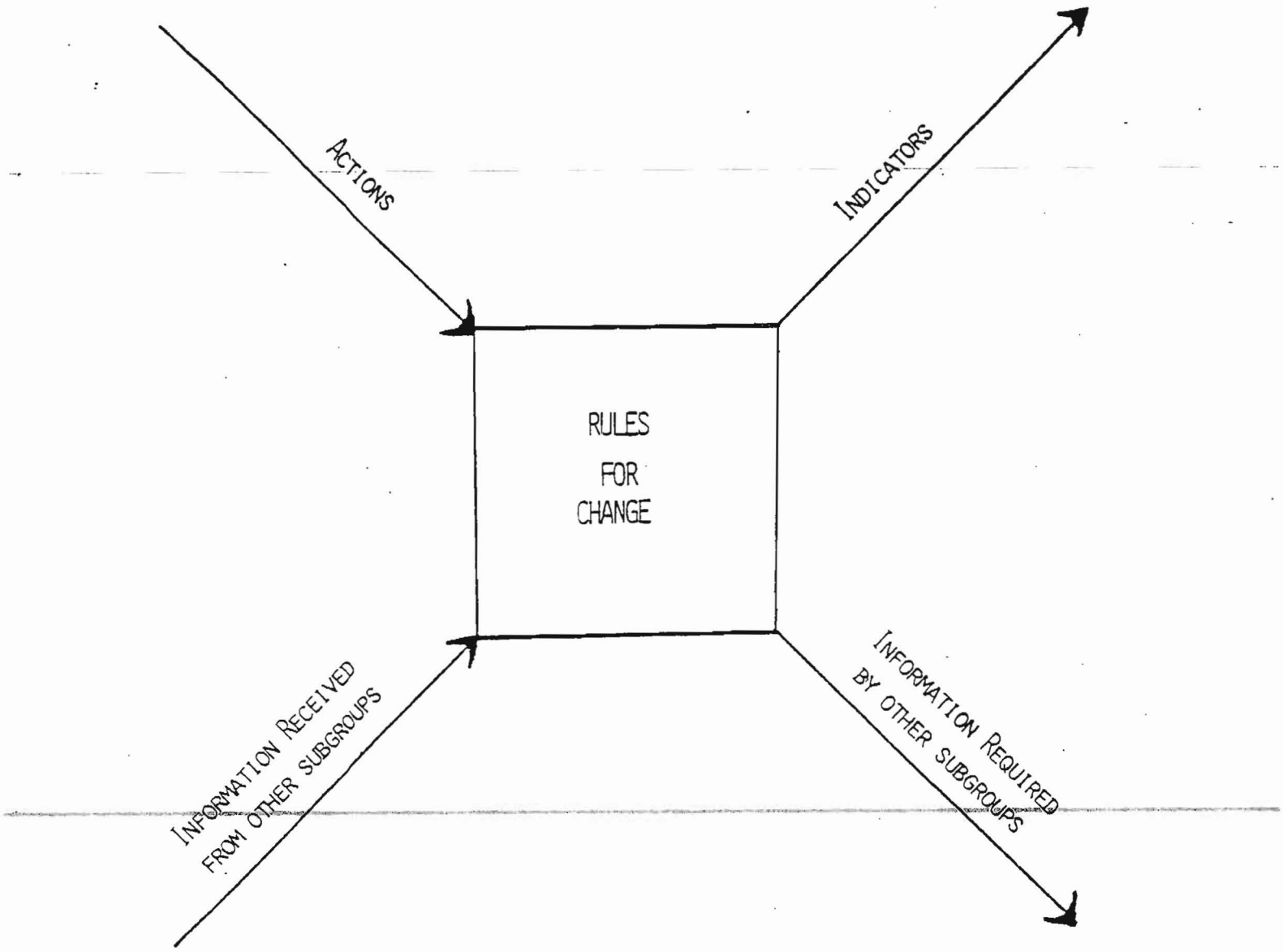

Figure 2. Diagram illustrating basic subgroup responsibilities.

