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The Interactions Between an Orthodox Christian Worldview and Environmental Attitudes and Beliefs; for the Purpose of Developing Better Instructional Practice in Support of Environmental/Ecological Attitudes and Knowledge

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THE INTERACTIONS BETWEEN AN ORTHODOX CHRISTIAN WORLDVIEW AND ENVIRONMENTAL ATTITUDES AND BELIEFS; FOR THE PURPOSE OF DEVELOPING BETTER INSTRUCTIONAL PRACTICE IN SUPPORT OF ENVIRONMENTAL/ECOLOGICAL ATTITUDES AND KNOWLEDGE

by

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Students bring with them to the classroom a wide variety of beliefs and attitudes about the environment and its associated issues. One worldview belief structure prominently discussed in ecological discussions is the worldview of orthodox Christianity. This study uses both quantitative and qualitative measures to analyze the degree to which the orthodox Christian worldview of students influences their environmental attitudes and beliefs. Surveys were conducted with 281 undergraduate pre-service elementary teaching students enrolled in a science methods course to determine the degree to which orthodox Christian worldviews and ecological worldviews interact with one another. From this pool of students, 16 students representing both positive and neutral-negative orthodox Christian worldviews and ecological worldviews were interviewed to determine how orthodox Christian students may differ from non-orthodox Christian students in their attitudes and beliefs about the environment. Analysis revealed that students with orthodox Christian worldview beliefs do not as a general rule use their orthodox Christian worldview beliefs in the discussion of their environmental beliefs and attitudes. Exceptions to this may occur when environmental issues touch on orthodox Christian worldview beliefs which have a bearing on matters of origin, life purpose, or destiny. These interactions between ecological and orthodox Christian worldviews have implications for the teaching of environmental issues to

students in that the orthodox Christian worldview of students is not likely to hinder the appropriation of concepts associated with environmental issues. However, moving students with an orthodox Christian worldview to a view where they become actively involved in environmental issue resolution may require educators to situate curriculum in such a way as to invoke the students' orthodox Christian worldview beliefs.

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CHAPTER I

INTRODUCTION

> The moral of this story is that we have to look beyond the obvious in thinking about the curriculum, beyond the usual focus on questions of content and organization and authority. We have instead to examine the very characteristics of the human interactions that are at the heart of the school experience, and we have to consider meaning from any perspectives, above all, from that of the learners themselves. (Rutherford, 1998)

Who are our students and what do they bring cognitively with them to the science classroom? The ability to answer this question with any degree of certainty has the potential to open whole realms of understanding in teaching students in the content area of science. Yet students, as Rutherford notes in the quote above, are complex. They bring to the classroom much more than we realize, and abundantly more than just a mind waiting to be filled. Their way of looking at reality has developed into a complex worldview over years of growth, development, and interaction with other people. This worldview "consists of basic assumptions and images that provide a more or less coherent, though not always accurate, way of thinking about the world" (Kearney, 1984, p. 41). It will also impact their understanding of the concepts taught in the science classroom (Cobern, 1996). Not only does this worldview contain experiential knowledge, but attitudes toward the subject matter, epistemological and metaphysical foundations, sociological considerations, emotional states and a host of other cognitive and affective outlooks (Fig. 1). However, in an effort to affect conceptual change, curricular materials do not speak about these aspects of the student's worldview, though

they are very real to the student (Cobern, 1996). If cognitive development and cognitive change are to occur, instructors also need to understand their students from the perspective of their worldview. The problem then becomes making sense of the worldview of the students and more particularly, how the worldview of the student interacts with learning in the classroom.

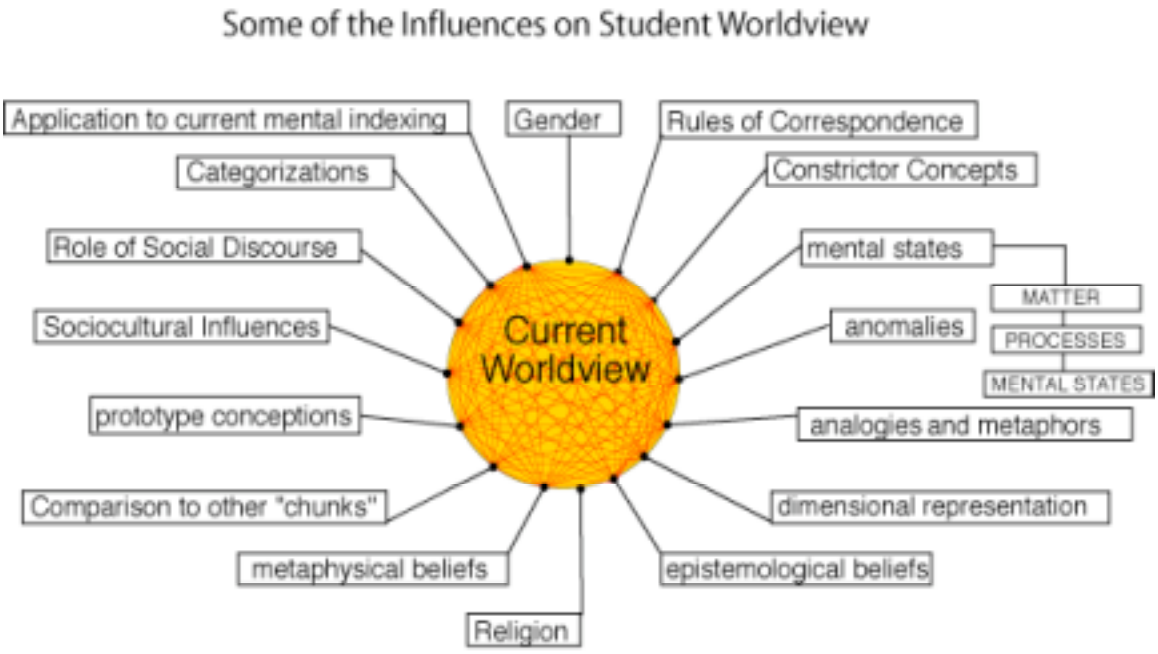

Figure 1. Possible Influences on the Development of Student Worldview

The Effect of Worldview on Learning

The reasoning underlying the need to understand the worldviews of students in developing effective science education curricula becomes clear when consideration is given to the research into how the worldviews of students may effect learning (Wandersee, Mintzes, & Novak, 1994). Over time and through experiences students

build theories of how the world functions in an effort to make it more intelligible (Abimbola, 1988; Bowers, 2001; Gilbert & Swift, 1985). Often, these views on the world that students bring with them to the science classroom are inconsistent with current understandings in science. Termed alternative conceptions, these alternative views on the world have an impact on the ability of educators to effect positive conceptual change. Driver and her colleagues (Driver, 1981; Driver & Easley, 1978) were some of the first to note the existence of these alternative conceptions. As she noted, "These alternative frameworks, in some cases strongly held and resistant to change, in other flexible and with many internal inconsistencies, have their influence on the effectiveness of formal school science programmes" (p. 63). Thus, students come to the science classroom with these conceptions about the world already entrenched as a part of their worldview.

Interaction Between Worldview and Student Conceptions of the Environment

However, what is not well understood is how a student's worldview interacts with learning in the classroom. Wandersee et al. (1994) note in their research on alternative conceptions that "alternative conceptions have their origins in a diverse set of personal experiences including direct observation and perception, peer culture, and language, as well as in teachers' explanations and instructional materials." The places where alternative conceptions interact with the worldview of the student is vast, yet our understanding of how these interactions affect student conceptions is not well documented. Cobern (1989, 1993, 1994, 1996, 2000) has suggested that the worldview of the student is an important part of what the student brings to the classroom. Thus, how worldview interacts with the learning environment becomes important in developing curricular materials in science which will be effective.

Collingwood (1972) has noted that within this worldview there exist certain

presuppositions upon which people build their worldview. The most basic presuppositions in a worldview are what he calls "absolute presuppositions." Absolute presuppositions are those concepts to which there is no answer. They are the foundational concepts on which people structure their world. Wolters (1996) in his work on worldview notes that these absolute presuppositions while providing the foundation for a worldview may at the same time seem inconsistent with one another to another evaluating them. These inconsistencies and how they structure the world of the student may potentially give rise to alternative conceptions noted in the science classroom. This may be a part of what Driver (1981) recognized as a part of student alternative conceptions. This is not to say that all alternative conceptions arise from the absolute presuppositions of a worldview, but that the absolute presuppositions of the worldview may play a role in a student's unwillingness to accept a more scientific view of the world.

In his model of worldview, Kearney (1984) has theorized that there exist relationships between various components of the absolute presuppositions of a worldview (what he terms first-order assumptions). He believes that within the universals of a worldview (e.g., Self, Other, Causality) there exist at least one if not more of these absolute presuppositions. Of significance here are the relationships that exist between the worldview universals of Self (presuppositions about who I am as a person) and the Non-self [this is Cobern's (1989) renaming of Kearney's Other, Non-self, or that outside of the Self and will be used here]. In the study of student interrelationships with the environment, the relationships existing between the Self and Non-self (e.g., God, Nature, other humans, economics) becomes important.

One conceptual area the student's worldview may influence is that of the environment. This outgrowth of the foundational function of a worldview incorporates a person's beliefs, attitudes, and behaviors toward the environment and has been

designated by researchers as the ecological worldview (Dunlap & VanLiere, 1978). Understanding how ecological worldview influences people's belief and behavior toward the environment has been the focus of a number of researchers over the past 30 years (Arcury, Johnson, & Scollay, 1986; Blaikie, 1992; Catton & Dunlap, 1980; Clark, 1995; Corral-Verdugo & Armendáriz, 2000; Dunlap & VanLiere, 1984; Dunlap, VanLiere, & Mertig, 2000; Hess-Quimbita & Pavel, 1996; Hines, Hungerford, & Temera, 1986; LaTrobe & Acott, 2000; Stern, Dietz, & Guagnano, 1995; Yount & Horton, 1992). Most of this work has centered on a scale developed by Dunlap and Van Liere (Dunlap & VanLiere, 1978, 1984; Dunlap et al., 2000) which has been designed to measure commitment to various conditions which are seen as component parts of an ecological worldview (See Appendix A). The measure of commitment to these conditions is measured on a continuum (Fig. 2). Those who have a strong level of commitment to those conditions which are pro-environmental (limited resources, population limitations, rights of nature, etc.) are said to hold a positive ecological worldview (i.e. New Ecological Paradigm), while those with a weaker level of commitment to these conditions (earth as having unlimited resources and the ultimate triumph of technology) are said to have a negative ecological worldview (i.e. Dominant Social Paradigm) (Dunlap & VanLiere, 1984). These ecological worldviews are well defined and the scales mentioned show a high validity.

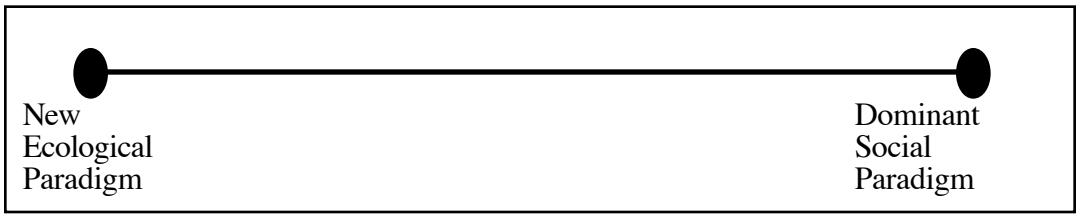

Figure 2. Ecological Worldview Paradigm Continuum

However, what is not well understood is how the ecological outgrowth of a student's worldview interrelates with other components of the worldview (in this case orthodox Christian religious beliefs). Is the interrelationship between presuppositional components of a worldview (views on God) key to the understanding of student beliefs, attitudes, and behaviors toward the environment?

Potential Historical Roots of Ecological Worldview

In 1967, Lynn White, Jr. (1967) described what he believed were the historical roots of our ecological crisis. He conjectured that many of the environmental problems we are facing today could be traced to Judeo-Christian beliefs about the environment. The validity of this claim has been tested and criticized by different researchers (Boyd, 1999; Eckberg & Blocker, 1996; Harrison, 1999; Kearns, 1996) and while results have been mixed, what White hypothesizes could be one of the origination points on which ecological worldviews may be based. Others (Colding & Folke, 2001; Heinen & Low, 1992) have hypothesized that our lack of care for the environment could be linked to human evolution. As Heinen and Low (1992) state:

> We argue that natural selection has shaped all living organisms to exploit resources effectively, in competition with each other, and that our human problem is that, through our cleverness, we have created a novel evolutionary circumstance – we now have such technology that the very behaviours which we evolved to do well, outpacing others, are those most likely to ruin us. (p. 105)

While these are two possible origins underlying the ecological worldviews of people which have led to our current environmental state of affairs, they still do not explain the reasoning behind the wide range of beliefs which form the foundation of various perspectives within a person's ecological worldview.

This variation of beliefs within a worldview is very evident in the environmental views of people subscribing to an orthodox Christian worldview. While some have

argued that White's thesis regarding the role of the Judeo/Christian worldview leading to our current environmental problems is unsubstantiated (Eckberg & Blocker, 1996; Harrison, 1999), a look at the literature coming from orthodox Christian religious circles seems to indicate that a conflict about how to respond to environmental problems exists within the orthodox Christian worldview. On the one side, there seems to be a total rejection of any science which advocates an ecological crisis (Sanera & Shaw, 1999). Proponents of this viewpoint perceive issues such as loss of biodiversity, global climate change, ozone depletion and other ecological issues as overblown and scare tactics of the scientific community. Instead, proponents see the earth as a resource for human use and economic development, and if there are problems, technological advancement will enable humans to deal with any problems (Beisner, 1990; Burkett, 1993; Simon & Kahn, 1984). On the other side of the orthodox religious perspective is a growing movement focusing on the role of the orthodox religious community's need to embrace a stewardship ethic. This perspective stems from a different interpretation of the Bible's Creation mandate in the book of Genesis to be caretakers of the earth rather than dominators. Beginning with the philosopher Francis Schaeffer (1970), a steady stream of authors have promoted this Biblical interpretation of care for the environment. The books *Earthkeeping* (De Vos et al., 1980) and *Earthkeeping in the Nineties* (De Vos, De Witt, Dykema, Ehlers, & Wilkinson, 1991) challenged the Christian orthodox community to develop a stewardship philosophy of caring for the earth. This was subsequently followed with the establishment of the AuSable Institute of Environmental Studies, an institute in Michigan devoted to "the integration of knowledge of the Creation with Biblical principles for the purpose of bringing the Christian community and general public to a better understanding of the Creator and the stewardship of God's Creation" (http://www.ausable.org) through scholarly scientific study. This stewardship of Creation perspective has taken root and numerous volumes and articles

promoting this point of view now appear in scholarly journals (Cajes, 2001; DeWitt, 2003; Harrison, 1999; Johnson, 2000; Petersen, 2003; Santmire, 2003; Sheldon & Foster, 2003; Van Dyke, Mahan, Sheldon, & Brand, 1996; Wilkinson, 2003). The question then is how do these orthodox Christian worldview perspectives interact with a students' ecological worldview? How might an ecological worldview predisposed toward orthodox Christian foundational principles influence a student's ability to apprehend concepts taught in the classroom? Are there other interrelationships between the Self and Non-self which might influence a student's ecological worldview?

Impact of Ecological Worldview on Learning

Studies of conceptual change curriculum in environmental science and ecology have shown a hesitancy on the part of students to change their initial ecological conceptual understanding for a more scientific one (Bjorn Anderson & Wallin, 2000; Brody, Chipman, & Marion, 1988; Cothron & Thompson, 1984; Griffiths & Grant, 1985; Griffiths, Thomey, Cook, & Normore, 1988; Hellden, 1998; Okebukola, 1990). Cobern (1996) has proposed that this could be due to the fact that the presuppositions students bring with them to the classroom hold a greater scope and force (i.e. meaning, power, influence) for the student than the scientific concept being presented. Because they hold more power for the student than the newly presented scientific concept, student's can have the tendency to separate out these new concepts for temporary use (i.e. exam, paper, etc) before reverting to the way they perceived the world before the introduction of the concepts. Chi et al. (Chi, Slotta, & de Leeuw, 1994) have noted that these alternate views of the world can be difficult to change because they are based in another part of the student's worldview from that of the scientific understanding.

Problem Statement

Developing an understanding of how the foundational presuppositions of a worldview relate to a student's ecological worldview could provide the foundation for the creation of effective environmental education curriculum materials. This may prove more effective in bringing about conceptual change than current materials, which seem to lack effectiveness (Cothron & Thompson, 1984; Griffiths & Grant, 1985; Griffiths et al., 1988; Hellden, 1998; P. A. White, 2000; Wood-Robinson, 1995). Therefore, this research seeks to develop an understanding of how worldview perspectives interrelate with ecological worldviews and to determine the level of the scope and force these interrelationships may provide for the student. The research will also seek to determine how these foundational worldview perspectives empower or hinder students from apprehending a more scientific understanding about the environment.

Surveys of the American public have shown that 60% of the people have an orthodox Christian worldview (Barna Research Group of Ventura, 2002). This and the focus in the research on how the orthodox Christian worldview has potentially affected beliefs and attitudes toward the environment, leads this research to center on the how orthodox Christian worldview interacts with student beliefs and attitudes toward the environment. It is hypothesized that while the orthodox Christian worldview may influence a student's ecological worldview, the degree of importance this relationship plays will vary from student to student. For some, orthodox Christian religious beliefs may play a significant role in the development of an ecological worldview, while for others the role it plays may be minimal at best. Thus, it is expected that while orthodox Christian religious beliefs may interact with an ecological worldview, this role may result in very different ecological worldviews and thus differences in students' beliefs and behaviors toward the environment.

Definition of Terms

Worldview

Many authors have undertaken the task of defining the idea of worldview (Kearney, 1984; R. H. Nash, 1999; Sire, 1988; Walsh & Middleton, 1984; Wittmer, 2001; Wolters, 1996). Wolters (1996) condenses these into a concise definition in which he describes worldview as "the comprehensive framework of one's basic beliefs about things" (p. 2). Worldview is composed of both absolute and relative presuppositions concerning the world in which the student lives. These presuppositions provide a foundational structure for thought and learning (Cobern, 1996, 2000; Collingwood, 1972; Kearney, 1984).

Ecological Worldview

This research deals specifically with how students' express their worldview through their beliefs, attitudes, and behavior toward ecological systems, the environment, and issues related to the environment. As proposed by Dunlap et al. (2000), an ecological worldview encompasses "our fundamental views about nature and humans' relationship to it" (p.425)

Religiousity, Orthodox Christian Religiousity

Unless otherwise noted, these are a reference in this research to orthodox Christianity as identified by those who hold to the beliefs central to Christianity. These foundational statements which define orthodox Christianity are expressed in the Apostles' Creed and Nicene Creed (Hill & Hood, 1999). As Fullerton and Hunsberger (1982) note, "Whatever other differences the various Christian denominations might

have among themselves, the Creed comprises a ‘rockbed’ of doctrinal beliefs on which is virtually unanimous agreement by Catholics and Protestants alike” (p. 318).

CHAPTER II

LITERATURE REVIEW

The publication of Rachel Carson's book *Silent Spring* in the summer of 1962 began a new era of thought about how humans should view and care for the environment. The book provoked people in such a way that it created a paradigm shift in the way humans view their natural resources and environmental activities. It caused us to think about how humankind was impacting the environment. With well-penned words about the impact synthetic chemicals were having on the environment, Carson grabbed the attention of the American public and eventually much of the Western world. The insights of her book, grounded in relevant research, opened the door for scientists to begin openly studying the influence of humans on the environment. In 1970, the cry for action became louder with the celebration of the first Earth Day. The early 1970s saw a plethora of environmental regulations making their way through the governmental channels – the Clean Water Act, Clean Air Act and Endangered Species Act. With so much attention focused on the environment and needed changes to the way we interact with the natural world, it was almost a given that education about the environment would also become a worthwhile part of the school curriculum (Bedwell, 1984). Thus, in the early 1970s environmental education began its appearance as a part of the educational mix. Science classes began to teach students about recycling, environmental issues, and other environmentally related topics.

Yet, this large push for educational reform in environmental education has had mixed results in affecting children and their attitudes toward the environment. In fact,

throughout its 30-year history, environmental education curricula seem to be having a difficult time connecting with the students. Determining the causes surrounding the seeming failure of environmental education curricula to achieve a student population with a more scientific view of the environment is an area of research in which further exploration is necessary. Expanding our understanding of how students view various aspects of the environment may help in seeking answers as to how students may approach the topic of the environment from philosophically different viewpoints based on their view of the world.

From this perspective it is important to consider the concept of worldview and how it has the potential to impact student learning. The foundational worldview premises (absolute presuppositions) students bring with them to the classroom have the potential for directly and indirectly influencing teaching in the classroom. They will play an important role in the ability of educators to affect conceptual change, which to this point seems to have been ineffectual in many instances. However, in order to apply worldview thinking to situations in environmental education, it is important to first define the concept of worldview and how its structure and function relate to cognitive change in students.

When approaching issues pertaining to the environment, some of these worldview components can play a role in the determination of beliefs and attitudes about the environment and ecological systems. The debate in the world community about environmental issues, ranging from water pollution to global climate change, clearly shows a variety of worldview perspectives surrounding these issues. This framework of beliefs concerning the environment has been studied around the world over the last 35 years and forms the basis for studies on what is more commonly referred to as environmental or ecological worldview (Arcury et al., 1986; Catton &

Dunlap, 1978, 1980; Dunlap & Catton, 1979, 1983).

Over this same period, the role that orthodox Christian worldview beliefs play in relationship to environmental attitudes and beliefs has been a topic of considerable debate. Understanding this particular worldview stance and its relationship to the environment is important, especially given the controversy which has surrounded adherents of this particular worldview and the claims that have arisen asserting that it may be at fault for many of our current ecological and environmental problems (Means, 1967; L. White, Jr., 1967, 1973).

All of these pieces – an understanding of worldview theory, beliefs and attitudes toward the environment, and the basis of an orthodox Christian worldview and its possible views toward the environment, and finally how worldview theory may influence learning, especially in environmental education – are an important basis for this present research into how students from an orthodox Christian worldview tradition interact with issues and ideas relating to the environment. Understanding the relationship between these four factors and how they influence environmental thought in students may empower educators in the development of curricular materials which will be effective in affecting change in student attitudes and behavior.

An Overview of Worldview Theory

When a science teacher is confronted with a student who seems disinclined to change his/her conception of the world to a more scientific explanation, we are often quick to label that student as having an alternative conception which needs to "make a considerable journey in thought" to a more scientific belief (Driver, 1981). Yet, the rationale for why the student holds to this conception of the world may be more complex. He/she may be comfortable with the way they understand the world and not

feel a need to acquire the scientific knowledge to make the shift to a more scientific explanation (Culen & Volk, 2000; Hungerford & Volk, 1990). Even discovering how a new scientific explanation may be more fruitful (Posner, Strike, Hewson, & Gertzog, 1982) in everyday life may not be enough to create a shift in understanding. What may be hindering the student from apprehending this scientific view of the world is a view of the world established within their framework of perception and beliefs – their worldview.

Worldview: Definition and Structure

Just what is this thing called worldview and how does its structure and function influence student thinking? Simply defined, a worldview is "the comprehensive framework of one's basic beliefs about things" (Wolters, 1996, p.2). Nevertheless, wrapped up in this simple statement are two centuries of thought on the structure and function of a worldview. Beginning with Kant's use of the word in 1769, the researchers exploring the worldview concept have developed a better understanding of how worldview influences everyday life (Naugle, 2002). Wittmer (2001) expands on Wolters definition and adds flesh to this idea of worldview being a framework. As he defines it, "A worldview is a framework of concepts or beliefs about the world, a web of belief that hold together, all the beliefs that you have in your mind, how they all hang together…The glasses through which we see the world; the lens through which we see reality" (transcribed from audio).

This "comprehensive framework" is the structure for a worldview. It provides a foundational base upon which all aspects of life are evaluated. Developing an understanding of how the structural components of a worldview relate to each other provides for a more complete awareness of how worldview may function in the life of

the student.

One of the first and most important aspects of worldview which requires understanding is that a student can build a worldview on any number of assumptions and presuppositions about the world. Sire (1988) provides an overview of how these presuppositions and assumptions structure a worldview. As he states,

> "A worldview is composed of a number of basic presuppositions, more or less consistent with each other, more or less consciously held, more or less true. They are generally unquestioned by each of us, rarely, if ever, mentioned by our friends, and only brought to mind when we are challenged by a foreigner from another ideological universe" (p.17).

These presuppositions and assumptions provide the foundation for everything else the student encounters. They are the final authority from which the student derives and develops conclusions on what they encounter in the science classroom. Collingwood (1972) calls the most foundational assumptions "absolute presuppositions." These absolute presuppositions are ones which "stand, relatively to all questions to which it is related, as a presupposition, never as an answer" (p. 32). The key to understanding these absolute presuppositions is that "the logical efficacy of an absolute presupposition is independent of its being true: it is that the distinction between truth and falsehood does not apply to absolute presuppositions at all, that distinction being peculiar to propositions" (p. 32). Thus, these absolute presuppositions go beyond classroom teaching. They are the foundational filters through which students will evaluate the materials in the classroom. Collingwood further provides an excellent application showing the nature of these absolute presuppositions.

> Thus, if you were talking to a pathologist about a certain disease and asked him "What is the cause of the event E which you say sometimes happens in this disease?" he will reply "The cause of E is C"; and if he were in a communicative mood he might go on to say "That was

> established by So-and-so, in a piece of research that is not regarded as classical." You might go on to ask: "I suppose before So-and-so found out what the cause of E was, he was quite sure it had a cause?" The answer would be "Quite sure, of course." If you say, "Why?" he will probably answer "Because everything that happens has a cause." If you are importunate enough to ask "But how do you know that everything that happens has a cause?" he will probably blow up in your face, because you have put your finger on one of his absolute presuppositions, and people are apt to be ticklish in their absolute presuppositions. But if he keeps his temper and gives you a civil and candid answer, it will be to the following effect. "That is a thing we take for granted in my job. We don't question it. We don't try to verify it. It isn't a thing anybody has discovered, like microbes or the circulation of blood. It is a thing we just take for granted." (p. 31-32)

These absolute presuppositions have also been labeled as "first order assumptions" (Kearney, 1984) and "principia" (Ketner, 1972). They are the assumptions which a student may make about the world for which there is no real answer to the question of how we know. A theist would term this faith.

Though these worldview presuppositions exist and provide answers about the world, the use of these foundational or absolute presuppositions is generally subconscious and rarely a conscious act. R. H. Nash (1992) asserts, "a worldview, then, is a conceptual scheme by which we consciously or unconsciously place or fit everything we believe and by which we interpret and judge reality" (p.16). This subconscious set of guiding principles are not easily identified and are generally unquestioned (Sire, 1988). There are of course other presuppositions about the world which are not absolute in nature. Collingwood (1972) terms them "relative presuppositions" and Kearney (1984) "second-order assumptions". These presuppositions are taken-for-granted conceptual understandings we have about the world. (Cobern, 1989; Collingwood, 1972; Kearney, 1984). These are basic conceptual "units of mental representation roughly equivalent to a single word, such as object, animal, alive, heat, weight, and matter" (Carey, 2000). While these

presuppositions about the world are an important part in helping to understand the conceptual framework which students bring with them to the classroom, they are of secondary importance here. Cognitive scientists would class these types of presuppositions as prototypical, rules-based or causal theories of the world (Allen & Brooks, 1991; Keil, 1989; Keil, Smith, Simons, & Levin, 1998; Rips, 1989; Smith, 1989; Smith, Patalano, & Jonides, 1998; Strevens, 2000). The key here is that as educators, we are often dealing with an aspect of the cognitive framework (whether it be an absolute or relative presuppositions) which students bring to the classroom intuitively. They are assumptions that students make that they do not realize they are making a presupposition at all (Collingwood, 1972).

The structure of worldview is also culturally dependent. That is to say that the worldview of one area of the world (or for that matter of one country) may not be transferable to another cultural area. Wolters (1996) calls a worldview "a matter of shared everyday experience of humankind, an inescapable component of all human knowing…" (p. 9). This idea of cultural/environmental influence on the formation of worldview is the basis of Heidegger's (1988) worldview theories. As he remarks:

> Our world-view is determined by environment - people, race, class, developmental stage of culture. Every world-view thus individually formed arises out of a natural world-view, out of a range of conceptions of the world and determinations of the human Dasein which are at any particular time given more or less explicitly with each Dasein. We must distinguish the individually formed world-view or the cultural world-view from the natural world-view. (p. 6)

Others have also noted how culture influences the structural formation of a worldview (Cobern, 1989, 1994; Collingwood, 1972; Kearney, 1984; Naugle, 2002). The underestimation of this formative aspect of student worldview may be critical in the development of curriculum materials in science (Colding & Folke, 2001; Driver, Asoko, Leach, Mortimer, & Scott, 1994; Lemke, 2001; Snively & Corsiglia, 2001).

Curriculum which may work well in one cultural setting may not in another.

One other aspect of worldview formation is the fact that unlike logical thought, the presuppositions which form a worldview may contain a certain inconsistency. Because of its mainly unarticulated nature (i.e. most people would not be able to describe the nature of their worldview clearly due to the subconscious nature of much of its structure (Naugle, 2002; Orr, 1897)) the set of presuppositions forming the worldview of a person may have a number of what outwardly appear to be inconsistencies. However, as Wolters (1996) states,

> That is not to say that worldviews are never internally inconsistent - many are (in fact, an inconsistency may be one of the most interesting things about a worldview) - but it remains true that the more significant feature of worldviews is their tendency toward pattern and coherence; even their inconsistencies tend to fall into clearly recognizable patterns. Moreover, most people will not admit to an inconsistency in their own worldview even when it is very obvious to others. (p. 3)

The noteworthy point here is that while from the perspective of the teacher the student worldview may have inconsistencies, from the standpoint of the student the pieces correspond to each other and provide a framework of reality – they make sense and are valid in the mind of the student.

How then can sense be made of these various structural aspects of a worldview if that worldview is not even something consciously obvious to the student? In an effort to provide a structural understanding of worldview, Kearney (1984) developed a "logico-structural" framework theory to evaluate and help us understand worldviews. This logico-structural framework is composed of five components which he sees as universal in every worldview: Self and Other; Relationship; Causality; Classification; and Time and Space. Figure 2.1 illustrates how Kearney envisions these various universal aspects of worldview integrating with one another. Cobern (1989), in an evaluation of Kearney's model has broken the five

universals into groups of three which is helpful here. Cobern groups Self and Other (which he renames Non-self to help clarify the universal and which will hereafter be used in the stead of Other) as first order universals. Being the foundation on which worldview exists, the Self and Non-self speak to the way in which a person (Self) perceives themselves in relationship to everything else (both natural and supernatural) or things beyond one's self – Non-self. Redfield (Cobern, 1989; Naugle, 2002; Redfield, 1953) envisions this Non-self as being in three divisions: Society, Nature, and Supernatural (or God). In this current research, this division is important. The way in which Self perceives the Relationship

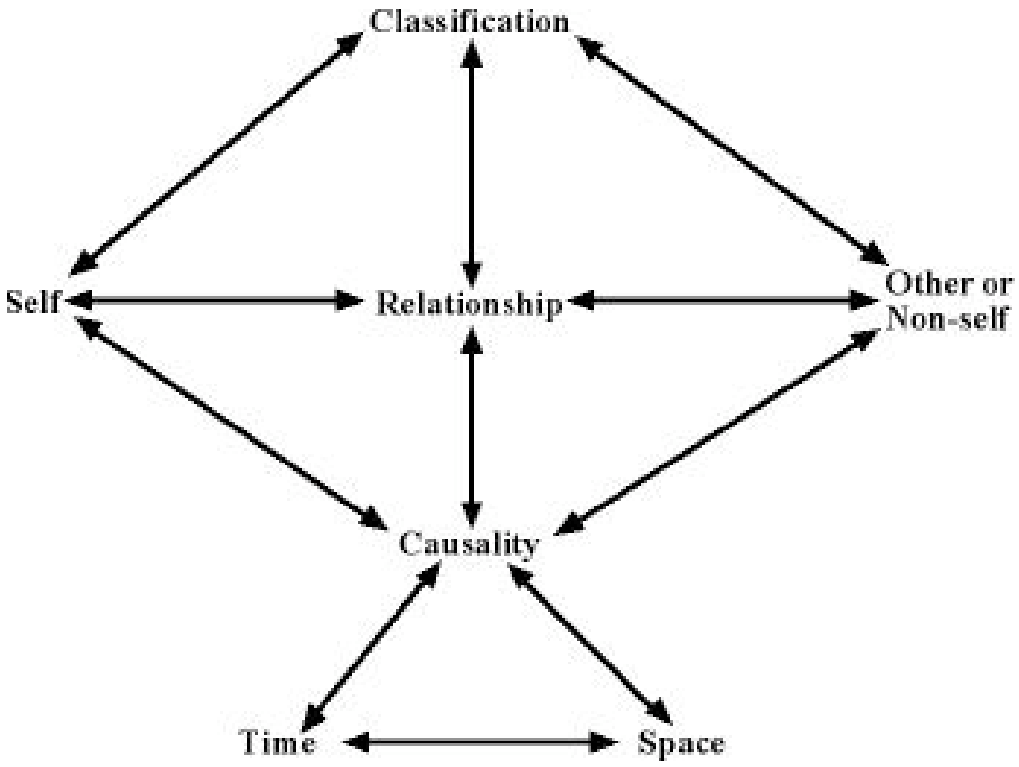

Figure 3. Kearney's Logico-structural Model (Kearney, 1984)

(2nd order universal) between Nature, Society, and God from both the orthodox Christian and non-orthodox Christian worldview and the interrelationships between Self and each of these three components of the Non-self are the root of this research. As Cobern (1989) notes, "Fundamentally the relationship between the Self and Non-Self can be one of harmony, subordinance, or dominance. In actuality there is likely to be mixing" (p. 12).

