U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

Citizen Knowledge of and Attitudes toward Black-tailed Prairie Dogs: *Completion Report*

by

Berton Lee Lamb[1]
Kurt Cline[2]
Ayeisha Brinson[1]
Natalie Sexton[1]
Phadrea D. Ponds[1]

Open-File Report 01-471

[1] Midcontinent Ecological Science Center
[2] Johnson Controls World Services, Inc.

2001

I → III

Table of Contents

List of Tables

Executive Summary

In the late summer of 2000, we canvassed a random sample of residents in the 11-state short grass prairie region of the United States. We asked about people's attitude toward and knowledge of black-tailed prairie dogs and their management. The survey received 1,933 useable responses with a response rate of 56.4% (margin of error ±2.2%).

We developed a questionnaire (OMB Control Number: 1028-0073; see Appendix B) to answer the following questions:

- What is the level of citizen knowledge regarding black-tailed prairie dogs?
- What are citizens' attitudes and preferences regarding black-tailed prairie dogs and the environment in general?
- What are the factors that explain differences in attitudes and knowledge about prairie dogs?
- What are the factors that explain citizen participation in these types of issues?
- What are the important differences between rural and urban citizens regarding their political participation and their knowledge and attitudes about prairie dogs?

In general, we found that citizens do not have a high regard for black-tailed prairie dogs. Citizens generally have a positive orientation toward the environment and favor a balanced or somewhat environmental approach on questions—like prairie dog management—that involve environmental protection and economic considerations. People having direct experience with prairie dogs are less inclined to view them as beneficial to society than are those who infrequently see or come in contact with the animals. When asked about prairie dogs specifically, most citizens did not believe the question of what to do about these animals was a highly important environmental issue.

Knowledge

We measured knowledge in two ways: familiarity with terms and knowledge of specific facts. Most people are familiar with some terms used in prairie dog management. Two commonly used terms were known by almost all of our respondents: burrowing and Endangered Species Act. Other terms, such as habitat conservation, biological vulnerability, and habitat fragmentation were known by about half the people we surveyed. In contrast, specific or technical terms (i.e., Sylvatic Plague, diurnal, and extirpated) were known by only a very few citizens. About half the people surveyed knew some general facts (e.g., that prairie dogs are most active during the day) but some facts seem to be the province of only a tiny few (i.e., relation to chipmunks, 1 litter per year, and coteries).

Knowledge seemed to be related to people's direct experience with prairie dogs (especially their likelihood of seeing the animals and knowing where the nearest prairie dog town is located) in combination with using printed sources of information to learn

about prairie dogs. This held true for both measures of knowledge we examined. People who found environmental issues hard to understand were less likely to be knowledgeable. Significantly, people who were more politically active tended to have more knowledge about prairie dogs.

Participation

Four out of ten respondents to our survey had not participated in any type of political activity. To measure this we asked citizens to answer yes or no to each item on a list of possible activities (e.g., signing a petition or leadership of a group). Forty-percent said they had participated in at least one activity. Of those who had participated, 83% were categorized as passive participants and 17% as active participants. Well-educated, higher income people, as well as women were more likely to be politically active. Although active political participants were more likely than passive participants to say they were familiar with terms, those who had participated in any form of political activity were more likely to be knowledgeable of terms and facts about prairie dogs than those who had not participated.

Those who used printed and formal organizational sources of information (such as public meetings and hearings), possessed a higher level of formal education, higher income, and were more knowledgeable. A positive orientation toward prairie dogs was associated with political participation. Those who engaged in more outdoor activities were more likely to also be politically active and those with an orientation toward post-material values (desiring a sense of belonging and inclusion rather than economic security) were more likely to participate in politics, as were persons in agricultural occupations.

General Attitudes Toward the Environment

We measured general environmental attitudes in three ways: opinions about the balance between environmental protection and economic growth; trust in science and technology as an answer to environmental problems; and environmental orientation as measured by the New Environmental Paradigm (NEP; i.e., the perception that the earth is a spaceship with finite resources that should be protected).

First, respondents tended to favor a balance between environmental protection and economic growth. Thirty-nine percent of respondents said the environment was the most important, 38% said equal consideration should be given to the environment and economy and 23% said the economy was most important. About 6 in 10 people with an environmentalist orientation and half of the women (49%) indicated that the environment was most important when considering environmental protection and the economy. Forty-two percent of those who were politically active and 44% of those who did not trust in science also believed the environment was the most important consideration. Residents of rural and urban counties were divided on this question, with

48% of urban respondents and 33% of rural respondents indicating that the environment was most important.

The variables that most explain an environmental or economic orientation are related to belief system, experience, and age. Older people, those who held agricultural jobs, and those who relied on formal organizational sources of information (e.g., public meetings and hearings) tended to favor economic growth. Not surprisingly, those who held an environmental orientation (as measured by the NEP) tended to favor environmental protection.

Second, we examined the factors that seemed to be behind general environmental orientation as expressed by support for the NEP and trust in science and technology. There are fewer of policy-relevant findings in this section than in other parts of this report. The models explaining NEP and trust in science and technology are weak and really cannot be relied upon to draw concrete conclusions about what drives support for the NEP or science and technology. For that reason, we have not reported the model explaining trust in science and technology. But we do report the NEP relationships.

Those who use printed sources of information about prairie dogs and the women in our study were more likely to hold an environmental orientation as measured by the NEP. Interestingly, those who reported a trust in science and technology were not likely to support the NEP. This may be because people who trust in science believe science will solve future environmental problems. Those who rated themselves as politically conservative were more likely to hold the dominant social paradigm as opposed to the NEP. Also likely to support the dominant social paradigm were those who held agricultural jobs and those who relied on formal organizational sources of information.

Attitudes Toward Prairie Dogs

Respondents indicated a very moderate level of overall support for prairie dog protection. When we asked people to tell us how much in the way of social benefits were provided by prairie dog management, 58% (37% medium, 21% high) said there was at least some benefit to prairie dog management. However, when looking at this question in another way, more than 4 in 10 respondents said that the benefits to society of managing prairie dogs were low.

Interestingly, factors that may be related to direct experience tended to foster negative views of prairie dogs. Such things as frequency of seeing prairie dogs, friends and neighbors as a source of information about the animals, and holding agricultural jobs were associated with negative views. On the other hand, those who support the NEP are likely to find social benefits in protection of the species. This is a good example of how the context and medium in which information is received can have important influences on attitude. The fact that friends and neighbors and frequency of seeing the animals were associated with negative attitudes toward prairie dogs (coupled with the

association between using formal organizational sources of information and support for economic growth) suggests that those with policy-making responsibilities and media gate-keepers may have less of an opportunity to shape attitudes than local and personal factors.

This is supported by our findings on the seriousness of the problem of deciding what to do about prairie dogs. People who supported the NEP and those who used electronic media as a source of information tended to rate the problem of deciding what to do with the species as more serious. Those who were more politically conservative, lived in rural counties, or held agricultural jobs tended to see the problem as less serious.

Conclusions

Presentation of prairie dog information in forums and in ways that emphasize personal experience and use electronic media may be the most effective strategy in working with citizens concerned about prairie dog management. Although we did not ask whether respondents had experienced positive or negative interactions with prairie dogs, it might be safe to assume that attitudes and knowledge have often been formed from negative personal experience. Knowledge alone is not the key to citizen perceptions of the prairie dog. That key lies in the level of political activity and general environmental orientation coupled with personal experience.

However, our findings suggest that public discussion of prairie dog protection could be improved by increasing the relevant knowledge and vocabulary of citizens. This is, in itself, a worthy objective for wildlife managers. Rather than focusing on increasing knowledge as a way to build support for a species, it would be better to focus on building knowledge as a way to enhance the decision process. This can be done if people recognize the animals in the wild, know how they live and the role they play in the ecosystem, have access to trusted sources of information about the problems the animals cause, and understand the range of viable management options.

Introduction

What do residents of the short-grass prairie region know and think about black-tailed prairie dogs? How can federal and state resource managers use this information to communicate with involved publics, participate in planning and decision-making activities, and ultimately successfully manage this species? These are important and timely questions in light of the ongoing controversy surrounding the black-tailed prairie dog and its recent Endangered Species Act designation as a "warranted but precluded" threatened species (U.S. Fish and Wildlife Service 1999).

Data on the publics' attitude toward and knowledge of prairie dogs remains limited (Zinn and Andelt 2000; Reading, et al. 1999; Lee and Henderson 1989). To expand this knowledge base, social scientists with the U.S. Geological Survey surveyed citizens of an 11-state area in the summer of 2000. The study area encompassed the short-grass prairie region of the United States (Figure 1). The U.S. Fish and Wildlife Service (USFWS) commissioned the Social, Economic, and Institutional Analysis Section of the Midcontinent Ecological Science Center to conduct the most extensive public survey on these issues to date. There were four purposes for the survey: (1) to determine citizens' attitudes toward and knowledge of black-tailed prairie dogs and their management; (2) to describe the factors that explain citizens' knowledge and attitudes regarding black-tailed prairie dogs (including rural and urban influences); (3) to describe factors that explain citizen participation in natural resource issues such as black-tailed prairie dog management; and (4) to synthesize the results to assist managers in communicating with the public.

Specifically, we aimed to answer the following questions:

- What is the level of citizen knowledge regarding black-tailed prairie dogs?
- What are citizens' attitudes and preferences regarding black-tailed prairie dogs and the environment in general?
- What are the factors that explain differences in attitudes and knowledge?
- What are the factors that explain citizen participation in these types of issues?
- What are the important differences between rural and urban citizens regarding their participation, knowledge, and attitudes?

The controversy over the species has been fueled by the emerging scientific understanding of prairie dogs, historical perceptions, differing attitudes between rural and urban citizens (Zinn and Andelt 2000), and a growing public interest and demand for involvement in natural resource decision-making (Becker 1993; Gericke and Sullivan 1994).

Recently, scientists have begun taking a fresh look at prairie dogs because studies have shown that the conservation of prairie dogs may be vital not only for their own survival, but also for a large number of other grassland species such as the black-footed ferret

and ferruginous hawk (U.S. Forest Service 1978; Knopf 1993; Miller et al. 1996; Kotliar et al. 1999).

Historic perceptions of the species have furthered the debate over conservation strategies. Livestock operators implemented extensive poisoning of prairie dogs around 1880. The federal government began subsidizing prairie dog poisoning in 1915 and poisoning quickly became common practice for federal, state, tribal, and county governments (Dunlap 1988). Although states are beginning to address prairie dog conservation (Denver Rocky Mountain News 2000; Sanko 2000; Wyoming Tribune-Eagle 2000), all states within the historic range of the black-tailed prairie dog "classify the species as a pest for agricultural purposes and either permit or require their eradication" (64 Federal Register 57 at 14427). Prairie dog numbers have been further reduced due to disease (i.e., Sylvatic plague; see Barnes 1993); such habitat-related factors as drought, housing developments, cultivation and grazing practices; and recreational shooting (Utah Division of Wildlife Resources and U.S. Fish and Wildlife Service 1991; Graber and France 1998). In addition, the currently occupied black-tailed prairie dog habitat is, perhaps, only 1% of the species' original range (Graber and France 1998; Dolan 1999; Kotliar et al. 1999).

Despite this reduction in the species' population and habitat range, most people perceive prairie dogs to be abundant (Long 1998). With the exception of those who identify themselves as "environmentalists," most people have little regard for prairie dogs (Randall 1976; Reading 1993; Dolan 1999). However, there is a continuum of attitudes and perceptions. Based on limited existing studies, farmers and ranchers are on one end, expressing little value for the species. Next are rural dwellers who generally report a more negative attitude toward prairie dogs than their urban counterparts. On the other end of the spectrum are environmentalists, who express the most value for prairie dogs. Native Americans' value for prairie dogs falls somewhere in the middle of this continuum (Long 1998; Graber and France 1998; Dolan 1999; U.S. Fish and Wildlife Service 1999). However, these findings represent only results from limited samples and geographic areas.

Successful management of a threatened species requires effective participation of all groups in the decision process. As a planning tool for citizen involvement, wildlife management research has traditionally concentrated on the biological, technical, and economic aspects of wildlife issues—as reflected in single-species instead of ecosystem management—but not on assessing citizen attitudes and knowledge (Kellert 1985; Reading 1993). Over the past two decades more holistic attempts have been made to appraise wildlife issues by including assessments of public attitudes and knowledge about a variety of management problems (Jacobson and Marynowski 1997; Messmer et al. 1999; Coluccy et al. 2001). The results have provided managers, stakeholders, and concerned citizens with an improved framework for expediting the policy process and rendering it more effective (Kellert and Clark 1991).