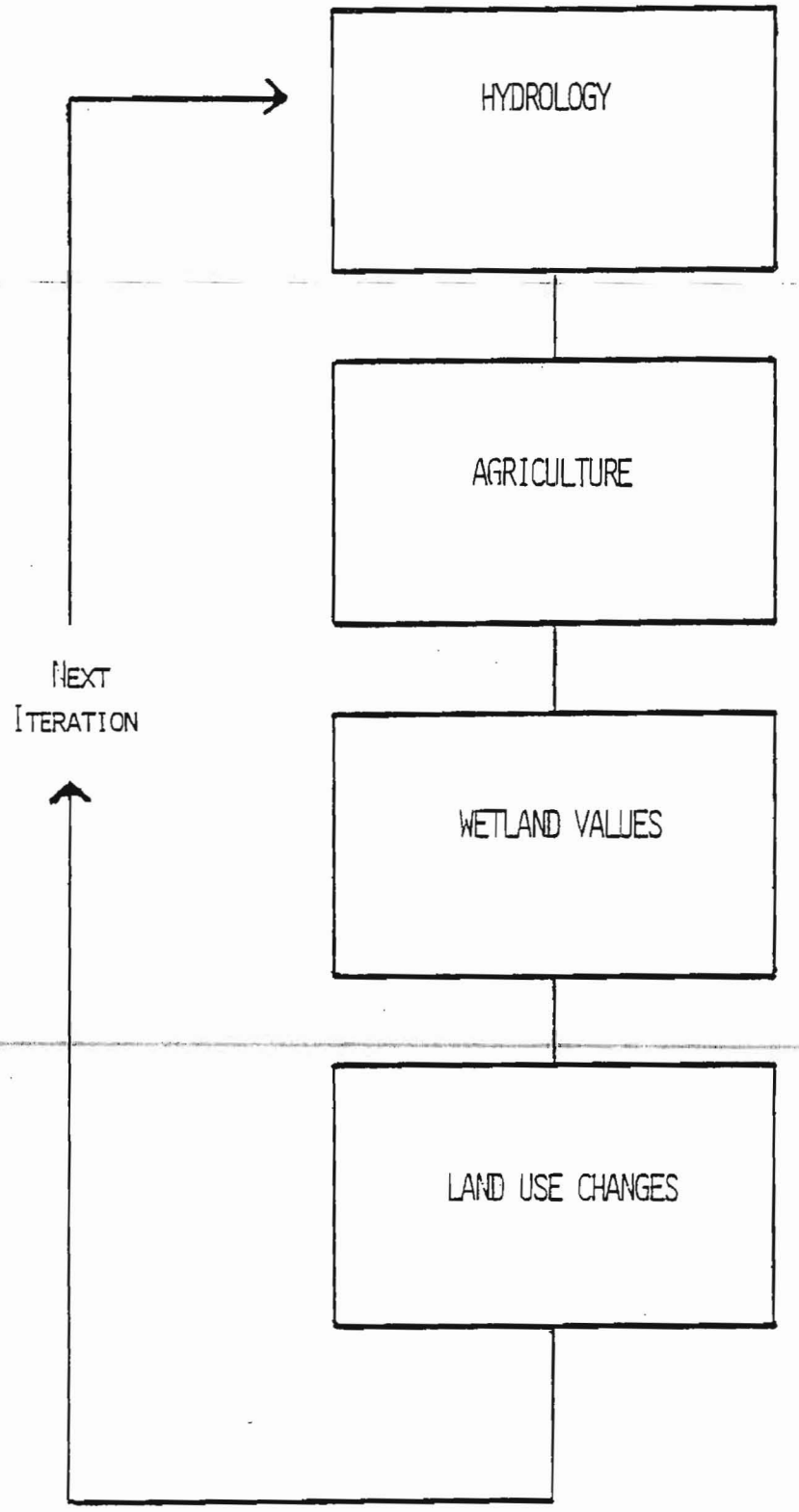

Figure 3. Model structure and order of calculations.

potential area is actually covered by water. In fact, Type I wetlands often dry out completely by summer. A distinction was therefore made between those acres of potential wetland which are actually covered by water at any given time, and those acres of potential wetland which are dry at that time. The Wetland Values Submodel utilized the number of acres of each wetland type covered by water in the spring and in the fall in the calculations of breeding and migratory waterfowl habitat. The Agriculture Submodel used spring soil moisture, summer precipitation, and the number of acres of each wetland type not covered with water in the spring as part of the calculations for crops planted and subsequent yields.

Modeling Approach. Although the time step for the workshop model was one year, it was decided based on hydrologic considerations and information needed by other submodels, that calculations in the Hydrology Submodel would be performed seasonally. These seasons corresponded approximately to winter snow accumulation (November-March); spring thaw, spring rains, agricultural planting, and waterfowl breeding (April-May); summer agricultural production (June-August); and fall waterfowl migration (September-October). It was recognized that the Hydrology Submodel should be keyed to individual precipitation events rather than seasonal averages but time constraints precluded this additional temporal resolution. It was also recognized that spatially the Hydrology Submodel should be based on a watershed subdivided to reflect the location of each wetland within the watershed and the pattern of drainage between wetlands. Time constraints also precluded this finer level of spatial resolution so it was assumed that wetlands were distributed randomly in the watershed and model coefficients were adjusted to approximate effects of drainage between wetlands.

A series of annual precipitation values and distribution of that rainfall by seasons was generated from statistical properties of the 30-year precipitation record from the Devil's Lake area. The mean, standard deviation, and minimum and maximum values of the annual precipitation series could be modified to represent different geographical areas or weather modification programs. Soil moisture was calculated from those seasonal precipitation values. Runoff calculations were based on the Soil Conservation Service's curve-number technique which indicates the amount of runoff per acre resulting from different rainfall intensities on land in different agricultural activities. In the Hydrology Submodel, these curve-number data were weighted by the number of acres in each agricultural activity and modified based on soil moisture at the end of the previous season to determine total potential runoff. Actual runoff was calculated as total potential runoff minus that portion of runoff stored in wetlands. The amount of water stored in wetlands was a function of the storage capacity of each wetland type, the number of acres of each wetland type, the number of watershed acres draining into each wetland type, the amount of water already stored in each wetland type at the end of the previous season, loss or gain of water associated with groundwater, evaporation, precipitation, total potential runoff, and storage lost due to siltation. Siltation was assumed to be a constant 5 tons per year per acre of tilled agriculture. Storage lost by each wetland type due to siltation was calculated from this rate and the number of watershed acres which drain into each wetland type. The acreage of each wetland type actually covered by water was calculated from crude stage-area relationships based on the amount of water stored in each wetland type.