Though not as important to this current research, the other second order universals of Causality and Classification also provide structural roles in the formation of worldview between Self and Non-self. The 3rd order universals of Time and Space and how they relate to Causality may be important here, especially how the concept of Time is seen in the orthodox Christian tradition (as will be discussed later).

Worldview: Function

While the understanding the structure of worldview is an important part of determining what students bring with them to the classroom, it is equally important to ascertain the functional aspect of the students' worldview. As functional, we speak of the purpose the worldview plays in the life of students. This functional aspect is the application of all of the structural aspects of the developed or developing worldview. Wolters (1996) describes the function of worldview as:

> "…a *guide to our life.* A worldview, even if it is half unconscious and unarticulated, functions like a compass or a road map. It orients us in the world at large, gives us a sense of what is up and what is down, what is right and what is wrong in the confusion of events and phenomena that confronts us. Our worldview shapes, to a significant degree, the way we assess the events, issues, and structures of our civilization and our times. It allows us to 'place' or 'situate' the various phenomena that come into our purview" (p. 4).

While Wolters statement refers to both the absolute and relative presuppositions held mostly at the unconscious level of the mind, most authors on the subject of the functionality of worldview speak largely to the function of these absolute presuppositions. Absolute presuppositions speak to areas of life to which absolute answers may not exist. While various authors view different categories of questions which absolute presuppositions will answer, there tends to be a general form of agreement amongst them. For the purposes here we will use the categorical questions which have been proposed by Sire (1988). Sire proposes that a worldview provides the answers to seven key questions about life (which would generally be held as absolute presuppositions within the worldview):

1. What is the prime reality – the really real?
2. What is the nature of external reality, that is, the world around us?
3. What is a human being?
4. What happens to a person at death?
5. Why is possible to know anything at all?
6. How do we know what is right and wrong?
7. What is the meaning of human history? (p. 17-18)

Throughout the formative years students, though it may not be consciously, are working through these questions and developing the absolute presuppositions which will make up the foundation of their worldview. Naugle (2002), in summarizing the work of James Orr and others, postulates that this search for the answer to these questions "lies deep within human nature and its native capacities for thinking and acting" (p. 9). The need to develop answers is:

> generated by the mind's quest for a framework to orient people to the world around them and to the ultimate issues of life…worldviews are inescapable realities, rooted in the constitution of human beings, who must think about and act in the world. (p. 10)

The structuring of the answers to these questions to guide life will mature and challenge the student throughout his/her life, though during the developmental years they receive their most intense development. Molding the functional worldview is termed by Kearney (1984) as “dialectical constructionism” (p. 3). As students reach adulthood “the malleableness of a worldview begins to decrease. It becomes resilient in the face of change providing an adult with cognitive stability" (Cobern, 1989, p. 4). This is not to say that the structure and functional aspects do not change in adulthood, but rather that they will be adaptive, allowing for the adult to adjust their worldview in the face of new problems and environments (Cobern, 1989).

One area in which the absolute presuppositions about the world have an impact is on the view of the environment and humankind’s impact on the natural world. Throughout the world, different cultures view the environment from a variety of perspectives (Hertsgaard, 1998). How people view the environment is partially an outgrowth of their foundational worldview and has commonly been referred to as an ecological worldview.

Ecological Worldview

Developing an understanding of various worldview perspectives (i.e. how absolute presuppositions work together to create various cultural subgroups) then allows the application of these various worldviews to other areas of life. Of interest here is the way in which worldview integrates with beliefs, attitudes and behaviors toward the environment, or an ecological worldview. The use of the term worldview with ecology is something of a misuse of the word worldview. As has been previously shown, a worldview speaks to questions which guide and give purpose to our lives (Sire, 1988; Wolters, 1996), whereas an ecological worldview is actually a resultant

outcome of the presuppositional components of our foundational worldview. In this sense, it is not really a worldview, but rather a portion of the worldview which arises from the foundational presuppositions of a person's worldview. However, due to the pervasiveness of the use of the term in literature, we will continue to use the term as defining that portion of the worldview which expresses environmental attitudes, beliefs, and behaviors.

Over the past 30 years ecological thinking has changed to reflect changes in worldview. Researchers have constructed surveys to ascertain how widespread these changes have become. The results of these surveys has resulted in a sociological paradigm shift in which researchers have moved from looking at humans as exempt from ecological constraints to one where humans are now seen to be a part of their environment (Catton & Dunlap, 1980; Clark, 1995; Dunlap & Catton, 1979).

This shift in thinking by researchers places new focus on how humans view their environment. As Kellert (1997) notes, "The influence of society has a great effect on the content, intensity, and direction of these tendencies to affiliate with nature"(p. 6). This new worldview paradigm was originally termed the "New Environmental Paradigm" (Dunlap & VanLiere, 1978), but later changed to reflect a deeper understanding of the worldview to the "New Ecological Paradigm" (NEP) (Dunlap et al., 2000). The key components of this new worldview paradigm were its ability to define behavior most closely associated with positive attitudes and behaviors toward the environment. The worldview scale developed to determine commitment to a New Ecological paradigm focuses on five dimensions: that there are limits to growth (both population and resource use); exemptionalism (that man is separate from nature); the fragility of nature's balance; rejection of human ability to dominate nature (anti-anthropocentrism); and the possibility that we are facing an

ecological crisis (Dunlap et al., 2000) (Table 1). Each of these values is an important component of a strong ecological worldview.

The opposite extreme of the NEP is what Dunlap and Van Liere (1984) entitle the "Dominant Social Paradigm" (DSP). While the NEP focuses on what a strong commitment by humankind to the environment might look like, the DSP focuses on a more anthropocentric view of the environment. Key features of this worldview are: support for laissez-faire government; support for the status quo (in regards to how natural resources are used); support for private property rights; faith in science and technology to solve environmental problems; support for individual rights; support for continued economic growth; and belief that there are abundant resources which will ensure future prosperity (Table 1). This worldview is clearly articulated by Julian Simon (1999) who stated,

> More people put more demands upon the system and therefore "disturb" it more. But more people also bring about greater understanding of the system and increased capacity to bend it to our will. This results both from the increased demand for goods and services that more people cause, which leads to improved technology, and from the greater potential fro knowledge creation that more people represent (all else equal). (p. 71)

> With reasonable surety one can expect that the material conditions of life will continue to get better for most people, in most countries, most of the time, indefinitely. Within a century or two, all nations and most of humanity will be at or above today's Western living standards.…Whatever nature has spontaneously produced that we use - food, oil, diamonds - humankind now can also produce by design, and faster than nature. (p. 123)

Holders of the DSP do not see a species going extinct as a negative factor, but rather as an advantage which may allow another species to succeed, which may in turn be more beneficial to humankind than the species which became extinct (Brackney & McAndrew, 2001; Simon & Kahn, 1984).

Of course, these two perspectives represent the extremes of both of these

particular ecological worldview positions. Others have developed a more balanced definition of ecological worldview. Passmore (1974) breaks ecological worldview into three distinct categories: Despot, Steward, and Cooperation with Nature (Table 1). In Passmore's view, the Despot was one in which humankind has an arrogance which makes "men think of nature as a 'captive to be raped' rather than as a 'partner to be cherished' (p.5)

> Christianity has encouraged man to think of himself as nature's absolute master, for whom everything that exists was designed. they are wrong only in supposing that this is also the Hebrew teaching: it originates with the Greeks. (p. 13)
>
> Cartesianism is central to this view, that humans should make the world a better place for themselves" (p.21).

Passmore's second view, of the Steward sees humankind as a type of "'farm manager', actively responsible as God's deputy for the care of the world" (p.28). This picture draws mainly from a Biblical position in which the earth is under the care of humans who are responsible for its stewardship and wise use.

Finally, the view of humans as Cooperating with Nature is the third ecological worldview Passmore proposes. In this worldview, humans cooperate with nature in an attempt to perfect nature to what it can be. From this perspective, humans are "to actualize its potentialities, to bring to light what it has in itself to become, and by this means to perfect it" (p. 32). Thus, humans must cooperate with the natural world in such a way as to bring no harm, but to shape it in a way to bring out its best.

Table 1. Comparison of Various Environmental Worldview Schema

<table>
<tr><th>Catton, Dunlap, Van Liere
(Catton & Dunlap, 1978, 1980; Dunlap & Catton, 1983; Dunlap & VanLiere, 1978, 1984; Dunlap et al., 2000)</th><th>Passmore
(Passmore, 1974)</th><th>Zweers
(Zweers, 2000)</th></tr>
<tr><td rowspan="2">Dominant Social Paradigm
• support for laissez-faire government
• support for the status quo (in regards to how natural resources are used)
• support for private property rights
• faith in science and technology to solve environmental problems
• support for individual rights
• support for continued economic growth
• belief that there are abundant resources which will ensure future prosperity</td><td rowspan="2">Despot
• arrogance of man
• nature as a ‘captive to be raped’
• science as tool to shape nature to human desire
• make world a better place for humans</td><td>Despot
• humans as absolute rulers
• nature subject to will of humans
• no restrictions because of possible fragility of nature
• human thinking totally opposite to nature</td></tr>
<tr><td>Enlightened Ruler
• humans dependent on nature
• finite resources and limited carrying capacity
• nature as utilitarian
• humans can mold to make best for humans and nature</td></tr>
<tr><td rowspan="3">New Ecological Paradigm
• limits to growth (both population and resource use)
• anti-anthropocentrism
• fragility of nature’s balance
• rejection of human ability to dominate nature
• possibility that we are facing an ecological crisis</td><td rowspan="2">Steward
• man as ‘farm-manager’
• nature under the care of humans
• responsibility to God for this care
• wise use of resources
• use but not abuse</td><td>Steward
• manage on the behalf of another
• no ownership
• inspired by Christianity
• use of nature in moderation</td></tr>
<tr><td>Partner of Nature
• nature has a status of its own
• man and nature as partners at the same level
• aim to benefit both but not at the expense of either</td></tr>
<tr><td rowspan="2">Cooperation with Nature
• cooperation with nature in an attempt to perfect
• bring out the potential in nature
• bring no harm to the natural world</td><td>Participant with Nature
• humans as integrated, connected part of nature
• allows humans to participate with nature at a more intimate level (spiritual)
• everything embedded in nature, humans as positioned within nature</td></tr>
<tr><td>‘Unio Mystica’
• Unity with nature
• No separation between human and nature
• Spiritual connection - humans and nature
• Cannot separate human and nature - all one</td></tr>
</table>

Zweers (2000) takes an even more partitioned approach than either of the previous two. From his perspective, the ecological worldview is subdivided into six distinct categories, with some potential overlap between the various sub groupings. These six categories: Despot, Enlightened Ruler, Steward, Partner of Nature, Participant with Nature, and 'Unio Mystica', represent a continuum from the most harsh treatment of the environment to a spiritual connection between man and nature.

The first two levels of this continuum and possibly the third represent in Zweers' mind a view of the world in which nature has an "instrumental orientation", that is, that the world is purely for human use and consumption at the cost of other living beings (p. 55). This aligns well with the previous comments of Simon and corresponds with both Passmore's "despot" and the extreme end of Dunlap et al.'s "dominant social paradigm". For Zweers' model, this "instrumental orientation" encompasses the "despot", "enlightened ruler" and may even include some of those who hold a "steward" worldview (p.55). From Lynn White's (1967, 1973) perspective, this is the view taken from an historical Christian perspective.

Secondly, partly in the view of the "steward", "partner with nature", and especially with the view of the "participant with nature", Zweers sees an "intrinsic orientation" (p. 56). In this categorization, humans see the natural world as an "end in itself", and humans want to "let this other be itself" and "accept it for what it is". Here there is respect for the natural world in and of itself. Schaeffer (1970) notes that this view is the view which should be at the heart of the Christian community, though often in the Christian community the views fall more as White (1967) theorized. Since the publication of Schaeffer's work many other orthodox Christian environmental writers have continued to develop these ideas further (Clifford, 1994; Harrison, 1999; Irwin & Pellegrino, 1994; Johnson, 2000; Kearns, 1996; J. A. Nash, 1991; Van Dyke

et al., 1996; Wilkinson, De Vos, De Witt, Dykema, & Ehlers, 1991). For Christians with an ecological/Biblical belief, the intrinsic value of nature in and of itself in relationship to the Creator is an important part of their relationship with God the Creator. To see the natural world as instrumental in nature and only for human use is in their minds a misinterpretation of the Scriptures (Ohlman, 2002a). For them, Zweers' third alternative is not a possibility.

The third perspective offered by Zweers is that of an "identifactory orientation" to the natural world. This orientation is associated with an almost mystical view of the world in which there is a "reality with which one therefore wishes ultimately to merge" (p. 56). It is this type of alternative to the traditional "instrumental orientation" to which Means (1967) proposed that the human race should strive. Zweers himself suggests that in order for environmental solutions to occur this "identificatory orientation" is a necessity. This view holds within it the views of a deistic quality to nature as is encompassed through Native American traditions of the "Great Spirit", or Eastern religions focusing on "Tao", or Deep Ecology emphases on the spiritual quality of "Nature". These views all acknowledge a pantheistic view of the world. This mystical quality to the natural world tends to predominate in the more extreme views of some environmental groups who observe a spiritual quality to nature, seen most recently in the spiritual quality given to trees by Julia "Butterfly" Hill (Ohlman, 2002b). Taylor (1994, 1997, 2001a, 2001b) has written extensively on the spiritualization of the environmental movement and how "Earth and nature-based spirituality is proliferating globally (and) that although participants in countercultural movements often eschew the label religion, these are religious movements, in which these persons find ultimate meaning and transformative power in nature" (Taylor, 2001a). Thus, from the Julia "Butterfly's" of the redwood

forests of the Pacific Coast to the ecowarriors of the moors of Derbyshire England, the purpose behind the movement has as much to do with the spiritual quality perceived to be in the natural world as with the actual need to preserve nature for its own sake.

While all three of these views of the underlying beliefs of varying ecological worldviews are valuable, the views of Zweers tend to provide a more richly diverse landscape from which to develop a foundational understanding of how students come to develop their views about the environment. The views of people hold toward the environment can be very robust, as evidenced by groups such as Earth First! on one end of the spectrum and the "Julian Simon's" at the other end. The question then is, if by using this foundational understanding expressed through these various viewpoints it is possible to determine the interactions between these various ecological worldview beliefs and the holding to a particular worldview stance (i.e. Christianity, theism, naturalism, etc.). This has been a topic of great debate among researchers, especially the interactions between ecological worldview and orthodox Christian beliefs. In order to provide structure for these arguments, it is first essential to develop an understanding of the essence of the orthodox Christian worldview.

Orthodox Christian Worldview

Employing Sire's (1988) seven components of a functional worldview, we will examine the tenants of an orthodox Christian worldview. This evaluation of orthodox Christian worldview uses assumptions generally held by all who profess this worldview (Nicaean and Apostles Creeds – See Appendix B). The various branches of the orthodox Christian dominations differ more with interpretation of specific Biblical texts, but on these aspects of belief, most theologians holding an orthodox Christian

worldview show a general agreement.

Beginning with the nature of prime reality, for the orthodox Christian worldview it centers on the existence of God. This belief supercedes all other aspects of their worldview. Wittmer (2001) notes that it is the central presupposition which brings all others into perspective. The major assumption is that God is outside of time as we know it and was the Creator of time as humans understand it when Scripture states, "In the beginning God created …" (Gen 1:1). However, unlike the gods of other religions, the Christian worldview believes in the existence of a "Personal, Ethical, Self-Revealing God" (Orr, 1897, p. 32). He is also the one and only God (Deut 6:4), demanding of total allegiance (Exodus 20:3-6). God is also transcendent, that is outside of the realm of knowing as we know it. He is "beyond all, yet in all and sustaining all" (Sire, 1988, p. 25). He is "sustaining all things by His powerful word" (Heb. 1:3). As God spoke to Moses in the wilderness, "I am who I am. This is what you are to say to the Israelites: 'I AM has sent me to you'" (Exodus 3:14). R. H. Nash (1992) states that if the Christian worldview were broken down to one "touchstone proposition" it would be that the existence of God as revealed in Bible" (p. 52).

With the center of the worldview focusing on the existence of one God, the nature of external reality (outside of the Self) relates directly to this presupposition. Again, looking at the beginning of the Bible, Genesis 1:1 states directly the nature of the external reality: "In the beginning God created the heavens and the earth." This theme is inherent throughout both the old and new testaments of the Bible. As Sire (1988) states, "God is *He Who Is,* and thus he is the source of all else" (p. 26). The universe that God created exists,

> "as the result of a free decision to create by a God who is eternal, transcendent, spiritual (that is, nonmaterial), omnipotent, omniscient,

> omnibenevolent, loving, and personal. Because there is a God-ordained order to the creation, human beings can discover that order. It is this order that makes science possible; it is this order that scientists attempt to capture in their laws" (R. H. Nash, 1992, p. 36).

This uniformity and order is the trademark of a wise and orderly God, who has not left it to its own design, but watches and cares for it. As the Psalmist says, "For he spoke, and it came to be; he commanded, and it stood firm" (Ps. 33:9), and again,

> He makes springs pour water into the ravines;
> it flows between the mountains.
> They give water to all the beasts of the field;
> the wild donkeys quench their thirst.
> The birds of the air nest by the waters;
> they sing among the branches.
> He waters the mountains from his upper chambers;
> the earth is satisfied by the fruit of his work (Ps. 104:10-13)

Not only is there a uniformity and order, but God has made it knowable (Ratzsch, 2000). This attribute of knowability relates to the next attribute of a worldview, that of the nature of human beings.

Orr (1897) asserts that the Christian worldview "affirms the spiritual nature and dignity of man – his creation in the Divine image, and destination to bear the likeness of God in a perfected relation of sonship" (p. 32). This aspect of the Christian worldview is often at the heart of the perceived conflict between a Christian worldview and views on the environment. That humans are in the image of God is one of the key components of the Christian belief. This belief stems from the Creation account of Genesis 1, in which God asserts,

> "Let us make man in our image, in our likeness, and let them rule over the fish of the sea and the birds of the air, over the livestock, over all the earth, and over all the creatures that move along the ground." So God created man in his own image, in the image of God he created him; male and female he created them. (Gen 1:26-27).

This worldview presupposition gives a certain inherent right to the only living

thing in the Creation created in the image of God. It means we are like God, thus we have personality, self-transcendence, intelligence, morality, gregariousness, and creativity (Sire, 1988). It also provides a sense of place in the order of the universe. The Psalmist writes that humans are "a little lower than the heavenly beings" (Ps 8:5), yet at the same time they are lifted above the rest of the Creation. This relationship upward to God and downward to the rest of Creation puts humans in a special position of needing a relationship with the God who created them, yet at the same time being a part of the created order (Schaeffer, 1970). Therefore, humanness in the fullness of its meaning rests in a "proper relation with God, …in proper relation with other people, and …in proper relation with the world" (Blocher & Wittmer, 2003, p. 2).

Because God endowed humans with intelligence and morality, He allows humans to know the difference between right and wrong. This ability choose between right and wrong received the ultimate test and failure in the Garden of Eden (Gen. 3) when Adam and Eve disobeyed God by eating the fruit which was forbidden to them. Through this wrong choice, sin entered the world and broke the perfect relationship with God. This presupposition of the Christian worldview has ramification in a couple of different areas. First, it speaks to the nature of morality and knowing right from wrong. As a part of the created nature of humankind, God, who is the ultimate source of the moral world as well as the physical world (Sire, 1988) gives humans the ability to know right from wrong because they carry with them the image of God their Creator (R. H. Nash, 1992). God's standard is the absolute standard to those holding a Christian worldview. The Bible reveals this standard in God's dealings with humankind through its entire text. Through it He has revealed His character, and thus his standard of right and wrong for the world (Sire, 1988, p. 36). As Nash (1992)

points out,

> According to the Christian worldview, God is the ground of the laws that govern the physical universe and that make possible the order of the cosmos. God is also the ground of the moral laws that ought to govern human behavior and that make possible order between humans and within humans. (p. 41)

This relationship with an infinite God who provides the moral character of the universe also provides presuppositional perspectives on what happens at death. In the Christian worldview, time is a linear "sequence of events leading to the fulfillment of God's purposes for humanity" (Sire, 1988, p. 36). Within this linear framework, the life of a human has a beginning, but not an ending. In contrast to the naturalistic worldview which sees death as the end of existence (Ayer, 1968). For the Christian death is an either/or proposition. Because of sin which has separated humans from God, only the redeeming work of God's son Jesus Christ provides a way to restore that relationship. This redemption is possible because of Jesus, fully God and fully man, who came from heaven to provide himself as an atoning sacrifice for humankind through his death on a Roman cross and subsequent resurrection from the dead, showing his power over death itself (Phil. 2:6-11). A restored relationship will lead, at death, to an existence with God in heaven. Failure to restore a right relationship with God leads to eternal separation from God – "holding their uniqueness in awful loneliness apart from precisely that which would fulfill them" (Sire, 1988, p. 35). The Bible reinforces this concept through the words of Christ who stated, "I am the way, the Truth, and the Life. No one comes to the Father except through me" (John 14:6).

In addition, because of this linearity of history, the Christian worldview views history as having an end, when the purpose of God for humanity is completed. The end of history will be "closed by the judgment and a new age inaugurated beyond time" (Sire, 1988, p. 37). This final judgment depicted in the Bible is the passing away

of the earth, as we know it and the creation of a new heaven and earth in which there is a restoration of perfect harmony between God and humankind who have restored their relationship with Him through the redemptive work of Jesus Christ.

> Then I saw a new heaven and a new earth, for the first heaven and the first earth had passed away, and there was no longer any sea. I saw the Holy City, the new Jerusalem, coming down out of heaven from God, prepared as a bride beautifully dressed for her husband. And I heard a loud voice from the throne saying, "Now the dwelling of God is with men, and he will live with them. They will be his people, and God himself will be with them and be their God." (Rev. 21:1-3)

Is There a Conflict Between the Christian Worldview and an Ecological Worldview?

When the development of research on ecological worldview began in earnest in the mid-1960s, it seemed that the initial goal was to try to determine in the simplest terms possible the reason why humankind was facing this environmental crisis written about in the books *Silent Spring* and *The Population Bomb*. How did humans end up in such a tight spot? Two articles really opened the door for the debate on ecological worldview and its roots. The most well known of these submissions, by historian Lynn White, Jr. (1967, 1973), has stirred debate for over three decades. White believed from an historical perspective that much of the blame for the current environmental crisis lands squarely in the lap of those with Judeo-Christian religious beliefs. White's thesis states that orthodox Christian worldviews, brought over with the earliest settlers to North America, were responsible for the view of resources as unlimited in this new land. In White's view, this philosophy has produced the unchecked use of natural resources across the continent without thought to the future or the environment. As White states,

> What people do about their ecology depends on what they think about themselves in relation to things around them. Human ecology is deeply conditioned by beliefs about our nature and our destiny - that is by religion. … Our science and technology have grown out of Christian attitudes toward man's relation to nature which are almost universally held not only by Christians and neo-Christians but also by those who fondly regard themselves as post-Christians. (p. 1205, 1206)

Means (1967) also provides support for White's thesis. Looking at what was happening culturally with the 'hippie' generation of the 1960s, Means noted that this return to a more 'sound instinct' might be what humans needed. Returning to a pantheistic view of life would enable humans to more adequately deal with the ecological crisis. He saw this as an "overdue perception of the fact that we need to appreciate more fully the religious and moral dimensions of the relation between nature and the human spirit." Religion in Means case is a separation from Judeo-Christian beliefs which brought us to this point of ecological crisis.

These two articles have prompted a great deal of research into the source of ecological beliefs. The main question being, are orthodox Christian beliefs responsible for the ecological problems we currently face as humans? Are the foundational assumptions of this belief system such that they provide a basis, albeit an unconscious one, to current ecological troubles?

Other researchers have attempted to provide support for White's thesis. From an historical perspective, Worster (1994) notes that the pastorialistic tendencies of Christianity can only lead to one conclusion – that humans are dominant over all of the creation. Worster argues that of all of the world's religions, Christianity "has been the most insistently anti-natural." The exclusion of all but man from divine grace and the anthropocentric values of the religion have separated man from nature. Nature is seen a means to support man's desires. Worster uses his interpretation of the works of Sir Robert Boyle's to support these beliefs. As Boyle (1744) states,

> The veneration wherewith men are imbued for what they call nature has

> been a discouraging impediment to the empire of man over the inferior creatures of God: for many have not only looked upon it, as an impossible thing to compass, but as something of impious to attempt … and whilst they look upon her as such a venerable thing, some make a kind of scruple of conscience to endeavour so to emulate any of her works, as to excel them. (p. 363)

Even Christian scholars have noted that a Judeo-Christian perspective is in part responsible for the ecological problems now being faced (Marsch, 2002). The misuse of Biblical proof-texts for man's dominion over the creation has led to defilement of the natural order. However, unlike others, these Christian scholars note that it is because of misuse of this creation mandate and sinful nature of humans that has lead to our current ecological problems, not the Judeo-Christian beliefs in and of themselves (Marsch, 2002; Schaeffer, 1970). It is not only these perceived historical connections to Judeo/Christian beliefs which fuel the perception of orthodox Christian apathy toward the environment. Other positions held by members within the orthodox Christian worldview (though not necessarily by all holders of the worldview) also seem to support White's thesis that orthodox Christians have less concern for their Creation.

What is of concern here is another Judeo-Christian belief which has more recently appeared in general print (though held within certain orthodox Christian circles for a long time). Using eschatological arguments, some Christians have taken the stance that if God is going to annihilate the present world to make way for a new earth, why should we be concerned about the environment (Clifford, 1994). This type of belief system has shown itself to be very prevalent in the best selling apocalyptic writings of LaHaye and Jenkins (2001). This view of the linearity of time fits well within some interpretations of a Christian worldview perspective and provides one possible way to investigate the structural relationship between Self, the Non-Self components of environments and God and its relationship to the Causality of Time.

Other research has also pointed to a possible connection between Christian beliefs and anti-environmental beliefs and behavior. Kellert and Berry (1982) noted in a study of American attitudes toward wildlife that "formal religious activities" can act as a differentiator. They note that the more involved a person is in religious activities, the more likely they are to have a limited knowledge about wildlife. They also linked participation in religious activities to an attitude of wildlife having a more utilitarian purpose (i.e. the purpose of wildlife is to help meet the needs of humans) than those who attended religious services less frequently. This relationship between belief and participation was also noted by Eckberg and Blocker (1996). They also observe that the more fundamental or sectarian a person is in their beliefs, the more likely they are to be anti-environmental.

Contrary to this, there has also been a great deal of research which would seem to negate the basic premise of White's thesis. Much of this revolves around the belief that there is a principle of stewardship of the creation implied in its opening book of Genesis. As Anderson (1994) notes regarding White's thesis,

> Prooftexting has resulted in taking texts out of their scriptural context as in the case of the passage in Genesis 1:26-28 concerning human dominion over the creation. Misuse of the latter text drew the fire of Lynn White, Jr., in his famous 1967 essay, 'The Historical Roots of Our Ecological Crisis,' in which he endeavored to trace the philosophical and theological origins of the environmental crisis to the Judeo-Christian doctrine of creation. (p. 28)

This view is also strongly held by many other researchers (Cajes, 2001; Harrison, 1999; Irwin & Pellegrino, 1994; Johnson, 2000). However, as many authors are quick to point out, some of White's arguments are not without some merit. R. H. Nash (1999), an orthodox Christian philosopher, believes that the complaint against Christianity's view toward ecology is essentially true. He believes it is actually the misinterpretation of the Bible by its "billions of its adherents" over a long period of

time that has created this ecological problem. This due mainly to the anthropocentric view of the Bible as interpreted by theologians from Augustine to Luther and into the current age. This anthropocentric view has mainly focused on man's sin and salvation and the "divine-human relationship over against the biophysical world as a whole." (p. 72). Human history has been the focus of orthodox Christianity rather than looking at the importance natural history plays in human history. It is the interpretation of this anthropocentrism within the orthodox Christian worldview that may relate directly to the problem of ecological use of natural resources. Because of the great focus on the spiritual need of humans, orthodox Christianity has for the most part ignored and not seen an importance to ecological problems (Schaeffer, 1970; Van Dyke et al., 1996). Thus, it is not because the orthodox Christian worldview cannot speak to these issues of natural history, but rather "because we haven't acted on the value that we know, or should know, it has as a creature of God" (Schaeffer, 1970). Yet, is it accurate to claim that because the orthodox Christian worldview has over the last two centuries had little interest for ecological matters that it, as White claims, is responsible for the ecological problems the world currently faces?

Many researchers would answer with an unqualified negative. Long before White published his thesis, others had already looked at this issue. The issue is more than ecological degradation, but rather the issues that also lead to these problems. Most environmentalists and other historians would point to the capitalistic nature of man as one of the primary factors pointing toward the great use of natural resources for the gaining of personal profit. Tawney (1938) noted early on that the early ventures in capitalism did not arise out of the orthodox Christian tradition, but rather was seen as an excess by many of the major orthodox Christian denominations of the time. As he points out,

> The 'capitalist spirit' is as old as history, and was not, as has sometimes been said, the offspring of Puritanism. But it was found in certain aspects of later Puritanism a tonic which braced its energies and fortified its already vigorous temper. (p. 225)

This is supported by others who note that the orthodox Christian tradition was not the dominant worldview that was responsible for the scientific-technological-industrial revolution, but rather that it arises more from a Greek philosophy of life than from a Judeo-Christian perspective (Glacken, 1967; Merchant, 1980; Passmore, 1974). In fact, as Merchant (1980) points out, the image of the Creation as denoted by the Christian worldview of a living organism was more likely an ethical and cultural restraint against its exploitation. So, if this orthodox Christian worldview is not the primary key to current problems of environmental degradation, where can we place the blame? Merchant observes that other factors were at work which are more likely causes which lead to a greater use of natural resources,

> rather population pressures, the development of expansionistic capitalism in the forms of commercialism and industrialization (particularly ship-building, glassworks, iron and copper smelting), the triumph of Cartesian mechanism in science (which meant the "death" of nature, since it represented the defeat of organic assumptions, and the victory of the view that nature is "dead," inert particles moved by external forces), and the triumph of Francis Bacon's notions of dominion as mastery over nature. Resistance to these developments was strong, and generally operated on Christian value assumptions other than exploitative dominion. (in J. A. Nash, 1991, p. 76)

This is not to say that there is not a strong Western tradition that believes that humankind is given the right to use natural resources as they please and that it exists for their use, but rather that this worldview does not arise out of an orthodox Christian worldview as noted by White's thesis. Rather, it seems that Greek philosophical and Enlightenment influence on this worldview that led to the belief that humankind was justified in using natural resources for their gain (Passmore, 1974).

Given the nature of absolute presuppositions, such as those of the orthodox Christian worldview, as an underlying factor in student evaluation of materials they

are presented in the classroom and the outgrowth of these presuppositions in views of the world, as in an ecological worldview, what influence does worldview theory have on learning, especially about the environment?

Worldview and Conceptual Change and Environmental Education

A basic understanding of the structure and function of worldview enables the educator to apply this to the realm of learning, in this case, science education. However, the use of worldview theory in science education seems to be minimal. Emphasis in the research tends to focus on alternative conceptions and conceptual change strategies designed to bring students to a more scientific worldview. What has been missing in the realm of science education is a realization and acceptance of the value of the variations of worldview that students bring with them to the classroom (Cobern, 1989).

In the field of science education, educators are concerned with the development of science literacy in students. Rutherford and Ahlgren (1991) explain that science literacy is a multifaceted exploration of the natural and social sciences – including mathematics and technology – to develop scientific ways of looking at the world which will be used in everyday life. One of the main tools used in this building of a scientific literate society is the focus on the conceptual change of alternative frameworks which students bring with them to the classroom (Wandersee et al., 1994). The intention of conceptual change is to present students with a scientific conception of the world which will provide them with a more fruitful way in which to understand the world in which they live (Posner et al., 1982). However, as Cobern states,

> For all its merits, my objection to the conceptual change model is that it uncritically accepts the strategic framework in which it operates. In

> my view, that framework in involves a much too narrowly conceived notion of knowledge and the role knowledge plays in an individual's life. (Cobern, 1996, p. 1)

Cobern argues that the conceptual change tactic is flawed and fails to take into account the diversity of worldviews that students bring with them to the classroom. He also contends that classroom instruction focused on conceptual change does not provide a frame of reference in the student's real world and therefore lack the scope and force necessary to develop scientific understanding or conceptual change. Even if the argument for the scientific concept presented by the teacher is perfect and the interpretation by the student accurate, the conception may still be rejected (Arendt, 1978).