Historically, it has been thought that better information (e.g., accurate descriptions of species life history) would be the key to better participation by the public. Agencies at all levels of government have acted on the twin assumptions that (1) well-informed citizens will be more active in policy-making and (2) the result will be better decisions and less conflict (Selin et al. 1997). As a result of this premise, the information available to the general citizenry has increased over time. This is especially true in the field of natural resources management where managers have come to recognize the importance of developing policy-relevant information and are required to share that information with the public (National Environmental Policy Act 1969, 42 U.S.C. Section 4321).

Interestingly, although the information available to the general citizenry has increased over time, citizen involvement in politics in the United States—especially as measured by voting—has not. It has been decreasing since the 1950's. However, there is reason for optimism. Although participation, as reflected in voting, has not increased and conflict has not been reduced (Cupps 1976; Behan 1990), a link has been established between the level of formal education and participation in policy-making (Wolfinger and Rosenstone 1980; Luskin 1993; Verba et al. 1995). Citizens with more formal education are more likely than others to participate. In addition, a recent study by Bimber (2001) concluded, "political participation is not regulated directly by the cost or availability of information." Bimber actually questioned whether social contacts, citizen involvement programs, and education affect participation by providing different forms of information. He suggested, instead, that participation might be explained more by emotional attachments and predispositions (or attitudes, values, and beliefs; see also: Ezrahi 1980; Collingridge and Reeve 1986; McCool and Guthrie 2001).

Zelezny (1999) seemed to support this point in her findings that there is a relation between formal learning activities and changed environmental behavior among younger persons. Most behavioral changes result from experiences that are hands-on, more than 10 hours in duration, and where social context is important (Zelezny 1999). But Zelezny's (1999) findings seem to address more the role of specific, policy-relevant training, rather than simply formal education levels. This raises three questions.

First, are knowledgeable people more likely to participate in natural resource decision making? If, as Bimber expected, participation is explained by emotional attachments and predispositions (i.e., attitudes and beliefs) we would expect to find that formal education, income, location of residence, occupation, source of information and attitudes are associated with participation to a greater extent than knowledge (i.e., simply knowing about prairie dogs).

Second, are some types of people more knowledgeable about prairie dogs than others? If as Zelezny (1999) indicated, people's behavior may be altered through formal activities that are sufficiently long and within supportive social contexts it would be important to understand whether the quality of knowledge about prairie dogs differs

among citizens with different formal and informal learning experiences. For example: Are those who live close to prairie dogs (Zinn and Andelt 1999)—or hold occupations or conduct recreational activities in which they have contact with prairie dogs—more likely to be knowledgeable than those with higher income or formal education? Are rural residents more knowledgeable than urban residents (Reading et al. 1999)? Is there a relation between attitude and knowledge? What separates (in terms of attitudes or socio-demographics) the people who know more about prairie dogs from those who are less knowledgeable?

Third, although legislation requires decisions about listing a species as threatened or endangered to be based upon scientific evidence (Endangered Species Act 1973, 16 U.S.C. Section 1531), it is important to understand the predominant attitudes toward wildlife in general and the particular species of concern. What explains peoples' attitudes toward these issues? Is it their subject-specific knowledge and technical orientation? Is it how the information is presented (e.g., electronic media or print media)? Is it the level of political participation, personal interaction with the resource, or socio-demographic characteristics (including level of formal education)? An understanding of these questions can help managers design more relevant policy processes and gauge the acceptability of wildlife policy, thus decreasing the potential for contention.

Methods and Measurements

Survey and Sampling Design

In order to capture the attitudes and knowledge level of the 14 million people who live in the areas where black-tailed prairie dogs occur, we developed a mail-out questionnaire to administer this survey. We sent the questionnaire to citizens in an 11-state area encompassing the short-grass prairie region (Figure 1). This study area was based upon black-tailed prairie dog distribution maps provided by USFWS and included portions of all of the following states: Arizona, Colorado, Kansas, Montana, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, Texas, and Wyoming. Potential respondents were randomly selected from rural, suburban, and urban counties within the study area. Counties were categorized as rural, suburban, or urban using Cleland's (1995) Rurality Index. Survey Sampling, Inc. provided the names and addresses of a sample of 4,380 citizens in the region. To administer the survey, we followed a step-by-step procedure called the Total Design Method (Dillman 1978, 2000). This is a dependable process for survey sampling that maximizes the quality and quantity of responses for mail and telephone surveys. Specifically, we followed these steps:

1. We sent a postcard to all potential respondents to: (1) tell them about the survey (2) give them an opportunity to decline participation, and (3) determine any undeliverable addresses.

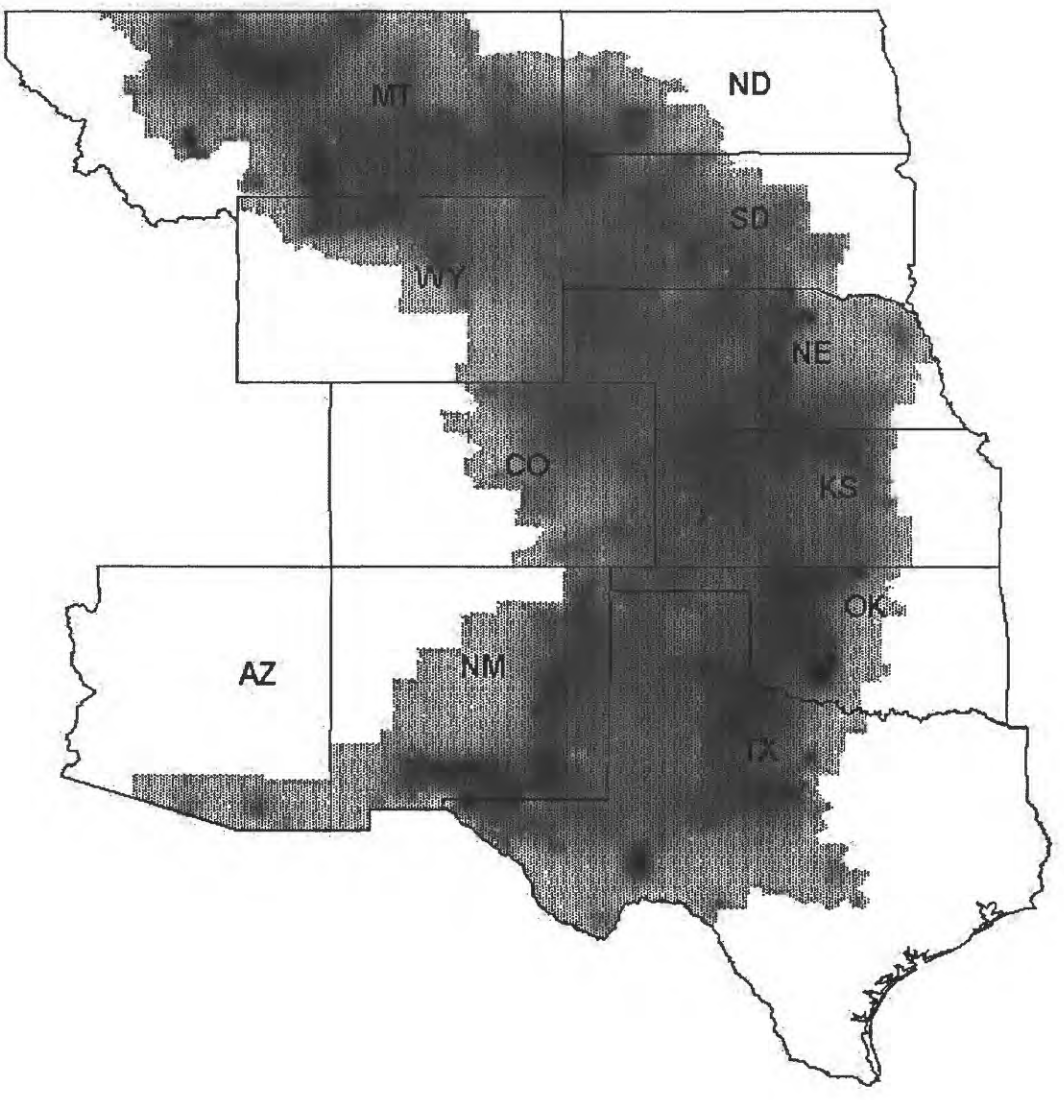

Figure 1. Eleven state study area.

2. One week later, we sent the survey package, which included: the survey, a postage-paid return envelope, and a cover letter explaining the study.
3. Over the course of the following 9 weeks, we sent 2 more packages to those who had not responded.
4. As a final attempt, we telephoned approximately 50% of those from whom we had not yet received responses.[1] The purpose of the telephone calls was two-fold: (1) to encourage responses from nonrespondents, and (2) to see if the nonrespondents differed from the respondents. We achieved the latter by asking 4 questions from the survey and then comparing those answers (telephone respondents) with mail respondents' answers.

Before administering the survey, we pre-tested a draft of the survey with 9 citizens of Fort Collins and 10 employees of the U.S. Bureau of Reclamation, Eastern Area Office, in Loveland, Colorado in an effort to identify any questions that were not easily understood or any answer set that was unclear. We used the results of these pretests to develop the survey instrument that was sent for approval to the Department of the Interior and Office of Management and Budget.

Data Analysis

Hypotheses. In an effort to answer our questions of interest, we developed the following hypotheses:

1. Knowledge:

H_1: Those who are older, males, those with higher levels of formal education and income; those who use published sources of information; those who have a technical orientation; and those with environmentalist attitudes have a higher level of knowledge.

H_2: Those who have greater experience with prairie dogs or participate in outdoor activities near prairie dog habitat have a higher level of knowledge about the animals.

Knowledge was measured in two ways: First, by respondents' familiarity with a set of terms related to prairie dogs (Question 5; see Appendix B for a listing of all questions on the survey). These terms were identified from Federal Register documents and government press releases related to black-tailed prairie dogs and their management. Second, by respondents' answers to factual questions about black-tailed prairie dog life history (Question 6). We developed multiple-choice questions from facts provided on the U.S. Fish and Wildlife Service prairie dog informational web page located at: www.r6.fws.gov/BTPrairieDog/QANDA.htm.

[1] A Spanish-speaking interviewer was provided for the 9 people called who preferred to answer in Spanish.

2. Participation

H_1: Those who are younger, male, have a higher level of education and income, use printed sources of information, have experience with prairie dogs, hold a technical orientation, and an environmentalist attitude are more likely to be politically active participation.

H_2: Those who are more knowledgeable about prairie dogs are more likely to be politically active.

We measured participation by the types of activities in which respondents said they tried to influence decisions (e.g., attend a public hearing or lead a citizen group) (Question 8).

3. General environmental attitudes:

H_1: Those who are more knowledgeable about prairie dogs are more likely to hold environmentalist attitudes and technical orientation.

H_2: Those who are more politically active and have experience with prairie dogs are more likely to hold environmentalist attitudes.

H_3: Those who are older, male, well educated, have higher incomes, hold a technical orientation, and use printed sources of information are more likely to hold an environmentalist attitude.

To measure general environmental attitudes, we relied on respondents' views on the protection of the environment versus growth of the economy (Question 6), their support of the NEP (Question 12), and their trust in science and technology (Question 12). The New Environmental Paradigm is a measure that predicts respondents' environmental behavior and participation (Van Liere and Dunlap 1981; 1980).

4. Specific attitudes toward prairie dogs:

H_1: Those with more knowledge about prairie dogs are more likely to hold positive attitudes toward prairie dogs.

H_2: Those who are politically active and those who have experience with prairie dogs are more likely to hold positive attitudes toward prairie dogs.
H_3: Those who are older, male, have higher levels of education and income, hold a technical orientation, and use printed sources of information are more likely to have positive attitudes toward prairie dogs.

Specific attitudes toward prairie dogs were measured by the level of benefits respondents associated with protecting prairie dogs (Question 1a) and the seriousness of prairie dog issues as compared to other environmental issues (Question 1b).

Listed in Table 1 are the independent variables hypothesized as possible factors to explain knowledge, participation, or attitudes. To test our hypotheses, we developed ordinary least squares (OLS) regression models to analyze what factors explain respondents' knowledge, participation, and attitudes. These analyses allowed us to determine which variables were significantly correlated with our dependent variables, while at the same time controlling for other possible explanations.

Creation of Indices

The first step in analyzing the data was to create analytical concepts that reflected our research questions. Using the data gathered by the survey, we constructed indices to reflect these larger analytical concepts. In order to examine the self-assessed knowledge and factual knowledge variables, we created indices of both these measures. To assess attitudes toward prairie dogs, an index was created based on responses to a series of ideas concerning prairie dog management. We also created analytical concepts that could be used to explain respondents and attitudes. These indices included: Postmaterialism, Trust in Science, and New Environmental Paradigm. While all of these analytical concepts were constructed using such techniques as factor analysis and reliability analysis, our theoretical framework was always the guiding principle. Indices and measures of central tendency are described in Appendix A.

