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A CONTENT ANALYSIS OF ELEMENTARY SCIENCE TEXTBOOK SERIES FROM 1930 THROUGH 1990 FOR THE PRESENTATION OF THE PRINCIPLE OF HUMANS AS A COMPONENT OF THE ECOSYSTEM

DISSertation

Presented in Partial Fulfillment of the Requirements for the Degree Doctor of Philosophy in the Graduate School of The Ohio State University

By

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The Ohio State University
1996

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To My Parents,
Whose support and understanding
have always been there.
And
To God
Through whom all things are possible.
ACKNOWLEDGMENTS

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Introduction

All species have a function within their habitats, and on a larger scale in the world. Those functions have changed little throughout time; when changes do occur, the species either adapt or become extinct. However, the species Homo sapiens has radically changed its place within the world system on large scales and many times throughout its history, and has had many impacts on other species. Only Homo sapiens can contemplate these impacts and how they affect the world system. The fact that we as humans have a great impact on the world around us is not a new revelation, but how we view those impacts has changed radically within the last century.

In the Thirty-First Yearbook of the National Society for the Study of Education (1932), the following statement was made concerning science education:

The future will demand a utilization of science in the multitude of problems that involve the life of man. He cannot continue to be ignorant of the web of life in which, as one of the species of animals, he is by nature involved. The change from a haphazard development of natural resources must eventually give way to an intelligent plan, backed by accurate scientific information. ... This is a task for the elementary school and can be done by instruction in the relationship of the animate and inanimate, of the extensive linkages and interdependence of living things, and the importance of accurate information in dealing with the world's problems (p. 140).
Sixty plus years have passed since that statement was made and one wonders how well those lessons have been learned.

Entreaties to switch from an anthropocentric framework to an ecocentric framework also are not new. An anthropocentric framework has nature valued in terms of what use humans can make of nature rather than nature having value in and of itself. Whether humans intervene on an environmental issue is based on how something would benefit humankind. An ecocentric framework has nature as intrinsically valuable, whether it benefits humankind or not. Humans are viewed as part of the system with responsibilities for preserving and maintaining the system.

Ecocentrism can be traced back to the time of Thoreau. As can be seen in the NSSE statement above, instruction in the linkages and interdependence of living things where humans are no longer ignorant of the web of life was seen as necessary in the 1930's.

The continuing environmental crisis is really a crisis of character and a crisis of culture. Neither providing more information to students about conservation nor providing short term, typically one week, 'nature camps' is enough to lead students to a possible paradigm shift away from what MacGregor calls the 'sacred cows of anthropocentrism, humanism, science and technology built up in the pursuit of a more efficient, competitive, and materially prosperous society' (Devall, 1984-85, p. 1).

This study seeks to determine the framework within which environmental principles have been presented to elementary school students for the past 60 years. Textbooks may still be presenting these environmental principles in such a way that students are receiving hidden values. Sessions (1983) suggests that in American education the dominant themes, including many of those in environmental education, are opposed to ecological, ecocentric education. He goes on to state
Education is surely teaching values both explicitly and implicitly; it is teaching the world view and values of the scientific/technological society. It is teaching by precept and example that values (and maybe facts as well) are all subjective and relative, that it is 'rational' to compromise on issues, and that nature exists as but a commodity to be enjoyed and consumed by humans. It teaches that there is a technological solution to all problems (p. 28).

In the late 1980's beaches were closed due to pollution. There have been increasing problems with flooding, global warming, an increase in the size of the ozone holes, increasing loss of habitat, a closing of fisheries, an increase in the number and severity of oil spills, logging of old-growth forests, a debate over whether to drill for oil in the Arctic National Wildlife Refuge, increases in wetland loss, a continued loss of tropical rainforests, famine caused by changes in climate, environmental degradation due to war, and concern over population growth. Schools are a primary source of information about these issues and provide the foundation for understanding of the problems involved with these issues.

Because textbooks are an important component of the curriculum taught in the schools, it is important to understand what messages are contained within the textbook. Textbooks have been identified as a dominant factor in science education (Harms and Yager, 1981). In many classrooms, the textbook serves as the source of knowledge, provides instructional support, and becomes the curriculum (Stake and Easley, 1978). Tobins, Tippins and Gallard (1994) stated in a discussion on strategies for teaching science that:

We can anticipate that the textbook industry, like other industrial counterparts, will continue to be driven by the free-enterprise market--thus, changes will occur slowly. Accordingly, the role of the textbook in relation to both teacher and student learning is inextricably linked to policy issues that have important implications for how science...should be taught. (p. 70)
It has been stated that "conservation and environmental education is not a visible reality when one examines textbooks..." (Charles, 1987, p. 14). Hungerford and Peyton (1977) stated, "The science teacher - whether by choice or by chance - plays a major role in environmental education and chances are that he/she will continue to do so" (p.1). Bybee (1993) stated that while the science, technology and society (STS) theme not only is related to the ecological crisis, it can potentially be an organizing theme in science education and it is also evident that the "STS theme has not been embraced by school personnel, textbook authors, and commercial publishers" (p.137).

Textbooks also generally reflect values and priorities of a society (Reynolds, 1976). An EPA working group for K-12 education suggested that environmental education be written into existing textbooks (EPA, 1991). Before recommendations for future textbooks can be made, there is a need to know where emphasis on environmental literacy has been and is being placed by the textbooks.

In terms of how much and where environmental education should be included in the curriculum, Leopold (1949) stated, "The usual answer to this dilemma is 'more conservation education.' No one will debate this, but is it certain that only the volume of education needs stepping up? Is something lacking in the content as well? ... [T]he education actually in progress makes no mention of obligations to land over and above those dictated by self-interest" (p. 173). The role of education in furthering the cause of the environment has long been debated. Faulconer (1993) summed it up in her analysis of conceptual trend in environmental social thought:
Because education functions within the socio-cultural political context of the larger society, of which the environmental crisis is a significant phenomenon, the messages students receive will in large part determine their contribution toward ending or exacerbating this crisis. The language used to define ecological issues is crucial to the development of attitudes, values and understandings students will use the future. The environmental crisis is complex and encompasses a confusing and interconnected mixture of cultural, social, economic, scientific, and political dimensions. Education about the environment needs to address those complexities and interrelationships in order to help students make sound informed decisions about their own behavior (pp. 3-4).

The fact that much of what students learn about the environment is from science classrooms has been established. Bybee (1993) identified a tie between science education and environmental education:

Given my view that science educators have an obligation to contribute to the development of individuals and the aspirations of society and that we continue to change the planet's ecological systems in irreparable ways, I think there is a clear and compelling case for science educators to recognize and include environmental concerns in school science programs. In the 1960's, we had no trouble initiating a massive reform in science education in order to put men on the moon; and in the 1990's, we are engaged in a reform of education to improve our economic productivity. Why is it so difficult to incorporate an understanding of concepts, such as sustainable growth, continuous low-level change, limits, and systems? Why is it that every science educator makes choices about what to teach and not to teach based on scientific values (for example objectivity, curiosity, appeal to data) and personal values, yet avoids values that are common to philosophy and theology, such as justice, beneficence, stewardship, prudence, cooperation, and mutual regard? Why is it so difficult to incorporate content and processes that will contribute to the improvement of our planet? (pp. 144-5)

What has happened in science textbooks over the 60 years between where the goal was to learn of our place within the web of life and the interrelationships that exist in the world ecosystem, and today's goals in environmental and science education? Have science textbooks communicated these relationships?
The Problem Statement

The purpose of this study was to investigate the extent to which elementary science textbooks have included, overtime, the principle **humans as a component of the ecosystem** and whether that principle is one of humans outside of the ecosystem (an anthropocentric framework), or humans as a biological component of the ecosystem (an ecocentric framework).

One phase of the study examined in-depth this principle as presented through 60 years by one publisher. This publisher started with one of the first elementary science textbook series in the 1930’s and continued without merging with other publishers until the mid-1980’s.

All series reviewed in this study were examined for the principle **humans as a component of the ecosystem**. Each series has had several editions and / or revisions within the period of 1930 to 1990. The data collected from 269 textbooks from 14 publishers were used to:

1. describe the emphasis given the principle **humans as a component of the ecosystem**, in each specific elementary science textbook series for a particular publisher;
2. trace the historical development of the treatment of the principle **humans as a component of the ecosystem** given by elementary science textbook series by a particular publisher;
3. identify differences and similarities in the presentation of the principle **humans as a component of the ecosystem** for various editions of a given elementary science textbook series having the same author or authors for a particular publisher;
4. identify differences and similarities in elementary science textbook series for the principle **humans as a component of the ecosystem** at particular grade levels; and
5. describe the emphasis given the principle **humans as a component of the ecosystem** in a group of elementary science textbook series published during a given period.

**Limitations**

1. The study has identified trends dealing with ecological principles in elementary science textbooks. The study did not attempt to specify or imply cause and effect relationships among social, legal, and religious factors or trends and the inclusion or absence of environmental principles in the elementary textbooks.

2. The study was limited to analysis of a sample of elementary science textbook series published during the time of the study. Only textbooks that had a publishing history of several editions were chosen. Textbooks with only one edition, or published for less than two decades, were not analyzed in this study. Establishment of trends over a period requires textbooks that were published during the period of 1930 to 1990 to show those changes. The publisher chosen for the in-depth analysis had a publishing history for the entire study period without merging with another publisher, so that the textbooks were only reflecting changes in the publishers or authors ideas, not those of another publisher or author from a merger.

3. The selection of textbooks was based on the publishing history of the series. No attempt was made to determine which elementary textbook series were most widely used in given periods. An attempt has been made to include
all textbooks in a given series and all series which existed over the period of years covered by this study through various editions and revisions. A continued record of publication can be one indication of popularity and continuing adoption by school systems.

4. This study was limited to the period of 1930 to 1990. Elementary science textbooks series were not being published until the 1930's, at which time a change from nature and science readers to science textbook series was made. Two readers were included in the early portion of the study to show a publishing history for a particular publisher.

5. This study did not attempt to evaluate the correctness of environmental principles presented in the elementary science textbook series.

6. This study is not intended as a criticism of authors or publishers, but only as an analysis of the changing treatment of environmental principles in elementary science textbook series.

7. Whether or not science classrooms are the only place where environmental literacy is transmitted was not examined in this study.

Significance of the Study

In the 1930's, approaches to elementary science education began to change from nature study to a more defined curriculum. Elementary science was formed around a continuous program that started with first grade. This progressive curriculum was formed around six principles:

I. There are limiting factors in the environment of living things.
II. The environment of living things changes continually.
III. Living things respond to stimuli in their environment.
IV. Living things have structures, functions, and habits which enable them to attain adult life and to leave offspring.
V. A balance in nature is maintained through interrelations of plants and animals with each other and with their physical environment.

VI. Through long ages there has been persistence of life upon the earth (NSSE, 1932, p. 165).

In 1947 the NSSE published its 46th yearbook in which it again specifically dealt with science education. A section of this addressed "the study of the environment for the development of understandings, attitudes, and appreciations" (NSSE, 1947, p. 87). Further, it explored a framework in which the understanding that "man is an integral part of nature" (NSSE, 1947, p. 88) could be incorporated in the curriculum. This framework had several parts, which reflected the principles stated in 1932:

1. Man is an integral part of the environment.
2. All living organisms, including man, are dependent upon the environment.
3. Man must recognize sequence of events.
4. Man is a factor in changing his environment. (NSSE, 1947, p.88-91)

Science was again the topic in the 59th yearbook by NSSE in 1960. Here, seven objectives were given that are associated with the development of scientific attitudes. These are

1. Man's conception of truth changes.
2. It is desirable to have confidence in the scientific method.
3. Nature's principles are invariable.
4. There is a cause for every effect.
5. Much knowledge remains to be discovered.
6. Conditions favorable to life are apt to persist on the earth for a very long time; no catastrophe for the entire earth is probable for immense periods of time.
7. Man has become an important determining factor of the environment of many forms of life. His continued existence and advancement are dependent upon his wise modifications and control of the environment. (NSSE, 1960, p. 137)

During the period of time between these two yearbooks, there was a shift from humans being part of their environment to humans being in control of their
environment. This is also when many of the science curriculum projects supported by the National Science Foundation were started.

In 1980's, Project Synthesis and A Nation at Risk took a look at where education had been and where it should be focused in the future. A merger of science, technology and society was seen as a way to focus in on the problems of society and involving students in science. The National Science Teachers Association issued a statement that

The goal of science education during the 1980's is to develop scientifically literate citizens who understand how science, technology, and society influence one another and who are able to use this knowledge in their everyday decision-making. (NSTA, 1988, p. 162)

Today, the goals of science education have been organized around the six major overarching concepts found in Project 2061. These concepts—energy, evolution, patterns of change, stability, systems and interactions, and scale and structure—are designed to allow students to make connections which make science more meaningful. There are some similarities between the goals stated in 1932 and the goals of science education today. Terms such as change, structure, and systems are used in both statements. Stability is implied in balance of ecosystems, evolution in persistence of life, energy in limiting factors and interactions in interrelations.

The goal of environmental education is to build a foundation of knowledge and awareness about the environment (Hungerford, Peyton, and Wilke, 1980). What have textbooks presented to students about the environment over the years? This study was undertaken to determine the extent to which elementary science textbooks have included one environmental principle, humans as a component of the ecosystem, over the last 60 years.
Analysis of the series for particular publishers was undertaken to illustrate changes over the years each series treated this environmental principle. If the textbooks chosen were representative, and did not present this environmental principle at all, then it can be inferred that elementary science textbooks generally did not address this principle.

An analysis of one publisher gave data that determined whether textbooks included a strong knowledge foundation of the environmental principle, **humans as a component of the ecosystem**, which sub-components of the principle were not represented during the time, and how that representation changed over 60 years for that particular publisher.

The depth and complexity of the presentation of the principle over the 60 years within each series were also examined to determine in which ways they changed. Because a strong knowledge base is required for higher levels of understanding, a higher level facilitating understanding of the environment could help students build positive attitudes and make educated decisions about the environment. Continuity throughout the series would also help to reinforce attitudes about the environment.

If changes in our understanding are to take place, an understanding of the past and what has been presented as significant for students to know is needed. This study was not undertaken to show that there has been a lack of information presented during the past 60 years; rather, it was designed to show what has been presented in an effort to learn from the past to project where we should go in the future. The significance of understanding environmental history, which can be extended to the understanding of the history of environmental concerns in general, was stated by Nash:
Rather than shaking moralistic fingers at pioneers, environmental historians would do better to attempt to understand why people acted as they did toward nature. There is no imperative that makes environmental historians environmental advocates. Advocacy can take the form of simply recording the past as a warning to the present (Nash, 1990, p.7).

This information could also help future textbook authors and publishers, and science and environmental educators, develop materials that include environmental principles within an ecocentric framework. The significance of this study lies in providing examples of how textbooks have represented **humans as a component of the ecosystem** and data that represent this environmental principle in elementary science textbooks for 60 years. These data indicate whether textbook authors and publishers have responded in the past to evolving environmental principles.

**Overview of the Study Design**

Two hundred and sixty-nine elementary science series textbooks published from 1930 through 1990 were analyzed to determine the extent to which the principle **humans as a component of the ecosystem** had been emphasized. A computer database was employed where data were entered under the following headings: title, author(s), date of publication, publisher, grade level, and text. The files were then searched under these key words or phrases: use of plants, use of animals, habitat destruction, pollution, change, competition, food chain/web, ecosystem, balance, and dependence / interdependence. These key words and phrases then formed the framework for the anthropocentric and ecocentric framework. Files were then analyzed for changes in the treatment of the principle over a period, by grade levels and by the publishers.
Textbooks were selected only if they were part of series for elementary science textbooks. Efforts were made to obtain grades one through six books for a particular series, though some series were incomplete and some textbooks were not available for the study. Thirty-one textbooks were not located in efforts to complete series. These were spread over all grade levels, with an average of five textbooks at each grade level. Nine series for the various publishers and time periods were also not located during the search. Textbooks that were published as topic units or workbooks were not used in this study because grade level usage was difficult to determine. An attempt was made to obtain textbooks which had continued to be published over an extended period, so that changes from edition to edition could be noted. The continued appearance of a textbook could be interpreted as an indication of sustained use.

The textbooks published by Ginn were chosen for an in-depth analysis for several reasons:

1. They were originally based on research done by their author, Gerald S. Craig, on what should go into elementary science textbooks. Craig also was prominent in pre-service elementary science education and published several science methods textbooks during much of the study period;

2. They were among the first elementary science textbooks published as a series;

3. Ginn published elementary science textbook series throughout the study period making possible an analysis of how the treatment of the principle changed during the publishing history of one series; and
4. Ginn did not merge with other publishers until the middle of the 1980's so the views expressed in the textbooks were those of that publisher and authors, providing continuity to the study.

During the collection and analysis of data for the principle **humans as a component of the ecosystem**, a series of sub-components emerged that were then used in the in-depth analysis of the Ginn textbooks. These were:

1. humans use plants;
2. humans use animals;
3. humans cause pollution;
4. humans change ecosystems;
5. humans cause habitat destruction;
6. humans compete with other components of an ecosystem;
7. humans are a component of food chains/webs;
8. humans are dependent / interdependent with the ecosystem;
9. humans are part of the world ecosystem; and
10. humans influence the balance of ecosystems.

The first five of these sub-components were interpreted as anthropocentric viewpoints such as how we use, how we cause, or how we change ecosystems- or a human control emphasis. The last five sub-components were interpreted as ecocentric viewpoints, or how humans fit in a biological way into ecosystems such as competition, dependence, balance, or food chains/ webs- or a biological balance emphasis.

Each textbook was examined for the emphasis given to the principle **humans as a component of the ecosystem**. Examples were pulled from the textbooks, and notes were made as to placement within the books. These examples might be in the form of text, questions, or illustrations. In some cases
exact quotations were recorded and in others the meaning of a portion of text was recorded. For example, a discussion of various plants used by humans as food was recorded as the sub-component of *humans use plants*. No attempt was made to record the number of words, paragraphs, or pages covered by a topic. The purpose of this study was to report occurrences and examine context of this principle and not the extent of coverage.

**Definition of Terms**

The significant terms as used in this study were defined as follows:

**Anthropocentric.** A perspective of the environment where nature is valued in terms of what use humans can take from nature rather than nature valued for itself. Statements such as "we should save the ____ because it may provide medicines, food, etc." shows an anthropocentric perspective. Whether we save or intervene on an environmental issue is based on how it would benefit humankind. Anthropomorphism is different in that it gives human characteristics to such things as objects, plants or animals.

**Content Analysis.** To make "inferences by systematically describing specific characteristics of the content or material which is the object of study". (Holsti, 1969)

**Content Samples.** Content samples are "chosen to provide the means of illustrating, explaining, and developing the main and organizing ideas. Each content sample is in the form of an in-depth study of human behavior and consists of a variety of specific details or facts about the behavior" (Taba, 1971, p. 13).

**Ecocentric.** Viewing a world system as intrinsically valuable, whether it benefits humankind or not. Humans are viewed as part of the system with
responsibilities for preserving and maintaining the system. Statements such as "we need to save the ____ because it is unique, wonderful, etc." express an ecocentric perspective.

**Environmental Principle.** The term environmental principle as used in this study is based on the twenty-four principles defined by Hungerford, Peyton and Wilke. They are statements that embody the objectives of knowledge, awareness, attitude, skill and participation that students need to become environmentally literate. The principle used in this study humans as a component of the ecosystem emphasizes the effects of human behavior on natural systems, attitudes, values and technology.

**Framework.** The term framework is used in this study as a cognitive system or structure that places the ten sub-components within the anthropocentric and ecocentric perspectives.

**Series.** A series is a group or number of related or similar texts coming one after another. For this study the texts are related by publisher and /or authors, and progressively follow from grades one through six.

**Sub-component.** This study identified ten sub-components, or ideas, that are based on the environmental principle, humans as a component of the ecosystem.
Chapter II
LITERATURE REVIEW

The literature was reviewed to build support for the use of content analysis of elementary science textbook series for the presentation of the principle humans as a component of the ecosystem. The review included literature related to content analysis of science textbooks, content analysis of environmental and environmental education-related literature, history of elementary science education, history of environmental education, and past and present science content standards.

Content analysis has not been commonly used in research in science education, and its use is somewhat limited in environmental education. Using content analysis for a historical perspective has also not been a common approach in science or environmental education. Content analysis is appropriate when: (a) the data have been limited to documentary evidence, (b) when the subject's own words are necessary for the study, and, (c) the volume of material studied exceeds the amount one investigator can undertake by themselves (Holsti, 1969).

Content Analysis of Textbooks in Science Education

Gerald Skoog (1969, 1979, 1984) traced the historical development of evolution concepts contained in biology textbooks. This history was traced from 1900 until 1968 in his dissertation (1969), and the 1970’s and 1980’s in two subsequent papers (1979, 1984). Each concept was analyzed by word count.
Skoog concluded that evolution has been neglected in biology textbooks up until the 1960's, increased in the '60's and '70's and then decreased again in the 1980's. Skoog attempted to attribute coverage of content to social and political moods of the times by looking at where individuals and organizations have stood in their positions towards evolution during these times. Not only did this study reflect a historical overview but also considered how outside pressures influenced textbook content.

Selden (1991) studied how eugenics was represented in biology textbooks from 1914 until 1949. Methodology was not described. Forty texts were analyzed. Because the sample was not random, no claim was made for the representative nature of the study. Categories cited for number of incidents included eugenics as a legitimate science, studies of "superior" families, studies of "inferior" families, programs of positive eugenics, and programs of negative eugenics. Six textbooks were chosen, with no mention on why they were chosen, for a more in-depth analysis. A combination of overall content with examples of that content provided the opportunity of not only knowing what areas were covered, but how they were covered, which this study seeks to do.

Rosenthal (1984) looked at social issues in high school biology textbooks from 1963 until 1983. Twenty-two textbooks were chosen for analysis from among those most frequently used by teachers or having the highest sales. The amount of space, expressed as a percentage of the total text, was used as the unit of analysis.

Twelve categories of social issues were analyzed where a "social issue" was defined as an issue that either has been or is being disputed in society or about which society has yet to decide. These issues were the nature of science, the social system of science, human behavior, population, food supply
and agriculture, human reproduction, human genetics, human health, evolution, energy resources, environment, and space research/exploration. The choice of issues was based on a literature search of social issues.

Each textbook was read and portions relevant to the study were identified. These sections were placed in one of the twelve categories above. The percentage of text used for social issues decreased during the period analyzed. The social system of science and evolution received the most attention, with space exploration/research and human behavior receiving the least. The environment had percentages averaging 2.9%, energy resources 0.2%, and population 0.6%. The environment peaked during the 1973-1976 period at 3.1%. Only coverage was analyzed, though the author reported that the textbooks minimized controversial aspects of these issues, avoided ethics and values, lacked global perspective, and lacked emphasis on the interdisciplinary aspects of these problems. Again, the historical overview, some of which included environmental issues, especially the peak during the 1970's, provided some background to this study.

Hamm & Adams (1987) analyzed sixth and seventh grade science textbooks for coverage and treatment of global problems and issues. Ten textbooks were chosen that were published in the mid-1980's and determined to be the most popular textbooks used at these grade levels. Five global issues were chosen from Bybee's 1984 survey of science experts and included population growth, war technology, world hunger and food resources, air quality and atmosphere, and water resources. Textbooks were analyzed on a four-point scale as to how in depth the issues were treated based on Bloom's taxonomy. Less than 2% of the contents of these textbooks dealt with global issues. While the study focused on percentage of total coverage, the
conclusion that the environment still received little coverage, even in the 1980's, makes this study of the past presentation of the environment important in filling in a gap of information about what has been presented.

Jackson (1976) looked at 44 geography textbooks from 1900-1970 for environmental determinism, or the impact of the environment on man. The study was to analyze what the time lag for new ideas adopted at the university level and when the ideas were first presented in high school textbooks. Environmental determinism was chosen as the topic to trace through this evolution. Environmental determinism as a unifying theory for geography was abandoned at the university level in the mid-1940's. It was the mid-1960's before high school textbooks began to question determinism as the basic explanation for humans' activities on the earth. One reason cited for the persistence of outmoded ideas is that less than 20% of the textbooks written for high schools were authored by university professors. The study suggests a lag between changes in paradigms and when these paradigms are then reflected in the textbooks, which this study could also reflect.

Bennett (1989) completed a content analysis of first, second, and third grade science textbooks for the environmental themes of air quality, water quality, wildlife, soil, and energy. She found that only 1% of the content in these textbooks was devoted to environmental themes. There was also no linkage of the themes through the grades. The study compared how the environmental themes were treated in the four series, each of the grade levels of each series, and each of the grade levels of all four series. The study concluded that there was not adequate treatment of the themes with minimal information and with little linkage. The series were not found to provide the knowledge base needed to establish a framework for learning about the environment. The study
suggested a lack of framework present in the 1980's, but did not address the presence or absence of this framework over a period of time on in all elementary science textbooks.

Willson (1980) completed a content analysis of basal readers for environmental problems. Six series were analyzed for 11 environmental problems, and 1.9% of total pages were found to be devoted to environmental problems. Wildlife and human settlements had the largest portions, with energy and toxic substance problems having the least amount of space. No environmental problem content was found in the first grade readers. Macmillan readers contained the most content devoted to environmental problems with Ginn, Houghton Mifflin, Benziger, Scott-Foresman, and Harper and Row decreasing from latter to former. Most of the problems were presented as fiction and as information rather than problem solving or environmental action. Children were seen as experiencing rather than solving the problem. Most of the settings were local and centered in the urban or rural areas rather than suburban/town. The percentages reflected the coverage of environmental problems for grade level, for textbook series, and for eleven characteristics such as settings, age level of those involved, race, and gender.

Content Analysis of Environmental and Environmental Education-Related Literature

Burrows-Bammel, Bammel, and Kopitsky (1988) analyzed national forest service brochures for environmental attitudes. Units of analysis included written, graphic, and photographic material. Categories used for photographs included environment, people, activities, animal/wildlife, and clarity. Brochures were requested from 115 Forest Service administrative units. Ninety-one
brochures were received representing either a national forest or attraction in a national forest and these were used as the sample. It was determined from the analysis that the brochures needed to include more pictures of women, of minorities, and of the elderly; identify people actively pursuing forest recreation offerings; show a larger number of undomesticated animals; use a lower reading level; and use a larger number of graphic techniques on the title panels. The study suggests that illustrations reflect environmental attitudes prevalent at the time of publishing, which should be seen in this study.

