Natural-Resources Education in Utah's Public Schools

John J. Van Niel
Utah State University

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NATURAL-RESOURCES EDUCATION IN UTAH'S PUBLIC SCHOOLS

by

John J. Van Niel

A thesis submitted in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

in

Fisheries and Wildlife

Approved:

UTAH STATE UNIVERSITY
Logan, Utah
1990
ACKNOWLEDGEMENTS

I would like to thank the S.J. and J. Quinney Foundation for providing the funding for this program. I would also like to thank Dr. Fred Wagner for his support and encouragement throughout my program. It has been a pleasure to be under his tutelage.

Dr. Cliff Craig deserves thanks for his assistance in all phases of this project. Finally, I would like to thank Drs. Chuck Gay and John Kadlec, whose comments and guidance have been greatly appreciated.
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</tr>
</tbody>
</table>

Stratum Boundaries (Adapted from the Utah School Directory 1989-1990)
Several aspects of natural-resources education were explored in this study. First, a statewide survey of science, social studies, and elementary teachers was conducted to determine the current form and extent of natural-resources education in Utah. Returns were received from 51% of the surveyed teachers. The percent of time devoted to natural resources, the factors affecting natural-resources instruction, and the need to improve that instruction were assessed.

Utilizing that information, the Natural-Resources Curriculum Framework was developed. The Framework is designed to provide educators with the essential concepts to be included in a comprehensive natural-resources program.
Finally, examples of classroom support materials were created as extensions of the Framework. These materials, specifically designed for geography teachers, cover a wide variety of concepts involving natural resources.

(97 pages)
CHAPTER I
INTRODUCTION

Review of Previous Work

Recently, interest in environmental education in the United States has reached new heights. Many states are taking steps toward making public schools accountable for some form of environmental education. For example, Wisconsin now requires all new elementary teachers to complete college-level courses in environmental education before they become certified (Wilke 1985).

Natural-resources education is usually studied as a component of the broader content area of environmental education. The term conservation education is most often used as synonymous with natural-resources education. Various definitions of environmental education appear in recent literature (Disinger 1985), and I do not intend to add to the confusion by providing yet another.

Although no recent studies have surveyed natural-resources education in the schools exclusively, numerous studies have assessed the extent of some form of environmental education in various states. The majority of these studies surveyed administrators or other non-teaching personnel (Michaud and Hilterbrand 1972, Bottinelli 1976, Trojcak and Harvey 1976, Pettus and Schwaab 1978-79, Tewksbury and Harris 1982, Brouillet et al. 1986). In general, these
surveys focused on official district policy on environmental education. They often asked the respondents to provide information concerning the resources and teaching materials used by teachers in that district. The results were varied, but most districts reported some environmental education being taught.

Although personnel at the district level are familiar with the official district policies and course offerings, these often vary substantially from what is actually being taught in the classroom. Also, asking for information on a schoolwide basis provides different types of results from information gathered on an individual teacher basis.

Of the studies that directly surveyed teachers (Cornwell 1960, Engleson 1970, Pettus and Teates 1983, Barber and Tomera 1985), only one (Pettus and Teates 1983) was conducted in the same state as an earlier study of administrators (Pettus and Schwaab 1978-79). The teacher survey showed a much lower percentage of individuals reporting environmental education in their courses (34%) than the percentage of principals indicating that their schools provided some environmental education (72%) (Pettus and Teates 1983). Although these results are not contradictory, they do illustrate the importance of choosing the population to survey according to the type of information desired.

Surveys that have been conducted in Utah or have included Utah in a national sample are few. Cornwell (1960)
conducted a random survey of sixth through twelfth grade teachers in the Utah public school system. Of the 361 teachers returning surveys, 50% reported that they taught some form of conservation education, although no school reported an entire course devoted to the subject. Teachers identified three major ways that professional conservation agencies could be utilized: (1) provision of movies and publications, (2) school visits by natural-resources personnel, and (3) assistance in conducting field trips (Cornwell 1960).

The applications of Cornwell's results to the public school system are limited by two factors. First, the study was conducted 30 years ago. Second, Cornwell acknowledges that the low return rate of his survey prevented strong generalizations, even at that time.

A national survey of state education departments conducted in 1987 (Disinger 1988) assessed the amount and nature of environmental education offered in each state. The survey was sent to and completed by the state specialist in science education at the Utah State Office of Education. In Disinger's report, Utah's state science specialist indicated that "0-20%" of elementary and secondary schools provided environmental education. Of the categories available to choose from (nature study, outdoor education, conservation education, population education, energy education, marine/aquatic studies), only "outdoor education" was identified as a common form of environmental ed-
ucation in both elementary and secondary schools. Disinger also asked if data were available to support these figures. Utah reported none.

In summary, although a great deal of information has been amassed concerning the broad topic of environmental education, most does not focus on the narrower topic of natural-resources instruction. In addition, I have found no recent surveys that thoroughly assess the amount of, or restrictions on, natural-resources education in Utah. Since this type of data does not lend itself to generalizations from one state to another, little is actually known of the status of natural-resources education in the Utah public school system.

In 1988, the College of Natural Resources at Utah State University received a grant from the S.J. and Jessie Quinney Foundation to create a program for increasing Utah's awareness of "...local, regional and global issues focusing on people, environment and resources." One of the goals of this program, entitled Outreach Education, is to assist Utah public school teachers in the instruction of natural-resources concepts.

Before a program of this nature can be implemented, a clear understanding of the present status of and restrictions on natural-resources education is needed. Direct information on what is taught statewide is not available, nor can it be inferred from state requirements. The state provides minimum guidelines for school districts to fol-
low, and these are open to broad interpretation. Some districts have adopted their own curriculum standards that meet or exceed the state requirements but may vary in emphasis.

Objectives

The overall purpose of this study was to provide a means for increasing natural-resources instruction in Utah by assisting the teachers. But as discussed above, it was necessary first to gain some sense of the current status of natural-resources education in the public schools. For this purpose, I chose to utilize a mailed questionnaire to survey the extent and nature of material being taught, the perceived constraints on the amount of natural-resources instruction being taught, and the characteristics of the teachers which might influence that amount.

I then set out to design instructional material. But sound educational practices dictate that clear objectives for natural-resources education be outlined before any instructional material is developed. Therefore, I first designed a curriculum framework specifically for natural-resources instruction. This framework recommends general objectives or goals for natural-resources instruction in the Utah public school system. It is based in part on the results of the survey, in part on similar frameworks reported in the literature, and in part on the core curriculum of the Utah public school system.
Finally, I developed teaching material to facilitate the increase in natural-resources instruction based on the results of the survey and as a natural extension of the curriculum framework.

Accordingly, the objectives of this study were

1. To assess the form and extent of natural-resources instruction in Utah's public schools
2. To identify Utah teachers' needs for natural-resources instruction
3. To identify the factors affecting Utah teachers' use of natural-resources instruction
4. To present a model for natural-resources instruction in Utah based on the results of this study and professional recommendations
5. To design natural-resources instructional materials for geography teachers in Utah to serve as examples of integrating natural-resources topics into existing curricula.
CHAPTER II
SURVEY OF UTAH PUBLIC
SCHOOL CURRICULA

Survey Method

Questionnaire Design

I considered several methods of data collection and found the mailed-questionnaire method to be the most practical for my needs. A mailed questionnaire allows sampling over a large geographic area and is inexpensive compared to telephone or personal interviews (Dillman 1978).

I reviewed the literature on similar surveys to search for a suitable questionnaire. Although I found none that suited the needs of this study entirely, I used several as models (Andrew 1980; Johns 1984; Brouillet et al. 1986; Heikkinen 1988). I designed additional questions as needed. The entire survey was designed to accommodate teachers from grades K-12. I determined the length of the survey and the question format and layout according to recommendations in Fowler (1988).

The questionnaire was divided into three major categories:

1. Current practices in natural-resources education
2. Factors affecting natural-resources education
3. Teacher classroom needs
I reduced the questionnaire to 50% of its original size and had it printed on tan-colored, bonded paper. Questionnaires were folded into booklets and saddle stitched. On the last page of the questionnaire, in order to induce a better return rate (Powers and Alderman 1982), I provided respondents with the opportunity to obtain a summary of the results.

**Questionnaire Pre-test and Validation**

Successive drafts of the survey instrument were reviewed by University faculty members from both the natural-resources and survey fields.

Next, teachers at Edith Bowen Lab School (K-6) completed a draft questionnaire and an item-by-item evaluation form for the questionnaire. The teachers also evaluated the format, structure, appearance, and length of the questionnaire.

In addition, several of the questions were adapted from previously validated questionnaires.

**Questionnaire Distribution and Follow-up**

I contacted superintendents of each district involved in the study (Appendix A) and followed appropriate district approval procedures for each. I then sent a letter to the principal of each school selected (Appendix B) to gain assistance in distribution of the questionnaires to the teachers. One week later, principals were sent an instruction letter (Appendix C) and questionnaire packets for the
teachers in their schools. Each packet contained a cover letter, a questionnaire, and a self-addressed business reply envelope (Appendices D and E). Each envelope was marked with a code number to facilitate follow-up contact.

All correspondence in relation to the survey was conducted with the College of Natural Resources letterhead stationary and envelopes. To facilitate a better response, I hand signed the letters accompanying the questionnaires for the original and follow-up mailing with blue ink (Dillman 1978).

Three weeks after the original contact, I sent a follow-up letter (Appendix F) and a replacement questionnaire, identical to the first, to nonrespondents.

Sampling Procedure

I decided at the outset that the population which I wished to sample was all elementary teachers (K-6) and all secondary (7-12) science and social studies teachers in the Utah public school system. On the basis of recommendations from various survey specialists, I decided upon a 10% sample of this population.

I did not take a simple random 10% sample of the population for two reasons. The first, and most compelling, was that I could not obtain a list of all the Utah teachers. The second is that I wanted to ensure a full 10% sample of both rural and urban areas. Urban teachers outnumber rural teachers in Utah by a factor of 2.6. By chance a random
sample of the State could have produced an unrepresentative sample with regards to geographic location.

For these reasons, I divided the State into four strata: two urban and two rural (Figure 1). I utilized SMSA (Standard Metropolitan Statistical Area) boundaries for the two urban areas (Provo/Orem and Salt Lake City/Ogden) and geographical similarities to divide rural Utah into northern rural and southern rural areas.

Lacking a list of names of the teachers in the State, I defined the sampling units for this study as the regular public school buildings in the four strata. I then selected schools randomly from each stratum until the number of teachers represented 10% of those in each stratum.

Using the schools as sampling units constituted a 10% stratified random sample based on clustering. I have analyzed the nominal data using the replies from individual teachers and the interval data using grand means by computing the returns from each building. GLM-ANOVA and Newman/Keul's tests were used as tests of differences among means. All analyses were completed using the Number Cruncher Statistical Systems computer package.
Fig. 1. Stratum Boundaries (Adapted from Utah School Directory 1989-90)
Survey Results

Respondent Population

**Teacher return rates.** Of the 1,099 teachers in my sample, 561 (51%) returned questionnaires. Since I sent questionnaires to 10% of the elementary, secondary science and secondary social studies teachers throughout the state, the respondents constitute approximately 5% of the statewide population.

Secondary teachers within my sample replied at a higher rate (63%, n = 157) than did elementary teachers (47%, n = 404). This proportions are significantly different at p = .05.

The percentage of return by 307 rural teachers was higher than that of 792, 58% vs. 48%. These percentages are also significantly different at p = .05.

**Cluster samples.** A total of 72 schools (clusters) were chosen in the course of my sampling. These subdivided into 47 elementary (27 urban and 20 rural), 24 secondary (13 urban and 11 rural), plus one school which had both elementary and secondary grades. Teacher numbers within the clusters ranged from 2-19.

The cluster sampling, while sharply reducing the sample sizes from those of individual teachers, reduced the sample-size disparity between urban and rural. Where the
urban teachers outnumbered the rural by a factor of 2.6, urban schools outnumbered the rural by a ratio of 4:3.

**Distribution of responding teachers by grade levels.**
Current grade level taught was also reported (Table 1) by both elementary and secondary teachers. Only elementary results are reported here, since 85% of secondary teachers reported multi-grade assignments. If we assume equal distribution of teachers across the elementary grades, a representative return would provide 4/7 or 57% of those returns from the primary (K-3) grades and 3/7 or 43% of the returns from the upper elementary grades (4-6). In fact, 56% of the returns were from the primary grades and 45% were from the upper elementary. Mixed-grade-level classes for at least one subject were reported by 34% of the elementary returnees. This general uniformity was present in both the urban and rural schools.