We then proceeded to work with the refined data set. The first step was to analyze the data in a descriptive manner. This entailed looking at the data in terms of frequency distributions, difference of means tests, correlations, and nonparametric statistics. After examining the data in univariate and bivariate forms, we moved on to a multivariate analysis of the data. We chose to use OLS regression to analyze the impact of a multitude of explanatory variables on respondents' level of knowledge and attitudes about prairie dogs. This analysis allowed us to determine which variables were significantly correlated with our measures of knowledge and attitude, while at the same time controlling for the impact of other possible explanations (Blalock 1972). This report was submitted to four peer reviewers outside of the USGS. Three peer reviews were received (Appendix C) and changes were made accordingly; all reviewers recommended that the report be submitted to the USFWS.

Table 1. Identification of variables and their use in hypotheses 1-4.

Variable Name	Survey Question[a]
Socio-demographic Indicators	***13,14,16,18,19,20***
Age in years	13
Respondent's gender	14
Highest level of formal education	18
Agriculture occupational status	19
Annual family income	20
Racial origin	16
Respondent's residence	
Experience with Prairie Dogs	***2,3,4***
How often respondents see prairie dogs	2
Know how far primary residence is from a prairie dog town	3
Index of total outdoor activity near prairie dog towns	4
Sources of Information Indicators	***9***
Learned about prairie dogs from person-to-person information sources (Friends and Neighbors)	9
Learned about prairie dogs from person-to-person information sources (Formalized communication)	9
Learned about prairie dogs from printed information sources	9
Learned about prairie dogs from electronic information sources	9
Technical Orientation Indicators	***11,12***
Agreement with the statement "environmental issues are hard to understand"	12
Trust in science and technology	12
Support of the New Environmental Paradigm[a]	12
Post-Materialism	11
Knowledge Indicators	***5,7***
Index of familiarity with terms related to prairie dogs	5
Index of factual knowledge related to prairie dogs	7
Political Factors	***8,10***
Index of total political participation	8
Ideology	10
Attitudes	***1a, 1b, 6***
Benefits of Managing to Protect Prairie Dogs	1a
Importance of Protecting Prairie Dogs	1b
Best management option (environment vs. economic growth)	6

[a] See Appendix B for survey questions.
[b] The New Environmental Paradigm is a measure that predicts respondents' environmental orientation (Van Liere and Dunlap 1981; 1980.

Response Rates and Reliability

Response Rates

As a result of our sampling design and methodology, the response rate for the entire survey was 56.4% (1,933 total respondents; +/-2.2% margin of error), with 539 from urban counties, 673 from suburban counties, and 721 from rural counties (Table 2). Summary information, including frequency distributions for each question on the survey, can be found in Sexton et al. (2001).

Table 2. Response rate for the survey of residents of the 11-state short-grass prairie region conducted in August-November 2000.

Survey Response Rate	Total	Urban	Suburban	Rural
Total Addresses	4,309	1,333	1,550	1,426
Undeliverable Addresses	882	308	346	228
Respondents	1933	539	673	721
Response Rate (%)	56.4	52.6	55.9	60.2
Standard Error ±(%)	2.2	4.2	3.8	3.7

Nonresponse Bias

We conducted a telephone canvas of those who had not responded to the survey after three mailings. We used the telephone follow-up calls to determine if nonrespondents to the mail-out survey were different from people who had already returned the questionnaire. Our findings are limited in this regard because we did not ask the telephone respondents the full panel of questions from the questionnaire. In terms of demographics, we cannot compare education, income, race or ethnicity. We did not gather data to allow a comparison of differences in knowledge-holding and we asked only one question of telephone respondents regarding attitude toward prairie dogs.

We telephoned 50% of nonrespondents, and found that the telephone respondents and mail-out respondents differed significantly with respect to age and rurality of county. Telephone respondents tended to be older (median age 60 as opposed to 53 for mail-out respondents) and were significantly more likely to reside in urban counties than mail-out respondents. However, mail-out respondents saw prairie dogs more frequently than telephone respondents. There was no demonstrable difference between the respondents in terms of gender or whether or not they were employed in an agriculturally related occupation. The two groups of respondents did not exhibit a difference in how important prairie dogs were compared to other environmental issues.

Knowledge

Knowledge was measured in two ways: First, by respondents' familiarity with a set of terms related to prairie dogs and, second, by respondents' answers to factual questions about black-tailed prairie dog life history.

Knowledge-holding: Familiarity with Terms

Univariate Analysis. Most people are familiar with some terms that are often used in management of prairie dogs. Two terms were familiar to most people: more than 80% said they knew the terms "burrowing" (90%) and "Endangered Species Act" (85%). Four terms were familiar to a majority of respondents: "urban sprawl" (68%), "prairie ecosystem" (61%), "habitat conservation" (54%), and "biological vulnerability" (54%). Three terms were familiar to approximately a third of respondents: "habitat fragmentation" (42%), "Sylvatic Plague" (31%), and "random demographic events" (28%). Two terms were familiar to only a very few respondents: "diurnal" (16%) and "extirpated" (14%).

Of those terms that were familiar to at least half of respondents, all are found in common parlance. Certainly, burrowing is a term in everyday use while Endangered Species Act is very frequently mentioned in newspaper or television and radio news reports. Urban sprawl is also a term that is in common usage. Other well-known terms contain referents that are commonly used such as "conservation" and "vulnerability."

What seems to set these terms apart from the less-well known items is that the less familiar terms are specific descriptors of technical aspects of wildlife management. For example, random demographic events refers to a phenomenon that must be understood in its precise context, Sylvatic Plague is a specific disease, and diurnal and extirpated are technical terms in the field biology discipline. Individuals are not likely to know these terms without specific training in or exposure to wildlife management. Thus, what distinguishes this list of terms is the sharp break between familiar and unfamiliar terms. These findings are reported in Table 3.

Urban respondents rated themselves as significantly more knowledgeable about prairie dogs (term familiarity index score: 5.59; see Appendix A) than did their rural counterparts (term familiarity index score: 5.25; P=0.05) but there were no significant differences in the scores of suburban and rural or suburban and urban respondents. There was also a significant difference between those rated as passive political participants (6.14) and active political participants (6.90; P=0.00). Each level of respondent education and income resulted in significantly higher scores on term familiarity (P=0.00; the difference between medium and high income was significant at P=0.04).

Table 3. Familiarity with terms related to black-tailed prairie dog management.

Term	Know meaning	Heard of but don't know meaning	Don't know meaning
Burrowing	90%	5%	5%
Endangered Species Act	85%	10%	5%
Urban sprawl	68%	10%	22%
Prairie ecosystem	61%	16%	23%
Habitat conversion	54%	24%	22%
Biological vulnerability	54%	22%	25%
Habitat fragmentation	42%	25%	34%
Sylvatic Plague	31%	21%	49%
Random demographic events	28%	24%	48%
Diurnal	16%	11%	73%
Extirpated	14%	15%	71%

Multivariate Analysis. A scale representing familiarity with terms was constructed using 11 terms concerning the management of prairie dogs. The scores on the scale ranged from 0 to 11. Using this index as the dependent variable, we developed an OLS regression model to ascertain which variables seemed to explain the variance in self-assessed knowledge of terms (Table 4). The resulting model demonstrates the importance of participation in politics and outdoor recreation, gender, formal education, experience with prairie dogs, use of information sources, and people's political ideology in explaining respondents' level of self-assessed knowledge.

Because the dependent variable was scored 0 to 11 with the highest score indicating familiarity with the most terms, a negative coefficient indicates that the higher the level of the independent variable the lower the familiarity index. F-tests results indicate that the model is statistically significant and the adjusted R^2 indicates that the model explains 30% of the variance.

Variables that may be associated with the attentive public—political activity and outdoor recreation—were positively related to familiarity with terms. The model suggests that more political participation is associated with increased familiarity with terms. Higher levels of self-assessed knowledge were also bolstered by a different kind of activity. Those who reported a higher level of outdoor recreation near prairie dog towns were

familiar with more of the terms. This is not surprising because those more active in the outdoors are more likely to come in contact with prairie dogs. Knowing the location of prairie dog towns also contributed to increased familiarity with terms. This increased experience with prairie dogs can make the issue more important (i.e., salient) for some respondents. Thus, those who participated more in politics and had a direct experience with prairie dogs reported higher levels of self-assessed knowledge.

Besides these variables related to attentive publics, there were other types of variables that were positively related to familiarity with terms. One of these was respondents' use of information sources. People who indicated they received information from personal experience and those who consulted printed materials were likely to report that they knew the meaning of terms. Socio-demographic characteristics were also important. Men reported a higher level of self-assessed knowledge than women. Not surprisingly, those with higher levels of education reported increased familiarity with the terms. On the other hand, those who said they had a hard time understanding environmental issues recorded lower levels of self-assessed knowledge.

Table 4. Ordinary least squares model of self assessed familiarity with terms related to black-tailed prairie dogs (Adjusted R^2 of .304; F=52.679 Sig.=0.000).

Variable	Unstandardized Coefficient B	Standardized Coefficient ß
Index of total participation	0.386[c]	0.249
Highest level of education	0.300[c]	0.188
Personal experience as a source of information	0.478[b]	0.083
Environmental Issues are hard to Understand	-0.261[c]	-0.116
Know location of prairie dogs	0.611[c]	0.101
Index of total outdoor activity	0.093[a]	0.070
Printed materials as a source of information	0.346[c]	0.099
Gender	-0.495[a]	-0.077
Ideology	-0.216[c]	-0.133

[a] Significant at $p < 0.05$.
[b] Significant at $p < 0.01$.
[c] Significant at $p < 0.001$.

Knowledge-holding: Factual Knowledge

Univariate Analysis. Close to half of the respondents knew when prairie dogs were most active, that they are most often killed by poison, and that plague is the disease that can most likely occur in both prairie dogs and humans. These facts deal with some form of human-prairie dog interaction. The less well-known facts were those that had to do solely with prairie dog life history. Just over a quarter of respondents knew that prairie dogs were most closely related to chipmunks. And just 10% knew that prairie dogs have one litter per year and live in groups called coteries (Table 5).

Although there were no significant differences between suburban and urban or suburban and rural respondents, urban residents (factual knowledge index score: 1.72; see Appendix A) were significantly less knowledgeable than their rural counterparts (factual knowledge index score: 2.03; P=0.00). There was no significant difference between passive and active political participants (P=0.75), but there was a difference in knowledge between low and medium levels of education levels (P=0.01) and low and high education (P=0.05). Low income respondents were less knowledgeable than medium income respondents (P=0.00) and high income respondents were less knowledgeable than medium income respondents (P=0.04).

Table 5. Percentage of all respondents who correctly answered multiple choice fact questions about the life history of Black-tailed prairie dogs.

Fact	Percent who knew correct answer
Prairie dogs are most active in the *daytime*	56%
Prairie dogs that interfere with human activity are most often *killed with poison*	49%
A disease that can occur in prairie dogs and people is *Plague*	41%
Prairie dogs are most closely related to *chipmunks*	29%
Prairie dogs have *1 litter each year*	10%
Prairie dogs live in groups called *coteries*	9%

Multivariate Analysis. The factual knowledge index is an objective measure of knowledge. We developed the index by scoring all the correct answers to a series of multiple-choice questions as a 1 and all the incorrect answers as a 0 then summing. The resulting scale ranged from 0 to 6, with the higher score indicating greater factual knowledge.

We found a mix of variables to be important in explaining respondents' level of factual knowledge about prairie dogs. Those who were more involved in the political system knew more facts about prairie dogs than those who participated less. Age was also associated with knowing more facts. Older respondents tended to have a higher level of factual knowledge than their younger counterparts. Respondents' experience with and use of different information sources regarding prairie dogs was also associated with their level of factual knowledge. Those who saw prairie dogs more often and reported knowing where prairie dog towns were located possessed a higher level of factual knowledge than those who lacked these kinds of direct experience. Those who reported learning about prairie dogs through personal experience and printed information sources, such as government pamphlets, demonstrated a higher level of factual knowledge than those who did not use these information resources. The model for factual knowledge is presented in Table 6.

Table 6. Ordinary least squares model of factual knowledge with an Adjusted R^2 of .149 (F=29.878 Sig.=0.000).

Variable	Unstandardized Coefficient B	Standardized Coefficient ß
Index of total participation	0.068[b]	0.097
Personal experience as a source of information	0.217[a]	0.083
Printed materials as a source of information	0.185[c]	0.116
Frequency of seeing prairie dogs	0.154[c]	0.165
Know location of prairie dogs	0.363[c]	0.135
Age	0.005[a]	0.060

[a] Significant at $p < 0.05$.

[b] Significant at $p < 0.01$.

[c] Significant at $p < 0.001$.