Kirk & Karbon (1986) analyzed environmental content in children's literature from 1960 until 1982. To be selected, books must have won one of the following awards: Boston Globe-Horn Book, The Caldecott Medal, John Newberry Medal, or the National/American Book Award. The books were analyzed using one of the environmental concepts from Robert Roth's (1969) list of fundamental concepts. The concept was that all things living are interdependent not only with the environment but with each other. This concept was rated as the most important concept in Roth's study.

Sixty-six of the 72 books analyzed by Kirk and Karbon contained some environmental content, but only one used the environment as the theme. The books used social and environmental issues as backdrops to the main story. More messages were related to human physical and emotional needs than to animals and plants. Many of the settings were rural, in the country but not on a farm, for the environmental messages. More environmental content was found in the books from 1970-1982 than before 1970. A few stories had animals as the main characters and none had plants. The books with the most environmental content concerned characters living off the land. The authors of the books showed a traditional view of the environment as seeing forests and
rural areas as environmental, Native Americans and farmers having more contact with nature and having greater an awareness of cycles, and contact with the environment in isolated areas in which dependence on the land for survival is necessary. The study suggests a change in environmental coverage after 1970, which could be reflected in this study. The study also suggests more of a human-oriented perspective with concentration on human needs rather than the needs of other organisms.

Faulconer (1993) traced conceptual trends in environmental social thought from 1950 to 1990 that was contained in journal articles that covered purposes and goals of conservation, environmental education, and nature study. The study had three goals: (a) compile a brief history of ecological beliefs and make distinctions between ecocentric and anthropocentric perspectives, (b) compare beliefs and assumptions of environmental educators with social ideas as they developed over the period, and, (c) analyze underlying assumptions, beliefs, and values that have guided environmental education from 1949. Eighty-four articles published between 1950 and 1990 which had statements of purposes or goals for conservation education, nature study, or environmental education were selected. Before 1969 articles were used from forty different educational journals. After 1969 The Journal of Environmental Education became the primary source.

The issues seen in educational literature were consistent with contemporary issues during the 1950's, but mostly one-sided, with conservation seen as a patriotic duty and preservationists seen as hoarders. Issues emphasized during the late 1960's and into the 1970's included population, pollution, and pesticides. These issues were also seen in the social literature. Other issues emphasized in the social literature but not in the educational
literature included nuclear power, energy crisis, and endangered species. Environmental concerns of the 1980's such as land use, ozone depletion, and rainforest deforestation were not seen in the educational literature. Most educational literature of the 1980's stressed the debate of how the value of nature should be determined and the debate of human values versus intrinsic values of undisturbed systems.

Assumptions were analyzed as to whether each author had a deep ecology philosophy or a reform environmental perspective. The 1950's and 1960's had the least variety of viewpoints expressed with an increase in viewpoints seen as the environmental crisis became more complex. By the 1980's, more writers were expressing a deep ecology viewpoint. Faulconer stated that the language changed as a change from conservation education to environmental education took place in the 1960's and 1970's. Though new terms were used, these new terms still expressed old ideas. By the 1980's, deep ecology had become a part of the discourse. This study focuses on whether textbooks of the 1980's reflect this change in discourse, or whether there is the lag suggested by Jackson between a change in discourse and its reflection in the textbooks.

Ingraham (1990) conducted a content analysis of the anthropocentric and biocentric views expressed in the environmental program Project WILD. Anthropocentric views were interpreted as showing humans apart from and over non-human nature where other species are seen only in respect as to how they are used by humans. A biocentric view places humans within nature where species are valuable for themselves, not by what they do for humans. Results of the study showed that Project WILD had a predominately anthropocentric view. Ingraham stated that many of the illustrations showed
humans and only animals that humans like or resemble. Humans were also not included within the wildlife classification, nor were they shown as a part of the food web or within food pyramids. The framework statements represent a strong tendency towards science facts and little towards value. Science textbooks have a tendency towards science facts and little towards social value, so they also may reflect a strong tendency towards placement of these facts in an anthropocentric perspective.

Elementary Science Education

Near the end of the 19th century, elementary science saw a change in the materials and development of curriculum for science education. With the publication of the report on secondary science education as part of the study by the National Education Association Committee of Ten, changes filtered down to elementary science. During this time, G. Stanley Hall and Colonel Francis W. Parker developed a philosophy of education that included support for the study of nature. Henry H. Strait and Wilbur S. Jackman worked under the influence of Parker in developing elementary curriculum that contained an underlying principle for the use of science. Jackman is considered to be one of the primary movers at developing guidelines in the relationships between children and science.

The nature study movement started in the early 20th century at Cornell University under the guidance of Liberty Hyde Bailey for the primary purposes of promoting the improvement of agriculture and stopping the movement of people from the farms to the cities. Anna Botsford Comstock published one of the most used handbooks on nature study which ran through several editions.
Cornell also published a series of rural school leaflets for distribution to teachers.

During the 1920's, nature study began to lose some of its hold over elementary science. The first

...serious and scientific attempt to define a curriculum that would enable some functional relationship to be seen between purpose and procedure was carried on by Craig in a study reported in 1927. This study had a wide influence, and the results of its findings were soon seen reflected in school curricula throughout the country. ... The emphasis on a continuous and unified program aimed at giving understanding of the significant ideas of science has resulted in the preparation of graded series of texts for use by the grade pupil. The first of these was published in 1932 by Craig, in co-authorship with several elementary-school teachers, and embodied the results of his research of 1927 (Underhill, 1941, pp. 220-221).

These texts reflected a movement from nature study, which is seen as different from science with respect to how science is viewed and the underlying philosophies of how the nature of truth is viewed and how that truth is attained. (Underhill, 1941) These differences are seen as follows:

1. Nature-study deals with facts primarily for their own sake, whereas elementary science is concerned with facts in relationship to generalizations.

2. Nature-study appeals aesthetically and morally, whereas elementary science appeals intellectually and philosophically.

3. Nature-study is primarily simple observation, whereas elementary science has its foundations in classification and an organized system of knowledge (Underhill, 1941, p. 168).

McCormack (1992) characterizes this period of 1920-1957 as the "utilitarian / textbook" period. It has also been called the Progressive Era. The elementary level was a "read about science" that depended on commercially produced textbooks. Most of these were based on work by Gerald Craig which used a scope-and-sequence curriculum. Emphasis was away from "hands-on"
and more on the most efficient way to cover the material. Science was seen in terms of practical, everyday use, and led to a view of science that was different than what practicing scientists saw as science. Memorization was seen as the primary goal of science education. John Dewey's concerns over the lack of use of the scientific method and lack of emphasis on the need to solve the social and economic problems present at the turn of the century were also reflected in the science curriculum of that time.

The Post-Sputnik era of 1957-1978 saw the development of new elementary programs such as the Elementary Science Study, which promoted an exploration of science by children; the Science Curriculum Improvement Study, which was designed to give students an understanding of basic science concepts and a chance to develop an inquiring mind; and Science - A Process Approach, which emphasized processes and had less emphasis on science facts. These approaches emphasized hands-on, relating of concepts to processes, and they had a strong influence on elementary science textbooks (McCormack, 1992).

This time period also saw the influence of the educational psychologists and writers of the day—Jean Piaget, Jerome Bruner, and David Hawkins. Piaget suggested that memorized knowledge wasn't real or useful to a child's life, so held no meaning, and that children develop at different rates and construct much of their own knowledge through interactions with the world around them. Bruner's aim for science education was that the curriculum was determined by the most basic understanding of the underlying principles of the subject that then give that subject its structure. This formed the basis for the spiral curriculum, where principles were introduced at the elementary level, and revisited several times throughout middle and senior high school years.
Hawkins advocated a curriculum that stressed direct experience combined with mastery and clear thinking, a discovery method that formed the core of the Elementary Science Study (ESS).

Starting in the 1970's there was an introduction of environmental education and the science-technology-society (STS) frameworks into the science curriculum. The STS movement was to add a more issue- and value-oriented aspect to science education that promoted relevancy to personal, societal, and environmental issues. Environmental education is addressed later in this chapter. The late 1980's into the 1990's saw an introduction of science education standards, which are discussed below.

Science Education Standards

During the late 1980's and early 1990's there was a call for standards in science education. The American Association for the Advancement of Science responded with the Benchmarks for Science Literacy, the National Science Teachers Association with The Content Core: A Guide for Curriculum Designers, and the National Research Council with the National Science Education Standards. One set of standards, The Content Core, specifically targeted secondary school science and so had little to say of relevance to this study. The other two sets of standards targeted a Kindergarten through grade 12 curriculum.

In Benchmarks two sections address humans as a component of the ecosystem. One section is under the living environment, and only at grade levels 9 through 12 are humans represented as part of ecosystems. At all other grade levels, discussion remains with plants and animals and those interrelationships. The one reference to humans as a part of the ecosystem was
the last one in the section, which states that "human beings are part of the earth's ecosystems. Human activities can, deliberately or inadvertently, alter the equilibrium in ecosystems" (AAAS, 1993, p. 117).

The section on the nature of technology also contained references to humans as part of the ecosystem. For grades three through five, one statement referred to the idea that:

Technologies often have drawbacks as well as benefits. A technology that helps some people or organisms may hurt others - either deliberately (as weapons can) or inadvertently (as pesticides can). When harm occurs or seems likely, choices have to be made or new solutions found (AAAS, 1993, p. 55).

During grades nine through twelve, students are introduced to the ideas presented in the statement that:

The human species has a major impact on other species in many ways: reducing the amount of the earth's surface available to those other species, interfering with their food sources, changing the temperature and chemical composition of their habitats, introducing foreign species into their ecosystems, and altering organisms directly through selective breeding and genetic engineering (AAAS, 1993, p. 57).

Under the Benchmarks, much of the focus of this study is found only in grades nine through twelve, not at an elementary level.

In the National Science Standards, at the K through 4 level humans are separated from other organisms in that the same principle is stated twice; once for other organisms and once for humans:

All organisms cause changes in the environment where they live. Some of these changes are detrimental to the organism or other organisms, whereas others are beneficial.

Humans depend on their natural and constructed environments. Humans change environments in ways that can be either beneficial or detrimental for themselves and other organisms. (NRC, 1996, p. 129)
At the same grade level under the personal and social perspectives, several of the statements pertain to the concept used in this study:

Environments are the space, conditions, and factors that affect an individual's and a population's ability to survive and their quality of life.

Changes in environments can be natural or influenced by humans. Some changes are good, some are bad, and some are neither good nor bad. Pollution is a change in the environment that can influence the health, survival, or activities of organisms, including humans.

Some environmental changes occur slowly, and others occur rapidly. Students should understand the different consequences of changing environments in small increments over long periods as compared with changing environments in large increments over short periods (NRC, 1996, p. 140).

The standards for grade levels five through eight also contained several statements pertinent to this study:

Populations of organisms can be categorized by the function they serve in an ecosystem. Plants and some micro-organisms are producers - they make their own food. All animals, including humans, are consumers, which obtain food by eating other organisms. Decomposers, primarily bacteria and fungi, are consumers that use waste materials and dead organisms for food. Food webs identify the relationships among producers, consumers, and decomposers in an ecosystem (NRC, 1996, pp. 157-158).

Under personal and social perspectives the statements included:

Causes of environmental degradation and resource depletion vary from region to region and from country to country.

Human activities also can induce hazards through resource acquisition, urban growth, land-use decisions, and waste disposal. Such activities can accelerate many natural changes.

Natural hazards can present personal and societal challenges because misidentifying the change or incorrectly estimating the rate and scale of change may result in either too little attention and significant human costs or too much cost for unneeded preventive measures (NRC, 1996, pp. 168-9).

Only at the grade nine through twelve level does the statement that pulls
it all together appear:

Human beings live within the world's ecosystems. Increasingly, humans modify ecosystems as a result of population growth, technology, and consumption. Human destruction of habitats through direct harvesting, pollution, atmospheric changes, and other factors is threatening current global stability, and if not addressed, ecosystems will be irreversibly affected (NRC, 1996, p. 186).

The standards do call for a presentation of humans as part of the ecosystem, but usually at the secondary level. This may be due to the developmental level of elementary students as compared to secondary levels.

Environmental Education

When working within environmental education, one encounters the major dilemma of finding a definition that is accepted by the community. This study attempts to determine the extent to which elementary science textbooks present the one environmental principle. A definition of environmental education is necessary to give a framework in which this environmental principle could fit.

With the historical perspective of this study, there must also be a trace of the historical evolution of environmental education. Early antecedents of environmental education include nature study, outdoor education, and conservation education. A more recent addition to the list is that of environmental literacy.

Nature study was initiated in the late 1800's by Wilbur Jackman and others as a movement to involve students in the outdoors as an approach to integrated education. Nature study involved Louis Agassiz's precept of studying nature, not books. Activities found in nature study included tree identification, animal tracking, pond studies, and weather forecasting. It was
later taken on by Cornell University as a way to encourage the agricultural community not to leave the farms for jobs in the city. Nature study was common in elementary schools during the early 1900's, and in many places existed well into the 1960's as a substitute for science.

Outdoor education evolved in the 1920's with similar purposes to nature study. Based on L.B. Sharp's idea of teaching outdoors that which is best experienced outdoors, activities drew upon traditional subject areas and included such topics as cemetery studies, map and compass, crafts, and creative writing. Much of this we still see today with field trips, land labs, and outdoor camps.

The 1930's saw the Dust Bowl and the need to educate people to conservation methods. Conservation was not a new approach, but the social issues of the 1930's, such as the displacement of farmers in the Midwest due to the Dust Bowl, introduced a need to include these concepts in education. Studies included wise use of natural resources and management practices. Much of the education was carried out by government agencies, the cooperative extension service, and school systems. Much of the content was science oriented and management centered. Activities included stream improvements, forest management, soil formation, and farm practices. Conservation education continued on into the 1950's in the schools, and still continues on within the context of government agencies and the cooperative extension service.

Environmental education as a movement started in the late 1960's and was a blend of the other three. Environmental education provided the environmental concepts, the problem solving skills, and the motivation necessary for people to act responsibly towards improving environmental
quality. Environmental education is found at the formal and informal levels. Formal levels would include schools and universities while the informal levels would include parks and museums. The term itself can be attributed to Thomas Pritchard in a 1948 address to the International Union for the Conservation of Nature and Natural Resources in Paris. Schoenfeld credited the term to Brennan who used it in a 1957 article for the Massachusetts Audubon Society and again in a 1964 address to the American Association for the Advancement for Science.

Stapp later defined environmental education in the first issue of Journal of Environmental Education to be "aimed at producing a citizenry that is knowledgeable concerning the biophysical environment and its associated problems, aware of how to help solve these problems and motivated to work toward their solution" (Stapp, 1969, p. 30).

The Environmental Education Act of 1970 established one "official" definition of environmental education:

Environmental education is an integrated process which deals with man's interrelationships with his natural and man-made surroundings, including the relationships of population growth, pollution, resource allocation and depletion, conservation, technology, and urban and rural planning to the total human environment. Environmental education is a study of the factors influencing ecosystem, mental and physical growth, living and working conditions, decaying cities, and population pressures. Environmental education is intended to promote among citizens the awareness and understanding of the environment, our relationship to it, and the concern and responsible action necessary to assure our survival and to improve the quality of life (Senate Report for the Environmental Education Act of 1970, P.L. 91-516, 1970, p. 1).

Brennan (1970) defined environmental education as education "which develops in man a recognition of his interdependence with all of life and a recognition of his responsibility to maintain the environment in a manner fit for
life and fit for living— an environment of beauty and bounty, in which man lives in harmony” (p. 2).

Barry (1976) defined as the goal of environmental education to "develop a world population that is aware of and concerned about the environment and its associated problems and which has the knowledge, skills, attitudes, motivations and commitment to work individually and collectively toward solutions of current problems and the prevention of new ones" (p.2).

Environmental education and science teaching came together is the NSTA Positions on Understandings in Science Education (1986) where the NSTA urged that:

1. It is imperative that students at all levels develop an understanding of how humans relate to natural systems, and realize the importance of making wise individual and social decisions in respect to the use of natural resources and the maintenance of environmental quality.

2. Science educators have a responsibility to help students establish a firm knowledge of fundamental scientific principles in order that they might better comprehend, explain, and predict the consequences of human actions on natural systems.

3. Firsthand interaction with terrestrial, aquatic, atmospheric, and human-designed components of the environment is considered both relevant and necessary for effective science teaching and learning. With such an experiential base, science educators can help students to develop the kind of reasoned thinking that will result in responsible decision making regarding human / ecosystem interaction.

4. NSTA supports activities that promote increased awareness and responsible educational use of terrestrial, aquatic, atmospheric, and human-designed components of the environment (p.15).

Anthropocentric perspectives in education have been the predominate viewpoint: "that nature exists as but a commodity to be enjoyed and consumed by humans. It teaches that there is a technological solution to all problems" (Sessions, 1983, p.28). Ingraham (1990) suggested that the "human-centered
view of living in this world has helped to create the environmental crisis at hand by acting to preserve the environment only when human interests would best be served" (p. 17). The opposing view is that of an ecocentric or biocentric perspective which "places humans and their techno-scientific capabilities in the web of life as an 'equal' to other species, not as their keeper" (Ingraham, 1990, p. 22). This is the same interrelationship stressed in the 1932 NSSE statement.

**Summary**

Humans' interrelationships with nature have been included in standards, statements by organizations, legislation, and as goals for environmental and science education. The use of this principle **humans as a component of the ecosystem** was an integral part of many of these standards and definitions over the study period. Content analysis is one way to determine how that interrelationship has been presented in elementary science textbooks. This study was undertaken to determine to what extent the principle **humans as a component of the ecosystem** has been covered and whether that representation was primarily anthropocentric, as some have suggested.
Problem Statement

The purpose of this study was to investigate the extent to which elementary science textbooks have included, over time, the principle **humans as a component of the ecosystem** and whether that representation of the principle is one of humans outside of the ecosystem (an anthropocentric framework), or humans as a biological component of the ecosystem (an ecocentric framework).

One phase of the study examined in-depth this principle as presented through 60 years by one publisher. This publisher started with one of the first elementary science textbook series in the 1930's and continued without merging with other publishers until the mid-1980's. All series reviewed in this study were examined for the same principle. Each series has had several editions and/or revisions, within the time period of 1930 to 1990. The principle **humans as a component of the ecosystem** was found to contain ten sub-components. The textbooks were then analyzed for the coverage given these ten sub-components. The collected data were used to:

1. describe the emphasis given the principle **humans as a component of the ecosystem**, in each specific elementary science textbook series for a particular publisher;
2. trace the historical development of the treatment of the environmental principle **humans as a component of the ecosystem** given by elementary science textbook series by a particular publisher;

3. identify differences and similarities in the presentation of the principle **humans as a component of the ecosystem** for various editions of a given elementary science textbook series having the same author or authors for a particular publisher;

4. identify differences and similarities in elementary science textbook series for the principle **humans as a component of the ecosystem** for particular grade levels; and

5. describe the emphasis given the principle **humans as a component of the ecosystem** in a group of elementary science textbook series published during a given period of time.

**Methodology: Content Analysis**

Content analysis was selected as the methodology to study the elementary science textbook series for a particular publisher to determine if and how the selected series included the principle **humans as a component of the ecosystem**. This method was used to describe the treatment given the principle and whether that principle was presented as text, a question, or an illustration in each of the selected elementary science textbook series for a particular publisher. This study was designed to analyze only what was said, not what the authors intended or what the users of the textbooks took away with them. The questions of the study were answered directly by a description of the content.
Content analysis is a way to approach documentary research involving archival material such as textbooks. Content analysis is "any technique for making inferences by objectively and systematically identifying specified characteristics of messages" (Holsti, 1969, p. 14). Holsti goes on to say that content analysis is "used most frequently to describe the attributes of messages, without reference to either the intentions (encoding process) of the sender or the effect of the message upon those to whom it is directed (decoding process)" (Holsti, 1969, p.27). Content analysis is a "research technique for objective, systematic, and quantitative description of the manifest content of communication" (Berelson, 1952, p.18). This form of analysis can also be viewed as an assessment technique in which complex phenomena such as conversations or textbooks can be reduced to simpler data such as frequency counts (Anderson, Ball and Murphy, 1975).

Content analysis methodology was addressed by Cartwright (1953):

The objective of content analysis is to convert recorded 'raw' phenomena into data which can be treated in essentially a scientific manner so that a body of knowledge may be built up. More specifically, content analysis must be constructed so as (1) to create reproducible or 'objective' data, which (2) are susceptible to measurement and quantitative treatment, (3) have significance for some systematic theory, and (4) may be generalized beyond the specific set of material analyzed (p. 435).

Cartwright went on to state that problems such as objectivity, quantification, significance and generalization occur in the conversion of qualitative materials into acceptable scientific data.

"Objectivity stipulates that each step in the research process must be carried out on the basis of explicitly formulated rules and procedures" (Holsti, 1969, p. 3). Categories should reflect both the hypothesis and research questions of the study. Categories should be clear, specific, and defined so that
they are mutually exclusive and inclusive. In this study, one environmental principle stated by Hungerford, Peyton, and Wilke was used as the framework. During the initial analysis of data, ten sub-components of this principle, those of humans use plants, humans use animals, humans cause pollution, humans change ecosystems, humans cause habitat destruction, humans compete with other components of the ecosystem, humans are a component of the food chain / web, humans are dependent / interdependent with the ecosystem, humans are part of the world ecosystem, and humans influence the balance of ecosystems, were found to exist. These ten sub-components were then used in defining the anthropocentric and ecocentric frameworks of the textbooks. Berelson (1952) suggested that, "...content analysis should employ the categories most meaningful for the particular problem at hand and relatively specific and concrete categories are often the most meaningful" (p. 148).

Quantification is based on the selection of the unit of enumeration (Cartwright, 1953). These units need to be chosen based on the purposes of the analysis. Units are then processed through counting and tabulation. Assigning numbers or values to the content may be accomplished in several ways: (a) counting of objects in each category, (b) ranking of objects according to a specified criteria, or (c) rating or assigning objects a place on a continuum (Kerlinger, 1965). This study used the ten sub-components as the categories. Each textbook was then analyzed to determine if any or all of these sub-components were contained within the text. Examples of the sub-components were also noted and used to describe the context of those sub-components.

A study is determined to be significant if its findings have some implications for a theory or contribute to a formal body of knowledge. Cartwright (1953) stated that "For this reason significant content analysis begins with some
systematic problem whose solution will be determined by the specific nature of the data resulting from the analysis" (p. 448). The significance of this study lies in providing examples of how elementary science textbooks have represented humans as a component of the ecosystem and how elementary science textbooks have changed over time in that representation.

Generalizations must also be drawn from the data. This depends on how representative the sample is for the population from which the data are extracted. Holsti (1969) asked in regard to this sample "What is the universe of communication to be described, and what sample is to be derived therefrom"? (p. 127) Kerlinger (1965) referred to a unit that is selected from the entire data base as being the most important part of content analysis because it directly reflects the theory and problem of the study.

A thorough search to obtain the universe of elementary science textbooks series published during the period covered in the study was completed. From this database, every effort was made to obtain all books in all series to provide as thorough coverage as possible. Thirty-one textbooks were not located in efforts to complete series. These were spread over all grade levels, with an average of five textbooks at each grade level. Nine series for the various publishers and time periods were also not located during the search.

Budd, Thorp, and Lewis (1967) suggested six steps to follow for completing content analysis that address the issues of generalization, significance, quantification, and objectivity:

1. Formulate the research question, theory and hypotheses.
2. Select a sample and define categories.
3. Read and code content objectively.
4. Obtain scores.
5. Compare scores with other variables.
6. Interpret findings according to appropriate concepts and theories (p. 6).

Validity is the extent to which an instrument measures what that instrument was designed to measure. In content analysis, validity depends upon how appropriate the categories are into which the content is coded.

Choice of categories and content units similarly enhance or diminish the likelihood of valid inferences; unless they are appropriate indices of these events, attitudes or behaviors the analyst wants to measure, inferences drawn from the findings will not be valid (Holsti, 1969, pp.142-143).

Holsti (1969) indicates that if the purpose of the research is descriptive in nature then content validity is the most appropriate. The validity can result from the generalization of the conclusions of the study to other situations and recognition that the investigator has made knowledgeable and professional judgments (Holsti, 1969). Content validity can be established by the informed judgment of the researcher. Budd, et al. (1967) states that categories that are rigidly defined and have a high degree of reliability will provide a measure of the content validity. Holsti (1969) refers to five questions that can be asked in addressing content validity in content analysis:

1. Are the results plausible?
2. Are they consistent with other information about the phenomena being studied?
3. Is the sample of document analyzed representative (of the content area being studied)?
4. Are the categories adequate for the purpose of the study?
5. Is the coding reliable? (p. 143)

Another way of establishing validity in content analysis is for a panel of experts knowledgeable about the study area to judge the methodology of the content analysis process and instrument. (Budd, et al., 1967)
Validity has been established by the consistency throughout the study that this principle was present in the science education standards, by having a large sample, by determining the sub-components from the initial sample, and the reliability of the collection of data by excerpts of the original material.

Holsti (1969) makes reliability a "function of coders' skill, insight, and experience, clarity of categories and coding rules which guide their use; and the degree of ambiguity in the data" (p. 135). Budd, et al. (1967) notes that establishing reliability does not need to be difficult. Two ways of establishing reliability are agreement of coders and category refinement (Holsti, 1969).

Reliability was established by clearly defining the principle and the sub-components coded from that principle. The definition of the principle as discussed in Chapter II is that humans have interacted with the world ecosystem and those interactions have resulted in both beneficial and detrimental results for the ecosystem. The representation of those interactions in elementary science textbooks was the focus of this study. The definitions of the sub-components were discussed within the researcher's advisory committee and are given later in this chapter. Sections of one textbook were given to members of the committee for their interpretation, and discussion was held on how that interpretation was made. Committee members have backgrounds in elementary science education, history of science education, environmental education, and content analysis.