Agriculture Submodel

Responsibilities. The Agriculture Subgroup was responsible for determining rules to calculate the acreage in various agricultural activities (row crop, small grain, hay, summer fallow, grazing and idle), crop yields, and economic costs and returns. In addition the Land Use Changes Submodel required an estimate of desired wetland drainage in acres and the maximum level of participation at fair market value in various ownership/protection programs (in units of acres by land type). Lack of time, programming constraints and differences in the participants' perceptions of the economic and attitudinal factors governing participation in various wetland ownership/protection programs forced a relatively simple representation of this aspect. The Land Use Changes Submodel description contains a more detailed discussion of these problems.

All economic calculations were based on current prices and costs assuming no inflation. Thus, dollar values over time are relative indicators only.

Modeling Approach. The Agriculture Submodel began with a determination of acreage available for agricultural use based on the constraints of various ownership/protection programs and hydrologic conditions. Land in the water bank protection program was not available for agriculture. A fraction of the suitable land in public ownership was available for agriculture (primarily hay crop and grazing), while all the suitable land in private ownership and long-term easement was available. The short-term easement program was not utilized in actual simulation runs during the workshop due to programming difficulties.

Agricultural activity was assumed to occur on the other and Type I wetland land types only. The remaining land types (Type III, Type IV, and Type V wetlands) were placed in the idle agricultural activity class.

Agricultural activities in the other land type were set as 1/6 grazing, 1/6 hay, and 2/3 crop rotation. Two crop rotation schemes were identified. The first rotation consisted of summer fallow, small grain, row crop, etc. Row crops were represented by sunflowers and small grains by wheat. The continuous cropping rotation consisted of alternating small grain and row crops. The proportion of arable land in each activity was calculated based on its representation in the rotation schemes and the relative importance of the two rotation schemes. Land which would have been in summer fallow was placed in crops if soil moisture was high in the spring of any particular year. In addition, an expected transition between the initially equal importance of each crop rotation scheme toward more continuous cropping was represented as a constant percentage transfer to continuous cropping. The Hydrology Submodel provided the acres of Type I wetland which were suitable for planting (not covered with water) in the spring of a particular year. These acres were allocated to the various agricultural activities according to the same rules used for the other land type. The remaining Type I wetland acres available for agriculture were allocated to hay and grazing activities.

Yields per acre for the various agricultural activities were calculated as a base yield for each activity plus an incremental yield directly proportional to the water added during the growing season (either by precipitation or irrigation) up to a maximum yield for each crop. The identified maximum yields were constrained by the genetic potential of the crops and the maximum

number of acres with suitable soil which could be irrigated from available groundwater supplies. Dollar values were assigned to various yield types (tons, bushels, etc.) based on current prices and summed over agricultural activities and acres to generate total agricultural return.

Agricultural costs were calculated as the sum of basic operating costs for various activities including amortization of basic capital expenditures, land taxes, amortization of capital expenditures for irrigation (irrigated acres only) and operating costs for irrigation water (irrigated acres only). Additional desired drainage (required by the Land Use Changes Submodel) was calculated as a fraction of the private ownership acres in various wetland classes, unless summer precipitation was substantially above normal in which case drainage was not requested for that year due to the difficulty of conducting drainage operations.

The private acres available at fair market value for various ownership/protection programs by land type were required by the Land Use Changes Submodel. The maximum currently available acreage for each ownership/protection program by land type was determined by a concensus of the participants representing agricultural interests. Acreage available for participation in a given year was based on the difference between current participation in each ownership/protection program by land type and maximum participation in acres. A program acceptance factor (initially set to 1.0) was included in the model to increase or decrease the maximum available acres based on changes in the perceived desirability of the respective programs (as a result of changes in program management or public education).

Wetland Values Submodel

Responsibilities. The Wetland Values Submodel was responsible for the rules relating acreages by land type (from the Land Use Changes Submodel), agricultural activity (from the Agriculture Submodel), and water conditions (from the Hydrology Submodel) to nonagricultural, nonhydrological values of wetlands. In addition, the Wetland Values Submodel was responsible for producing (for use in the Land Use Changes Submodel) the number of acres of each land type desired in protection programs.

Modeling Approach. The Wetland Values Subgroup considered values of wetlands arising from their use by breeding waterfowl, migratory waterfowl, other aquatic wildlife, and nonaquatic wildlife. Recreational opportunity was also identified as an extremely important value of wetlands, but was not incorporated in the model due to lack of information concerning the complex of factors (e.g., human population density and proximity to wetlands, weather, wildlife population sizes) that determine levels of recreation use.

Breeding waterfowl population levels in North Dakota appear to be strongly corelated with wetland acreages actually containing water in May, and not strongly related to flyway population levels. This correlation is apparently a result of two factors. First, wetland acreages in North Dakota constitute a relatively small proportion of the total wetlands in the prairie pothole region. Second, breeding habitat in the prairie pothole region tends to be occupied from south to north as waterfowl move northward in the spring. Thus breeding habitat in North Dakota, which is among the first encountered by waterfowl during the spring migration, tends to be fully occupied even during years when the flyway waterfowl population is low.

For this reason the Wetland Values Subgroup determined that it was unnecessary to represent waterfowl population dynamics explicitly in the model. Instead, the following approach was taken for generating an indicator of breeding waterfowl population size. Breeding waterfowl were divided into dabbling ducks and diving ducks. For each of these groups the number of breeding pairs supported by an acre of each land type in each agricultural activity was entered into the model. For any simulation year, the breeding waterfowl population on the 1,000,000-acre hypothetical watershed was determined by multiplying the number of acres of each land type in each agricultural activity actually inundated with water in the spring (as estimated by the Hydrology Submodel) by the number of pairs supported, and summing over all land types and agricultural activities. This approach makes two important assumptions. First, as noted above, it assumes that there will always be sufficient spring migrants to occupy available habitat in North Dakota. Second, it assumes that the wetlands are sufficiently interspersed spatially and have sufficient associated upland habitat to meet the complex habitat requirements of waterfowl and other wildlife.