Discussion

The research questions related to knowledge were two-fold: (1) What is the current citizen level of knowledge and (2) what explains these levels of knowledge?

What do people know about prairie dogs and their ecology? Not surprisingly, respondents were more familiar with terms used in everyday conversation. They reported much lower levels of knowledge on more specific and technical terms. For example, many respondents knew the meanings of general ecological terms such as burrowing, Endangered Species Act, urban sprawl, or habitat conservation. But, only

some knew the meanings of terms like Sylvatic plague, habitat fragmentation, or extirpated (Table 3).

There was a similar answer when looking at factual knowledge. Respondents were more apt to correctly answer questions concerning how humans interact with prairie dogs. This was demonstrated with a majority of people (56%) knowing that prairie dogs are active in the daytime. Those questions concerning only prairie dogs (e.g., not something people are likely to learn from just "interacting" with prairie dogs) were missed by a vast majority of people (Table 4).

With respect to both self-assessed and factual knowledge, information that is more specific, technical, and harder to attain was less likely to be possessed by the majority of respondents. All of this suggests that people may know something about general ecology, but when it comes to specifics about prairie dogs, knowledge is not as high.

We examined the results of the multivariate analyses for familiarity with terms and factual knowledge. An important difference between these types of knowledge is the role of formal education. Education provided part of the explanation for levels of self-assessed knowledge (term familiarity), but not for factual knowledge. People's self-assessed knowledge was also affected by their difficulty in understanding environmental issues. This suggests that higher levels of education (e.g., beyond a high school degree) can expose people to at least some of the management terms and increase their understanding of somewhat complex issues like the environment. On the other hand, it seems to be less effective in providing people with specific facts related to prairie dogs.

Having examined the major difference, it is important to focus on what these different types of knowledge have in common. The analyses suggest that three factors explain both factual knowledge and familiarity with terms about prairie dogs and their ecology: (1) the importance of information sources, both printed and personal experience; (2) knowledge about where prairie dogs are located; and (3) political participation. All of this indicates that people who possess higher levels of both self-assessed and factual knowledge will be part of an attentive public (e.g., higher levels of political participation) that has experience with prairie dogs and is willing to use additional information resources to learn more about them.

Participation

Participation refers to respondents' political activity in terms of efforts to influence decisions (Question 8: Appendix B). We measured this by asking respondents to answer yes or no to a series of activities in which they might have engaged. These questions related to attempts to influence "a decision about land use" but were not specific to prairie dog management. We categorized respondents into active political participants

and passive political participants. Active political participants is an index developed by scoring yes as 1 and no as 0 for Question 8, options e (leading a citizen advisory group), g (leading a natural resource or environmental interest group), and i (helping organize a petition concerning natural resources or the environment). Any respondent who answered at least one of these questions with "yes" was labeled as an active political participant. Passive political participants is an index developed by scoring yes as 1 and no as 0 and for Question 8, options a (attending a public hearing), b (contacting or writing a state/federal agency), c (contacting or writing an elected official), and h (signing a petition concerning natural resources or the environment). Any respondent who answered at least one of these questions with a "yes" but did not answer yes to active indicators was labeled as a passive political participant. Finally we totaled all yes responses for each respondent, which resulted in an index of Total Participation. Scores on the Total Participation index ranged from 0 (indicating no participation) to 9 (indicating high participation).

Univariate Analysis

Forty-six percent of respondents indicated that they had not engaged in any political activities. Of the 54% who had participated in at least 1 activity, 83% were categorized as passive participants and 16% were categorized as active participants. Active political participants were more likely than passive participants to report a familiarity with terms (P=0.00) but there was no difference between active and passive participants in terms of their factual knowledge (P=0.75; Appendix A).

The activities in which most people engaged included: "signing a petition" (37%) and "attending a public hearing" (36%). Almost a quarter of respondents (24%) said they had written an elected representative or state or federal agency. Other activities received less participation. Thirteen percent said they had joined a natural resource or environmental interest group and fewer than one in ten said they had become a member of a citizens advisory group. Even fewer said they had helped organize a petition (7%), led a citizen advisory group (3%), or led interest group (2%).

Multivariate Analysis

Political activity is correlated with several variables, which explain about 27% of the variance (Table 7). These can be grouped roughly into four categories: perception, direct experience, information sources, and demographics. First, perception includes post-materialist orientation, self-assessed term familiarity, and attitude toward prairie dogs. Measuring post-materialism has been an important ingredient in many surveys of the public over the past 10 years. Post-materialism is the feeling that needs (such as a desire for belonging, self-expression, and participation in decisions, as well as concern for the quality of life) are among the most important personal values. Materialism, on the other hand, is defined as the feeling that more basic needs such as economic security are more important. In the prairie dog model, those who hold a post-

materialist, rather than materialist orientation were more likely to score well on the total participation index. Although there was no significant difference between passive and active political participants, those who were either passively or actively participants in politics were significantly more likely (P=0.000; Appendix A) to rate themselves as post-materialist. Those who rated themselves as more familiar with terms and/or who believed prairie dogs have a positive benefit to society were also more likely report higher levels of political activity.

Second, it is not surprising that direct experience is also a predictor of participation. Those who engaged in outdoor recreation are likely to have higher total participation scores. This is perhaps explained by the propensity for outdoor recreationists to identify with or be concerned about natural resource issues. Those who classified themselves as holding agricultural occupations were also likely to be participants. Third, sources of information were correlated with higher total participation scores. People who relied on printed materials or formal organizational sources of information (e.g., public hearings) were more likely to be active in politics.

Fourth, several demographic variables explained higher total participation scores. Women were more likely than men to score high on this index as were older persons and those with higher levels of formal education (above a high school education). Those with higher incomes were likely to report more political participation as well.

Table 7. Ordinary least squares (OLS) model for predictors of total political participation (F=35.643, Adjusted R^2=0.271, p=0.000).

Variable	Unstandardized Coefficients B	Standardized Coefficient ß
Post-Materialism	-0.200 [a]	-0.068
Familiarity with terms	0.185 [c]	0.286
Attitude toward prairie dogs	0.033 [b]	0.077
Outdoor Activity	0.126 [c]	0.146
Printed materials as source of information	0.371 [c]	0.162
Person-to-person communication as source of information (formalized Communication)	0.436 [c]	0.114
Income	0.055 [b]	0.087
Education	0.073 [a]	0.071
Gender	0.249 [a]	0.060
Agricultural jobs	0.374 [a]	0.075

[a] Significant at p < 0.05.

[b] Significant at p< 0.01.

[c] Significant at p< 0.001.

Discussion

It is heartening to find that nearly half (48%) of respondents indicated that they had engaged in some form of political activity. Although, less than 1 in 10 indicated that they engaged in active political participation, 41% said they had at least signed a petition, attended a public hearing, or contacted someone in an elective or bureau office. Among those who were active, there was a correlation with using printed materials as a source of information. This bodes well for the usefulness of newspaper articles, pamphlets, and other publications to reach the portion of the public who are attentive to policy questions. This group of people is also more likely to be ones who have relied on formal organizational communication as a source of information about prairie dogs.

The role of basic attitudes is interesting. People who found a positive social benefit from prairie dogs were more likely to be more politically active. This may suggest that people with positive orientations toward prairie dogs tend to become more active in decisions concerning natural resource and environmental issues. Consistent with other findings, older, well-educated, higher income people and women were also more likely to be politically active. Politically active respondents were also more likely to say that they were familiar with more terms. From this pattern we expected to find that those with a post-materialist orientation were also more active (as hypothesized by Inglehardt 1995). Indeed, in this study, post-materialists were more likely than materialists to be active in politics. This pattern may suggest that while some political activity is associated with affluent citizens who hold more tolerant views toward wildlife, another cadre of political activist is characterized by direct experience with the species, holding agricultural occupations, and reliance on formal organizational sources of information.

General Environmental Attitudes

To measure general environmental attitudes, we relied on respondents' preference for protection of the environment versus growth of the economy, their support of the NEP, and their trust in science and technology. Preference for the environment or the economy is a fairly straightforward indicator of environmental attitudes. The NEP measures the relationship between people and nature. It especially casts that relationship in terms of the "spaceship earth" idea in which the earth is said to consist of finite resources (Pierce et al. 1989). We chose to measure trust in science and technology because those who believe in the promise of scientific progress are thought to expect a bright future in which ecological problems are overcome. On this measure, trust in science and technology indicates faith that solutions to environmental problems can be achieved (Pierce et al. 1989).

Environmental Protection versus Economic Growth

Univariate Analysis. We asked respondents to choose a best scenario for natural resource management (ranging from protection of the environment to growth of the economy as the most important consideration). Thirty nine percent of respondents indicated, "protection of the environment should be the most important or only consideration." These findings are consistent with other national surveys in which 35% to 40% of the public said the environment was among the most important issues (Krause 1993; Pleschberger 1995; Smith and Krannich 2000; Ungar 1994).

Interestingly, however, urban and rural residents were significantly different on this measure. A significantly higher percentage (48%) of urban county respondents as compared to 33% of rural county residents said that the environment was the most important consideration. Politically active respondents (42%), women (49%), NEP supporters (59%; see explanation below), and respondents who do not support science (44%) also felt that the environment was the most important consideration (Table 8).

Multivariate analysis. An index of general environmental attitude was constructed using the five options that ranged from rating environmental preservation as most important to rating economic growth as most important. Using this index as the dependent variable, we estimated an OLS model for respondents' attitudes toward environmental protection and economic growth (Table 9). F-tests (F=80.7) indicate that the model is statistically significant and the adjusted R^2 explains 25% of the variance. A positive coefficient indicates a favorable attitude toward economic growth.

The model suggests that older people, those with agricultural jobs and those who used formal organizational sources for information about the species were more likely to support economic growth as opposed to environmental preservation when considering natural resource issues, such as black-tailed prairie dog management. This is not surprising because those who work in agriculture are more likely to see prairie dogs and would likely support economic growth rather than preservation of natural resources.

At the other end of the spectrum were people who supported protecting the environment in its natural state. Those who supported the NEP were likely to support environmental preservation of natural resources, such as black-tailed prairie dog habitat.

Table 8. Respondent categories related to general environmental attitudes.

Variable	Protection of the environment	Equal consideration	Growth of the economy
All Respondents (n=1797)	39%	38%	23%
Urban County Residents (n=495)	48%	35%	17%
Suburban County Residents (n=608)	39%	40%	21%
Rural County Residents (n=678)	33%	40%	27%
No Political Participation (n=766)	38%	37%	25%
Active Political Participants (n=146)	42%	33%	25%
Passive Political Participants (n=774)	40%	41%	19%
No Activity Outdoors (n=570)	38%	36%	26%
Active Outdoor Recreationists (n=946)	39%	42%	19%
No Trust in Science (n=354)	44%	33%	27%
Trust in Science (n=342)	35%	40%	25%
Low NEP (n=186)	11%	34%	55%
High NEP (n=720)	59%	33%	8%
Men (n=1267)	36%	41%	23%
Women (n=487)	49%	31%	20%

Table 9. Ordinary least squares model for respondents' preference for protection of the environment versus growth of the economy (Adjusted R^2 =0.252, F=80.717, p=0.000).

Variable	Unstandardized Coefficient B	Standardized Coefficient ß
Agriculture jobs	0.181[a]	0.071
Person-to-person communication as source of information (formalized communication)	0.125[a]	0.064
New Environmental Paradigm	-0.094[b]	-0.461
Age	0.006[b]	0.093

[a] Significant at $p < 0.05$.

[b] Significant at $p < 0.001$.

New Environmental Paradigm

Univariate Analysis. Previous researchers have characterized the attitudes of the public by attempting to classify ecological attitudes into two opposing views: the dominant social paradigm and the NEP. Dunlap and Van Liere (1984) found evidence to suggest that the dominant social paradigm, which is based upon traditional American values and beliefs (for example, hunting and trapping), poses a barrier to developing strong pro-environmental orientations. The NEP measures basic orientation toward the environment and a high NEP score suggests pro-environmentalist values (Dunlap and Van Liere 1978; Van Liere and Dunlap 1980 and 1981). The premise of the new environmental paradigm is if persons achieve a high score, they are more likely to have increased environmental concern; advocates of the new environmental paradigm are more likely to exhibit pro-environmental behavior (Dunlap and Van Liere 1978, Van Liere and Dunlap1980 and 1981; Steel and Weber unpublished data available from the authors).

We developed an NEP index from answers to a series of statements regarding the environment (Appendices A and C). The resulting categories were high, medium, and low support for the NEP. Most respondents either had medium (47%) or high (42%) support for the NEP. Eleven percent of respondents had low support for the new environmental paradigm.

Multivariate Analysis. We found that age, occupation, political ideology, and information sources were important in explaining support for the NEP (Table 10). F-tests (F=17.66) indicate that the model is weak but statistically significant with an adjusted R^2 explaining 10% of the variance. A positive coefficient indicates support for the NEP.