Selection of Elementary Science Textbook Series

The population for this study consisted of bound elementary science textbook series published between 1930 and 1990. These series were used to trace the development of the principle humans as a component of the
ecosystem by grade level and over time. One publisher with a continuous history of publication of elementary science textbooks from 1930 until 1990 was studied in depth for a historical treatment of this principle. In order to have a comparative unit that was a common thread throughout the study, only grades one through six were analyzed. Instead of looking only at series dealing only with grades one through six, this study looked at all series and disregarded pre-primers through kindergarten and the seventh and the eighth grade textbooks that were part of the series, since not all series during the study period contained these components.

The sample consisted of elementary science series from 14 publishers (Appendix C). These 14 publishers--ABC, Ailyn and Bacon, Bobbs-Merrill, Merrill, Ginn, Harcourt-Brace-Jovanovich, Heath, Laidlaw, Laidlaw-Macmillan, Macmillan, McGraw-Hill, Scott-Foresman, Scribner, and Silver-Burdett--, published consistently over several decades and/or several editions. Only two of the fourteen publishers had a continuous publishing history starting in the 1930's and continuing into the 1980's--Ginn and Scott-Foresman. The series published by Ginn were chosen for a more in-depth analysis.

Every attempt was made to trace a particular series or author for as long as possible. Series were not considered in this analysis if their books were published for only one decade or had only one edition. No attempt was made to determine usage or popularity. An assumption was made that if a particular author or series went through several editions and was published for several decades, then the series was used by elementary schools.

A complete bibliography of elementary science textbook series was compiled using The American Educational Catalog published by Publisher's Weekly and R. R. Bowker in the 1920's through 1955. In 1956 this catalog
became *Textbooks in Print: The American Educational Catalog*, still published by R. R. Bowker. The catalog became the *El-Hi Textbooks in Print* published by R. R. Bowker in 1970 and underwent another title change in 1985 to *El-Hi Textbooks and Serials in Print*. Textbooks were obtained from various education libraries around Ohio, The University of Illinois curriculum library collection, and The Ohio State University's interlibrary loan department.

**Identification of Components**

Content analysis for this study made it necessary to construct categories that addressed the goals for environmental education. "Content analysis stands or fails by its categories. Particular studies are productive to the extent to which the categories are clearly formulated and well adapted to the problem and to the content" (Berelson, 1952, p. 147). Holsti (1969) stated that the "categories should reflect the purpose of the research, be exhaustive, be mutually exclusive, be independent, and be derived from a single classification principle" (p. 95).

The textbooks were analyzed using the goals for curriculum development defined by Hungerford, Peyton and Wilke (1978). An inventory for environmental curriculum was developed by Gardella (1992) based on work by Hungerford, Peyton and Wilke. The environmental goals developed by Hungerford, et al., were validated by a panel of five professional environmental educators. These goals were also prepared and validated in 1978 by using the objectives for environmental education that arose from the Tbilisi Conference (Hungerford, Peyton, & Wilke, 1978).

A superordinate goal based on Harvey's dissertation (1977) is also of underlying importance for the goals developed by Hungerford, Peyton, and
Wilk. This goal is purposed to "...aid citizens in becoming environmentally knowledgeable and, above all, skilled and dedicated citizens who are willing to work, individually and collectively, toward achieving and/or maintaining a dynamic equilibrium between quality of life and quality of the environment".

Assumptions made by Hungerford, et al., regarding the goals for curriculum development in environmental education include:

1. That the goals for curriculum development in EE are appropriate for use in guiding both formal and nonformal EE curriculum development efforts.

2. That a 'receiver' can be thought of as any person, of any age, who can be reached through either formal or nonformal educational sectors. ...

3. That ecological foundations are critical to any EE program as prerequisite or corequisite cognitive knowledge. That ecological concepts are an integral part of environmental education. ...

4. That some level of "environmental sensitivity' is probably critical to the receiver's being willing and/or able to engage profitably in Levels II, II and IV of this set of goals. ...

5). That the concept of maintaining and/or achieving a dynamic equilibrium (homeostasis) must be interpreted from both cultural and ecological perspectives. That said equilibrium may well result in a distinct compromise between quality of life on one hand and quality of the environment on the other. The curriculum developer must be constantly aware of this in order to produce curricular materials that look rationally at both the cultural and ecological costs involved in achieving a true equilibrium (Hungerford, Peyton, Wilke, 1978, p.9-11).

The four levels of the goals that were then developed by Hungerford, Peyton and Wilke consisted of:

1. Ecological foundation level, which included the principle of humans are a component of the ecosystem.
2. Conceptual awareness level.
3. Investigation and evaluation level.
4. Environmental action skills level. (1978, pp. 4-8)
These environmental goals have been used in developing a middle school environmental curriculum. In further discussion, Hungerford, et al, (1989), stated that the first two goals focused on conceptual awareness of ecological principles and environmental issues. The last two goals are dealing with development and application of skills needed to investigate and evaluate environmental issues and participate in remediation of those issues.

These environmental goals also have been used in other research studies. Volk, et al(1984) used these goals in a survey on curricular needs in the United States and Stevenson (1986) used them as criteria to analyze curricula in Australia and in the United States. In addition, Gardella (1987) used them to develop an instrument to assess environmental curricula.

Two other studies, Champeau, et al, (1980) and Peyton and Hungerford (1980) surveyed elementary and secondary teachers on the educational importance of these goal levels and how well teachers felt they could implement these goal levels in their instruction. Teachers felt that all four goal levels were important as part of an instructional program but felt they lacked training and resources to implement the instruction.

The principle humans as a component of the ecosystem was chosen for the framework it provided to explore how humans view their place within an ecosystem. All textbooks identified for this study were reviewed for statements that used "humans" or "man" or "people" doing something to the environment, or causing something to happen to the environment, or using the environment, or any other statements implying a sense of where humans fit in. Each text was examined page by page. The data collected included quotes, descriptions of illustrations, questions, and notes from the textbooks which expanded on the theme of man and nature.
The information was then reviewed to determine if there were any common threads in the data. During the collection of data for the principle humans as a component of the ecosystem, a series of sub-components emerged that were then used in the in-depth analysis of the Ginn textbooks. These sub-components were:

1. humans use plants;
2. humans use animals;
3. humans cause pollution;
4. humans change ecosystems;
5. humans cause habitat destruction;
6. humans compete with other components of an ecosystem;
7. humans are a component of food chains/webs;
8. humans are dependent/interdependent with the ecosystem;
9. humans are part of the world ecosystem; and,
10. humans influence the balance of ecosystems.

The first five of these sub-components were interpreted as an anthropocentric framework such as how humans use, how humans cause, how humans change ecosystems- a human control emphasis. The last five sub-components were interpreted as an ecocentric framework, or how humans fit in a biological way into ecosystems, including competition, dependence, balance, or food chains/webs - a biological balance perspective.

Treatment of Data

Each textbook was reviewed, page by page, for citations that referred to the principle humans as a component of the ecosystem. Direct quotes of text, questions and description of illustrations were recorded. A file was set up
on File-Maker Pro where data were entered under the following headings: title, author(s), date of publication, publisher, grade level and textual data. As data were entered into the files, certain topics were found to repeat. These topics then formed the basis for searches of all of the files and included these key words or phrases: *use of plants*, *use of animals*, *habitat destruction*, *pollution*, *change*, *competition*, *food chain/web*, *ecosystem*, *balance*, and *dependence/interdependence*. These topics then formed the ten sub-components used in the study.

The ten sub-components formed the basis for the anthropocentric and ecocentric frameworks. These sub-components emerged from the initial study of the 269 textbooks. These sub-components were repeatedly seen over the study period and at all grade levels. The first five sub-components fit the anthropocentric framework as they referred to how humans work outside the ecosystem to cause change more of a human control emphasis. The last five became the ecocentric framework as they refer to how humans work within ecosystems in biological ways.

**Anthropocentric Sub-Components**

1. **Humans use plants** included such topics as use of plants for food, for clothes, for shelter, for shade, and for beauty. Also included were citations that referred to plants as pests (weeds) and plants are used to provide drugs and medicine. There were some less mentioned uses of plants for paper, dyes, and erosion prevention.

2. **Humans use animals** included many of the same topics as plants. These included the use of animals as food, for clothes, for shelter, as pets, as pests (mostly insects), as friends or controls over other animals.
and plants, for enjoyment (bird watching), in sport (hunting), and work.

3. **Humans cause pollution** citations included those for air, water, and land. Some citations referred to dirty air and dirty water. Topics also referred to needs for pollution control and pollution of water resources such as the ground and the ocean. Causes of pollution such as burning, dumping garbage, cars, factories or industry were included. Types of pollution included heat, chemical, air, and water.

4. **Humans change ecosystems** went beyond the topics of habitat destruction and pollution and specifically mentioned change. These included changes in plant and animal populations, changes in environments, changes in communities, adaptation to change, and how humans view change.

5. **Humans cause habitat destruction** included examples as forests cut carelessly, draining of swamps and marshes, plowing of prairies and grasslands, damming of rivers, converting deserts to farmland, and building cities and highways.

**Ecocentric Sub-Components**

6. **Humans compete with other components of an ecosystem** included topics such as certain plants or animals compete with humans for food or energy, which moves it beyond the idea that certain plants and animals are pests or enemies. It places humans within the ecosystem as a part of, instead of separate from the ecosystem.

7. **Humans are a component of food chains or webs** citations were many times seen as illustrations showing humans as the end of the food chain. Other citations were textual and some described humans eating
chickens. The chickens in turn ate seeds which received their energy from the sun. Mentions were also made of humans as part of the food chain. A mention of humans eating plants or animals was not enough to include the citation in this section.

8. *Humans are dependent / interdependent with the ecosystem* required a direct reference to this idea. The topics included a dependence on the environment, dependence on plants and animals, or interdependence with the environment. These citations moved humans away from using or needing to depending on the environment.

9. *Humans are a part of the world ecosystem* were drawn from citations where humans were included in the world ecosystem. These topics referred to dependence on the world ecosystem, damage or change the world ecosystem, or some other method of including humans within the world ecosystem. Humans changing an animals' ecosystem was seen as change or habitat destruction depending on that citation and was not included in this group.

10. *Humans influence the balance of ecosystems* included topics that represented humans in balance with the ecosystem, by recognition of the need for that balance. The citations that were found that mentioned how humans fit within that balance did not reflect a balance. Instead, these citations referred to how humans have upset the balance and included instances of destruction of the balance by introducing new species, destruction of homes, upsetting the balance between living things, and how balanced ecosystems are upset by the way humans live. These citations, even with their anthropocentric
overtones, still remained with the ecocentric perspectives since they recognize a need for humans living in a balance with the ecosystem.

The data obtained from the 269 textbooks formed a framework in which to search the 42 textbooks from Ginn Publisher. All pages that included textual, illustrative or questions that referred to the principle of humans are a component of the ecosystem were photocopied. These data were used as examples of how Ginn textbooks presented these ten sub-components over the study period and at grade levels one through six. These data were also used to determine if the Ginn textbooks represented an anthropocentric or ecocentric framework and if that framework varied over the study period or grade levels.
Chapter IV
ANALYSIS OF DATA

Two hundred and sixty-nine elementary science textbooks published from 1930 through 1990 were analyzed to determine the extent to which the principle **humans as a component of the ecosystem** was emphasized.

Examples of the principle were selected from the textbooks, and notes were made as to placement within the books. These examples might be in the form of exact text, questions or descriptions of the illustrations. In some cases exact quotations were recorded, while in others the meaning of a portion of text was recorded. For example, a discussion of various plants used by humans as food was recorded as *humans use plants*. No attempt was made to record the number of words, paragraphs or pages for each incident. The purpose of this study was to examine context of the principle, not page counts or word counts.

Data consisted of these examples and the number of textbooks that covered each of the ten sub-components. These data were then organized to indicate trends for grade levels, decades and publishers. The following analysis concentrated on the context of the ten sub-components, using the examples from the Ginn series, analysis of trends of these sub-components by decades, and analysis of the trends of these sub-components by grade levels. Tables and histograms are located in the text and in Appendix D.

The first section of this chapter examines each sub-component, citing examples from the texts that represent the context and changes in the sub-component at the grade levels or over the study period. Percentages of the
sample were used to indicate the coverage of each sub-component for the grade levels and each decade.

The next section focuses on changes at the decade level. The Progressive Era in education continued until the late 1950's, but social changes were occurring during the different decades, such as the Depression and Dust Bowl during the 1930's and World War II during the 1940's. The 1960's saw the influence of the NSF curriculum projects and the Post-Sputnik emphasis on science and science education. The environmental movement influenced the 1970's. The 1980's saw the influence of Project Synthesis and A Nation at Risk. That made the decades a reasonable unit of analysis for changes over the study period.

The last section concentrates on coverage by each grade level. Sub-components that received little or no coverage at certain grade levels or with changes in the coverage, are addressed. The most apparent observation was the lack of citations for the ecocentric sub-components, especially at the lower grade levels.

**Anthropocentric Sub-Components**

**Humans Use Plants**

The sub-component *humans use plants* was represented by citations at all grade levels, in all decades, by all publishers. The greatest percentage of books citing this sub-component occurred at Grade Level Two, with 67% of the sample having some reference to *humans use plants* and Grade Level Four with 65%(Table 1). All Grade Levels were represented at over 50% of the sample with references to the sub-component.
Table 1
The Occurrence of Sub-components by Grade Levels for All Textbooks

<table>
<thead>
<tr>
<th>Grade level (Number of Books)</th>
<th>Anthropocentric Sub-Components</th>
<th>Ecocentric Sub-Components</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Humans use plants</td>
<td>Humans use animals</td>
</tr>
<tr>
<td>One (45)</td>
<td>25 (56%)</td>
<td>14 (32%)</td>
</tr>
<tr>
<td>Two (48)</td>
<td>32 (67%)</td>
<td>32 (67%)</td>
</tr>
<tr>
<td>Three (44)</td>
<td>27 (61%)</td>
<td>23 (52%)</td>
</tr>
<tr>
<td>Four (46)</td>
<td>30 (65%)</td>
<td>32 (67%)</td>
</tr>
<tr>
<td>Five (42)</td>
<td>23 (55%)</td>
<td>27 (64%)</td>
</tr>
<tr>
<td>Six (44)</td>
<td>27 (61%)</td>
<td>30 (65%)</td>
</tr>
</tbody>
</table>

Dates below the percentages represent the first appearance of the sub-component at that grade-level. Sub-components without dates have appeared throughout the study period.
Table 2
The Occurrence of Sub-Components by Decades for all Textbooks

<table>
<thead>
<tr>
<th>Decade (Number of Books)</th>
<th>Anthropocentric Sub-components</th>
<th>Ecocentric Sub-components</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Humans use plants</td>
<td>Humans use animals</td>
</tr>
<tr>
<td></td>
<td>(Number of Books)</td>
<td>(Number of Books)</td>
</tr>
<tr>
<td>1930-1939 (10)</td>
<td>13 (72%)</td>
<td>11 (61%)</td>
</tr>
<tr>
<td></td>
<td>1 (6%)</td>
<td>1 (6%)</td>
</tr>
<tr>
<td></td>
<td>7 (39%)</td>
<td>1 (6%)</td>
</tr>
<tr>
<td></td>
<td>1 (6%)</td>
<td>1 (6%)</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>1 (6%)</td>
</tr>
<tr>
<td></td>
<td>1 (28%)</td>
<td>5 (28%)</td>
</tr>
<tr>
<td>1940-1949 (32)</td>
<td>27 (84%)</td>
<td>25 (78%)</td>
</tr>
<tr>
<td></td>
<td>5 (16%)</td>
<td>7 (22%)</td>
</tr>
<tr>
<td></td>
<td>12 (38%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td></td>
<td>4 (13%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td></td>
<td>6 (19%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td></td>
<td>2 (6%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>1950-1959 (28)</td>
<td>18 (64%)</td>
<td>17 (61%)</td>
</tr>
<tr>
<td></td>
<td>6 (21%)</td>
<td>7 (25%)</td>
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<tr>
<td></td>
<td>8 (29%)</td>
<td>0 (0%)</td>
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<tr>
<td></td>
<td>0</td>
<td>0 (0%)</td>
</tr>
<tr>
<td></td>
<td>2 (7%)</td>
<td>0 (0%)</td>
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<tr>
<td></td>
<td>3 (11%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>1960-1969 (52)</td>
<td>32 (52%)</td>
<td>29 (47%)</td>
</tr>
<tr>
<td></td>
<td>10 (16%)</td>
<td>10 (16%)</td>
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<tr>
<td></td>
<td>7 (11%)</td>
<td>3 (5%)</td>
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<tr>
<td></td>
<td>2 (3%)</td>
<td>7 (11%)</td>
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<tr>
<td></td>
<td>2 (3%)</td>
<td>3 (5%)</td>
</tr>
<tr>
<td></td>
<td>19 (31%)</td>
<td>19 (31%)</td>
</tr>
<tr>
<td>1970-1979 (55)</td>
<td>26 (47%)</td>
<td>31 (56%)</td>
</tr>
<tr>
<td></td>
<td>20 (36%)</td>
<td>14 (26%)</td>
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<tr>
<td></td>
<td>12 (22%)</td>
<td>4 (7%)</td>
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<tr>
<td></td>
<td>5 (9%)</td>
<td>7 (13%)</td>
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<tr>
<td></td>
<td>2 (4%)</td>
<td>3 (6%)</td>
</tr>
<tr>
<td></td>
<td>14 (26%)</td>
<td>14 (26%)</td>
</tr>
<tr>
<td>1980-1989 (74)</td>
<td>48 (65%)</td>
<td>45 (61%)</td>
</tr>
<tr>
<td></td>
<td>37 (50%)</td>
<td>20 (27%)</td>
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<tr>
<td></td>
<td>18 (22%)</td>
<td>1 (1%)</td>
</tr>
<tr>
<td></td>
<td>2 (3%)</td>
<td>3 (4%)</td>
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<tr>
<td></td>
<td>7 (9%)</td>
<td>4 (5%)</td>
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<tr>
<td></td>
<td>6 (8%)</td>
<td>6 (8%)</td>
</tr>
</tbody>
</table>
Eighty-four percent of the sample for the 1940-1949 decade contained references which cited *humans use plants* which dropped to 47% of the sample during the 1970-1979 decade (Table 2). One hundred percent of the sample of textbooks for McGraw-Hill and 98% of the sample of textbooks for Ginn contained references which cited *humans use plants* (Table 3). At the lower end of representation for this sub-component, 24% of the sample for ABC and 35% of the sample for Laidlaw, Laidlaw-Macmillan contained references which cited *humans use plants*.

Trends at the grade levels did not stand out. At the decade level the percentages were higher for the 1930's and the 1940's, dropped through the 1950's, 1960's, and 1970's and then increased for the 1980's. No trends were seen overall for the publishers.

The use of plants as food was the most cited topic of the sub-component *humans use plants*. This topic was cited in textbooks at all grade levels for all decades. It varied from making the actual statement such as "We eat plants every day" (Ginn, 1933, p. 17, grade 1) to "We could not live without plants, we must have them for food" (Ginn, 1932, p.80, grade 2). By the 1970's the need for plants was stated as "Without green plants, all of the animals on Earth-including human beings- would starve to death" (Ginn, 1973, p. 2, grade 5). The textbook went further to state that "Although man depends on green plants for his food, green plants do not depend on man" (Ginn, 1973, p. 46, grade 5). One common practice in discussing the use of plants as food was labeling what parts of the plants we eat. This was seen at some point in all grade levels and in all decades.
Table 3
The Occurrence of Sub-Components by Publishers for all Textbooks

<table>
<thead>
<tr>
<th>Anthropocentric Sub-components</th>
<th>Ecocentric Sub-components</th>
</tr>
</thead>
<tbody>
<tr>
<td>Publisher (Number of Books)</td>
<td>Humans use plants</td>
</tr>
<tr>
<td>ABC (17)</td>
<td>4 (24%)</td>
</tr>
<tr>
<td>Alyn &amp; Bacon (14)</td>
<td></td>
</tr>
<tr>
<td>Bobbs-Merrill (23)</td>
<td>10 (44%)</td>
</tr>
<tr>
<td>Ginn (42)</td>
<td>41 (68%)</td>
</tr>
<tr>
<td>Harcourt Brace, HBJ (23)</td>
<td>18 (87%)</td>
</tr>
<tr>
<td>Heath (25)</td>
<td>18 (72%)</td>
</tr>
<tr>
<td>Laddaw, Leckiew-Macmillan (29)</td>
<td>8 (35%)</td>
</tr>
<tr>
<td>Macmillan (27)</td>
<td>12 (44%)</td>
</tr>
<tr>
<td>McGraw-Hill (7)</td>
<td>7 (100%)</td>
</tr>
<tr>
<td>Scott-Foresman (28)</td>
<td>14 (50%)</td>
</tr>
<tr>
<td>Scribner (8)</td>
<td>7 (68%)</td>
</tr>
<tr>
<td>Silver Burikes (29)</td>
<td>18 (57%)</td>
</tr>
</tbody>
</table>
Clothes, medicine, dyes, and shelter were other ways that were cited as ways humans use plants. Less cited topics were use as paper, furniture, and fuel. Plants that were usually discouraged, especially in gardens, were the weeds. As early as the 1930's and the first grade level, weeds were "not friends of a garden...we are not going to have them in our garden" (Ginn, 1933, p. 175, grade 1). In a 1960's textbook, weeds were viewed somewhat differently. The text had discussed protecting plants, but noted that some plants such as dandelions were not protected. It went on to say that "they grow where they do because they have become adjusted to living there" and went on to illustrate a garden that looked very nice, with no weeds, and then one that had a lot of weeds. Interestingly enough, the garden with the weeds also showed the most wildlife, such as birds and butterflies but was not discussed in the text (Ginn, 1965, p.166, grade 4).

Another topic of this sub-component was how and why humans protect plants. One early reference to this was in the 1930's where a textbook referred to wildflowers and how they had grown in large numbers but "thoughtless boys and girls as well as grown-ups have picked so many of the flowers that few were left to go to seed. Unless all join in protecting our wild flowers, many of the very loveliest kinds are soon going to disappear" (Ginn, 1932, p. 249, grade 4). Protecting trees was also an example of the sub-component: trees protect us from wind, give us shade, prevent erosion and preserve watersheds so that "the cutting away of forests are often the cause of great floods and droughts" (Ginn, 1932, pp. 287-301, grade 5). The text went on to point out that we have cut down more trees than we needed to cut down, and that we have set aside large stretches of forests for special protection from fires and careless cutting of
lumber. These topics were carried on throughout the grade levels and the decades.

Among other topics: flowers and other plants are pretty and make a home look nice; flowers and other plants smell good and some plants, such as dandelions, are soft; plants also help to keep the air fresh (Ginn, 1973, p. 156, grade 1); and, plants also provide oxygen and make the air fit for us to breathe (Ginn, 1932, p. 244, grade 4).

**Humans Use Animals**

The sub-component *humans use animals* was represented by citations at all grade levels, in all decades, by all publishers. The greatest percentage of books citing the sub-component occurred at Grade Level Four with 70% of the sample having some reference to *humans use animals* (Table 1) and Grade Levels Six and Two followed with 68% and 67% respectively. The lowest percentage of the sample with citations occurred at Grade Level One with 32% and was the only grade level under 50%.

Seventy-eight percent of the sample of textbooks for the 1940-1949 decade contained references which cited the sub-component *humans use animals* which dropped to 47% of the textbooks during the 1960-1969 decade (Table 2). Eighty-eight percent of the sample for Scribner and 86% of the sample for Ginn cited *humans use animals* (Table 3). Lower sample representation for *humans use animals* was seen with ABC at 29%.

Except for Grade Level One, with a low percentage of the sample presenting *humans use animals*, there were no outstanding trends at the grade levels (Table 1). At the decade level, the percentage of samples increased during the 1930's into the 1940's, with the 1940's being the highest, then
dropped into the 1950's, with a large drop into the 1960's (Table 2). There was a slight increase into the 1970's and back to 1950's levels in the 1980's. A similar trend was seen in the representation of humans use plants.

The topic most cited within textbooks for humans use animals was different from what was cited for humans use plants. For humans use plants, the topic of food and clothes was the most cited, and while that topic was often referred to in textbooks for humans use animals, it was not the most predominant. For humans use animals the most cited relationship by textbooks for humans concerned animals as enemies or friends on varying levels.

This portrayal of animals as friends or enemies started as early as 1933 in the first grade level with the representation of some worms as friends of the garden and some insects as enemies. This text went on to describe robins and toads as friends since they ate insects and other enemies of the garden (Ginn, 1933, 167-189, grade 1). Much of the portrayal of animals as enemies centered around insects. Early ways of controlling insects were by using other friends such as toads and birds. One textbook asked students to respond to the question: do "they (the insects) hate man?" (Ginn, 1932, 342, grade 5). This book was also the first to mention the use of poison to control insects (Ginn, 1932, p.370, grade 5). The concern for the use of poison was stated in a 1946 textbook where the question was asked "will the use of DDT to kill insects make new problems for mankind?" (Ginn, 1946, 139, grade 6). The topic of insects as enemies or as harmful dropped off in the 1970's and into the 1980's, as well as did the examples of control methods used on insects.

Textbooks also referred to pests or enemies that dealt with changing attitudes towards some animals that had been considered pests in the past, such as hawks and skunks. "Some people have been enemies to some helpful
animals without knowing that these animals were helpful. Skunks, hawks, crows and owls have been used very badly....Now that people are learning that skunks, owls and hawks do more good than harm, they will protect them instead of killing them" (Ginn, 1940, pp. 130-2, grade 3).

Endangering animals by human carelessness was also presented in the textbooks as a topic of humans use animals. One text stated that "although people are great friends to animals, they are also great enemies. Hunters, trappers and fishermen have done more toward destroying many kinds of animals than all their other enemies put together" (Ginn, 1932, p.127, grade 3). The textbook went on to point out that when "people finally found out that their pleasures and some kinds of work were taking the lives of a great number of useful animals, they began to feel worried and very much ashamed" (Ginn, 1932, p. 139, grade 3). This moved past just hunting to asking questions such as "how can we develop responsibility for living things?" (Ginn, 1965, p. 20, grade 6). This text went on to extend the causes for extinction to "changes in habitat, competing animals, and pollution have also helped..." (Ginn, 1965, p. 284, grade 6). An interesting pre-Endangered Species Act citation looked at this attitude towards saving species:

As you have been reading did you sometimes wonder why all the effort was made to save a species? If you should read in the morning paper that the last polar bear had died, would it bother you? Polar bears are a part of our environment. Their loss would leave a vacant spot. No longer would the environment be as complete as it is now. It is difficult to say what the value of any of the animals on the endangered list is. Neither can a price tag be placed on wildlife in the environment. All are needed. And all are worth the time, money and effort it takes to save them.(Ginn, 1965, pp. 288-9, grade 6)

Other topics for the sub-component humans use animals included the use of animals for food, clothes, and shelter. Transportation was a topic not
seen with plants but was for *humans use animals*. Domestic animals such as cows and pets such as dogs were also mentioned as being useful to humans. Another reference to animals, humans, and food dealt with feeding animals, at bird feeders, in sanctuaries and on farms. In these sanctuaries and parks, it was stated that the animals are also safe from humans.