**Subjects taught.** Teachers were asked to report the subjects they currently teach (Table 2). 80% of the elementary teachers reported teaching science and social studies, either listed directly or reported "all classes taught" rather than listing them individually. Ten percent did not answer this question, but had otherwise given usable data. Therefore, between 80-90% of the responding elementary teachers currently teach science and social studies. An additional 5% teach social studies, but not science. I suspect that this is representative of the true population.
<table>
<thead>
<tr>
<th>Grade Level</th>
<th>% Teaching in Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary</td>
<td></td>
</tr>
<tr>
<td>Kindergarten</td>
<td>10</td>
</tr>
<tr>
<td>First grade</td>
<td>13</td>
</tr>
<tr>
<td>Second grade</td>
<td>12</td>
</tr>
<tr>
<td>Third grade</td>
<td>08</td>
</tr>
<tr>
<td>Primary mix</td>
<td>13</td>
</tr>
<tr>
<td>Total primary</td>
<td>56</td>
</tr>
<tr>
<td>Upper elementary</td>
<td></td>
</tr>
<tr>
<td>Fourth grade</td>
<td>10</td>
</tr>
<tr>
<td>Fifth grade</td>
<td>08</td>
</tr>
<tr>
<td>Sixth grade</td>
<td>21</td>
</tr>
<tr>
<td>Upper elementary mix</td>
<td>06</td>
</tr>
<tr>
<td>Total upper elementary</td>
<td>45</td>
</tr>
</tbody>
</table>
Table 2
Percentage of Responding Teachers Teaching Courses by Grade Level

<table>
<thead>
<tr>
<th>Subject Taught by Grade Level</th>
<th>% of Teachers Teaching Subject</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Elementary</strong></td>
<td></td>
</tr>
<tr>
<td>Science and social studies:</td>
<td>80</td>
</tr>
<tr>
<td>Science only:</td>
<td>&lt;01</td>
</tr>
<tr>
<td>Social studies only:</td>
<td>05</td>
</tr>
<tr>
<td>Neither subject taught:</td>
<td>04</td>
</tr>
<tr>
<td>Not indicated:</td>
<td>10</td>
</tr>
<tr>
<td><strong>Secondary Science</strong></td>
<td></td>
</tr>
<tr>
<td>Physical science:</td>
<td>48</td>
</tr>
<tr>
<td>Biology/life science:</td>
<td>63</td>
</tr>
<tr>
<td>Earth science:</td>
<td>33</td>
</tr>
<tr>
<td>Chemistry:</td>
<td>14</td>
</tr>
<tr>
<td>Other science:</td>
<td>12</td>
</tr>
<tr>
<td>Not science:</td>
<td>15</td>
</tr>
<tr>
<td>Not indicated:</td>
<td>01</td>
</tr>
<tr>
<td><strong>Secondary Social Studies</strong></td>
<td></td>
</tr>
<tr>
<td>History:</td>
<td>66</td>
</tr>
<tr>
<td>Geography:</td>
<td>23</td>
</tr>
<tr>
<td>Law/politics:</td>
<td>08</td>
</tr>
<tr>
<td>Sociology:</td>
<td>03</td>
</tr>
<tr>
<td>Other social studies:</td>
<td>33</td>
</tr>
<tr>
<td>Not social studies:</td>
<td>18</td>
</tr>
<tr>
<td>Not indicated:</td>
<td>02</td>
</tr>
</tbody>
</table>
Of the secondary teachers, 66% reported teaching more than one subject, hence the column totals in Table 2 exceed 100%. Of those, 16% reported teaching a subject other than science or social studies. These percentages generally hold true for urban and rural respondents.

Natural-Resources Education Emphasis

Emphasis by subject. I knew from examining the State Core Curricula (Utah State Department of Education 1988) that there were no subjects specifically entitled "natural resources", and that instruction on that on the subject was contained in such major units as science and social studies. In order to gain some general insight into the amount of natural-resources instruction, I asked the teachers to indicate on the questionnaires what percentage of the time spent on each of these units was devoted to instruction on natural resources.

Elementary teachers indicated that they devote about a third of their science instruction to natural resources, and about 13% of their social-studies instruction (Table 3). These amounts are statistically similar in both urban and rural schools, although the science and social-studies percentages differ at p=.05 by Paired T-Test.

At the secondary Science level, about the same amount of emphasis is allocated to natural resources within the Biological Science instruction (32.7% urban, 28.2% rural)
Table 3

Percentage of Science and Social-Studies Time Devoted to Natural-Resources Instruction

<table>
<thead>
<tr>
<th>Subject by Grade Level</th>
<th>Urban</th>
<th>Rural</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N*</td>
<td>Mean±</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elementary</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science</td>
<td>30</td>
<td>31±07</td>
</tr>
<tr>
<td>Social Studies</td>
<td>29</td>
<td>13±14</td>
</tr>
<tr>
<td>Secondary Science</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical</td>
<td>12</td>
<td>16±09</td>
</tr>
<tr>
<td>Biological</td>
<td>14</td>
<td>33±16</td>
</tr>
<tr>
<td>Earth</td>
<td>9</td>
<td>19±07</td>
</tr>
<tr>
<td>Secondary Social Studies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>History</td>
<td>10</td>
<td>8±03</td>
</tr>
<tr>
<td>Geography</td>
<td>5</td>
<td>30±23</td>
</tr>
</tbody>
</table>

*N here refers to the number of clusters.
as that allocated within all science instruction by elementary teachers (Table 3). Within Physical Science and Earth science, the time devoted to natural resources ranges from 16-20%, with the conspicuous exception of a 54.5% reported by rural Earth science teachers. This percentage differs from the 18.6% allocated by urban Earth science teachers (p = .05), again by Paired T-Test. If I average three percentages each for urban and rural secondary science, I infer that roughly a fourth to a third of secondary-science instruction time is allocated to natural resources.

Within secondary social-studies instruction, less than 10% of history time is allocated to natural resources, both by urban and rural teachers (Table 3). But 29.8% (urban) and 27.2% (rural) of geography time is devoted to natural resources. These percentages are significantly greater than their respective history percentages.

Although these reported percentages are not verifiable, I have gathered some evidence which supports the results found in this study. As mentioned earlier, the Utah State Department of Education publishes a series of core curricula to serve as guidelines for teachers. I ranked the objectives in the Science (Utah State Department of Education 1988) and Social Studies (Utah State Department of Education 1988) curricula to determine the percent of objectives that are related to natural-resources instruction. I utilized four classifications relevant to natural resources: directly related, indirectly related, possibly related and not re-
lated. I found that 41% of the science objectives and 11% of the social studies objectives were directly or indirectly related to natural resources. These percentages fall close to the confidence limits for the reported amount of instruction in each subject.

**Emphasis by resource.** Given the above amounts of time allocated to natural-resources instruction within the subjects taught, I next asked the teachers to indicate on the questionnaire a subjective appraisal of the emphasis they place on each of eight resources (cf. Appendix D). I provided them a scale of six degrees of emphasis with 0 = no emphasis and 5 = heavy emphasis, on which they should individually rate each of the eight resources. This rating was to reflect the total attention addressed to each resource within all of their natural-resources instruction.

A GLM-ANOVA revealed differences in the reported results for elementary teachers at a p=.05 level. Elementary teachers place greatest emphasis on plants, wildlife, water and air (Table 4), there being no difference among their mean scores by Newman/Kuel's Test. But their means were significantly greater (p=.05) than those for energy, forests, soils and mineral ores. Emphases were generally the same for urban and rural teachers except that rural teachers gave significantly greater emphasis to plants and wildlife than urban: 3.8±.2 vs. 3.3±.3 and 3.7±.2 vs. 3.1±.3
<table>
<thead>
<tr>
<th>Resource</th>
<th>Mean ± ( .95 ) C.I.</th>
</tr>
</thead>
<tbody>
<tr>
<td><em><em>Elementary, ( N^</em> = 47 )</em>*</td>
<td></td>
</tr>
<tr>
<td>Plants</td>
<td>3.4 ± .2</td>
</tr>
<tr>
<td>Wildlife</td>
<td>3.3 ± .2</td>
</tr>
<tr>
<td>Water</td>
<td>3.1 ± .2</td>
</tr>
<tr>
<td>Air</td>
<td>3.0 ± .2</td>
</tr>
<tr>
<td>Energy</td>
<td>2.6 ± .2</td>
</tr>
<tr>
<td>Forests</td>
<td>2.5 ± .2</td>
</tr>
<tr>
<td>Soils</td>
<td>2.5 ± .2</td>
</tr>
<tr>
<td>Minerals</td>
<td>1.7 ± .2</td>
</tr>
<tr>
<td><em><em>Secondary Science, ( N^</em> = 24 )</em>*</td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>3.6 ± .4</td>
</tr>
<tr>
<td>Air</td>
<td>3.6 ± .4</td>
</tr>
<tr>
<td>Energy</td>
<td>3.5 ± .3</td>
</tr>
<tr>
<td>Wildlife</td>
<td>3.4 ± .3</td>
</tr>
<tr>
<td>Plants</td>
<td>3.3 ± .3</td>
</tr>
<tr>
<td>Forests</td>
<td>3.0 ± .3</td>
</tr>
<tr>
<td>Soils</td>
<td>2.7 ± .3</td>
</tr>
<tr>
<td>Minerals</td>
<td>2.5 ± .3</td>
</tr>
<tr>
<td><em><em>Secondary Social Studies, ( N^</em> = 18 )</em>*</td>
<td></td>
</tr>
<tr>
<td>Energy</td>
<td>2.5 ± .4</td>
</tr>
<tr>
<td>Water</td>
<td>2.4 ± .5</td>
</tr>
<tr>
<td>Forests</td>
<td>2.3 ± .4</td>
</tr>
<tr>
<td>Minerals</td>
<td>2.3 ± .4</td>
</tr>
<tr>
<td>Soils</td>
<td>2.2 ± .4</td>
</tr>
<tr>
<td>Wildlife</td>
<td>2.0 ± .5</td>
</tr>
<tr>
<td>Plants</td>
<td>1.9 ± .4</td>
</tr>
<tr>
<td>Air</td>
<td>1.8 ± .5</td>
</tr>
</tbody>
</table>

\( *N \) here refers to the number of clusters.
respectively.

Emphases were essentially the same among secondary science teachers (Table 4). Water, air and wildlife remained among the top four, although energy replaced plants as the fourth. And while plants dropped to fifth in the ranking, the mean score was not significantly different from those for the first four, so that plants remained among the most emphasized resources. Attention given to forest, soils and minerals is significantly less than the other resources, as was the case with elementary teachers. There were no significant differences in these patterns between urban and rural teachers.

Among secondary social-studies teachers, there is a suggestion of a shift in emphasis. The mean scores for wildlife, plants and air, all of which were among the top four among both elementary and secondary science teachers (Table 4), are the three lowest among the social-studies instructors. Further, mean scores for forests and minerals, consistently among the lowest in the first two groups, are among the top four emphases in social studies. In fact, the sample size for social studies is small, the range of differences in means for the eight resources narrow, and the GLM-ANOVA does not disclose any significant differences among the scores. Hence, there may not be any. But if the order is valid, it could reflect the pattern shown in Table 3 that most of the natural-resources instruction within the social-studies block is provided in geography. Forest and
mineral resources may be more conveniently treated in a geographic context than plants and wildlife.

There are no significant differences between urban and rural schools in these patterns of emphasis.

Emphasis by geographic area. Although the Utah State Core Curriculum for Social Studies (Utah State Department of Education 1986) includes natural-resources objectives that are linked to specific geographic areas (i.e. Utah, local, North America), the Utah State Core Curriculum for Science (Utah State Department of Education 1988) does not. Due to the increasing importance in understanding such global issues as ozone depletion, global warming and overpopulation, I considered it important to gain some insight into the extent to which teachers link their natural-resources instruction to various geographic scales.

I chose 5 levels (Local, State, Intermountain West, United States and Global) to represent important and easily recognizable areas. As with the resources emphases, I provided teachers with a six-point scale (0-5) on the questionnaire ranging from "No Emphasis" (0 score) to "Very Large" (score of 5) (Appendix D). I asked them to score the degree to which their natural-resources instruction is oriented toward each of these geographic scales.