That a student will understand a concept completely and still reject it addresses a factor in science education with which many science educators have struggled. Students will learn the concepts, apply them on the exam, and then forget them. This idea of "school science" must mean that there are other factors besides the learning of the concept at play in the development of knowledge in a student (Driver & Warrington, 1985). Cobern (1993) contends,

> Science educators need not be at a loss to understand why some students fail to develop orthodox scientific conceptions even after the best of instruction. The argument from world view is that in some cases, it is not that the students fail to comprehend what is being taught – it is that they simply do not believe it. Therefore, there are occasions when the careful epistemological explication of a concept is not sufficient to bring about learning. The instruction must also include a discussion of the metaphysical foundations that support the epistemology. (p. 2-3)

This dichotomy between concept understanding and actual use in life is quite apparent in the literature in environmental education. The focus of environmental education is to produce 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 et al., 1969, p. 31) (italics mine). The first key here is knowledge in the form of scientific literacy of concepts relating to ecology, ecological interrelationships, and other factors of the biophysical world and the way in which humans interact with it. Secondly, students need to be aware of how human impact affects the environment and how they can act and finally, there must be a motivation to act. With three aspects of conceptual change to deal with, it is somewhat apparent how problems in teaching can arise. For most environmental educators, the focus has been to change the attitude of students by making them scientifically literate (Arcury, 1990; Hungerford & Volk, 1990; Pooley & O'Connor, 2000). As Bush (1997) states, "For us to understand modern environmental issues we need some background in ecology" (p. 6). However, this philosophy has been only minimally successful. That is not to say that worldview is the underlying cause of all of these learning issues, but it is one which should not be ignored as a possibility for the "entrenched" beliefs which students bring with them to the classroom (Vosniadou & Brewer, 1992).

Investigating the research literature regarding various environmental education programs reveals some of the successes and failures in teaching students the basic ecological literacy needed to understand environmental issues. For instance, at the most basic level of understanding the biosphere, Paraskevopoulos et al. (Paraskevopoulos, Padeliadu, & Zafiropoulos, 1998) discovered in a unit on plants that urban elementary students had a very limited knowledge of plants and animals. While they are aware of some of the characteristics which denote plants and animals, they tended to overestimate the value of plants and generally describe only mammals when referring to animals. In a similar study on the nature of plants and their decomposition, Hellden (1998) found in a longitudinal study of students from 9 to 15

that students at many different levels had difficulties describing in their own words how biomass builds up and breaks down. They also had difficulty determining where matter comes from and where it goes. Even after extensive studies of photosynthesis and respiration, students have difficulty and are unable to apply this to general issues of the environment. This inability to understand decomposition is consistent with other research by Wood-Robinson (1995) who noted that

> Very few of the youngest children were able to make any prediction about the fate of the matter that comprised the fruit after decay had taken place. Those who did suggested that the total amount of matter would get less as decay proceeded. By the age of 11 all children were familiar with decay and used words like rot, moldy, and decay to describe the process that they had observed. About half the children of this age made some prediction about the fate of matter after decay - mostly to say that some matter would enter the soil. *But none suggested that the total amount of matter would remain the same.* (p. 118, italics mine)

While the aforementioned studies focus on specific aspects of the biosphere, other studies seem to indicate that students also have difficulties in understanding the interrelationships between various parts of a biotic community. A study on the formation of ecological concepts in upper elementary students (Cothron & Thompson, 1984) found that students may increase conceptual understanding of the underlying concepts of ecology (such concepts as life requirements of food, minerals, gas exchange and community groups) as they get older, but the interrelationship of higher-order concepts such as producer, consumer, decomposer, and environmental factors were difficult for them to conceptualize. In regards to the interrelationship between these concepts, students at the sixth grade level tend to think in a linear fashion.

This linearity is not restricted solely to elementary students. In numerous studies on the interrelationships of food webs with college level students, White (P.

A. White, 1997, 1998, 1999, 2000) found that students tend to follow linear patterns of thought when presented with perturbations within a food web system. Rather than invoking conceptual patterns which show an interrelationship between members of a food web, students tend to follow linear patterns of thought, only showing effects of problems affecting members of the food web who are linearly connected to one another.

Others have also recognized this problem with food webs and food chains. Barman and Mayer (1994) noted that students tend to hold on to alternative conceptions about food chains and food webs. They also noted that the textbooks used by students in the classroom provide an inadequate description of food chains and food webs. This is regrettable as these concepts are key to understanding other ecological concepts. Unfortunately, it not only the textbooks, but also the instructors themselves who are responsible for the perpetuation of these alternative concepts (Zuefle & Beck, 1996). Griffiths and his colleagues also noted the tenacity of alternative conceptions in regards to food webs and food chains in high school students (Griffiths & Grant, 1985; Griffiths et al., 1988). They found that even with curricular materials specifically designed to address the alternative conceptions that students are reluctant to renounce their alternative conceptions.

The problem is not only in the development of environmental knowledge, but also with an understanding of the environmental issues. Students come to the classroom with a variety of alternative conceptions about environmental issues which seem very difficult to change. In a way, this is not surprising given that students first have a difficult time developing the conceptual foundations in ecology which are important for the development of conceptual understanding in environmental science. However, it is more complex than this. Environmental issue concepts also require

students to think beyond the science and to look at societal, economic, and other factors in order to understand the full conceptual framework of the issues.

For instance, in a study on greenhouse effect and ozone depletion Anderson and Wallin (2000) found Swedish student understanding of the greenhouse effect was for the most part incomplete, but had a potential for improvement. The central issue missing in students' responses was their lack of understanding on how changes in the emission of greenhouse gasses (particularly CO_2) would also lead to necessary societal changes (i.e. changes in local climate, agricultural changes). On the other hand, Swedish students seemed to have a well-developed conceptualization of ozone depletion and its effects on humankind.

This contrasts with American studies on greenhouse effect and ozone depletion. Studies on high school and undergraduate college students (Boyes, Chambers, & Stanisstreet, 1995; Boyes, Chuckran, & Stanisstreet, 1993; Boyes & Stanisstreet, 1994, 1998; Dove, 1996) show there exists a confusion about these two issues. Students tend to conflate the two issues using pieces of one to explain the other and visa versa. Boyes et al. (1993) note:

> Perhaps the most general conclusion to be drawn from our results is that some students seem to confuse different major environmental problems - global warming and ozone-layer depletion in particular, but perhaps also radioactive contamination, acid precipitation, and even global biodiversity reduction. The origins of one problem are confounded with the origins of the others; the manifestations of one are confused with the manifestations of the others. (p. 555)

> One task of educators will be to disentangle these various issues, without adopting a completely nonholistic approach, which is seen by many as a contributing cause of environmental insensitivity. This task will not be easily accomplished, in view of the fact that the misconceptions are embedded in an alternative framework of high conceptual inertia. (p. 556)

Students also have problems developing a scientific understanding of how

ecological systems and human impacts relate to acidic precipitation. Brody et al. (1988) in a study of 4th, 8th, and 11th grade students noted that while students often have a partial understanding of the problem, they were often missing key concepts which are important to the issue and did not have a good grasp of how complex and multidisciplinary the problem is. Dove (1996) also found that pre-service elementary teachers have an inadequate and often fallacious understanding of this issue. He notes that, "Identification in undergraduate courses of misconceptions about these environmental issues is important, because otherwise the students might pass on false information or fail to correct the children they eventually teach." (p. 99)

Other environmental issues have faced the same problems in the classroom (Buck & Meduna, 2001; Glazar, Vrtacnik, & Bacnik, 1998; Hines et al., 1986; Palmer, 1995). Four possible reasons for these problems related to student comprehension could be: 1) lack of knowledge of the ecological/human systems necessary to understand the issue; 2) strongly held alternative conceptions (some of which could arise from worldview commitments); 3) views students have of science in general (Ma & Bateson, 1999) or; 4) the way the information is communicated to the students (Koballa, 1985). Yet, from any view, students seem to have a difficult time piecing together the chunks of conceptual knowledge necessary to have a complete understanding of ecological and environmental concepts.

This is not to say that there have not been some successes in developing conceptual understanding of students in the area of ecological concepts and environment issues. There are a number of studies which show that effective ecological and environmental programming can lead to conceptual change in students knowledge about the environment (Bjorn Anderson & Wallin, 2000; Brackney & McAndrew, 2001; Dettmann-Easler & Pease, 1999; Dickey, 1994; Dill, 1982; Eagles

& Demare, 1999; Gillett, Thomas, Skok, & McLaughlin, 1991; Harding, 1997; Keys, 1995; Knapp & Barrie, 2001; Leeming, Porter, & Dwyer, 1997; Manzanal, Barreiro, & Jimenez, 1999; Martin, 1999; Oberst, 1997; Shepard & Speelman, 1986). Yet, it is interesting to note that most of this successful research relates to learning ecological concepts and environmental issues using pedagogical methods which are not of a traditional nature, especially the use of outdoor resources and issue investigation.

On the other side of this issue, and perhaps of more importance in developing an environmentally literate individual is a student's attitude toward the environment. This affective aspect of environmental education is more difficult to assess and change (Hungerford & Volk, 1990). While there have been successes in the development of knowledge about environmental systems and issues, the affective part of the equation, what the student does with this knowledge is more difficult to change. While the student may have environmental knowledge, it is the student's attitude about the environment that will influence his/her behavior (Newhouse, 1990). Hwang, Kim, and Jeng (2000) differentiate between three different areas related to attitude and behavior. First, the locus of control will determine whether an individual believes "he or she has the ability to bring about change through his or her own behavior" (p. 20). The locus of control has two different dimensions related to the previous discussions on worldview. An internal dimension (focus on Self) focuses on the abilities one believes they have to bring about change, while the external dimension of locus of control focuses on beliefs centered on chance or intervention. For example, a student with a strong external locus of control may believe in the intervention of a powerful other (such as God or the government) who will bring about change without the need for personal involvement (Hines et al., 1986; Hungerford & Volk, 1990). Secondly, Hwang et al. (2000) note the value of personal responsibility. Again using the research

base of Hungerford and Volk, they state that,

> a person who has more individual interest in a certain issue is more likely to invest resources in it and, thus, have a higher responsibility. Obligation or sense of duty about the environment can be categorized into either personal or social responsibility, depending on one's personal perception. Personal responsibility describes more individual-oriented responsibility in contrast to social responsibility. (p. 21)

Haluza-Delay (2001) correlates this with a dichotomy within worldview between two aspects of the Non-self, nature and civilization. He notes that teens create a division between nature out there and civilization here. Nature is not something to be experienced where they live, but rather exists in another part of the Non-self.

Eagles and Demare (1999) in studying the effects of a Sunship Earth program on the attitudes of students found that student attitude toward the environment did not change even after a week long intensive residential environmental education program. What they did discover is that students came to the program with moderate levels of ecological attitudes derived from a variety of sources. These sources included the influences of family, media, and previous school-based environmental education programs. Harding (1997) also notes that students' past experiences and gender can be influencing factors in student attitudes toward the environment. Female students tend to have more favorable attitudes toward the environment than do male students at the elementary level (Martin, 1999). Also, students who come into an environmental education programs with a more favorable attitude toward science already in place will tend to show a more favorable attitude toward the environment as well (Ma & Bateson, 1999).

Other outdoor residential environmental education programs have also shown ineffectiveness in changing student attitudes toward the environment. From

wilderness camping (Gillett et al., 1991), to outdoor field trip programs (Harding, 1997; Knapp & Barrie, 2001; Martin, 1999; Oberst, 1997; Shepard & Speelman, 1986; Sills, 1999; Simmons, 1998) knowledge gains about ecological systems make a steps forward, but the attitude of the students toward the environment remains relatively unchanged as measured by the various instruments used in these studies.

However, there have been a few successes in changing attitude toward the environment. In one such instance, building on previous research of student behavior toward the environment, Culen and Volk (2000) developed an extended case-study issue investigation of wetlands for seventh- and eighth-graders. They compared the results of student understanding and environmental behavior with students who received traditional instruction on issues related to wetlands. In their final analysis, they found that students in the extended case study had a greater overt environmental behavior and greater knowledge of the issues than students participating in a traditional learning environment.

If the goal of environmental education is environmental literacy for use outside of the classroom, then there needs to be a different approach taken in order to help students understand their relationship with the natural world. As has been shown here, a worldview provides a foundational function in student thought. This foundational role of the worldview influences environmental thought and gives rise to an ecological worldview. This ecological worldview will influence the student behavior toward the natural world. As has been noted in the environmental education research, not only are there problems in the development of knowledge about ecological and environmental issues, but also the effectiveness of influencing student behavior toward the environment has for the most part been ineffective, even if there is understanding of the ecological concepts. Culen and Volk (2000) show that

environmental education requires a different approach, one which takes into account more than alternative conceptions that students bring with them to the classroom. Worldviews, such as the orthodox Christian worldview, have the potential to impact both student conceptual learning and attitudes toward the environment. It is important for the educator to develop an understanding of how these foundational worldview perspectives may influence a student's thinking and to determine to what extent these perspectives are influencing learning.

CHAPTER III

METHODS

Subjects

The choice of subjects is important to this study. As I desire to focus my attention on how students' worldviews interact with their views on the environment and how orthodox Christian religiosity may impact this interaction, it is important to have students who have at least given some thought to the environment. In addition, because my teaching interests lie with the teaching of undergraduate non-science majors, the student selection will consist of students from this population.

Research has shown that people whose careers are science-based tend to invoke scientific explanations more quickly and readily in response to questions about nature (Cobern, 1992). Because the nature of this research is not to invoke novice/expert comparisons, but rather to investigate worldview/ecological worldview interactions which may hinder or empower the student in their learning, I have decided not to specifically seek out science or environmental studies majors, but rather work with a group of students who have fairly homogeneous science backgrounds. Therefore, the students in this study consist of pre-service elementary teachers who were currently enrolled in their elementary science methods class. Students enrolled in this class have completed a core of science classes, one of which includes the teaching of ecological principles. Also, because of their wide range of studies, pre-service elementary teachers are somewhat representative of the educated public. Thus, while some may have been had more exposure to the topics that compose an ecological worldview, all have had at least a

minimal introduction to the ecological principles which are necessary to make sense of ecological issues. A 2000 Gallup Poll (Dunlap, 2000) using questions similar in nature to those used in the survey of this research indicated that 83% of the US population hold views indicative of positive environmental views. Therefore, it is hypothesized that a similar number of students in this research will hold positive ecological worldview beliefs.

The students were enrolled in the Elementary Science Methods course at Western Michigan University, a large Midwestern university, or in a similar course at Cornerstone University, a smaller religiously conservative Midwestern university. The purpose in the selection of the two groups is to provide the greatest possibility of a student population which includes the continuum of ecological worldviews, some extremes of which have been linked to orthodox religious views (Boyd, 1999; Eckberg & Blocker, 1996). The study sample includes 281 upper level undergraduate students with similar educational backgrounds and levels of exposure to ecological principles. National survey data from the Barna Research Group (2002) indicates that 60% of the US population holds orthodox Christian worldview beliefs. While the measures used in the Barna survey are different than those used in this research, there are enough similarities (literal interpretation of the Bible, the deity of Jesus Christ, forgiveness of sins) to make a comparison. Therefore, it is hypothesized that at least 60% of this surveyed student sample will hold an orthodox Christian worldview.

Following the guidelines implemented by the Human Subjects Review Board of Western Michigan University (Appendix E), no student was required to participate in the study, but did so only with his/her full, informed consent. Students were also allowed to retire from the study at any time. All student surveys and interviews were coded using the last six digits of the student's student identification number. Student names used in this research are pseudonyms used to maintain anonymity (Appendix F).

These identification codes were keyed to participant consent forms which included the same student number code, student name, e-mail address, and phone number for contact purposes. The consent forms with participant information will be held in separate locations from the surveys, interviews and other data materials containing identification codes. Students participating in the study were informed of the nature of the research only to the extent that the research is seeking to elicit their attitudes toward various environmental issues and their relationship to religious beliefs.

Methodology

Two research pieces were used in tandem to facilitate a determination of how a student's orthodox Christian worldview might interact with their ecological worldview. A number of studies have used surveys in an effort to describe peoples' views on the environment with mixed success (Dunlap & VanLiere, 1984; LaTrobe & Acott, 2000; Stern et al., 1995). While surveys are useful for descriptive analysis of ecological worldview, this study proposes to instead use a qualitative interviewing methodology to delve more deeply into how students' orthodox Christian worldviews interact with their views on the environment. As such, the first goal of the research was to establish a pool of students from which to make comparisons. To establish this pool, a survey was used which allowed the researcher to determine both the ecological and orthodox religious worldviews of the students. As stated previously, while the interactions between worldview and environmental beliefs, attitudes, and behaviors are not well understood, the characteristics of various ecological worldviews have been studied extensively and been fairly well documented (Milbrath, 1989). There has also been considerable research on assessing the orthodox Christian religious worldviews of students (Hill & Hood, 1999).

The major goal of this initial step was to group into quadrants based on both

ecological and orthodox religious worldviews. This grouping of students allowed the researcher to divide students into four quadrants based on their current ecological and orthodox religious worldviews. The survey administered to created these quadrants is composed of two parts. To create the quadrants of students in the area of ecological worldview, the well-established New Ecological Paradigm (NEP) scale developed by Dunlap, Van Liere and Mertig (2000) was used (Appendix A). The scale employs a five-point Likert-type rating scale which operationalizes student responses to 15 items related to issues of environmental importance. The current NEP scale was shown to have high validity and reliability both in the research conducted by Dunlap, van Liere and Mertig (2000), but also in a variety of other studies which have made use of the survey (Brackney & McAndrew, 2001; Corral-Verdugo & Armendáriz, 2000; LaTrobe & Acott, 2000; Stern et al., 1995). In their study, Dunlap et al. (2000) note that the 15 items in the NEP scale can be used legitimately as a single measure for determining ecological worldview. In a test of the survey, 667 respondents scores for all 15 items were shown to have an internal consistency coefficient alpha of .83. In their initial development of the NEP, Dunlap and Van Liere (1978) showed the NEP to have predictive, construct and content validity. This has been supported for both the initial and current NEP scales by other authors. A study in a Mexican community (Corral-Verdugo & Armendáriz, 2000) showed the NEP to be compatible with the results obtained by Dunlap et al. In a comparison of the NEP with other scales of environmental worldview Stern et al. (1995) found the NEP to have a theta reliability of .78 (in comparison to the .83 obtained by Dunlap et al., 2000). They also determined that the NEP correlates highly ($r = .78$) with another measure of ecological worldview, the general awareness of consequences (GAC) scale.

A second aspect of the NEP scale are the five different dimensions which are used in the construction of the survey. These dimensions underlying the construction of

the survey have been investigated by Dunlap et al. (2000) and other researchers (Brackney & McAndrew, 2001; Corral-Verdugo & Armendáriz, 2000; LaTrobe & Acott, 2000; Stern et al., 1995) as a potential way of looking at specific beliefs about environmental issues. While there have been mixed results from these investigations, they are also investigated in this study to evaluate potential differences between orthodox Christian and non-Christian students. The dimensions included in the construction of the survey include balance, eco-crisis, exemptionalism, limits, and anti-anthropocentrism. Dunlap et al. (2000) found that when the four factors with eigen values greater than one are subjected to varimax rotation three eco-crisis items (5, 10, 15), two balance items (3, 13), and one exemptionalism item (9) load heavily (loading of .3 and above) on the first factor. Four items load heavily on the second factor: two exemptionalism items (4, 14), one balance item (8), and one limits item (6). The eco-crisis item from the first factor (10) also loads heavily on this second factor. The final two limits items load heavily on the third factor (1, 11) as does the limits item (6) from the second factor. The three anti-anthropocentrism items (2, 7, 12) load heavily on the fourth factor.

The second part of the survey was an evaluation of student views on orthodox Christian religiosity. In order to evaluate this aspect of student worldview, a scale was sought which would measure student commitment to basic tenants of the Christian faith. Although Christian groups around the world have variability among their beliefs, there are particular beliefs which are foundational to all groups who hold to the name "Christian." These foundational statements can be found expressed in two documents central to the Christian faith, the Apostles' Creed and the Nicene Creed. Thus, a scale was chosen which would be broad enough to encompass a variety of Christian faiths who take these two defining documents as the foundation for their faith. The Christian Orthodoxy Scale (CO) met these requirements (Hill & Hood, 1999). Two versions of

the CO scale exist, a longer version and shorter version. The short version of the scale, which includes six questions on Christian religious orthodoxy, was used in this research (Appendix B). Both versions use a seven-point Likert-type scale to assess the degree to which students hold to various points of Christian religious orthodoxy. The longer version, on which the shorter version is based, has been shown to have a high degree of statistical reliability. In studies using this scale (Altemeyer & Hunsberger, 1992; Fullerton & Hunsberger, 1982; Pancer, Jackson, Hunsberger, Pratt, & Lea, 1995) the mean inter-item correlation coefficients have ranged from .57 to .70 and the internal consistency reliability coefficients range from .97 to .98 for all of the studies (Fullerton & Hunsberger, 1982; Hill & Hood, 1999). Hill and Hood (1999) also note that the factor analysis of the entire scale as a whole loads well to form a "unidimensional measure of orthodox belief."

Hunsburger (1989) also showed that the CO scale reflects the beliefs of many known orthodox Christian denominations (conservative Christian, Methodist, Lutheran, Catholic, and Reformed). In the same way, Fullerton and Hunsberger (1982) also note that groups who had rejected the orthodox Christian denominations mentioned above score on the lower end of the CO scale, with a score of 61.8 (on a scale of 21 to 147). This seems to indicate that the scale does well in measuring non-orthodox Christian beliefs as well as strong orthodox Christian beliefs.

The shorter version of the CO scale used in this research, developed by Hunsberger (1989), maintains the high internal consistency consistent of the longer version. The short scale's inter-item consistency is similar to that of the longer version, with a coefficient range of .69 to .78 (compared with .57 to .70 on the longer version) and an internal consistency coefficient of .93 to .95 (compared to .97 to .98 in the longer version). This validity and reliability of the short version was further documented by Altemeyer and Hunsberger (1992). The purpose for using the shorter version rests

in the fact that the purpose of the survey is primarily to establish whether a student has orthodox Christian beliefs, not describe those beliefs.

Student responses were recorded on a scantron form with the NEP scale on the front side and the OC scale on the back (Appendix A and B). This layout was used to avoid confusion between the five-point Likert scale used in the NEP and the seven-point Likert scale used in the CO. Scantron forms were tallied and the means for each scale calculated. Scores on the NEP scale are marked as 1, strongly disagree, 2 mildly disagree, 3 unsure, 4, mildly agree, and 5, strongly agree. On the OC scale, scores are marked as 1, strongly disagree, 2, moderately disagree, 3, slightly disagree, 4, exactly and precisely neutral, 5, slightly agree, 6, moderately agree, and 7, strongly agree. Scantron forms were tallied and mean scores for each of the scales determined.

Using the mean scores from each scale, each student was grouped into one of four quadrants (Figure 4) for the purpose of selecting students to conduct semi-structured interviews. A NEP scale mean of 3 (unsure) was chosen as the splitting point for the quadrants for ecological worldview. An OC scale mean of 4.5 (slightly above neutral) was chosen as the splitting point for the quadrants for orthodox Christian worldview to gain a greater pool of students from which to interview (due to the small number of neutral-negative OC scores). The quadrants consist of: Q1) positive NEP/OC (NEP+/OC+) (NEP>3, OC > 4.5); Q2) positive NEP/neutral-negative OC (NEP+/OC<+) (NEP>3, OC ≤ 4.5); Q3) neutral-negative NEP/positive OC (NEP<+/OC+) (NEP≤ 3, OC > 4.5); and Q4) neutral-negative NEP/OC (NEP<+/OC<+) (NEP ≤ 3, OC≤ 4.5).

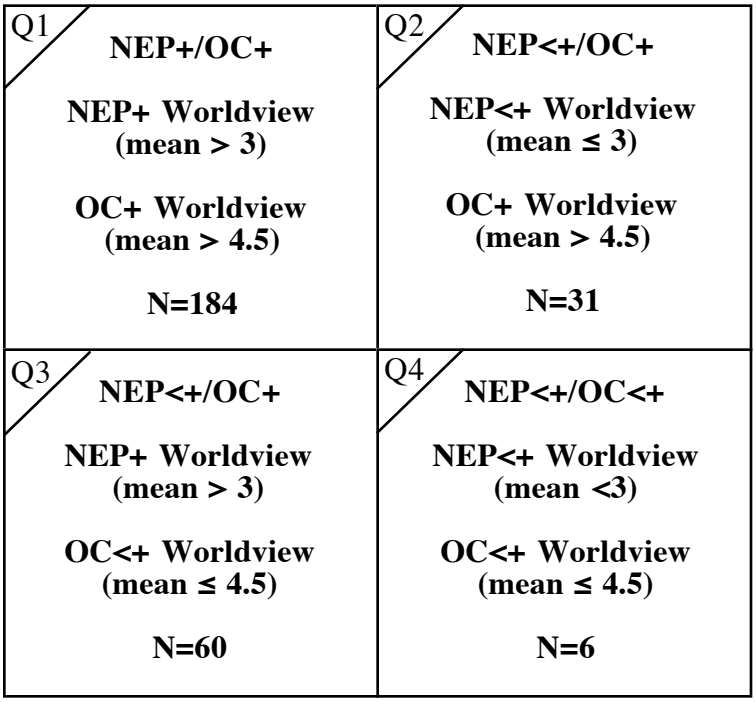

Figure 4. Division of Students into Quadrants Based on NEP and OC Scores

Quantitative analysis of the survey means was conducted to determine if any significant differences existed between quadrants where survey means should be comparable (e.g. NEP+ quadrants). Analysis was also conducted on each of the NEP dimensions to see if students' means on these dimensions (e.g. eco-crisis, balance, limits, exemptionalism, etc.) were significantly different from each other.

Qualitative interviews were conducted with a sample of students from each of the four quadrants. Based on the numbers of students in each of the quadrant, six students were chosen for interviews from Q1 (NEP+/OC+, n=184) quadrant, four each from Q2 (NEP+/OC<+, n=60) and Q3 (NEP<+/OC+, n=31) quadrant, and three from Q4 (NEP<+/OC<+, n=6) quadrant. Students were chosen from each of the quadrants based on their NEP and OC scores. The objective was to choose students representing the strongest beliefs in each quadrant. For instance, a student for the NEP+/OC+ group

was likely to have an NEP score above four and an OC score above six.

The interviews followed the semi-structured format as described in Ginsburg (1997) and Kvale (1996). A pilot student group (n=8) was used to develop the questioning protocol for the research interviews. Questions using specific dimensions within the NEP scale were written to examine the interaction of ecological worldview with orthodox Christian worldview. Dimensions used in the interview included ecological crisis, ecological limits, balance of nature, and anthropocentrism. Interviewees were also asked questions about specific issues, including population, endangered species, and global climate change (Appendix C). Interviews used a three-fold analysis matrix composed of a digital audio recording of each student's interview, a written transcript based on the audio recording and interviewer notes taken during the interview. The constant comparative method of interview analysis as described in Lincoln and Guba (1985) was used in evaluation of each data set. A set of coding definitions was developed for each dimension and issue investigated (Appendix G). This method allowed the researcher to develop an operationalized data set as interviews were analyzed on each of the above factors. Interviews were studied in detail and coded as to the claims and implied claims students made showing the interactions which occur within their worldview (naturalistic or orthodox Christian) on their beliefs and attitudes toward the environment.

Hypotheses

After the completion of the coding and the operationalization of the data, various hypotheses were tested and analyzed.

Hypothesis 1) There is a positive relationship between an orthodox Christian worldview and a positive ecological worldview.

The initial analysis of the hypothesis will use a Pearson correlation coefficient

analysis to look for relationships in the survey data. First, the relationships of the entire survey pool will be analyzed. Secondly, it will be determined if relationships exist among students with an OC+ and their NEP. Third, the data will be analyzed to see if relationships exist between students with a NEP+ and their OC, and finally, the data will be analyzed for relationships within the quadrants. Subsequent analysis will use the interview data to analyze these relationships from various dimensional and environmental issue perspectives. It is expected that students with a NEP+/OC+ will use responses consistent with a positive ecological worldview. It is further anticipated that students in the NEP+/OC<+ quadrant will also respond in a like manner. Finally, it is assumed that students in the NEP<+/OC<+ quadrant will not have responses consistent with a positive ecological worldview.

Sub-hypothesis 1) There is a relationship between an orthodox Christian worldview and beliefs on ecological crisis.

Sub-hypothesis 2) There is a relationship between an orthodox Christian worldview and beliefs on natural resource use.

Sub-hypothesis 3) There is a relationship between an orthodox Christian worldview and beliefs on anthropocentrism.

Sub-hypothesis 4) There is a relationship between an orthodox Christian worldview and beliefs ecological balance

Sub-hypothesis 5) There is a relationship between an orthodox Christian worldview and beliefs on human population.

Sub-hypothesis 6) There is a relationship between an orthodox Christian worldview and beliefs on endangered species.

Sub-hypothesis 7) There is a relationship between an orthodox Christian worldview and beliefs on global climate change.

Hypothesis 2) Students with an orthodox Christian worldview will use language

consistent with that worldview to describe their environmental beliefs and attitudes.

Hypothesis 3) Non-orthodox Christian students will not use orthodox Christian worldview language to describe their environmental beliefs and attitudes.

CHAPTER IV

RESULTS

Student Responses to and Validity of the Survey

In assessing the validity of the survey, the study replicated the validity analyses conducted by the original NEP and OC researchers (Dunlap et al., 2000, Hunsburger, 1989). As in Dunlap et al.'s research, the responses to the 15 NEP items were examined for consistency. The next to last column of Table 2 shows the corrected item-total correlations for each item of the survey. These correlations are mostly consistent with those obtained by Dunlap et al. (last column). In this case, the correlations are still reasonably strong, with correlations ranging from .07 to .60. The weak exceptions of NEP 2, NEP 4, and NEP 6 were also weaker in Dunlap et al., though the .07 of NEP 6 shows a greater deviation from the .34 recorded by Dunlap et al. However, when all of the items are taken together as a whole, an acceptable Cronbach's coefficient alpha of .81 was achieved. This is consistent with the .83 obtained by Dunlap et al. Thus, as in Dunlap et al., the 15 items can be treated as internally consistent in this survey.

Table 2. Frequency Distribution and Corrected Item-Total Correlation for the NEP

	SD[a]	MD	U	MA	SA	(N)	$r_{i\text{-}t}$	$Dr_{i\text{-}t}$ [b]
NEP 1	8.40%	22.10%	25.62%	36.30%	7.47%	281	.39	.43
NEP 2	9.61	42.7	11.74	24.16	1.78	281	.26	.35
NEP 3	3.91	19.22	16.37	43.42	17.08	281	.45	.42
NEP 4	5.34	29.54	43.77	19.93	1.42	281	.26	.38
NEP 5	5.69	14.23	6.05	46.26	27.76	281	.52	.53
NEP 6	4.63	24.2	22.42	35.94	12.81	281	.07	.34
NEP 7	9.96	11.39	3.91	27.05	47.69	281	.53	.46
NEP 8	16.37	45.91	23.84	12.1	1.78	281	.60	.53
NEP 9	7.12	6.76	12.1	42.35	31.67	281	.48	.33
NEP 10	12.46	30.6	35.94	17.79	3.2	281	.55	.62
NEP 11	5.69	28.11	14.95	40.93	10.32	281	.43	.51
NEP 12	28.47	22.42	8.9	20.64	19.57	281	.38	.51
NEP 13	4.98	15.3	17.79	45.2	16.73	281	.55	.48
NEP 14	16.73	34.16	28.11	17.08	3.91	281	.37	.35
NEP 15	2.49	19.22	33.1	34.52	10.68	281	.60	.62

[a]SD=Strongly Disagree, MD=Mildly Disagree, U=Unsure, MA=Mildly Agree, and SA=Strongly Agree
[b]Dunlap et al. (2000) Corrected Item-Total Correlation

Dunlap et al. (2000) also assessed the internal consistency by analyzing the principle-components of the survey. As in Dunlap et al.'s, in an unrotated factor analysis of the survey, all 15 items loaded heavily (loadings > 0.3) on the first unrotated factor with the exception of NEP 6 (.07) and NEP 4 (.26). The first factor explains 30% of the total variance among the items (while the second accounts for only 10%). This is consistent with Dunlap et al. (Table 3).