**Humans Cause Pollution**

The sub-component *humans cause pollution* was represented by citations in textbooks at all grade levels, in all decades, and by all but one publisher—Scribner. The greatest percentage of textbooks citing the sub-component occurred at Grade Level Four, though all grade levels were very close, ranging from 25% of the sample at Grade Level Two to 33% of the sample at Grade Level Four (Table 1). Six percent of the sample for the 1930's contained references which cited the sub-component *humans cause pollution* which rose to 50% during the 1980's (Table 2). Publisher references to *humans cause pollution* varied from 0% for Scribner to 57% for McGraw-Hill and Ginn with 48% (Table 3).

Trends for this sub-component were not apparent for the grade levels with all being from 25% to 33% of the sample. Decade level sample percentages rose from the 1930's through the 1950's, dropped during the 1960's, and then began rising again into the 1980's.

Air pollution had the earlier citations, its first reference being in 1932. Smoke, dust, and soot and the effect these had on plants was the main focus of this citation (Ginn, 1932, pp. 252-5, grade 5). The source of this dust and soot was given by the textbooks as chimneys, which is why cities were so dirty. Factories finally were mentioned as one of the sources for dirty air in the 1950's.
(Ginn, 1954, p.27, grade 1). This text had an illustration showing factories with dirt and smoke coming out of their chimneys. Air pollution was identified as a problem only for the cities. Citations noted that burning coal will put soot, ash and harmful gases into the air and that this is important because impurities are often carried from one community to another as the air moves (Ginn, 1954, p. 275, grade 6). Later textbooks asked students to identify sources of pollution and indicate some solutions used to clean up the air. Insecticides and other chemicals also were cited by textbooks as contributing to air pollution.

Water pollution appeared in textbooks starting in 1940. Wastes from mills, factories, mines, and wastes from oil refineries that were sometimes being dumped into rivers which destroyed water life was the topic of that textbook (Ginn, 1940, p. 243, grade 6). Illustrations often contrasted either a dirty stream or lake, with dead fish and no one playing around it, with one that was clean and had many people enjoying recreational opportunities (Ginn, 1954, p. 106, grade 3). Population increases and industrialization were cited by textbooks as one reason for water pollution and the need to treat sewage before it is dumped into the water (Ginn, 1954, p. 267, grade 6). The cost of water pollution and Lake Erie's pollution were mentioned in 1973 with "it's very expensive to stop pollution and to start cleaning up lakes and rivers that are already polluted. But, if we don't control pollution, the consequences will be much more expensive" (Ginn, 1973, p. 269, grade 6).

Humans Change Ecosystems

The sub-component *humans change ecosystems* was represented by citations in textbooks at all grade levels, in all decades, by all but two publishers—McGraw-Hill and Scribner. The greatest percentage of the sample
of books with citations occurred at Grade Level Six with 39% (Table 1) and Grade Level Five followed with 33%. The lowest percentage of books which cited this sub-component occurred at Grade Levels One and Two with 2% and 4% respectively, of the sample containing some reference.

Twenty-seven percent of the sample of textbooks during the 1980's contained references which cited the sub-component which dropped to 6% of the sample during the 1930's (Table 2). There was an increase in the percentage of the sample that contained references which cited humans change ecosystems during the 1940's and 1950's with a decline into the 1960's and an increase during the 1970's into the 1980's. Forty-eight percent of the sample from Ginn contained references which cited the sub-component which was followed by Harcourt-Brace-Jovanovich with 41% of the sample reporting citations of the sub-component (Table 3).

Trends at the grade level showed an increase from Grade Level One up to Grade Level Six with a large change from Grade Level Two to Three. Trends at the decade level showed an increase from the 1930's through the 1950's, a decline into the 1960's and then an increase up through the 1980's. No trends were found for the publishers.

One type of change was represented by humans moving plants and animals from one ecosystem to another or changing where plants and animals live: "We can not go on upsetting things as we are doing and expect our wildlife to live through it. Every change that is made by man in field or forest or stream affects the wildlife in that place" (Ginn, 1940, p. 288, grade 4). Other changes to wildlife included what was previously there and what was brought in. "When this land was forest area many years ago, there were no ...domesticated animals. They were brought by men to this farm land. Forest animals, such as
foxes...lived here once. Now there is no longer a place for these animals in this farm community...." (Ginn, 1954, p. 229, grade 5).

Another type of change is change over the time that humans occupied an area. One example of the references was to changes made when the Europeans came to America. "America in 1492 was a huge storehouse for the people who came here from Europe to use. It was a land so full of riches that man could not imagine ever using them all. Only four hundred years and yet what changes have been made" (Ginn, 1940, p. 244, grade 4). Some of those changes are daily. "People make greater changes in their environment than any other living thing can. You are changing your environment every day. You change it when you make things or use them up. You change it when you plant things or dig them up" (Ginn, 1973, p. 25, grade 3).

Change of landscape was another topic of humans change ecosystems. These changes can be on a large or small scale. "What changes have people made in the land near you? Are there any new streets or roads? Have any new houses or other buildings been built? Are there plowed fields where trees once grew? Some changes you can see in your community may be small changes. People, however may make large changes in the surface of the land. They may change the land over many miles. Think how much of the land is changed when a dam is built across a large river" (Ginn, 1965, pp. 201-2, grade 3).

The last topic under humans change ecosystems deals with an attitude—whether change is good or bad. These citations refer to whether it is good for humans, such as "Not all the changes which are now taking place are to the advantage of the human race. Some of them may even threaten man's continued life" (Ginn, 1932, p. 427, grade 6). But generally, changes were seen as something that should be done to benefit humans. "Probably one of the most
important things man has learned is that he can change his community. He can change it for better or worse. This we know - the changes should always be the kind that benefit man" (Ginn, 1954, p. 276, grade 6). Change took on a world perspective in the 1980's. "We live in a time when it is impossible to carry on our lives without upsetting large parts of the environment. We change it in more ways than we know. And those changes affect people the world over. Humans make changes because they want to improve their lives. But sometimes a change backfires. It may end up that more harm has been done than good" (Ginn, 1980, p. 30, grade 6).

Humans Cause Habitat Destruction

The sub-component humans cause habitat destruction was represented by citations in the textbooks at all grade levels except Grade Level One. The highest percentages of the samples of textbooks that reported citations for this sub-component occurred at Grade Levels Three and Six with 39% (Table 1). The lowest percentage of the sample of textbooks with citations occurred at Grade Level Two at 4%.

All decades were represented with a percentage of the sample of textbooks citing humans cause habitat destruction. The highest percentages were during the 1930's and 1940's, with 39% and 38% respectively (Table 2). Percentages declined into the 1960's to a low of 11% and rose to 22% in the 1970's and 1980's. Textbooks from all the publishers contained citations for humans cause habitat destruction (Table 3). Forty-three percent of the sample for Ginn contained references which cited the sub-component which dropped to 9% of the sample for Laidlaw, Laidlaw-Macmillan.
Many of the early references to humans cause habitat destruction were to what farmers and pioneers had done in settling the land.

As he cultivated the land, the grazing grounds for buffaloes and deer were destroyed. The freedom of many animals was disturbed; they were killed by the hundreds. Towns and cities have destroyed many of the natural nesting places of birds. Forests have been destroyed and birds do not have as many places in which to live. They are not protected in the places that do remain. Swamps have been drained that were once places where birds could get food and find some protection. Man is just as careless in destroying plant life. But man has been very wasteful in cutting down the forests. He cut and burned great numbers of trees when he cleared the land for farming (Ginn, 1932, p. 212, grade 6).

Most of the descriptions of habitat destruction through the 1930's and 1940's parallel the above citation. Humans moved westward, plowed fields, cut trees, drained marshes, overgrazed grasslands and destroyed the homes of the wildlife. Protection and sanctuaries showed up at the end of the 1940's and into the 1950's. "We are still learning to protect wild animals in still another way. For a long time people destroyed the homes of animals. They did not mean to do this. They just didn't think….protect certain forest areas... set aside certain grasslands as grazing land for bison...special areas set aside for birds" (Ginn, 1954, pp. 267-8, grade 5). Questions about responsibilities began to appear in the 1970's:

Who is to regulate this abuse of the environment? Should it be the responsibility of the developer, the town's people or the state? It is easy to point an accusing finger after a deed has been done - whether the deed is strip mining, building a dam, the mass spraying of a forest, or destroying a marshland. Having enough knowledge to foresee what might happen is quite different. It is then up to us to decide what we want, and what we are willing to give up" (Ginn, 1973, p. 247, grade 6).

While the types of habitat destruction described varied little during the study period, discussion of the responsibility for such actions did change from humans did what they did because they didn't understand and had little choice
to asking questions of who is responsible and indicating that responsibility changes depending upon the issue.

Summary of Anthropocentric Sub-Components

The anthropocentric sub-components—humans use plants, humans use animals, humans cause pollution, humans change ecosystems, and humans cause habitat destruction—were found at all grade levels and in all decades, except for humans cause habitat destruction, which was not found at Grade Level One (Table 1). The higher percentages of the sample of textbooks containing citations occurred at the higher grade levels with the exception of the sub-component humans use plants which varied little throughout all grades.

These sub-components showed a decline in the percentage of samples containing citations into the 1960's, which may have been from the influence of the Post-Sputnik curriculum projects and the shift away from societal issues toward a "hard science" focus. These percentages increased again into the 1970's and 1980's (Table 2). These sub-components were also cited by most of the publishers except Scribner and McGraw-Hill (Table 3). The most consistently high percentage of the sample was for Ginn which cited all of the sub-components. Silver-Burdett, Scribner and McGraw-Hill were represented by high percentages for three of the five sub-components. ABC was represented with the lowest percentages of the samples with citations for all of the anthropocentric sub-components, though all were represented.
Ecocentric Sub-Components

Humans Compete with Other Components of the Ecosystem

The sub-component *humans compete with other components of the ecosystem* was represented by citations in the textbooks in four of the six grade levels, with Grade Levels One and Three not having any citations (Table 1). The highest percentage of the books citing competition occurred at Grade Level Five with 7% of the sample containing some reference to the sub-component. This sub-component was cited once in the 1930's with no citations in the 1940's and 1950's, then increased into the 1960's and 1970's, followed by a decrease into the 1980's (Table 2). The highest percentage of the textbooks with citations occurred in the 1970's at 7%. Only four publishers included citations for *humans compete with other components of the ecosystem*, with Silver Burdett the highest at 21% (Table 3).

While Craig never used the word "competition", one citation asked whether "man likes or needs some of the same things that insects do?" (Ginn, 1932, p. 342, grade 5). Other citations concerning animals included a very clear reason that humans call some animals enemies. They use our food for energy but does that make them enemies? (Silver Burdett, 1965, grade 2). Another reason animals are pests is because they compete with us (Silver Burdett, 1975, grade 3). One textbook asked the question as to whether humans have increased the competition between plants and animals (ABC, 1972, grade 5).

Humans are a Component of the Food Chain / Web

The sub-component *humans are a component of the food chain / web* was represented by citations in the textbooks in Grade Levels Two through Six.
(Table 1). The highest percentages of the samples citing this sub-component occurred at Grade Levels Four and Six with 7%. The percentages of the textbooks with citations were higher in the 1930's and 1940's, and then declined into the 1950's (Table 2). These percentages increased into the 1960's, with the highest occurring in the 1970's at 9%, then declined into the 1980's back to 1%. Six publishers made reference to *humans are a component of the food chain / web* (Table 3). The publisher with the highest percentage was Ginn with 17%.

An early example of *humans are a component of the food chain* was in a children's nursery rhyme cited by one of the textbooks:

> The House That Jack Built  
> These are the plants the sun made;  
> These are the boys who ate the plants the sun made.
>  
> These are the plants the sun made;  
> This is the cow which ate the plants the sun made;  
> These are the children who drank the milk that came from the cow which ate the plants the sun made (Ginn, 1932, p. 56, grade 3).

Illustrations of the poem were also shown. Later textbooks added the terms "producers" and "consumers". "When you eat the chicken, you are also a consumer. Such a series of producers and consumers is often called a food chain" (Ginn, 1965, p. 34, grade 6). Food chains and nutrient cycles were related and showed humans as the meat-eaters (Ginn, 1973, pp. 338-340, grade 5). Food pyramids were also illustrated with humans at the top. Though it is stated that humans would lose less energy eating plants instead of meat, the food chains and pyramids illustrated humans at the top, as meat eaters (Ginn, 1980, p. 21, grade 6).
Humans are Dependent / Interdependent with the Ecosystem

Textbooks with citations for the sub-component *humans are dependent / interdependent with the ecosystem* were found only at Grade Levels Four through Six (Table 1). The highest percentage of the sample of textbooks with citations was 20% at Grade Level Four. Textbooks with citations for the sub-component were found in all decades except the 1950's (Table 2). The highest percentages of the textbooks citing this sub-component occurred during the 1940's and 1970's at 13%. These percentages increased through the 1940's, then dropped to 0% during the 1950's, increased through the 1970's and then declined into the 1980's. Seven publishers published textbooks with citations for the sub-component with Harcourt, Brace & Jovanovich the highest at 26%, followed by Ginn at 17% (Table 3).

Dependence / interdependence was stated usually in this manner: "Are you dependent only on people? No, there are many things in both the living and non living world that contribute to your welfare. How many things other than people can you think of that contribute to your welfare? "(Ginn, 1965, p. 263, grade 6). Many of the textbooks were very straightforward and made statements such as "we depend on the food made by green plants" or "humans depend on other animals and plants for their survival". One statement made in 1966 said that when scientists learn how green plants make their own food people may no longer have to depend on green plants for food (Macmillan, 1966, grade 4). Interdependence was found in a 1980 textbook which stated that people are interdependent with their environment (HBJ, 1980, grade 6).

Humans are Part of the World Ecosystem

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The sub-component *humans are part of the world ecosystem* was represented by citations in the textbooks at Grade Levels Three through Six (Table 1). The highest percentage of textbooks citing this sub-component occurred at Grade Level Six, with 11% of the sample referring to the world ecosystem. References to the sub-component were found only in the 1960's, 1970's, and 1980's with the highest percentage in the 1980's at 9% (Table 2). Six publishers published textbooks that referred to *humans are part of the world ecosystem* with the highest percentage for McGraw-Hill at 14% (Table 3).

The statement that "we are all part of the same community" was found in a 1973 textbook when it was stated that "all living things are part of your community" (Ginn, 1973, p. 5, grade 3). A further extension asked the question as to whether or not humans can build a community, and used examples of a farm or your neighborhood (Ginn, 1980, pp. 6-7, grade 5). Examples of other citations included "our life depends on the world ecosystem" and "we are the only living thing that can live almost anywhere in the world ecosystem" (HBJ, 1972, grade 6).

**Humans Influence the Balance of Ecosystems**

References to *humans influence the balance of ecosystems* were found at Grade Levels Four through Six with the highest percentage found at Grade Level Six with 21% (Table 1). Textbooks containing citations of the sub-component were found for all decades with the highest percentage in the 1940's at 19% (Table 2). Percentages of the sample with citations remained low for the rest of the study period. The sub-component was represented by citations from all but two publishers, Heath and McGraw-Hill, with Scribner having the highest percentage at 25% (Table 3).
The sub-component *humans influence the balance of ecosystems* was represented by citations in early textbooks. "When the balance of living things is upset rather badly, it is usually because of something man has done" (Ginn, 1932, p. 210, grade 6). Many of the citations of the sub-component dealt with habitat destruction, pollution, or introduction of species, by humans not behaving as part of the ecosystem. "Man unbalances nature by cutting down trees, draining swamps, building cities, putting sewage into lakes and streams and by killing large numbers of animals" (Scribner, 1941, pp. 304-5, grade 4). How upsetting balances may affect humans was described in one textbook as follows:

...when man makes changes in the community balance, he must be sure that they will be to his advantage. If not, he may regret them. Man has put his understanding of community balance to work for him in many ways. He has come to realize that it is probably the only effective way of controlling the communities of plants and animals which surround him (Ginn, 1954, p. 163, grade 6).

**Summary of Ecocentric Sub-Components**

The ecocentric sub-components-- *humans compete with other components of an ecosystem, humans are a component of food chains / webs, humans are dependent / interdependent with the ecosystem, humans are part of the world ecosystem, and humans influence the balance of ecosystems* -- were represented by citations mostly at Grade Levels Four through Six, with no representation occurring at Grade Level One and most of the citations occurring at Grade Level Six (Table 1). The citations for the sub-components *humans are dependent / interdependent with ecosystems* and *humans influence the balance of ecosystems* were represented by higher percentages of the sample.
These sub-components were represented by citations from the 1960's through the 1980's, with the highest percentage of the sample occurring in the 1970's except for *humans influence the balance of ecosystems*, which was the only sub-component with any citations during all the decades (Table 2). Only one sub-component was represented by citations in the 1950's with little coverage in the 1930's and 1940's. Scant coverage before the 1970's may be due to how these sub-components were perceived by the public before the start of the environmental movement in the 1970's.

Publisher coverage of these sub-components varied considerably (Table 3). Ginn was represented by consistently high percentages of the sample overall with citations for all of the sub-components and Silver-Burdett, Harcourt / Brace / Jovanovich and Bobbs-Merrill, Merrill were represented by citations for four of the five sub-components. Only four publishers published textbooks with citations for the sub-component *humans compete with other components of the ecosystem*. The most complete coverage was for the sub-component *humans influence the balance of ecosystems* with only two publishers not publishing any textbooks with citations.

**No Mentions of the Principle: Humans as a Component of the Ecosystem**

Textbooks were found at all grade levels that lacked references to the principle *humans as a component of the ecosystem*. The highest percentage of textbooks with no references was found at Grade Level One with 31% of the sample containing no reference to the principle (Table 1). Percentages of the samples of textbooks with no references decreased as the grade level increased, except for a slight increase at Grade Level Five. Textbooks with no references to the principle *humans as a component of*
the ecosystem were also found during all decades, with the highest percentage occurring during the 1960's at 31% (Table 2). More of the textbooks contained references to the principle in the 1970's and 1980's as the percentage of textbooks with no references decreased to 8% during the 1980's. Percentages were also higher during the 1930's and decreased for the 1940's and 1950's. Ginn, McGraw-Hill and Scribner were the only publishers with textbooks that cited the principle in all of the textbooks they published. The publisher with the highest percentage was ABC at 47% of the textbooks having no references to humans as a component of the ecosystem.

Analysis By Decade

1930-1939

Figure 1: Comparison of the cumulative percentages of the samples for each grade level that had citations for each of the sub-components for the decade of 1930-1939.

Texts from only four publishers were available for the 1930's with a total sample of 18 textbooks (Table 10). These publishers were Allyn and Bacon,
Ginn, Macmillan, and Scott-Foresman. Five of these textbooks contained no mention of the principle **humans as a component of the ecosystem**. All sub-components were mentioned in the 1930's except for **humans are part of the world ecosystem**.

Texts for Grade Levels One and Two concentrated on **humans use plants** and **humans use animals** (Figure 1). These citations were on the order of "we eat the seeds, leaves, roots, stems, flowers and buds "(Ginn, 1932, p. 80, grade 2). Gardens were a topic for Grade Level One. There were also references during this time to Native Americans; many comparisons were made between the Native Americans and those who came after. Among such citations were "Indians had used porcupine quills to embroider beautiful designs for headbands and bags for arrows. ...Indians eat the flesh of porcupines but white people have little use for it " (Ginn, 1932, pp. 204-207, grade 2).

Grade Level Three texts added **humans cause habitat destruction** and **humans are a component of food chains / webs**. Grade Level Four texts contained citations for only three of the four mentioned sub-components, with no citations for **humans are a component of food chains / webs**.

**Humans cause pollution, humans compete with other components of the ecosystem**, and **humans are dependent / interdependent with the ecosystem** were added to the previous sub-components at the fifth grade level. Saving trees and wildflowers for their aesthetic and economic value was a central theme at this grade level. Wetland drainage for the growing of crops was cited. Wetlands, along with deserts, were seen as useless until humans came and either drained or irrigated them.

**Humans influence the balance of ecosystems and humans change ecosystems** were sub-components addressed at the sixth grade level, along
with the humans use plants, animals, and humans cause habitat destruction. Even this early it was recognized that "not all the changes which are now taking place are to the advantage of the human race" (Ginn, 1932, p. 427, grade 6).

The anthropocentric sub-components were covered by more of the grade levels than the ecocentric sub-components, none of which were mentioned at more than one grade level, if at all.

1940-1949

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<td>G.L. 2, 3, 4, 6</td>
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<tr>
<td>Competition</td>
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<td>Plants</td>
<td>G.L. 1, 2, 3, 4, 5, 6</td>
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Figure 2: Comparison of the cumulative percentages of the samples for each grade level that had citations for each of the sub-components for the decade of 1940-1949.

Again, only four publishers accounted for a sample of 32 textbooks (Table 11). All sub-components except humans compete with other components of the ecosystem and humans are part of a world ecosystem were addressed during this decade. Only two textbooks did not contain mention of the principle humans as a component of the ecosystem. All publishers
addressed *humans use plants, humans use animals,* and *humans cause habitat destruction.*

Grade Level One texts covered only the sub-components *humans use plants* and *humans use animals* (Figure 2). There were some references to gardens and to how gardens give humans food, and that some animals and plants are friends and some are enemies of gardens. Grade Level Two texts added *humans cause pollution* to the previous sub-components. Numerous animals were cited as helpful or harmful to humans, such as "skunks are good friends of the farmer...worms are eaten skunks...worms get into the farmers' wheat, grasses and corn" (Ginn, 1940, p. 275, grade 2). Pollution in the form of dirty air from burning coal was cited.

Citations for *humans change ecosystems* were added to Grade Level Three texts. Native Americans and the European settlers were not contrasted now, but seen as having similar goals. "The Indians and the early white people to come to America used to shoot wild turkeys for food...shot deer for food and had many uses for the skins" (Ginn, 1940, p. 130, grade 3).

*Humans influence the balance of ecosystems, humans are dependent / interdependent with the ecosystem, humans change ecosystems,* and *humans cause pollution* were all new sub-components during this decade for Grade Level Four texts. *Humans cause habitat destruction* was mentioned in great detail-- destruction of grasslands, forests, overgrazing, and draining of swamps were described.

Grade Level Five texts added as new sub-components *humans change ecosystems, humans are part of the food chain / web,* and *humans influence the balance of ecosystems.* Grade Level Six texts contained references to *humans cause pollution* and *humans are dependent / interdependent with the*
ecosystem, in addition to the sub-components mentioned in the earlier decade. Pollution went beyond dirty smoke to the "wastes from mills, factories, mines and oil refineries...streams have been used for dumping grounds" (Ginn, 1940, p. 243, grade 6).

The anthropocentric sub-components continued to be represented by an increase in coverage during this decade and there were new additions to several grade levels. The ecocentric sub-components also were represented by an increase in coverage for more grade levels, but lost coverage for the sub-component _humans compete with components of the ecosystem_. A higher percentage of the texts were represented by citations of the principle _humans as a component of the ecosystem._

1950-1959

![Diagram showing comparison of the cumulative percentages of the samples for each grade level that had citations for each of the sub-components for the decade of 1950-1959.](image)

Figure 3: Comparison of the cumulative percentages of the samples for each grade level that had citations for each of the sub-components for the decade of 1950-1959.
Six publishers contributed 28 textbooks to the sample for this decade (Table 12). Three textbooks in that sample made no mention of the principle **humans as a component of the ecosystem**. All publishers made reference to **humans use plants** and **humans use animals**. None of the textbooks referred to **humans compete with other components of the ecosystem**, **humans are part of the food chain / web, humans are dependent / interdependent with the ecosystem**, and **humans are part of the world ecosystem**, all ecocentric sub-components.

Grade Level One texts made reference to the same sub-components as the previous two decades (Figure 3). Caring for plants and animals was a dominate topic. Grade Level Two texts added the sub-component **humans change ecosystems**. Caring for plants and animals continued and pollution was described only as dirty air from factories.

One sub-component which was represented by citations in the previous two decades but not recorded in this decade and the next ones in Grade Level Three texts was **humans are part of the food chain / web**. Another sub-component that was not mentioned during this decade was **humans change ecosystems**. That paper and garbage in streams causes water pollution was discussed at this level. Grade Level Four texts lacked citations for the previously mentioned sub-components **humans cause habitat destruction**, **humans are dependent / interdependent with the ecosystem**, and **humans influence the balance of ecosystems** during this decade.

Grade Level Five texts no longer contained references to two of the sub-components from the previous decade, **humans are part of the food chain / web** and **humans are dependent / interdependent with the ecosystem**. All of the other sub-components continued to appear. Protection of plants and animals
was stressed. Only one of the sub-components in the Grade Level Six texts ceased to be cited during this decade, *humans are dependent / interdependent with the ecosystem*. Pollution was discussed in great detail at this grade level.

The anthropocentric sub-components were represented extensively by citations during this decade, though the percentages of the samples containing references did drop. The ecocentric sub-components were represented with very little coverage, and *humans influence the balance of ecosystems* the only one that was cited. Most of the texts in the sample contained some reference to the principle *humans as a component of the ecosystem*.

![Figure 4: Comparison of the cumulative percentages of the samples for each grade level that had citations for each of the sub-components for the decade of 1960-1969.](image)

Nine publishers provided the sample for this decade, with 62 textbooks (Table 13). All sub-components were represented, but 18 textbooks contained no reference to the principle *humans as a component of the ecosystem*. 

81
Humans use plants and humans use animals were referred to by all publishers during this decade. This is the first decade that humans are part of the world ecosystem was mentioned. All references to Native Americans and the coming of the "white man" were gone by this decade.