The results (Table 5) show differences in treatment of several of these areas by different groups of teachers,
### Table 5
Degree of Geographic Emphasis Given Natural-Resources Instruction by Utah Teachers

<table>
<thead>
<tr>
<th>Region</th>
<th>Mean± .95 C.I.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Elementary, N = 47</strong></td>
<td></td>
</tr>
<tr>
<td>Local</td>
<td>2.6±.2</td>
</tr>
<tr>
<td>State</td>
<td>2.4±.2</td>
</tr>
<tr>
<td>United States</td>
<td>2.0±.2</td>
</tr>
<tr>
<td>Intermountain West</td>
<td>1.9±.2</td>
</tr>
<tr>
<td>Global</td>
<td>1.8±.2</td>
</tr>
<tr>
<td><strong>Secondary Science, N = 24</strong></td>
<td></td>
</tr>
<tr>
<td>Local</td>
<td>3.1±.3</td>
</tr>
<tr>
<td>State</td>
<td>2.9±.4</td>
</tr>
<tr>
<td>Intermountain West</td>
<td>2.8±.4</td>
</tr>
<tr>
<td>United States</td>
<td>2.7±.5</td>
</tr>
<tr>
<td>Global</td>
<td>2.6±.3</td>
</tr>
<tr>
<td><strong>Secondary Social Studies, N = 18</strong></td>
<td></td>
</tr>
<tr>
<td>United States</td>
<td>2.1±.5</td>
</tr>
<tr>
<td>State</td>
<td>2.0±.6</td>
</tr>
<tr>
<td>Local</td>
<td>1.7±.5</td>
</tr>
<tr>
<td>Intermountain West</td>
<td>1.7±.5</td>
</tr>
<tr>
<td>Global</td>
<td>1.7±.5</td>
</tr>
</tbody>
</table>
again detected using GLM-ANOVA and a Newman/Kuel's Post Hoc Test to reveal where these differences exist. Elementary teachers provide more natural-resources instruction linked to the local and state scales than they did for Intermountain West, United States and global scales. This is not surprising, since children at that age can understand things best that relate to them directly. In addition, rural elementary teachers provide more local emphasis than do their urban counterparts (p=.05).

At the secondary level, the amount of geographic emphasis is spread evenly among the five scales by both the science and social studies teachers (Table 5). Their respective five scores do not differ significantly from the others within either science or social studies.

Unexpectedly, the entire range of scores by the science teachers exceed that of social studies teachers by a factor of about 1.5. Each score is significantly different at p=.05. This implies that the science teachers give more geographic emphasis to their natural-resources instruction despite the fact that such instruction among social studies classes is heavily weighted toward geography classes. I suspect that the results for various social studies teachers may cancel each other out. For example, A United States history teacher might provide a great deal of instruction at the United States scale, and very little at the other four. Another teacher of world cultural geography might provide a high degree of emphasis at the global scale only. Com-
bining these results would not show the strong individual emphasis of each teacher. Otherwise, I cannot suggest any reasons for the uniformly low scores among the social studies teachers.

This question was not designed, nor was it answered in, a mutually exclusive or collectively exhaustive format. Some reported very low scores for all five areas. One possible explanation for this is that the instruction provided is broad in nature and not specifically linked to the geographic scales listed.

Instructional materials used by teachers. The type and amount of supplementary materials used by teachers in natural-resources instruction is another indirect measure of the form and extent of that instruction. I asked teachers to report which of a list of ten commercially available materials they utilize for their classroom instruction. These materials can be classified by subject, recommended grade level and scale of availability (Table 6).

I felt that these results would be most representative if they were reported using the number of respondents as the sample size, rather than by clustering. I conducted tests for differences between two proportions at p=.05.

Overall, elementary teachers reported the greatest use of these ten materials (Table 7). Water Education, Ranger Rick, Project WILD and Project Learning Tree are reportedly used by 66%±5, 46%±5, 45%±5 and 31%±5 of the elemen-
Table 6
Natural-Resources Materials Classified by Grade Levels, Subject Matter, and Availability

<table>
<thead>
<tr>
<th>Material</th>
<th>Availability</th>
<th>Grade Levels</th>
<th>Major Subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audubon Adventures</td>
<td>National</td>
<td>K-6</td>
<td>Science</td>
</tr>
<tr>
<td>Tread Lightly</td>
<td>National</td>
<td>K-12</td>
<td>Science</td>
</tr>
<tr>
<td>Project WILD</td>
<td>National</td>
<td>K-12</td>
<td>All</td>
</tr>
<tr>
<td>O.B.I.S.</td>
<td>National</td>
<td>K-12</td>
<td>Science</td>
</tr>
<tr>
<td>Ag in the Classroom</td>
<td>Utah</td>
<td>K-6</td>
<td>Agriculture</td>
</tr>
<tr>
<td>Energy/Man's Environment</td>
<td>National</td>
<td>K-6</td>
<td>Science</td>
</tr>
<tr>
<td>Project Learning Tree</td>
<td>National</td>
<td>K-12</td>
<td>All</td>
</tr>
<tr>
<td>I.Y.E.</td>
<td>National</td>
<td>K-12</td>
<td>Science</td>
</tr>
<tr>
<td>Water Education</td>
<td>Utah</td>
<td>K-6</td>
<td>All</td>
</tr>
<tr>
<td>Ranger Rick</td>
<td>National</td>
<td>K-6</td>
<td>Science</td>
</tr>
</tbody>
</table>

Secondary teachers respectively. The others are reported by 12% or fewer. Moreover, a significantly higher percentage of rural teachers (63%±9) use Project WILD compared to urban (36%±6). Similarly, Project Learning Tree and Ag in the Classroom are used by 50%±8 and 16%±7 of the rural teachers respectively. This is significantly higher (p=.05) than the 23%±5 and 3%±2 of urban teachers that reported using these same materials.

Only about a third of the secondary science teachers use Project WILD and Energy/Man’s Environment (Table 7). Less than 20% reported using each of the other materials. All of the materials were reportedly used by less than 10% of the social studies teachers. The high use of Energy/Man’s Environment by secondary science teachers is curious in that...
Table 7

Materials Used by Teachers for Their Natural-Resources Instruction

<table>
<thead>
<tr>
<th>Materials</th>
<th>Elementary</th>
<th>Science</th>
<th>Social Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Water Education</td>
<td>66%±5</td>
<td></td>
<td>8%±7</td>
</tr>
<tr>
<td>2. Ranger Rick</td>
<td>46%±5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Project WILD</td>
<td>45%±5</td>
<td>32%±10</td>
<td></td>
</tr>
<tr>
<td>4. P.L.T.</td>
<td>31%±5</td>
<td>19%±9</td>
<td>8%±7</td>
</tr>
<tr>
<td>5. Energy/Man Environment</td>
<td>12%±3</td>
<td>16%±9</td>
<td></td>
</tr>
<tr>
<td>6. Ag in Classroom</td>
<td>7%±3</td>
<td>14%±8</td>
<td></td>
</tr>
<tr>
<td>7. Aud Adventures</td>
<td>5%±2</td>
<td>8%±7</td>
<td></td>
</tr>
<tr>
<td>8. I.Y.E.</td>
<td>5%±2</td>
<td>7%±7</td>
<td></td>
</tr>
<tr>
<td>9. Tread Lightly</td>
<td>1%±2</td>
<td>4%±5</td>
<td></td>
</tr>
<tr>
<td>10. O.B.I.S.</td>
<td>1%±2</td>
<td>3%±3</td>
<td></td>
</tr>
</tbody>
</table>

27
it is designed for grades K-6. Also unexpected is the low use of Project WILD (2±5%) and Project Learning Tree (0%) by the social studies teachers since both of these materials include 7-12 grade social studies components.

Factors Affecting Natural-Resources Instruction.

Attitudes toward an increase in natural-resources instruction. I asked the teachers to report, on a scale from 1 (Strongly Disagree) to 5 (Strongly Agree), their reaction to the suggestion that natural-resources instruction be increased. They were asked to respond to that suggestion made for each of five levels of administration: the teacher's own classroom, the teacher's district, the State, the Core Curricula, and the nation.

All of the data were analyzed by GLM-ANOVA, followed by Newman/Kuel's Post Hoc Tests. Mean scores were calculated from cluster means.

The responses were very nearly identical in all three teacher blocks (elementary, secondary science, secondary social studies): aggregate scores were 3.6, 3.6, and 3.5 respectively. Moreover, within each teacher block, there were no significant differences among the scores for the five administrative levels. In general, the response was a uniform weak assent for increasing natural-resources instruction at all levels (note that 3.0 represented "No Opinion").
A sixth question asked, using the same scale as above, the teachers' opinion as to whether natural resources should be taught as a distinct subject. Once again, the mean scores were extremely uniform, in this case toward mild dissent (2.6, 2.7, 2.6, for elementary, secondary science, and secondary social studies respectively).

Factors influencing natural-resources instruction. I listed 13 factors on the questionnaire which I thought might influence natural-resources instruction. Possible positive and negative influences were selected:

1. District curriculum regulations
2. Teacher interest
3. Student interest
4. Planning time
5. Classroom material availability
6. Attitudes of administration
7. State core curriculum requirements
8. Funding
9. Attitudes of community
10. Class size
11. In-service training availability
12. Background information
13. Relevance of topic

I provided a 7-point rating scale ranging from -3 (Strongly Negative), through 0 (No Influence), to +3 (Strongly Positive). Thus, a mean negative score indicates
a negative effect, a score near zero implies no influence, and a positive score indicates a positive influence.

I again analyzed the data by GLM-ANOVA and the Newman/Kuel's Post Hoc Test. Group means were calculated from the cluster means.

The three influences that were scored consistently by all three teacher blocks as having the greatest positive influence were Teacher Interest, Student Interest, and Relevance of Topic (Table 8). Factors which most often were scored as having no effect were Class Size, Community Attitudes, Funding, Training, District Curriculum Regulations, and Attitudes of the Administration. Two factors which averaged faintly negative scores among the social studies teachers, although not significantly different from zero, were District Curriculum Regulations and Training (Table 8).

The reported results reflect only the influence each factor has on the responding teachers' content. For example, 14% of the elementary teachers reported that student interest had "no influence" on the amount of natural-resources instruction which they offer. This does not mean that 14% of the elementary teachers feel their students have no interest in natural-resources topics. Instead, 14% of the elementary teachers do not take student interest into account when making decisions on their natural-resources instruction.

In general, the responses were quite consistent among the teacher blocks and there were no significant differences between urban and rural teachers.
#### Table 8

Teacher Scores on Factors Considered to Influence Natural Resources or Related Fields

<table>
<thead>
<tr>
<th>Factor</th>
<th>Mean Score ± .95 C.I.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher Interest</td>
<td>1.9±.1</td>
</tr>
<tr>
<td>Student Interest</td>
<td>1.7±.1</td>
</tr>
<tr>
<td>Relevance of Topic</td>
<td>1.5±.2</td>
</tr>
<tr>
<td>Background Information</td>
<td>1.2±.2</td>
</tr>
<tr>
<td>Core Requirements</td>
<td>1.2±.2</td>
</tr>
<tr>
<td>Classroom Materials</td>
<td>1.1±.2</td>
</tr>
<tr>
<td>District Regulations</td>
<td>1.1±.2</td>
</tr>
<tr>
<td>Planning Time</td>
<td>0.9±.2</td>
</tr>
<tr>
<td>Training</td>
<td>0.8±.2</td>
</tr>
<tr>
<td>Attitudes of Administration</td>
<td>0.7±.2</td>
</tr>
<tr>
<td>Community Attitudes</td>
<td>0.6±.1</td>
</tr>
<tr>
<td>Class Size</td>
<td>0.6±.2</td>
</tr>
<tr>
<td>Funding</td>
<td>0.5±.2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Factor</th>
<th>Mean Score ± .95 C.I.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher Interest</td>
<td>2.2±.2</td>
</tr>
<tr>
<td>Student Interest</td>
<td>1.8±.3</td>
</tr>
<tr>
<td>Relevance of Topic</td>
<td>1.7±.5</td>
</tr>
<tr>
<td>Background Information</td>
<td>0.9±.4</td>
</tr>
<tr>
<td>Classroom Materials</td>
<td>0.7±.4</td>
</tr>
<tr>
<td>Core Requirements</td>
<td>0.6±.4</td>
</tr>
<tr>
<td>Community Attitudes</td>
<td>0.6±.4</td>
</tr>
<tr>
<td>Planning Time</td>
<td>0.5±.5</td>
</tr>
<tr>
<td>Attitudes of Administration</td>
<td>0.4±.3</td>
</tr>
<tr>
<td>District Regulations</td>
<td>0.4±.4</td>
</tr>
<tr>
<td>Training</td>
<td>0.4±.4</td>
</tr>
<tr>
<td>Funding</td>
<td>0.1±.4</td>
</tr>
<tr>
<td>Class Size</td>
<td>0.0±.5</td>
</tr>
</tbody>
</table>
### Table 8 continued