In studies by others, the NEP was correlated with three socio-demographic characteristics: age, ideology, and education level (Noe and Snow 1990; Van Liere and Dunlap 1980; Steel and Weber unpublished data available from the authors). As with those studies we did find a relation between NEP and ideology, with more conservative respondents tending to support the dominant social paradigm. We did not find age or education level to be significantly correlated with the new environmental paradigm. Women and people who used printed materials as information sources about prairie dogs were more likely to be associated with the new environmental paradigm (Table 10).

People who relied on formal organizational sources as a means of gathering information on prairie dogs and people who supported science and technology were more likely to support the dominant social paradigm (Table 10). Others who held the dominant social paradigm attitude included those who frequently see prairie dogs, worked in the agricultural sector, and relied on direct experience for information. We are reluctant to

ascribe great weight to these findings because of the weakness of the regression model.

Table 10. Ordinary least squares for the New Environmental Paradigm (Adjusted R^2=0.108, F=17.661, p=0.000).

Variable	Unstandardized Coefficient B	Standardized Coefficient ß
Person-to-person communication as a source of information (formalized communication)	-0.628[a]	-0.066
Gender	1.015[b]	0.098
Printed materials as a source of information	0.745[c]	0.130
Trust in science and technology	-0.195[c]	-0.146
Ideology	-0.412[b]	-0.158
Agriculture jobs	-2.026[c]	-0.162
Frequency of seeing prairie dogs	-0.310[b]	-0.093

[a] Significant at $p < 0.05$.

[b] Significant at $p < 0.01$.

[c] Significant at $p < 0.001$.

Trust in Science and Technology

We developed an index for trust in science and technology by scoring respondent answers to a series of statements measuring faith that science can find solutions to environmental problems (Appendix A). The resulting categories were high, medium, and low trust in science and technology. An overwhelming majority (60%) of people had a medium level of trust in science and technology. Twenty percent of the respondents had low and high levels of trust in science and technology. The multivariate model explaining trust in science and technology was statistically significant but not deemed to be meaningful.

Discussion

Foci of this study were (1) to determine what goals people prefer related to protecting natural resources and prairie dogs; and (2) what explains people's attitudes toward the environment in general.

In answering these questions, it is important to look at such things as direct experience, basic perceptions, and important sources of information. Peoples' basic perceptions, including political ideology and support of the NEP, have been reinforced by their direct

experiences with prairie dogs. The views of political conservatives and those who supported the dominant social paradigm took a dim view of protecting the environment. Those holding agricultural occupations and who have seen prairie dogs frequently were less likely to favor efforts to protect the environment. Formal organizational sources of information, such as public hearings, simply worked to compound a general lack of support for environmental protection.

For those looking to promote environmental protection, it is an uphill struggle. They must deal with the perceptions and values of the opposition, which are reinforced by direct experience with prairie dogs. Printed information sources, such as newspapers and government pamphlets, seemed to promote more pro-environmental views. Those who relied on printed media as an important source of information about prairie dogs were more likely to support the NEP and favor environmental protection over economic growth. Proponents of environmental protection need to reach out and make their case with objective information in whatever communication forum is available. Given the importance of printed sources of information to promoting knowledge and political participation, this is an avenue that should be explored by those seeking to protect the environment in general and prairie dogs in particular.

Attitudes Toward Black-tailed Prairie Dogs

Specific attitudes toward prairie dogs were measured by the level of benefits respondents associated with protecting prairie dogs and the seriousness of prairie dog issues as compared to other environmental issues.

Benefits of Prairie Dog Management

Univariate Analysis. We used a set of four questions concerning the benefits respondents' perceived would accrue to society from the protection of prairie dogs. These responses were summed to form an index of the perceived level of benefits that would be derived from protecting prairie dogs (Appendix A). Higher scores indicate that a respondent viewed protecting prairie dogs as more beneficial than those with lower scores. Respondents' scores ranged from 4 to 20. Although 58% felt that there were at least moderate benefits to society, respondents who reported an overall "low" level of benefits outnumbered those who indicated a "high" level of benefits by a 2 to 1 ratio (42-21%; Table 11).

Multivariate Analysis. Ordinary least squares estimates for respondents' attitudes concerning the benefits of protecting prairie dogs are presented in Table 12. The dependent variable is a scale measuring the perceived benefits to society of protecting prairie dogs through various management options (see Appendix A). A positive coefficient suggests an increasing level of perceived benefit for protecting prairie dogs. F-test results indicate the model is statistically significant. The adjusted R^2 indicates the

model explains a little over 27% of the variation in respondents' perceptions of the level of benefit received from protecting prairie dogs.

Socio-demographic factors provide an important part of the explanation. Older respondents and those employed in the agricultural sector were less likely to see a benefit from protecting prairie dogs than those who were younger and employed in other types of occupations. Respondents who lived in more rural counties or who reported seeing the animals more frequently were less likely to view protecting prairie dogs as highly beneficial.

There are other factors that offer an insight into these attitudes. Electronic media and person-to-person communication with friends and neighbors provide a contrasting view of the role of information sources in determining respondents' attitudes. Those who find electronic information sources useful were more likely to find protecting prairie dogs beneficial. However, those who relied on friends and neighbors for their information concerning prairie dogs were less likely to view protection in a positive light. Respondents who identified themselves with the NEP were more likely to see protecting prairie dogs as beneficial than were those more closely identified with the Dominant Social Paradigm. Those who reported having a more conservative political ideology were more likely to place a lower value on protecting prairie dogs.

Table 11. Social Benefits Provided by Prairie Dog Management.

Benefits	Score Range	Number of Respondents	Percent
Low Benefits	4 – 9	747	42.0
Medium Benefits	10 – 14	654	36.8
High Benefits	15 – 20	378	21.2
Total		1779	100.0

Table 12. Ordinary least squares model of benefits of managing to protect prairie dogs (Adjusted R^2=0.274; F= 46.063; p=0.000)

Variable	Unstandardized Coefficient B	Standardized Coefficient ß
Frequency of seeing prairie dogs	-0.527[c]	-0.170
Ideology	-0.225[b]	-0.092
NEP	0.313[c]	0.334
Person-to-person communication as a source of information (friends & neighbors)	-0.649[a]	-0.066
Electronic media as a source of information	0.539[c]	0.086
Age	-0.032[c]	-0.109
Agriculture jobs	-1.899[c]	-0.162
Respondents' residence	-0.062[b]	-0.069

[a] Significant at p < 0.05.

[b] Significant at p< 0.01.

[c] Significant at p< 0.001.

Seriousness of Prairie Dog Problem

Univariate Analysis. Respondents were asked about the importance of deciding what to do about prairie dogs compared to other environmental problems in their state. Approximately 31% of respondents indicated that deciding what to do with prairie dogs was as important or more important than other environmental problems. However, 69% felt the prairie dog problem was less important or not even an issue at all. Overall, this seems to indicate that deciding what to do about prairie dog populations is not a pressing issue for most respondents (Table 13).

Table 13. Respondent perceptions of the seriousness of the prairie dog problem.

Protecting Prairie Dogs Is	Frequency	Percent
One of the most serious environmental problems	142	7.6
About the same as any other issue	433	23.0
Less important than other environmental issues	676	36.0
Not an issue at all	628	33.4
Total	**1879**	**100.0**

Multivariate Analysis. Ordinary least squares estimates for respondents' attitudes concerning the relative importance of deciding what to do about protecting prairie dogs compared with other environmental problems are presented in Table 14. Because of the

way the dependent variable (Seriousness of the prairie dog problem; Appendix A) is scored (1 = Protecting prairie dogs is one of the more serious issues to 4 = Protecting prairie dogs is not an issue at all), a negative coefficient indicates that respondents see protecting prairie dogs as a serious issue when compared to other environmental problems. This model is statistically significant.

We found that a variety of variables explained respondents' attitude toward the importance of deciding what to do about prairie dogs. Respondents who reported possessing a more conservative political ideology were less likely to view prairie dogs as a serious issue. Those who were employed in the agricultural sector were much less likely to view protecting prairie dogs as a serious issue than were those employed in other types of occupations. As with the question of social benefits from prairie dog protection, respondents who identified with the NEP and found electronic information sources to be highly useful were more likely to view protecting prairie dogs as a serious issue. Interestingly, those with more formal education were more likely to view prairie dogs as not even being an issue at all.

Table 14. Ordinary least squares model of seriousness of the prairie dog problem. (Adjusted R^2=0.122; F= 27.548; p=0.000)

Variables:	Unstandardized Coefficient B	Standardized Coefficient ß
NEP	-0.054[c]	-0.266
Agriculture jobs	0.262[b]	0.104
Electronic media as a source of information	-0.177[c]	-0.131
Ideology	0.047[b]	0.089
Education	0.033[a]	0.063

[a] Significant at p < 0.05.

[b] Significant at p< 0.01.

[c] Significant at p< 0.001.

Discussion

The research questions regarding attitudes toward prairie dogs were two-fold: (1) What are citizens' attitudes/preferences regarding prairie dogs and (2) What are the factors that explain differences in attitudes? We examined those questions by (1) looking at the level of benefits to society people perceive are provided by management that is aimed at prairie dog protection and (2) asking how important the problem of deciding what to do about prairie dog protection is in relation to other environmental issues.

Citizens generally reported unfavorable attitudes toward black-tailed prairie dogs. As has been suggested by earlier research (Reading et al. 1999; Zinn and Andelt 1999),

negative attitudes were associated with familiarity with the animal. Those who frequently saw, were in occupations that might bring them in contact with, or relied on friends and neighbors for information about prairie dogs felt that the protection of the rodents was less beneficial to society and not as important as other environmental issues. Negative attitudes were also associated with older respondents and those who possessed a more conservative political ideology. Environmentalists (identified with the NEP) and those who relied on electronic media for their information were less negatively disposed.

Although this pattern seems to suggest a rural/urban divide in attitude toward prairie dogs, those geographic factors did not emerge as significant in our models. More than where people live (unless they live near prairie dog colonies), it is direct experience with the animals that seems to predict attitude. Even the reliance on electronic media (i.e., radio and television) versus person-to-person contacts (e.g., friends and neighbors) for information bespeaks this same phenomenon. The divide of overall orientation augments the divide of direct experience, with environmentalists and those with more liberal political ideologies being more favorably disposed toward prairie dogs.

This suggests a daunting challenge for wildlife managers. Protection of prairie dogs does not evoke images of environmental protection, suggesting that the idea of these burrowing rodents as keystone species has not taken root in the perceptions of the general public. The most successful symbols of environmental concern are ones that evoke a fear of eminent ecological disaster. Prairie dogs may achieve that status only with environmentalists. Factors like direct experience (e.g., frequency of sighting and agricultural jobs) are associated with negative attitudes towards prairie dogs. Wildlife managers may have to find avenues to reduce the potential for harm that may be caused by the populations that do exist. Changing these negative perceptions will rely on using different forms of communication to demonstrate the relation of a keystone species to other environmental amenities. Wildlife managers should attempt to use print media as well as sources like the Internet to present a more positive image of the prairie dog.

The Role of Rurality

We specifically designed this study to examine the role of rurality in knowledge of and attitudes toward black-tailed prairie dogs. To do this, we divided our sample into counties that were rural, suburban, and urban. These categories were based on the rurality index developed by Cleland (1995). The role of rurality seemed to be an important question for two reasons. First it seemed important because a difference between rural and urban residents had been reported in the literature on attitudes about prairie dogs (e.g., Reading 1993; Zinn and Andelt 1999). Second, understanding the difference between rural and urban residents seemed important because it might provide insight into developing effective outreach and public involvement programs for

wildlife management agencies. We found that rurality itself was only once an explanatory factor in models of attitude toward or knowledge of prairie dogs. But some variables related to rurality do seem to be important.

In support of the findings of Reading (1993), we found a difference between rural and urban residents in terms of general environmental attitudes. When asked how residents would balance environmental protection and economic progress, the vast majority of respondents (77% overall) and the majority of urban, suburban, and rural residents said that the environment and economy should be balanced or the environment should be emphasized (Table 8). But urban county respondents were significantly (P=0.000) more likely to express environmental attitudes than were rural residents.

However, when we ran the regression models, rurality was a significant factor only in explaining attitude toward the social benefits of managing to protect prairie dogs. The variables that more frequently emerged as important were agricultural jobs and frequency of seeing prairie dogs. Zinn and Andelt (1999) reported that people who most commonly saw prairie dogs (especially those living close to prairie dog colonies) were more likely to have generally negative attitudes toward them. In our examination of general environmental orientation we found that frequency of seeing prairie dogs was likely to be associated with lower environmentalist scores.