Another component of the NEP Scale of relevance here is the value of its dimensionality. Factor analysis with varimax rotation was used to create orthogonal dimensions to test the dimensionality of the survey as per Dunlap et al. (Table 3). Though the dimensionality of the survey varied somewhat from Dunlap et al.'s, the factoring of the various dimensions of the survey show that individual dimensions can be grouped together. On the first factor nine items load the most heavily (> 0.3): all three balance items (3, 8, 13), all three eco-crisis items (5, 10, 15), one anti-

anthropocentrism item (7) and two of the three exemptionalism items (9, 14).

Table 3. Principle Components Analysis of NEP Items With Varimax Rotation

	Dimension	Factor 1	DF1[a]	Factor 2	DF2	Factor 3	DF3	Factor 4	DF4
NEP 1	(Limits)	22	20	05	-05	**74**	**76**	-03	16
NEP 2	(Anti-Anthro)	-03	11	**75**	10	-06	-02	11	**75**
NEP 3	(Balance)	**58**	**60**	05	04	25	07	01	19
NEP 4	(Anti-Exempt)	03	19	12	**74**	00	05	**83**	-05
NEP 5	(Eco-Crisis)	**71**	**71**	10	12	13	20	08	09
NEP 6	(Limits)	-39	-18	13	**54**	**59**	**52**	25	11
NEP 7	(Anti-Anthro)	**64**	**38**	**42**	01	-03	10	00	**63**
NEP 8	(Balance)	**44**	**30**	**44**	**63**	23	11	**30**	21
NEP 9	(Anti-Exempt)	**75**	**62**	-01	20	-02	-15	26	00
NEP 10	(Eco-Crisis)	**37**	**54**	**47**	**36**	25	27	19	22
NEP 11	(Limits)	24	**31**	05	15	**71**	**75**	08	01
NEP 12	(Anti-Anthro)	19	08	**71**	28	15	26	-18	**71**
NEP 13	(Balance)	**51**	**60**	**30**	00	13	**33**	29	14
NEP 14	(Anti-Exempt)	**34**	06	-10	**72**	16	-03	**62**	18
NEP 15	(Eco-Crisis)	**52**	**66**	**38**	13	**37**	**35**	02	21
Eigenvalue		4.5		1.4		1.3		1.1	
Dunlap et al. Eigenvalue			4.7		1.4		1.3		1.1
Percentage of variance		30.0		9.2		8.8		7.3	
Dunlap et al. Percentage of variance			31.3		10		7.8		7.4

Note: Loadings of .50 and above are in bold
[a] DF designation refers to Dunlap et al. (2000) Principle Component Factor Analysis

The other factors also show substantial loading on specific dimensions. All three anti-anthropocentrism items (2, 7, 12) load heavily on the second factor, all three limits items (1, 6, 11) load heavy on the third factor, and two of the three exemptionalism items (4, 14) load heavily on the fourth factor. This indicates that the first major factor taps the balance and eco-crisis dimensions well, but also has connections with the anti-anthropocentrism and exemptionalism dimensions.

These dimensionality factors are similar to those found by Dunlap et al. (2000). Their first factor also shows heavy loading on the dimensions of balance, eco-crisis, and

exemptionalism. Also, the dimension of anti-anthropocentrism loaded more heavily and significantly (first and second factor) here, while it did not load heavily until the final factor of their research. However, what is important here is that a dimensionality does seem to exist and that it is similar in nature to the results recorded by Dunlap et al. (2000) and others (Mueller, 1986; Stern et al., 1995). In addition, the internal consistency of the survey does allow for its use as a single unit, which is consistent with the results of Dunlap et al.

The Short Orthodox Christianity Scale (OC) was tested using the same validity tests as used by Hunsberger (1989). The validity of the survey was tested using the item-total correlations and Cronbachs alpha. The mean of the item-total correlations was .71 and the Cronbach's alpha was .92. This compares well with the item-total correlation mean of .72 and Cronbach's alpha of .94 recorded by Hunsberger. Factor analysis of this survey also revealed a single large factor with an eigenvalue of 4.25 accounting for 71% of the total variance and all items loading higher than .74 on this factor. The next largest factor only had an eigenvalue of .57. This is also similar to the eigenvalue of 4.61 accounting for 76.9 % of the variance with all items loading higher than .78 as recorded by Hunsberger. These similarities with Hunsburger suggest the strong validity of the OC survey in this research.

Overview of Student NEP and OC Survey Scores

National survey data has shown that approximately 60% of Americans tend to hold orthodox Christian beliefs (Barna Research Group of Ventura, 2002). This research hypothesized that there would be at least this percentage of orthodox Christians in the survey population. The results show that 91% (N=255) of the surveyed students come from a OC+ background (Figure 5). Thus the premise for orthodox Christianity was sustained by the survey data. This was not unexpected given the historically

religious demographics of the western Michigan region.

As regards the NEP scale, a majority of the students also show a NEP+ worldview. As Figure 5 illustrates, 79% (N=226) of the surveyed population possess this NEP+ worldview in comparison to 21% (N=54) who have the NEP<+ worldview perspective. The hypothesis stated that 83% of the students would hold NEP+

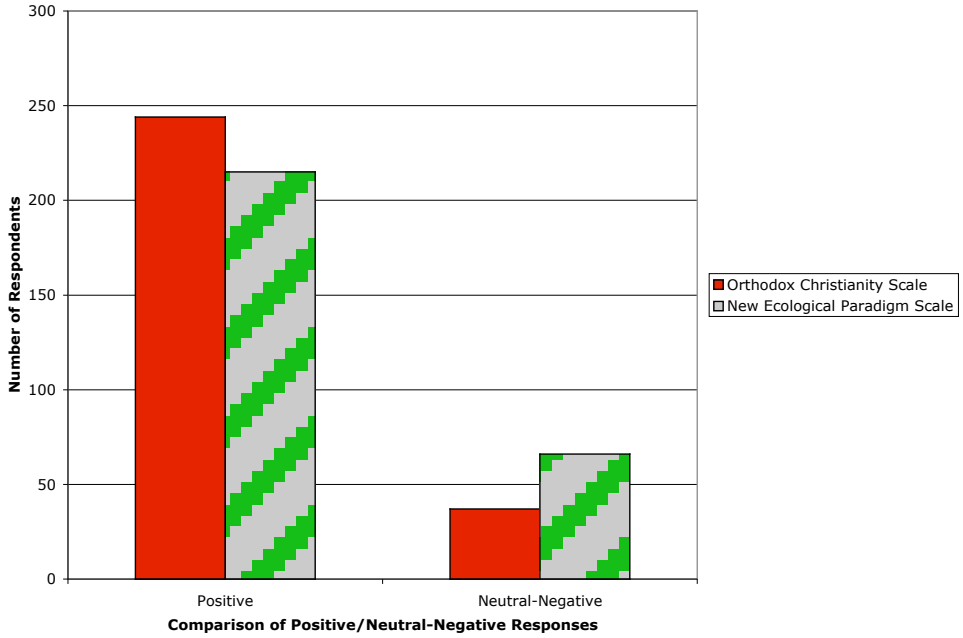

Figure 5. Comparison of Numbers of Students for Each Survey

worldview beliefs. The 4% difference between the survey results and the hypothesis are not of practical significance, thus this hypothesis was supported.

As per Chapter 3, the students were divided into four quadrants based on mean scores of the NEP and OC surveys (see Table 4 and Figure 6). The quadrants consist of: Q1) NEP+/OC+) (NEP>3, OC > 4.5); Q2) NEP+/OC<+ (NEP>3, OC ≤ 4.5); Q3) NEP<+/OC+) (NEP≤ 3, OC > 4.5); and Q4) NEP<+/OC<+) (NEP ≤ 3, OC≤ 4.5).

Each quadrant was then tested using T-tests to determine if expected

Table 4. Numbers of Students in Each Quadrant and Mean Score

	1) NEP+/OC+	2) NEP+/ OC<+	3) NEP<+/OC+	4) NEP<+/OC<+
N	184	31	60	6
NEP $\overline{X}$	3.60	4.01	2.62	2.32
OC $\overline{X}$	6.51	3.57	6.68	2.81

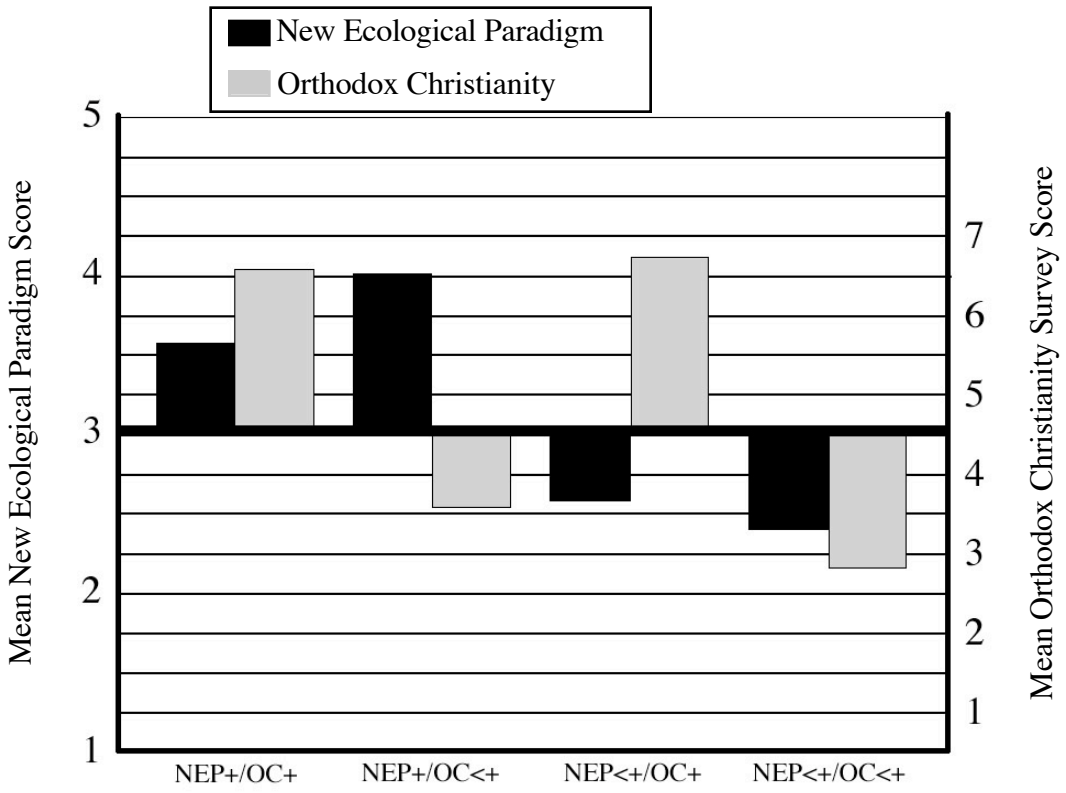

Figure 6. Comparison of Mean Scores of all Quadrants

homogeneity existed between Q1 and Q2, Q3 and Q4, Q1 and Q3, and Q2 and Q4. While each quadrant may have one comparable worldview characteristic (i.e. NEP+), the mean scores do show some variation. Figure 6 shows the disparity existing between the means of the students in each of the quadrants. The statistical comparison between

students in the two quadrants with OC+ scores, but different NEP scores, T-test results indicate there is no statistically significant difference in the OC score of those who have NEP+ scores and those who have NEP<+ scores. In the same vein, amongst students with OC<+ scores but differing NEP scores, T-test results indicate there is no statistically significant difference in the OC score of those who have NEP+ scores and those who have NEP<+ scores (Tables 5 and 7).

Table 5. T-test Comparisons of Orthodox Christianity Scores Between Quadrants with OC+ Scores and Quadrants with OC<+ Scores

Quadrants with OC+

	NEP+/OC+	NEP<+/OC+
N	184	60
$\bar{X}$	6.51	6.68
SD	0.627	0.616
df	102	
t	-1.89	
p	0.0622	

Quadrants with OC<+

	NEP+/OC<+	NEP<+/OC<+
N	31	6
$\bar{X}$	3.57	2.81
SD	0.805	1.087
df	6.11	
t	1.64	
p	0.1519	

Table 6. T-test Comparisons of New Ecological Paradigm Scores Between Quadrants with NEP+ Scores and Quadrants with NEP<+ Scores

Quadrants with NEP+

	NEP+/OC+	NEP+/OC<+
N	184	31
$\bar{X}$	3.60	4.01
SD	0.387	0.427
df	38.8	
t	-3.12	
p	0.0034	

Quadrants with NEP<+

	NEP<+/OC+	NEP<+/OC<+
N	60	6
$\bar{X}$	2.62	2.32
SD	0.316	0.529
df	5.36	
t	1.38	
p	0.2238	

On the other side of the quadrant matrix, amongst students who have NEP+ scores but opposite OC scores, T-test results indicate there is a statistically significant difference in the NEP scores of students who have OC+ scores and those who have OC<+ scores. In the same manner, between those with NEP<+ scores but opposite OC

scores, T-test results indicate there is a no statistically significant difference in the NEP scores of those who have OC+ scores and those who have OC<+ scores (Tables 6 and 7).

These results show that a measure of homogeneity does exist between quadrants with similar characteristics. However, the heterogeneity between the two NEP+ quadrants does raise questions as to the nature of the differences between two groups who should show a measure of homogeneity. To discover where these differences may be focused, the two NEP+ quadrants were also analyzed using the dimensional items contained within the NEP survey.

Table 7. Comparison of T-test Results by Quadrant

Quadrants	NEP+/OC+	NEP+/OC<+	NEP<+/OC+	NEP<+/OC<+
NEP+/OC+		[a] t = -3.12 p = 0.0034 [b] t = 19.37 p < 0.0001	t = 19.66 p < 0.0001 t = -1.89 p = 0.0622	t = 5.88 p = 0.0018 t = 8.30 p = 0.0001
NEP+/OC<+	t = -3.12 p = 0.0034 t = 19.37 p < 0.0001		t = 14.20 p < 0.0001 t = -18.37 p < 0.0001	t = 6.70 p = 0.0004 t = 1.64 p = 0.1519
NEP<+/OC+	t = 19.66 p < 0.0001 t = -1.89 p = 0.0622	t = 14.20 p < 0.0001 t = -18.37 p < 0.0001		t = 1.38 p = 0.2238 t = 8.60 p = 0.0003
NEP<+/OC<+	t = 5.88 p = 0.0018 t = 8.30 p = 0.0001	t = 6.70 p = 0.0004 t = 1.64 p = 0.1519	t = 1.38 p = 0.2238 t = 8.60 p = 0.0003	

[a] Top half of cells shows t and p values for NEP mean comparisons
[b] Bottom half of cells shows t and p values for OC mean comparisons

Analysis of Quadrant NEP Dimensional Differences

The significant differences in the NEP scores of the NEP+/OC+ quadrant and NEP+/OC<+ quadrant raised questions about the possibility of significant differences

between these quadrants on the NEP dimensions to be investigated during the interview. A statistical analysis of the dimensions of balance, eco-crisis, limits, and anti-anthropocentrism revealed that a significant difference does exist within the dimension of anti-anthropocentrism. T-test results on the anti-anthropocentrism dimension indicates a statistically significant difference ($t(56.6)= -4.18$, $p = <.0001$) in the mean anti-anthropocentrism dimension score of those who have positive mean OC scores and those who have OC<+ scores ($\overline{X} = 3.67$, $SD = 0.8113$, $N = 184$; $\overline{X} = 4.30$, $SD = 0.533$, $N = 31$) respectively.

Correlation Between Quadrants

In analyzing the relationships between NEP and OC scores a Pearson correlation coefficient analysis of the survey data revealed that as a group a weak negative correlation ($r = -0.147$) exists. Further analysis shows that among NEP+ students a weak negative correlation existed ($r = -0.236$) and among NEP<+ students a weak positive correlation ($r = 0.259$) is found. Also, in examining OC+ students, it was found that a weak negative correlation exists ($r = -0.149$) and among OC<+ students a weak positive correlation is found ($r = 0.152$). None of these correlations showed themselves to be of any significance.

In analyzing the specific quadrants for these relationships, it was found that the NEP+/OC+ students show a very weak negative correlation ($r =-0.075$) exists between the NEP and OC scores, and in the NEP+/OC<+ quadrant a weak negative correlation also occurs ($r = -0.156$). Among the NEP<+/OC+ students a very weak positive correlation is found ($r = 0.099$) and in the NEP<+/OC<+ quadrant a very weak positive correlation exists ($r = 0.026$). As before, none of the quadrants showed a significant correlation between NEP and OC scores.

Selection of Students for Interviews and Background of Interviewees

Recruitment and Validation of Interviewees

The recruitment of students for the interview portion of the research was successful for three of the quadrants. The NEP<+/OC<+ quadrant was the exception. Only six students fit the parameters for this quadrant. All six of the students in this quadrant were contacted for interviews, but only three of the six agreed to sit for the interview. Moreover, of the three students, one only marginally met the parameters for this quadrant (OC mean score = 4.33, max. 4.5 allowed). During the interview the student's responses revealed a much more positive orthodox Christian worldview than indicated by the OC survey. A review of the student's OC survey data revealed that the student may have misread one of the statements and juxtaposed the Likert scale value on question number six. This is partially corroborated by the student's answer to question number four which has contained in it similar orthodox Christian belief statements. A reversal on this question would change the student's OC score to 5.0 and move her out of the NEP<+/OC<+ quadrant. Thus, only two students were considered to be valid members of the NEP<+/OC<+ quadrant.

Socioeconomic Aspects of Interviewees

General socioeconomic information was gathered on students sitting for interviews regarding their families and where they grew up. All but two of the interviewees come from two parent families. Most of these parents have been married for 20+ years. The two interviewees who came from single parent homes were both members of the NEP+/OC<+ quadrant. Both of these students also participated in major moves as a result of their parents' separations.

The students that chose to respond to the questions on the economic background of their families indicated that families were somewhere in the middle to upper/middle class economic range. The two students from farming settings indicated that farming income was supplemented by other income sources.

The neighborhood settings of the students showed a mixture of urban, suburban,

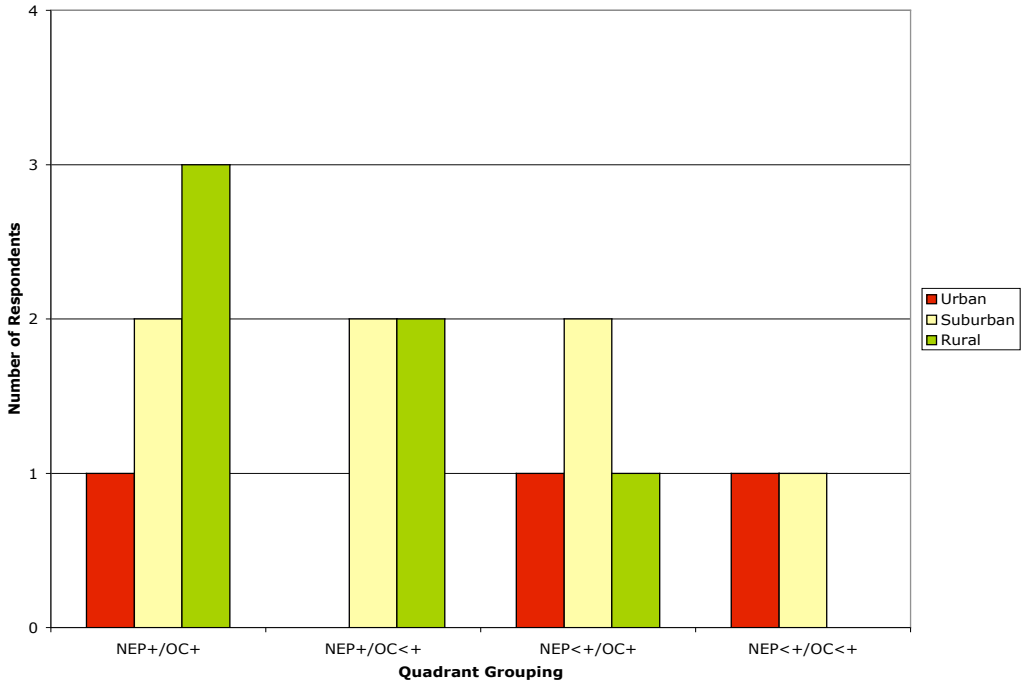

Figure 7. Socioeconomic Neighborhoods of Students by Quadrant

and rural settings. Figure 7 illustrates the breakdown of this by quadrant. Note that both of the students in the NEP<+/OC<+ quadrant are from urban or suburban settings, while the majority of the students in the NEP+/OC+ quadrant and NEP+/OC<+ quadrant come from suburban or rural settings. The NEP<+/OC+ quadrant shows a split across the urban to rural settings.

The extent to which students participate in activities related to the outdoor and environment also varies amongst the quadrants. As Figure 8 illustrates, students in the

NEP+ quadrants tend to participate in activities related to the outdoors more than students in the NEP<+ quadrants. Among these are activities such as hiking, camping, fishing, hunting and outdoor related sporting activities.

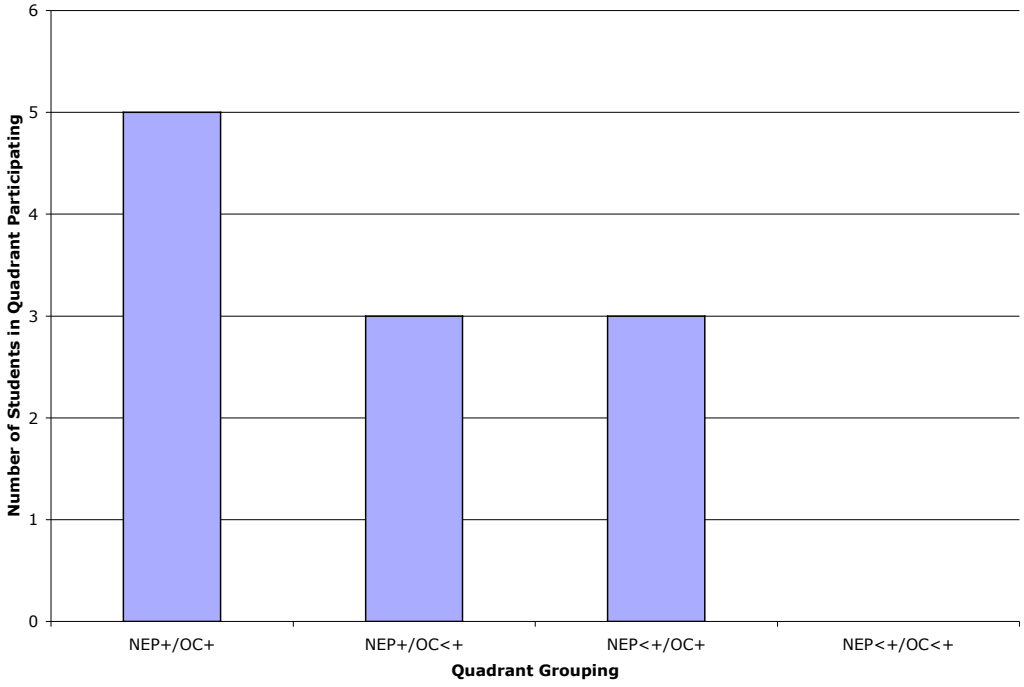

Figure 8. Number of Students Participating in Outdoor Activities in Each Quadrant

Hypothesis 1: There Is a Positive Relationship Between Students an Orthodox Christian Worldview and a Positive Ecological Worldview

Analysis of this hypothesis involved the examination of the individual interviews with students from the four quadrants. This data was analyzed to determine what relationships exist among students of the various quadrants. As per methods, the constant comparison methodology (Lincoln and Guba, 1985) was used to develop the categorical responses in each of the sub-hypotheses analyzed.

Relationship Between OC and Beliefs about Ecological Crisis

An analysis of student responses to questions on the existence of an ecological crisis shows that responses fall along a continuum. This continuum extends from:

1. There is no ecological crisis – student response indicates a belief that there is no widespread ecological crisis or believes a specific issue is not a crisis.

2. There is no ecological crisis presently, but it is coming and I am not concerned – student response indicates a belief that there is no crisis presently, but that in the future it is coming. However, even at this point they are not concerned.

3. There is no ecological crisis presently, but it is coming and I am concerned – student response indicates a belief that while there may not be a crisis presently, there is a crisis coming, for which they have concern.

4. There is an ecological crisis – student response indicates a belief in a current ecological crisis.

The sub-hypothesis for this dimension states that a relationship exists between an orthodox Christian worldview and beliefs on ecological crisis. As Table 8 shows, this hypothesis was supported by the NEP+/OC+ quadrant, but not in the other three quadrants. As per expectations, all ten of the NEP+ students articulate their beliefs and concerns about an ecological crisis. Also as expected, three NEP<+ students expressed views that there is no ecological crisis or if there is one coming are not concerned. What was not expected was the belief in an ecological crisis or concern about an ecological crisis expressed by two NEP<+ students. One NEP<+/OC+ student could not be categorized because she was unsure if there was or was not an ecological crisis and would not commit to any of the viewpoints expressed here. Support for these results are excerpted from the interviews below by quadrant.

Table 8. Numbers of Students in Each Quadrant Holding Beliefs for Each Category of Ecological Crisis

	NEP+/OC	NEP+/ OC<+	NEP<+/ OC+	NEP<+/OC
No Crisis	0	0	1	0
Crisis Coming –No Concern	0	0	1	1
Crisis Coming –Concern	1	3	0	1
Crisis	5	1	1	0
Unsure			1	

Shading indicates support of hypothesis

Q1) Positive NEP/OC Quadrant

As expected, the students in this quadrant all have a concern about an ecological crisis. None of the students believed that there is no crisis or was unconcerned about the existence of an ecological crisis. Though one student disagreed with one environmental issue, he still maintained that we are currently in the midst of an ecological crisis.

No Ecological Crisis, but Concerned about it Coming. Wendy is the only student of the six in this quadrant who believes we are not currently in the midst of an ecological crisis, but believes that is coming.

> Wendy: I think a lot of people still don't hear about it. I think that any time you want to get people interested, you almost have to make it sound like it's a crisis so that they start to get involved, because eventually it will, if it isn't already, it will become a crisis. You have to get people interested now and get them working toward a goal of sustaining our resources and sustaining what we have and sustaining the plant life before you can make any progress. So, maybe it was exaggerated to begin with so that people could hear about it and want to do something about it. But, I think that we're moving more and more toward a crisis and if we aren't already at that point already. We have already gotten rid of--caused a lot of things to go extinct. Some of things we don't even know about. As I was saying earlier we have no idea what they could of been used for. We have no idea if that was useful to us or if that was necessary for something else to survive. We don't even realize where we're breaking the food chain and where were breaking a life balance between ourselves and the rest of the world. If we don't even realize what

> we're doing now, we're just constantly causing more and more problems. It's a cycle that we're going to keep building and building and building because were not even aware of it. I think that that's one of the reasons we have to call it a crisis because whether or not what we're doing right now is horribly affecting the planet, it will just continue to build. It will become a huge problem at the rate we're moving. (WFW028: 420-464)

There is an Ecological Crisis. Five of the six students in this quadrant give statements reflecting a belief in a current ecological crisis. Excerpts from three of the five students are provided below.

> Anne: A lot of scientists and a lot of people in general are taking things to an extreme level with biological advances and advances in medicine that is taking it in a different direction. And in advances in ways we get rid of our waste and cover up problems. I have a little theory, but it's kind of extreme, my theory, but just that, when I did the survey it was relating to religion and to my ideas about God… My theory is that we're going to kind of, will ultimately contribute to our own demise because we are taking things too far. We're taking things that are supposed to be left up to God in to our own hands and we're going to screw everything up. (WFA861: 47-70)

> Laura: I mean we are becoming more aware of problems we have caused and are causing. I guess in a way steps and measures are taken to prevent that, but just looking even back to the 1800's or to another time period when there was not as much construction or pollution. The chemicals being used and such. I just believe that those causes and those reasons are affecting our earth negatively… I feel that it's very real and it's something we do need to face. I guess personally I would say that the stand that people might take saying that it is exaggerated might be a more political one. Maybe by admitting it is such a serious problem it might hurt like the big business. It might hurt government and so it's going to be those avenues, those people that are not going to want to admit that the problem is what it is. Because it all boils down to the big business and government, and money. (WFL066: 320-331, 448-462)

> Randy: I think there's a lot of things that are environmentally hazardous that people are around every day, not the…like you know like habits people have like smoking and stuff like that, isn't exactly healthy. Then you…just like a lot of big companies have no regard for the people who live in the communities that…they're polluting…mean obviously the PCB's in the lakes and remediation of chemicals and people with incid…entire incidences of cancers in places closer…learning disabilities in the…in the relationship of how close they live to like factories and stuff like that. I mean I think there's a lot more things that could be done to make it a lot safer, more healthy place. But it costs money and the…majority of it comes from a big…corporations and making money the bottom line for them and they really don't have the people's common good in mind for what they're doing. So I think if it keeps on going at

> the rate it is…I mean we've made strides since…the industrial age and coming about the middle 60's or the 70's people started coming aware of that, but it's still not to the point where it needs to be for people to…to continue to have happy, healthy lives… It's bound to happen unless there's more regulation and management of industries and vehicles, things that cause pollution. (WFR045: 97-130, 497-499)

However, while Randy holds a strong belief in the existence of ecological problems, he also has reservations about one area considered to be an ecological crisis. For him, global climate change is not an issue.

> Randy: I don't think we are *(facing global climate change)*. Because …just … according to some people ten thousand years ago the earth was covered in ice we had to warm up some how and patterns…I think this is a pattern going from cold to warm and eventually that it will go back to cold again…And I'm not really concerned about global warming, because I think it's more of myth than a fact. (WFR045: 591-599, 618-620)

Q2) Positive NEP/Neutral-negative OC

The students in this quadrant also provide evidence through their statements consistent with a NEP+ worldview belief. None of their statements reflect that there is no crisis or a lack of concern for a crisis, but rather a genuine concern that we will be facing or are facing a true ecological crisis.

No Ecological Crisis, but Concerned about it Coming. Three of the four students reflect their belief that the crisis is not here, but coming. The following excerpts offer a sketch of their thoughts on this dimension.

> Becca: The world's in trouble environmentally. Well, you know they…sometimes I sort of feel when scientists tell us things, they just tell us things to maybe get our rears in gear… and we do need to do something about it. (WFB749: 139-148)

While Becca's statement may seem to indicate a belief in a current ecological crisis, a later statement further clarifies her beliefs about how she perceives this issue of ecological crisis.

> I kind of think it has been exaggerated. But at the same time but may be

> it does need to be exaggerated to get attention. Because it seems like most people aren't impressed unless it's something big and huge. And in the environment it's one of those gradual problems that you know, it's not going to be anything that you're going to see immediately. It's going to be a gradual thing and if you don't get somebody's attention to it right away; that gradual thing is just going to sneak right up on you. So may be it has been a little exaggerated but it's just to bring more attention to the issue. (WFB749: 589-605)

Holly also says, "They're probably telling us information … telling the people information…to make us concerned about it and start thinking about it, but I don't think it's a huge problem right now" (WFH967: 313-318).

> Mary: I tend to think that I do believe in you know twenty or thirty years down the road there will be a serious problem and…You know I don't know if you could just go outside and play or whatever, you know as we're used to now. You know, you don't know what the air's going to be like or what our water supply is going to be like. Just…if we continue to do what I think is going on right now. (WFM029: 70-80)

> So right now I kind of feel that the bad is out weighing the good but like I said I feel like we have the capacity…to turn that around. But right now it seems like people don't think that that's that important or oh that's so many years down the road that's it's really going to affect us. But, it's, it's a chain reaction and things in the planet happen so slowly you know you've go to do it now. (WFM029: 306-317)

> …since people (don't) see the consequences right now or they don't feel like it's affecting like today, this minute, that it doesn't exist. It seems like so many people now…you know before they realized what's going it has to happen directly to them. And I do think that there probably is a crisis. Because like I said you know things happen so slowly as, as far as the earth is concerned you know…that…how do I want to say this? You know, they're not, it's not happening to them today, it's not…they can't see it today. But you know 20, 30, 40, 50 years it will be happening today and by then it'll take so long to fix it, that you know…it'll just continually get worse and worse because it won't be affecting those people directly. So I feel like we need to start fixing so that 50 years from now it's not…disastrous. (WFM029: 345-329)

<u>There is an Ecological Crisis</u>. Barb is the only student in this quadrant who indicates a belief in an ecological crisis. As she sees this dimension,

> Barb: I would say that it's relatively accurate to say that it'd be a crisis at this point. Although a lot of times it doesn't seem like it because we go by our daily lives like we normally do. And we don't see the affects around us immediately. So…I think people, other people may be would start thinking of it a crisis when they have to go about their…their daily

> lives in a different way and I think that's when may be they would start noticing…noticing other problems. (WFB473: 315-328)

Q3) Neutral-negative NEP/Positive OC Quadrant

The responses of students in this quadrant do not follow a path consistent with their beliefs. While three of the four students respond as expected, one student views this dimension of ecological crisis as a very real issue. One student's responses do not correspond to any of the categories as she is unsure that there is or is not an ecological crisis. None of the students' responses falls in the category of concern about a future coming crisis.