**Secondary Social Studies, N = 19**

<table>
<thead>
<tr>
<th>Factor</th>
<th>Mean Score ± .95 C.I.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher Interest</td>
<td>1.1±.5</td>
</tr>
<tr>
<td>Student Interest</td>
<td>1.1±.5</td>
</tr>
<tr>
<td>Relevance of Topic</td>
<td>0.9±.6</td>
</tr>
<tr>
<td>Classroom Materials</td>
<td>0.6±.6</td>
</tr>
<tr>
<td>Attitudes of Administration</td>
<td>0.3±.2</td>
</tr>
<tr>
<td>Planning Time</td>
<td>0.2±.6</td>
</tr>
<tr>
<td>Core Requirements</td>
<td>0.2±.5</td>
</tr>
<tr>
<td>Funding</td>
<td>0.2±.5</td>
</tr>
<tr>
<td>Background Information</td>
<td>0.2±.5</td>
</tr>
<tr>
<td>Community Attitudes</td>
<td>0.1±.3</td>
</tr>
<tr>
<td>Class Size</td>
<td>0.1±.4</td>
</tr>
<tr>
<td>District Regulations</td>
<td>-0.1±.6</td>
</tr>
<tr>
<td>Training</td>
<td>-0.2±.5</td>
</tr>
</tbody>
</table>
Teacher preparation. I asked the teachers to report the numbers of college courses taken in various natural-resources disciplines by having them check one of five categories (0, 1-2, 3-4, 5 or more) for each subject (Table 9). Using results from individual teachers instead of clusters, I simply tabulated the frequency distributions in each category, then converted these to percentages, and recorded the modal class.

Among the elementary teachers, 81% had taken one or more courses in biology/ecology, 9% having taken five or more. Similarly, 80% had taken one or more geography courses. Roughly two-thirds had had one or more geology courses.

Secondary science teachers were more strongly grounded, 93% having had one or more biology course, and 61% having had five or more. Similarly, three-fourths had had one or more geology course and roughly half had had one or more in geography. Additionally, about one-half of them had had one or more courses in wildlife, with 14% having had five or more.

Two-thirds, three-fourths, and half of the secondary social studies teachers had had one or more courses in biology, geography, and geology, respectively.

All of these patterns were relatively constant between urban and rural teachers.

I also asked the teachers to indicate whether they had
Table 9
Number of College-Level Courses Taken by Utah Teachers in the Natural-Resources or Related Fields

<table>
<thead>
<tr>
<th>% of Teachers by No. Classes Taken</th>
<th>Subjects by Grade Level</th>
<th>Number of Courses Taken</th>
<th>Modal Class</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0 1-2 3-4 5 or more</td>
<td></td>
</tr>
<tr>
<td>Elementary, N* = 398</td>
<td>Agriculture</td>
<td>85 11 02 02</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Bio/Ecology</td>
<td>19 57 15 09</td>
<td>1-2</td>
</tr>
<tr>
<td></td>
<td>Fisheries</td>
<td>97 03 00 00</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Forestry</td>
<td>87 12 01 01</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Geography</td>
<td>20 64 12 05</td>
<td>1-2</td>
</tr>
<tr>
<td></td>
<td>Geology</td>
<td>31 58 07 04</td>
<td>1-2</td>
</tr>
<tr>
<td></td>
<td>Natural Res.</td>
<td>76 20 03 02</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Water Res.</td>
<td>83 15 02 01</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Wildlife</td>
<td>74 21 03 02</td>
<td>0</td>
</tr>
<tr>
<td>Secondary Science, N* = 73</td>
<td>Agriculture</td>
<td>76 13 04 07</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Bio/Ecology</td>
<td>07 20 12 61</td>
<td>5+</td>
</tr>
<tr>
<td></td>
<td>Fisheries</td>
<td>79 14 03 04</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Forestry</td>
<td>70 16 08 06</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Geography</td>
<td>46 38 10 07</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Geology</td>
<td>27 34 16 22</td>
<td>1-2</td>
</tr>
<tr>
<td></td>
<td>Natural Res.</td>
<td>60 21 14 06</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Water Res.</td>
<td>71 19 07 03</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Wildlife</td>
<td>52 23 11 14</td>
<td>0</td>
</tr>
<tr>
<td>Secondary Social Studies, N* = 60</td>
<td>Agriculture</td>
<td>93 05 00 02</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Bio/Ecology</td>
<td>32 50 13 05</td>
<td>1-2</td>
</tr>
<tr>
<td></td>
<td>Fisheries</td>
<td>98 02 00 00</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Forestry</td>
<td>95 05 00 00</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Geography</td>
<td>22 33 18 27</td>
<td>1-2</td>
</tr>
<tr>
<td></td>
<td>Geology</td>
<td>58 38 02 02</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Natural Res.</td>
<td>90 08 02 00</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Water Res.</td>
<td>97 03 00 00</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Wildlife</td>
<td>98 02 00 00</td>
<td>0</td>
</tr>
</tbody>
</table>

*N in this case refers to number of individuals
attended any of a number of workshops related to natural resources:

1. Teton science school
2. Project learning tree
3. Bear lake inservice
4. Four corners school of outdoor education
5. Water education
6. Project WILD

Here again, I used the teachers as samples and used a test of differences between proportions.

Among the elementary teachers, 32%±5, 30%±5, and 26%±4, respectively, had attended Project WILD, Water Education, and Project Learning Tree. In each case, a higher percentage (significant at p=.05) of rural teachers had attended than did urban. Only 5% or less of the teachers had attended the other workshops.

Secondary science teachers reported Project WILD (30%±11) and Project Learning Tree (18%±9) most often. All others were attended by less than 5% of the science teachers. There were no significant differences between rural and urban attendance rates.

Attendance by social-studies teachers was all but nonexistent, ranging from 5% to 0% of the teachers among the six workshops.
Needs Assessment

In order to gain some assessment of the teachers' perceptions of the constraints preventing more natural-resources instruction, I provided a list of 14 specific natural-resources services, programs, materials, and opportunities on the survey form. I instructed teachers indicate any and all of these which they would like to see provided. The responses reflect the percentage of individual teachers, not clusters, that indicated each need. Confidence intervals were calculated using appropriate techniques for proportions.

As with the other questions discussed above, the responses were similar across the three teacher blocks (Table 10). Four of the needs -- Classroom Activities, Guest-Speaker Lists, Audio-visual Materials, and Funding -- appeared in the top six of all three lists. The five least-mentioned needs also had considerable similarity: Mandatory Objectives and Teacher Recognition were the least two mentioned needs in all three groups.

In general, elementary teachers expressed the largest number of needs, with 50% or more checking 11 of the 14 needs on the list (Table 10). Only five needs were checked by half or more of the secondary science teachers, although the percentages for an additional four do not differ significantly from 50%. Social-studies teachers expressed the fewest needs, with only three items being checked by at least
Table 10
Reported Needs of Responding Teachers

<table>
<thead>
<tr>
<th>Needs</th>
<th>Elem.% ± .95 C.I.</th>
<th>Sci.% ± .95 C.I.</th>
<th>Soc.Std.% ± .95 C.I.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(N* = 402)</td>
<td></td>
<td>(N* = 73)</td>
</tr>
<tr>
<td>Classroom Activities</td>
<td>75%±4</td>
<td>59%±11</td>
<td>43%±12</td>
</tr>
<tr>
<td>Guest-Speaker List</td>
<td>69%±5</td>
<td>55%±11</td>
<td>50%±13</td>
</tr>
<tr>
<td>Field-Trip Locations</td>
<td>67%±5</td>
<td>47%±11</td>
<td>28%±12</td>
</tr>
<tr>
<td>Field-Trip Activities</td>
<td>62%±4</td>
<td>40%±11</td>
<td>18%±10</td>
</tr>
<tr>
<td>A/V Materials</td>
<td>62%±4</td>
<td>64%±11</td>
<td>60%±12</td>
</tr>
<tr>
<td>Funding</td>
<td>61%±4</td>
<td>64%±11</td>
<td>47%±12</td>
</tr>
<tr>
<td>Training</td>
<td>55%±5</td>
<td>42%±12</td>
<td>52%±12</td>
</tr>
<tr>
<td>Background Materials</td>
<td>55%±5</td>
<td>37%±11</td>
<td>45%±12</td>
</tr>
<tr>
<td>School-Ground Activities</td>
<td>54%±5</td>
<td>37%±11</td>
<td>15%±9</td>
</tr>
<tr>
<td>Utah-Specific Materials</td>
<td>54%±5</td>
<td>37%±11</td>
<td>37%±12</td>
</tr>
<tr>
<td>Better Access to Published Materials</td>
<td>50%±6</td>
<td>45%±12</td>
<td>38%±12</td>
</tr>
<tr>
<td>Facilities</td>
<td>32%±4</td>
<td>29%±11</td>
<td>22%±11</td>
</tr>
<tr>
<td>Mandatory Natural-Resources Objectives</td>
<td>13%±3</td>
<td>11%±7</td>
<td>8%±7</td>
</tr>
<tr>
<td>Teacher Recognition</td>
<td>9%±3</td>
<td>5%±6</td>
<td>7%±6</td>
</tr>
</tbody>
</table>

*N here refers to individual teachers
half of the teachers. Percentages for four other items did not differ significantly from 50%.

A few differences were found between urban and rural elementary teachers. Statistically (p=.05), differences existed in the reported need for guest-speaker lists, field-trip locations, audio-video materials, funding, and better access to published materials, with urban teachers' scores being higher than rural.

Discussion and Recommendations

Limitations of the Study

As with all surveys, the respondents are assumed to have answered truthfully and accurately. To aid truthful reporting, all respondents were assured anonymity and questions were designed to be non-threatening in nature. I tried to avoid biased language at all times.

A second concern is that of non-response bias. Non-response bias is the degree to which the answers of persons returning questionnaires differ from the answers non-respondents would have given, had they answered. The presence of non-response bias is well documented in other studies (Aiken 1988). How that bias is best measured is not as well established (Hartman et al. 1985-86), therefore several methods will be discussed.

Sudman and Bradburn (1984) suggest that bias becomes a factor for any survey below 100%, but concede that a return rate of more than 80% is generally sufficient for most
studies. Since this study achieved an overall return rate of 51\%, I assume that non-response bias is a factor. The question is: to what degree?

One approach is to survey a random sample of non-respondents and determine if their answers vary from the respondents. This alternative was not feasible in this study due to the method of survey distribution. Several schools were reluctant to conduct even a single follow-up.

A second approach is to look for differences between first contact response and follow-up responses and extrapolate to determine the degree of bias (Sudman and Bradburn 1984). However, non-respondents may bear little resemblance to late respondents (Hartman et al. 1985-86). In this study, the mean scores for each questionnaire item on the first mailing were not significantly different from those of the second mailing at the \( p=.05 \). Although in most cases the mean was lower, the differences must be assumed to be due to chance.

I suggest that there is a degree of bias inherent in the study, but the extent to which it can be measured appears to be limited. Additional factors, such as inaccurate distribution of the questionnaires for the first and/or second mailings, account for some of the non-response. Several schools contacted me to explain that the follow-up questionnaires were never distributed. Surveys with two different code numbers were received from the same teacher on several occasions, indicating that principals did not
always take care in the survey distribution. Finally, a number of surveys (n = 23) were received from teachers not included in the target population. If these teachers returned the surveys at the same rate as the other teachers, at least 4% of the surveys were distributed to non-target teachers.

**Major Findings**

Certainly, differences exist among the three groups of teachers studied. The results of the secondary teachers must be discussed within the context of the specific courses taught by the respondents. Had a higher percentage of chemistry teachers, for example, answered, the results would have been noticeably different.

