

SIGNIFICANT NATURAL RESOURCE ISSUES FOR THE NEXT FIVE TO TWENTY YEARS

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The formulation of agricultural and resource policy inevitably involves consideration of conditions likely to prevail several years in the future. The need to place considerable emphasis on future conditions results from the substantial time periods required to effect major changes in consumption and production patterns. Policy makers thus face the necessity of not only responding to present conditions but also of anticipating situations which may develop and problems which may emerge over at least the next two decades. The importance of formulating realistic assessments of future developments is difficult to overemphasize.

Agricultural and resource policy pose particularly challenging forecasting problems. World markets have several characteristics which cause traditional predictive tools to be less useful than they may be in other settings. The events of the last decade offer numerous examples of the influence of international conflicts and domestic political controversies on the domestic agricultural and resource sectors.

The purpose of this article is twofold: to briefly describe a research project¹ to identify emerging natural resource issues, and to present results of that research that are significant to North Dakota's future.

PROCEDURE

Delphi analysis² was employed in identifying and prioritizing energy and natural resource issues in 13 Rocky Mountain and Great Plains states, including North Dakota. The sponsor³ believed that current information concerning perceptions of emerging issues in this region would be valuable in guiding the agency's research and data collection programs.

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¹This article is a synopsis of Leitch, Leistritz, Vollmers, and Stroh, 1983.

²Delphi analysis is an iterative survey procedure developed by the Rand Corporation for predicting the likelihood of future events (Brown, 1968).

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The study involved four major steps. First, a literature search led to the development of a preliminary list of energy and natural resource issues as well as a listing of potential contact persons ("experts") for the Delphi survey. Special effort was made to include individuals knowledgeable in each of several broad natural resource areas (e.g., energy, minerals and mining, water, grazing, etc.) as well as ensuring that all parts of the region were represented. The contact network (Delphi panel) was also structured to include representation by state and federal agencies, the private sector, and academicians.

The second research phase was a Delphi inquiry to the initial contact network. The survey instrument, mailed to 371 members of the contact network, asked the respondent's professional and geographic areas of expertise. Each respondent was also asked to identify what they felt would be the three most significant natural resource problems/issues in the study area over the next 5 to 20 years. Finally, each respondent was asked to identify up to three persons they felt were the most knowledgeable concerning the issues/problems they had identified. Results of the survey provided the basis for expanding both the list of issues and the contact network.

The third step was an expanded Delphi survey which had the objective of narrowing (prioritizing) the list of issues to those most significant. Delphi panel members were asked to evaluate the magnitude, scope and urgency of 127 issues identified in the first two phases of the study, and also to rate his/her degree of knowledge concerning each issue. A nine-point Likert scale was used, with a value of one corresponding to an insignificant issue. Analysis of the survey responses included development of several alternative rankings for the issues stratified by respondent characteristics. The magnitude, scope, and urgency ratings of the issues were computed. Then, scores were computed based on weighting each respondent's magnitude, scope, and urgency ratings of an issue by that individual's self-appraised knowledge level concerning the issue. Finally, an overall index of the importance of each issue was computed by aggregating the knowledge-weighted magnitude, scope and urgency ratings.

The fourth and final step in the study was a consensus building workshop. Workshop participants were drawn

primarily from the Delphi panel and were given an opportunity to examine the survey results prior to the workshop. Although participants were given ample opportunity (one and one-half days) to re-examine the issues, propose new issues, and reformulate existing issues, the issue list emerging from the workshop was very similar to the one resulting from the Delphi survey. This suggests that the Delphi process is a reliable, replicable method for identifying and prioritizing problems and issues.

RESULTS

Analysis of the Delphi survey results allowed an evaluation of the extent to which respondents' type of employment (government, private sector, or academic), area of expertise, and geographic location affected their ranking of issues. In general, type of employment had little influence on rankings. Similarly, neither area of residence nor area of expertise were associated with significant differences in rankings. This finding is important as it suggests that the results of such a Delphi process will not be affected substantially by small changes in the composition of the panel.

Of particular interest to North Dakota is the priority of natural resource issues that affect or will affect the state. Figures 1 and 2 show the top 20 issues as ranked by respondents, first, from the entire sample and, second, from the three states of North Dakota, South Dakota, and Nebraska. There were no striking (nor strong statistical) differences in the issue rankings by panelists from different geographic areas. A comparison of Figures 1 and 2 shows that 17 of the 20 issues are the same on each top-20 list. This is significant when one considers there were over 100 preselected issues for panelists to rank as well as having the opportunity to introduce additional issues.