There is No Ecological Crisis. One student of the four from this quadrant responded in this category.

> Sara: But I don't know if our world's in trouble environmentally. I think that…there…the environment knows how to take care of itself pretty much. And that once humans start trying to use all of it's resources or deplete it or whatever, I think the environment just naturally knows how to take care of itself and replenish itself. (WFS115: 62-71)

While for the most part Sara believes that we are not facing an ecological crisis, she does believe that there is reason for concern in one area – global climate change.

> I think that there…there is a problem with the global, the whole global warming, but I don't think it's at the point…I mean we can start worrying about it early just like anything you need to…you know get it early and start working towards fixing it. I think if we left...left…left it, let it go then it would…we would just…it would be beyond repair. But I think right now it's…there is a problem but it's not a severe problem if we start working on it right now, in the future may be that'll decrease the chances of it ever becoming a major threatening problem. (WFS115: 268-302)

No Ecological Crisis, but Coming and Not Concerned. Of the four students in this quadrant, only one comments about their belief in the possibility of a coming crisis, but she is not concerned.

> Diane: (I)t's not a concern to me. Not meaning that I'm like…could care

> less about what they're doing, I don't mean it that way. It's not a concern because I know God's in control. So may be we are. But then again that will be in his providence and He will use it for His design. (WFD047: 381-389)

> But yes because we are…the world is groaning to be delivered from sin. And as more and more population…I mean population, sure that's a big…they portray it as very big concern…And I think that before something huge happens, I mean may be that's what the end of the world is going to be like. I don't know. But the Lord is going to return. You know he's told us what to expect and if you are a child of God you have nothing to fear. But if you don't I guess…I would be very concerned. (WFD047: 136-150)

There is an Ecological Crisis. Penni, is the only student from a NEP<+ perspective to make statements about an ecological crisis. She is responsible for all four statements made in this category. Her beliefs assert themselves through her statements when she says,

> Oh I definitely think that we are. I don't think its blow out of proportion at all. I think that people are ignoring the fact that we're in trouble. It's like every day people throw away thousands of cans. And those aren't biodegradable and they're everywhere. You know it's like I go for a walk and I see all this trash on the ground and people are just throwing this out their windows and they don't see the long term affect of how that's affecting our natural resources. And people aren't using our natural resources wisely. You know like California has a water problem, you know. When I went out to California, I couldn't believe that nobody has any lawns, because they can't use any water, they don't have any water. And so no I don't think at all that it's blown out of proportion. I mean we're hurting our ozone, I mean obviously our temperatures are warming up, we are not having as cold of a winters as we usually do. And we're throwing away plastic, people are using a lot of plastic. I mean when you go to the grocery store and you ask for a paper bag they look at you weird. Like why do you want a paper bag? They don't understand and…when it…recycling is free. And people don't recycle. You know like a lot of people just…like I see a lot of people here at campus just throw stuff out in the trash and there's a recycling bin right next to it. You know they couldn't like the…little step over, may be a half of step to put it in the recycling bin instead of just throwing it in the trash. And of course, I mean the trash people, they're just so busy they just wrap it up in a bag and put a new one in that they don't worry about what they're picking out and stuff. I think that we're in major danger. I don't think that it's blown out of proportion. And I think that people are ignoring it. I mean there's people out and people have been saying this for years, but we're so selfish. And American's are selfish I should say, that we don't look at it at how are actions affect other people. (WSP022: 166-218)

Q4) Neutral-negative NEP/OC Quadrant

Once again, there are responses in this quadrant that do not coincide with expectations for a NEP<+ worldview. Though one student's responses do match expectations, the other students' responses indicate a slightly NEP+ response. Neither student unequivocally believes that there is no ecological crisis or that humans are facing an ecological crisis.

No Ecological Crisis, but Coming and Not Concerned. Kelly, provides the only example from this quadrant. As she relates,

> In trouble…probably long term. I don't think that I'll ever see a point in time when the entire world is going blow up or be overcome by anything too dramatic. You know may be long term, but then again I…you know I mean for so many years, for billions of year now, it's gotten to the point where it's now. You know, so I think anything that's happening is more of a long-term thing. I think the pollution, it's probably like with the industries and stuff that we've created and you know manufactured and stuff, has sped up the process a little bit but I don't think it's anything that's going to kill us right away. And I think like my grandkids will be okay, I think their grandkids might not be as…as well off but…I'm not ultra worried like that. (WFK965: 83-103)

> We have, we definitely have an effect, most certainly do. Much more of an effect than any other like species or animals, because nobody else you know throws away paper and drives cars and stuff like that. So, we definitely have more of an effect on it than anyone else. (WFK965: 490-495)

No Ecological Crisis, but Concerned about it Coming. Sue provides an interesting view on ecological crisis. Her beliefs tend to center around the existence of an ecological crisis and concern about what may happen, yet at the same time reflect a NEP<+ view that long term effects will not be as harsh as people believe they will be.

> Sue: Can I say both? Well I think that we are in the midst of an ecological crisis but I…I think that it has been exaggerated a little bit just to kind of get people's attention. Obviously if you just go up to somebody and say "hey guess what we're like in the midst of an ecological crisis," people are going to be like okay sure. But if you tell them, "you know, well the earth is running out of supplies…" or this or that and kind of beef it up a little bit. I think people take it a little bit more seriously. So I think it's kind of a little bit of both. (WFI989: 280-295)

> I think it's in trouble. I don't think I'll ever see the complete devastation of it in my lifetime, but …I don't think we're heading in a positive direction. (WFI989: 50-53).

> Everything is so…I don't know…some new age and everything, but I don't think, like some people, the end of the world is going to come because of it (*ecological crisis)*. I don't…I don't think that that's going to happen.

Relationship Between OC and Beliefs about Natural Resource Use

Student responses to the dimension of natural resource use (limits) fall along a three-point continuum. This continuum has as its points:

1. There are no limits to our natural resources – student response indicates a belief that there are limitless natural resources available for use.

2. Natural resources are limited to a certain extent, but not completely – student response indicates a belief in a limited amount of resources, but also a belief in other resources available.

3. There are limited amounts of natural resources – student response indicates a belief in the limited amount of resources available on the planet.

The sub-hypothesis for this dimension states that a positive relationship exists between an orthodox Christian worldview and beliefs on natural resource use. As Table 9 shows, this hypothesis was not supported in the NEP+ quadrants, but was supported in both of the NEP<+ quadrants. As per expectations, seven students in the NEP+ quadrants believe that the use of natural resources is limited and six students in the NEP<+ quadrants believe there are some or no limits. However, three students in the NEP+ quadrants also believe that there are some or no limits on the use of natural resources. Support for these results are excerpted below.

Table 9. Numbers of Students in Each Quadrant Holding Beliefs for Each Category of Natural Resource Use

	NEP+/OC	NEP+/ OC<+	NEP<+/ OC+	NEP<+/OC<+
No Limits	0	0	3	2
Some Limits	2	1	1	0
Limited	4	3	0	0

Shading indicates support of hypothesis

Q1) Positive NEP/OC

Students in this quadrant believe that there are limits to the resources available on our planet. However, two of the students do not have a consistent NEP+ worldview, but rather a viewpoint that while resources may be limited there are alternatives for all resources that are currently used. None of the students believed that there were no limits.

Natural Resources are Limited to an Extent, but not Completely. Two students believe that there are some limits to our natural resources, but that they are not completely limited and that alternatives are available.

> Laura: We do have limited resources, however, I know that for a space shuttle what you've got is what you've got, but the earth is constantly replenishing. It can replace, not replace, but sort of replace any resources that we use to an extent. But then again, like trees you can always plant more trees and things are constantly growing and evolving, but the oil for example, that's something that once you tap out, maybe, then you're out to. Then you have to go to an alternative source. So I can agree with that statement to an extent, but not totally. (WFL066: 212-229)

> Wendy: I don't think that it is necessarily like a spaceship because we do have ways that we can renew our resources. A lot of our resources are renewable. We can continue planting trees, but a lot of times we just don't. It's a choice we make. And, if we choose to make it more like a spaceship, then it will be like one. But, we have the option not to make it that way too. People have to understand you have to replant trees and you have to make sure that your renewable resources are renewed. I think in that way it's not like a spaceship we just pack things and a where

> once you run out your done. It's like a spaceship that stops at the grocery store a lot and picks stuff up if you plan on doing that. So, I guess that's how I would change mine, or a spaceship with farming. It's not like to pack things and they're just there, it's that you have the opportunity to renew things. It's just a choice that you make. (WFW028: 173-198)

> …at a rate where we're not giving ourselves time to discover and explore new possibilities. So, I think that we definitely are headed towards a lot of problems if don't slow down the way we use up our resources. And, if we don't research how to adapt and change our world so that those resources either last longer or so that we have alternative forms of resources. (WFW028: 58-71)

Natural Resources are Limited. Four of the six students in this quadrant believe that the earth's natural resources are limited.

> Randy: We're probably pretty close to that (number of people the earth can support) considering how many people there is, where 200 years ago compared to what there is now, double the …I don't remember right off hand…like anywhere…between 28 and 40 years the population doubles and once you start doubling, more and more… you're going to run out of space for everybody, not to mention resources, food, places to live. (WFR045: 165-169)

> Anne: I mean, it's not getting bigger, the world doesn't expand, and actually, probably, it's getting smaller with people on it and destructive processes. Mining is making areas not livable, erosion, you know, the high tides, the water level rising. So it's actually making smaller land area than we had previously had. And with the increase in population it's making less room, and then the resources are--although a lot of our resources are renewable and can regrow, they're not being given that time because they're taking them in such large quantities and not thinking about giving them time to regroup. Like trees, they're clear-cutting areas and then going somewhere else, and oil and all those things. (WFA861: 197-220)

> Beth: …that if we're planning to grow at the rate that that we are that we also need to make sure that we have ample resources to support all of these people… because, yeah, I think right now at the point where at, we don't have the resources to support the population. (WSB900: 122-127, 135-138)

Q2) Positive NEP/Neutral-negative OC

Three of the four students in this quadrant have beliefs consistent with a NEP+ worldview, but one student believes that while there may be some limits, humans have

the ability to overcome these limits. None of the students believes that there are no limits to the natural resources available to humans.

Natural Resources are Limited to an Extent, but not Completely. Barb, the only student in this category, believes the earth does have some limits, but only in as much as the ingenuity of humans are able to overcome those limits. As she remarks,

> I think there's some limits, but I think that over all you have to look at alternatives to methods or resources that we're using. In terms of…you know we use a lot of oil and petroleum, well maybe you know we need to start making more electric cars. Or we need to take a look at other … rather than nuclear energy, start to look more at wind energy or something like that. Just trying to see what other alternatives there (are), so we're not using only one resource but we're using a variety of different resources. (WFB473: 177-191)

Yet, Barb also recognizes that even this human ingenuity to discover alternative resources may be stretched by the burgeoning human population.

> …how our population has grown over the last 100 years and 200 years, it's grown so significantly that…I know that there's going to be a point when we use up all of our resources. That the earth will not be able to…essentially support all the people who live on it. (WFB473: 147-154)

Natural Resources are Limited. Three of the four students in this quadrant give responses which reflect their belief in the limited nature of the earth's natural resources.

> Holly: …there's definitely an amount of life that the world can support. I think it's a good analogy, I don't know what I would use. I just...maybe like an ant farm. When they run out of room, then there's no resources left for them to survive and then they start dying off in numbers. I guess that would be my analogy that I would use. (WFH967: 170-179)

> Becca: There's definitely limits to our natural resources. I mean once they're all gone they don't necessarily replenish themselves at the rate that we're taking them. So you know if we keep taking them a lot more than we're ever going to get back, there's going to be a time where you're going to run out and that's not going to be good. I know that you know we're trying to replenish what we do. I mean even look at the rainforest that's not what it used to be. And all the animals that are going to be extinct that didn't use to. But…there definitely is limited resources and you know there is going to be a time when what we're using is not what we're putting back. And that's going to be a…that will be a terrible thing when that finally happens. (WFB749: 295-305, 313-325)

Q3) Neutral-negative NEP/Positive OC

The NEP<+/OC+ students express beliefs which are consistent with the beliefs of those who hold to a NEP<+ worldview. They see the earth as having a multitude of resources which humans are not likely to expend. However, two of the students also articulate a deeper understanding of a wise use of these resources in spite of their seeming inexhaustibility. None of the students believes that there are absolute limits on the natural resources available to humans.

There are No Limits to Natural Resources. Three of the four students in this quadrant made statements in which they express their beliefs that the earth has more resources than humans will use.

> Diane: Of course, I've never heard a study on it, but you think of all the resources that we still have on yet in this planet. Many may be haven't even been discovered yet. It's huge…and true I guess there is some limit, because just if you look at…I don't know which law of energy is, but the one that energy can be never…never created or destroyed, but then once it's used, I mean it can re…converted to heat and of course heat is lost, you can't take heat, usually you can't take heat and convert it into a more useful form of energy. So in that sense yes there is limit because eventually it can't return to the heat. But…analogy…in the sense that there is probably some limit yes, but that limit being narrow? I don't agree with it being narrow, it's huge.
>
> I don't know. Yeah, that too. And I mean, they portray this…I think they portray it, sometimes environmentalists --- people. I don't know if that's the word, correct term to use but they, they present…prevent…present it as a big fear and something we should be really, really concerned about…And again back to the worldview, it's not something I'm concerned about. May be, may be someday we will run out of resources. (WFD047: 203-224)
>
> Linda: I don't know if there are limits to resources available. I just don't think we have found … I mean, we have found a lot I'm sure, but I don't … I mean I'm sure we haven't found them all. (WFL024: 169-174)
>
> I don't know if there are limits to resources available. I just don't think we have found…I mean, we have found a lot I'm sure, but I don't… I mean I'm sure we haven't found them all. And I'm sure there's more great resources out there that we're just…you know unaware of so far. But…I mean I don't think we're to are limit or you know, that's it – we're going to be out. I don't know…as far as how…many people we can hold I

> don't know. I don't think I have that great of a concept how, how big the world is. I don't know, you know I don't other countries, their populations and…I'm not sure. (WFL024: 169-185)

> Penni: …we have tons of resources, tons of space. I mean it is limited to a certain extent but if you use your resources wisely…there's plenty enough room for people to live. I mean again, if you want to go to heavily populated areas you're going to see that it's like a spaceship. But you need to…I guess look at your resources and use them wisely. You know start…I don't know…I don't really think that…I wouldn't consider it a spaceship but I don't what to consider it as. But I think it's…I think that we're not using our resources, what's available. (WSP022: 320-336)

While Penni believes that the earth has an abundance of room and resources, she also believes that that does not give humans the right to abuse the resources we do have. Using the issue of recycling, Penni becomes very adamant about using the resources we have wisely.

> …we're throwing away plastic, people are using a lot of plastic. I mean when you go to the grocery store and you ask for a paper bag they look at you weird. Like why do you want a paper bag? They don't understand and…when it…recycling is free. And people don't recycle. You know like a lot of people just…like I see a lot of people here at campus just throw stuff out in the trash and there's a recycling bin right next to it. You know they couldn't like the…little step over, may be a half of step to put it in the recycling bin instead of just throwing it in the trash. And of course, I mean the trash people, they're just so busy they just wrap it up in a bag and put a new one in that they don't worry about what they're picking out and stuff. I think that we're in major danger. (WSP022: 188-210)

<u>Natural Resources are Limited to an Extent, but not Completely</u>. Sara is the only student to respond in this category. She sees some resources as limited and in danger of being overused, but others as having a natural replenishment system.

> A limit to a point, like as in…resources as in like oxygen and trees those can replenish itself but over a long time, you know what I mean. But as in some other resources like may be natural oil we find or the resources that we know of are getting depleted and there is a limited amount. (WFS115: 137-144)

> …we might be depleting all of our resources. I think that is true that we're starting to overload and then trying to use them over and over again. But I don't know if our world's in trouble environmentally. (WFS115: 58-64)

Q4) Neutral-negative NEP/OC

Both of the student in this quadrant have beliefs consistent with a NEP<+ worldview. Neither of them believes that there are limits to the natural resources available to humans or that these resources may be limited to a certain extent.

There are No Limits to Natural Resources. Both of the students in this quadrant fall into this category.

> Sue: I think that they're right, the earth obviously only has very few resources and I think that we have the ability…I think it has lot's more resources just that we don't know about and…but we aren't at the stage in our development where we can figure out how to access them, so we're just kind of chipping away at what we have right now. And…people are like "well yeah it's depleting", but in the same instance they're not making any efforts to try and find other ways to get resources or to substitute or stuff like that, so… (WFI989: 153-167)

> Kelly: Well…I don't know. I don't know, some resources like…I mean like water, it's the same water that's been here for billions and billions of year, I don't think we're going to run out of water. Oil and stuff like that, like I don't…really know how that…I mean that just comes from the ground, right? That's not really like made…so it's kind of a…so I don't know may be we'll run out of something like that. I…like I don't really know like the statistics on like that stuff so I don't really. But…I don't know, like I don't feel like we're in jeopardy of like…but I mean there's different, you know I mean everybody has something to share…and so…I mean eventually somewhere down the line millions (of years) from now we'll probably run out of things. (WFK965-- Lines: 242-266)

Relationship Between OC and Beliefs about Anthropocentrism

Student beliefs on anthropocentrism (the dominion of humans over the rest of the natural world) were analyzed in response to questions related to the topic, but were also found consistently throughout the interviews. Student responses on anthropocentrism fall into one of three categories which vary across a continuum from:

1. Humans have the right over animals and plants – student responses indicate that the student believes that humans are at a higher level than plants and animals and have dominion over them.

2. There must be a balance between human and natural uses – student responses indicate that the student believes that humans and the natural world need to live in balance with each other with give and take.

3. Humans do not have intrinsic rights over the natural world – student responses indicate that the student believes that living things in the natural world have a right to exist over the needs of humans.

The sub-hypothesis for this dimension states that a positive relationship exists between an orthodox Christian worldview and beliefs on anti-anthropocentrism. As per expectations, two students in the NEP+ quadrants believe that animals/plants have rights to exist in themselves apart from the rights of humans and four students in the NEP<+ quadrants have the belief that humans maintain dominance over all nature. However, three students in the NEP+/OC+ quadrant also believe that humans have the right to dominion over other living things. Seven of the students responded that there needs to be a balance between human dominion and the rights of other living things. Thus, as Table 10 demonstrates, this hypothesis was only supported by the NEP<+/OC<+ students. Excerpts from students in each quadrant group are shown below.

Table 10. Numbers of Students in Each Quadrant Holding Beliefs for Each Category of Human Rights (Anthropocentrism)

	NEP+/OC	NEP+/ OC<+	NEP<+/ OC+	NEP<+/OC<+
Humans over animals/nature	3	0	2	2
Balance	2	3	2	0
Animals/nature over humans	1	1	0	0

Shading indicates support of hypothesis

Q1) Positive NEP/OC

This dimension in this quadrant is of particular interest given the significant difference found between the NEP+/OC+ and NEP+/OC<+ students in the survey t-test on this dimension. The number of students supporting an anthropocentrism belief seems to give further evidence of this difference in beliefs between these two groups.

Humans Have the Right Over Animals/Nature. Three students describe their beliefs on the rights of humans over the rest of the natural world.

> Randy: All right, we have the ability to alter the environment which plants and animals do not do. And if plants and animals could alter the environment we would be…I mean to a more…like…if someone…this is totally a hypothetical, nothing to relate to this, but if an alien came down and they could…they flew in from some far away place and had…were more advanced than we were, they'd be put on the level probably higher than humans because since they'd have all these advances and more knowledge and more tools, they would take…overtake us. ----ways we run the earth and then. If we were as…on equals of not being able to alter environment, I mean tech…it will make stuff, technology stuff like that, we'd be on a similar plane but we weren't created the same, humans were meant to do this and animals were meant to do that. (WFR045: 467-489)

While Randy believes that humans are dominant over other species, he also believes that humans need to exercise limits on where they impact the environment.

> We do to an extent, we have the right to build places to live, to be warm and have like industry but you can't just take things. That you're the supreme owner of the earth, it belongs to everybody and all the species that ---…I don't think that it's… doesn't makes a whole lot of sense to put cities in the desert when there's a lack of water, a lack of resources and bring everything, using air condition, electricity, more than their fair share. There's places where people are meant to live and there's places where people aren't meant to live. I think if we stick to the places where we're meant to live…we'd be a lot better off as a society. I mean like the whole world as a society not just the United States. (WFR045: 283-303)

> Beth: Just because I think we're the ones with the technology and with the ability to change our environment. Animals out in the wild have to do with what they have. They can't really make new forests after the old ones have burnt down, or what ever. They have to live with what they have or move to an area that they can sustain life, whereas, we can build an area. So, I guess in that respect we are the dominant species. (WSB900: 199-211)

While it may appear that Beth takes a more balanced view, subsequent statements provide a more detailed view of her beliefs about human dominance.

> I don't know, that's hard. I guess if it was an absolute, you know, them or us kind of scenario, I would think that humans would have the right, (pause) or the power. I shouldn't say the right, more so the power, to take over. But at the same time for morality reasons I think that they should do something. You know, put the animal, the remaining animals, in a zoo or something. Try to preserve their habitat and their life styles instead of just trying to slaughter them off and kill them. You know, and do something to allow them to survive as well. It may not be in the exact same location, but relocate them into an area which they could live.
>
> I definitely think there is a moral issue, but I don't think a lot of people pay attention to the moral issue. A lot of times I think they just do what's right for them. And not really think of the consequences for other people or other lives or beings. For me, I don't know, I guess that would be from my parents. You know, they always taught me to think of other people as well as myself. Sometimes you have to do what's best for you, but think about how it affects other people. So, I think that other people should adapt that as well and think about what's best for you, but don't forget how it's going to affect everyone else around you. (WSB900: 245-288)

In the same way, Lisa believes that while animals need to be protected, they can be moved to different locations easily to new homes and humans can then use the land.

> Lisa: The population on the face of the earth is growing, and each new family needs a home. For them to build a home they might have to pick their piece of property that would have one of these endangered species I think there are other alternatives for those animals. I believe that they have a right to live obviously. I don't know if there are places out there-- I know that there are places that take the endangered gorillas and some of those and they just have this big wildlife where these animals live in freedom type thing. (WSL867: 467-495)

She then goes on to describe a project where a threatened butterfly was "moved" for a road project. This she believes was for the betterment of the butterfly and people (WSL867: 495-519). As she describes herself and her anthropocentrism,

> I'm an outdoors person and I enjoy nature and we value it, I mean we try to protect it as much as we can. I think that it comes back to the God thing. He built it that way for a reason. I'm not the ruler He is. (WSL867: 668-674)

Humans Must Balance Rights with Value of Animals/Nature. Two of the students take a more balanced view of the relationship between humans and the natural world with their responses.

> Anne: Some people think that they're doing what's best for everyone but they're not critically thinking about it and the long-term effects. They're only thinking, "OK for the next 20 years this is going to work", but then what's going to happen later? (WFA861: 238-245)

> I think that it is a cohabitation. I feel like we need plants and animals, just like plants and animals need us. We all cohabitate on the earth. I benefit from things that happen in the plant and animal world and they benefit from things that happen, but they also are not benefiting from a lot of the things. But, I think that it is a give-and-take, and if we just said "Forget about plants and animals, they're not important because humans are the most important, they're the most dominant, and the only thing that matters." I think that everything would just go down. (WFA861: 292-308)

> Laura: I think that there is some medium ground there where you can utilize what we've got without totally destroying it … I believe--I mean we're all here to co-exist. But that's just me. We don't have any given right. It's never stated anywhere for us to take over just because we're humans and we have that ability to. I just believe there's some common ground. (WFL066: 261-265, 299-306)

Humans Do Not have Intrinsic Rights over Nature. Wendy is the only student whose statements reflect a strong NEP+ worldview belief system.

> Wendy: So, we can go just about anywhere and still have a comfortable lifestyle and still have the things that we need. Whereas, a plant or animal can't adapt that quickly. They don't have the tools that we have to change their environment. So I think that it does become the right of that plant or animal over the right of the human because we can live pretty much anywhere and they can't. Animals and plants need very specific environments and if it's endangered it's obviously going to have to be more important than your new sauna or your hot tub or your patio. It's going to need to be more important because there's only that one space where it can survive in. (WFW028: 256-277)

> Well, it's important because we need a wide variety of plants and animals. First of because we don't even know, for plants, what all of them can be used for. So, the plant that we could be getting rid of could be the cure to a form of cancer or to AIDS. We don't know that, we can't ... it's foolish to get rid of our resources before we've explored what it can be used for. And we haven't done that yet and every day we're killing off more plants and animals, like in the rain forests. We don't know what those could have been used for. We could be killing off our only chance

> to save millions of people, because we wanted to cut it down and do some logging. In addition to that, the more plants and animals we have, the more ... it's like the food web. Everything is reliant on each other, so when you get rid of one thing, you're hurting something else in addition. Eventually that will catch up with us. Eventually it's going to come back to get humans, and if we really want to take care of ourselves, it's better to take care of the other things too, because they are necessary to its balance which is already in place. (WFW028: 281-312)

Wendy's stressing of the importance of all species is not exclusionist, but also includes what she sees as necessary needs for humans.

> I guess I think we can modify it to fit our basic needs, but like I was saying earlier a lot of people buy a lot more land than they actually need to live. A lot of times they don't leave it and let it just been natural. They cut down all the trees and everything so they can have a really big lawn, or they put in a swimming pool where there used to be pond. So, they're taking away things from animals and organisms that lived in that environment for things that are not necessary. So, I guess that I feel it's OK if things are necessary, but if things are just want instead of the need, I think that it is our responsibility to kind of keep that in check and not to allow people to do quite so much cutting down without replanting. (WFW028: 205-225)

Q2) Positive NEP/Neutral-negative OC

It was noted previously that the statements of the NEP+/OC+ students seem to give further evidence of the difference between these two quadrants. This is further supported by the lack of responses in this quadrant expressing a strong anthropocentric view. However, it is also important to note that even among the NEP+/OC<+ students only one student holds to what would be considered a strong NEP+ worldview belief.

Humans Must Balance Rights with Value of Animals/Nature. Statements are made by three students in this quadrant. In examining these statements, Holly provides two statements which are indicative of those made by students in this quadrant when she says,

> I think we definitely have some rights. But not to like demolish whole rainforests. I mean I'm a farmer and I…I'm not a farmer personally, but you know coming from the farm, I definitely see that there's a need to have you know farm land for the world to survive. But to demolish

whole rainforests, you're killing off thousands of species. And where are they going to go? So I think…may be that's just being like…from the United States, because we're not clearing away the wildern…I mean what if this was like hundreds of years ago we did the survey. May be I'd have a different view, but…I think we have certain rights but not to…I think we have to weigh those rights with the animals' rights that are out there. If they have a place…if they have…places to go, then it's okay if we take some of the land. But instead of spreading out I think may be we should go up. So you don't take…you don't tear down so much of the environment.

We need to look out for things that can't really look out for themselves. Like the rainforest, I was saying before…there's so much…so many acres that are unexplored, hundreds of acres I would say that are unexplored and what if that holds a…the solution for cancer. We need to protect…protect the animals and plants…but we need plants and animals to, to live. But to keep that in moderation. (WFH967: 190-216, 263-279)

Barb: I think to use what we need without…I guess without restricting that environment and then in the least way possible. So these…you know as least restriction to the environment. I don't if that quite answers it. But…I guess to take what we need but at the same time try to keep that environment as natural as it can be and without overusing what we do need. Or exceeding…exceeding our needs. (WFB473: 279-290)

Mary: Well it seems like we are the dominant role and obviously it's…we are. And I think our roles as it is right now it seems to be like we're hurting the place where we need to live and what we need to support us. But I think we, we need to turn that into, we need to support what it is that keeps us alive and that helps us to continue to evolve.

Well I, I think that we need…to…you know protect it and there's a limit. As we kind of talked about before, as to…you know how, how much can the earth support us as we continue to go now? And you know I think that as humans and as you know the most evolved being or whatever, we have the capacity to kind of co-exist and support one another just as you learn like with the food chain and everything. We never see…or we never really learn how people fit into that, but like I think that we have the most important role because we're the ones that seem to be altering it the most dramatically. So if…you know if…if we…if we don't support what the earth natural does then…you know it…we're ultimately going to be the one that pays the price. (WFM029: 238-247, 260-280)

Humans Do Not have Intrinsic Rights over Nature. Becca, the only student from this quadrant in this category, makes her views of anti-anthropocentrism clear when she states,

I've always felt that…I don't think that human beings are superior to

> anything else. I don't think that we should modify the world just to make it better for us, because there's so many other living things in the world that you need to take in consideration…You know may be all the animals of the world can't speak their mind as well as we can or…don't mean they can to each other but not to us, I don't think that we should think that we're so great that we can destroy other peoples' habitats and…I don't know, that's one of those…those things that I never really agreed with humans thinking that they are the ones make all of the best choices in the world and you know…for anything else it's just…you know well we can make the decision for you because you can't think for yourself and…You know, I don't, I don't know, I just think that humans aren't as necessarily as smart as they think that they are. And you know there are times when you know…I don't know it's just...I guess this is a good example. I guess, I don't if it's kind of weird or not. My friend, when we were learning to drive like if an animal come into the road and it was either you hit or you hurt yourself, I always thought that was a hard question because what makes me more important than them? So that sort of relates to that. And why should I make a decision for something else? Or why should I look out for me, when I should be looking …you know why not look our for everything? (WFB749: 359-399)

She also speaks to what she believes are the beliefs of humans as a species and the reason why other living things are not given rights.

> Yeah, I don't think it's with all humans, I just think that a lot of…a lot of humans, you may be can see it in a lot of people that you know, they just have to have everything just so and they just sort of think that the world revolves around them. And you know they don't think of the other things, other life that you know their choices affect. So I think that…a lot of humans are like that, but I don't think everyone's like. And may be not to an extreme extent, but I think a lot of people have a self-serving purpose to themselves. (WFB749: 672-689)

Q3) Neutral-negative NEP/Positive OC

Students in this quadrant are split between views on total anthropocentrism and a balance between humans and the natural world. None of the students in this quadrant gives statements that would indicate that other living things have as much right to live as humans.

Humans Have the Right Over Animals/Nature. Three students from this quadrant articulate their views on the rights of humans over other living things, yet it is evident that this is not without respect for other living organisms.

Linda: I think it's ours and ours to…you know do what we want with. But in that same respect…I mean you have to have respect for it. And you know, I mean treat it good so that we can keep it that way and keep it there for as long as we can. (WFL024: 214-220)

Diane: God gave us…to be stewards of the earth. So we need to…I mean as stewards, biblical stewards, we are not to abuse the earth but we are to use it in a God glorifying way. But…I don't think that's something that we should be saving baby whales at the expense of saving baby humans. (WFD047: 119-127)

I think that nature is given for us to glorify God through. But at the same time it's given for us to use as stewards. So I would guess it would depend on what your purpose is for…whatever it is to endanger those species. Again if it's for your own greed well then may be that's not necessary. (WFD047: 305-313)

And so…in terms of rights versus humans, well we are over them. So, right…a right to be respected but not necessarily a right, they can't determine our lives. That makes sense? Yeah, that's, that's what I'd say. (WFD047: 322-328)

But not protecting at the…for the…for…not protecting it at the expense of…forgetting your role also, because we already use it. Some people who, I have friends who are vegetarians and their argument may be we don't have a right to kill an animal. Well I disagree with them; I think we do have that right. To abuse an animal, to torture an animal – no; I get very upset when I see that. But we do have the right to use those resources. But yeah we are to definitely protect it. (WFD047: 344-357)

It depends what their needs are. I mean sometimes I think…again looking back at the biblical stewardship position, we're not given to abuse nature. I'm a lover of nature, science is my favorite subject. I am nowise promoting the abuse of nature. … if you are going to use nature and use the resources of nature then have it be for a purpose, not just for…your own greed. (WFD047: 254-277)

Penni uses the same types of reasoning as Diane to build her belief that while humans control, it should be for their needs, not their wants.

Penni: Well sure we're God's people and so the environment is God's too. This is like his…his land and we're his people. So I think that…yeah it is. It's not really…I mean he, he put us here for us to use it, but we're doing what we want. And I don't think people really think about when they go to put a building up or when they go to…I don't know, dump oil somewhere that they're thinking about hmm what is this doing, what kind of effect does this have? They're more like what do I want, I need to get rid of this. Like…more than just like me, I want to get rid of this, how can I do it? They just do it, or I need or I want this, I want that. So I don't think that…I think that we're more doing it on our

> wants right now; that we're thinking that, you know, like we're God and we can do whatever we want. But I think when it all comes down to it, they're going… everybody's going to find out the truth; in the end. (WSP022: 399-424)

Humans Must Balance Rights with Value of Animals/Nature. Sara views consider human needs, but she also sees the needs of other living things through her statement.