The first reference to humans cause pollution in Grade Level One texts occurred during this decade (Figure 4). The second highest level of no mention of the principle humans as a component of the ecosystem occurred during this decade with 56% of the sample lacking citations. Humans are part of the food chain/web and humans compete with other components of the ecosystem were cited for the first time at this grade level during this decade. The second highest level of no references also occurred for Grade Level Two texts during this decade at 25%. Most references to plants and animals were in growing gardens and farming.

Grade Level Three texts introduced no new sub-components during this decade, though the sub-component humans change ecosystems reappeared after a one decade absence. This decade tied for the highest percentage of the sample, 50%, having no references to the principle humans as a component of the ecosystem. Pollution by factories and cars was discussed in detail at this grade level with a reference to smog.

Humans compete with other components of the ecosystem was first cited during this decade in Grade Level Four texts. Protecting plants and animals was cited at this grade level. Several sub-components were cited again during this decade after an absence during the previous decade-- humans cause habitat destruction, humans are dependent/interdependent with the ecosystem, and humans influence the balance of the ecosystem.
Grade Level Five texts introduced *humans are a part of the world ecosystem* during this decade. The 1960's were represented by the highest percentage, 30%, of no mentions of the principle *humans as a component of the ecosystem for this grade level*.

All sub-components were referred to during this decade in the Grade Level Six texts. All forms of pollution were discussed at this grade level. The first ecosystem-oriented approach to food chains and humans was discussed where all components of food chains were shown with humans shown as consumers. *Humans compete with other components of the ecosystem, humans are part of the food chain / web, and humans are part of the world ecosystem* were first cited at this grade level during the 1960's.

The 1960's were represented by the lowest percentage of the sample with citations of the sub-components of all of the decades for the anthropocentric sub-components except for *humans cause habitat destruction*. There were also a higher percentage of texts with no references to the principle *humans as a component of the ecosystem*. References to the ecocentric sub-components increased in coverage from the previous decade.

1970-1979

Eight publishers provided the sample of 55 textbooks for this decade (Table 14). All sub-components were referred to during this decade. References to *humans use plants, humans use animals, and humans cause pollution* were made by all the publishers. *Humans cause habitat destruction* and *humans change ecosystems* were referred to by all but one of the publishers. The principle *humans as a component of the ecosystem* was not mentioned in 26% of the textbooks.
Grade Level One texts were represented by the highest percentage of no references to the principle **humans as a component of the ecosystem** during this decade at 71% (Figure 5). There were no changes in the sub-components covered by the previous decades at this grade level. There were also no changes in the sub-components cited during this decade in comparison to the previous ones for the Grade Level Two texts. The highest percentage, 40%, of no mentions of the principle **humans as a component of the ecosystem** occurred during this decade for this grade level. Many references asked students "how do you feel about" questions, such as "How do you feel about picking flowers in a park?" (Ginn, 1973, p. 215, grade 2).

Grade Level Three texts also contained no changes in the representation of the sub-components from the previous decades except that all textbooks in the sample contained some reference to the principle **humans as a component of the ecosystem**. Changes in the water, the air, and the
environment, and how those changes affected the environment, formed many of the citations. Grade Level Four texts introduced *humans are part of the food chain/web* during this decade. There were no other changes.

Grade Level Five texts reintroduced *humans compete with other components of the ecosystem* and *humans are a part of the food chain/web* after they were absent for several decades. All sub-components were again cited in the Grade Level Six texts. Strip mining was cited as one form of habitat destruction for the first time.

The percentage of texts containing citations to the anthropocentric sub-components increased during this decade, though not to the previous high levels of the 1940's and 1950's. The ecocentric sub-components continued to increase in percentage of the sample containing citations and were represented at more grade levels. Texts with no mentions of the principle *humans as a component of the ecosystem* continued to be higher than the 1940's and 1950's.

1980-1989

This decade was represented by eight publishers and a sample of 75 textbooks (Table 15). Four textbooks made no mention of the principle *humans are a component of the ecosystem*. Four of the sub-components, *humans use plants*, *humans use animals*, *humans cause pollution*, and *humans cause habitat destruction* were cited by all of the publishers. *Humans change ecosystems* was cited by all but one of the publishers.

Grade Level One texts first referenced the sub-component *humans change ecosystems* during this decade (Figure 6). There were no other
changes in the sub-components previously reported at this grade level. One new sub-component was first referenced during this decade in the Grade Level Two texts—humans cause habitat destruction. Two sub-components mentioned during previous decades were absent during this decade—humans compete with other components of the ecosystem and humans are a part of food chains/webs.

![Bar chart showing sub-components for each grade level.]

Figure 6: Comparison of the cumulative percentages of the samples for each grade level that had citations for each of the sub-components for the decade of 1980-1989.

One new sub-component was first referenced in the Grade Level Three texts during this decade—humans are part of the world ecosystem. No other changes were seen. Grade Level Four texts also contained the first references to humans are part of the world ecosystem during this decade. Humans compete with other components of the ecosystem was absent after being cited during the previous two decades.
No new sub-components were referenced in the Grade Level Five texts, though several were absent after several decades of citations—*humans are a part of food chains/webs, humans are dependent/interdependent with the ecosystem, and humans influence the balance of ecosystems*. Grade Level Six texts contained citations for all of the sub-components except for *humans compete with other components of the ecosystem*.

The most complete coverage was for the anthropocentric sub-components during this decade when both grade levels and percentage of sample with citations are considered. Representation of the ecocentric sub-components was less after better representation the previous two decades. The coverage of the principle *humans as a component of the ecosystem* increased from the previous two decades with most of the texts referring to this principle.

**Summary of the Decades**

The anthropocentric sub-components were represented by citations during the 1930's in more of the grade levels than the ecocentric sub-components, which were only referenced at one grade level. The anthropocentric sub-components increased in coverage during the 1940's and citations were added at several grade levels. The ecocentric sub-components continued increased in percentage of citations for the 1940's at more grade levels, but lost representation for the sub-component *humans compete with components of the ecosystem*. A higher percentage of the texts contained references to the principle *humans as a component of the ecosystem*.

The anthropocentric sub-components were represented during the 1950's, though the percentages of the samples containing references did drop.
The ecocentric sub-components continued to be scant, with *humans influence the balance of ecosystems* the only sub-component that was cited. Most of the texts in the sample contained some reference to the principle *humans as a component of the ecosystem*.

The 1960's was represented by the lowest percentage of the sample with citations of the sub-components of all of the decades for the anthropocentric sub-components except for *humans cause habitat destruction*. There was also a higher percentage of texts with no references to the principle *humans as a component of the ecosystem*. The ecocentric sub-components were represented by citations increased in coverage from the previous decade.

The percentage of texts that contained citations for the anthropocentric sub-components increased during the 1970's, though not to some of the previous high levels noted in the 1940's and 1950's. The ecocentric sub-components continued to increase in coverage with an increase in percentages of the sample with citations or by an addition of grade levels with references. Percentages of texts with no references of the principle *humans as a component of the ecosystem* were higher than during the 1940's and 1950's.

The anthropocentric sub-components received the most complete coverage during the 1980's when both grade levels and percentage of sample with citations are considered. The coverage of the ecocentric sub-components fell after greater representation during the previous two decades. The coverage of the principle *humans as a component of the ecosystem* increased from the previous two decades, with most of the texts having some references to the principle.
Analysis by Grade Level

Grade Level One

The sample contained 45 textbooks at Grade Level One over the study period (Figure 7). *Humans use plants* and *humans use animals* were referenced during all decades. The sub-component *humans cause pollution* was represented by citations during the last three decades and the sub-component *humans change ecosystems* was represented by citations only during the 1980's. The highest percentages of no mention of the principle *humans as a component of the ecosystem* occurred during the 1970's at 71% and the 1960's at 56% with the lowest percentage during the 1940's at 0%. All citations for Grade Level One were found within the anthropocentric sub-components.

Figure 7: Comparison of the cumulative percentages of the samples for each decade that had citations for each of the sub-components for Grade Level One.
Eight publishers published three or more textbooks for Grade Level One and were considered in the publisher analysis (Table 16). Textbooks from Macmillan contained no mention of the principle **humans as a component of the ecosystem**. Seventy-five percent of the textbooks from Laidlaw, Laidlaw-Macmillan also made no reference to the principle at this grade level. Ginn was the only publisher that referenced all four cited sub-components at this grade level.

Thirty-one percent of the texts at this grade level made no reference to the principle **humans as a component of the ecosystem**. There was also a total absence of representation of the ecocentric sub-components and some anthropocentric sub-components. Textbooks at this grade level offered little to no grounding in the principle. **Humans use animals** and **humans use plants** were the only sub-components that were represented throughout the study period at this grade level.

**Grade Level Two**

The sub-components **humans use plants** and **humans use animals** were represented by citations during all decades in the Grade Level Two texts (Figure 8). A sample of 48 textbooks were reviewed for this grade level. **Humans influence the balance of ecosystems, humans are part of the world ecosystem, and humans are dependent / interdependent with other components of the ecosystem** were sub-components not found at this grade level. The sub-component **humans cause pollution** was represented by citations during all decades except the 1930's. Forty percent of the sample for the 1970's made no mention of the principle **humans as a component of**
the ecosystem; the 1960's followed with 25%, with all of the sample from the 1930's referencing the principle.

Eight publishers published three or more textbooks at Grade Level Two to comprise the sample for publishers (Table 17). The sub-components humans use plants and humans use animals were represented in textbooks by all publishers. Sixty percent of the textbooks from Laidlaw, Laidlaw - Macmillan, and Scott Foresman made no mention of the principle humans as a component of the ecosystem.

Though 21% of the sample made no reference of the principle, there was an increase in the representation at Grade Level Two of the principle humans as a component of the ecosystem. All anthropocentric sub-components, and two ecocentric sub-components were represented by citations, though humans use plants, humans use animals, and humans cause pollution
received the most complete coverage through the study period. Many of the sub-components were not represented by citations until the 1950's.

**Grade Level Three**

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Figure 9: Comparison of the cumulative percentages of the samples for each decade that had citations for each of the sub-components for Grade Level Three.

All but three sub-components—*humans compete with other components of the ecosystem, humans influence the balance of ecosystems, and humans are dependent/interdependent with the ecosystem*—were represented by citations in Grade Level Three texts (Figure 9). A sample of 44 textbooks were reviewed at Grade Level Three; eight of those textbooks contained no references that mentioned the principle *humans as a component of the ecosystem.* Fifty percent of the textbooks in the 1930's and the 1960's made no mention of the principle with all textbooks from the 1940's and the 1970's referencing the principle. *Humans use plants, humans use animals, and humans cause habitat destruction* were represented by citations in all decades.
Eight publishers published three or more textbooks in the sample for Grade Level Three (Table 18). No sub-component was represented by citations by all publishers. *Humans use plants* and *humans change ecosystems* were cited by all but one of the publishers. Textbooks published by Harcourt-Brace-Jovanovich, Heath, and Silver-Burdett contained citations for all anthropocentric sub-components. Only two ecocentric sub-components were represented by citations in textbooks published by Ginn and Heath—*humans are part of the food chain/web* and *humans are part of the world ecosystem*.

Three anthropocentric sub-components were represented by citations at Grade Level Three during all decades. Only two ecocentric sub-components were represented by citations—*humans are part of the food chain/web* in the 1930's and 1940's and *humans are part of the world ecosystem* in the 1980's.

**Grade Level Four**

All sub-components were represented by citations during at least one of the decades at this grade level (Figure 10). The sample reviewed consisted of 47 textbooks, six of which made no mention of the principle *humans as a component of the ecosystem*. *Humans use plants* and *humans use animals* were represented by citations during all decades. Citations of *humans cause habitat destruction, humans cause pollution, and humans change ecosystems* occurred in five of the six decades. This was the first grade level that all ecocentric sub-components were represented by citations, though the majority of these citations did not occur until the 1960's or later.

Eight publishers published three or more textbooks in the sample for Grade Level Four (Table 19). Textbooks from Silver-Burdett contained citations to all but one sub-component—*humans are a part of the world ecosystem.*
Humans use animals and humans cause pollution were represented by citations by all publishers. Humans use plants was represented by citations by all publishers except Laidlaw, Laidlaw-Macmillan. Four publishers—Ginn, Harcourt-Brace-Jovanovich, Scott-Foresman, and Silver-Burdett—published textbooks that referred to all five anthropocentric sub-components. Two ecocentric sub-components were represented by citations by only one publisher—humans compete with other components in the ecosystem was represented by a citation from Silver-Burdett and humans are part of the world ecosystem was represented by a citation from Ginn. The other ecocentric sub-components were referenced several times and by several publishers.

This was the first grade level at which all sub-components were represented by citations and at which nearly all of the texts addressed the principle humans as a component of the ecosystem. Most of the ecocentric sub-component citations did not occur until 1960 or later. Only four
anthropocentric sub-components were represented by citations during the 1950's, with *humans cause habitat destruction* not represented. No ecocentric sub-components were represented by citations during this decade. Only the sub-components *humans use plants*, *humans use animals*, and *humans cause habitat destruction* were represented by citations during the 1930's.

Grade Level Five

All sub-components were represented by citations during at least one of the decades. A sample of 42 textbooks were reviewed for Grade Level Five (Figure 11). Seven textbooks did not contain citations for the principle *humans as a component of the ecosystem*, during the last three decades. Four sub-components, all anthropocentric, were represented by citations during all decades: *humans use plants*, *humans use animals*, *humans cause pollution*, and *humans cause habitat destruction*. The fifth anthropocentric sub-component-- *humans change ecosystems*-- was represented by citations in the last five decades but lacked representation in the 1930's.

Eight publishers published at least three textbooks representing Grade Level Five (Table 20). No publisher made reference to all sub-components, though Ginn made reference to all but one- *humans influence the balance of ecosystems*. All anthropocentric sub-components were represented by citations in textbooks from four publishers-- Ginn, Scott-Foresman, Macmillan, and Bobbs-Merrill / Merrill-- and three other publishers' textbooks referred to four of the five anthropocentric sub-components. Textbooks from all publishers contained references to *humans use plants* and *humans use animals*, with *humans change ecosystems* referred to by all but one publisher. Only textbooks from three publishers contained references to more than one of the
ecocentric sub-components—Ginn, Harcourt-Brace-Jovanovich, and Bobbs-Merrill/Merrill—though none contained references to all of these sub-components. Only Ginn textbooks contained references to *humans compete with other components in the ecosystem* and *humans are part of the food chain*.

During the last three decades 17% of the textbooks in the sample contained no references to the principle *humans as a component of the ecosystem*, an increase from the previous grade level. Anthropocentric sub-components were represented by citations in all decades except for one instance, that being *humans change ecosystems*, which was not represented during the 1930's. During the 1970's all but one sub-component—*humans are a part of the world ecosystem*—was represented by citations. Only one sub-component—*humans influence the balance of the ecosystem*—was represented by citations during the 1950's.
Grade Level Six

- none
- balance
- world ecosystem
- dependence
- food chain
- competition
- habitat destruction
- change
- pollution
- animals
- plants

Figure 12: Comparison of the cumulative percentages of the samples for each decade that had citations for each of the sub-components for Grade Level Six.

All sub-components were represented by citations in the textbooks from a sample of 44 textbooks for Grade Level Six (Figure 12). All ten sub-components were represented by citations during the 1960's and the 1970's. Only four textbooks of the 44 contained no references to the principle humans as a component of the ecosystem. Four of the five anthropocentric sub-components were represented by citations during all decades, with the fifth sub-component—humans cause pollution—referenced only during the last five decades. The textbooks from the 1980's contained references to all but one of the ten sub-components—humans compete with other components of the ecosystem. One ecocentric sub-component, humans influence the balance of ecosystems, was represented by citations during all decades.

Eight publishers published three or more textbooks representing Grade Level Six (Table 21). No textbooks from the publishers contained citations for all ten sub-components and no sub-component was represented by citations by
all publishers. Textbooks from three publishers—Ginn, Macmillan, and Scott-Foresman—contained citations for all five anthropocentric sub-components. Textbooks from Silver-Burdett contained references for four of the five anthropocentric sub-components. Textbooks from Scott-Foresman contained references for the most ecocentric sub-components, three. *Humans are part of the food chain/web* was represented by citations from only one publisher—Ginn. The other ecocentric sub-components were represented by citations from two or three publishers.

All anthropocentric sub-components were represented by citations during all decades except one—*humans cause pollution,* in the 1930's. All ecocentric sub-components were represented by citations during the last three decades except for one—*humans compete with other components of the ecosystem,* during the 1980's. Excluding *humans influence the balance of the ecosystem,* which was represented by citations in all decades, only one other citation occurred during the first three decades in the ecocentric sub-components—*humans are dependent/interdependent with the ecosystem.*

**Summary of the Grade Levels**

Thirty-one percent of the texts for Grade Level One contained no reference to the principle *humans as a component of the ecosystem.* There was also a total absence of representation of the ecocentric sub-components, and some anthropocentric sub-components in the textbooks at this grade level which offered little to no grounding in the principle. An increase in the representation of the principle *humans as a component of the ecosystem* occurred at Grade Level Two, though 21% of the sample lacked citations for the principle. All anthropocentric sub-components, and two
ecocentric sub-components were represented by citations. Many of the sub-components were not represented by citations until the 1950's.

Textbooks from Grade Level Three contained citations for three anthropocentric sub-components during all of the decades. Only two ecocentric sub-components were represented by citations. Grade Level Four was the first grade level to have textbooks that contained citations for all sub-components and a very small portion of the texts did not contain citations for the principle humans as a component of the ecosystem. Most ecocentric sub-component citations did not occur until 1960 or later. No citations for ecocentric sub-components were made during the 1950's.

At Grade Level Five there was an increase from the previous grade level in the number of texts, 17%, that contained no reference to the principle humans as a component of the ecosystem with these occurring in the last three decades. Anthropocentric sub-components were represented by citations during all decades except for one instance. All but one sub-component- humans are a part of the world ecosystem - was represented by citations during the 1970's. Coverage of ecocentric sub-components was haphazard, with the 1950's receiving the least coverage.

For Grade Level Six all anthropocentric sub-components were represented by citations during all decades except one-- the 1930's. All ecocentric sub-components were represented by citations during the last three decades except for one-- the 1980's. Excluding humans influence the balance of the ecosystem, which was represented by citations in all decades, only one other ecocentric sub-components was represented by citations during the first three decades-- humans are dependent / interdependent with the ecosystem.
Summary

The anthropocentric sub-components-- **humans use plants, humans use animals, humans cause pollution, humans change ecosystems, and humans cause habitat destruction** -- were represented by citations at all grade levels and in all decades, except for **humans cause habitat destruction**, which was not represented by citations at Grade Level One during any decade (Table 1). The higher percentages of the sample of textbooks which contained citations to the anthropocentric sub-components occurred at the higher grade levels with the exception of **humans use plants**, which varied little throughout all grades.

The percentage of textbooks with citations for the anthropocentric sub-components declined into the 1960's, which may have been from the influence of the Post-Sputnik curriculum projects and the shift away from societal issues to hard science in science education. The percentages increased again into the 1970's and 1980's (Table 2). Most of the publishers--except Scribner and McGraw-Hill--published textbooks that contained references to these anthropocentric sub-components (Table 3). The percentages of the sample of textbooks with citations for all anthropocentric sub-components were high for Ginn, with high percentages for three of the five sub-components for Silver-Burdett, Scribner and McGraw-Hill. The publisher with the lowest percentages of the sample of textbooks with citations for the anthropocentric sub-components was ABC.

The ecocentric sub-components-- **humans compete with other components of an ecosystem, humans are a component of food chains / webs, humans are dependent / interdependent with the ecosystem, humans are part of the world ecosystem, and humans influence the balance of ecosystems** -- were represented by citations most often at Grade Levels Four through Six, with
no citations occurring at Grade Level One and most of the citations occurring at Grade Level Six (Table 1). The highest percentages of the sample of textbooks which contained references were for the sub-components—*humans are dependent / interdependent with ecosystems* and *humans influence the balance of ecosystems*.

These ecocentric sub-components were represented by citations from the 1960's through the 1980's, with the highest percentage of the sample occurring in the 1970's except for *humans influence the balance of ecosystems*, which was the only ecocentric sub-component represented by any citations during all the decades (Table 2). Only one ecocentric sub-component was represented by citations in the 1950's, and the 1930's and 1940's had very little coverage. Scant coverage before the 1970's may be due to how these sub-components were perceived by the public before the start of the environmental movement in the 1970's.

Publisher coverage of these ecocentric sub-components varied considerably (Table 3). Consistently high percentages of the sample overall with citations for all of the sub-components was represented by Ginn, with Silver-Burdett, Harcourt / Brace / Jovanovich and Bobbs-Merrill / Merrill textbooks containing citations for four of the five sub-components. The sub-component *humans compete with other components of the ecosystem* represented the least coverage, with textbooks from only four publishers containing any citations. The sub-component *humans influence the balance of ecosystems* represented the most complete coverage, with textbooks from only two publishers not containing any citations.

The coverage for the 1930's of the anthropocentric sub-components was for more of the grade levels than the ecocentric sub-components, which were
only represented at one grade level, if at all. The representation of the anthropocentric sub-components continued to increase in coverage during the 1940's and representation was added at several grade levels. The representation of the ecocentric sub-components increased some for the 1940's for more grade levels, but declined in representation for the sub-component *humans compete with components of the ecosystem*. A higher percentage of the texts covered the principle *humans as a component of the ecosystem*.

The anthropocentric sub-components were still represented by citations during the 1950's, though the percentages of the samples containing references did drop. The ecocentric sub-components received very little coverage, with *humans influence the balance of ecosystems* the only sub-component that was represented by any citations. Most of the texts in the sample contained some reference to the principle *humans as a component of the ecosystem*.

The lowest percentage of the sample with citations for all of the anthropocentric sub-components for all of the decades except for *humans cause habitat destruction* occurred during the 1960's. There was also a higher percentage of texts with no references to the principle *humans as a component of the ecosystem*. An increase from the previous decade in the representation of the ecocentric sub-components was represented by the data.

An increase in the percentage of texts that contained citations for the anthropocentric sub-components occurred during the 1970's, though not to some of the previous high levels found in the 1940's and 1950's. The representation of the ecocentric sub-components continued to increase with increasing percentages of the sample containing citations or representation at
additional grade levels. Percentages of texts that contained no reference to the principle *humans as a component of the ecosystem* were higher than the 1940's and 1950's.

The anthropocentric sub-components were represented by the most complete coverage during the 1980's when grade levels and percentage of sample containing citations was considered. The representation of the ecocentric sub-components declined in representation from the previous two decades. The representation of the principle *humans as a component of the ecosystem* increased from the previous two decades with most of the texts containing some reference to the principle.

With 31% of the texts for Grade Level One containing no references to the principle *humans as a component of the ecosystem* and the total absence of representation of the ecocentric sub-components and some anthropocentric sub-components, textbooks at this grade level offered little to no grounding in the principle. Grade Level Two was represented by an increase in the referenced to the principle *humans as a component of the ecosystem*, though 21% of the sample lacked citations for the principle. All anthropocentric sub-components, and two ecocentric sub-components were represented by citations. Many of the ecocentric sub-components were not represented by citations until the 1950's.

Textbooks for Grade Level Three contained citations for the anthropocentric sub-components, with three of the sub-components represented by citations during all of the decades. Only two ecocentric sub-components were represented by citations. Textbooks from Grade Level Four were the first to contain citations for all ten sub-components with a very small portion of the texts not addressing the principle *humans as a component of*
the ecosystem. Most of the citations for the ecocentric sub-components did not occur until 1960 or later. The ecocentric sub-components were not represented during the 1950's.

There was an increase in the number of texts for Grade Level Five, 17%, that contained no reference to the principle *humans as a component of the ecosystem* from the previous grade level. These occurred during the last three decades. Anthropocentric sub-components were represented by citations during all decades except for one instance. The 1970's were represented by citations for all but one sub-component— *humans are a part of the world ecosystem*. Coverage of ecocentric sub-components was haphazard, with the fewest citations during the 1950's.

For Grade Level Six all of the anthropocentric sub-components were represented by citations during all decades except one. The ecocentric sub-components were all represented by citations during the last three decades except for one. Excluding *humans influence the balance of the ecosystem*, which was represented by citations in all decades, the first three decades were represented by only one other citation for the ecocentric sub-components— *humans are dependent / interdependent with the ecosystem*. 
Chapter V

CONCLUSIONS AND DISCUSSION

The purpose of this research was to investigate the extent to which elementary school science textbooks have included the principle humans as a component of the ecosystem and whether that component is presented as humans outside of the ecosystem (an anthropocentric framework), or is presented as humans as a biological component of the ecosystem (an ecocentric framework). Two hundred sixty-nine elementary science textbooks from 14 publishers were reviewed to identify sub-components included in the principle. These sub-components were then employed in an in-depth analysis of one publisher, Ginn. These data were then analyzed for trends over time, over grade level and over the 14 publishers.

The study employed content analysis, a method of studying types of communication, including textual and illustrative material, to identify themes present. The principle, humans as a component of the ecosystem, was chosen based upon the work of Hungerford, Peyton and Wilke. Ten sub-components were identified during the initial review of data; the separation of these sub-components into anthropocentric or ecocentric frameworks was based upon the perceived perspective of those sub-components.

Conclusions

The purpose of this study was to determine the extent of coverage present in elementary science textbooks for the principle, humans as a
component of the ecosystem. The identification of ten sub-components of that principle which then formed the anthropocentric and ecocentric frameworks provided one of the more important outcomes of this study.

Data from the textbooks— all pages that were scanned and text, illustrations, or questions— that related to the principle were noted and recorded in a computer database. There were certain key words or phrases that repeated over grade levels and decades. These were then chosen to form the basis on which to search the files for trends. Those key words and phrases were refined and reworked to form the ten sub-components that were used to search the Ginn textbooks for more in-depth examples of changes over grade levels and time.

The ten sub-components— 1) humans use plants, 2) humans use animals, 3) humans cause pollution, 4) humans change ecosystems, 5) humans cause habitat destruction, 6) humans compete with other components of an ecosystem, 7) humans are a component of food chains / webs, 8) humans are dependent / interdependent with the ecosystem, 9) humans are part of the world ecosystem, and 10) humans influence the balance of ecosystems— were then reviewed for the perceived perspective of the sub-component.