Indicators representing the value of wetlands for migratory waterfowl (dabbling ducks, diving ducks, and geese) other aquatic wildlife, and non-aquatic wildlife were treated similarly, but placed on relative scales. For each of these groups, each land type and agricultural activity was assigned a relative value (between 0 and 1) reflecting the importance of that habitat to that group. Multiplying these relative values by the simulated acreages and summing over all land types and agricultural activities produced a relative index of the amount of habitat provided for each group. Only those acreages

estimated to be inundated with water were used in computing habitat for migratory waterfowl and other aquatic wildlife. Both wet and dry habitats were used in computing the index for nonaquatic wildlife, since it was felt that the presence of water was not absolutely essential for these species.

The final obligation of the Wetland Values Subgroup, acreages desired in ownership/protection programs, was discharged by setting, at the start of each simulation, the number of acres of each land type desired and a priority order for their acquisition both by wetland type and by ownership/protection program.

Land Use Changes Submodel

Responsibilities. The Land Use Changes Submodel was charged with two responsibilities: first, general bookeeping of total acres in each land type according to the several methods of controlling activities on the land types, and second, administration of the various ownership/protection programs for acquisition and/or management of the land types under public (state or federal) jurisdiction. The subgroup considered fee acquisition, lease-in-perpetuity, short-term renewable lease (up to 10 years), and water bank protection programs. However, after review of the test scenarios, short-term leases and water bank programs were eliminated due to programming difficulties.

Two additional concepts affecting draining and selling of wetlands were considered by both the Agriculture and Land Use Changes Subgroups. The first

of these, whether or not a wetland would be drained, can be disaggregated into three considerations. These deal with the economics of draining including increasing costs for drain construction as the more easily drained wetlands are eliminated, the potential value of the drained wetland for crop production, and the complex interaction of nuisance to present farm operations and how often the area is too wet to farm. This concept was not included in the model because: 1) the geographic scale selected for the model precluded keeping track of the physiographic, hydrologic, and biologic attributes of individual wetlands; 2) there was insufficient available information on either varying costs of drain construction, given various difficulties of drainage, or the potential of a given wetland for crop production (and consequent return on investment); and 3) calculations were too detailed for inclusion in a "first cut" model of economic cost of having to farm around a wetland or costs for lost time and damaged equipment due to farming close to wetlands.

Consideration of willingness to sell produced very different perceptions from the Agriculture and Land Use Changes Subgroups. The Agriculture Subgroup, primarily consisting of individuals with farming and ranching backgrounds, indicated that few individual landowners would be willing to participate in fee acquisition or lease-in-perpetuity programs (a view supported by recent State legislation). The Land Use Changes Subgroup consisted of individuals with extensive experience in the two types of acquisition programs considered in the model and they stated that, within the constraints of program funds, they had not experienced a shortage of willing sellers.

After discussing this apparent anomaly with members of both subgroups we concluded that the differences in perception were (again) one of scale. The most significant factor influencing willingness to sell is apparently landowner age. Individuals approaching retirement often wish to dispose of part of their holdings in these kinds of programs (for a great variety of reasons). Therefore, on the broad scale, only a small percentage of landowners is willing to relinquish control over their land permanently; but, within the constraints of program funds, there has been a sufficient percentage of the landowners willing to divest themselves of land to exhaust the available funds. Consequently, the whole concept of willingness to sell was represented in the model according to the concensus opinion because there was insufficient available information to predict the age composition of landowners over the 50-year period of simulation.

Modeling Approach. The conceptual operation of the fee acquisition and lease in perpetuity protection programs was designed to function, within the limits of available data, as closely as possible to the actual operation of those programs when they were suspended in 1977. Briefly, the Wetland Values Submodel input a request for total (cumulative) acres of wetlands to be protected, the priority in which the various wetland types should be acquired, and the priority for use of protection-program funds. The Agriculture Submodel provided information on number of acres of each type of wetland that the private sector was willing to relinquish to these programs. Finally, the Land Use Changes Submodel purchased the wetlands within these constraints of availability, demand, and funds and moved them from the private account to the appropriate ownership/protection program account.

Drainage of wetlands by agriculture was handled more simply as a bookkeeping operation moving wetland acres from the wetland type accounts to the "other" category for use by agriculture. The only model constraint on wetland drainage was availability of wetland acres under control of the private sector.

The Land Use Changes Submodel then calculated annual and cumulative total values for: 1) member of wetland acres (by type) acquired by the two protection programs; 2) dollars expended in the acquisitions; 3) acres of wetlands drained; and 4) payments made in lieu of taxes.

The updated information on number of acres in each of the land types and ownership/protection programs was then passed to the Hydrology Submodel.

WORKSHOP RESULTS

Simulation models, including the one constructed during the course of this workshop, are oversimplifications of real world systems; systems that we usually do not fully understand. Nevertheless, the process of building such models and examining their behavior under a vareity of conditions can contribute significantly to our understanding of the systems they represent.

The process of building an interdisciplinary simulation model requires participants to state openly and explicitly their understanding and assumptions about how a resource system operates and how the various parts of the system are interconnected. Important conceptual and information gaps are

easily identifed, and research efforts can often be refocused in an attempt to fill those gaps. The interdisciplinary nature of such a model serves to heighten awareness of the linkages between the important components of the system.