Reported percentages of time spent teaching natural-resources topics were substantial: roughly a fourth to a third each of the time spent in elementary science, secondary biological science and secondary geography; and additional percentages ranging from 13-20 of elementary social studies, and secondary physical and earth sciences with the conspicuous exception of 55% in rural earth science. These estimates had high variances. Secondary results produced standard deviations that were, in some cases, as high as the mean. Future studies may wish to refine further the broad subject categories I used. For example, "biological science" may include subjects as diverse as physiology and ecology, thus confounding the results.
Elementary science and social-studies subjects had mean reported percentages of 33 and 13, respectively. I did not ask the teachers to report the total amount of time they spent on science and social studies, but a New Hampshire study (Andrew 1980) reports elementary teachers (K-6) providing approximately 2.5 hours per week on each of these subjects. Primary teachers (K-3) reported up to 2 hours per week for each subject. Individual teachers reported allocation times as low as 15 and as high as 540 minutes per week. Assuming that Utah teachers would report similar results, I multiplied the means from the two studies and produced approximate weekly figures of 1 hour of natural-resources instruction provided in science and 20 minutes provided in social studies to the "average" student. These tenuous figures should be viewed with caution, as there is no evidence that Andrew's results would apply to Utah. However, a similar study of elementary science practices conducted in Illinois (Fitch and Fisher 1979) reported results almost identical to Andrew's.

I could find no clear or consistent indication that either the urban or rural teachers showed more interest in, or devoted more time to, natural-resources instruction. A higher percentage of rural teachers responded to the questionnaire, attended workshops, and a very high percentage of instructional time is devoted to natural-resources issues by rural earth-science teachers. But urban biological-science and geography teachers devoted more time to these
issues than did their rural counterparts, and urban elementary teachers listed more needs, perhaps indicating more concern for adequate presentation of the subject matter.

Similarly, there were no consistent signals to differentiate the elementary and secondary teachers. Secondary teachers returned a higher percentage of questionnaires than did elementary, and their science teachers had the strongest educational background in natural resources. However, elementary teachers reported the greatest use of instructional materials, attended more workshops, and listed more needs. Perhaps understandably, in view of their subject matter, social-studies teachers reported the lowest values in most of these measures: fewest college courses taken in natural resources, lowest workshop attendance, smallest list of needs, least use of instructional materials. Obviously, they have their own subject-matter demands on their time.

Major differences appear to exist in the types of resources for which teachers provide instruction. One-quarter of the elementary teachers reported teaching nothing about mineral ores and an additional 46% reported teaching about them with a small to very small degree of emphasis. Surprisingly, at least 36% of the social-studies teachers reported a moderate or higher amount of emphasis for each of the eight resources listed in Table 4.

Overall, more than half of the responding teachers
agreed with the statement that more natural-resources instruction should be given in their classrooms. This, coupled with the needs-assessment results, would seem to indicate that a program structured around the reported desires of the teachers would meet with results.

Once the desire to increase natural-resources instruction has been established, the next step is to decide how best to facilitate that increase. Of the possible factors affecting natural-resources instruction which I provided for the respondents, the three checked as being the leading positive factors were the same for all three groups. These factors (Teacher Interest, Student Interest, and Relevance of Topic) were not statistically different within elementary and secondary science teachers, with secondary social-studies teachers showing a significantly lower (p < .05) score for "Relevance of Topic".

The fact that teachers see their own interest and the interest of their students as positive influences on the amount of natural-resources instruction indicates that an increase in teacher and/or student interest might elicit an increase in natural-resources instruction.

Another possible indication that the teachers' interest in the subject matter influences their emphasis on it is shown by correlating the proportion of time elementary teachers spend in science instruction which they devote to natural resources with the proportion of social-studies time they devote to natural-resources issues. I calculated this
correlation and found it to be highly significant \((r=0.42, n=122, p<.01)\). Evidently, an elementary teacher's interest in the subject is expressed in both areas of instruction.

One can then ask how teacher interest in the subject matter could be strengthened. One hypothesis would be that taking more college courses in natural-resources subjects might stimulate more interest and as well more confidence in presenting the material. However, correlating the percentage of natural-resources instruction with the number of college courses taken in the subject among five teacher groups -- elementary, the three secondary science groups, and secondary social studies teachers -- produced only one significant correlation. This was among the urban physical-science teachers \((r=0.53, n=21, p=.05)\).

The survey questions on academic preparation of Utah's teachers show that elementary and social-studies teachers have little formal college coursework in the natural-resources field. Biology, geography, and geology were the most often reported courses for those groups. While only 23% of the responding social-studies teachers reported teaching geography now, 18% reported having taken 3 or 4 geography courses in college and an additional 27% reported 5 or more. This compares favorably with a national study conducted by Farrell and Cirrincione (1989). They sent questionnaires to 1,138 social-studies teachers throughout the United States and obtained a return rate of 52%. Using a slightly different breakdown of results, they
report only 19% of their responding teachers had 4 or more geography courses at the undergraduate level.

As expected, science teachers showed the largest numbers of natural-resources courses taken in all areas except geography. Despite the higher numbers, over 70% of the responding teachers have no college credits in forestry, fisheries, or water resources. A recent study of secondary teachers in Idaho (Heikkinen 1988) shows that 43% of that state's science teachers were not endorsed to teach the subject they were assigned. Moreover, 39% of the teachers have less than a minor in the subject they teach. Given the increasing shortage of qualified science teachers throughout the United States, I would expect Utah's science teachers to show the same trend toward a lack of academic preparedness.

Finally, one other possible way to increase natural-resources instruction is to provide the teachers with the needs they indicated in Table 10. Provision of a variety of activities, especially to elementary teachers, is a readily identifiable need. In an effort to test whether these expressed needs do in fact operate as constraints on the amount of natural-resources instruction, I tested for correlation between the number of needs that the teachers reported and the amount of natural-resources instruction provided. None of these was statistically significant. Either these needs are not acting as true constraints on the amount of natural-resources instruction, or the teachers
see them more as constraints on the quality of instruction.

The lowest scoring needs were "mandatory objectives" and "teacher recognition." The low report for mandatory objectives corresponds with the previously reported agreement with the statement that natural resources should not be taught as a separate subject.

A similar study of needs conducted in Washington (Brouillet et al. 1986) surveyed district curriculum directors' restrictions on environmental education within each district. About 25% of the directors returned their surveys. Lack of funds, curriculum materials, and planning time were the top three restrictions reported. Comparisons between the two studies should be made with caution, considering the different populations studied.
CHAPTER III
NATURAL-RESOURCES
CURRICULUM FRAMEWORK

Introduction

The survey results and my review of the Core Curricula now provide a perspective within which natural-resources instructional material for the Utah system can be designed. In brief, these sources disclose that:

1. There is already a considerable amount of natural-resources instruction in the system.

2. Notwithstanding the current amount, the teachers generally agree on the desirability of more instruction, although not to the extent of establishing distinct, new courses.

3. Although there was no measurable correlation between the number of needs which teachers listed and the amount of time they spend on natural-resources instruction, the needs were expressed by major fractions of them. Some -- e.g. guest-speaker lists, field-trip locations, and funding -- are beyond the concerns of this study. Others (classroom activities, A/V materials, field-trip activities, and background materials) can be provided in part by instructional material.

On the basis of these considerations, I have proceeded with the design of instructional material, doing
so in two states. The first is the design of a curriculum framework which is discussed here. The second is the actual development of classroom instructional materials to be discussed in the next chapter.

A curriculum framework is an outline of the key concepts of a given subject which are to be communicated to the students in order that they achieve a certain level of mastery; and a specified set of learning outcomes in connection with these concepts. It is very similar to what the Utah Board of Education refers to as its Core Curricula.

I designed the curriculum framework for three reasons: (1) to serve as a working model for developing natural-resources curricula containing the essential elements recommended in the literature, (2) to serve as a definition of natural-resources education, and (3) to become a reference point from which educators and resource persons alike can work.

Although natural-resources instruction can be increased without a framework or master plan being followed, the guidance provided by such an instrument can serve to improve the quality and quantity of the instruction concurrently. The framework provides persons not trained in natural resources issues a way of identifying the essential elements to be explored when providing natural-resources instruction. It does not, however, pro-
vide specific information on each resource.

An equally important benefit of the framework is the establishment of a starting point from which resource and education professionals can proceed. Since the term "natural-resources education" is one not frequently discussed in the literature, a need to formalize it's definition and concepts.

Attempts have been made to allow both the natural-resources and education communities to compliment each other to the benefit of natural-resources instruction. In my study and others (Fitch and Fisher 1979), teachers expressed a lack of familiarity with the background information and knowledge essential to teaching natural-resources or other science-oriented topics. While this framework does not provide specific information to teachers, it does outline the important aspects of natural-resources issues in general. Natural-resources professionals, on the other hand, are frequently not trained in the areas of education (Schafer 1984) and may feel more comfortable in the role of disseminator of information to educators. Therefore, this framework was also constructed from the standpoint of a natural-resources professionals of the conceptual approaches used by educational professionals.
Methods

To maximize the potential for adoption of my curriculum framework by the public school teachers of Utah, I incorporated the overall concepts found in the existing natural-resources objectives in the Utah State Core Curricula for Science (Utah State Department of Education, 1988) and Social Studies (Utah State Department of Education, 1986). Most of the objectives were broad in nature (see Table 11 for examples), making it easy to ensure compatibility. As stated earlier, school districts are not required to follow the state guidelines exactly, but they do provide an appropriate reference point for this study.

My review of science curriculum frameworks from other states and a careful consideration of the published goals of selected successful national programs were combined with the results of this study and my professional perceptions to form the framework.

I sampled state education departments' science and environmental education policies throughout the United States based on several criteria. First, states in the Intermountain West were assessed to provide a comparison with Utah. I found that Wyoming and Idaho provide no guidelines or frameworks for their teachers.

Other states were chosen for their reputations as
### Science:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>K-3</td>
<td>The students will use the five senses to gather and compare information about their natural environment. The students will identify characteristics of water and its uses.</td>
</tr>
<tr>
<td>4-6</td>
<td>The students will determine the composition of soil, identify the properties of soil, and discuss the importance of soil conservation. The students will identify natural resources and discuss conservation and pollution of these resources.</td>
</tr>
<tr>
<td>7-8</td>
<td>The students will investigate ways in which man's impact upon the environment affects living things.</td>
</tr>
<tr>
<td>9-12</td>
<td>The students will observe that a natural balance between organisms and their environment can be altered by natural or man-controlled events. Cite examples.</td>
</tr>
</tbody>
</table>

### Social Studies:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>K-3</td>
<td>The students will understand that people use natural resources to meet their basic needs and these resources must be protected and conserved.</td>
</tr>
<tr>
<td>4-6</td>
<td>Explain that the geographical features of places within the Western Hemisphere vary and contribute to their distinctiveness.</td>
</tr>
<tr>
<td>9-12</td>
<td>The students will evaluate how the natural environment affects the way people live.</td>
</tr>
</tbody>
</table>
being leaders in the field of state education. The Florida State Department of Education provides teachers with a framework for science courses, but nothing else. New York (New York State Department of Education 1978) provides very structured frameworks for their teachers in all science areas. In addition, information such as sample activities for each objective and suggestions on the amount of time a teacher should spend on each topic are provided. While these are provided for the teachers' convenience only, the objectives are mandatory and students are tested on their knowledge of them through standardized tests.

California provides teachers a handbook of activities related to environmental education (Sly, Comnes, and Cuomo 1988). Alaska has frameworks for both renewable (Alaska State Department of Education 1988) and non-renewable natural resources (Alaska State Department of Education 1988) for vocational students. within these are a series of recommended "competencies and tasks" for teachers.

Finally, Washington provides its students with a series of guidelines for science curricula (Duxbury 1988) that include a curriculum framework for each course and additional information such as "learner outcomes" and "instructional implications". These are of great benefit to a teacher, since they further define the objectives and provide direction without restricting a teacher to a
single course of action.

The difficulties encountered when sampling these states were many. First, job titles and duties vary from state to state, making it difficult to find the correct person to answer all of my questions. Second, guidelines provided by each state did not always apply to the entire student population within that state. For example, Alaska's natural-resources courses are intended for vocational students only and the structured guidelines provided by New York are for their "non-college bound" students. Last, some states were in the process of revising their materials, but were unsure as to the direction the new material would take.

Next, I looked at the published goals of two successful national programs: Project Wild (Western Regional Environmental Education Council 1988) and Project Learning Tree (The American Forest Council 1988). Although each program focuses on one resource in particular, their frameworks provided valuable references. Both programs emphasize a multidisciplinary approach to learning and proceed from awareness-type to action-oriented goals. The materials provided in the guides are cross-referenced to the frameworks to provide additional help to the teachers.