Sub-components which focused on humans outside of the ecosystem were considered to present an anthropocentric framework. Five sub-components— humans use plants, humans use animals, humans cause pollution, humans change ecosystems, and humans cause habitat destruction— fit within the anthropocentric framework. Sub-components which focused on humans as within the ecosystem were considered to present an ecocentric framework. The other five sub-components— humans compete with other components of the ecosystem, humans are a component of food chains /
webs, humans are dependent / interdependent with the ecosystem, humans are part of the world ecosystem, and humans influence the balance of ecosystems -- fit within the ecocentric framework.

These ten sub-components were then used to determine how much balance existed between anthropocentric and ecocentric frameworks in elementary science textbooks over six decades, at each grade level, and for the textbooks of each of the 14 publishers. The trend over the decades, through the grade levels and through the publishers was that the ecocentric sub-components were not balanced with the anthropocentric sub-components.

Of the 14 publishers studied, none published a majority of the sample of textbooks with citations falling within the ecocentric framework, though Ginn texts included at least one citation for each sub-component, and several other publishers' texts included citations from all but one of the sub-components. The greatest percentage of textbooks with citations for the ecocentric sub-components never went over 20% of the sample for any of the publishers. This indicates that no publisher seemed to embrace an ecocentric framework for their textbooks, at least through the 1980’s which addresses the concerns expressed by Charles (1987) and Bybee (1993) who stated that the Science-Technology-Society movement has not been "embraced by...textbook authors, and commercial publishers" (p. 137). One possible question to examine at a later time is whether that trend has continued into the 1990's or if there is still a lag between textbook publishing and environmental discourse.

During the 1930's few publishers had initiated elementary science textbook series; they were still publishing elementary science or nature readers. Of the few series published at that time, many of the sub-components were represented by only one citation. But each of four of the ecocentric sub-
Timeline of Sub-Components

- Emphasis on plants and animals at all grade levels; habitat destruction at upper grade levels.
- Emphasis on plants and animals at all grade levels.
- Increase emphasis on pollution at all grade levels.
- Highest percentage of textbooks with no references to the principle.
- Emphasis on pollution and change at all grade level.
- All ten sub-components represented during this time period.
- Increase in representation of the ecocentric subcomponents.
- Ecocentric subcomponents absent for this decade.
- Lowest representation of anthropocentric subcomponents.
- Decline in representation of anthropocentric sub-components.

Figure 13: Timeline of occurrences in the anthropocentric and ecocentric sub-components.
components were represented by a single citation. Therefore, while the ecocentric sub-components were not emphasized even during this early decade, they were minimally present.

During the 1940's three of the ecocentric sub-components were represented by citations, with an increase in the percentage of the samples containing those sub-components. One ecocentric sub-component, *humans compete with other components of the ecosystem*, though represented by citations during the 1930's, was not represented by citations for the 1940's. Into the 1950's (Figure 13) what few references there were to the ecocentric sub-components decreased even more, with only two citations for *humans influence the balance in ecosystems*. This sub-component was represented by citations throughout the study period. The disappearance of the ecocentric sub-components is unexplained and worthy of further study.

The 1950's was also the decade in which a decline in the percentages of citations for the anthropocentric sub-components began. This decline continued into the 1960's, where the lowest percentages of citations representing the anthropocentric sub-components occurred. Reynolds (1976) stated that textbooks generally reflect values and priorities of a society so what started the decline may be the influence of a society that did not want to acknowledge that there was anything wrong with the environment or society. Other problems were more pressing than the problems of the environment and scientific advancement. The continued decline in the 1960's may be due to the influence of the NSF curriculum projects and beyond the scope of this study.

Starting with the 1960's (Figure 13), all of the ecocentric sub-components were represented by citations, many of them represented by a relatively large number of citations. This trend continued into the 1970's where there was an
increase in the representation of ecocentric sub-components, in most cases at
the highest percentages of samples with citations for the study period. During
the 1960's the highest percentage of the sample of textbooks not containing
citations for the principle humans as a component of the ecosystem
occurred. Whether this was a lag from the 1950's or the influence of the NSF
curriculum project or some other cause is unexplained.

During the 1930's and 1940's the emphasis was on the sub-components
humans use plants and humans use animals at all grade levels and the sub-
component humans cause habitat destruction at the upper grade levels. This
continued into the 1950's, with a decrease in the emphasis on humans cause
habitat destruction and an increase in emphasis on the sub-component
humans cause pollution at all grade levels. By the 1970's and 1980's the
emphasis had increased for the sub-components humans cause pollution and
humans change ecosystems at all grade levels. While the emphasis had
diminished for humans use plants and humans use animals, it still remained
higher than most of the other sub-components. These are all anthropocentric
sub-components. The ecocentric sub-components never received comparable
emphasis at any grade level or during any time period.

Trends at the grade levels also indicated that there was not a balance
between the representation of the anthropocentric and ecocentric sub-
components. There was an increase in the number of sub-components
represented by citations as the grade levels increased, with all sub-components
represented by citations at Grade Levels Four through Six (Figure 14). The
percentages of the textbooks with citations for the anthropocentric sub-
components was fairly consistent as the grade levels changed for humans use
plants, humans use animals, and humans cause pollution. The sub-

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### Variation in the Sub-Components at the Grade Levels

<table>
<thead>
<tr>
<th>Grade Level</th>
<th>Anthropocentric Sub-Components</th>
<th>Ecocentric Sub-Components</th>
</tr>
</thead>
<tbody>
<tr>
<td>First grade</td>
<td>High representation, 30% to 67%. for humans use plants and human use animals, 25% for humans cause pollution, and 0% to 4% for the other two anthropocentric sub-components.</td>
<td>No representation of the ecocentric sub-components. Four anthropocentric sub-components represented.</td>
</tr>
<tr>
<td>Second grade</td>
<td>Little representation, 4%-5%, of three of the five ecocentric sub-components. No representation of two of the five ecocentric sub-components. All of the anthropocentric sub-components represented.</td>
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<tr>
<td>Third grade</td>
<td></td>
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<tr>
<td>Fourth grade</td>
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<tr>
<td>Fifth grade</td>
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<tr>
<td>Sixth grade</td>
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</tbody>
</table>

Highest representation of the five anthropocentric sub-components, 50%-70% for humans use plants and humans use animals, 25% to 40% for the other three sub-components.

Highest representation of the ecocentric sub-components, 10% to 20% for humans are dependent/interdependent with the ecosystem and humans influence the balance of ecosystems, 4% to 7% for the other three ecocentric sub-components.

All ecocentric and anthropocentric sub-components represented.

Figure 14: Grade level variances in the occurrences in the anthropocentric and ecocentric sub-components.
components humans change ecosystems and humans cause habitat destruction increased in the percentages of the samples with citations from the lower grade levels up through the upper grade levels.

The ecocentric sub-components were not represented by citations for Grade Level One and only two of the sub-components were represented by citations for Grade Level Two—humans compete with other components of the ecosystem and humans are a part of the food chain/web. Only two of the ecocentric sub-components—humans are part of the food chain/web and humans are part of the world ecosystem—were recorded for Grade Level Three. All of ecocentric sub-components were represented by citations at Grade Levels Four through Six.

The data indicates that the ecocentric perspective is not presented until the upper elementary grade levels, and even then, it is not in balance with an anthropocentric perspective which was the concern Leopold addressed back in 1949 concerning conservation education. When children are able to understand where they fit within the world ecosystem, and that what they do impacts the ecosystem for better or for worse, is somewhat determined by the developmental level of those students and worthy of further study.

An in-depth analysis of the textbooks published by Ginn found that the trends shown by the other publishers were also represented in the Ginn textbooks, those trends being:

1) a lack of citations at the lower grade levels for the ecocentric sub-components;

2) more emphasis on the anthropocentric sub-components at all grade levels;
3) a heavy emphasis placed on the anthropocentric sub-components during all decades; and
4) less emphasis placed on the ecocentric sub-components during all decades.

A look at the data from Ginn showed that the coverage of *humans use plants* and *humans use animals* varied little by grade level (Table 22) or by decade (Table 23). Representation of the sub-component—*humans cause pollution*—increased in the percentage of the samples with citations over the decades but higher percentages were found over the first three grade levels, which then decreased for the next two grade levels and then increased greatly for Grade Level Six.

The sub-component *humans change ecosystems* increased in percentage of representation for the first three decades, then decreased in representation for the 1960's, then increased again. The percentage of textbooks which contained citations for the sub-component *humans cause habitat destruction* ran at 50% for the first three decades and then decreased in representation, with a slight increase in the 1970's before declining again. There were no citations for the first two grade levels and the number of citations increased progressively over the next four grade levels.

The ecocentric sub-components varied in representation in the Ginn textbooks. *Humans compete with other components of the ecosystem* was represented by citations only in the 1930's. *Humans are a part of the food chain* was represented by citations for all of the decades except the 1950's. *Humans are dependent / interdependent with the ecosystem* was represented by citations for all decades except the 1950's and 1980's. *Humans are part of the world ecosystem* was not represented by citations until the 1970's and...
humans influence the balance of ecosystems. Data from Ginn reflected no citations for the ecocentric sub-components at Grade Levels One and Two. Coverage was sporadic for the upper grade levels, with citations representing only two or three of the sub-components. Grade Level Five was represented by citations for all of the ecocentric sub-components except *humans influence the balance of ecosystems*. Grade Levels Five and Six were represented by the highest percentage of the sample with citations for ecocentric sub-components over all.

The indication of the data gathered in this study is that publishers, over time, have paid little attention to the ecocentric sub-components that place humans within ecosystems, even during recent decades. Whether this imbalance still exists in textbooks today is worthy of further study.

**Implications**

Science education has gone through several curriculum reforms—Progressive education, Sputnik / National Science Foundation curriculum movement, Science-Technology-Society, environmental education, *Project Synthesis*, and today's reform movements towards standards that have been put forward by the American Association for the Advancement of Science, the National Science Teachers Association and the National Research Council. Responsiveness to these reforms reflected in the textbooks and the speed of that response is beyond the scope of this study.

The principle that is addressed in this study, **humans as a component of the ecosystem**, and all the sub-components that comprise this principle, have been present in some form in the standards and reforms throughout the
study period. While the response by publishers to reform cannot be measured by response to only one principle, this study indicated that the publishers' treatment of that principle was not balanced and may not have reflected the intention of the standards of that time.

The standards put forth in 1932 called for humans to learn of their place within the web of life, their interrelationships in nature. The principle **humans as a component of the ecosystem** has both anthropocentric and ecocentric aspects. The framework that has been presented in the textbooks published during the 1930's-1950's were predominately anthropocentric, or humans outside of the ecosystem, outside the web of life. The question is not whether understanding of the ecocentric framework existed, since there were citations that fell within that ecocentric framework, but what influenced publishers and authors not to present a balanced treatment to both frameworks.

The 1960's did see an increase in the percentage of the samples which contained citations in the ecocentric framework. While that increase still did not provide a balance with the anthropocentric framework, it was an increase from the 1950's, which was represented by only two citations for the whole ecocentric framework. The question is, where did it come from? The curriculum movement of the 1960's developed specialized curricula that were not reviewed in this study, though some components made their way into the more traditional texts considered here. To take the NSF curricula and analyze then using the framework from this study would give a comparison on the sub-components presented. The environmental movement had not yet become a national movement. The increase in representation continued into the 1970's, where the influence of the environmental movement could be seen, where case
studies of environmental issues such as the use of DDT and pesticides were presented.

Textbooks have entered the age of electronic publishing, where new editions can be published every two or three years, if not more often. Response time to the reforms should be much less, and teachers and students should have in their possession textbooks that reflect current thought in science education. Publishers have many agendas that influence what textual material is actually published, especially where mergers have brought together two or three similar products. Publishers also are aware of who their major purchasers are. Today, those are the states that have a state-wide adoption, such as California and Texas. Their state curriculum standards also drive what is published in textbooks.

Authors also bring their influences into the mix of putting together a textbook. They bring in influences from their professional obligations, whether that is from the university, public school, state, or another institution. Textbooks become a balance, trying to blend all or ignore some, of the standards and reforms, at the national and state levels.

Developmental levels of students also determine what and how information is transmitted to those students. When are children able to understand where they fit within the world ecosystem, and that what they do impacts the ecosystem, for better or for worse? The data suggests that authors and publishers refrain from presenting an ecocentric perspective until the upper elementary grade levels, and even then, it is not overwhelmingly balanced with an anthropocentric perspective.

Much has been said in terms of where environmental issues fit in a curriculum. Most agree that environmental issues have a scope that goes
beyond just science, but it places elementary science teachers in a dilemma and somewhat outside of their expertise, when it comes to teaching about those issues. Textbooks can help if they present balanced perspectives. While this study did not address whether or not textbooks are presenting a balanced perspective on the environment, since this study did not examine all principles found in environmental education, it did address how textbooks presented one principle, and the lack of balance that existed there. If textbooks are still presenting the framework that humans are outside of the ecosystem, will children learn to balance their decisions concerning the environment?

Future Research

The results of this study raised several questions that future research could investigate to enhance the understanding of how environmental principles are presented in curriculum.

1. As early as the 1930's and the 1940's we recognized that humans have caused considerable and detrimental changes in the environment. Is just presenting facts within curriculum enough to overcome these patterns? If changes have not occurred over these sixty years, what will cause them to change?

2. This study only examined one principle, **humans as a component of the ecosystem**, for the last 60 years and for the elementary grade levels. This study should be continued for grades 7 and 8 for the same period. Which principles are presented and how these principles fit within an anthropocentric or ecocentric framework will give an even more in-depth analysis of what has been presented over the last 60 years. Other subject series, such as geography
and social studies, should also be examined for their perspectives on the environment.

3. Research on what is actually presented in classrooms about the environment and how the textbooks are used in classrooms would add another dimension to this body of knowledge.

4. One possible question to examine at a later time is whether elementary science textbooks have continued to present a predominately anthropocentric framework into the 1990's and if there is still a lag between textbook publishing and environmental discourse.

5. Textbooks from the 1950's and 1960's reflected data that suggests upheaval in science curriculum beyond what can be explained by the NSF curriculum projects, which should not have impacted traditional textbooks until later in the 1960's. A decline in the representation of the anthropocentric and ecocentric sub-components during the 1950's which continued for the anthropocentric sub-components into the 1960's to their lowest levels, while the ecocentric sub-components not only increased in representation, but increased to the highest levels in 40 years, is unexplained. The 1960's also reflected the highest percentage of textbooks in the sample not citing the principle humans as a component of the ecosystem. Further investigations into what influenced the information presented in textbooks and whether that influence was seen at the middle school level would add another dimension to this body of knowledge.
LIST OF REFERENCES


Yearbook of Environmental Education and Environmental Studies. Columbus, Ohio: ERIC/SMEAC.


Appendix A

Ginn Data 1932-1933

These data represent excerpts from the texts for grade levels one through six for the 1932-1933 edition.

G. S. Craig, A. Burke  We Look About Us  1933  one  We eat plants every day. (17, 18) If you want to have a good garden, you must pull out the weeds (173). When the weeds were all out, the garden looked beautiful. (174) Weeds are not friends of a garden...we are not going to have them in our garden. (175)

A long time ago horses and cows were wild. Horses did not work for man. Cows did not give milk. (55) (chp. on where animals live) Earthworms...are friends of a garden. (167) (gardening). First time I ever heard that a worm was a friend...are all worms good for gardens...not all worms are good for gardens, but the earthworm is a friend of everyone who has a garden. (168) You have another enemy in your garden...it is called a cutworm (176-77). There are other insect enemies in your garden, too. Birds eat insects and worms, you can invite birds to your garden. (178) Robins like to live near people (185). Found a large toad...are you a friend. If you are a friend, you may stay in our garden. If you are not a friend you must get out. (186) Toads eat insects. He is a friend...He may stay in our garden. (189). Butterflies and bees are friends of the garden too. (191) Tom and I call it our garden because we made it. But it would not be much of a garden if the birds and the toads and the bees and the butterflies did not help. (194). Q-How many of these animals were friends of the garden? How many of these animals were not friends of the garden? (194) I showed children watching the animals in the garden (184, 189, 193)

We could not live without plants. (17) (chap. on living things)

G. S. Craig, S.E. Baldwin  Out of Doors  1932  two

What part of plants do we eat? (79) (food from plants) We eat the seed, leaves, roots, stems, flowers and buds. Let's name some seeds which we eat (beans, peas, corn, flour). Stems we eat (celery, potatoes, onions). Roots we eat (carrots, beets, turnips, radishes). Leaves we eat (lettuce, cabbage, spinach, etc). Flowers & buds (cauliflower, asparagus). We could not live without plants, we must have them for food. (80-81) Carrots, beets, radishes, and turnips hold much plant food in their roots. They hold so much food that people like to eat them. The plant food becomes food for people. (85) Find nuts to give the squirrels a winter party. Fun to watch a moth come out of its cocoon in the spring. Do you like to hear the crickets chirp? Do you like to hear the call of the katydids and the hum of the locusts? (8,9) Do you think that animals are as safe in the winter as people are? (39) (seasons) Should you like to give them (birds)
food? (44) Did you ever see the pretty little potato beetle? People who have potato plants do not like this little insect. (51) Potato beetles would eat all the plants in the garden if they were not stopped...if the farmer does not stop them. (52) That is our friend the porcupine. (201) (animals) Indians had used porcupine quills to embroider beautiful designs for headbands and bags for arrows. (204) Porcupines seem to choose the food which people do not want them to eat. Indians eat the flesh of porcupines but white people have little use for it. (207) Can you think of some ways in which squirrels might be a bother to people? Think of the places where squirrels build their nests. Would any of these nests be a bother to people? Where do squirrels get much of their winter food? Does a farmer like to have the squirrels get into his grain and vegetables? In other ways squirrels are a great help in the world. They help to plant new forests. (220) Skunks are good friends to farmers. Their food habits make them very useful. Some people say that skunks are no good that they eat birds’ eggs and steal chickens. But skunks do not choose to eat eggs and chickens. Insects taste just as good to them. They only eat eggs and chickens when other food is hard to get. Skunks eat army and tobacco worms that spoil crops. Mice, rats, pocket gophers, ground squirrels all cause the farmer trouble. (226-7) Received a raccoon coat. Noticed other people wearing raccoon coats. Use to wear raccoon caps and robes for their laps. (235) Raccoons are a great bother to farmers. They steal hens and chickens. They steal melons and corn. They eat a little here and there but not the whole ear. They are very wasteful. (243) People trap raccoons for their fur. (248) Dogs are fine friends. Dogs are very useful. In many places people can not get along without dogs. A farmer always needs a dog. (250-1) (work oriented)

Do you like to take walks in the woods, fields or parks? (5) (seasons)

G.S. Craig, Sara E. Baldwin Our Wide, Wide World 1932 Three

Cows and hens had food from the plants to make them grow (50) All animals get their food from plants in one way or another. If they do not eat plant food, they eat other animals which do eat plant food. Whether our food is animal food or plant food, the sun is needed to make it, just the same. (52) See food chains for use of plants as food (66-8) People scatter seeds in many ways. The farmer, the vegetable gardener, the lady who takes care of a flower garden, all plant seeds with great care. Many times boys and girls carry seeds about without knowing it. (217) Do you ever find seeds on your clothing when you were walking through weeds? As you walk along a weedy path, you knock the seeds off the plants, scatter them, and plant them without thinking about it at all. illus. of children with seeds (218-9) Some of the best soil in the world is found in the desert lands of our own country. The only reason plants do not grow there is because there is no water for them. By bringing water to the desert, people have made great gardens. illus of irrigation. (246-7) We provide food for animals during the winter so they survive (105). Our winter animals are often great thieves. The farmer has to guard his grain, his chickens, his vegetables and his seeds from the animals, whose hunger makes them very bold. (106). Can you tell about other places where animals find
shelter in winter? What about dogs, cats, rats, mice, horses, cows, or sheep? (111) In winter, deer and other wild animals often come very close to places where people are living. You can feed them. In summer, they are very wild. You can hardly find them in the woods. Can you tell why this is so? (111) Here are some ways in which people are helping to keep animals from starving: Many states own great forests which are called "animal preserves." No one is allowed to harm the animals in these places. Food is placed where animals can get at it easily. Men are paid to keep these feeding stations supplied with food. Children who live in the city know how carefully the birds and squirrels and other animals are cared for in the city parks. The city pays people to scatter food for them several times a week. (Illus. of feeding station for bears-121) Visitors also feed the animals. Birds fly in and out among trucks, wagons and street cars to pick up crumbs and grain. Do you know any other ways by which people help to feed wild animals? (120-122). Here are some of the dangers which come to the food supply of people: ...Harmful insects (pests). How do people manage to have enough food, in spite of these dangers to their food supply? (122) What animals can you help to keep from starving during the winter? What animals can you help to keep from starving during the summer? (123) Although people are great friends to animals, they are also great enemies. Hunters, trappers, and fishermen have done more toward destroying many kinds of animals than all their other enemies put together. People have been enemies to some helpful animals without knowing that they were helpful. Skunks, some kinds of hawks, crows and owls have been treated very badly. They were known to eat... and other things which man wants to keep. These are their bad habits. For a long time people know more about their bad habits than they did about their good ones. They did not know how many ... and other harmful creatures these animals used for food. Now that people have learned that these animals do more good than harm, they will protect them instead of destroying them. (127-8) When people finally found out that their pleasures and some kinds of work were taking the lives of a great number of useful animals, they began to feel worried and very much ashamed. If there were no enemies of insects and mice, there would be many more of them than there are now. Now they are trying in every possible way to save the useful animals. Bird sanctuaries, life easy for birds, feeding stations. (Illus. of bird sanctuary-139) Fish hatcheries to replace fish caught by fishermen. People have been able to help the animals a great deal by means of laws. Limiting hunting season. (137-141) Since so many millions of animals are born every year, why is it not right for a fisherman or a hunter to say, "I can take as many as I want, for there are plenty more"? Why is it not right for boys or girls to take ...or capture small animals which are easy to find? (142) People dislike the cowbird almost as much as the other birds do. It does eat harmful insects, but it also takes the lives of many helpful birds. The good which it does is spoiled by the harm it does. (153)

Before people were able to send the water from the mountains, however, this land was a bare, dusty desert. Everything was there to make plants grow, except water. But the trees could not grow without water. By bringing water to the desert, people have made great gardens. (247)
House that Jack Built: These are the plants the sun made; These are the boys who ate the plants the sun made; these are the plants the sun made; this is the cow which ate the plants the sun made; these are the children who drank the milk that came from the cow which ate the plants the sun made. (56—illus also of this poem). Another verse was also given w/o illus. Here is the grass the sun made; here are the hens that ate the grass the sun made; here are the children who ate the eggs laid by the hens that ate the grass the sun made. Asked students to make up other verses. (57—8).