Another example in which direct experience with the animals was associated with lower levels of environmentalism was in the analysis of the NEP. In the regression model (Table 10) people were less likely to hold the NEP if they were in agricultural jobs or frequently saw prairie dogs. These examples illustrate that factors related to rurality are significant indicators even when rurality, itself, is not.

Residence in a rural county was not related to general attitudes on protection of the environment. However, factors related to a rural experience—i.e., agricultural jobs and frequency of seeing prairie dogs—were important. Certainly, people who have agricultural jobs and see prairie dogs more often are likely to be rural residents or travel in rural areas. Beyond that, the data seem to suggest that formal organizational sources of information—such as public hearings or meetings--is an element in the development of environmental attitudes.

This is supported by the data regarding people's attitudes toward prairie dogs specifically. Rurality was a factor, along with frequency of seeing prairie dogs and agricultural jobs, when we asked respondents to tell us whether they believed prairie dogs to be beneficial to society (Table 12). People from rural counties were more likely to view prairie dogs as providing little or no benefits to society. Similarly, when asked about the seriousness of the problem of deciding what to do about prairie dogs, most people did not think the animals were part of a serious problem (Table 14).
We thought that residence in a rural county would also be associated with higher levels of knowledge about prairie dogs. That proved to be untrue. In the question about

respondents' familiarity with terms rural, suburban, or urban county of residence was not a significant factor. People who frequently see prairie dogs and those who know where the nearest prairie dog town was located were more likely to know both terms and facts. People with direct experience knew more.

In conclusion, we did not find that residence in rural counties was directly tied to knowledge of prairie dogs. However, we did find that residence in a rural county was associated with believing in low social benefits from protecting the animals. One reason for this is that sampling rural counties means surveying people who live in towns, small cities, as well as on farms and ranches. The factors explaining attitudes and knowledge about prairie dogs seem to be related to direct experience because those factors (e.g., frequency of seeing the animals, and agricultural occupation) increase the salience of the prairie dog issue for these people.

Prairie Dogs in Context

General Environmental Attitudes

In a 1999 study of the general public The Pew Research Center for the People and the Press (2000) asked respondents to weigh two options about environmental protection. People were asked to choose between these statements: "Stricter environmental laws and regulations cost too many jobs and hurt the economy" or Stricter environmental laws and regulations are worth the cost." Pew found that 62% (margin of error ±8%) favored the statement that environmental laws were worth the cost.

We made a similar inquiry, when we asked respondents to choose one out of three options: "Protection of the environment should be the most important or only consideration," "Equal consideration to protection of environment and growth of the economy," or "Growth of the economy should be the most important or only consideration." We found that 39% of respondents believed the environment should be the only or main consideration and 77% believed that the emphasis of environmental policy should be on the environment or a balance between environment and the economy (23% said the economy should be the most important or only consideration).

In both surveys, more than 6 in 10 people said that the environment was an important consideration. In another question from the Pew study (Pew 2000), 81% said that they (either completely or mostly) agreed with the statement that "there need to be stricter laws and regulations to protect the environment." In that same survey, 79% said that they "personally worry" about "the loss of natural habitat." This compares with findings from the Gallup organization in 1989 and 1990 that more than 8 in 10 respondents said they personally worry about the loss of natural habitat (Pew 2000).
When the Pew (2000) study asked the question about personal worries, about 70% said they worried about a wide variety of environmental issues, ranging from the ozone

layer to loss of tropical rain forests. From the Pew (2000) study it appears that people worry about pollution and other threats. They worry about environmental issues that might be considered distant or general problems. In a question similar to ours, almost 7 in 10 respondents (66%; Pew 2000) said they had confidence in environmental groups to strike the right balance between protecting the environment and keeping the economy growing. All of this speaks to a reservoir of concern about the environment.

Attitudes Toward Black-tailed Prairie Dogs

However, when it comes to more particular issues and problems that are closer to home, citizens reported a lower level of concern or worry. For example, the Pew (2000) study found that "commercial development of open space" is a concern to fewer people (59%). Other researchers have found that prairie dogs are a specific example of this phenomenon (Reading et al. 1999; Zinn and Andelt 1999).

In our study area, only 3 in 10 (Table 13) said they believed deciding what to do about prairie dog management held about the same or more importance as other environmental problems. Sixty-nine percent believed it was a less important problem or not an issue at all. People were concerned about specific issues related to prairie dogs: about 4 out of 10 thought disease prevention was an important management question; a quarter of respondents said ranch and farm operations were the most important issue and only 11% said habitat protection was the most important issue (taken together, 32% said that habitat protection and private land development were the least important issues).

Although more than half (58%; Table 11) of the people we surveyed perceived some social benefits from protecting prairie dogs, people with direct experience of prairie dogs were less likely to find benefits from protecting them (Table 12). This response places prairie dogs in the position of one of the less salient environmental issues; far less important to the public than problems like toxic waste (83%; Pew 2000); the ozone layer (68%; Pew 2000); water pollution (78%; Pew 2000); or even the greenhouse effect (58%; Pew 2000).

The percentage of citizens who reported positive benefits from protecting prairie dogs in our study is similar to those who believed the United States was "losing ground" in its fight against environmental pollution (27%: Pew 2000). In short, protecting prairie dogs is not an issue that has much traction with the public.

Knowledge of Black-tailed Prairie Dogs

The lack of traction is related to three interlocking elements: salience (a combination of visibility and importance), knowledge (and sources of knowledge), and negative experience. Understanding people's knowledge about prairie dogs is an important first step in working on these three elements. People do not see prairie dogs as

environmentally important; they do see them as sometimes harmful or threatening; and they do not really know much about the animals.

Who does know about natural resource management? It has already been demonstrated that there is a difference between the knowledge levels of the general public and managers or politicians who specialize in natural resources. Pierce and Lovrich (1986) showed that there is a difference in knowledge between the attentive and general public. On some issues, the difference is not great. Pierce et al. (1989) reported that 30% of the public, 32% of environmentalists, and 21% of officials knew about sources of soil pollution. Steel and his colleagues (1990) reported that the average respondent said they were familiar with 6 of 10 technical terms associated with environmental risk and scored 7 on a 10-point scale of knowledge of pollution sources. In another example, Cantrell et al. (2000) found that only 31% of "community leader" respondents could correctly identify the amount of "protected land" in the area in which they live. But on other issues, there is a great difference between the attentive and general public. Pierce et al. (1989) reported that 62% of the public and 81% of officials knew about sources of water pollution, and 51% of the public knew about phosphate pollution as compared with 72% of officials, 64% of civic group members, and 62% of environmentalists. In other words, it is not only managers who have specialized knowledge; those who are active in or give attention to natural resource issues also possess knowledge.

Knowledge of prairie dogs is a fairly specialized type of information. Is knowledge holding about prairie dogs similar to peoples' knowledge of other environmental issues? Looking at two non-wildlife-related environmental issues, Pew (2000) found that 62% were able to give a correct answer to a question about "the greenhouse effect" and 45% knew that the United States produces more carbon dioxide that other countries with similar populations. We divided our terms into those that seemed to be in common use and those of a more specialized nature. Between 50% and 90% told us they knew the meaning of many of the terms commonly used to discuss prairie dogs. However, far fewer (40% to less than 20%) said they knew the meaning of terms specific to prairie dogs.

We found a similar differentiation in the results of the objective evaluation of respondent knowledge (Tables 5 and 6). Although almost 6 in 10 respondents knew that prairie dogs were active in the daytime and a plurality knew the animals are most frequently killed with poison and can carry plague, far fewer (10%) knew that prairie dogs have only one litter per year or that they are related to chipmunks (29%). Many people have some knowledge of prairie dogs, but few know detailed facts.

Interestingly, urban respondents said that they knew more terms than did their rural counterparts. But the factors associated with objective knowledge about prairie dogs were related to direct experience with the animals and political participation (Table 6).

Those engaged in active political participation were also more likely to be familiar with terms and know facts (Table 4).

It may be a problem for outreach efforts about prairie dog protection that urban dwellers seem to think they know more terms than they actually know facts. However, the central finding for addressing the traction issue is that knowledge is associated with those who said they frequently see, live near, or hold agricultural occupations that might put them in contact with the animals or are active in politics. It may be reasonable to consider those who are politically active and those who have direct experience with the animals as comprising the attentive public.

We saw, in Table 7, that higher income, higher education, and more outdoor activity as well as women and those with agricultural jobs were associated with higher total political activity. Of that group agricultural occupation was associated with a negative attitude toward prairie dogs (Tables 12 and 14). Personal experience as a source of information was important in shaping knowledge while formal organizational sources of information was important in shaping general environmental attitude.

This suggests that the role of the wildlife manager may be most effective when it seeks out those who are already actively participating in natural resource issues in addition to performing the necessary role of meeting the general public, answering questions in public forums, and presenting information to citizen groups. Those who are politically active but not currently engaged in the prairie dog debate might be important audiences for updated information. Presentation of prairie dog information in forums and styles that are more personal and experiential may be the most effective strategy (see, for example, Firth 1998). It seems apparent that information-sharing that focuses on the urban citizen should include more opportunities for personal interaction with prairie species—emphasizing the general environmental benefits—and experienced-based learning about the role of a keystone species.

Knowledge of prairie dogs does not seem to be associated with positive attitudes toward the importance or need for protection of the animals. The first step in addressing this divide is to work toward a consensus among scientists on the relation between prairie dog protection and human use of public and private lands. Beyond that needed first step, reversing negative perceptions will require demonstrating how a keystone species is related to other environmental amenities and affects quality of life. That connection can probably be made only anecdotally. Wildlife managers may find it efficacious to use commonly available print media, as well as outlets like the Internet, to present scientific findings and give concrete examples. Those findings might be most effective if explained in terms of personal experience.

Wildlife managers must overcome the apparent perception among most citizens that the protection of prairie dogs is not a major environmental concern. More information, better explained, might expand the public's knowledge but there is no guarantee that

increased information will result in more positive public perceptions. People seem to be aware of the environment as an important question for the nation and favor protection of the environment. But many competing issues are raised in the name of environmental protection and it is probably difficult for citizens who do not have first-hand experience with a species to sort among those issues and focus on ones that are immediately relevant. To address this, wildlife managers could focus on providing indications to the public about how to evaluate environmental problems. For example, the decision by the USFWS in 2000 to not immediately list the black-tailed prairie dog as a threatened species is one way to transmit a professional assessment of relative environmental priorities.

Our findings suggest that public discussion of prairie dog protection could be aided by increasing the relevant knowledge and vocabulary of citizens. This is a worthy objective for wildlife managers. It is noteworthy that the attentive public—especially those who attend meetings, write letters, and the like, as well as those having direct experience (especially in the form of routine, frequent exposure to prairie dogs)—are more knowledgeable. But it is also important to note that these same factors did not help explain attitudes. In fact, increasing the breadth of the public knowledge domain may shift the debate over prairie dog management in ways that cannot be foreseen. This suggests that concentrating on the attentive public may not build a bridge to greater general appreciation of prairie dogs. That bridge is more likely to arise from helping people see personal consequences. This can be done if people recognize the animals in the wild, know how they live and the role they play in the ecosystem, have access to trusted sources of information about the problems they cause, and understand the range of viable management options.

Acknowledgements

Although the descriptions and analysis in this completion report are the responsibility of the authors, we are grateful for the review comments provided by Dr. Shana Gillette, and outside reviewers: John C. Pierce, Brent Steel, and Delwin Benson.

References

Barnes, A.M. 1993, A review of plague and its relevance to prairie dog populations and the black-footed ferret, *in* Oldemeyer, J.T., and others, eds., Management of prairie dog complexes for reintroduction of the black-footed ferret, Biological Report 13, Washington, DC: U.S. Fish and Wildlife Service, p. 28-37.

Becker, M.L., 1993, The International Joint Commission and public participation: Past experiences, present challenges, future tasks, *Natural Resources Journal* 33(2): 235-274.

Behan, R.W., 1990, The RPA/NFMA: Solution to a nonexistent problem, *Journal of Forestry* 88(5):20-25.

Bimber, B., 2001, Information and political engagement in America: The search for effects of information technology at the individual level, *Political Research Quarterly* 54(1):53-67.

Blalock, H. M., 1972, Social statistics (2d ed.): New York, McGraw-Hill Book Company. http://www.cswe.org/publications/jswe/00-3ed.htm

Cantrell, J., Potter, T., and Stephenson, W., 2000, Protected areas and regional sustainability: Surveying decision makers in the Lake Superior Basin, *Natural Resources Journal* 40(winter):19-45.

Cleland, C.L., 1995, Measuring reality, *Human Services in the Rural Environment* Vol 18(4):13-18.

Collingridge, D., and C. Reeve, 1986, Science speaks to power: The role of experts in policymaking: New York, St. Martins Press.