> Sara: I don't think we should change the environment and cut down the trees and destroy land to build buildings and suit our needs. But then…that's our existence. I don't know…that our existence as we know it. Well I'm not sure what we're supposed to do about that, but I don't totally think that we should go out and destroy nature for ourselves. (WFSS115: 160-169)

Q4) Neutral-negative NEP/OC

Both students provide statements which would place them in this category. However, neither provides comments which would indicate a strong belief in a balance between humans and other living things or the rights of other living things as being equal with the rights of humans.

Humans Have the Right Over Animals/Nature. While both students in this quadrant do have respect for other living things, their statements give an indication that humans are dominant and in the long-term have the right over other living things.

> Kelly: I don't...I don't…I don't know. I don't think like...I mean I think that we do rule over nature because we have the ability to knock down like their homes and their areas and trees and stuff like that and we have…we have the capabilities to do so, so I do think that we over rule nature. I don't think we should be able to, you know necessarily. I mean like I said with the endangered species you can't just like…I mean I don't know, that's just wrong, like…and if you think about like morally you know you wouldn't do that to a neighbor or something. So I don't think we should be able to. I think we do, we most certainly do. And you know also…like the circle of life, you know the chain, you know life cycle and stuff like that. In the chain of command we, you know dominate over most things, you know can even…beasts and animals and stuff like that can kill us we find some way to…you know tranquilize them or whatever and then do what we want and stuff like so…I don't know. I think we do, I don't think we necessarily should, but in essence it is like meant to be.

(WFK965: 395-424)

> Sue: But just like anybody has the right to do anything in…in a civil way. I mean we shouldn't just go out and like build buildings and strip malls and abuse natural resources because we're superior and we can do it. I think that there should be a good purpose behind it. I think that far too many times people just do things just to do it, just to make something look pretty, but it was already nice looking before. (WFI989: 179-190)

Sue seems to give a perspective of balance, but when pressed shows a much stronger belief in her rights and desires as a human over other living things.

> Of course it's easy for me to say well the plant or animal but I'm sure that if I was in love with this piece of land and I just you know wanted to build my house and raise my family there, I would feel differently. But…I don't know that's hard. Gosh…I mean…well I don't know, I really don't know. Because I feel split because I'm not in the position so it's easy for me to say well pshhh I'm sure that there's more of them, if they're endangered they're not completely extinct so there's got to be more somewhere else. (WFI989: 206-221)

Relationship Between OC and Beliefs about Ecological Balance

Two different categories of response arose out of the analysis of the student interviews on the topic of the ability of the natural world to maintain a balance in the face of human activity. These categories were:

1. Nature is resilient to human intrusion.

2. Nature is not very resilient to human intrusion.

The sub-hypothesis for this dimension states that a positive relationship exists between an orthodox Christian worldview and beliefs on the ecological balance of the natural world. As per expectations, six NEP+ students believe that nature is not resilient to human impact and three NEP<+ students believe that it is resilient. However, four NEP+ students also believe that nature is resilient to the impacts of humans and two NEP<+ students believe that it is not (Table 11). One NEP<+/OC+ student did not respond to this question. Thus, the hypothesis is not supported. Excerpts of student

statements are shown below by quadrant.

Table 11. Numbers of Students in Each Quadrant Holding Beliefs for Each Category of Natural Resilience

	NEP+/OC	NEP+/ OC<+	NEP<+/ OC+	NEP<+/OC<+
Nature is Resilient	1	3	2	1
Nature is not Resilient	5	1	1	1

Shading indicates support of hypothesis

Q1) Positive NEP/OC

With the exception of one student, all of the students in this quadrant believe that nature is not resilient to human impact.

Nature is Resilient to Human Intrusion. Laura is the only NEP+/OC+ student who believes that nature is resilient to human impact. However, her comments suggest that this resilience is holding a fine line.

> Laura: I think nature is very resilient. It can hold its own. But then again I just think because of the mass population and just the extremes that we're going with--what were doing sometimes I wonder if that can overcome the resiliency of nature. I mean I just think there's a fine line there that we have not crossed yet, but depending on which way we go, in the human race, it could be a determining factor. (WFL066: 514-525)

Nature is not Very Resilient to Human Intrusion. Five of the six students believe that nature is not resilient to human impact.

> Wendy: It takes generations and generations for things to adapt and actually change the environment. Over time the more fit of the species will survive, but it takes generations and generations for that to occur. So, if you slowly make changes in the environment, then it's resilient. But, if you change----if you cut an entire forest at once, then all of the animals that live in the forest don't even have a chance. You've just killed them all right there. They're really not going to have enough offspring for the adaptations to begin to occur to the point where they're resilient enough to deal with that change. By that point, even if you had done the slow change, probably another quick change would come about that would

> devastate the population again. So I think that it is resilient over generations, but each current population isn't very resilient. It's very fragile and it has to be taken care. So, if we make slow changes over time as humans, it's better for the environment to have a chance for the generations to adapt. Then you're causing adaptations, but you're really not killing off a population. Your just killing off a small part of that population while the rest of it has a chance to build an adaptation and build something that helps them survive. (WFW028: 622-658)

> Randy: …if you go and clear woods and put in parking lots you can't go back and change it back to woods again all that easy. Or strip mining or knocking down mountain, you can't really put a mountain backward. It needs to be…or if a river dries…dries up because they're mining for mineral water and there's no more water going through the river, it's not coming back. (WFR045: 245-255)

> Anne: I don't think they're being given the time for the opportunity to replenish themselves or to ... the newer generation of plants and animals are not being given opportunity or the time to grow into the adults which might eventually become, not extinct, but cut down, killed or used for human benefit. (WFA861: 352-361)

Beth sees both sides of the resilience issue. First, she believes that the forces of the natural world are more than humans can counter, but as her last statement her indicates, she also believes that human impacts can have an effect on the natural world greater than its ability to rebound.

> Beth: I think that nature is very strong. It's been kind of proven time and time again. You know, humans have tried to control nature, and you know they haven't done a very successful job at it. You know you have flooding and and hurricanes and tornadoes and all the natural disasters. You know it just goes to show that as much power as we think we have over nature we really don't. We're kind of at its will.
>
> I think it changes as we change. It kind of fights back. The more we try, for example, the waters or what ever, the more we try hold back water, you know, like building houses or what ever, it works even harder at tearing through it, following its natural path. So I think it's kind of an equal balance. The harder we try to control it the harder it ends up reacting to it. (WSB900: 354-380)
>
> I don't think we were careful from the beginning. We saw it an didn't see what was going to happen in the future. We just used it and used it and didn't think what would happen if we used to much of it. Would we have anything to replace it with. Like now, when they do cutting for lumber, what ever, you know, you hear about their transplanting or planting more seedlings and stuff in its place. But, for a long time, you know, they were just straight clear-cutting and then you had erosion and all that stuff. But

> even now, with them planting the seedlings, I mean, those take time, hundreds of years to form so, you have that kind in between where you're still in trouble where you're still using the natural Resources. (WSB900: 85-105)

> Lisa: Not very. I think the animals will move to (if there is a forest fire that is driving them out), but then they're going to end up in the middle of a city where they're obviously not going to be able to survive. Changing environments, they have to go to where the habitat is capable for their survival. But what about plants and trees? You know, they can't move, they're kind of stationery. (WSL867: 864-875)

Q2) Positive NEP/Neutral-Negative OC

In a reversal of the anthropocentrism dimension results, the NEP+/OC<+ students in this dimension tend to hold beliefs which are not consistent with a NEP+ worldview. Three of the four express beliefs in the ability of the natural world to rebound from severe human impact.

Nature is Resilient to Human Intrusion. Three students make statements showing a belief in the resilience of nature to the impacts of humans. What is interesting about these statements is the giving of an anthropomorphic sense of determination on the part of the natural world to respond to human intrusion.

Holly uses the ability of natural systems to recover from natural disasters such as Mississippi River floods and coastal hurricanes as evidence that it can withstand human stresses. She also believes that these natural disasters are the natural world's way of responding to human impact.

> Holly: When humans drastically change the environment, nature has a way of bringing it back to normal, over the way it should be I would say. … So I mean nature's going to…try get back to its normal state I would say. Through those kinds of natural disasters I would say. (WFH967: 489-515)

> Becca: I think nature's gotten a lot more resilient. However that just increases the determination of humans. You know you can't knock a tree the first time, you're going to come back with something bigger to knock it down the second time. I think that animals and plant life and trees they've had to become more resilient, they've had to make

> adaptations to the changing world that they can't control around them. But at the same time, I don't know. I mean you know if humans see changes and they change right with it, they're changing a lot faster than I think any of the other life around us does. (WFB749: 653-664)

> Mary: I would say that it's pretty resilient because…you know the last 100 years say…you know it's…we learn in school about all the changes that have gone on in the industrial revolution and what not. It's obviously resilient because…you know I mean…the changes that have gone on in the last 100 years have been dramatic. You know, with the invention of cars and you know just airplanes and everything like and all the pollutants that we had developed so quickly in the span of…you know all of earth's time, a hundred years in nothing. And all of the changes that have gone on there, it would seem like if the earth wasn't resilient it wouldn't have handled that, you know shock. --- to and especially…you know in the…in countries like the United States and Europe and things like that where things have changed so quickly and dramatically that, you know we're still here and the earth is…it still has trees and it still has animals and…so I think, I think it is resilient. (WFM029: 390-417)

Nature is not Very Resilient to Human Intrusion. Barb is the only student in this quadrant who believes that the natural world cannot keep up with the intrusion of humans. Using the ecological concept of adaptation, she does not see the natural world as being able to keep pace with human change.

> Barb: I think that they can still evolve and adapt, but I think that we're changing so rapidly that they cannot keep up with all the changes that are being imposed on them. Because I know that they will evolve and adapt, but…our change is so rapid that…I don't know how…how, how, how resilient they would be then and bouncing back I guess. And being able to sustain themselves. (WFB473: 580-590)

Q3) Neutral-Negative NEP/Positive OC

Only three of the four students in this quadrant responded to this question. Of those three, two believe the natural world is resilient, while one does not.

Nature is Resilient to Human Intrusion. Two students from this quadrant take the view that nature is resilient to the impacts of humans. However, the students do not use the same argument as to why it is resilient.

> Sara: I know that we do a lot of damage to the environment but I also know that…there…I mean there are people out there in organizations

> and what not that actually care and are giving back to the environment so I think it's…it's sort of balances itself out. If it doesn't balance itself out I think that…I don't know I think the environment would somehow take care of it as in like a natural disaster to…I don't know to balance, balance it's health back out I guess. (WFS115: 237-250)

> Diane: I think that's one of the beautiful things about nature and that's one of the beautiful things about the Creator, is that, not always and I understand that. I mean oil spill or ground water contamination I mean things like that take a long time to clean up and the impact is huge. But the amazing thing is that…I mean just this is the picture that pops to my mind. You can see…a road, a parking lot paved with asphalt, right? A beautiful thing is that years later a little seed can pop through that hard asphalt and grow into a tree. I mean just think that's so cool. But I don't know if that really addresses the question but…I think nature is resilient. I think that's built in it and I think that's a very important principle of nature. (WFD047: 599-619)

> But I think it's really neat how creation runs on its own. I mean there's not one person in charge…I mean God is in control, but I mean he's formed creation through his providence. It runs, you know…the water cycle and all of that, it just purifies itself. Now of course it could take years. But I think it is resilient, how many years it takes I don't know. So… Yeah. But I do think that nature is capable. (WFD047: 623-640)

Nature is not Very Resilient to Human Intrusion. Penni, the only student from this quadrant in this category notes that while nature is resilient, humans have pushed it beyond its capacity to respond effectively.

> Penni: You know it does bounce back quite a bit but again if you keep pushing and pushing and pushing your limits…I mean we've seen the ozone because we've pushed our limits. And you know we're seeing like our water supply, so wasteful for water. To an extent it's resilient, but like anything it can't bounce back as fast as we need it to. (WSP022: 785-795)

Q4) Neutral-Negative NEP/OC

The two NEP<+/OC<+students provide contrasting views on the resilience of the natural world. Sue believes humans help provide a resilience, while directly contrary to this Kelly sees the same actions as creating an irreplaceable alternative to what should exist.

Nature is Resilient to Human Intrusion. Sue provides an observation from this

quadrant . When she comments on the resilience of nature she says,

> Sue: I think it's…its pretty decent. I mean there are places…there are places where nature is pretty abundant and people aren't…going to…people aren't like expanding to and I think that…even in…even cities when they like chop down trees and build over everything, even though it may be a bit artificial, they plant you know trees that are already grown or put in sod grass, it's still kind of like maintaining a little bit of it so that there's still like a quality of somewhat of an environment there. (WFI989: 410-423)

Nature is not Very Resilient to Human Intrusion. Looking at the impact humans have on the natural world, Kelly interprets actions differently than Sue.

> Kelly: I don't think …you know I mean if you dig up an area and you know put trash in there and you know cover it up. I don't think it's going to be as resourceful and definitely won't have like the nutrients and stuff like that that it once had because it'll be changed. You know with all the different pollutants and stuff like that. And I think when you tear down a forest, you know and build something over it it's not going grow a new forest. You know because you're going to have new things over it. I don't…so I don't think…I mean I think once you change it, you've pretty much changed it, when it comes to stuff like that. I don't know if you try to like…you know I mean if you tear down a few trees and you know replant different ones, you know I mean you'll have new trees and you'll have…you know it'll be pretty much the same, but…but yeah I don't…I mean when you change it like…you know large scale like that I don't…I don't think it it'll ever be back the way it was. (WFK965: 664-696)

Relationship Between OC and Beliefs about Human Population

Analysis of the responses to the human population issue focuses on the current nature of human population. Examination of the student interviews reveals that students tend to generally fall into one of three different categorical responses. These responses vary across a continuum which includes:

1. There is no human population problem.

2. Human population numbers are problematic, but it is more of a future concern

3. The human population of the world is too high.

The sub-hypothesis for this environmental issue states that there will be a positive relationship between an orthodox Christian worldview and beliefs on the

impacts of human population on the planet. As Table 12 shows these expectations were met by three students in the NEP+ quadrants and four students in the NEP<+ quadrants. However, there were seven NEP+ students and one NEP- student who believe that population issue will not be a problem until a far future time. There was also one NEP<+/OC+ student who believes that population is an issue. Thus, the hypothesis was not supported by the NEP+ quadrants, but was by the NEP<+/OC<+ quadrant. Excerpts from the student interviews are shown below quadrant.

Table 12. Numbers of Students in Each Quadrant Holding Beliefs for Each Category on Human Population

	NEP+/OC	NEP+/ OC<+	NEP<+/ OC+	NEP<+/OC<+
No Population Problem	0	0	2	2
Population Problem in Future	4	3	0	0
Current Population Problem	2	1	2	0

Shading indicated support of hypothesis

Q1) Positive NEP/OC

Students in this quadrant grouped into one of two categorical responses. Four believe that population issues are a future problem, while two believe that we are faced with a population problem currently. None of the students responded that there was no population problem.

Human Population Numbers are Problematic, but it is More of a Future Concern. Four students provide the perspective from this categorical viewpoint. They

use a variety of arguments to provide support for their beliefs.

> Randy: There's…you can have as many people on earth as you want and it will carry…I mean you can only go so far and then people…just like animals I mean if you…deer in Michigan, if there wasn't a hunting season there'd be so many deer that they'd just…there would be a lack of resources and they'd just die of disease and hunger. And it will get to that point eventually, but animals in nature have a tendency to correct themselves. It will probably stay at a level, we won't all die off but we'll stay at certain level, we won't be able to any higher or any lower. I mean go lower but not…it'll peak out and that's where we'll stay out. We're probably pretty close to that considering how many people there is, where 200 years ago compared to what there is now, double the…I don't remember right off hand…like anywhere…between 28 and 40 years the population doubles and once you start doubling, more and more…you're going to run out of space for everybody, not to mention resources, food, places to live. (WFR045: 142-169)

> Wendy: So I think it's more ... I think we will eventually approach it, but I think that's still a long way off and I think that if people were more creative and more understanding why it's important not to use up everything at once, then we could probably fit a lot more people. (WFW028: 118-126)

> Beth: I agree that the earth is becoming extremely populated. I don't think that we're to the point in the United States like they are in China, where they've had to limit the number of children that you can have. But, I definitely think that if we're planning to grow at the rate that that we are that we also need to make sure that we have ample resources to support all of these people. I think we're working towards that right now, but I don't think we're at that point yet, so we're kind of still in the danger zone where we don't have enough resources to support this upcoming population. So I think that's something that definitely needs to be worked on. Because, yeah, I think right now at the point we're at, we don't have the resources to support the population. (WSB900: 116-138)

From Lisa's perspective, the population of the world is increasing and will become a problem somewhere in the future, but she also believes that the United States is at a point where the population is too high. This is based more on a view on immigration and welfare in our country.

> Lisa: I don't know if it will ever happen in my lifetime or my children's lifetime but yes I think we are approaching that. How we solve it, I don't really know. I get frustrated when I see people on welfare who have six or seven kids. (WSL867: 560-576)

> One of the things that bothers me is the United States is becoming over populated, there's not many farms around, there's not many of the Home

> grown mom-and-pop type shops. Everything is a superstore, Megastore and then we're continuing to let immigrants from other countries come in and take jobs that could provide for our homeless and or neglected children and our abused environment. (WSL867: 627-637)

Human Population of the World is too High. Two students represent the thoughts of students in this category. Neither of the students provided a great deal of depth in their responses, but the response from Anne provides a small example of these students' thoughts.

Anne agrees that population in the world is a problem and that it is getting too high. She believes that people are having children who are not prepared to have children and this is the reason for our world's overpopulation. However, after she notes this belief she immediately responds, "but I don't think that that is going to hinder me from having children" (WFA861: 146-148).

Q2) Positive NEP/Neutral-Negative OC

There is very little difference between the responses of NEP+/OC+ students and NEP+/OC<+ students. Neither groups responses indicate a strong NEP+ worldview. As with the previous quadrant responses, there were no responses that there was no population problem.

Human Population Numbers are Problematic, but it is More of a Future Concern. Three students believe human population is reaching a point where the earth will no longer be able to support that population, but that it is still somewhere in the future.

> Mary: But I do feel that there probably is a limit and knowing how many people are on earth right now…it's…I mean, it's…it would seem like it would be clos…you know close to it's maximum capacity because you, you can't just inhabit the whole earth with people because you have to have farmland to feed those people and you have to have the pastures for the animals to graze. People…you know so…I, you know there does

> have to be a limit I think in order…you know some…at some point the people have to stop expanding so that those people that are already here can be supported. You know because we…and there's only a limited supply of water and you know if we just continually grow there, there won't be anything for people to you know live off of. (WFM029: 96-117)

> Becca: Yeah, I think that's a true statement. I don't think that we're like going to reach it tomorrow or the next day, but I'd say…you know there's going to be a time where we are going to run out of space because…you know it, it (WFB749: 208-213)

> Holly: Our population is definitely getting very, very large and there's a lot of crowding going on. I can, I can see how there will be problems in the future. I mean you have places like China that are limiting the amount of children people can have. I think, I think (WFH967: 64-71)

> I actually I don't know how many years that we…it will have before it's too full to support us. I don't think it's a concern like I was saying within our lifetime. (WFH967: 113-118)

Human Population of the World is too High. Barb is the only student from this quadrant who provides evidence in a belief in overpopulation.

> I no…noticed a lot of with just urban sprawl in general where I live in the Detroit area, it's growing. There are new houses going up everywhere and I see that as a problem as well. Even just in terms of population control and congestion and I know that…you know people in the US, you know having a child here I think is almost worse than the mother in Africa who has ten children because one child here consumes so many more resources in terms of the houses that we have and the cars and things like that. (WFB473: 116-130)

However, even with these beliefs, she does not yet believe we have reached the critical overload of population.

> But looking at how our population has grown over the last 100 years and 200 years, it's grown so significantly that…I know that there's going to be a point when we use up all of our resources. (WFB473: 146-151)

Q3) Neutral-Negative NEP/Positive OC

Responses from this quadrant span the entire response continuum. Two students believe there are no problem and two that there currently is a population problem.

There is No Population Problem. Two students responded that they believe there is no population problem.

> Penni: …but there's still room here if we use it wisely. But in the most populated like California, you know there's…of course there's…we're reaching a limit of how many we can support in there. But there's many countries, there many rural areas like Montana, you know Nebraska, it has plenty of resources for us to do, but we just have use them wisely rather than letting this huge manufacturing companies pollute…people don't want to go to those areas. They would rather just go where the city is and that often cause more pollution. So I can see how the scientist would say that we're reaching close to the end. I mean there are signs that say we are reaching close to end with the wars that going on now. And it says that in the Bible that we're reaching close to the end. And it tells you…you know it's kind of interesting of how you look at like what's going on in the world news and then you refer it back to the Bible. And its going…its corresponding right with it.…there's, there's plenty of enough resources here, there's you know space, we just have to find it. They're just looking at the most populated areas, the biggest cities, the big major states to live in, I guess its how I would see that that's where they're looking at, they're not looking at the rest of the world. They're not looking at the areas that you can move to, you can migrate to. So I wouldn't agree with that statement. (WSP022: 235-263, 300-312)

> Diane: I lived in Indonesia, by the way, for six months with an orphanage, so I've seen a bit of poverty situations in third world countries and if you look how they live as opposed to how Americans live…I mean American who's used to their space, used to their luxury, I think they would more view that the world population has come to limit because they want their --- space. I don't if that…answers your question much. But in terms of population coming to a limit…it's something I'm not worried about, as I mentioned before, the Lord knows how many people he has ordained to be on this earth. It's not something I'm losing sleep over. I don't know if that's the answer. (WFD047: 183-190)

Human Population of the World is too High. Two students provide their perspectives on how they believe that human population is an issue.

> Linda: Overpopulation I think for one thing. I mean I…I don't know figures I don't exactly if we are but it seems to be that way. I mean they're constantly building new h…you know everything's being built, you know trees are being take…no matter where you go, if it's in the city, if it's in the country. (WFL024: 66-74)

> Sara: I think it's true because we keep going farther and farther into nature, into the forest to like live and we're just running out of room I think, in the cities and…I think we are reaching maximum potential for people on the planet. As the population grows we have to keep using

more and more resources and I mean, I think the environment naturally can replenish itself, but it does take time and if we keep pushing it too fast, I think that that's not good. (WFS115: 80-92)

I think that if the population continues to grow and we keep using all of our resources and not…putting anything back, I think then it might become more serious…a more serious problem. [Rob: Okay, so you think a lot of it's related to population then?] Yeah I would say population, because with population comes obviously more people, more growth, more buildings, more houses… (WFS115: 263-277)

Q4) Neutral-Negative NEP/OC

Both students responded to this question in a manner consistent with their ecological worldview beliefs. Neither believes that population is an issue now or will be in the future.

There is No Population Problem. Both Sue and Kelly provide statements on why they believe there is no human population problem.

Sue: people die…lots of people die all at once. Which is sad, but it's the truth; you know, I don't know, I don't know anybody that gave birth to like 3000 people all at once. I mean all over the world there are people having babies and stuff but I think that the death rate and birth rate kind of balance each other out enough that there won't be overcrowding. (WFI989: 91-101)

Kelly: I don't know, because I think everybody needs different…I mean for the basic resources like water and food and stuff like that, I mean… I don't know, I don't know that's kind of hard to say because some cultures need different things than other cultures, so I think it almost balances out a little bit. In... I don't know, I mean like you see how overpopulation in Japan…Japan or China where they have the population control, and you know I mean for them, I think they're…you know they realize that they're kind of overpopulated. I don't think right now the States are because…I mean there's plenty of barren land. And so you know there's nothing there and you know I mean, so I think that…you know we could like…branch out and stuff like that. So I don't think like the States so much, but as far as the world, I mean there's probably areas that are a little more overpopulated than others. I don't think the entire world is…totally populated right now, but I think we can hold more. I think we can do it. (WFK965: 133-161)

Relationship Between OC and Beliefs about Endangered Species

In addressing the issue of endangered species, questions revolved around the concept of the rights of humans verses the rights of other species. The section on interactions associated with beliefs in anthropocentrism partially addressed this issue. However, given the nature of this issue and its prominence in the media, it receives analysis as a separate issue. Analysis of the interview responses to these questions sort out into three general categories:

1. Endangered species must give in to the demands of humans.

2. Humans are dominant over endangered species, but those species are still important and have the right to exist.

3. Endangered species and humans are of equal importance.

The sub-hypothesis for this environmental issue states that a positive relationship exists between an orthodox Christian worldview and belief about the rights of endangered species to exist. As per expectations, three students in the NEP+ quadrants believe that endangered species have as much right as humans and two students in the NEP<+ quadrants believe that endangered species must give in to the

Table 13. Numbers of Students in Each Quadrant Holding Beliefs for Each Category on Endangered Species

	NEP+/OC	NEP+/ OC<+	NEP<+/ OC+	NEP<+/OC<+
Endangered Species give in to Human Demands	3	0	1	1
Humans Dominant, but Endangered Species still important	2	2	1	0
Endangered Species and Humans have equal value	1	2	2	1

Shading indicates support of hypothesis

demands of humans. However, contrary to expectations, three students in the NEP+ quadrant believe that endangered species must give in to the demands of humans and three students in the NEP<+ quadrants believe that endangered species have equal rights with humans (Table 13). Therefore, this hypothesis was not supported. Comments made by the students are excerpted below by quadrant.

Q1) Positive NEP/OC

Humans are Dominant over Endangered Species. Three students' comments provide a perspective of responses in this category.

Using bases his belief in the need for humans to be dominant over endangered species on the need to control and manage large predatory species.

> Randy: They have just…they don't have…the exact amount of right as the people, but conflicts with animals, especially bigger animals such as cougar and bear could be handled through a management of those animals. States like New Jersey have bears crawling all over the place, so they don't have season to manage the animals…and I mean it kind of just goes back to the urban that hunting is not an acceptable thing. (WFR045: 425-435)

> Beth: Well I guess, I think they almost have, you know, an equal right to the land as much as we do. You know, like I said, they were there first. So, at the same time, our population is growing and we need to find places for humans to go, but the happy ideal would be to incorporate the two. Not to destroy so much of their natural habitat that they can't survive, but still allow us to live there as well. (WSB900: 217-231)

While Beth's comments give an impression of developing a balance, her next comments show that in a conflict with endangered species, humans have the rights.

> Beth: I guess if it was an absolute, you know, them or us kind of scenario, I would think that humans would have the right, (pause) or the power. I shouldn't say the right, more so the power, to take over. But at the same time for morality reasons I think that they should do something. You know, put the animal, the remaining animals, in a zoo or something. Try to preserve their habitat and their life styles instead of just trying to slaughter them off and kill them. You know, and do something to allow them to survive as well. It may not be in the exact same location, but relocate them into an area which they could live. (WSB900: 235-262)

Lisa uses the same type of rationale as Beth, that endangered species can be moved to another area when there are conflicts.

> Lisa: I think that this kind of goes to a growing population. The population on the face of the earth is growing, and each new family needs a home. For them to build a home they might have to pick their piece of property that would have one of these endangered species I think there are other alternatives for those animals. I believe that they have a right to live obviously. I don't know if there are places out there--I know that there are places that take the endangered gorillas and some of those and they just have this big wildlife where these animals live in freedom type thing. (WSL867: 462-493)

Lisa goes on to describe a situation described earlier in this chapter about a butterfly in the way of a road construction project. Her belief is that humans can just move species to another location where they can continue to "live in freedom."

Humans are Dominant Over Endangered Species, but They are Important. Two students provide examples of these beliefs in this category.

> Wendy: I would say that humans have learned to adapt to pretty much any environment on earth. So, we can go just about anywhere and still have a comfortable lifestyle and still have the things that we need. Whereas, a plant or animal can't adapt that quickly. They don't have the tools that we have to change their environment. So I think that it does become the right of that plant or animal over the right of the human because we can live pretty much anywhere and they can't. Animals and plants need very specific environments and if it's endangered it's obviously going to have to be more important than your new sauna or your hot tub or your patio. It's going to need to be more important because there's only that one space where it can survive in. (WFW028: 249-312)

Wendy then goes on to develop the importance of endangered species and biodiversity in general and its ultimate importance to humans in potential medicines, foods, and other products. She also recognizes that humans are not separate from the "food web" and that we are connected to other species on the planet.

Laura continues this thought on this balance between endangered species and humans.

> Laura: I mean extinction as a very--what am I looking for--I mean it's a very natural process as long as it's natural. As long as it's not force. I

> mean I believe that if there's an animal that's being killed off because someone is digging for oil or some resource reason like that then I don't believe that's fair. I mean that animals should have that right to live. But if it's more of a natural thing, like the dinosaurs for example, then that's just part of the life cycle. I mean--I just don't think that plants and animals should be deprived of life for no other reason than to be for someone else's gain. (WFL066: 270-291)

Endangered Species and Humans are of Equal Value. Anne, the only student from this quadrant in this category, sees endangered species as "important to our resources." She points out that we need plants for the O_2 they provide. However, when it comes right down to the issue she states, **"**I think that it's not my choice to decide if we're going to say, '0h, plants and animals do not need to be in this area'" (WFA861: 280-283).

Q2) Positive NEP/Neutral-Negative OC

None of the students in this quadrant believes that endangered species should have to suffer because of human demands. However, they do split between a balance between humans and other species and the equal value and rights of humans and other species.

Humans are Dominant Over Endangered Species, but They are Important. Two students' responses put them into this category.

> Mary: I think that they should have just as much as a right as we do. Because we are also in essence an animal. And we are…or just like they are. And I really don't…I, I can kind of see both sides, I feel like I'm in the middle in a lot of this. Because I feel like the animals should have a right but then it's also part of their being to support us and what we have evolved to be, you know. So…I feel like they have a right to be here but I also feel like it's part of what and who they are that they help to support us. (WFM029: 208-226)

> Barb: A lot of times we do [take precedence over endangered species] just because they can and the plants don't have a voice in the same way that people do. I don't know, a part of me says that you know humans do have a greater right because it's kind of the way that it's always been. And we need…we do need those environments in a way to support ourselves and sustain our existence as humans. But I don't think that the

> plants and other environments are without rights themselves. And that's why a lot of people are advocates and things like that for those particular environments. (WFB473: 231-253)

Endangered Species and Humans are of Equal Value. Two students also believe that endangered species have as much of a right to survival as humans.

> Becca: They have all the right in the world. They've been here just as long as people have been here. That's just very cocky of a human to ever think "Well, I need a house and I don't care that animal in extinction. Do we need that animal anyway?" Yeah it's here for some reason it balances out somebody's life cycle, it's here for a purpose. Everything's got some sort of purpose. And why should we so presumptuous to think that you know, "I want a house right here." Go live some place else, go have an apartment. You know? I don't know, I just…I don't think that we should ever think that you know we're better than anything living. Because it's all equal, I mean who's to say who's more important? (WFB749: 456-482)

Holly, on the other hand, believes that endangered species should have a "place to live and thrive." While there may be places where humans and the species cross paths, and that there may be conflicts between humans and other species, they still have the right to live. She does not believe this right stems from their role as useful to humans, but rather because, "they have feelings, you know you can…having animals, they definitely have feelings and personalities and they're their own thing. So I mean I don't think that they're just here for us…to manipulate and take advantage of" (WFH967: 222-257).

Q3) Neutral-Negative NEP/Positive OC

This quadrant once again has responses that range across all of the categories.

Humans are Dominant over Endangered Species. Diane, the only student to respond from in this category, uses her orthodox Christian worldview to justify her beliefs.

> Diane: As I said, I love nature and so of course I would rather not see an endangered species wiped out. Because I think they're beautiful, I think that nature is given for us to glorify God through. But at the same time

> it's given for us to use as stewards. So I would guess it would depend on what your purpose is for…whatever it is to endanger those species. Again if it's for your own greed well then may be that's not necessary. What rights do plants and animals have? Well they're not the crown of God's creation, but they still our God's creation, so as being part of God's creation I think that they hold a very important role and they are to be respected for that, but not glorified for it. And so…in terms of rights versus humans, well we are over them. So, right…a right to be respected but not necessarily a right, they can't determine our lives. That makes sense? Yeah, that's, that's what I'd say. (WFD047: 299-328)

Humans are Dominant Over Endangered Species, but They are Important. Linda has the only response from this quadrant in this category and speaks of her views on our need for endangered species when she says,

> I don't…well the animal would have the right. I mean it's not just us who lives here. There are other…yeah. I mean I just don't…I definitely think that we're the dominant being in the universe but I don't think that means we get to chose, we get to you know…well actually we do get to chose but…I don't, I just don't think we should always put us before…you know because we need those things too. I just don't think everyone realizes how much we need them. (WFL024: 262-274)

Endangered Species and Humans are of Equal Value. Finally, two students from this quadrant offer examples of their beliefs on how they believe endangered species and humans have equal value.