Last, my experiences as a classroom teacher led me to the conclusion that teachers often do well when provided
some guidance, but are allowed the creativity to draw from their own personal strengths and experiences when providing the particulars to their students.

Drafts of the framework were reviewed by Utah State University educators and resource persons alike. Further revisions and modifications are expected as the framework is actually put to use.

Results

I developed the Natural-Resources Curriculum Framework for Utah (Table 12) to reflect the stated objectives of similar, existing programs and the specific needs of Utah. From my analysis of the Core Curricula, it is apparent that natural-resources standards and objectives are many. However, they often are written in broad terms and specific resources are not continuously followed throughout a student’s coursework. This uneven treatment could allow students to receive unequal information and understanding on certain natural resources. The Framework can serve as a single source of natural-resources objectives from which a teacher may refer while planning a unit on natural resources.

From my review of various state education curricula and commercially available material, I observed that existing frameworks, although not specifically designed
Table 12
Natural-Resources Curriculum Framework for Utah

Goal 1: Students will become aware of natural resources and their importance (K-12).

1.1 Natural resources are materials found in nature that are used by mankind for it's benefit.

1.2 Our everyday existence is dependent upon natural resources.

1.3 Natural resources can be used for "essential" purposes (substance, shelter) and "non-essential" purposes (recreation, aesthetic value).

1.4 Natural resources are often interdependent.

Goal 2: Students will gain the background knowledge necessary for understanding natural-resources issues (K-12).

2.1 Natural resources are classified as renewable or nonrenewable. Nonrenewable resources are further categorized as exhaustable and inexhaustable.

2.2 Each of these classifications of resources has it's own management strategies, as does each specific resource.

2.3 Natural resources are culture-dependent, and therefore, are value-laden.

2.4 The short-term and long-term economic implications of natural resources management decisions are often different.

Goal 3: Students will develop positive attitudes toward natural-resources topics (4-12).

3.1 As with any social issue, natural-resources problems have no right answer.

3.2 Different values will produce different solutions to natural-resources issues.
3.3 Long-term as well as short-term effects are important in making management decisions.

3.4 Humans affect natural-resources in a variety of ways and to different degrees, depending on the specific course of action taken.

Goal 4: Students will demonstrate the skills needed to investigate and act upon natural-resources issues (7-12).

4.1 Students will identify the components of a natural-resources issue.

4.2 Students analyze a natural-resources issue and provide possible solutions.

4.3 Students will demonstrate knowledge of proper management techniques for achieving specific goals.

4.4 Natural-resources decisions may have far reaching effects.

Goal 5: Students will be active in natural-resources issues (9-12).

5.1 Students will explore their role in natural-resources issues, appropriate to their age group and as citizens of the United States.

5.2 Students will follow through with a course of action decided upon by each student that concerns a natural-resources issue.
for natural-resources instruction, could be used as models for my framework.

The framework that proved to be of most value to me was the "Conceptual Framework" found in Project WILD. I chose to pattern my framework after the one used in Project WILD for several reasons. First, unlike most of the curricula from the state education departments, Project WILD does not cover all areas of "science" or "biology". It is restricted to wildlife-related instruction. Second, despite the focus on wildlife, Project WILD is meant to be interdisciplinary. This type of instruction is an important factor in environmental education in general (Hart 1981; Brennan 1986) and, I believe, in natural-resources instruction specifically. In addition, Project WILD is a highly successful program used throughout the United States by teachers in grades K-12. Finally, as is one intention of my framework, the conceptual framework of Project WILD was actually used to create materials for grade school teachers (Western Regional Environmental Education Council 1988).

The conceptual framework found in Project WILD is broken down into seven major sections (Awareness and Appreciation of Wildlife; Human Values and Wildlife; Wildlife and Ecological Systems; Wildlife Conservation; Cultural and Social Interactions with Wildlife; Wildlife Issues and Trends -- Alternatives and Consequences;
Wildlife, Ecological Systems and Responsible Human Actions. Each section is subdivided into more specific content statements.

Through a careful analysis of these sections and a thorough examination of the literature, I constructed five "Goals", each divided into narrower objectives, based on concepts consistently mentioned (Kelly 1975; Hart 1981; Lucko, Disinger, and Roth 1982; Yockers and Miller 1984; Schafer 1984; Brennan 1986; Ramsey 1989) as being important in a comprehensive program.

I decided to follow the "awareness to action" approach outlined in the conceptual framework of Project WILD. The first step toward mastering a subject is being introduced to it at its most basic level. "Students will become aware of natural resources and their importance" is the first goal in my framework. The purpose of this goal is to introduce students to natural resources and increase their interest in them. In the survey portion of this study, "student interest" was listed by all three groups of teachers (elementary, science, and social studies) as one of their top three positive factors influencing the amount of natural-resources instruction which they provide. If this interest could be enhanced, especially in the early grades, an increase in the amount of natural-resources instruction should follow.

The next three goals of my framework deal with the
acquisition and development of the knowledge and skills pertinent to natural-resources issues. The establishment of background knowledge (Goal 2) is an ongoing process that becomes increasingly sophisticated as the students do.

As this knowledge is being accumulated, developing positive attitudes toward natural resources (Goal 3) is an essential next step toward understanding natural-resources issues. I use the term "positive attitudes" in an attempt to avoid bias. I do not wish teachers to impose their views on students, but to have students develop their own attitudes based on their knowledge of the issues.

Goal 4 takes these positive attitudes one step further by requiring the students to demonstrate the skills necessary to investigate natural-resources issues.

The logical end product of education is practical application. The last goal of my framework ("Students will be active in natural-resources issues") is, in fact, the ultimate purpose of natural-resources instruction. By fostering an increase in natural-resources instruction, I hope to increase the amount of informed involvement of Utah's citizens.

These goals are similar to the sections found in Project WILD, but differ in several ways. First, my goals are written for natural resources in general, not just
wildlife. Second, I do not provide the specific content statements that Project Wild does. I do not believe that a framework can provide a teacher with an adequate amount of background information. Therefore, I have limited my framework to goals and objectives. Finally, none of the goals or objectives found in my framework can be attributed to one source. As stated earlier, although these ideas appear in various sources, none are taken directly from any other source.

Discussion and Recommendation

The results of the survey indicate that teachers see a need to increase natural-resources instruction in their classes, but not necessarily through the creation of a separate subject to accommodate that end. Although the proposed curriculum framework provided could certainly be used to implement an entire course devoted to natural-resources instruction, I recommend that it be used to develop self-contained units within an existing science or social-studies course. The framework may help provide the structure lacking in the area of natural-resources instruction.

This framework, as stated earlier, is intended to serve as a functional model. Much debate and discussion will undoubtedly arise concerning its particulars. As the
goals for natural-resources education in Utah are further refined, the framework will be adapted to fit these new needs. To this end, I recommend that an entire research project should be devoted to the revision and implementation of this model framework.

Once the basic framework for natural-resources instruction has been identified, units for each individual resource can be developed. Since the desire for Utah-specific materials has been documented by this study for elementary and science teachers, these units may be tailor-made for Utah teachers. Multiple units can be created for each resource to meet the needs of a variety of subject matter teachers. In addition, the varying lengths of time teachers devote to natural-resources instruction should be considered, and units should be constructed in both long and short forms.
CHAPTER IV
CREATION OF INSTRUCTIONAL MATERIALS

Introduction

The final objective of my project to increase the level of natural-resources instruction in the Utah schools was to create classroom materials for the teachers in the state, to be used in their classroom instruction. The results of the needs assessment portion of my survey bore out my suspicion that the teachers in Utah would be receptive to classroom materials. Elementary teachers reported classroom activities as their No. 1 need (75%±4). Secondary science and social-studies teachers, while reporting at lower rates of need (59%±11 and 43%±12 respectively), still showed a strong to moderate desire for more materials.

Consequently, I created these materials to meet two ends: (1) to serve as functional materials that could actually be used by teachers and effect an increase in the quality or quantity of natural-resources instruction, and (2) as extensions of the Natural-Resources Curriculum Framework for Utah which I presented in the last chapter. The Curriculum Framework provided the outline of key concepts to be communicated to the students, and a set of learning goals. The materials I have developed are actual classroom exercises about real-world, natural-resources
entities and processes that give realism to the Curriculum Framework concepts. They are therefore the vehicles by which the Framework is conveyed.

Methods

The creation of classroom materials involved two basic steps. First, I had to decide what concept I wished to teach, and second, how best to teach that concept.

I decided to focus the materials toward geography teachers specifically, although I have incorporated the multidisciplinary approach recommended in the literature (Hart 1981). I chose geography teachers as my target population based on the amount of natural-resources objectives found in the social studies core (Utah Department of Education 1986) and the fact that few materials have been specifically designed for this subject. Next, I correlated the goals and objectives in my curriculum framework to the widely used "Five Themes of Geography" endorsed by the National Council for Geographic Education (1984). These themes (Transportation, Region, Location, Place, and Human/Environment Interaction) lend themselves well to natural-resources instruction. I have found no commercially available material that takes this approach.

I garnered ideas for the materials from my own educational experiences. Having taught science at grades 4-12 to under-motivated and special-education students, combined
with 5 summers as an environmental educator and 2 years as a naturalist at a community nature center, I had a unique base of experience with natural-resources instruction in a variety of settings. Most of the activities were my own original creations, while others were adaptations of existing work. When the latter was the case, I cited the original source for the idea.

I developed activities not only to motivate the students who are to be instructed, but also the classroom teachers who were, in most cases, not currently providing much natural-resources instruction. Two of the top three positive influences on natural-resources instruction, as reported by the teachers in my survey, are teacher and student interest. Participation and/or manipulation of materials, opportunities for individual success, and a chance for students to explore new ideas have been recognized elsewhere as important aspects of successful classroom materials (Schwaab 1982-83). "Relevance of the topic" was the other of the top three positive influences on natural-resources instruction that teachers cited in my survey. I have made every effort to make these activities relevant to the students, teachers, and the curriculum at hand.

I decided upon the layout and format of the materials by assessing these qualities in the materials found in Project WILD (Western Regional Environmental Education Council 1988) and through my own experiences.
I presented early drafts of these materials at teacher in-service workshops held at Utah State University. I modified them on the basis of the teachers' reactions to them, and developed final drafts.

Results

I created a total of ten activities that cover a range of objectives in my framework:

1. The total cost of a product
2. Play nice!
3. Natural-resources relay
4. Wildlife want-ads
5. Natural-resources web
6. The adventures of student
7. Natural resources and society
8. Be a drip
9. Ballet of the air
10. Ballet of the air II

Only two of these activities are presented here (Table 13) for illustrative purposes. All are presented in Appendix G. The final layout of each activity includes six parts: Objective, Framework Correlations, Geography Concept, Materials, Procedure, and Extension.

The objective portion is simply a concise statement of what the students will learn from completing this activity. The correlations with my framework and the statement of which geography concepts are covered in each activity
Table 13

Examples of Classroom Activities

PLAY NICE!

OBJECTIVE: Students will discuss the impact of recreation on natural resources.

FRAMEWORK CORRELATION: 1.3, 2.1, 2.3, 3.2, 3.4

GEOGRAPHY CONCEPT: Human/Environment Interaction

MATERIALS: 3x5 cards

PROCEDURE: Give each student a 3x5 card. Have each student list his/her ten most favorite activities. After everyone is finished, have each student place an "X" after each activity that requires some external source of energy (driving a car does; riding a bicycle does not), and an "O" after every activity that requires specialized equipment (riding a bicycle does; walking does not) that is created from natural resources. Activities may have both symbols after them.

Discuss the "responsible" use of resources. If we have a resource in short supply, should we be using it for recreational (nonessential) purposes? Besides consumption of resources, what other consequences arise from our actions?

EXTENSIONS:

Have students compose a hypothetical list of activities from students in other countries. What are the differences in resource use?

Have students ask their grandparents for similar lists of activities they enjoyed as children. What changes have occurred in our use of resources in the last 50 years?
WILDLIFE WANT ADS

OBJECTIVE: Students will explore the habitats and niches of a variety of wildlife.

FRAMEWORK CORRELATION: 1.4

GEOGRAPHY CONCEPT: Region, Movement

MATERIALS: Job applications, want ads, reference material

PROCEDURE: Each student is assigned a wild animal to role play and given a teacher-created job application (see attached) to complete. The students are encouraged to be creative and imaginative, but all information appearing on a student's application must be plausible and based on accurate information about his/her animal. Once students have completed their applications, they must search the "Wildlife Want Ads" provided by the teacher (see attached) to find jobs that they are qualified for.