Coluccy, J.M., Drobney, R.D., Graber D.A., Sheriff S.L., and Witter, D.J. 2001, Attitudes of central Missouri residents toward local giant Canada geese and management alternatives, *Wildlife Society Bulletin* 29 (1): 116-123.

Cupps, D.S., 1976, Emerging problems of citizen participation, *Public Administration Review* 37(5):478-487.

Denver Rocky Mountain News, August 8, 2000. Most in state call prairie dogs pests, p. 4A.

Dillman, D.A., 1978, Mail and telephone surveys: The total design method: New York, John Wiley & Sons.

Dillman, D.A., 2000, Mail and internet surveys: The tailored design method: New York, John Wiley & Sons.

Dolan, C.C., 1999, The national grasslands and disappearing biodiversity: Can the prairie dog save us from an ecological desert?, *Environmental Law* 29: 213-234.

Dunlap, T.R., 1988, Saving america's wildlife: Princeton NJ, Princeton University Press.

Dunlap, R.E., and Van Liere, K.D., 1978, The 'New Environmental Paradigm,'. *Journal of Environmental Education* 9(4): 10-19.

———1984, Commitment to the dominant social paradigm and concern for environmental quality, *Social Science Quarterly* 65: 1013-1028.

Ezrahi, Y., 1980, Utopian and pragmatic rationalism: The political context of scientific advice, *Minerva: A Review of Science, Learning and Policy* 81(?):111-131.

Firth, P., 1998, Freshwater: Perspectives on the integration of research, education, and decision making, *Freshwater Systems* 8(3):601-609.

Gericke, K.L., and Sullivan, J., 1994, Public participation and appeals, *Society and Natural Resources* 7(2):125-135.

Graber, K., and France, T., 1998, Petition for rule listing the black-tailed prairie dog as threatened throughout its range, National Wildlife Federation, petitioner to the U.S. Fish and Wildlife Service.

Inglehardt, R., 1995, Public support for environmental protection: Objective problems and subjective values in 43 societies, *PS: Political Science* 28(1):57-71.

Jacobson, S.K., and Marynowski, S.B., 1997, Public attitudes and knowledge about ecosystem management on Department of Defense land in Florida, *Conservation Biology* 11(3): 770-781.

Kellert, S.R., 1985, Social and perceptual factors in endangered species management, *Journal of Wildlife Management* 49(2): 528-536.

Kellert, S.R., and Clark, T.W., 1991, The theory and application of a wildlife policy framework, *in* Mangun, W.R., and Nagel, S.S., eds., Public policy and wildlife conservation: New York, Greenwood Press, p. 17-36.

Knopf, F.L., 1993, Avian assemblages on altered grasslands, *Studies in Avian Biology* 15: 247-257.

Kotliar, N.B., Baker, B.W., Whicker, A.D., and Plumb, G., 1999, A critical review of assumptions about the prairie dog as a keystone species, *Environmental Management* 24(2): 177-192.
Krause, D., 1993, Environmental consciousness: An empirical study, *Environment and Behavior* 25(1): 126-142.
Lee, C.D., and Henderson, R., 1989, Kansas attitudes on prairie dog control, Paper presented at Ninth Great Plains Wildlife Damage Control Workshop, Fort Collins, CO, April 18-20.
Long, M.E., 1998, The vanishing prairie dog, *National Geographic* 193(4): 116-130.
Luskin, R.C., 1993, Explaining political sophistication, *in* Niemi, R.G., and Weisberg, H.F. (eds), Controversies in voting behavior (3d ed.): Washington, DC, Congressional Quarterly, p. 114-136.
McCool, S.F., and Guthrie, K., 2001, Mapping the dDimensions of successful public participation in messy natural resources management situations, *Society and Natural Resources* 14:309-323.
Messmer T.A., Brunson, M.W., Reiter, D., and Hewitt, D.G., 1999, United States public attitudes regarding predators and their management to enhance avian recruitment, *Wildlife Society Bulletin* 27 (1): 75-85.
Noe, F.P., and Snow, R., 1990, The new environmental paradigm and further scale analysis, *Journal of Environmental Education* 21(4): 20-26.
Pierce, J. C., and Lovrich, N.P., 1986, Water resources, democracy and the technical information quandary: Millwood, NY, Associated Faculty Press, Inc.
Pierce, J. C., Lovrich, N.P., Tsurutani, T., and Abe, T., 1989, Public knowledge and environmental politics in Japan and the United States: Boulder, CO, Westview Press.
Pleschberger, W., 1995, Environmental concern of the local elite, *Annals of the American Academy of Political and Social Science* 540: 90-104.
The Pew Research Center for the People & the Press, 2000, Performance and purpose: Constituents rate government agencies, (**www.people-press.org/questionnaires/npr00que.htm** [08.09.01]).
Randall, D., 1976, Shoot the damn prairie dogs!, *Defenders* 51(6): 378-381.
Reading, R., 1993, Toward an endangered species reintroduction paradigm: A case study of the black-footed ferret, Ph.D. Dissertation: Yale University, New Haven, CT.
Reading, R.P., Miller, B.J., and Kellert, S.R., 1999, Values and attitudes toward prairie dogs, *Anthrozoos* 12(1):43-52.
Sanko, J., 2000, Prairie dogs doing fine, says new report, Denver Rocky Mountain News. (14 November).
Selin, S.W., Schuett, M.A., and Carr, D.S., 1997, Has collaborative planning taken root in the national forests?, *Journal of Forestry* 95(5):25-28.
Sexton, N., Brinson, A. Ponds, P.D., Cline, K., and Lamb, B.L., 2001, Citizen knowledge and perception of black-tailed prairie dog management: Report to respondents: U.S. Geological Survey Open-File Report 01-467, 23 p. (http://www.mesc.usgs.gov/products/pubs/10001/10001.shtml).
Smith, M.D., and Krannich, R.S., 2000, 'Culture Clash' revisited: Newcomer and longer-term residents' attitudes toward land use, development, and environmental issues in rural communities in the Rocky Mountain West, *Rural Sociology* 65(3): 396-421.
Steel, B.S., Soden, D.L., and Warner, R.L., 1990, The impact of knowledge and values on perceptions of environmental risk to the Great Lakes, *Society and Natural Resources* 3:331-348.
Ungar, S., 1994, Apples and oranges: probing the attitude-behaviour relationship for the environment, *Canadian Review of Sociology and Anthropology* 31(3): 288-304.
U.S. Forest Service, 1978, Management of prairie dogs on lands administered by the supervisor of the Nebraska National Forest, *in* Sutton, L. (ed.), Prairie dog management: USDA Forest Service Environmental Statement (USDA-FS-R2-FES).
U.S. Fish and Wildlife Service, 1999, Positive 90-day finding for a petition to list the black-tailed prairie dog: Washington, DC: http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=1999_register&docid=99-7273-filed
Utah Division of Wildlife Resources and U.S. Fish and Wildlife Service, Region 6, 1991, Utah prairie dog recovery plan: Salt Lake City, Utah and Denver, Colorado.
Van Liere, K.D., and Dunlap, R.E., 1980, The social basis of environmental concern: A review of hypotheses, explanations, and empirical evidence, *Public Opinion Quarterly* 44, 181-197.

——1981, Environmental concern: Does it make a difference how it's measured, *Environment and Behavior* 13: 651-684.
Verba, S.,Schlozman, K.L., and Brady, H.E., 1995, Voice and equality: Civic voluntarism in American politics: Cambridge, MA, Harvard University Press.
Wolfinger, R.E., and Rosenstone. S.J., 1980, Who votes?: New Haven, CT: Yale University Press.
Wyoming Tribune-Eagle, 2000, Prairie dogs get needed protection: Wyoming Tribune-Eagle. (December 05), A9.
Zinn, H., and Andelt, W., 1999, Attitudes of Fort Collins, Colorado residents toward prairie dogs, *Wildlife Society Bulletin* 27(4): 1098-1106.
Zelezny, L., 1999, Educational interventions that improve environmental behaviors: A meta-analysis, *The Journal of Environmental Education* 31(1):5-14.

Appendix A: Description of Indices and Table of Variables

Term Familiarity: This scale was constructed by summing a respondent's answer for items Q5a thru Q5k. Respondents received a score of 1 if they reported "Knowing the meaning and a 0 if they reported either "Heard of but don't know meaning" or "Have not heard of the term." Scores can range from 0 to 11. Reliability analysis was performed to construct this scale. Its Alpha coefficient was .8501.

Term Familiarity Expert: Respondents were classified as experts with respect to terms if they met two criteria. First, they had to know at least 8 out of 11 of these terms (Q5a through Q5k). Second, items Q5c and Q5e had to be among the terms they report knowing.

Active Political Participation: This index was constructed by summing Yes (1) and No (0) responses to items Q8e, Q8g, and Q8i. If a respondent answered Yes to any of these items, they were considered to be involved in an active form of political participation.

Passive Political Participation: This index was constructed by summing the Yes (1) and No (0) responses to items Q8a, Q8b, Q8c, and Q8h. If a respondent answered Yes to any of these items, they were considered to be involved in a passive form of political participation.

Total Political Participation: This index was constructed by summing the Yes (1) and No (0) responses to items Q8a thru Q8i. Scores ranged from 0 to 9.

Trust in Science: This index was constructed by summing a respondent's answers to items Q12a thru Q12d. Items Q12b, Q12c, and Q12d were recoded so that higher scores reflected a support of science. Scores could range from 4 to 20 with higher scores indicating more trust in science.

Person-to-Person Information Sources (Friends and Neighbors): This index was constructed from the response to item Q9a. Respondents indicating that they either use the source "Some" or "A Great Deal" received a 1. Responses of "None" and "Not Much" received a 0. Scores are either a 0 or 1.

Person-to-Person Information Sources (Formalized Communication): This index was constructed from the responses to items Q9e, Q9f and Q9g. Respondents indicating that they either use the source "Some" or "A Great Deal" received a 1. Responses of "None" and "Not Much" received a 0. Scores range from 0 to 3. The reliability coefficient for this scale (Cronbach's Alpha) was 0.60.

Printed Information Sources (PRISOURC): This index was constructed by summing responses to items Q9d, Q9h, Q9j, and Q9l. Respondents indicating that they

either use the source "Some" or "A Great Deal" received a 1. Responses of "None" and "Not Much" received a 0. Scores ranged from 0 to 4.

Electronic Information Sources (ELESOURC): This index was constructed by summing responses to items Q9b, Q9c, and Q9i. Respondents indicating that they either use the source "Some" or "A Great Deal" received a 1. Responses of "None" and "Not Much" received a 0. Scores could range from 0 to 3.

Personal Experience as Sources (PESOURC): This item was constructed by recoding item Q9k. Respondents indicating that they either use the source "Some" or "A Great Deal" received a 1. Responses of "None" and "Not Much" received a 0. Scores were either 0 or 1.

Postmaterialism (POSTMAT): This index was constructed by a combination of responses on items Q11a and Q11b. If respondents indicated that answers "b" and "d" were their first and second choice for this country's future goals, they were considered to be postmaterialist. Both "b" and "d" are considered to be postmaterialist values. If respondents indicated that answers "a" and "c" should be the future goals of this country, they were classified as traditional. Answers "a" and "c" are considered to be traditional values. If respondents mixed these answer sets, then they were considered to in a "mixed" values category. This construction generated scores of 1, 2, and 3 (1 = postmaterialist, 2 = mixed values, 3 = traditional).

New Environmental Paradigm (NEP): This index was constructed by summing responses to items Q12f thru Q12j. Items Q12i and Q12j were recoded so that a higher score reflected a positive orientation to the NEP. Scores could range from 5 to 25 with higher scores indicating more support for the NEP.

Perceived Level of Benefits to Society: The index used to create this measure was produced from questionnaire items Q1a.1 – Q1a.4. The first three items (Q1a.1 – Q1a.3) were recoded to reflect a positive orientation towards the protection of prairie dogs. The reliability coefficient (Cronbach's Alpha) for the index was .8011. This suggests that respondents were mostly consistent in their response patterns for the additive scale and that scale components were intercorrelated.]

Importance of Protecting Prairie Dogs: This index was constructed from question 1b. Respondent scores ranged from 1 to 4. A score of 1 indicates that the respondent placed a high value on protecting prairie dogs (e.g., one of the more serious environmental problems in my state). A score of 4 indicates that respondents feel protecting prairie dogs "is not an issue at all."