While simulation models, especially those constructed during a time frame as short as a week, are seldom precise or accurate enough to be used for predictive purposes, examination of the qualitative behavior and general trends in model output can also improve our understanding of system function. The implications of the linkages established during the model construction phase can be examined in terms of the ways in which the consequences of individual actions are propagated through the system. By comparing participants' perceptions about how a resource system would behave under various management actions with model results under those same actions, the limits of the model's credibility can be established. Differences between expected (in the real world) and model results indicate errors either in model formulation or in participants' understanding of the consequences of the management actions. In the former case, alternative model formulations are easily examined. In the latter, an understanding of why the model produced unanticipated results often suggests other management actions that are more likely to lead to the expected outcome, both in the model and in the real world.

The process of building and testing a simulation model thus provides a more integrated picture of the resource issue to all of the interests participating in its construction. As such, the model building and testing process

is well suited to the objectives of this workshop--identifying alternative strategies, identifying opportunities and constraints, and promoting communication and understanding. In the following sections we attempt to summarize the results of the workshop in terms of these objectives.

MODEL RESULTS

On the final day of the workshop, participants used the workshop model to explore the possible consequences of various combinations of management actions (scenarios). The basic scenarios included:

Scenario 1.

a. drain all privately owned Type I and III wetlands and convert them to small grains and row crops.

b. convert all fallow, hay, and grazing lands to small grains and row crops.

c. use continuous cropping agricultural practices.

Scenario 2.

a. drain all privately owned Type I and III wetlands and convert them to small grains and row crops.

b. convert all hay and grazing lands to small grains and row crops.

c. use summer fallow agricultural practices.

Scenario 3.

a. convert all public land to private ownership and implement conditions of Scenario 1.

b. eliminate all wetland protection programs.

Scenario 4.

a. eliminate all wetland drainage.

b. create 50% more Type I, III, and IV wetlands.

c. increase average precipitation by 10% through cloud seeding.

d. put 75% of privately owned wetlands in protected status.

As results of these scenarios were presented and discussed, participants suggested a number of additional scenarios involving various mixes of agricultural practices, wetland drainage rates, and wetland protection and restoration programs. The results of these model runs and associated discussions provided some interesting insights into model function and, consequently, the wetlands issue.

In general, the workshop model indicated that draining Type I and III wetlands and converting them to agricultural use did not significantly increase total agricultural production in the hypothetical watershed. The number of acres in Type I and III wetlands was small in comparison to the number of acres in agricultural production. Bringing the wetland acres into production thus had little effect when averaged over the entire watershed. In reality, of course, production from drained wetlands could well be very important to an individual land owner. A revised model with finer spatial resolution would be useful in examining this question, as well as others concerning advantages, disadvantages, and economic feasibility of various programs to individual farmers.

Under several scenarios, the workshop model indicated that draining Type I and III wetlands in private ownership did not result in significantly higher runoff to the river; that is, storage capacity of these wetlands in the model was small in comparison to total runoff from the watershed. At least two factors account for this. First, the technique used to determine total runoff was developed for individual precipitation events, rather than average seasonal precipitation, and tended to overestimate runoff when applied to long time periods. Second, runoff usually passes through a series of wetlands before entering a river. This degree of spatial complexity could not be represented in the workshop model, however, and any wetland that overflowed was assumed to do so directly into the river. Although model parameters were adjusted in an effort to compensate for this simplification, participants felt that the workshop model probably still underestimated the actual flood storage capacity of wetlands. Despite this difficulty, the scenario results did serve to remind participants that wetland type, size, and location must all be considered

when assessing the utility of wetlands for flood control purposes. Finer spatial and temporal resolution in the model would of course have allowed more explicit analysis of the importance of these factors.

As expected based on the way in which the Wetland Values Submodel was formulated, model behavior under the various scenarios indicated a close tie between wetland acreages, as modified by drainage patterns, agricultural practices, and precipitation, and waterfowl use. Spring migration habitat and breeding populations of dabblers tended to be more affected by drainage of Type I and III wetlands, while fall migration habitat and diver breeding populations were more responsive to acreages of the deeper, more permanent wetland types. The other general result was that wetland protection and enhancement programs tended, not surprisingly, to be more effective if implemented sooner rather than later. This was of course due to the fact that early implementation of model policies allowed them to operate on a larger wetland base.

One problem that was never adequately resolved occurred at the interface between the Agriculture and Land Use Changes Submodels--how to model the wetland acreages that would be available from willing sellers under various programs and price structures. While model representation of this process was not good, there seemed to be a general concensus among participants that the future effectiveness of the FWS Small Wetlands Acquisition Program (SWAP), even if reactivated in North Dakota, in reaching long-term habitat protection goals, is likely to be limited by availability of funds, availability of willing sellers, or both. To the extent that this is true, achievement of long-term habitat protection goals will require alternatives to SWAP, and the

sooner such programs are designed and implemented, the more likely they are to be successful. We turn now to a discussion of some general considerations that will likely be important in determining the effectiveness of any future protection programs, followed by a brief description of several specific alternatives suggested at the workshop. It should be noted that the section on general considerations represents our interpretation of the interactions that occurred at the workshop. We hope that we have adequately captured the opinions of those present.