G.S. Craig, Beatrice Davis Hurley The Earth and Living Things 1932

What plants do for us. All animals depend upon plants for food. Of course some animals eat other animals. But the animals which were eaten had to get their food from plants. The story may go like this. A tiger ate a fox...but the cow ate grass. (239) Make a list of all the foods you eat which re plants. All fruits ...vegetables ...all meat...cereal ...Should you like to live without these good things to eat? Could you live without some of them? (240) Plants give us clothes. Wool...Cotton...silk...leather...Can you think of anything which you wear that was not made from plants or animals. (241) flax...hemp...linen (242) Plants give us shelter. Wood ...house...furniture ...paper...tent (242) illus (243) things made from plants. Plants help us to have oxygen (244) Plants help to make the air fit for us to breathe. Plants are used as medicine (244) Grandmother and home remedies. Indian medicine men. (245) illus of medicine man. Plants are used for coloring (246) dyes used by Indians. Plants are used to add beauty (246) illus of two houses—one with plants, one without. Plants make all the difference in the world. (248) I wonder if you have ever gone walking in the woods in the spring of the year when the wild flowers were in full bloom? Different flowers...These and many other wild flowers used to grow in great numbers in the woodlands. Thoughtless boys and girls as well as grown-ups have picked so many of the flowers that few were left to go to seed. Unless all of us join in protecting our wild flowers, many of the very loveliest kinds are soon going to disappear. (248—9). Plants help hold the soil to the earth. roots of plants keep the soil from blowing about. (250) How plants keep moisture in the earth. (251) Illus of trees around reservoir. Trees keep the rain from running away as it falls. They keep the moisture in the ground...roots, leaves. (251—2) How very important plants are anyway. They give us our food, our clothing, and some of our shelter. They make the earth beautiful. They give off oxygen for us to breathe. (252) 253—Why is all life dependent upon plants? In what different ways do plants help us in our everyday living? How did the Egyptians of long ago use plants? What did the Indians use plants for? Plants help to keep us healthy in the following ways...food, use carbon dioxide, give oxygen, material for clothing. Make a list of ...clothes you wear made from plants. Make a list of plants used in your school room. Try and make some dye.(253) Farmers would be glad if they could get rid of some of the spores that are in the air. Spores often ruin the farmers' crops. One spore helps to make cheese. (272—3)
The economic value of plants and animals. (iv) Bees-trees, build homes for them (illus of tree and a home-132-3). Men were not only interested in caring for the bees in order to get honey. (133) It is because of this fact that bumblebees have not been cared for by man. Man wants honey for his own use. Since honeybees supply it, he makes a special home for them. Pollinate red clover also. (156) Carpenter ants nest in wood. They bore holes in posts or trees and build their nests there. These ants have destroyed may posts, beams in houses, and trees. They make them soft and useless. (178) Why would termites, or white ants, be pests? (180) ...and sometimes man, are enemies of the beavers. (211) Men have always trapped the beavers. They want their fine, brown coats of fur to use for coats, hats and muffs. Even the Indians trapped the beavers. They used the skins as we use money. They traded beaver skins for the for things they needed. (218) How are beavers useful to man? In what ways are the beavers being protected by our government? (219) When white men first went to the western part of our country, they found great herds of buffaloes eating on the western plains. (220-1) Long years ago the Indians used to hunt in large groups. They built a large trap-fence with gates. They would drive animals into this to get caught. They needed the animals for food. (226-7) Illus of Indians hunting (226). Of course, the wild animals have no kind-hearted farmers to look after them. (229) It is impossible for any person to live without the help of plants and other animals. (232) Plants and animals are of great value to us. Did you ever stop to think about what animals do for us? ...animals help man. (233) Some scientists tell us that if all our birds were to be destroyed, it would be only about seven years before man and other animals of the earth would begin to starve. Birds help us because they kill insects. Insects would destroy all plants. (233) Mosquitoes, garden pests,-birds help us. Some eat seeds. Many are the weed seeds which farmers do not want. If you are wise, you will protect the birds. The homely garden toad is a helper of ours, too. It is an insect eater. (234) 235-illus of birds that are our friends. Snakes...are very helpful. They also eat mice which are found in the fields eating more than their share of the farmer's grain. (235) Animals give us food. Most of us eat some meat every day. Cows give us milk and cream and butter. Hens furnish eggs. (235) Animals give us clothing. Long ago people learned to use the skins of animals for clothing. People found...warm and comfortable. Eskimos use the skins of polar bears and other animals to make their warm suits. How lovely Indian suits are. They are almost always made from the skins of deer. Some Indians use animal skins for their house too. You wear animals skins. Gloves, shoes, fur collar, sweaters, wool. (235-7) 236-illus of Eskimos in fur. 237-What other animals help man besides those you have read about in this story? In how many ways do animals help man? Birds are often called "Balancers of Nature." How do you think they got that name? What harmful insects do birds destroy? 238-Make a list of all the birds which live near you that are helpful to man. The next time you go to a circus, or to the zoo, or to a farm, notice the way the animals are cared for. Notice how they are fed and watered. See how clean their homes are kept. Since animals are so valuable to us we should do all we can to protect them. Many of you probably have a rabbit...for a pet. Do you take good care of it?
Protection of our wild flowers and forests because of their aesthetic and economic value is stressed. (iv) Plants live in communities, as we do. Joan wanted to know what would happen if there were no plants on the earth. Man and the other animals would soon disappear, because they couldn't get any food. Plants are needed by animals. Plants supply enormous quantities of food for man and the other animals. They supply many kinds of materials that man needs for his home and for his clothes. (246) Animals and plants help each other. Animals give out carbon dioxide, plants take it in. Plants give out oxygen, animals breathe it in. (251) Grains, fruits and many of the vegetables contain starch and sugar. (253) These plants are used for food. Can you tell what part of each plant is eaten? (255) Everyone picking...not a single flower is left. Many people have pulled the whole plant, root and all, out of the moist earth. Most...thrown away. People have gathered all the wild flowers they wished. The country places near the cities have been stripped bare. Many of our most beautiful flowers can no longer be found because of careless picking. Flowers are living things, too. They should have a chance to live. (268-9) illus (269) poster The Outdoor Code- Help save the Trees and Wild Flowers, Protect the Birds and Game, Keep the Highways Beautiful, Pick up the Picnic Rubbish, Put out your Fire; the bury it. question.-Here are some if's to think about. Can you answer them?- If most or all of the flowers are picked, where will seeds for new plants be found? If the whole jack-in-the-pulpit plant is picked with the flower, how is the plant going to make its food? If fruit dealers continue to decorate their stands and baskets with branches and leaves of laurel, what will happen to the laurel bushes? If we wish to continue to decorate our homes at Christmas time with beautiful greens and holly, what must we do? If we see the flowers in the woods and fields and along the roadside and are satisfied to let them stay where they are, what will happen? (270) Make posters asking for help in saving the dogwood and other wild flowers. (270) People stopped and picked seeds off their clothes, helping them to travel from place to place. (275) People have helped plants to travel nearly all over the world. They have carried seeds from place to place and planted them. (279) Illus of plant brought from Asia (279) They did this because they wanted seeds and plants for their food, their clothing, their homes and their pleasure. (280) How should you like to live in a place where there were no trees? (284) When we see trees...how they are used, what is done to care for them. ...Forest trees do for us. They also tell some of the things we must do for our trees. You will find a number of things that you yourself can do to help take care of our trees. (284) Shade means cooler temperature. Trees protect them from chilly wind of the open country. (287-8) They break the force of the wind and so protect the country near them (illus of wind break on farm) (289) People who live in regions where there have always been trees seldom think how important the trees are. They have always had them; so they think very little about them. People...planted them. Many farmers plant rows of trees around their field and buildings. (289-90) Have you ever seen men building a new road or a state highway? Such roads often go
through hilly country. Coarse grass and grain are planted along the bare, hilly, side ...prevent the bank from going to pieces and slipping down on the roadway. (292) Cutting away the forests is often the cause of great floods and droughts. Can you name a river that causes much damage because of floods? Do you know where the water you drink and use in your home comes from? The water supply of many of the largest cities comes from forest streams in the mountains...It is often used to turn deserts into vegetable and flower gardens and fruit orchards. (294-5) Cutting down forests often causes floods which destroy all kinds of living things, cities and villages. Forest streams may be depended upon to supply water for many purposes. Forest help to make a country beautiful. (296) Should you be interested in making a list of all the things you know that are made out of wood? ...wood has a very important place in our homes and in our lives. It is said that we are using much more wood today than our forest produce each year. This could be done in the past, for trees were used that were growing long before the white man came to this country. early settlers ...homes ...to get wood for their cabins they cut down the trees. To grow food, they cleared the land of trees for their gardens and farms. Often they cut down a great many trees for their farms. They made the tree trunks into piles and burned them. (297) Years ago there were many, many trees in our country. Some people act as though there were still a great many trees. Most of the early trees are gone. The people living today should be allowed to use all the wood that they really need, but they should not be allowed to waste it. What will happen if we continue to use more wood than our forest produce? We should plan to take care of the trees so that the people who live after us many have forests. Here are some of the things ...new trees should be planted ...cut trees so others may grow...young trees protected...much wood is wasted by careless cutting...watch for insect pests and diseases ...insect pets should be destroyed...watch for forest fires (298) The United States has put aside for special protection many large stretches of forests in different parts of the country. Why do you think there is a greater number of forests west of the Mississippi? Many of them are very beautiful and are called parks. Some forests are owned by individual people. They may do as they please with their trees. There are many reasons why the US puts aside ...forest lands. We must have enough lumber. We must have a supply of water for our homes and for our lands. (299)The forest need to be protected most against fires and the careless, wasteful cutting of timber. (301) Campers, picnickers and hunters start a great many forest fire. (302) Many poets have written poems about trees. (308) Make posters or signs about preventing fires, wasteful cutting of branches and young trees. (309)

In early times man had to hunt and fish in order to live...soon learned to know the habits and the movements of the animals that would furnish his food and clothing.(44) migrating locusts appear in great numbers...do much damage to plant life...whole fields of grain are destroyed (50) Why do we no longer find great herds of buffaloes wandering over our plains? (51) The bat is a very helpful little animal. It eats... insects that bother us. Some people are afraid of bats because they have heard such foolish stories about them....there is no reason why one should be afraid of a bat. (69) Most people think that all snakes
are poisonous and harmful...Many of them are very useful to us. If we take the
time to become acquainted...we shall find them interesting and friendly (76-7)
Whether the woodchuck's fur is valuable? (80) Why farmers do not like to have
woodchucks on their farms? Why the bat is a good friend to man? (80)
Toads...are of very great value to people who have greenhouses. They are
great friends of the farmer and the gardener, for they eat the harmful insects that
destroy their crops. (318-9) The caterpillars of some butterflies and moths
destroy many, many dollars' worth of crops and trees every year. (333)
Silverfish...do a lot of damage. They destroy the bindings of
books,...clothing...stored food. (337) Do you know it is thought by some that
man must wage war on the insects or be conquered by them? How can we fight
insects? Does this mean we should kill every insect we meet? Are all the
insects harmful? Some insects enter our homes and eat our food...clothes.
Some destroy the grain and cotton in the fields...spread diseases. Do they hate
man? (342) Some of these insects are very useful to man...some are quite
harmful. Many of them do not help man in any way, but neither do they harm
him. (343) There are people who think that all insects are bad and should be
killed. Man must constantly fight the harmful insects. If he doesn’t, his food, his
trees, and some of his clothes may be eaten and destroyed. A few of the
harmful ones may attack and annoy him. (345-6) Insects that are useful to man
because of what they make. Honeybees are even more valuable because they
carry pollen from flower to flower. Bees give us wax too. This wax is of great
value to man. (346-7) Silkworms-cloth...are among our most important
domestic animals. (349-50) Lac insects are very valuable. Layers are taken off
and made into many things. (351) Many insects attack, kill and eat other insects
that are harmful to man. They eat those that destroy his crops and his trees.
They eat those that suck his blood or poison or annoy him. They eat those that
attack his animals. (351) This scale pest was destroying many of the best fruit
trees. So people brought a special kind of ladybug from Australia to help them
get rid of the pest. (353) The mantis eats a great many grasshoppers and other
harmful insects. (354) Bees...helping to fertilize the flower and fruit seeds is
one of the most important ways in which insects help man. (355) What is the
most valuable work that insects do for man? Do you know any useful insects
that are not mentioned in this unit? (356) Insects that interfere with Man's health
(357) Certain kinds of mosquitoes are the means of spreading malaria and
yellow fever. People are trying hard to get rid of them by draining the swamps
and by pouring oil on the surface of the water in swampy places. (357-9) House
flies are as dangerous to man's health as mosquitoes (359) Insects that eat
man's food and his trees. Man must take care of his food, or the insects will
have the larger part of it. (362-3) Harmful insects brought to us from other
countries. (366) People need to watch their trees carefully and to spray them
with the right kind of poison. (370) Many of the insects that are brought into the
US become dangerous pests. In their home country there is usually some
enemy to prey upon and kill them. (373) What is the very best and surest way to
get rid of some of the bad insect pests? Explain each of the following:-Man
must declare war on those insects that are harmful. We should not kill all
insects. Insects that are not harmful in Europe may become very harmful when
brought to America. Birds help us in fighting harmful insects. Some insects help us in fighting other insects. What is the greatest thing which man has that insects do not have? (374) Plants in cities have great difficulty in making all the food they need. Smoke, dust, and soot collect on the upper surfaces of the leaves. A great deal of sunlight is shut out from the leaves because of this. Why do trees often look so much fresher and greener in the country than in the city? (255)

Many farmers irrigate dry lands so that crops can be grown upon them. Much land which was formerly useless... Farmers often drain swamps and marshy lands and then plant crops there. Do you know of any swampy lands near your home that have been drained? What use has been made of the drained lands? (224-5) Illus. (226) farmer draining land

Gerald S. Craig, Goldie M. Johnson Our Earth and its Story 1932 six

Quantities of lumber have been used for building and making furniture. Trees are used for fuel, telegraph and telephone poles, and in the manufacture of paper. (213) We need our forests, and we must save them. (214) Why is it necessary to weed your garden? (221) Our daily lives are greatly influenced by plants...food, drugs, medicine (249) Think of one plant or animal...is it helpful or harmful to man? (256)

Some birds that were once living here in great numbers have become extinct. There are now laws which say that some animals shall not be killed at all, and that other animals may be killed only a few at a time. (214) It has been estimated that insects destroy about one tenth of all the crops grown. There are so many of them that when we undertake to kill them, it is as if we were fighting whole armies. (216) Birds are always helping to keep down the number of insects that would soon cover the earth if they were ever left long without enemies. (219) If millions of weed seeds were not destroyed each year, such plants would soon spread over the world. Seed-eating birds destroy billions of weed seeds, which under the right conditions, might produce billions of weeds. (220) What do men do to destroy harmful insects? (221) Tell in how many ways harmful insects may be destroyed. What does the government do to destroy them? (222) It is a good thing that many animals are destroyed, for the earth is not large enough to allow all animals to live their full life and die of old age. (225) Animals are not able to think as human beings do. (242) Because of his guns, man is the most dangerous enemy of many animals, and because of his intelligence he has become the ruler of the earth. Because of their great numbers, some harmful insects are among his worst enemies. There are many more insects than men on the earth, but by using his mind, man is discovering ways of controlling the numbers of some of his insect foes. ...he has learned to use things around him for his own good. (243)

This is because man has added his efforts to the forces of nature. He turns rivers from their courses. He irrigates the desert and clothes it with life. He chops down forests and builds great cities. He carries plants and animals from one country to another. He kills off whole changed the conditions under which many plants and animals must live. It has been estimated that man is
causing life on the earth to change ten thousand times as fast as it did before he came upon the scene. (424) Not all the changes which are now taking place are to the advantage of the human race. Some of them may even threaten man's continued life. It is certain that he is wasting his natural resources. He is destroying forests without replacing them. But the greatest problem of all is for man to learn how to use these natural resources and to preserve the beauty of the earth so that there will be food and happiness for everyone. (427)

As he cultivated the land, the grazing grounds for buffaloes and deer were destroyed. The freedom of many animals was disturbed; they were killed by the hundreds. Towns and cities have destroyed many of the natural nesting places of birds. Forests have been destroyed and birds do not have as many places in which to live. They are not well protected in the places that do remain. Swamps have been drained that were once places where birds could get food and find some protection. Man is just as careless in destroying plant life. But man has been very wasteful in cutting down the forests. He cut and burned great numbers of trees when he cleared the land for farming. (212)

...but a balance upset in this way is not difficult to build up again. When the balance of living things is upset rather badly, it is usually because of something man has done. Perhaps without meaning to do so, he has carelessly brought in some harmful insect from another country and has separated it from its enemies, which keep it from spreading. This happened in the case of the Mediterranean fruit fly, which has done so much damage to fruit. (210-1) How many ways can you think of in which man has done something to upset the balance of the living world? What would happen if all the birds were killed and the insects were allowed to increase? (221)
Appendix B

Grade Level Six Data

These data represent the excerpts and interpretation of textual material from all publishers during the initial phase of the study for only one grade level—six.

Discover Our World  
Beauchamp, Melrose, Blough  
Six  Scott Foresman 1939

We protect plants from their enemies (pests and weeds). We use poison on pests and weeds. People get all clothing, shelter, food from plants and animals. We have cut trees carelessly. Fire, insects, disease destroy trees. We need to plant trees, use better logging practices. Animals are killed, habitat destruction. We need sanctuaries and laws to protect animals and plants.

Work of Scientists  
Patch, Howe  
six  Macmillan 1935  None

The Earth Then and Now  
Craig, Johnson, Lewis  
six  Ginn 1940

Man makes great changes in the plant and animal world-farming, domestication. Man upsets the balance among the living things. Billions of acres of land have been greatly changed since men began to raise their own food-forest, plowing, swamps. Habitat destruction-some plants and animals destroyed. Brought in plants and animals from other regions. Fishing, dams, industries, sewage, oil, cut down on number of fish changes farm lands into deserts-erosion. Habitat destruction. Man upset balances.

Wonderworld of Science  
Knox, Meister, Stone, Wheatley  
six Scribner 1941, 1957

We use plants and animals for food. We use plants and animals.

New Ideas in Science  
Craig, Hyde  
six  Ginn 1946

Oceans-food. Man cannot carelessly interfere in the animals’ struggle for life without making mistakes. Man must know a great deal about animal life before he can make any changes that will be helpful to himself and his animal neighbors. Habitat destruction-grasslands/grazing, cutting forests, plowing.

Will the use of DDT to kill insects make new problems for mankind? Change to help us. Habitat destruction. Oceans-food. We are connected to animals and plants.

Discovering Our World Three  
Beauchamp, Williams, Blough  
six  Scott Foresman 1948, 1957

Farming-erosion. When a farmer protects his animals and plants and uses them wisely he is helping to conserve living things. We need living things—forests, grasslands. Conserve water, soil, wood, pasture, food. Early settlers
killed, plowed, destroyed forests, habitat destruction. Living things help us in many ways. We enjoy living things—birds, wildflowers. What will probably happen if people change the place where these things live? We need living things. Conservation—habitat destruction.

Adventures in Science with Ruth and Jim Carpenter, Bailey, Smith six Allyn and Bacon 1949

Soil not used wisely. People, without intending to harm birds, have done things which in many cases have caused them to die out or go elsewhere to live. Changed nesting places—drain, plow, settle (habitat destruction). Forests—wood, destroyed by fires, insects, cutting. Humans upset balance—introduce new species, hunting, destroy habitat. Partners with nature. Habitat destruction. Upset balance. Partners with nature.

Adventuring in Science Craig, Hill six Ginn 1955

Control pests. We control nature.

Science for Today and Tomorrow Schneider six Heath 1955

We use plants for food. Farming has changed the land. Irrigation has changed desert to farmland. We use plants. We control nature.

Exploring Science Thurber six Allyn and Bacon 1955

People have been careless with soil-farming, fire, overgrazing. Help with good cover, crop rotation, strip cropping, contour. Garbage and waste will ruin fishing. Rivers to dirty for shad and Atlantic salmon—laws to protect salmon. Dams are a danger. Lumbering—we are using forest faster than growing—we waste too much—parasites, burning. Conservation.

Science/Health/Safety Barnard, Stendler, Spock, Bradford, six Macmillan 1959

Insecticides—control pests. Fish for food. We use animals. We control nature.

ABC Science Series Jacobson, Lauby six ABC Science Series ABC 1961

Insects harmful to man—dust crops. Some insects beneficial. Insects harmful to man.


Harmful insects—use chemicals to control. Make sure won't harm people. Insects one of farmer's biggest problem. Plankton for food, fish for food, farm the ocean. Insects harmful. We use oceans for food.

Science is Adventuring Blough, Marshall, Bailey, Beauchamp six Scott Foresman 1965, 1968
Many of these living things are necessary to us. Plants and animals are used for food and clothing (we use plants and animals). "Scientists are studying our living neighbors to learn how to improve and use the helpful ones and how to control the harmful ones." p. 28-9. We use plants for food, beauty. Fertilizers help plants, chemicals control pests. We use plants and animals. We control nature.

Science for Today and Tomorrow Schneider six Heath 1965
We use plants for food. We use plants.

We control insects that would destroy crops and man himself. Some useful for pollination. We improve fishing by using technology. We control nature. Insects harmful to man.

Dynamic World of Science Novak, Meister, Knox, Sullivan six World of Science Bobbs-Merrill 1966
Man, like other living things, is affected by his environment. Man utilizes resources carefully. In what ways might man affect the environments in which the various plants and animals live? Man uses resources. We affect the environment, the environment affects us.

Science six Smith, Blecha, Sternig six Laidlaw 1966, 1972
none

Concepts in Science Brandwein, Cooper, Blackwood, six Harcourt Brace 1966
Man also is adapted to and interdependent with his environment. Man makes changes in his environment instead of adjusting to a changing environment to control and change his environment. Man too depends on his environment and on plants and animals. Man controls his environment. Man depends and is interdependent on his environment.

Science for Tomorrow's World Barnard, Stendler, Spock six MacMillan 1966
The idea that as civilization spreads, all wildlife become scarcer is false. Many animals have been very successful to changed conditions brought about by man. Animals and plants die as their environments are destroyed-water and air pollution. Because of man's carelessness, these animals are extinct. To let any species of plant or animal vanish is to lose for all time a part of our inheritance-drugs, living resources-important for man to protect. Habitat destruction. We use plants and animals. How have changes affected living things? We use plants and animals. Habitat destruction.

Science for You Craig, Sheckles six Ginn 1965
Insects cause disease, pests. Many things in both the living and non living world contribute to your welfare. Men have introduced new species of
plants and animals when we move—unwanted invaders if we don’t want them—we use laws, chemicals and biological controls to control. We have killed animals for food, fur, sport, habitat destruction (swamps, forests, grasslands), introduction of new species, pollution. What good are bald eagles to mankind?

We use plants and animals. Habitat destruction. We control nature.

Science six Mallinson, Smallwood six Silver Burdett 1965

Man is in the middle of the competition. Insects are among man’s competitors. There is competition whenever man and some other organism use the same material. The term “enemy of man” is not scientifically accurate—why? Man is in competition with other species.

Modern Science Smith, Blecha, Pless six Laidlaw 1970 none

Discovering Science Six Piltz, Van Bever six Merrill 1970 none

Science Measuring Things Barnard, Lavatelli six MacMillan 1970

Conservation problems are mostly man-made problems. Need laws for conservation of soil, water, forest, air. Need laws for pollution control of factories, cars. If we waste our resources the world may be barren for those who follow. Problems are man-made, we can control. Waste resources affect the future.

Science Formulating Ideas Jacobson, Victor, Bullett, Konicek, Vessel, Wong six ABC 1972

People are part of the biotic community. People changed the biotic community to suit themselves—habitat destruction. People change communities (habitat destruction). People are part of the community.

Concepts in Science Brandwein, Cooper, Blackwood, Hone, Fraser six HBJ 1972

Man is interdependent with his environment. Man not only is adapted to the environment he can change his environment. Man can adjust to a changing environment. Without a healthy ecosystem, plants and animals and man cannot live. There is only one living thing that can live almost anywhere in the world ecosystem—man. Your life and the life of many persons depends on the world ecosystem. Man can and does modify his environment. Man can change his environment. Man is interdependent with his environment. Plants, animals and man need a healthy ecosystem. We depend on a world ecosystem.

Ginn Science Program Intermediate C Asimov, Gallant six Ginn 1973

Man has caused more changes in the environment in a shorter time than any other species of animal that we know.—Cities, timber, farms, mining, dams done for the good of man (habitat destruction). Some things done with the best intentions turn out to be harmful to man and to those parts of the environment.
that he claims to value. Use of fertilizers and pesticides as examples of
previous statement. If we come to depend too much on such "pills" for the
environment we invite trouble by tampering with nature. Man has a long history
of changing the environment to suit his own and sometimes selfish needs. Strip
mining, dams, oil spills, wetland drainage. We must try to see an animal, plant,
or ocean as whole, not a lot of bits and pieces that have nothing to do with each
other. Helps us come to know more about ourselves in relating to the
environment. Does smog, soil pollution effect plant growth?
Might our environment change so that man could not survive? Man changes
environment to suit himself (habitat destruction) All parts of nature as
interdependent, including man.

Science for today and tomorrow Schneider six Heath 1973
We use plants for food. We use plants for food.

Science Understanding Your Environment Mallinson, Brown, Smallwood
six Silver Burdett 1972,1975
Hundreds of different organisms use the same food you use—they
compete with you for the food supply. Insects are your greatest competitors.
many insects aid us. We are partly to blame for the damage caused by rodents-
we killed the predators. Competition for food.

Exploring Science Red Blecha, Gaga, Green six Laidlaw 1976
People upset the balance with careless farming (topsoil), cleared forests,
factories pollute air, water. Keep the balance by fewer cars, better cars, filter air
new energy sources. laws save animals We can control nature. Habitat
destruction.

Science Understanding Your Environment Mallinson, Brown, Smallwood,
Knapp six Silver Burdett 1978,1981
We use plants and animals as food. We farm the oceans. Pollution,
population explosion, conservation. We have polluted oceans with garbage
and oil. We use plants and animals as food. Habitat
destruction.

People are interdependent with their environment. people are adapted
to the environment and we change the environment. We and our environment
are one. Without a healthy ecosystem, plants, animals, and people cannot live.
Our environment must provide food, water, warmth. Your life and the life of
many people depends on the world ecosystem. Earth- ecosystem, all people
interdependent, should we share food. In order to live we must conserve the
world ecosystem. People are interdependent with their environment Should
we use pesticides to save our crops from insects? Save our crops from
insects. We are interdependent with the world ecosystem.

Elementary Science 6 Bendick, Gallant six Ginn 1980

138
We change the environment, some good, some bad. DDT, carbon dioxide, climate, trees. We change the environment.

Accent on Science Sund, Adams, Hackett six Merrill 1980
Population increases so that plants and animals affected—kill, habitat destruction, no food; areas and laws to protect. Food from sea—over fishing, pollution. We cause some air pollution—industry, cars, clean smoke. Most pollution is a product of people. Fertilizers, pesticides, thermal pollution, radiation. Habitat destruction. We use oceans for food. Pollution.

Heath Science Barufaldi, Ladd, Moses, Schneider six Heath 1981, 1985
We use plants for food. We are consumers. We use plants.

Gateways to Science Holmes, Leake, Shaw six McGraw-Hill 1983
We eat algae. We use trees for wood. We use mollusks for food. We use fish for food—save fish so food for future. Keep water clean. Snakes valuable because kill insects, rodents. Use reptiles for food, clothes, decorations. We use plants and animals.

Accent on Science Sund, Adams, Hackett, Moyer six Merrill 1983, 1985
Health problems—protists. Your life affects the lives of many different organisms. Many organisms also affect you. People are apart of many communities in the environment—have relationships, cause changes. We pollute water—sewage, chemicals, thermal. Most air pollution caused by people. Changes in lifestyle. How does population growth affect the environment. pollution. People are part of a community—relationships.

Silver Burdett Mallinson, Smallwood, Valentino six Silver Burdett 1984, 1987
Cleared deciduous forests for farms, cities. Half of rainforests destroyed (only 1984 mentioned humans as responsible for clear cut for farms and then move on; 1987 mentioned climate effect). Prairies changed to meet need of people, deserts changed by irrigation. Effects and change on biomes by humans. Natural resources material found in nature and used by people to meet their needs. Trees thought we'd never run out, trees scarce in many places—birds animals killed for sport. Farming oceans Habitat destruction.

HBJ Science Cooper, Blackwood, Boeschen, Giddings, Carin six HBJ 1985
We use plants for food. We change the balance. We change our environment—sometimes better, sometimes worse. We can change biomes. When you change one thing somewhere you may affect living and non-living things far away. Man can live in all biomes. We use plants. We change environment.
Carrying capacity of earth able to support a great increase in world population. Increase in people have resulted in many changes to the environment and to ecosystem—greater demand on food, water, energy, space, products. Hunters-farmers used resource to meet our needs. Farming—erosion, pest control, use up soil, minerals. Pollution—industries, waste, industrial revolution. Greater demand on resources, better use. Conservation environment—laws, planning, sanctuaries. What responsibilities do people have toward the environment? Who must take responsibility for conserving the resources? We change environment. Pollution.

Removing predators effects community. We distribute balances—hunting, insecticides. City as an ecosystem. Human population disturb ecosystem. Increasing needs of human population. We use resources other organisms need. Drilled and used ground water, pollute ground water. Use fish for food—sea farming. What kinds of relationships might people have with the organisms in the picture?

How do farmers compete with other organisms for resources?

What kind of consumers are people? We change environment. Pollution. We use animals for food. We have relationships with other organisms.