> Penni: …just the same right as we have to exist. You know like…it kills me how people…they know that something is endangered but they go and kill it anyway. You know, I mean yeah we still…we do have regulations on it and if they get caught, you know they can get in trouble. But even if they do get caught, there's just like a little fine to pay, usually it's minimal or nothing is ever done about it. But they have, they have just as much right as we do to be here. And I…that's another big issue. That's a huge issue. You know so many people work so hard to try to save plants, especially like in the rain forest and its like people just don't care. They don't care what kind of affect their actions have. It's like they're selfish. And in that aspect I don't think just…it's just Americans, I think it's everywhere. They're very selfish and they're not looking at like what their actions do. They're not taking responsibility for their actions. And…yeah I'm a big seal person. --- and it just…it kills me how like…people like they don't think about like those little six pack of pop cans, you know the little ringlets, like they don't see how throwing those out on the beach can kill like a seal or a bird or anything like that, that…you know and some of those might be endangered and…you know or are close to extinction and they don't…they don't see how that affects anything and…I mean if we keep killing off all of our animals

> there goes our resources. I mean they're a big part of our food chain, a big part of our resources as we kill one species and the other species can get too populated, you know I mean there's a big food chain, it's all coincide together. So if we delete one aspect of the chain the whole chain is ruined. (WSP022: 429-484)

Sara believes that humans have the ability to "go in and destroy a species or a plant or an animal just because they want to," but that the ability to do so does not make the action right. She believes that endangered species have just as much right to exist as humans because they were "put on this planet." Because of this belief, she holds the position that "we both have equal rights as in living on the planet and not having to…not having to move for each other" (WFS115: 174-214).

Q4) Neutral-Negative NEP/OC

The two students in this quadrant take opposite views on this issue. Sue believes that humans are dominant over other species, while Kelly believes that they have just as much right to exist as do humans. Neither of them takes a middle ground position.

Humans are Dominant over Endangered Species. Sue believes that since endangered does not mean extinct then is does not matter if she uses a piece of land where they live to build a home.

> Of course it's easy for me to say well the plant or animal but I'm sure that if I was in love with this piece of land and I just you know wanted to build my house and raise my family there, I would feel differently. But…I don't know that's hard. Gosh…I mean…well I don't know, I really don't know. Because I feel split. Because I'm not in the position so it's easy for me to say well pshhh I'm sure that there's more of them, if they're endangered they're not completely extinct so there's got to be more somewhere else, but it's really…oh man…if any environmentalists…environmentalists ever hear me say that, they'd probably be like, "Who is that?" (WFI989: 197-224)

Endangered Species and Humans are of Equal Value. Kelly understands that even in the face of loss of property usage because of the presence of an endangered species on the property, the endangered species still has the greater right over the rights

of the humans.

> I think they have every right in the world. Like…if they're endangered, I think we should protect them. You know, because…you can't be a bully, you can't you know…throw them away and get rid of them and everything just because you feel that you want to live there or what not. So I think endangered species definitely should be protected. [Rob: But what if it's your house? Land that you've bought?] Well then I mean it's…that's something that you'd have to make…your decision about. Like I wouldn't…I don't think…I mean because it's not like that's the only place in the world, you know…I mean that'd be a tough spot to be in, if you like bought and then were going to plan, you know plan on living there and then you found out there was an endangered species. Then I think that would be…be difficult because you know here you've invested all this money and all this time and everything, but at the same time they're endangered…you know I mean, you can't just kill off something because you want to live there. You know I mean that's kind of a…arrogant way to think about things, you know. So, you know…I don't think…I think they should be protected. I think that's…it's probably hard decision for people like that, you know when they're presented with that situation, but I think they should be protected. I think, you know, they…they were here before we were, you know and…I don't know. I don't…I think that'd be wrong to take away their…what if somebody came to your house and was like pssshh and knocked it down and then, was like I'm going to live here now. You know that's just…we wouldn't do that to each other, so why would we do that to animals? (WFK965: 332-387)

Relationship Between OC and Beliefs about Global Climate Change

Analysis on the issue of global climate change is difficult because students bring many forms of evidence as support of their beliefs. Many times this evidence is not related to the issue and the statement must be understood from that perspective. As such, analysis of the interviews indicates the presence of five different categories of response to this question:

1. Global climate change is happening – the student uses applicable evidence.

2. Global climate change is happening – the student uses a mix of applicable and erroneous evidence.

3. Global climate change is happening – the student uses erroneous evidence.

4. Global climate change is not happening.

5. The student is unsure if global climate change is happening.

The sub-hypothesis for this environmental issue states that a positive relationship exists between an orthodox Christian worldview and beliefs on the existence of global climate change issues. As Table 14 shows, this hypothesis was only supported in the NEP+/OC<+ quadrant. As per expectations, seven students in the NEP+ quadrants believe that global climate change is occurring (with various degrees of evidence as support). However, contrary to expectations, one student in the NEP+ quadrants does not believe global climate change is an issue and five students in the NEP<+ quadrants do believe that it is an issue. Support for these findings can be seen in the excerpts below.

Table 14. Numbers of Students in Each Quadrant Holding Beliefs for Each Category on Global Climate Change

	NEP+/OC	NEP+/ OC<+	NEP<+/ OC+	NEP<+/OC<+
Happening – Applicable Evidence	1	3	2	2
Happening – Mixed Evidence	1	1	1	0
Happening – Erroneous Evidence	1	0	0	0
Not Happening	1	0	0	0
Unsure	1	0	1	0

Shading indicated support of hypothesis

Q1) Positive NEP/OC

As Table 14 shows, responses in this quadrant encompass the entire range of categories. Students in this category use a wide variety of evidence to support their beliefs on the existence or non-existence of global climate change. One student from this quadrant did not provide a response to this question.

Global Climate Change is Happening – Applicable Evidence. Beth is the only student from this quadrant in this category. She has followed the topic of global climate change in the news and through school projects and provides a reasonably sound response.

> Beth: I think we definitely,... If we're not the sole cause of it, we're definitely a major factor in its steep increase and its rate of growing. You know, you have all the emission problems coming from vehicles and plants and the burning of fossil fuels and stuff like that. We wouldn't have cars or factories if it wasn't for humans building them. So I definitely think that we're a major, major contributing factor to that. I think now we've realized what we have done and so we're trying to fix it by slowing the process down. But, I think it's almost a little too late kind of thing. The damage is done. We can only hope to slow the process. (WSB900: 405-423)

> Just remembering even from the weather that I experienced from when I was little to what I experience now. It seems to be different to me, assuming that the cause of it is because of global warming and the effects of that. I'm not a meteorologist, I don't know the exact details of why. But, I definitely think that there has been a change, even in my lifetime. (WSB900: 442-453)

Global Climate Change is Happening – Applicable and Erroneous Evidence. Anne uses a variety of evidence to support her claims. Some of this evidence is not applicable to the issue, but some does apply accurately to the topic.

> Anne: There's a lot of research ... I've taken six science classes here Western and in one of them, I don't remember which one, we talk about global warming and how the trend is that everything is ... ... 0h, it was a my oceanography class actually ... we talked about how the trend of the climate's, if you put it out on a graph everything is continually rising. And with that rising our polar icecaps are melting and so are water is rising, and so we're getting less land. A big reason for that is the CO2 in the atmosphere. There're a lot of chemicals and gases in an atmosphere are contributing to the sun been able to permeate the ozone layer and in turn creating a hotter climate. Contributing to a destructive ... ... the ice caps are melting ... ... flooding of the land ... If I had listened more I would have more to say. (WFA861: 310-347)

Global Climate Change is Happening – Erroneous Evidence. Laura only uses evidence associated with ozone layer depletion to support her belief that global climate change is occurring. She uses both chemicals involved in the destruction of the ozone

layer and the actual thinning of the layer as her evidence for global climate change.

> It is an issue. I remember it being an issue from even years and years ago back to talking about grade school when we would hear about the chlorofluorocarbons and hair spray and such. And I've even seen trends in current events, whether it be like the newspaper or other sources of our temperature increasing just generally over the time. I think that it's a very prevalent issue. It's almost kind of scary when you try to think about it because it's such serious problem. I've even seen, I can remember where I saw it, something where showed like the level of ozone, like where it's the thinnest layer and the different problems associated with it. I guess the problem was bigger in its entirety than I had even realized, when I'd seen those figures. (WFL066: 405-429)

Global Climate Change is Not Happening. Using climatological history to provide support for these beliefs, Randy believes that global climate change issue is not an issue, but rather a myth that does not take into consideration the earth's history.

> I don't think we are. Because…just…according to some people ten thousand years ago the earth was covered in ice and if it was covered in ice we had to warm up some how and patterns…I think this is a pattern going from cold to warm and eventually that it will go back to cold again. I don't think it's a big concern because if everything keeps…continues to warm up, it's not going to flood everything. I think some people just assume…should not build places below sea level or at sea level because it's sea level a reason, because it was previously probably covered, by water, oceans. Geological facts that can prove that certain places were covered under water. And if that's a big concern then when we're not bigger than forces of nature. We might be…like I previously said we might be in charge of the animals but there's nothing we can do about landforms changing, earthquakes, floods, things along those lines and nature will take its course. And I'm not really concerned about global warming, because I think it's more of myth than a fact. (WFR045: 585-620)

Unsure if Global Climate Change is Happening. Lisa uses a variety of evidences that she has acquired to provide for her understanding of the issue. As she describes her understanding of global climate change. Yet, even with all of her understanding she is not willing to make a stand on the issue.

> I don't know – I don't really understand the concept and I think that's just because I really haven't heard it explained. But, I can't put it into perspective where it actually makes sense yet. Like, today it's supposed to be 90° down our way. They've declared this ozone awareness day or whatever where your not supposed to mow your grass until after dark and don't fill your gas tank up during the day. Try to do it in the

morning or at night. But, I have asthma, my son has asthma, I mean, so those are things that we are really kind of aware of because I know that this is the day that I drop him off at grandma's, because grandma watches him, I have to make sure I take his inhaler, because he is probably going to need it today. And she knows, she turned her air conditioning on last night, because she knew he was coming today and there was no way with the humidity that the child would even be able to breathe. He would be so stuffed up. As mild as our May was, I have trouble believing that there is such a thing as global warming. But, I honestly think that is probably there. I think it has a lot to do with the – what are those things that are in cans, aerosol cans – I think that the decrease of the manufacture of those probably will help it. Carpooling helps. I mean, I feel guilty on days like today when I'm driving an hour and a half up here for school, but there's no other way. I don't know anybody down our way who is coming up here. We try not to make extra trips. I get very – one of our neighbors goes by the house probably twenty times a day in their automobile, and I think, "Do you have any idea how much money you are wasting in gas? Wear and tear you are putting on your vehicle that is going to need additional oil changes. And where are they going to put that oil?" But, they are the same ones that are out there in the fall burning four and five piles of leaves. It's very frustrating. Where do you think that smoke is going. It's not going through a filtration system. It's going straight up into the ozone. I don't know. Like I said, I don't know a whole lot about it. (WSL867: 787-847)

Like I said, I don't know a whole lot about it. I think that is probably is happening. I think it was probably more evident as the ice age started to recede. But I definitely think that it is there. It's something that I need to know more about. I don't think they've done a very good job of educating the public on that. They've just thrown it out there that these scientists believe that it's happening. Okay, I'm a numbers person. Show me the facts. (WSL867: 847-858)

Q2) Positive NEP/Neutral-Negative OC

All of the NEP+/OC<+ students believe that global climate change is an issue and most use applicable evidence to support their beliefs. Only one student uses a mixture of applicable and erroneous evidence in their response.

Global Climate Change is Happening – Applicable Evidence. While three of the four students use evidence that is applicable, some of their beliefs rely on recent meteorological evidence to support their beliefs.

Barb: I think it is definitely a problem, but in terms of temperatures warmer where we are, I think that a lot of people, then again may not see

> it as a problem, because okay so may be it's one degree warmer today on the average. But then I know that…look up ---issues, don't they talk about the lake shores up in the…it's like northern and southern hemisphere, I mean…or the north and south pole. Don't they say that the temperature changes could perhaps make them melt and fall into the ocean? Is that one of the theories? [Rob: That is one of the things that they say, yes.] I guess I don't that much about how rapidly the temperature is changing to say whether or not these glaciers are going to melt and flow into the ocean and all the sudden it's…you know we're going to be washed away or something like that. But…I don't, I don't know if it's necessarily an immediate problem, I guess. Because I think it would take a very long time for the temperature to change that much, for glaciers and such to melt. But I could be wrong. Based on, based on…on I don't how rapidly the temperature is changing. (WFB473: 331-375)

> Becca: I remember, you know when I was little; the weather that we used to get and the weather we get now is it's not exactly the same. I remember like winters just being winters and cold and tons of snow and now it's like, oh there's snow and then there it goes. And you know it just seems the weather isn't exactly the same that it was and I think that has a lot to do with global warming. But…yeah I think that, I think that it has been changing. It's, it's one…again it's one of those gradual things, unless you look back like so many years, you're not…like you have to think wait a minute, you know it didn't used to be exactly like this. And you've got to think of where it is now. But that's exactly it, you know its one of those things that's gradual. It's not going be an overnight thing, so when you know discuss this issue you…may be you do have to exaggerate it a little just to put the point the across ---do something important. While it might not, you know help you exactly today, you're not going to see your immediate results like everybody wants to see. It might be something that'll help in the end. (WFB749: 609-646)

> Mary: I haven't noticed in my lifetime you know or my god it's so much hotter you know whatever. But, like I…the gradual affect that…or the gradual changes that we see on the earth over long periods of time have a great affect on things that we need. Like, you know crops and water and things like that and…living in Michigan and the Great Lakes, I've heard recently how much they have…I don't know lowered in their levels and what not and…that has to do with…climate change and it's supposedly increasing and things like that. (WFM029: 359-375)

<u>Global Climate Change is Happening – Applicable and Erroneous Evidence.</u>

Holly uses both applicable evidence and ozone activity to provide her belief for the existence of global climate change.

> The earth is definitely warming, the ice caps are melting. But aren't we just ending like an ice age too? Not just ending but like…just coming out of? Hasn't earth always like had ice age and then like an area of

> recession? And ice…I've read, I read somewhere, I don't know, I think when I was still at my community college, about this area or this time being…just coming out of an ice age, like recently so that there…of course it would still be…they're going to be melting and…I guess that's…I kind of think okay, that makes sense. [Rob: Do you think it has anything to do with human activity?] Oh sure. With the… holes in the ozone. It definitely has something to do with it. I'm not sure… might have. I definitely think peo…you know humans are helping that process alone, along. (WFH967: 323-355)

Q3) Neutral-Negative NEP/Positive OC

Three of the four students in this NEP<+ quadrant believe that global climate change is occurring, while the fourth, even though she understands the evidence, is unsure. Two of the students use applicable evidence and the third a mix of evidence in providing evidence for their beliefs.

Global Climate Change is Happening – Applicable Evidence. As with the previous quadrant, both students in this category use meteorological evidence to describe their beliefs.

> Sara: …there is a problem with the global, the whole global warming, but I don't think it's at the point…I mean we can start worrying about it early just like anything you need to…you know get it early and start working towards fixing it. I think if we left...left…left it, let it go then it would…we would just…it would be beyond repair. But I think right now it's…there is a problem but it's not a severe problem if we start working on it right now, in the future may be that'll decrease the chances of it ever becoming a major threatening problem. (WFS115: 286-302)

Sara's substantiation that global climate change is happening and that action does need to be taken before it would become "beyond repair," like others, is recent weather patterns. As she has observed, "I know in Michigan, over the past several years, just the winters are becoming more mild and …just the patterns of weather that you read about" (WFS115: 310-314). In the same way, Linda also uses some of these recent weather events as part of her evidence.

> Linda: I mean, I didn't even wear my coat on the way here. You know, and we're well into November. … And from the things that I've saw on

> TV it's not natural. You know a lot of people are claiming it's us who has done this and we're the ones that need to…figure out what we're going to do, you know so it doesn't get worse. I don't even know if it can get better, but I'm sure…you know we can slow it down. (WFL024: 447-481)

Global Climate Change is Happening – Applicable and Erroneous Evidence.

Penni, the only student from this quadrant in this category, spoke at great length about global climate change, but uses a mixture of applicable evidence and evidence relating to other issues to defend her beliefs.

> There's not a way to stop it. We're a little bit too far to stop it. But we can slow it down by the amount of gas that we use. You know like I think that the solar cars, there's one in our neighborhood that has a solar car. I think it's cool. It's like the neatest thing I've ever seen. I don't know if you've seen them at all, the little solar cars like that they have like…those things are so cool. You know like, I don't why we didn't think of those sooner. You know, yeah they don't, may not have as much power as gas but people…I mean I think a lot of it is…is our gas that we use burning… (WSP022: 808-824)

> …like people burn like I said Styrofoam and plastic. I mean our ozone depleting is what caused the warming, so it…I…a lot stuff that we do by like burning our…I know that there's other like…like I don't if Pharmacia, like when they make stuff, I know that you always see that the gas, it has to affect the ozone, somehow affect it. I don't know how much but I know that it affects. (WSP022: 824-834)

> You know we see that in our winters. You know even as I look back like this year, we really haven't had that bad of a winter. And I keep looking back and I'm like yeah I guess for the past few years we haven't had a major snow-fallage or you know or anything. I can see it hap…I mean you can see it, you can see, I mean we were in April and we had those three days that we were 90 degrees. That's way out of the norm that usually does not happen. So it's definitely warming up, definitely warming up, you know our winters are getting warmer and our summers are getting hotter. So it's definitely a problem. But I don't think there is a way to stop it. If there is, I don't know of it. … But I think a lot of it has to do with our vehicles. That's a lot of it. Because it can't be good to burn all of that gas and I'm a big one for car pooling. Carpooling or walking. (WSP022: 844-863, 834-839)

> I think it has lead to problems. With…you know more skin cancer problems, with letting in more of the sunlight in, more of the…I don't know which rays, I guess UVB or something that…one of those rays that come to…that causes skin cancer, I mean there's more skin cancer problems from people laying in the sun. People in the sun all the time, sorry, I mean that's obviously a sign that it is a problem now. But I don't

> really know how to stop it though. Besides having people become aware of their actions and ozone actions days. But I don't know, I thought about how can we stop this from happening. But it's too late, there's no way to stop it, but we could possibly slow it down now, if people would take action now. (WSP022: 868-887)

Unsure if Global Climate Change is Happening. Diane makes use of many of the applicable concepts associated with the global climate change issue, however she also mixes ozone depletion with the issue. She uses information gained from science classes and other information she has heard about to formulate her understanding of the issue. As she identifies with the issue,

> You know in a geography class I studied Florida. And in Florida supposedly the ocean level r…has raised, has been risen, in the last…I have no clue how many years they've measured it. And a few feet of Florida is lost every year. They say that is because of global warning, global warming and the polar ice caps, you know melting and the ocean levels rising. Now I guess if there's research. I mean if there are scientific facts I'm going to believe them. Of course we don't know, thousands, of thousands, of thousands of years ago, however long the earth has been here, what the temperatures were like back then. So, in my opinion…I mean I've heard…other people say well really it's getting colder. Or really…you know for somebody…of course I've never really read any thorough scientific investigation on it, but this is just different things I remember hearing in past years. And you know just hear one and then you hear about the ozone layer and this…--- getting bigger. I hear different. And so it's like, okay well they don't even know themselves, so most of the time we don't even know if it's happening. So no I don't know, but if it's getting warmer, well then it's getting warmer. I guess it's like, what can you do about it anyway? So…I know there are things you could do about it but…like no concrete you know…really good way to do anything. Yeah sure have less…what is it CSC's? In cans so that the ozone layer is not depleted and duda duda duda da so the ice caps don't melt. And I don't know…I just…to me it looks like okay what can you really…what can you really accomplish by it? But then again I haven't read much about it. So I'm speaking in…from a kind of an ignorant point of view. (WFD047: 391-449)

Q4) Neutral-Negative NEP/OC

Both students in this quadrant believe that global climate change is an issue and both use applicable evidence in support of those beliefs. While NEP<+ in their overall worldview perspective, on this issue they were both in agreement and use applicable

evidence in that belief.

Global Climate Change is Happening – Applicable Evidence. Both students use different evidence, though applicable, to describe their beliefs in global climate change.

> Kelly: Well it's proven that it's melting icecaps and melting things and stuff like that. I…and you know you notice like the seasons. Now like tomorrow it's going to be 63. It's you know the middle of…it's the beginning of November. You know, it's supposed to be chilly. And so I mean and you noticed like last winter it was a pretty mild winter and you know in the summer's its pretty hot, it's like 100 and some degrees. You know, I mean its Michigan so I know that the weather fluctuates a lot, but that's not fairly normal. I mean when I grew up Christmases were white. You had, you know, snow. And I don't remember you know having a Christmas with snow in last, you know, eight years. So, I mean it's definitely had an effect on the seasons and stuff like, where things aren't…aren't as perfect you know, season-wise. (WFK965: 497-525)

> Sue: I think it's been accelerated because of humans. I think it would have happened any ways, but I think just because of the way we live and the way we are and the number of people that there are, it's been…the process has been sped up and…so I guess in a sense by speed…by just existing and speeding up that process I guess it does kind of put us the midst of a crisis. But it would always, it would have always been a crisis, it just wouldn't have been as apparent. (WFI989: 299-321)

Hypothesis 2: Students with an Orthodox Christian Worldview Will Use Language Consistent with That Worldview to Describe Their Environmental Beliefs and Attitudes

Of the ten students comprising the OC+ quadrants, only five actually use their orthodox Christian worldviews to help provide an explanation of their environmental beliefs and attitudes. Of these five, two are from NEP+/OC+ quadrant and three from the NEP<+/OC+ quadrant. None of the students in the OC<+ quadrants use language consistent with an orthodox Christian worldview to describe their environmental beliefs and attitudes. The excerpts below provide examples of support for the use of orthodox Christian language when describing environmental beliefs and attitudes.

Q1) Positive NEP/OC

Anne. Anne believes that our world is in trouble environmentally. This is of great concern to her and something that she thinks about quite often. Though she does not consider herself to be very religious, she believes that her upbringing and the beliefs of both her mother and grandparents have influenced her greatly, especially their religious beliefs. She uses these beliefs, which she has accepted as her own, to assist her in the interpretation of what she sees happening environmentally in the world around her.

> I think that a lot of scientists and a lot of people in general are taking things to an extreme level with biological advances and advances in medicine that is taking it in a different direction. And in advances in ways we get rid of our waste and cover up problems. I have a little theory, it's kind of extreme my theory, but just that, when I did the survey it was relating to religion and to my ideas about God…My theory is that we're going to, kind of will, ultimately contribute to our own demise because we are taking things too far. We're taking things that are supposed to be left up to God into our own hands and we're going to screw everything up. (WFA861: 59-70)

Biblical analogy to environmental issues:

> I just think that's too much. That's taking things that are supposed to happen naturally and surprisingly into your own hands. And then I got to thinking about how Noah's Ark and how God had flooded the earth and just wiped everybody out and how He said He would never do that again. And then I just thought you know, He's never going to do that again, what's going to happen? The violence, and the destruction of our natural resources and taking our own land and making it land fills and dumping things into our water and oil. . . There are more efficient ways to do things, and people are not looking for those more efficient ways. They're looking for the convenient ways – it really makes my blood boil and really bothers me. (WFA861: 99-120)

Humans and God's interaction:

> Like we talked about global warming, and then we talk about all the scientific things that go into that. And then I think with they're being a higher Being, how would a higher Being let this happen? Then I think about our own destruction, how were eventually going to lead to our own demise because we just can't say " that's enough." (WFA861: 374-384)

Lisa. From Lisa's perspective, God created the world and everything in it with a

specific purpose and function.

> God created this world the way that it is and He did it for a reason. I don't think that we as people that live on the earth have the right to change what He obviously has decided needs to be the way that goes…I have to trust that God knew what he was doing when He built the earth the way that He built. Far be it from me to tell Him that He was wrong. Or anybody else. I think that we should do our best to keep it as much as possible the way that He has created it. (WSL867: 382-388, 410-417)

As Lisa sees the interaction between her orthodox Christian faith and the environment,

> I mean, it all comes, bottom line like I said before, it all comes down to he created it this way for a reason. And I really have trouble believing that he wants the global warming and the ozone problem and nature to be destroyed. That just doesn't seem like it's his way, so as my faith will not allow me to believe that that's what he wants as an outcome…You know, things that I have heard, things that I have seen, the way that I grew up, my beliefs, my values, to be able to take care of these issues so that everyone else down the line can enjoy them. (WSL867: 908-925)

Q3) Neutral-Negative NEP/Positive OC

Diane. Diane makes the greatest use of her orthodox Christian worldview. The following illustrate how Diane uses her orthodox Christian worldview beliefs in conjunction with her ecological worldview beliefs.

Bible as the source of all truth:

> Well, most people would probably consider me very narrow minded, but I believe that the way we view our worldview comes from the only source of truth, which I believe is the Bible. I've been called narrow-minded, I've been called that several times in classes of mine, but I believe that's the only way we can look at the world. So, viewing the world through the truth as God has revealed in the Bible. (WFD047: 92-103)

> Yes, I don't think our world is getting better, as the result of sin, the result of the fall. I believe that …I mean the word of God tells us that there is none that do good, no not one. That yes, of course with a planet filled with a bunch of sinners we're going to make mistakes and there's going to be problems. (WFD047: 103-111)

God is in control:

> I'm not so concerned about global warning, warming. If it ever does

happen, it'll happen a long time from now. And I guess the best way to look at the worldview concerns, is that God's in control.

You hear research, you, you read about it in articles and …they conflict with each other sometimes too, big time. But again, it's not a concern to me. Not meaning that I'm like…could care less about what they're doing, I don't mean it that way. It's not a concern because I know God's in control. So may be we are. But then again that will be in his providence and He will use it for His design. (WFD047: 111-117; 377-389)

Human Population:

…the world is groaning to be delivered from sin. And as more and more population…I mean population, sure that's a big…they portray it as a very big concern…and I think that before something huge happens, I mean maybe that's what the end of the world is going to be like. I don't know. But the Lord is going to return. You know He's told us what to expect and if you are a child of God, you have nothing to fear. But if you don't, I guess…I would be very concerned. (WFD047: 137-150)

But in terms of population coming to a limit…it's something I'm not worried about, as I mentioned before the Lord knows how many people he has ordained to be on this earth. It's not something I'm losing sleep over. (WFD047: 183-190)

In relation to natural resource consumption:

And I mean, they portray this…I think they portray it, sometimes environmentalists --- people. I don't know if that's the word, correct term to use but they, they present…prevent…present it as a big fear and something we should be really, really concerned about…And again back to the worldview, it's not something I'm concerned about. May be, may be someday we will run out of resources. But then I believe the Lord will provide. (WFD047: 231-244)

The resilience of the natural world:

I think that's one of the beautiful things about nature and that's one of the beautiful things about the Creator, is that, not always and I understand that. I mean, oil spill or ground water contamination. I mean, things like that take a long time to clean up and the impact is huge. But, the amazing thing is that …I mean, just this is the picture that pops to my mind. You can see … a road, a parking lot paved with asphalt, right? A beautiful thing is that years later a little seed can pop through that hard asphalt and grow into a tree. I mean, just think, that's so cool! But I don't know if that really addresses the question, but…I think nature is resilient. I thing that's built in it and I think that's a very important principle of nature. But then again, some human…effects are har…so deep that they may take years and years to be cleaned up, to be controlled, whatever. But I thing it's really neat how creation runs on its

> own. I mean, there's not one person in charge…I mean God is in control, but I mean He's formed creation through His providence. I runs, you know…the water cycle and all of that, it just purifies itself. Now of course it could take years, but I thing it is resilient. How many years it takes I don't know. (WFD047: 599-633)

Human stewardship covenant:

> Biblical stewardship is definitely a principle… You know we had to take…we were taught to take care of things, whether it just be our own bikes, you know to a tree…So yeah, that plays an important role too. And if anyone's a Bible reader and maybe I'm just even more interested in it, so it pops out at me. The Bible's just full of references to nature and examples taken from nature and about stewardship and creation. So, if you're a Bi…a studier of the Bible, you can't help but catch on. (WFD047: 565-587)

> As I said, I love nature and so of course I would rather not see an endangered species wiped out. Because I think they're beautiful, I think they're beautiful. I think that nature is given for us to glorify God through. But at the same time it's given for us to use as stewards. So, I would guess it would depend on what your purpose is for…whatever it is to endanger those species. Again if it's for your won greed, well then maybe that's not necessary.
>
> So, as a being part of God's creation, I think that they hold a very important role and they are to be respected for that, but not glorified for it. And so, in terms of rights versus humans, well, we are over them. So, right…a right to be respected, but not necessarily a right. They can't determine our lives. (WFD047: 302-327)

Linda. Linda only uses her orthodox Christian beliefs in relation to the use of natural resources. As she initially expounds on the issue,

> I think, I think…I believe that these things were put here for us, so I think that we have rights to use them, but in order for them to stay here and for us to use them, we have…you know, we have to protect them. (WFL024: 304-310)

After this initial idea of "being put here for us," Linda develops her idea further by saying, "I think God put plants, put animals for humans…to use" (WFL024: 315-316).

Penni. Penni uses the idea of God giving humans the resources to use, but that we should not abuse them. However, Penni does not limit this to plants and animals, but expands it to other parts of the Creation.

Natural resources are God-given:

No I think we need to respect it. I think that's what we're doing now is using what ever we want. Because we're not res…I mean we're throwing away junk, trashing it, because that's what we want to do. We're putting up huge buildings that pollute…and just because we want to. So I don't think. I think that's what we're doing now. I don't think that's right though. I don't think that…that's for us to say. We should be using the resources we have than rather trying to…be selfish it about it I guess…is the right word.---God decides what He gives us. And He did give…He gave us all this you know to use and we're abusing it. So I don't know what else to say.

Well sure we're God's people and so the environment is God's too. This is like His…His land and we're His people. So I think that…yeah it is. It's not really…I mean He, he put us here for us to use it, but we're doing what we want. And I don't think people really think about when they go to put a building up or when they go to…I don't know, dump oil somewhere that they're thinking about hmm what is this doing, what kind of effect does this have? They're more like what do I want, I need to get rid of this. Like…more than just like me, I want to get rid of this, how can I do it? They just do it, or I need or I want this, I want that. So I don't think that…I think that we're more doing it on our wants right now; that we're thinking that, you know, like we're God and we can do whatever we want. But I think when it all comes down to it, they're going…everybody's going to find out the truth; in the end. (WSP022: 366-424)

End-times and ecological issues:

Population and pollution

They would rather just go where the city is and that often cause more pollution. So I can see how the scientist would say that we're reaching close to the end. I mean there are signs that say we are reaching close to end with the wars that going on now. And it says that in the Bible that we're reaching close to the end. And it tells you…you know it's kind of interesting of how you look at like what's going on in the world news and then you refer it back to the Bible. And its going…its corresponding right with it. You know? So I guess I would say, yeah we are reaching close to the end of the ---. (WSP022: 248-265)

Global Climate Change

But it's too late, there's no way to stop it, but we could possibly slow it down now, if people would take action now. It's not too late to stop it or to slow it down. Once something starts warming up, there's not really a way to stop it. But I don't know, I don't what else causes it besides you know, I guess going back to the Bible. You know it kind of talks

> about…I don't know if it makes reference to global warming, I'm trying to think of Revelations. I'm not sure if it talks about global warming but all of the other stuff that's going on around…kind of relates to it so it's possibly in there. I'll have to go back to the Bible and read it and see. But I'm not sure. I don't know if that helps answer your question.

After her statement above, she was asked if an issue such as global climate change was a problem we should deal with because the Lord was coming back. She responded,

> You know He may come back tomorrow, but He may not come back until after you're gone, I mean after you've already passed away and gone in heaven. And you have to live here until you go to heaven and you can't live here if you're having a problem of global warming or if your resources are gone, you wouldn't be able to live. So no, I don't think that's right. I just hate that…I mean yeah we're not going to be here for long, but you don't know that, no one knows that answer but God. So why abuse something because the Bible says that you're not going to be here for long, when you don't know, it says that He…could be here today, He could be here tomorrow. He could come back a hundred years from now, nobody knows. Won't know until it happens.

Because she has gone to church her entire life, she believes that these orthodox Christian beliefs influence her everyday life and her views on ecology (WSP022: 757-774).

Hypothesis 3: Non-orthodox Christian Students will Use Language Consistent with Other Worldview Perspectives to Describe Their Environmental Beliefs and Attitudes.

The identification of worldview language consistent with a non-orthodox Christian worldview is more difficult than identification of the language used by orthodox Christians. However, there are statements made by students in the OC<+ quadrants which may be considered indicative of a non-orthodox Christian worldview belief. The statements excerpted below come from three students in the OC<+ quadrants. All statements are representative of a naturalistic worldview perspective. Two statements are made by students in the NEP+/OC<+ quadrant and one by a student in the NEP<+/OC<+ quadrant.

Q2) Positive NEP/Neutral-Negative OC

Mary. Looking at the idea of anthropocentrism from a non-orthodox Christian worldview, Mary uses language consistent with a naturalistic worldview to show why humans are dominant over other species.