OPPORTUNITIES AND CONSTRAINTS

General Considerations

Perhaps the most fundamental perception arising from workshop discussions concerns FWS goals for waterfowl production and wetland habitat preservation. Many people in North Dakota seem to feel that such goals have never been explicitly stated and that opportunity for state input to the goal-setting process has been minimal. This concern was very evident during the first day of the workshop when much of the discussion centered around goals and objectives, or the lack thereof. A clear, concise statement concerning continental waterfowl goals, the processes, both numerical and institutional, by which those goals are allocated among flyways, regions, and states, and the rationale for a wetland protection program based on those goals, would go a long way toward improving understanding and cooperation in North Dakota. Even a provisional statement reflecting current understanding and reserving the right of modification as understanding improves would be extremely useful. In addition, such a statement should reflect to the greatest degree possible that waterfowl

populations are only one of a variety of values arising from wetland habitat preservation. The general plan being developed in Step 1 (see the Introduction section in this report) of the current state-federal planning effort should be an important step in the right direction.

A second general impression arising from the workshop was that cooperative programs emphasizing multiple use practices are preferable, from the point of view of the private land owner in North Dakota, to outright federal acquisition programs. Cooperative programs have the virtue of maintaining the maximum amount of land in private ownership and are most in keeping with the individualality and independent nature of agricultural interests in North Dakota. From the current federal point of view, cooperative programs may be somewhat less attractive because they lack the permanency of outright acquisition.

A related point concerns the perception of several workshop participants that FWS programs as a whole would be more effective if lands already in federal ownership were better managed. Several examples of poor waterfowl productivity and unexercised opportunities for multiple use on refuges were mentioned during the workshop. Against these claims, of course, must be weighed the fact that refuges are established with a specific primary use, and that other activities must be consistent with and subordinate to that primary use.

A fourth point that became apparent during the workshop was that short-term (say, up to 10 years) programs are likely to be more appealing to agricultural interests than are long-term or in-perpetuity programs. Land owners feel that short-term alternatives maximize their flexibility to cope with the vagaries

of weather and markets. Once again, lack of permanence may make such programs less desirable from a habitat protection point of view. Tax credits, however, did not seem to be a particularly desirable alternative, even though they might be easily applied on a short-term basis. The tax structure in North Dakota is such that credits would not normally be sufficient incentive for maintaining wetlands in lieu of using them for agricultural production.

Which brings us to a final point concerning general attitudes. The perception of many of the wildlife resource interests at the workshop seemed to be that private land owners in North Dakota always want to be compensated for maintaining wetland habitat. While this may be understandable from a financial point of view, wildlife resource interests feel that such an attitude fails to recognize a very fundamental responsibility for the stewardship of land and preservation of public resources of significant value to the citizens of North Dakota, the United States, and indeed, the entire continent.

We reiterate that the items mentioned above represent only our perceptions of the attitudes and opinions expressed at the workshop. We discuss them here not from the point of view of determining good or bad, right or wrong, but rather in the realization that they represent legitimate points of contention and concern that will have an important bearing on the success of any future programs. Despite the differences in opinion noted above, the prevailing attitude at the end of the workshop was one of cooperation and a willingness to move ahead in the search for successful solutions to the wetland protection issue. In that spirit several interesting alternatives were discussed in some detail.

Specific Alternatives

Several of the alternatives discussed were related to the idea that it is not always necessary nor indeed even desirable (from an agricultural productivity or flood control point of view) to maximize the speed with which water is removed from the land surface. For example, it is possible that some drained wetlands (especially Type I's, but perhaps also Type III's) could be reflooded at times when the fields encompassing those wetlands are to be placed in summer fallow. Under this scheme the drainage channel for such wetlands would be closed in the fall preceeding the year of summer fallow. In many cases, this would apparently require only use of a scraper to fill the drainage channel and/or construct a small berm to retain water. In other cases more sophisticated control gates might be required. Areas so flooded would be much more useful to wildlife if they were left in stubble rather than plowed. Water would be retained on these areas at least through the fall, winter, and spring preceeding summer fallow, and perhaps through the summer fallow period itself. Such a scheme would probably be acceptable to agriculturalists as long as the purposes of summer fallow (soil moisture retention and weed control) continued to be met. Timing of water releases would be important in order to insure that fields would dry out in time to be worked. This approach would have less utility, of course, if agriculture tends away from summer fallow practices and toward continuous cropping.

An extension of this basic idea, however, would have utility even in the absence of summer fallow practices. It was suggested that water could be held in many Type I wetlands through about May 15th, even in those years when the wetland area is to be cropped, without detriment to agricultural productivity.

Timing of releases would again be important to insure that the ground was dry enough to be worked by late May. Smaller drains that would allow water to be released more slowly might be sufficient to carry out this type of program. In other cases, self-regulating gates might be used effectively.

A third example of the potential utility of water retention programs involves the road system in North Dakota. In the pothole region roads are often constructed by dredging material from the roadsides and piling it in the middle to form a raised roadbed. The resulting roadside ditches form a large interconnected drainage system and, indeed, drainage of agricultural lands into this system is apparently common. Simple gates installed at strategic points in this system might be used effectively to increase flood storage potential and provide additional wetland habitat.

Several other alternatives discussed at the workshop centered around the basic notion of using available, uncommitted water supplies to enhance or create wetlands. It was suggested that current and proposed water development projects, both large and small scale, might be slightly modified or expanded to provide water when and where it is needed for wetland management. Such a plan might be useful, for example, in providing a more dependable water supply to refuges during times when lack of water and concentration of waterfowl can lead to serious disease problems. During dry springs, water management might also be useful in maintaining wetlands that would otherwise be unusable by waterfowl. Water made available in this manner might also be used to create wetlands by damming wide, flat coulees that exist in some areas of the state. Of course, water management plans of this sort would have to be developed with the recognition that a certain amount of drying and reflooding is both normal and necessary for wetland maintenance.