Teachers may interview students themselves or assign students to act the part. Once students have some experience with this activity, the possibilities are endless. They can generate their own want ads and can even create an entire wildlife newspaper with news stories, sports and other sections.

Sample Employment Application

Name: Ali Gator
Address: 231 Swampy Lane, Everglades, Florida

Employment Desired: Meat-eater, Swimmer

Professional Experience:
1986: Survived poacher attack
1987: Guarded nest from predators
1987-1988: Taught my young to hunt

Sample Wildlife Want Ads

Aquatic forager. Must be able to consume fifty pounds of vegetation a day. Apply in person at Crystal Springs State Park, Florida.

Beach resort looking for predator to swim offshore. Must like cold water. Fire Island National Seashore, New York.

Carnivore needed for polar region. Work days all summer and nights all winter. Apply Barrow, AK.

Diver needed to catch fish and turtles in small lake. Experience preferred. Call Louisiana 8-9987.

Sample Interviewer Questions

Why do you want to work here?
What type of experience have you had?
Why should I hire you instead of (name another animal with a similar niche)?
What special working/living conditions do you require?
Whom may I contact as a reference?
are provided for the teachers' convenience. They enable a
teacher to find activities relevant to specific objectives
in the framework or to any of the "Five Themes of Geography"
(mentioned above). A listing of the materials required for
the successful completion of each activity is again pro-
vided for the convenience of the teacher.

The Procedures and Extension sections of the activi-
ties are, to me, the most important. I wrote the proced-
ures to be understandable and concise. By no means are
they the only possible way in which these activities can
be conducted. I encourage teachers to experiment with these
activities and modify them to fit their own specific needs.
In fact, as these materials were actually presented to
teachers in workshops, I allowed time for open discussion
on possible modifications for different grade levels, sub-
ject matter, and student ability levels. The extensions in-
cluded in some of the activities reflect some of my own
ideas for modifications. Often, I have presented extensions
to the activity that have not actually been field tested in
a classroom, but are interesting to me.

As I have stated, most of these activities have been
presented to in-service teachers at a variety of workshops.
Although I have not formally evaluated their responses to
the activities, informal feedback indicates a wide degree
of acceptance and enthusiasm from the organizers of the
workshops and the teachers themselves.
Discussion and Recommendations

Whereas the Curriculum Framework provides the overall outline of natural-resources instruction, classroom support material is the vehicle for achieving the framework’s objectives. Adherence to the framework is essential in providing a comprehensive program for teachers to utilize. The materials to date have served to focus teachers’ attention on natural-resources issues.

Given the enthusiastic response of the teachers in the workshops mentioned above, and the reported need for additional teaching material for the classroom in the survey phase of this study, I recommend that creation of classroom support material be continued through the Outreach Education Program. The possibility of providing a detailed curriculum framework, complemented by effective classroom support materials, is a viable long-term goal. Not only would teachers be receiving suggestions as to what should be taught, they would also be given the means to do so. These two elements, combined with the Utah teachers’ interest documented in my survey and Utah students’ interest documented in others (Lazarowitz et al. 1985), would surely prove successful in increasing the amount of natural-resources instruction in Utah.

Several areas of expansion are readily available, including the creation of materials that are specific to the natural-resources issues of Utah. Based on the results of
my study, I believe these materials would be directly applied by teachers throughout the state and are of a type that is not commercially available elsewhere.
REFERENCES


Utah State Department of Education. 1986. Social Studies core curriculum. Salt Lake City.

Western Regional Environmental Education Council. 1988. Project WILD. Boulder CO.


Appendix A

District Approval Request Letter

Dear Superintendent:

In response to the increasing number of requests by classroom teachers for improved knowledge and greater availability of environmental and natural-resources teaching materials, the College of Natural Resources at Utah State University is conducting a formal assessment of Utah classroom teacher's current practices, attitudes and needs concerning natural-resources education. Information gained will serve as a basis to strengthen the focus and direction of natural-resources education in Utah. This will be accomplished through the Outreach Education Program.

This letter is a formal request to survey a number of teachers in your district as part of this study. A stratified, random sample of schools has been selected and several schools from your district have been chosen. We realize that your teachers and principals are very busy. The time required of them will be kept to a minimum and mailing dates have been scheduled with consideration for school breaks and vacations. Complete confidentiality is assured, although no "sensitive" data is being requested. Results of the survey will be made available to you, your principals and teachers upon request.

I will contact you within the week to answer any questions you may have regarding the survey.

Thank you for your time in considering this proposal. If you have any immediate questions or concerns, please call me at (801) 750-2447.

Sincerely,

John J. Van Niel
Research Associate
Outreach Education
Appendix B

Principal Contact Letter

Dear Principal:

The College of Natural Resources at Utah State University is conducting a formal assessment of Utah classroom teacher's current practices, attitudes and needs concerning natural-resources education. Information gathered will serve as a basis to strengthen the focus and direction of natural-resources education in Utah.

__________ at the district office was contacted and permission has been granted to contact you directly. A stratified, random sample of the schools in Utah has been selected and your school was chosen to participate in this study. A mailed questionnaire will be utilized to gather the desired information from regular classroom teachers at the elementary grade levels and science and social studies teachers at the secondary levels.

This letter is a formal request for assistance in distributing the questionnaires to the appropriate teachers in your school. A more detailed letter will be sent to you one week from today, explaining the distribution method.

Thank you for your time in considering this proposal. If you have any immediate questions or concerns, please call me at (801) 750-2447.

Sincerely,

John J. Van Niel
Research Associate
Appendix C

Principal Instruction Letter

Dear Principal,

First, let me thank you for your time and effort in assisting me with this project. The distribution process has been designed for minimum effort and maximum efficiency.

Each teacher's cover letter and return envelope has been marked with a code number. These numbers are consecutive and unique to each school in the sample. The numbers are for follow-up purposes only. Three weeks from today, replacement surveys will be sent to non-respondents, utilizing the same code numbers. It is essential that you distribute the surveys in some manner that will allow you to give the replacement surveys to the correct teachers. Alphabetical-sequential (e.g. Anderson = 01, Brown = 02, Burrough = 03) may be easiest.

The amount of surveys provided to your school was based on the best information available to me. Surveys are to be distributed to social studies and science teachers at those grade levels that are taught on a separate subject basis and all "regular" classroom teachers at the elementary levels (including Kindergarten). For greater accuracy, if too few or too many surveys were sent to your school, please utilize the envelope marked "principal copy" to convey that information to me.

Please do not hesitate to call me if you have any questions or concerns at 750-2447. A copy of the results will be sent to you as soon as they become available.

Sincerely,

John J. Van Niel
Appendix D

Questionnaire

NATURAL RESOURCES EDUCATION SURVEY

Outreach Education Program
College of Natural Resources
Utah State University
Logan, Utah 84322-5200

General Instructions

Please take a moment to give us your ideas on Natural Resources Education in your classroom. Your response will (1) aid us in assessing current practices in Natural Resources Education and (2) enable us to better provide for Utah's teachers.

PLEASE RETURN IMMEDIATELY
Refer to the following definition when completing the survey:

NATURAL RESOURCES: objects or substances found in nature that are used by humans for their needs or wants (e.g., air, water, soil, natural gas, solar energy, minerals, sand).

PART I: CURRENT CLASSROOM PRACTICES.

1.1 The number of years you have been a classroom teacher (count this year as a full year).

______ YEARS

1.2 On the numbered lines indicate each subject you are currently teaching (list repeated subjects separately, including elementary subjects), number of years taught, grade level for each and approximate percent of time devoted to natural resources instruction.

<table>
<thead>
<tr>
<th>SUBJECTS YOU CURRENTLY TEACH</th>
<th>YEARS TAUGHT</th>
<th>GRADE LEVEL</th>
<th>% OF TIME DEVOTED TO NR</th>
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<tbody>
<tr>
<td>1.</td>
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<td>4.</td>
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<td>5.</td>
<td>6.</td>
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1.3 Circle the number which best indicates the degree to which you emphasize each of the following types of natural resources.

<table>
<thead>
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<th>RESOURCE</th>
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<td>4</td>
<td>5</td>
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<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
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<tr>
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<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
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</table>

1.4 Circle the number which indicates the relative amount of time you spend on natural resources instruction at each level indicated.

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<td>3</td>
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</tbody>
</table>
1.5 Place a check by the materials you utilize for natural resources instruction (check all that apply).

- Audubon Adventures
- Tread Lightly
- Project WILD
- O.B.I.S.
- Ag in the Classroom
- Energy/Man's Environment
- Project Learning Tree
- Investigating Your Environment
- Class Project
- Ranger Rick
- Other:

PART II: FACTORS AFFECTING NATURAL RESOURCES INSTRUCTION.

2.1 Express your feeling on the following questions by circling the numbers that most represent your beliefs.

A. GREATER EMPHASIS SHOULD BE PLACED ON NATURAL RESOURCE INSTRUCTION:

- a. IN MY CLASSROOM 1 2 3 4 5
- b. IN MY SCHOOL/DISTRICT 1 2 3 4 5
- c. AT THE STATE LEVEL 1 2 3 4 5
- d. IN THE STATE CORE 1 2 3 4 5
- e. AT THE NATIONAL LEVEL 1 2 3 4 5

B. NATURAL RESOURCES TOPICS SHOULD BE TAUGHT AS A SEPARATE SUBJECT 1 2 3 4 5

2.2 Circle the number which expresses the degree to which the following factors influence your natural resource instruction.

DISTRICT CURRICULUM REGULATIONS -3 -2 -1 0 1 2 3
TEACHER INTEREST -3 -2 -1 0 1 2 3
STUDENT INTEREST -3 -2 -1 0 1 2 3
PLANNING TIME -3 -2 -1 0 1 2 3
CLASSROOM MATERIAL AVAILABILITY -3 -2 -1 0 1 2 3
ATTITUDES OF ADMINISTRATION -3 -2 -1 0 1 2 3
STATE CORE CURRICULUM REQUIREMENTS -3 -2 -1 0 1 2 3
FUNDING -3 -2 -1 0 1 2 3
ATTITUDES OF COMMUNITY -3 -2 -1 0 1 2 3
CLASS SIZE -3 -2 -1 0 1 2 3
IN-SERVICE TRAINING AVAILABILITY -3 -2 -1 0 1 2 3
BACKGROUND INFORMATION -3 -2 -1 0 1 2 3
RELEVANCE OF TOPIC -3 -2 -1 0 1 2 3
PART III: TEACHER CLASSROOM NEEDS

3.1 What specific natural resources services, programs, materials or opportunities would you like to see provided? (Check all that apply)

- FUNDS
- FACILITIES
- A/V MATERIAL
- UTAH-SPECIFIC MATERIAL
- TEACHER RECOGNITION
- FIELD TRIP LOCATIONS
- SCHOOL GROUND ACTIVITIES
- FIELD TRIP ACTIVITIES
- LIST OF GUEST SPEAKERS IN YOUR AREA
- FUNDS
- FACILITIES
- A/V MATERIAL
- UTAH-SPECIFIC MATERIAL
- TEACHER RECOGNITION
- FIELD TRIP LOCATIONS
- SCHOOL GROUND ACTIVITIES
- FIELD TRIP ACTIVITIES
- LIST OF GUEST SPEAKERS IN YOUR AREA
- FUNDS
- FACILITIES
- A/V MATERIAL
- UTAH-SPECIFIC MATERIAL
- TEACHER RECOGNITION
- FIELD TRIP LOCATIONS
- SCHOOL GROUND ACTIVITIES
- FIELD TRIP ACTIVITIES
- LIST OF GUEST SPEAKERS IN YOUR AREA
- FUNDS
- FACILITIES
- A/V MATERIAL
- UTAH-SPECIFIC MATERIAL
- TEACHER RECOGNITION
- FIELD TRIP LOCATIONS
- SCHOOL GROUND ACTIVITIES
- FIELD TRIP ACTIVITIES
- LIST OF GUEST SPEAKERS IN YOUR AREA

3.2 Which of the following in-service workshops have you attended? (Check all that apply)

- Teton Science School
- Project Learning Tree
- Bear Lake In-service
- Four Corners School of Outdoor Education
- Water Education
- Project WILD
- Tracy Aviary
- Utah Museum of Natural History
- Other:

3.3 Place a check in the appropriate box to indicate the number of college courses taken in each natural resources field.

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<th>3-4</th>
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<td>OTHER:</td>
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</table>

83
If you desire a copy of the results of this survey, give your name and school address below. This page will be removed from your completed survey to assure confidentiality.