People, giraffes and barn owls all need green plants. We eat plants and animals. When you change one thing somewhere, you may affect living and non-living things far away. Other living things do not change their environment the way we do. We can damage our ecosystem in many ways. People also change ecosystem in many ways. People also change ecosystems for the better. If we destroy the green plants, all living things will die—actions of people can change a biome very quickly. We use plants and animals. We change the environment.
Appendix C

Elementary Science Textbook Bibliography

**ABC**

Bks. 1-6

"Beginning science" (1)  
"Looking into science" (1)  
"Searching into science" (2)  
"Learning in science"  
"Probing into science"  
"Inquiring into science"  
"Investigating in science" (6)

Jacobson, W.J., et al., Investigating in science, 1972, 1975, ABC.  
"Science, building ideas" (1)  
"Science, comparing ideas"  
"Science, discovering ideas"  
"Science, exploring ideas"  
"Science, formulating ideas"  
"Science, generating ideas"

**Allyn and Bacon**

"Adventures in Science with Judy and Joe"  
"Adventures in Science with Bob and Don"  
"Adventures in Science with Doris and Billy"  
"Adventures in Science with Jane and Paul"  
"Adventures in Science with Ruth and Jim" (1942)  
"Adventures in Science with Jack and Jill" (1943-4)

Bks. I-VI

**Bobbs-Merrill, Merrill**

"Inviting world of science"  
"Exciting world of science"  
"Changing world of science"
"Expanding world of science"
"Orderly world of science"
"Dynamic world of science"

Grs. 1-6.

Grs. k-6, levels k-6

Ginn
Craig, G.S. and others, Pathways in Science, Ginn, 1933.
"We Look About Us"
"Out of Doors"
"Our Wide, Wide World"
"The Earth and Living Things"
"Learning About Our World"
"Our Earth and Its Story"

Craig, G.S., New Pathways in Science, Ginn, 1940.
Primer "We Want to Know"
I "We Find Out"
II "Changes All Around Us"
III "Our Earth and Sky"
IV "The Earth and Life Upon It"
V "From Sun to Earth"
VI "The Earth Then and Now"

Craig, G.S., Our World of Science, Ginn, 1946.
I "Science All About Us"
II "Science Through the Year"
III "Science Every Day"
IV "Exploring in Science"
V "Working with Science"
VI "New Ideas in Science"

Craig, G.S., and others, Science Today and Tomorrow, Ginn, 1954-1956
"Science Near You"
"Science Around You"
"Science Everywhere"
"Discovering with Science"
"Adventuring with Science"
"Experimenting with Science"
"Learning with Science"

Bks. 1-6.
"Starting points in science" (p)
"introductory levels A-C" (1-3)
"intermediate levels A-C" (4-6)
"Advanced levels A-B" (7-8)

Ginn elementary science program, 1980, Ginn.
Grs. 1-6.

Harcourt, Brace and Jovanovich
Bks. 1-6

"Concepts in science, yellow" (k)
"Concepts in science, red"
"Concepts in science, green"
"Concepts in science, orange"
"Concepts in science, purple"
"Concepts in science, brown" (6)

Levels k-6, (yellow, blue, red, green, orange, purple, brown)

Cooper, E.K., et al., HBJ science series, 1985, Harcourt, Brace & J.
Levels 1-6 (Blue, red, green, orange, purple, brown)

HBJ science, nova ed., 1989, Harcourt, Brace, & J.
Levels 1-6, Grs. 1-6

Heath
I "Our Pets"
II "Trailing Our Animal Friends"
III "Baby Animal Zoo"
IV "Animal Life"
V "Makers of Progress"
VI "Early Men of Science"
VII "The Ladder of Life"

"Science for Work and Play" (1)
"Science for Here and Now" (2)
"Science for Far and Near" (3)
"Science in Your Life" (4)
"Science in Our World" (5)
"Science for Today and Tomorrow" (6)

"Science around you" (p)
"Science for work and play"
"Science for here and now"
"Science far and near"
"Science in your life"
"Science in our world"
"Science for today and tomorrow"


Laidlaw
Grs. 1-6

Grs. 1-6.

Grs. 1-6 (orange, gold, blue, brown, green, red)

Macmillan
Bk. 1-6.

Bks. 1-6

"Science, observing things" (1)
"Science, finding out"
"Science, being curious"
"Science, comparing things"
"Science, testing ideas"
"Science, measuring things"
McGraw-Hill
Grs. k-6

Grs. k-6

Scott-Foresman
"Look and Learn" (1)
"All Around Us" (2)
"How do we Know" (3)


"Science is wondering"
"Science is fun" (1)
"Science is learning" (2)
"Science is exploring" (3)
"Science is experimenting" (4)
"Science is discovering" (5) (1963)
"Science is adventuring" (6) (1963)

Grs. k-6

Scott Foresman science, 1984, Scott-Foresman.
Grs. k-6

Scribner
Meister, M., Living in a World of Science, Scribner, 1932.
"Bk. 1: Water and Air; Heat and Health"
"Bk. 2: Magnetism and Electricity; Energy and Power"

Bks I-VI

Meister, M., Living With Science, Scribner, 1940.
"Air and Water"
"Food and Sunshine"
"Life and the Weather"
"Man and His Neighbors"
"The Needs of Living Things"
"Life and Energy"

**Silver-Burdett**
Gr. 1-6, Bks. 1-6.

Gr. 1-6, levels 1-6

National Environmental education development, Adventure in environment, 1976, Silver-Burdett.
Levels k-8
### Table 4
The Occurrence of Sub-Components by Decades for Grade One

<table>
<thead>
<tr>
<th>Decade (Number of Books)</th>
<th>Anthropocentric Sub-components</th>
<th>Ecocentric Sub-components</th>
<th>No Mention of humans as a part of ecosystems</th>
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<tbody>
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<td>Humans use plants</td>
<td>Humans use animals</td>
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Table 5
The Occurrence of Sub-Components by Decades for Grade Two

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<th>Decade (Number of Books)</th>
<th>Anthropocentric Sub-components</th>
<th>Ecocentric Sub-components</th>
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<td>3 (100%)</td>
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Table 6
The Occurrence of Sub-Components by Decades for Grade Three

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<th>Decade (Number of Books)</th>
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Table 7  
The Occurrence of Sub-Components by Decades for Grade Four

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The Occurrence of Sub-Components by Decades for Grade Five

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<td>Humans compete in ecosystems</td>
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The Occurrence of Sub-Components by Decades for Grade Six

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## Table 10
The Occurrence of Sub-Components by Publisher for the Period 1930 - 1939

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<tr>
<td>Ginn (6)</td>
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<td>6 (100%)</td>
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<tr>
<td>Macmillan (5)</td>
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<td>Scott-Foresman (6)</td>
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Table 11
The Occurrence of Sub-Components by Publisher for the Period 1940 - 1949

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</tr>
<tr>
<td>Allyn &amp; Bacon (7)</td>
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<tr>
<td>Ginn (12)</td>
<td>12 (100%)</td>
<td>11 (92%)</td>
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<tr>
<td>Scott-Foresman (7)</td>
<td>4 (57%)</td>
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<td>Scribner (6)</td>
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Table 12
The Occurrence of Sub-Components by Publisher for the Period 1950 - 1959

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<td>Humans use animals</td>
</tr>
<tr>
<td>Allyn &amp; Bacon (6)</td>
<td>2 (33%)</td>
<td>3 (50%)</td>
</tr>
<tr>
<td>Ginn (6)</td>
<td>6 (100%)</td>
<td>5 (83%)</td>
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<tr>
<td>Heath (6)</td>
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<tr>
<td>Macmillan (6)</td>
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<td>Scott-Foresman (2)</td>
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<td>Scribner (2)</td>
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Table 13
The Occurrence of Sub-Components by Publisher for the Period 1960 - 1969

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The Occurrence of Sub-Components by Publisher for the Period 1970 - 1979

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<th>Humans are dependent with ecosystems</th>
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<th>Humans influence balance of ecosystem</th>
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<td>Humans are dependent with ecosystems</td>
<td>Humans are part of the world ecosystem</td>
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The Occurrence of Sub-Components by Publisher for Grade Two

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The Occurrence of Sub-Components by Publisher for Grade Five

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</tr>
<tr>
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<td>Humans use animals</td>
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</tr>
<tr>
<td></td>
<td>Humans cause pollution</td>
<td>Humans cause habitat destruction</td>
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The Occurrence of Sub-Components by Publisher for Grade Six

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<td>Laidlaw, Laidlaw-Macmillan (4)</td>
<td>1 (25%)</td>
<td>2 (50%)</td>
</tr>
<tr>
<td>Macmillan (5)</td>
<td>2 (40%)</td>
<td>3 (60%)</td>
</tr>
<tr>
<td>Scott-Foresman (4)</td>
<td>3 (75%)</td>
<td>4 (100%)</td>
</tr>
<tr>
<td>Silver Burdett (5)</td>
<td>2 (33%)</td>
<td>5 (63%)</td>
</tr>
</tbody>
</table>
Table 22
The Occurrence of Sub-Components by Grade Levels for Ginn

<table>
<thead>
<tr>
<th>Grade Level (Number of Books)</th>
<th>Anthropocentric Sub-components</th>
<th>Ecocentric Sub-components</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Humans use plants</td>
<td>Humans use animals</td>
</tr>
<tr>
<td>One (7)</td>
<td>7 (100%)</td>
<td>5 (71%)</td>
</tr>
<tr>
<td>Two (7)</td>
<td>7 (100%)</td>
<td>7 (100%)</td>
</tr>
<tr>
<td>Three (7)</td>
<td>6 (86%)</td>
<td>5 (71%)</td>
</tr>
<tr>
<td>Four (7)</td>
<td>7 (100%)</td>
<td>7 (100%)</td>
</tr>
<tr>
<td>Five (7)</td>
<td>7 (100%)</td>
<td>6 (86%)</td>
</tr>
<tr>
<td>Six (7)</td>
<td>7 (100%)</td>
<td>6 (86%)</td>
</tr>
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Table 23
The Occurrence of Sub-Components by Decades for Ginn

<table>
<thead>
<tr>
<th>Decade (Number of Books)</th>
<th>Anthropocentric Sub-components</th>
<th>Ecocentric Sub-components</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Humans use plants</td>
<td>Humans use animals</td>
</tr>
<tr>
<td>1930-1939 (6)</td>
<td>6 (100%)</td>
<td>6 (100%)</td>
</tr>
<tr>
<td>1940-1949 (12)</td>
<td>12 (100%)</td>
<td>11 (92%)</td>
</tr>
<tr>
<td>1950-1959 (6)</td>
<td>6 (100%)</td>
<td>5 (83%)</td>
</tr>
<tr>
<td>1960-1969 (6)</td>
<td>5 (83%)</td>
<td>5 (83%)</td>
</tr>
<tr>
<td>1970-1979 (6)</td>
<td>6 (100%)</td>
<td>6 (100%)</td>
</tr>
<tr>
<td>1980-1989 (6)</td>
<td>6 (100%)</td>
<td>3 (50%)</td>
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Table 24
The Occurrence of Sub-Components by Grade Levels for Macmillan Publishers

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<th>Anthropocentric Sub-components</th>
<th>Ecocentric Sub-components</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Humans use plants</td>
<td>Humans use animals</td>
</tr>
<tr>
<td>One (3)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Two (5)</td>
<td>3 (60%)</td>
<td>3 (60%)</td>
</tr>
<tr>
<td>Three (4)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Four (5)</td>
<td>5 (100%)</td>
<td>3 (60%)</td>
</tr>
<tr>
<td>Five (5)</td>
<td>2 (40%)</td>
<td>5 (100%)</td>
</tr>
<tr>
<td>Six (5)</td>
<td>2 (40%)</td>
<td>3 (60%)</td>
</tr>
</tbody>
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Table 25
The Occurrence of Sub-Components by Decades for Macmillan Publishers

<table>
<thead>
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<th>Decade (Number of Books)</th>
<th>Anthropocentric Sub-components</th>
<th>Ecocentric Sub-components</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Humans use plants</td>
<td>Humans use animals</td>
</tr>
<tr>
<td>1930-1939 (5)</td>
<td>3 (60%)</td>
<td>2 (40%)</td>
</tr>
<tr>
<td>1940-1949 (0)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1950-1959 (6)</td>
<td>2 (33%)</td>
<td>3 (50%)</td>
</tr>
<tr>
<td>1960-1969 (11)</td>
<td>5 (45%)</td>
<td>7 (64%)</td>
</tr>
<tr>
<td>1970-1979 (5)</td>
<td>2 (40%)</td>
<td>2 (40%)</td>
</tr>
<tr>
<td>1980-1989 (6)</td>
<td>0</td>
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Note: Numbers in parentheses indicate the percentage of occurrences.
## Table 26
The Occurrence of Sub-Components by Grade Levels for Scott-Foresman

### Anthropocentric Sub-components

<table>
<thead>
<tr>
<th>Grade level (Number of Books)</th>
<th>Humans use plants</th>
<th>Humans use animals</th>
<th>Humans cause pollution</th>
<th>Humans change ecosystems</th>
<th>Humans cause habitat destruction</th>
<th>Humans compete in ecosystems</th>
<th>Humans are part of the food chain/web</th>
<th>Humans are dependent on ecosystems</th>
<th>Humans are part of the world ecosystem</th>
<th>Humans influence balance of ecosystem</th>
<th>No Mention of humans as a part of ecosystems</th>
</tr>
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<tr>
<td>One (6)</td>
<td>4 (87%)</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2 (33%)</td>
</tr>
<tr>
<td>Two (5)</td>
<td>1 (20%)</td>
<td>2 (40%)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3 (60%)</td>
</tr>
<tr>
<td>Three (5)</td>
<td>2 (40%)</td>
<td>2 (40%)</td>
<td>1 (20%)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2 (40%)</td>
</tr>
<tr>
<td>Four (4)</td>
<td>1 (25%)</td>
<td>1 (25%)</td>
<td>1 (25%)</td>
<td>2 (50%)</td>
<td>1 (25%)</td>
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<td>0</td>
<td>0</td>
<td>0</td>
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<td>2 (50%)</td>
</tr>
<tr>
<td>Five (4)</td>
<td>3 (75%)</td>
<td>3 (75%)</td>
<td>1 (25%)</td>
<td>1 (25%)</td>
<td>2 (50%)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1 (25%)</td>
</tr>
<tr>
<td>Six (4)</td>
<td>3 (75%)</td>
<td>4 (100%)</td>
<td>1 (25%)</td>
<td>1 (25%)</td>
<td>2 (50%)</td>
<td>1 (25%)</td>
<td>0</td>
<td>1 (25%)</td>
<td>0</td>
<td>1 (25%)</td>
<td></td>
</tr>
<tr>
<td>Decade (Number of Books)</td>
<td>Humans use plants</td>
<td>Humans use animals</td>
<td>Humans cause pollution</td>
<td>Humans change ecosystems</td>
<td>Humans cause habitat destruction</td>
<td>Humans compete in ecosystems</td>
<td>Humans are part of the food chain/web</td>
<td>Humans are dependent with ecosystems</td>
<td>Humans are part of the world ecosystem</td>
<td>Humans influence balance of ecosystem</td>
<td>No Mention of humans as a part of ecosystems</td>
</tr>
<tr>
<td>-------------------------</td>
<td>------------------</td>
<td>-------------------</td>
<td>-----------------------</td>
<td>------------------------</td>
<td>-------------------------------</td>
<td>-------------------------------</td>
<td>-----------------------------------</td>
<td>--------------------------------------</td>
<td>--------------------------------------</td>
<td>----------------------------------------</td>
<td>---------------------------------------</td>
</tr>
<tr>
<td>1930-1939 (6)</td>
<td>3 (50%)</td>
<td>3 (50%)</td>
<td>0</td>
<td>0</td>
<td>2 (33%)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3 (50%)</td>
</tr>
<tr>
<td>1940-1949 (7)</td>
<td>4 (57%)</td>
<td>5 (71%)</td>
<td>0</td>
<td>1 (14%)</td>
<td>1 (14%)</td>
<td>0</td>
<td>0</td>
<td>1 (14%)</td>
<td>0</td>
<td>0</td>
<td>2 (29%)</td>
</tr>
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<td>1950-1959 (2)</td>
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<td>2 (50%)</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1960-1969 (6)</td>
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<td>2 (33%)</td>
<td>0</td>
<td>1 (17%)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3 (50%)</td>
</tr>
<tr>
<td>1970-1979 (6)</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1980-1989 (7)</td>
<td>4 (57%)</td>
<td>3 (43%)</td>
<td>4 (57%)</td>
<td>2 (29%)</td>
<td>2 (29%)</td>
<td>1 (14%)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1 (14%)</td>
<td>2 (29%)</td>
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</table>
Table 28
The Occurrence of Sub-Components by Grade Levels for Heath Publishers

<table>
<thead>
<tr>
<th>Grade Level (Number of Books)</th>
<th>Anthropocentric Sub-components</th>
<th>Ecocentric Sub-components</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Humans use plants</td>
<td>Humans use animals</td>
</tr>
<tr>
<td>One (5)</td>
<td>3 (60%)</td>
<td>0</td>
</tr>
<tr>
<td>Two (5)</td>
<td>4 (80%)</td>
<td>4 (80%)</td>
</tr>
<tr>
<td>Three (4)</td>
<td>3 (75%)</td>
<td>3 (75%)</td>
</tr>
<tr>
<td>Four (4)</td>
<td>3 (75%)</td>
<td>4 (100%)</td>
</tr>
<tr>
<td>Five (3)</td>
<td>1 (33%)</td>
<td>1 (33%)</td>
</tr>
<tr>
<td>Six (4)</td>
<td>4 (100%)</td>
<td>0</td>
</tr>
</tbody>
</table>
Table 29
The Occurrence of Sub-Components by Decades for Heath Publishers

<table>
<thead>
<tr>
<th>Decade (Number of Books)</th>
<th>Anthropocentric Sub-components</th>
<th>Ecocentric Sub-components</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Humans use plants</td>
<td>Humans use animals</td>
</tr>
<tr>
<td>1930-1939 (0)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1940-1949 (0)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1950-1959 (8)</td>
<td>5 (83%)</td>
<td>3 (50%)</td>
</tr>
<tr>
<td>1960-1969 (7)</td>
<td>7 (100%)</td>
<td>3 (43%)</td>
</tr>
<tr>
<td>1970-1979 (5)</td>
<td>3 (60%)</td>
<td>3 (60%)</td>
</tr>
<tr>
<td>1980-1989 (7)</td>
<td>3 (43%)</td>
<td>3 (43%)</td>
</tr>
</tbody>
</table>
Table 30

The Occurrence of Sub-Components by Grade Levels for Harcourt / Brace / Jovanovich

<table>
<thead>
<tr>
<th>Grade level (Number of Books)</th>
<th>Anthropocentric Sub-components</th>
<th>Ecocentric Sub-components</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Humans use plants</td>
<td>Humans use animals</td>
</tr>
<tr>
<td></td>
<td>Humans cause pollution</td>
<td>Humans change ecosystems</td>
</tr>
<tr>
<td></td>
<td>Humans cause habitat destruction</td>
<td>Humans compete in ecosystems</td>
</tr>
<tr>
<td></td>
<td>Humans are part of the food chain/web</td>
<td>Humans are dependent with ecosystems</td>
</tr>
<tr>
<td></td>
<td>Humans influence balance of ecosystem</td>
<td>No Mention of humans as a part of ecosystems</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>One  (4)</th>
<th>Two  (4)</th>
<th>Three (4)</th>
<th>Four  (5)</th>
<th>Five (5)</th>
<th>Six (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(25%)</td>
<td>(75%)</td>
<td>(100%)</td>
<td>(100%)</td>
<td>(75%)</td>
<td>(75%)</td>
</tr>
<tr>
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<td>1</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Humans use animals</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Humans cause pollution</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Humans change ecosystems</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Humans cause habitat destruction</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Humans compete in ecosystems</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Humans are part of the food chain/web</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Humans are dependent with ecosystems</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Humans influence balance of ecosystem</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>No Mention of humans as a part of ecosystems</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
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</table>
Table 31
The Occurrence of Sub-Components by Decades for Harcourt / Brace / Jovanovich

<table>
<thead>
<tr>
<th>Decade (Number of Books)</th>
<th>Anthropocentric Sub-components</th>
<th>Ecocentric Sub-components</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Humans use plants</td>
<td>Humans use animals</td>
</tr>
<tr>
<td>1930-1939 (0)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1940-1949 (0)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1950-1959 (0)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1960-1969 (5)</td>
<td>3 (60%)</td>
<td>2 (40%)</td>
</tr>
<tr>
<td>1970-1979 (4)</td>
<td>2 (50%)</td>
<td>3 (75%)</td>
</tr>
<tr>
<td>1980-1989 (18)</td>
<td>13 (72%)</td>
<td>13 (72%)</td>
</tr>
<tr>
<td>Grade Level (Number of Books)</td>
<td>Anthropocentric Sub-components</td>
<td>Ecocentric Sub-components</td>
</tr>
<tr>
<td>------------------------------</td>
<td>--------------------------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td></td>
<td>Humans use plants</td>
<td>Humans use animals</td>
</tr>
<tr>
<td>One (4)</td>
<td>1 (25%)</td>
<td>0</td>
</tr>
<tr>
<td>Two (5)</td>
<td>2 (40%)</td>
<td>2 (40%)</td>
</tr>
<tr>
<td>Three (3)</td>
<td>3 (100%)</td>
<td>1 (33%)</td>
</tr>
<tr>
<td>Four (3)</td>
<td>0</td>
<td>3 (100%)</td>
</tr>
<tr>
<td>Five (4)</td>
<td>1 (25%)</td>
<td>2 (50%)</td>
</tr>
<tr>
<td>Six (4)</td>
<td>1 (25%)</td>
<td>1 (25%)</td>
</tr>
<tr>
<td>Decade (Number of Books)</td>
<td>Anthropocentric Sub-components</td>
<td>Ecocentric Sub-components</td>
</tr>
<tr>
<td>--------------------------</td>
<td>-------------------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td></td>
<td>Humans use plants</td>
<td>Humans use animals</td>
</tr>
<tr>
<td>1930-1939 (0)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1940-1949 (0)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1950-1959 (0)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1960-1969 (5)</td>
<td>1 (20%)</td>
<td>1 (20%)</td>
</tr>
<tr>
<td>1970-1979 (13)</td>
<td>3 (23%)</td>
<td>6 (46%)</td>
</tr>
<tr>
<td>1980-1989 (5)</td>
<td>4 (80%)</td>
<td>3 (60%)</td>
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</table>
### Table 34
The Occurrence of Sub-Component by Grade Levels for Bobbs - Merrill / Merrill

<table>
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<th>Grade Level (Number of Books)</th>
<th>Anthropocentric Sub-components</th>
<th>Ecocentric Sub-components</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Humans use plants</td>
<td>Humans use animals</td>
</tr>
<tr>
<td>One (4)</td>
<td>2 (50%)</td>
<td>1 (25%)</td>
</tr>
<tr>
<td>Two (4)</td>
<td>2 (50%)</td>
<td>2 (50%)</td>
</tr>
<tr>
<td>Three (3)</td>
<td>1 (33%)</td>
<td>0</td>
</tr>
<tr>
<td>Four (4)</td>
<td>2 (50%)</td>
<td>2 (50%)</td>
</tr>
<tr>
<td>Five (4)</td>
<td>3 (75%)</td>
<td>4 (100%)</td>
</tr>
<tr>
<td>Six (4)</td>
<td>0 (25%)</td>
<td>1 (25%)</td>
</tr>
<tr>
<td>Decade (Number of Books)</td>
<td>Humans use plants</td>
<td>Humans use animals</td>
</tr>
<tr>
<td>--------------------------</td>
<td>-------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>1930-1939 (0)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1940-1949 (0)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1950-1959 (0)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1960-1969 (8)</td>
<td>2 (33%)</td>
<td>2 (33%)</td>
</tr>
<tr>
<td>1970-1979 (5)</td>
<td>2 (40%)</td>
<td>1 (20%)</td>
</tr>
<tr>
<td>1980-1989 (12)</td>
<td>8 (50%)</td>
<td>7 (58%)</td>
</tr>
<tr>
<td>Grade level (Number of Books)</td>
<td>Anthropocentric Sub-components</td>
<td>Ecocentric Sub-components</td>
</tr>
<tr>
<td>------------------------------</td>
<td>--------------------------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td></td>
<td>Humans use plants</td>
<td>Humans use animals</td>
</tr>
<tr>
<td>One (4)</td>
<td>1 (25%)</td>
<td>1 (25%)</td>
</tr>
<tr>
<td>Two (5)</td>
<td>2 (40%)</td>
<td>4 (80%)</td>
</tr>
<tr>
<td>Three (6)</td>
<td>5 (83%)</td>
<td>4 (67%)</td>
</tr>
<tr>
<td>Four (5)</td>
<td>3 (60%)</td>
<td>3 (60%)</td>
</tr>
<tr>
<td>Five (3)</td>
<td>3 (100%)</td>
<td>3 (100%)</td>
</tr>
<tr>
<td>Six (5)</td>
<td>2 (40%)</td>
<td>5 (100%)</td>
</tr>
<tr>
<td>Decade (Number of Books)</td>
<td>Anthropocentric Sub-components</td>
<td>Ecocentric Sub-components</td>
</tr>
<tr>
<td>--------------------------</td>
<td>--------------------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td></td>
<td>Humans use plants</td>
<td>Humans are part of the ecosystem</td>
</tr>
<tr>
<td></td>
<td>Humans use animals</td>
<td>Humans are part of the ecosystem</td>
</tr>
<tr>
<td></td>
<td>Humans cause pollution</td>
<td>Humans are dependent with ecosystems</td>
</tr>
<tr>
<td></td>
<td>Humans change ecosystems</td>
<td>Humans influence balance of ecosystem</td>
</tr>
<tr>
<td></td>
<td>Humans cause habitat destruction</td>
<td>No mention of humans as a part of ecosystems</td>
</tr>
<tr>
<td>1930-1939 (0)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1940-1949 (0)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1950-1959 (0)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1960-1969 (5)</td>
<td>4 (60%)</td>
<td>1 (20%)</td>
</tr>
<tr>
<td>1970-1979 (11)</td>
<td>7 (84%)</td>
<td>3 (27%)</td>
</tr>
<tr>
<td>1980-1989 (12)</td>
<td>5 (42%)</td>
<td>0</td>
</tr>
</tbody>
</table>