A related suggestion involved the use of irrigation systems to maintain wetlands during dry springs. The basic notion is that there may be cases where farmers, in return for some compensation, would be willing to pump groundwater through their irrigation systems for wetland maintenance at times when natural precipitation is insufficient.

The potential for re-establishment of "unsuccessfully" drained wetlands also offers some hope in the overall picture of wetland protection. There apparently exist rather large wetland acreages (the figure mentioned at the workshop was 10% of the total drained thus far) on which drainage has been attempted but which are still too wet to be consistently usable for agriculture. It is possible that a program to acquire and rehabilitate these wetlands might have rather broad applicability. Alternately, such wetlands could perhaps be rehabilitated first and then acquired through existing programs.

The workshop was thus successful in accomplishing the first two of its objectives--identification of alternative strategies, opportunities, and constraints. Nevertheless, we recognize that none of these alternatives offers a complete solution to the issue of wetland protection in North Dakota. In most cases the acreages that could be affected are probably small. With this limitation in mind, it seems likely that the most important result of the workshop concerns the third objective--promotion of communication and understanding. It was gratifying and encouraging to see the spirit of open communication and cooperation that developed by the end of the workshop. The fact that representatives from the various interests concerned with the wetlands issue participated in an open exchange of ideas and information marks an important step forward. We believe that it is imperative that this spirit of

cooperation be nurtured and maintained, and that there are a variety of ways in which this might be accomplished. Perhaps the simplest of these strategies concerns research needed to determine the affects of some of the suggested alternatives.

RESEARCH AND DATA NEEDS

The most obvious data need common to all of the alternatives mentioned above is the extent and location of wetlands that could be impacted. Such information is absolutely necessary for determining the potential utility of any alternative in an overall protection program. The FWS Wetlands Inventory will undoubtedly make a significant contribution toward filling this crucial information gap. Unfortunately, the Wetlands Inventory in North Dakota is not scheduled for completion for another 2-3 years.

In the interim, we suggest that the feasibility of some of the alternatives listed above could easily be determined experimentally. For example, consider the idea of retaining water in Type I wetlands during periods of summer fallow. The impacts of this practice on soil moisture, weed control, and agricultural productivity could be measured quite simply in a relatively short period of time. If necessary, wildlife use of such areas could also be monitored simultaneously though there seems to be little doubt that such areas would in fact be used. In addition to contributing significant data, such a simple project would be an excellent starting point for the kind of cooperative effort that will be necessary to insure a successful habitat protection program in North Dakota.

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APPENDIX A

CHARGE TO SPECIAL STUDY GROUP

ON ACQUISITION OF LANDS FOR WILDLIFE IN NORTH DAKOTA

CHARGE TO SPECIAL STUDY GROUP
ON
ACQUISITION OF LANDS FOR WILDLIFE
NORTH DAKOTA

I. BACKGROUND

The question of the purchase of lands or interests in lands in North Dakota for the purpose of preserving fish and wildlife habitats has become a controversial one. The controversy stems primarily from the fact that the purchase of private lands for wildlife purposes has assumed a level of public concern of major proportions because of the controversy about the Garrison Project.

The U.S. Fish and Wildlife Service has for many years purchased lands or interests in lands in North Dakota for the purpose of providing habitat necess for the production of migratory birds, principally waterfowl. With the advent of the Garrison Project, the question of lands needed to mitigate the wildlife habitat losses occasioned by the Garrison Project has arisen, and in the minds of the public the two basic efforts--the purchase of wildlife habitats to insu the continued production of migratory birds in the pothole region of the upper midwestern United States and the purchase of land to mitigate losses associate with the Garrison Project--have joined to create serious misunderstandings and conflicts.

In mid-July 1980 the Assistant Secretary for Fish and Wildlife and Parks and th Director of the U.S. Fish and Wildlife Service agreed with North Dakota Governc Link to establish a jointly led study group charged to review and report upon t two fundamental questions at issue: the mitigation needed to accompany the Garrison Diversion Project and long-term needs for fish and wildlife habitat generally in North Dakota.

This charge to the group is based upon the determination that there are two separate and distinct issues in fact, but not necessarily in public perception. Accordingly, the charge is divided into two parts, one relating to the mitigati question and the other to the longer term issue of general wildlife habitat protection.

The group will be co-led by Interior Secretary's Field Representative, Denver, Colorado, or Department official designated by Assistant Secretary for Fish and Wildlife and Parks, Interior, and Natural Resources Coordinator, Governor's Office, Bismarck, North Dakota. This will be a major undertaking and, as such, will require staff support. Staff will be provided by the Fish and Wildlife Service and the State of North Dakota; the co-leaders are encouraged to involve key Fish and Wildlife Service, Water and Power Resources Service, and State personnel in these activities and to turn to the Assistant Secretary for Fish and Wildlife and Parks or the Director, Fish and Wildlife Service, if additional skills or assistance are required.