Table of Variables Showing Measures of Central Tendency

Independent Variables	Mean Score	Standard Deviation
Socio-demographic indicators		
Age in years	52.84	15.94
Respondent's gender	.72 Female=0 Male=1	.49
Highest level of formal education	6.67 (1-10)	1.84
Agriculture occupational status	.19 No Ag job=0 Ag job=1	.39
Annual family income	5.14 (1-12)	2.92
Racial origin	.94 Non-white=0 White=1	.23
Respondent's county of residence (rurality): rural, suburban, or urban	9.32 (0-18) higher score indicates more rural	4.63
Experience with prairie dogs		
How often respondents see prairie dogs	1.38 (0-4) higher number indicates more often	1.43
Know how far primary residence is from a prairie dog town	.68 (0-1)	.47
Index of total outdoor activity near prairie dog towns	2.05 (0-8)	2.17
Sources of information indicators		
Learned about prairie dogs from person-to-person information sources (Friends and Neighbors)	.27 (0-1)	.45
Learned about prairie dogs from person-to-person information sources (Formalized communication)	.20 (0-3)	.55
Learned about prairie dogs from printed information sources	.52 (0-4)	.84
Learned about prairie dogs from electronic information sources	.39 (0-3)	.69
Technical Orientation Indicators		
Agreement with the statement "environmental issues are hard to understand"	2.92 (1-5) higher score indicates agreement	1.31
Trust in science and technology	12.36 (4-20)	3.39
Suport of the New Environmental Paradigm	17.32 (5-25)	4.56
Post-Materialism	1.94 1= postmaterialist; 2=mixed; 3=traditional	.61

Appendix B: List of All Questions Asked

1a. Listed below is a series of ideas concerning prairie dog management. For each idea, please rate its benefit to society using the scale below (Please circle the appropriate number).

High Benefits to Society 1 2 Neutral 3 4 5 Low Benefits to Society

Protecting prairie dogs on public and private lands will have...

Protecting prairie dogs on private lands owned by landowners who are willing to be compensated for their protection will have...

Protecting prairie dogs only on public lands will have...

Not protecting prairie dogs will have...

1b. Recently, there has been a lot of talk about whether prairie dogs will become endangered in the coming years. Generally speaking, how important is deciding what to do about prairie dogs compared to other environmental problems in your state? (Please circle the number of your answer.)

One of the more serious environmental problems
About the same as any other issue
Less important than other environmental issues
It is not an issue at all

1c. Listed below are several issues that wildlife experts are confronted with when managing prairie dogs. Please indicate which issue you feel is the most important and which is the least important by putting numbers in the appropriate blanks.

Disease prevention
Ranch and farm practices
Habitat protection
Size of prairie dog populations
Location of prairie dog towns
Private land development
Tourism and recreation opportunities
Other

2. In general, how often do you see prairie dogs?

Zero times per month	1 to 5 times per month	6 to 10 times per month	11 to 20 times per month	More than 20 times per month

3. Which best describes how far your primary residence is from a prairie dog town?

Within 50 yards of your home
Between 50 yards and ¼ mile from your home
More than ¼ mile from your home
I don't know where the nearest prairie dog town to my home is.

4. The next question is on the subject of outdoor activities. Please tell us how often you participate in each of the following outdoor activities near prairie dog towns. (Please circle the appropriate number.)

Activity	Zero times per year	Less than 1 time per year	1 to 2 times per year	3 to 5 times per year	6 to 10 times per year	More than 10 times per year
horseback riding						
camping						
hunting						
hiking/backpacking						
bicycling						
wildlife/nature viewing						
photography						
four wheeling						
other						

5. Below is a list of specific terms that mangers commonly use when they discuss management of prairie dogs. We are asking if you know each term, have heard of the term but do not know its meaning, or have not heard of the term at all. (Please fill in the blank with the number of the most appropriate answer.)

Term	Know Meaning	Heard of but don't know	Have not heard of
Burrowing			
Endangered Species Act			
Urban sprawl			
Prairie ecosystem			
Habitat conversion			
Biological vulnerability			
Habitat fragmentation			
Sylvatic Plague			
Random demographic events			
Diurnal			
Extirpated			

6. Because preserving or developing prairie dog habitat is one element of environmental policy, it is important to know how you feel about this issue. (Please write in the box the number of the best option.)

Option1:
Protection of the environment in its natural state should be the only consideration in deciding what to do with natural resources.

Option 2:
Protection of the environment should be the most important, but not the only, consideration in deciding what to do with natural resources.

Option 3:
Protection of the environment and the growth of the economy should be given equal consideration in deciding what to do with natural resources.

Option 4:
Growth of the economy should be the most important, but not the only, consideration in deciding what to do with natural resources.

Option 5:
Growth of the economy should be the only consideration in deciding what to do with natural resources.

7. In order to work well with citizens it is important to understand what is commonly known about prairie dogs. Please check the one box for each of the following statements that best completes each sentence. (Correct answer is in **bold text**.)

Prairie dogs that interfere with human activity are most often
Trapped and moved
Killed with poison
Killed by shooting
Not sure

Prairie Dogs are most active during

Daytime
Nighttime
Both day and night
Not sure

A disease that can occur in prairie dogs and people is
Rabies
Plague
None
Not sure

Prairie dogs live in groups called

Harems
Coterles
Pods
Not sure

How many litters of young do prairie dogs have each year?
1 litter
2 or 3 litters
4 litters
Not sure

Prairie dogs are most closely related to

Marmots
Domestic dogs
Chipmunks
Not sure

8. Have you ever tried to influence a decision about land use in any of the following ways? (Please circle the most appropriate answer.)

Influence Decisions	YES	NO
Signing a petition concerning natural resources or the environment		
Attending a public hearing		
Contacting or writing a U.S. senator, member of congress, or state legislator		
Contacting or writing a state/federal agency		
Joining a natural resource or environmental interest group		
Becoming a member of a citizen advisory group		
Helping to organize a petition concerning natural resources or the environment		
Leading a citizen advisory group		
Leading a natural resource or environmental interest group		

9. How much would you say that you have learned in the past year about prairie dogs from the following sources? (Please circle the most appropriate answer.)

Source	None	Not Much	Some	A Great Deal
Personal experience				
Friends and neighbors				
Television				
Newspapers				
Radio				
General mailings to your home				
Scientific/technical media				
County extension agents				
Government pamphlets				
Other				
Public hearings				
Organizational meetings				
WWW or Internet				

Which newspaper source do you use most often (for those respondents who said they learned about prairie dogs from newspapers in the question above)?

Local Newspaper

Regional Newspaper

State Newspaper

National Newspaper

10. In discussions of environmental protection, we hear a lot of talk about liberals and conservatives. Below is a 7-point scale in which the environmental policy views that people might hold are arranged from extremely liberal to extremely conservative. Where would you place yourself on the following scale? (Please circle the appropriate number.)

Extremely liberal
Liberal
Slightly liberal
Middle of the road or moderate
Slightly conservative
Conservative
Extremely conservative
Don't know; haven't thought much about it

11. There is a lot of talk these days about what our country's goals should be for the next 10 or 15 years. Listed below are some of the goals that different people say should be given top priority. Please write the letter in the blank that most accurately describes your beliefs.

A Maintaining order in the nation
B Giving people more say in important decisions
C Fighting rising prices
D Protection of free speech

12. Please circle the number indicating whether you agree or disagree with the following statements.

Strongly Disagree 1 2 No Opinion 3 4 5 Strongly Agree

Technology will find a way of solving the problems of shortages of natural resources.
People would be better off if they lived without so much technology.
Future Scientific research is more likely to cause problems than to find solutions.
Technical and scientific experts are usually biased.
Environmental issues are hard to understand.
The balance of nature is very delicate and easily upset by human activities.
The earth is like a spaceship with only limited room and resources.
Plants and animals do not exist primarily for humans to use.
Modifying the environment for human use seldom causes serious problems.
People were created to rule over the rest of nature.

13. Your age

14. Please identify your gender

Male Female

15. What ethnicity do you consider yourself?

Hispanic or Latino
Not Hispanic or Latino

16. What racial origin do you consider yourself?

American Indian or Alaska Native
Asian
Black or African American
Native Hawaiian or other Pacific Islander
White

17. Where is your current place of residence located?

On a farm or ranch
In the country but not on a farm or ranch
In a town or village of less than 2,500
In a town of 2,500 - 9,999
In a city of 10,000 – 24,999
In a city of 25,000 – 49,999
In a city of 50,000 – 99,999
In a city of more than 100,000

18. What is your highest level of education?

No formal education
Some grade school
Completed grade school
Some high school
Completed high school
Technical training
Some college/two year degree
Completed college
Some graduate work
An advanced degree
Other

19. Which category best fits your occupational status?

Professional/Technical
Retired
Agriculture
Self-employed
Trade Worker
Office Worker
Homemaker
Student
Unemployed
Other

20. What is your approximate annual family income before taxes?

Less than $10,000
$10,000 -19,999
$20,000 - 29,999
$30,000 - 39,999
$40,000 - 49,999
$50,000 - $59,999
$60,000 - $69,999
$70,000 - $79,999
$80,000 - $89,999
$90,000 - $99,999
$100,000 - $109,999
$110,000 and above

Additional Comments:

Appendix C: Reviewer Comments

Email Received: 24 August 2001

Lee:

I had a quick look at the report and believe that it is near ready to go out. I'd edit to avoid unnecessary phrases such as "as well as" and "the fact that." Conclusion that getting people closer to the source of issues is always good advice, yet your data suggest that knowing more will likely lead to less support. That is O.K. for your context since you are seeking the truth. The report seems quite long. Will it be used most for internal use by persons likely to read the whole document or by decision makers? Shorter is always better, but the Executive Summary gives ample details for the quick reader while more can be found by those inclined.

Del

Delwin E. Benson, Ph.D.
Professor and Extension Wildlife Specialist
Department of Fishery and Wildlife Biology
Room 109 Wagar, CSU, Fort Collins CO 80523

At 10:34 PM 08/15/2001 -0600, you wrote:
>Dear Del, John, Dennis, Brent, and Cindy;
>
>Here is the prairie dog knowledge/attitudes study completion report for
>your review, comments and suggestions. When you make comments please tell
>us whether or not the report should be forwarded to the FWS, substantially
>revised before submission, or completely rewritten and reviewed again.
>
>(See attached file: Completion report for FWS 8-15a-01.doc)
>
>Your suggested revisions are anticipated and appreciated.
>
>Regards,
>
>Lee
>
>Berton Lee Lamb
>Social, Economic, and Institutional Analysis Section
>USGS
>4512 McMurry Ave.
>Fort Collins, CO 80525-3400
>Phone: 970-226-9314
>FAX: 970-226-9230
>URL: www.mesc.usgs.gov/seias

Email Received: September 7, 2001

Lee,

I have been through your "Ctizien Knowledge of and Attitudes Toward Black-Tailed Prarie Dogs: Completion Report." In general I found the report to be well written with excellent analyses. I particularly am impressed with your multivariate analyses. Very interesting findings.

I have a couple of picky suggestions for improvement (from someone who teaches methods):

1. "H o" usually means "null hypotheses" (there is no relationship between the variables). I would just number the hypotheses 1,2,3, etc.

2. In terms of wording hypotheses, it is best to state the direction of the
hypothesis--i.e., instead of "experience with prarie dogs and participation explain people's level of knowledge," it would be better to say "the higher the level of experience with prarie dogs, the higher the level of policy relevant knowledge."

3. It would be helpful to have a summary table of the various independent variables you employ (could be an appendix). The table would provide the variable name, coding information, a measures of central tendency if appropriate). This would help the reader interpret your regressions better.
I've attched a recent paper where we have such a table. If you have this information in the paper, I must have missed it.

All in all this report is excellent!

Brent Steel
Professor, Department of Political Science
Oregon State University
Corvallis, OR

Email Received: September 7, 2001

Dear Lee:

I have read through your review draft of "Citizen Knowledge of and Attitudes Toward Black-tailed Prairie Dogs: Completion Report." I found the research and the report to be highly competent, information, and very interesting. Of particular note are the contrasts between the role of knowledge and the belief in the importance of prairie dogs when compared to other environmental issues. Apart from a few minor typos and word omissions (which I am certain you will identify), I have the following general comments which you might wish to address in a revision.

1. I think the report reflects ambivalence or uncertainty over the direction of the relationship between knowledge and participation. Would it be possible for you and your team to clarify and elaborate how you view that connection, for it would seem to have important implications for the recommendations that you make in the conclusion of the paper.

2. As a manager, which I am not, I would want you to elaborate more at the end of the paper as to the strategies and the content that would most effectively achieve agency goals. You introduce that issue, but I think more detail would make the report more useful to readers.

While obviously not an element of this study, you might consider some long-range plan to assess knowledge and participation relationships in a specific environmental policy area such as Prairie Dogs through a more quasi-experimental design. That is, do pre- and post participation measures of policy relevant knowledge for participants, and then do simultaneous measures of non-participants in the particular policy arena.

Thank you for allowing me the opportunity to review the draft of this report on a very important public policy issue.

John Pierce
Vice-Chancellor for Academic Affairs
University of Colorado at Colorado Springs
Colorado Springs, CO