NAME ________________________.
SCHOOL ADDRESS__________________.

Results will be available after January 1.
Dear Teacher,

The Outreach Education Program at Utah State University is conducting a formal survey of the current practices in natural-resources education in Utah (K-12). One of the goals of the Outreach Program is to provide teachers with the classroom materials, information and in-service experiences they desire.

As a public school teacher myself, I know how busy your day is. However, The other members of the Outreach Education staff and I need your input in order to better serve Utah's teachers.

Please take a moment today to complete this survey and return it to me in the self-addressed, stamped envelope provided. Complete confidentiality is assured. The return envelope is marked with a code number for follow-up contact of non-respondents only.

Your ideas are valuable to us regardless of the amount of teaching time you devote to natural resources.

Thank you for your time. Surveys should be completed before November 20th. If you have any questions or concerns please call me at 750-2447.

Sincerely,

John J. Van Niel
Dear Teacher,

Several weeks ago, you received a survey concerning natural-resources education from the Outreach Education program at Utah State. One of the goals of the Outreach Program is to help teachers, like yourself, by providing materials or in-service experiences desired. As of November 28, I have not received a completed survey from you. A replacement survey, identical to the first one you received, has been provided for your convenience. Again, total confidentiality is assured.

I urge you to take a moment today to complete this survey. Your ideas are important no matter what amount of natural-resources instruction you currently provide. Since decisions for 1990 will be made soon, surveys must be returned by December 20.

Thank you for your time and effort in making this project a success. If you have any questions or concerns, please call me at 750-2447.

Sincerely,

John J. Van Niel
THE TOTAL COST OF A PRODUCT

OBJECTIVE: Students will list the resources used in transporting a product from one place to another.

FRAMEWORK CORRELATION: 1.2, 2.1, 3.4

GEOGRAPHY CONCEPT: Movement

MATERIALS: 3x5 cards, US map

BACKGROUND INFORMATION: About one-quarter of the winter-grown tomatoes in the United States come from southern Florida. Ecologically, this area was once part of a vast wetland known as the Everglades. Today, much of the land has been drained to tap the fertile soil. Combined with a temperate climate, southern Florida is able to produce tomatoes year-round. The agricultural practices require much water that historically was utilized by the plants and animals of this ecosystem.

PROCEDURE: Students are to list all the natural resources necessary to produce and transport winter tomatoes from southern Florida to Logan, Utah. Give students some background information on southern Florida and ask them to brainstorm each step of the production and transportation process. As each step is listed, ask them to list the resources required to complete that step.

Have students label resources as renewable, exhaustable nonrenewable and inexhaustable nonrenewable. Once a list has been agreed upon by all students, ask the students to explain what the total cost of this product is to a consumer in Logan, Utah. Additional discussion questions could include:

- Which resources are used once and discarded?
- Are there any alternatives to using them once?
- Are winter tomatoes a need or a luxury?
PLAY NICE!

OBJECTIVE: Students will discuss the impact of recreation on natural resources.

FRAMEWORK CORRELATION: 1.3, 2.1, 2.3, 3.2, 3.4

GEOGRAPHY CONCEPT: Human/Environment Interaction

MATERIALS: 3x5 cards

PROCEDURE: Give each student a 3x5 card. Have each student list his/her ten most favorite activities. After everyone is finished, have each student place an "X" after each activity that requires some external source of energy (driving a car does; riding a bicycle does not), and an "O" after every activity that requires specialized equipment (riding a bicycle does; walking does not) that is created from natural resources. Activities may have both symbols after them.

Discuss the "responsible" use of resources. If we have a resource in short supply, should we be using it for recreational (nonessential) purposes? Besides consumption of resources, what other consequences arise from our actions?

Have students compose a hypothetical list of activities from students in other countries. What are the differences in resource use?

Have students ask their grandparents for similar lists of activities they enjoyed as children. What changes have occurred in our use of resources in the last 50 years?
OBJECTIVE: Students will role-play plants and animals while demonstrating gas exchange.

FRAMEWORK CORRELATION: 1.2, 1.4

GEOGRAPHY CONCEPT: Human/Environment Interaction

MATERIALS: None

PROCEDURE: Divide the class into two groups: green plants and animals. The green plants will act out the aquisition of the materials needed for photosynthesis, while the animals act out the process of respiration with the teacher as orchestrator. Exaggerated motions accompany the text.

PLANTS: "First we take in the carbon dioxide. Then we suck up water through our roots. We catch some rays (sunlight). We give off oxygen."

ANIMALS: "First we take in the oxygen. We use it all over our bodies. We give off carbon dioxide."

The groups stand facing each other and blow the gases back and forth. Require the students to actually become a specific plant or animal for better role playing.

Fast-motion, slow-motion and freeze-frame variations add fun and reinforce the concepts.

ORIGINAL SOURCE: Unknown.
BALLET OF THE AIR II

OBJECTIVE: Using the activity "Ballet of the Air", students will explore the role of green plants in the greenhouse effect.

FRAMEWORK CORRELATION: 1.1, 1.2, 1.4, 2.1, 2.3, 2.4, 3.3

GEOGRAPHY CONCEPT: Human/Environment Interaction, Region

MATERIALS: 3x5 cards with "oxygen" on one side and "carbon dioxide" on the other.

PROCEDURE: After students have completed the "Ballet of the Air", give each green plant a "gas exchange" card. Explain that the class is going to repeat the activity with a few changes. First, cards will actually be passed between the plants and animals during each round. The correct side must be facing outward. For an organism to remain alive for the next round, it must have the correct card. In addition, gas exchange cards will be available from the atmosphere (several volunteers standing between the two groups). To start, the atmosphere should contain the appropriate proportion of carbon dioxide and oxygen.

Let the activity proceed for a few rounds and then simulate the deforestation of an area by removing several green plants from the game (they assist as atmosphere). Now as the game continues, it will be increasingly harder for animals to find oxygen cards, while carbon dioxide cards continue to build in the atmosphere. Stop the game well before the animals run out of oxygen, since suffocation is not the issue!

From this point, teachers can tailor the discussion to their students' age group. Topics for discussion should include the reasons for tropical deforestations, implications of global warming and the physical processes involved with the greenhouse effect.
NATURAL-RESOURCES RELAY

OBJECTIVE: Students will identify natural resources as renewable or non-renewable.

FRAMEWORK CORRELATION: 2.1

GEOGRAPHY CONCEPT: Human/Environment Interaction, Movement

MATERIALS: 3X5 cards labeled with a variety of natural resources, two containers labeled "renewable resources" and "non-renewable resources".

PROCEDURES: Divide students into two teams with the two containers placed some distance away. Each team receives a set off natural-resources cards that are printed a different color. On the teachers command, one student from each team runs to the containers and places his/her card in the correctly labeled container. The student runs back to his/her team and tags the next person. The game continues until both teams have placed all their cards in the container. The winner is the team that correctly placed the most resources.

This activity can also be performed with exhaustable and inexhaustable resources or natural resources and non-natural resources. A further extension can utilize natural resources imports and exports from various countries.
WILDLIFE WANT ADS

OBJECTIVE: Students will explore the habitats and niches of a variety of wildlife.

FRAMEWORK CORRELATION: 1.4

GEOGRAPHY CONCEPT: Region, Movement

MATERIALS: Job applications, want ads, reference material

PROCEDURE: Each student is assigned a wild animal to role play and given a teacher-created job application (see attached) to complete. The students are encouraged to be creative and imaginative, but all information appearing on a student's application must be plausible and based on accurate information about his/her animal. Once students have completed their applications, they must search the "Wildlife Want Ads" provided by the teacher (see attached) to find jobs that they are qualified for.

Teachers may interview students themselves or assign students to act the part. Once students have some experience with this activity, the possibilities are endless. They can generate their own want ads and can even create an entire wildlife newspaper with news stories, sports and other sections.

Employment Application

Name: Ali Gator
Address: 231 Swampy Lane, Everglades, Florida

Employment
Desired: Meat-eater, Swimmer

Professional Experience:
1986: Survived poacher attack
1987: Guarded nest from predators
1987-1988: Taught my young to hunt


Hobbies: Scaring small children; Swimming; Sun bathing
Wildlife Want Ads

Aquatic forager. Must be able to consume fifty pounds of vegetation a day. Apply in person at Crystal Springs State Park, Florida.

Beach resort looking for predator to swim offshore. Must like cold water. Fire Island National Seashore, New York.

Carnivore needed for polar region. Work days all summer and nights all winter. Apply Barrow, AK.

Diver needed to catch fish and turtles in small lake. Experience preferred. Call Louisiana 8-9987.

Sample Interviewer Questions

Why do you want to work here?
What type of experience have you had?
Why should I hire you instead of (name another animal with a similar niche)?
What special working/living conditions do you require?
Whom may I contact as a reference?
NATURAL-RESOURCES WEB

OBJECTIVE: Students will demonstrate the interdependence of natural resources.

FRAMEWORK CORRELATION: 1.4

GEOGRAPHY CONCEPT: Human/Environment Interaction

MATERIALS: String, natural-resources cards.

PROCEDURE: Give each student a natural-resources card and have them pin it to the front of his/her shirt. Have the students stand in a circle and explain that you will all create a web using string, based on relationships between natural resources. For example, "air" has a relationship with "green plants". Plants take carbon dioxide from the air and return oxygen. Therefore, "air" could pass the string to "green plants". Relationships can be positive or negative and can proceed in either direction. Continue until each resource is included in the web at least once. Have the students back up to take up any slack and ask them what would happen if we removed one resource. Choose a resource and have that student drop the strings in his hand. Every student should feel slack to some degree. Have that student hold his strings again and tape the web to a large window or bulletin board. Add the natural-resources cards for a classroom display on the interdependence of natural resources.

Teachers may wish to add students with "occupation cards" that utilize various natural resources in their jobs.

ORIGINAL SOURCE: "Web of Life" Project Learning Tree.
THE ADVENTURES OF STU DENT

OBJECTIVE: Students will provide examples of natural resources being used in everyday life.

FRAMEWORK CORRELATION: 1.2, 1.3

GEOGRAPHY CONCEPT: Human/Environment Interaction

Materials: 3X5 natural-resources cards, overhead projector

PROCEDURE: "The Adventures of Stu Dent" is an activity designed to let students be creative and produce a class-generated story. Give each student a card labeled with a natural resource. Explain that you are going to recreate one day in the life of Stu Dent. Begin the story by providing the first line of the story using a leftover natural-resource card. It is best to write the story on an overhead projector so it can be copied easily. Then call on students at random to add the next step of the story. In all cases, Stu must utilize the natural resource listed on the student's card or a product made from that resource. The story is complete when all the cards are used.

Example: Stu awoke at 8:00 and felt the warm sunshine through his window (SUN). He went to the bathroom and took a shower (WATER). He dried off with a cotton towel (PLANTS). His mother made him a nice breakfast on their new stove (IRON ORE).
NATURAL RESOURCES AND SOCIETY

OBJECTIVE: Students will learn that natural resources and their importance change over time and from one society to another.

FRAMEWORK CORRELATION: 1.1, 2.3

GEOGRAPHY CONCEPT: Regions

MATERIALS: Posterboard

PROCEDURE: Prepare in advance five charts listing a variety potential natural resources. Each chart is to be labeled with a region name and a date. Divide the students into five groups and give each group one chart. Have the students rate how important each potential natural resource is to that society at that time. Students must be prepared to defend their selections. Have each group describe their society and how it used the resources listed. Allow other groups the opportunity to challenge their conclusions. Discuss reasons why the changes have occurred in the various societies and how some resources remained the same.

<table>
<thead>
<tr>
<th>Resource</th>
<th>Not Important</th>
<th>Somewhat Important</th>
<th>Very Important</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Wildlife
Water
Metallic Ores
Radioactive Material
Solar Energy
Wind
Coal

The five regions and dates:
- North America 1790
- North America 1990
- North America 2190
- Kalahari Desert 1790
- Kalahari Desert 1990
OBJECTIVE: Students will demonstrate a renewable resource through creative writing.

FRAMEWORK CORRELATION: 1.1, 1.3, 2.1

GEOGRAPHY CONCEPT: Movement, Human/Environment Interaction

MATERIALS: None.

PROCEDURE: To understand the concept of renewability, tell students that they are to write an autobiographical account of themselves as a drop of water. Give the students a starting point from recent times or prehistoric. You may wish to first generate a list of forms and uses of water.