II. MITIGATION

The fundamental charge here is to explore the possibilities and means of resolvi continuing problems of mitigating fish and wildlife habitat losses attributable the Garrison Diversion Project. In considering any approach, the group should k in mind that mitigation is intended to offset habitat loss resulting from the project. Lost habitat may be replaced or existing habitat can be intensively managed to increase productivity to a degree that affects the habitat loss. (It should be noted, however, that even with intensive management it is oft times difficult to achieve waterfowl production yields sufficient to fully offset loss

The group should look at approaches including, but not limited to, the following:

* Possible use of appropriate habitat on lands already purchased or acquired for project purposes but which may not be used for those purposes. Mitigati credit could be obtained by making such suitable tracts available to the Fis and Wildlife Service to be managed as part of the National Wildlife Refuge System.

* Explore ways in which Water and Power Resources Service/Project Sponsor funds can be coordinated with Fish and Wildlife Service funds to effect the purchas of small wetland units. For example, funds provided by WPRS/Sponsors could be used for associated uplands, FWS funds for the wetland proper. One result would be a marked extension of the effective use of FWS funds.

* Outline an effective public relations approach to support and explain the recommended mitigation approaches.

III. LONG-RANGE PROTECTION AND PRESERVATION PLANNING

The long-range objective of protecting and preserving migratory bird (and other wil life) production habitat associated with the unique wetlands area of North Dakota i one that is shared by federal and state officials. This objective is also supporte by people throughout the Nation since the benefits of the preservation of these are are realized by people of virtually every State and, indeed, of several foreign countries. The importance given this objective is reflected in the fact that protection of these areas is of highest priority in the use of FWS funds.

The goal is to maintain and enhance wildlife productivity to the greatest degree possible, using the purchase of fee and easements interests in lands as one of the tools to obtain that end. Such an effort can and should be a cooperative and coordinated one, perhaps involving several levels of government. The object is the long-term protection of these valuable habitat areas for future generations. The method or means of protection is less important than is the assurance of protection into the future.

With this in mind, the group is to examine:

* Long-range plans of the Fish and Wildlife Service.

* Long-range plans of the North Dakota Game and Fish Department.

* Trends and probable futures of land uses in North Dakota.

* Any other information likely to have a bearing upon the amount and location of habitat to be protected.

With this kind of information as a background, the group should develop a general plan for habitat preservation, based upon an integrated effort by the Federal Government and State agencies. Possible approaches include the following:

* Purchase of interests in land. (Emphasis should be given to the use of easements or other binding assurances for the protection of identified habitat.)

* Control of drainage of wetlands and the providing of alternatives to drainage.

* Variations on the idea of easements (including zoning and other local ordinances) that will assure long-term protection of unaltered habitat.

The group should also provide an assessment of practical goals (acres) that might be established, given the background information developed in the review.

The group should also identify constraints (real or perceived) that will affect the success of any effort (i.e., weed control, loss of tax revenue, hay management in drought periods, etc.).

Finally, the group should present a general plan for coordinated Federal and State public information programs associated with the long-range plan.

IV. SCHEDULING

This two-part effort will be undertaken with two deadlines in mind:

* Mitigation Review: report and recommendations due to Assistant Secretary for Fish and Wildlife and Parks and the Governor: October 1, 1980.

* Long-Range Review: a progress report will be due October 31, 1980; a final report and recommendations will be submitted by December 31, 1980.

Arthur A. Link
Governor of North Dakota

Bob Herrick
Assistant Secretary for Fish and Wildlife and Parks

05/19/80

APPENDIX B

LONG-RANGE PROTECTION AND PRESERVATION PLANNING FOR FISH AND WILDLIFE: CHARGE FROM THE COCHAIR

LONG-RANGE PROTECTION AND PRESERVATION

PLANNING FOR FISH AND WILDLIFE

CHARGE FROM THE COCHAIR

Protecting migratory waterfowl and other wildlife habitat in North Dakota is a long-range objective shared by state and federal interests. In recognition of this, the Assistant Secretary for Fish and Wildlife and Parks, the Director of the Fish and Wildlife Service, and the Governor of North Dakota agreed to direct a review and analysisi of long-term needs for migratory waterfowl habitat in North Dakota. These officials further directed Ms. Nancy L. Rockwell, Natural Resources Coordinator for North Dakota, and Mr. R. J. Bruning, Special Assistant to the Secretary, Denver, to serve as co-chair and develop a charge for carrying out this effort. Specific background information is included in the document signed by the Governor and Assistant Secretary on August 19, 1980. The following represents the charge from the cochair and is to be regarded as the initial step toward responding to the concerns of the Governor and the Assistant Secretary.

The approach to addressing the issue can best be divided into three distinct steps. The first step involves the development of a general plan that deals solely with migratory waterfowl and associated habitat (wetlands). Specifically, population objectives for species will be addressed, projection of acreages, and ways to preserve or protect the wetland habitat will be identified. This should be done suing the perspectives of the North Dakota Game and Fish Department and the U.S. Fish and Wildlife Service. Representatives from these two organizations should examine their long-range plans and

objectives of migratory waterfowl as a part of this first step effort. A report containing the results of this activity should be provided to the cochair by Friday, November 28, 2980. The report should be prepared to directly assist in the initiation of the second step to occur in December.

The second step in addressing this issue involves a comprehensive analysis of constraints and other impediments to successful accomplishment of the goals and methods of achieving these goals. Because this is a matter of considerable interest to a wide segment of the population of North Dakota, it is essential that the views of these people as regards wildlife habitat preservation be obtained and evaluated. Therefore, the expertise, advice, and input from a wide range of interests in North Dakota will be sought during this step. A progress status report will be provided on December 31, 1980.

A third step would be the establishment of a coordinated state-federal public information program prepared to assist in plan implementation. The final report for the cochair will be submitted on November 30, 1981.