Figure 1. Top 20 Issues Ranked by Natural Resource Experts Representing the 13 Rocky Mountain and Great Plains States and the Nation as a Whole (Numbers Represent Importance Index)

Energy Conservation	140
Surface Water Allocation	134
Groundwater Mining	133
Coal Development	130
Soil Conservation	127
National Economy	127
Potable Water Supply	120
Economics of Environmental Regulation	120
Management of Minerals on Federal Lands	118
Oil and Gas Development	117
Soil Productivity Losses	117
World Demand for Food	117
Public Land Development	116
Decreased Streamflow	113
Agricultural Productivity	112
Conversion of Prime Lands	112
Chemical Water Pollution	112
Energy Resource Depletion	112
Institutional Factors of Water Use	111
Public Decision Processes in Natural Resources	110

Figure 2. Top-20 Issues as Ranked by Natural Resource Experts from North Dakota, South Dakota, and Nebraska (Numbers Represent Importance Index)

Soil Conservation	148
Energy Conservation	139
Soil Productivity Losses	133
Groundwater Mining	122
Surface Water Allocation	121
Coal Development	119
Agricultural Productivity	119
Nonpoint Pollution	117
Potable Water Supply	113
World demand for Food	112
Chemical Water Pollution	111
Public Decision Processes in Natural Resources	108
Conversion of Prime Lands	108
National Economy	107
Wetland Preservation	106
Economics of Environmental Regulation	105
Management of Minerals on Federal Lands	105
Public Land Development	103
Air Pollution from Energy Development	103
Decreased Streamflow	102

The top-20 issues can be categorized into four general areas: agriculture, energy, water, and policy. These general areas, as well as the 20 specific issues, are not exclusive, and in fact, are highly interrelated.

The five issues that are related to agriculture are:
SOIL CONSERVATION,
SOIL PRODUCTIVITY LOSS,
AGRICULTURAL PRODUCTIVITY,
WORLD DEMAND FOR FOOD, and
CONVERSION OF PRIME LANDS.

These should come as no surprise to individuals in the Great Plains states. It should be reassuring to note that they are seen as high priority, emerging issues that need to be addressed.

Issues especially related to energy were:

ENERGY CONSERVATION,
COAL DEVELOPMENT,
AIR POLLUTION FROM ENERGY
DEVELOPMENT, and
MANAGEMENT OF MINERALS ON FEDERAL
LANDS.

Energy issues as well are not surprising, yet they point to the need for solutions. Almost everyone is in favor of "energy conservation," but our perceptions of conservation differ. If we are to have energy development, how do we manage "air pollution from energy development" to keep within acceptable limits? What are those limits? This study simply identified priority issues and does not suggest solutions.

Great Plains agriculture and energy development are nearly synonymous with water issues. Seven of the top-20 significant issues were water related. Some have been issues for years, while others are just now being

realized, or will be in the next few years. The water issues are:

GROUNDWATER MINING,
SURFACE WATER ALLOCATION,
NONPOINT POLLUTION,
POTABLE WATER SUPPLY,
CHEMICAL WATER POLLUTION,
WETLAND PRESERVATION, and
DECREASED STREAMFLOW.

Many of these issues involve problems among political jurisdictions. For example, "surface water allocation" and "decreased streamflow" are both issues among Missouri River Basin states. Wetlands preservation, on the other hand, is primarily an issue of national versus local values, i.e., wetlands have values to society in their natural state, yet may be more valuable to local areas if converted to alternative uses.

The final category of issues, public policy issues, is what all issues eventually become if not resolved. Those that were pointedly policy issues among the top-20 were:

PUBLIC DECISION PROCESSES IN NATURAL
RESOURCES,
NATIONAL ECONOMY,
PUBLIC LAND DEVELOPMENT, and
ECONOMICS OF ENVIRONMENTAL
REGULATION.

While there is little that can be done about the "national economy" from here in North Dakota, we are concerned about "public decision processes" and the costs and benefits of "environmental regulation."

CONCLUSION

Many of the issues tagged as emerging in this study may be more aptly described as persisting, yet they may emerge in different geographic areas or contexts. The identification of natural resource issues significant to North Dakota's future will assist federal agencies, especially the U.S. Geological Survey, with setting their long range plans and goals, and should ultimately lead to amelioration of the issues.

Perhaps the most significant outcome of the study was not identification of important issues per se, but rather that a consensus was reached among scores of experts on what is and what will be important in the near future.

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Field experiment. Volunteer sunflower control was more rapid in wheat sprayed postemergence with bromoxynil plus MCPA or bromoxynil alone compared to MCPA alone (Table 3). Sunflower visual control ratings were 99, 96, and 44 percent five days after bromoxynil plus MCPA, bromoxynil, and MCPA application, respectively. Sunflower control had increased to 89 percent by 18 days after MCPA application. Despite the slower rate of control and increased water use of sunflower treated with MCPA compared to bromoxynil or bromoxynil plus MCPA, wheat yields were similar.

Table 3. The influence of herbicide treatment on rate of sunflower control and wheat yield.

Treatment ¹	Sunflower visual control ²				Wheat ³ yield
	Rate	Day 1	Day 5	Day 18	
	(oz/A)	(%)			(bu/A)
Bromoxynil + MCPA	4 + 4	28	99	99	27.8
Bromoxynil	4	16	96	100	25.6
MCPA	8	33	44	89	25.6
Cut Control					27.5
LSD (0.5)			5		NS

¹Sunflower density at treatment averaged 53 plants/1.2 yd².

²Averaged over Fargo wheat seeded in early May and Absaraka wheat seeded in late May.

CONCLUSIONS

Wheat following sunflower should be seeded early since late seeding reduced wheat yield. Sunflower densities of 9 plants per 1.2 square yards should be removed before the wheat flag-leaf stage to prevent yield reductions. Equivalent wheat yields would be obtained if volunteer sunflower are sprayed postemergence with MCPA, bromoxynil or bromoxynil plus MCPA by the 5-leaf stage of wheat.

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