> Well it seems like we are the dominant role and obviously it's…we are. And I think our roles as it is right now it seems to be like we're hurting the place where we need to live and what we need to support us. But I think we, we need to turn that into, we need to support what it is that keeps us alive and that helps us to continue to evolve.
>
> Well I, I think that we need…to…you know protect it and there's a limit. As we kind of talked about before, as to…you know how, how much can the earth support us as we continue to go now? And you know I think that as humans and as you know the most evolved being or whatever, we have the capacity to kind of co-exist and support one another just as you learn like with the food chain and everything. We never see…or we never really learn how people fit into that, but like I think that we have the most important role because we're the ones that seem to be altering it the most dramatically. So if…you know if…if we…if we don't support what the earth natural does then…you know it…we're ultimately going to be the one that pays the price. (WFM029: 238-247, 260-280)

Barb. Her statements give an impression of a survival of the fittest, with humans being the fittest and therefore dominating other species because of this fitness.

> A lot of times we do [take precedence over endangered species] just because they can and the plants don't have a voice in the same way that people do. I don't know, a part of me says that you know humans do have a greater right because it's kind of the way that it's always been. And we need…we do need those environments in a way to support ourselves and sustain our existence as humans. But I don't think that the plants and other environments are without rights themselves. And that's why a lot of people are advocates and things like that for those particular environments. (WFB473: 231-253)

Q4) Neutral-Negative NEP/OC

Kelly. In talking about resource use and the availability of resources for the future, Kelly uses language which would indicate a worldview perspective which is not orthodox Christian in nature, given the comments made about the same topic by

orthodox Christian students in the previous section.

> Well…I don't know. I don't know, some resources like…I mean like water, it's the same water that's been here for billions and billions of year, I don't think we're going to run out of water. Oil and stuff like that, like I don't…really know how that…I mean that just comes from the ground, right? That's not really like made…so it's kind of a…so I don't know may be we'll run out of something like that. I…like I don't really know like the statistics on like that stuff so I don't really. But…I don't know, like I don't feel like we're in jeopardy of like…but I mean there's different, you know I mean everybody has something to share…and so…I mean eventually somewhere down the line millions (of years) from now we'll probably run out of things. (WFK965-- Lines: 242-266)

CHAPTER V

DISCUSSION AND CONCLUSIONS

An evaluation of the students in the four quadrants shows that while distinct differences exist between the quadrants due to beliefs and attitudes on orthodox Christianity and ecological worldview perspectives, some similarities also exist. The results indicate that student environmental beliefs and attitudes are complex and multidimensional. For most of the ecological dimensions and issues examined in this research, the consistency of student responses tends to fluctuate across the ecological worldview continuum depending on the dimension or issue under discussion.

The Relationship Between an Orthodox Christian Worldview and an Ecological Worldview

The Views of NEP+/OC+ Students

The views of NEP+/OC+ students are unique in the sense that there seems to be a struggle between their beliefs as orthodox Christians and what they want to believe about the environment. The survey showed there is no correlation between a NEP+ and OC+ worldview. Thus, it is not only students from one end the NEP continuum who have this struggle, but rather there seems to be a mix of ecological worldview beliefs among even those with a NEP+ worldview. An examination of the ecological dimensions and issues indicates there are some areas where students in this quadrant are more likely to give support to a positive ecological worldview than others.

One belief students do share strongly is that there is an ecological crisis. Though there may be some disagreement on specific issues, all of them believe the

human race is facing an ecological crisis. Their focus on ecological crisis seems to be on the role technology and business play in the creation of this crisis. However, there may be certain issues with which they do have problems. For instance, Randy's response on the existence of an ecological crisis was very strong, but when questioned about global climate change, he was in disagreement with the idea that global climate change is an issue.

NEP+/OC+ students also show a strong ecological worldview perspective on the dimensions of ecological limits, ecological balance, and on the issue of global climate change. In fact, in relation to other NEP+ students, the NEP+/OC+ students' interview responses show a much stronger belief in the ecological balance dimension (Table 15).

Table 15. Summary of Expected Responses of Students to Ecological Dimensions and Issues

	NEP+/OC	NEP+/ OC<+	NEP<+/ OC+	NEP<+/OC<+
Crisis	+	+	=	=
Limits	+*	+*	+	+
Anthorpocentrism	-	-	=	+
Balance	+*	-	+	=
Population	-	-	=	+
Endangered Species	+*	=	=	=
Global Climate Change	+*	+*	-	-

+ expected response from entire quadrant; +* expected response from majority of quadrant; - unexpected response from majority of quadrant; = equally divided response from members of quadrant

However, on anthropocentrism and the issues of human population and endangered species, the NEP+/OC+ students took a different perspective than their OC<+ counterparts. NEP+/OC+ students were much more likely to take views which placed humans in control of the natural world. This idea of human control of the natural world was also present in their responses to interactions between humans and

endangered species.

This dimension of anthropocentrism was a significant difference between NEP+/OC+ students and NEP+/OC<+ students in the initial survey. While the difference was still present among interviewed students, the NEP+/OC+ responses indicate a struggle occurring between the students' OC worldview and NEP worldview. The recent findings of Nooney et al. (Nooney, Woodrum, Hoban, & Clifford, 2003) may explain some of this difference between the survey and interviews. They found the NEP survey's wording on the statements dealing with anthropocentrism tend to be written in such a way as to prompt students with a OC+ to respond with a neutral-negative response.

Even though the difference between OC+ students and OC<+ student responses on the survey can be explained, students in the NEP+/OC+ quadrant were still more likely to place humans on a level above the natural world than were NEP+/OC<+ students. This surfaces in both the responses to questions on human rights versus the rights of other living things and on responses to the specific endangered species questions. This is not surprising given the values of an orthodox Christian worldview toward human dominion (Passmore, 1974). A reading of the Bible does show God giving humans a dominion role in the order of the natural world, as described in the biblical book of Genesis. What is at issue is the interpretation of this dominion role in relation to the natural world. Many orthodox Christian researchers who are active in the environmental movement do not see dominion as a negative. Marsch (2002) notes that "It is necessary for Christians to implement a more biblical concept of dominion, entailing a peaceful and beneficial co-existence with creation while extending our mastery over it, and a fulfillment of the mandate will come when this worldview comes to be society's" (p. 188). Others (DeWitt, 2002, Schaeffer, 1970) have also written that the biblical concept of dominion actually places a greater responsibility on Christians to

be stewards of the Creation because they will be accountable to the Creator. Thus, while those coming from a non-orthodox Christian perspective may see anthropocentrism as a negative aspect of an ecological worldview, many orthodox Christian researchers actually see an anthropocentric value as a necessary and important part of a positive ecological worldview. This ecological dimension is a difficult one for OC+ students. Most orthodox Christians see the world as something that God has given them to use. However, in the face of biodiversity loss, many students struggle with these concepts. Four of the six students actually have seemingly contradicting statements in this dimension. In one sense, many students see the rights of human dominion of the earth, yet, on the other hand, sense a need for protection of the earth's biodiversity. They struggle to find the balance between their orthodox Christian worldview beliefs and what they understand is needed for an ecologically sound planet. It is as if the worldview "roadmap" suggested by Wolters (1996) has become difficult to read. The unconscious and unarticulated aspects of the foundational worldview principles and the articulated ecological worldview statements often disagree with each other. This may be because orthodox Christian students are adept at using their orthodox Christian worldview to articulate their views on many other subjects (abortion, creation/evolution, etc.), but have not developed an understanding of how their foundational orthodox Christian worldview beliefs correspond with their beliefs and attitudes about the environment. Consequently, conflicting statements arise, showing the struggle between the two perspectives. As educators, it is important to understand students may come to the classroom with conflicting views about some ecological dimensions and issues. The way in which these are presented may trigger either type of response. Therefore, this demands an evaluation of the nature of the anthropocentric views of students with an orthodox Christian worldview to determine if their views incorporate a biblically-based understanding of human dominion or if they represent a view based on materialistic

dominion of the natural world for human gain.

However, NEP+/OC+ students are not the only students who struggle here. These discrepancies between ecological worldview beliefs are also found in other quadrants. These are found most conspicuously in the NEP+/OC<+ and NEP<+/OC<+ quadrants in regards to anthropocentrism and in the NEP+/OC<+ and NEP<+/OC+ quadrants in regards to human population. Considering the conservative nature of this study's geographic region and the historically underlying Judeo-Christian belief structure of the United States (White, 1967), these issues remain challenging in relation to foundational worldview beliefs among the various quadrants.

Views of NEP+/OC<+ Students

Not unexpectedly, the survey of students in this quadrant showed there is very little evidence of a correlation between students' orthodox Christian and ecological worldviews. In fact, in the interviews, the difference between NEP+/OC+ students and NEP+/OC<+ students was not very noticeable. Like their other NEP+ counterparts, the students' comments were generally indicative of a NEP+ worldview. On the dimensions of ecological crisis, limits to our natural resources, and global climate change, students in this quadrant take a consistently NEP+ worldview perspective. However, just as was the case for the NEP+/OC+ students, there were areas where the students in this quadrant varied their responses from what would be considered a strong ecological worldview position (Table 15).

Like the NEP+/OC+ students, these students struggle, though not as intensely, with the dimension of anthropocentrism. Three of the four students indicated in their responses that a balance is needed between human rights and the rights of other living things. What is interesting in these responses is how the students believe the natural world needs humans for its survival. All three of the students seem to indicate that there

is a dependence of the natural world on humans for us to look out for their welfare. This also applies to endangered species and the interactions between endangered species and humans. Thus, as mentioned previously, this perception of human dominion over the natural world is not limited to students with OC+ worldviews, but can be found acting on the ecological worldview beliefs of students who are not from an orthodox Christian background.

Another area where the NEP+/OC<+ students differed from their NEP+ counterparts was in the dimension of the resilience of the natural world to human impact. Students in this quadrant believe the natural world has much greater ability to respond to human intrusions. From their perspectives, the natural world is resilient because it has the ability to fight back against human impact. One student uses a Gaiaian anthropomorphic suggestion that when the human world intrudes too far, the natural world fights back against the intrusion. Another holds the idea that if the natural world has survived this far into the industrial revolution of humans, it will be able to withstand more human influence. While these ideas are indicative of a more NEP<+ worldview, it shows students, while believing in an ecological crisis, may not link the impact of the ecological crisis to the inability of the natural world to flex with the exploitation of humans.

Views of NEP<+/OC+ Students

The views of the NEP<+/OC+ students were more likely to be couched in orthodox Christian worldview language than their counterpart OC+ students with a NEP+ worldview. This seems to be indicative of responses garnered by both Kellert and Berry (1982) and Eckberg and Blocker (1996), who concluded that the more fundamental the orthodox Christian, the less positive their ecological worldview. The greater use of orthodox Christian language in these student responses would seem to

indicate that these students have more training in the use of their orthodox Christian views than OC+ student in the NEP+ quadrant, and may therefore fall into a more fundamental category than OC+ students in the other quadrant.

Their responses were also more likely to extend across the entire ecological worldview continuum than any of the other groups (Table 15). Of the seven dimensions and issues investigated, there is only one dimension in which hypothesis for NEP<+/OC+ students is supported – that of limits to natural resources. On the other six dimensions and issues, the NEP<+/OC+ students responses are across the ecological worldview continuum.

For instance, on the dimension of ecological crisis, two believed there was no crisis or that a crisis was coming, while one believed humans are in the midst of a crisis and one was unsure if there was or was not a crisis. Their responses are indicative of the variety of beliefs in this category.

Diane developed her ecological worldview belief in the unimportance of an ecological crisis using her orthodox Christian worldview beliefs. From her perspective, it is not an issue because God is in control and He will be taking all Christians out of this world when He returns. This idea of God being in control (which in and of itself would be agreed on by almost all orthodox Christians) is a common one among students of this quadrant. Whether it is a crisis, the use of natural resources, issues related to human population, or global climate change, the students in this quadrant often refer to the control God has over these situations. With God in control, they believe He will handle the issue and therefore they do not have to have to be concerned or take action.

On the other side of the continuum, many times students in this quadrant also take NEP+ ecological worldview stands. On the issue of human population – a highly charged issue in orthodox Christian circles – two of the students in this quadrant take

NEP+ stands on the issue saying there are too many people and that the resources our planet has are not sufficient to support a continuously growing population. Yet, these same students note in other places in their interviews that there are no limits or few limits to the availability of natural resources on the planet. This once again shows making a connection between different issues are very weak in students. They often do not connect one issue with another or see the ramifications one ecological factor has with another factor. Creating these links between issues is an important aspect of environmental education. However, given the conflict between issues like human population control and orthodox Christian beliefs in the right to life, it is also important for educators to understand how these orthodox Christian beliefs effect student understanding of the issue and to work to equitably develop instructional solutions which will address the issue from these multiple viewpoints.

Views of NEP<+/OC<+ Students

The NEP<+/OC<+ students were the most consistent of the four quadrants in their responses. In four of the seven dimensions and issues studied, the students in this quadrant agreed with each other. As was the case in other quadrants, the dimensions and issues of ecological crisis, the resilience of nature and issues related to endangered species show instances of both NEP+ and NEP<+ responses. However, the conclusions developed here are tentative at best. Given this quadrant only has two students representing the viewpoints, these conclusions can only act as a starting point for future research of students with this mix of worldviews.

As the NEP<+/OC+ students use their orthodox Christian worldview to guide many of their responses to these ecological dimensions and issues, so too, the students in this quadrant use naturalistic worldview perspectives to defend their NEP<+ perspectives. For instance, Kelly uses her naturalistic worldview perspective to defend

her belief about not having to be concerned about an ecological crisis. From her perspective, there may be a long-term problem, but because it has taken billions of years to occur, there is no need for concern. Their statements on natural resource use and endangered species reflect these same types of belief dichotomies. This illustrates the verity that two students with similar beliefs about an issue may be coming at that issue from very different perspectives based on their foundational worldviews. If this is the case, educators need to exercise caution when evaluating student responses in the classroom, as the groundwork for the response may be a foundational worldview perspective other than what is expected. Seeking clarification from the student is necessary if the educator is to understand how the student has situated their statements. It is also necessary in order for the educator to develop instructional strategies which will address these concerns and permit the possibility of cognitive change to occur.

Interactions Between an Orthodox Christian Worldview and Environmental Beliefs and Attitudes

While one aspect of this research has been to understand how students from fundamentally different orthodox Christian and ecological worldviews compare and contrast in their beliefs, another has been to determine how OC+ students use their orthodox Christian beliefs to respond to ecological worldview dimensions and issues. The results show orthodox Christian students do not necessarily make visible use of their OC beliefs in talking about their ecological worldview. In fact, in most cases, OC+ students used their OC beliefs very little in discussing their ecological worldview beliefs. There were two obvious exceptions to this in the NEP<+/OC+ quadrant. Diane and Penni made a much greater use of their orthodox Christian worldviews in relation to their ecological worldview than did the majority of the NEP+ students. Only two NEP+/OC+ students made obvious use of their orthodox Christian worldview beliefs in

their responses, and then only minimally. The question then arises as to why students who have strong orthodox Christian worldview beliefs only make minimal usage of those beliefs in defining their ecological worldview.

First, it is instructive to look at how students do use their orthodox Christian worldview in relation to their ecological worldview. First, as recorded earlier in this chapter, orthodox Christian students tend to hold a much stronger belief in the dominion of humans over the rest of the natural world than do students with non-orthodox Christian beliefs. This flows from the Biblical belief that humans are created in the image of God and that God has given human beings dominion over the rest of the natural world (Genesis 1:26-30; 2:15). Secondly, orthodox Christian students use their worldview as a means of providence. That is, God is in control of everything and because of this, environmental problems which may affect the world are not a concern. Diane's interview supplies a number of these statements based on the biblical concepts of God's providence and oversight of all that occurs (Job 38-41; Matthew 7:7-8). A third use of the orthodox Christian worldview comes through the use of language which denotes that the end-time of the human race is coming and that environmental problems are a sign of the end-time or environmental problems are not a concern because of the return of Jesus. This generally stems from an interpretation of the biblical book of Revelation and other end-time prophecies and interpretations of 2 Peter 3:7-13 which addresses the end of time and the destruction by fire of all things on the earth. These are the three main themes used by orthodox Christian students at various points in the interviews. However, if an orthodox Christian worldview provides the foundational presuppositions for a student's belief structure, why do students in these interviews not use it more prevalently, and why are these three themes mainly used?

In addressing the verbal use of the orthodox Christian worldview, I believe many students may not see their ecological worldview beliefs at the same level of importance

as their orthodox Christian worldview beliefs. Wittmer (2001) has proposed that the worldview of a student contains various levels of regression and that some beliefs have a greater level of importance than other beliefs. It is when the beliefs from the outer edges of a worldview begin to touch on the foundational beliefs (such as the orthodox Christian beliefs of the students in this research) that the foundational beliefs make themselves more noticeable in discussion. As such, many orthodox Christian students may not have reached a point where they see their ecological worldview beliefs as touching on their foundational orthodox Christian beliefs. Keil (1991) observes that the relationships between some beliefs are more cognitively natural than others. Thus, many students with orthodox Christian worldview beliefs may not be making a cognitive connection between their orthodox Christian beliefs and their ecological worldview beliefs unless there is an issue which directly touches on their orthodox Christian beliefs. Students such as Diane and Penni are more cognitively aware of this connection and thus make the connection between their orthodox Christian beliefs and their ecological worldview belief much more readily than other students who hold the same orthodox Christian worldview.

Orthodox Christian worldview and ecological worldview touch most frequently in the three areas of dominion, control, and end-times mentioned above. The rationale for these three touch points between orthodox Christian and ecological worldview beliefs can be explained by looking again at the main purpose of a foundational worldview. Orr (1897) stated that a foundational worldview focuses primarily on issues related to origin, purpose, and destiny. Orr's definition provides an avenue of explanation for each of the ways students use their orthodox Christian worldviews in the interviews. First, human dominion over the created world revolves around one of the primary purposes of humankind as seen by orthodox Christian worldview. According to Blocher and Wittmer (2003), the dominion of humans over the rest of the created refers

to the "cultural mandate" for humankind. God gave humans dominion over the rest of the created order by giving them a purpose for their existence. God's mandate to "subdue" and "rule over" the earth is a partial fulfillment of this purpose. Thus, when confronting orthodox Christian students with ecological worldview beliefs which contradict with or subsume their original cultural mandate, they cognitively activate and use their orthodox Christian worldview to explain why they believe humans interact with the natural world in the way they do.

Placing God in control of all ecological problems is a bit more problematic. This may be a way of dealing with ecological issues without having to deal with them. It contradicts the cultural mandate and the responsibility of humans and allows for misuse by promoting the idea that since God gave the earth and its resources to humans for their use, He will always provide for our needs despite our irresponsibility. While most orthodox Christians would agree that God is in control, they would also not negate the human responsibility for stewardship of the planet (Van Dyke, 1996; Nash, 1991; Santmire, 2003). That is not to imply that an orthodox Christian worldview suggests a "back-to-the-earth" model, as proposed by many left-wing environmentalists, but rather a responsible use of the materials.

Finally, the end-times references by orthodox Christian students come from a touching on the worldview perspective of destiny. In terms of the orthodox Christian worldview, many Christians believe that at the end of time, Jesus Christ will return for a judgment of sin in which fire will consume the earth (2 Peter 3:7-13). With the final destiny of the earth ending in destruction, many orthodox Christians do not see purpose in conservation of the earth's resources (Bouma-Prediger, 1995). From their point of view, if the world is to be destroyed, what does it matter if there is pollution, overpopulation, global climate change, and other environmental problems? In fact, many orthodox Christians, as evidenced in the students interviewed, welcome these problems

as a sign that the end of time is coming and that Jesus Christ is returning. However, more recently, many orthodox Christian scholars have been challenging this total destruction and have instead noted that a mistranslation of the biblical text has misled orthodox Christians (Wolters, 2003; Bouma-Prediger, 1995). Instead, they assert that while judgment will occur, the fire is a purifying fire and that the role of the orthodox Christian is to be Christ's cleansing agent, especially concerning the environment. They suggest that orthodox Christians have not played the role they should have been playing all along (DeWitt, 2002; Bouma-Prediger, 1998; Bouma-Prediger, 1995; Van Dyke, 1996; Wolters, 2003).

Thus, when an ecological worldview touches on the foundational worldview of an orthodox Christian, students are more likely to invoke their orthodox Christian worldview beliefs in their discussion. These foundational worldview beliefs seem to act as Cobern (1996) has suggested, with scope and force for the student. When confronted with ideas which may conflict with their foundational worldview, the foundational worldview provides the basis for how the student perceives the scientific explanation and thus becomes a more important part of the response than the use of scientific knowledge.

However, when students do not feel that their orthodox Christian beliefs impact their ecological worldview beliefs, they are less likely to invoke those orthodox Christian beliefs in their responses. This point leads to two key conclusions about the role of orthodox Christian worldviews in the development of ecological worldview. First, while a contentious factor in some of the sciences, orthodox Christianity may not be a major factor in hindering students in the development of ecological concept formation and relevant environmental issues. Yet, secondly, here also may lie part of the problem in getting orthodox Christian students involved in citizenship actions which will actually influence the environment. Because orthodox Christian students tend to focus their lives

on "living for Christ," they may not see the importance of involvement in activities which enhance environmental quality. Orthodox Christian students need realize that all ecological problems do touch on their foundational orthodox Christian beliefs. Only by creating this link will students with orthodox Christian beliefs apprehend the important role they play in the preservation of the planet's ecological balance.

Interactions Between a Non-Orthodox Christian Worldview and Environmental Beliefs and Attitudes

While the orthodox Christian worldview response to environmental issues gives one perspective for students' views on an ecological worldview, the same allegation can be made of students with OC<+ worldview perspectives. While White (1967) contends that the roots of our ecological crisis are founded in orthodox Christian worldview beliefs, some of the statements made by students with OC<+ indicate that another more naturalistic explanation is sometimes used.

Heinen and Low (1992) noted that "natural selection has shaped all living organisms to exploit resources effectively…"(p. 105). Students also use this reasoning to explain the role of humans in environmental degradation. As Mary noted in her comments (p. 135), the ability of humans to dominate the ecological world is part of what enables our evolution. Yet at the same time, she acknowledges that humans also have the ability to check themselves. Heinen and Low's research seems to indicate otherwise. In their view, the hording of resources and the competition in today's world are a carryover from past evolutionary times when humans lived in competition with each other. Thus, the ability to check ourselves, from a naturalistic worldview perspective, may not be in our "human nature."

Kelly (p. 136) also used this naturalistic worldview model to justify the current use of resources. From her perspective, the resources we use have been here for billions

of years and because they have been here for so long, it is unlikely we will run out in the near future (millions of years from now). This naivety is more of a lack of understanding of ecology and the actual resources than a strong worldview statement. Yet the naturalistic nature of the statement shows students are also using this worldview to make sense of environmental issues.

The question then is how to use this understanding of worldviews, especially the orthodox Christian worldviews of students to enhance and strengthen environmental education pedagogy. Though White (1967) may have blamed orthodox Christianity for leading to our current environmental situation, he also gives a key for the solution in his final statement – one not often considered in relation to the rest of the claims he makes in his seminal article.

> Since the roots of our trouble are so largely religious, the remedy must also be essentially religious, whether we call it that or not. We must rethink and refeel our nature and destiny. (p. 1207)

Other Issues Relevant to the Development of an Ecological Worldview

The discussion thus far has focused on the interactions between worldviews. However, there were some other issues, found across all of the quadrants, which also have the potential to impact the development of a positive ecological worldview. For instance, on the issue of global climate change, while students across all of the quadrants believe global climate change was an issue, many students use recent meteorological observations as support for their beliefs. This was not unique only to the NEP+/OC+ quadrant, but to all of the quadrants. Many of the students base their belief in "global warming" by referencing events occurring within the past days, months and years. Rather than basing their beliefs on scientific data collected over decades and centuries, students seem comfortable using memories from their lifetimes (some as recent as the day before the interview) to provide evidence for the existence of global climate change.

However, experiences and the perspectives of the time period may color these memories. For example, what seemed like "a ton of snow" back when a person was five may not seem so great from a current perspective. While it is important to acknowledge that the students' memories provide important perspectives to issues, they must also understand that an issue as complex as global climate change cannot not be supported primarily by their lifetime memories.

While the use of memories to explain global climate change is found across all quadrants, so also is the merging of information from different environmental issues. In providing explanations about global climate change, students from all of the quadrants mix the issues related to these global atmospheric changes and their subsequent consequences with issues related to the loss of atmospheric ozone and their subsequent consequences. Two commonly used pieces of evidence are the existence of a hole in the ozone layer and the increase in ultraviolet radiation. A common alternative conception is the use of evidence on the loss of atmospheric ozone to explain global climatic change. Others have also noted the use of these concepts (Boyes, 1995; Boyes, 1993; Boyes, 1994; Boyes, 1998; Boyes, 2001). In addressing this conflagration of various environmental issues, Boyes (1993) notes,

> One task of educators will be to disentangle these various issues, without adopting a completely nonholistic approach, which is seen by many as a contributing cause of environmental insensitivity. This task will not be easily accomplished, in view of the fact that the misconceptions are embedded in an alternative framework of high conceptual inertia. p. 556

The problem here is that complex environmental issues, such as global climate change, which depend on complex modeling, may be difficult for students to comprehend. As such, the evidence provided on the issue may not be sufficiently explanatory for the student to make a decision. Interviewed students who were "unsure" that global climate change was an issue (though they understood some of the supporting evidence) desired more "proof" that it was an issue. They wanted more

evidence than the simplified explanations which scientists use to explain the complex models used in monitoring the issue. Understanding this complex evidence, however, is not possible without first having an understanding of the ecological, atmospheric and hydrological concepts which underlie the study of global climate change.

Not only is the use of everyday memories at issue here, but also the general lack of an understanding of ecological principles on which to base these environmental beliefs and attitudes. This lack of understanding was not associated with one particular ecological dimension, issue, or quadrant investigated, but could be found in various student responses from every quadrant. However, on certain principles, students revealed that they had an inadequate understanding of the foundational ecological principles. Some of these key ecological principles included the renewablility of natural resources and what constitutes a renewable and non-renewable resource; the ecological importance of species within ecosystems; the ability of natural systems to respond to the ecological impacts of humans; ecological carrying capacity; and the relationship between atmospheric systems and ecological systems. These principles are important in the understanding of the ecological issues facing the planet today. Without an adequate understanding of them, making an informed decision on environmental issues is difficult. This lack of understanding is not new. Others also have reported similar findings on the lack of knowledge of ecological principles (Boyes et al., 1993; Boyes and Stanisstreet, 1994; Boyes et al., 1995; Boyes and Stanisstreet, 1998; Boyes and Stanisstreet, 2001; Carey, 2000; Griffiths and Grant, 1985; Griffiths et al., 1988; Dove, 1996; Driver et al., 1994). Arcury and his colleagues (Arcury, 1990; Arcury, Johnson, and Scollay, 1986) also have linked a lack of knowledge of ecological principles to environmental attitude. This is not to say that a building of a knowledge base of ecological principles will lead to a change in ecological worldview in students, but it may play a role. Developing an understanding of ecological principles combined with

educators understanding how foundational worldview beliefs touch on ecological worldview beliefs may play a major role in developing a citizenry who understands the role of human impact on the ecological systems.

A Pedagogical Response to the Interaction of Orthodox Christian Worldview and Environmental Beliefs and Attitudes

The primary purpose of this study has been to develop an understanding of the interaction of foundational worldview beliefs (in this case orthodox Christian worldview beliefs) and environmental beliefs and attitudes. These interactions can be key in the development of pedagogical practices which will be more effective in empowering students to become more responsible citizens. Understanding the orthodox Christian worldview implications on learning is part of developing an environment which acknowledges the differences which students bring with them to the classroom. As the National Science Education Standards (*National Science Education Standards*, 1996) state, "The diversity of students' needs, experiences, and backgrounds requires that teachers and schools support varied, high quality opportunities for all students to learn science" (p. 4). Thus, as educators seek to develop environmental education materials which address diversity, there needs to be a conscientious effort in bring together both the knowledge of ecological principles and the issues they address and the foundational worldview principles of the students.

The basic passing of information needs to take into consideration the scope and force (Cobern, 1996) that the foundational worldviews of the student play in the educational mix. Teaching purely for the scientific facts is not enough in environmental education. Because there are areas where the topics taught in environmental education touch on these foundational beliefs, educators need to develop curriculum materials realizing that other factors beyond the science are at play in the learning. This means

that teaching in environmental education may need to have a different focus, one that draws student foundational worldview ideas into the mix with the science. This is especially true if students are to go beyond basic knowledge. If the goal of environmental education is an environmentally literate society able to act on that knowledge, knowledge in and of itself is not enough. There must be a duel focus.

From the science perspective, Sheldon and Foster (2003), two orthodox Christian scientists, have listed what knowledge a responsible environmental steward requires. As they see it, all ecological issues relate to the imbalances in one or more of three essential areas of study: energy, matter, and life. As they stress,

> Stewardship begins with and requires recognition and understanding of the essential interconnections. Central to all living systems is the flow of energy through the biological (living) community of organisms, and the movement (recycling) of material as it travels from the living system to the non-living world and back to the living system. Powered by the sun that provides our ultimate source of energy, all living systems function within a delicate balance. Failure to understand the structure and function of these three key components has led to most of our environmental problems. (p. 369)

Therefore, building the proper scientific background that examines the interconnections between these three components is essential to the understanding of ecological problems in today's world. However, as this research has shown, there is also a need to consider the implications of how the understanding of these ecological principles and their application to the various environmental problems touches on the foundational worldview perspectives of the student. From an orthodox Christian worldview belief system, this involves recognizing how this touches on matters of purpose, origin, and destiny.

Some science educators may contend that a science pedagogy that steps outside the bounds of science to include worldview perspectives, such as orthodox Christian beliefs, is not science education. However, I believe it is necessary to incorporate learning strategies which engage the students from different foundational worldview

perspectives, especially in subjects such as environmental education where issues touch on the foundational worldview beliefs of the students. Just as Clement, Brown, and Zietsman (1989) argue that there are anchoring concepts which allow for the building of scientifically correct concepts, I would contend that the foundational worldview beliefs of students - given their scope and force in the student's life - may be another type of anchoring point from which to build scientifically literate students.

In defining how this mix of science and foundational worldviews might work in the classroom, DeWitt (2002) has proposed a model for understanding environmental issues from within an orthodox Christian worldview perspective. His model may be instructive in the development of pedagogical methods for engaging students at their foundational worldview belief level. DeWitt's model uses a three-dimensional approach to looking at environmental issues (Figure 16). Not only is scientific knowledge required, but when looking at environmental issues, there also needs to be a sense of ethics (focus on foundational worldview) and praxis (action based on science and foundational worldview).

As DeWitt states,

> The desire to live right and spread right living requires an understanding of what ought to be (ethics), whereas to know the way things are requires knowledge (science). *Within* religion, therefore, we have the necessity for both science *and* ethics, one completing the other to enable right action in the world (praxis). (p. 33)

Using a pedagogical model in environmental education which allows students to see how the science influences the environmental issues *and* how it relates to their orthodox Christian foundational worldviews, as proposed by DeWitt, may provide a means for achieving a more environmentally literate citizenry. This citizenry may be more likely to act on their beliefs built on a foundation of both science and their

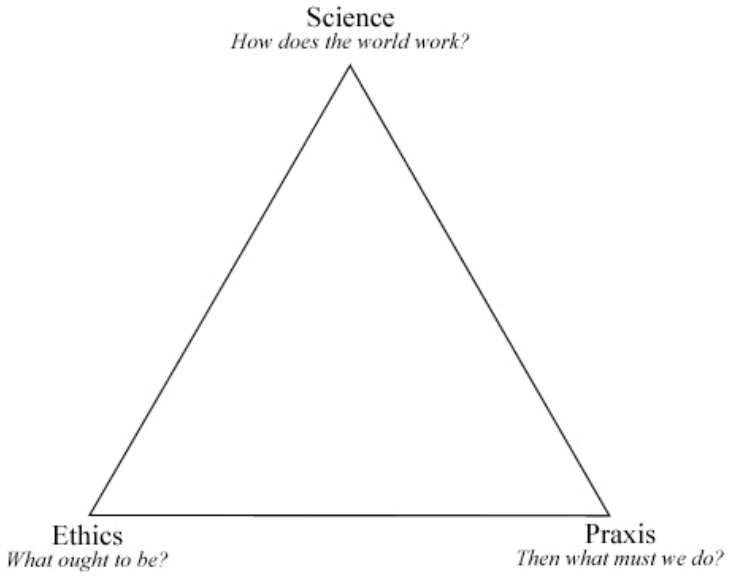

Figure 9. DeWitt's (2003) Model Showing the Connection Between Science and Worldview

orthodox Christian worldview. A good example of this has been practiced by scientists and theologians who see the need to set environmental issues in the framework of orthodox Christian worldviews. The Au Sable Institute of Environmental Studies (USA) and the John Ray Initiative (UK), brought together more than seventy leading climate scientists, policy-makers, and Christian leaders from six continents to discuss how orthodox Christian beliefs, current science, and policy interact on the issue of global climate change. The outcome of a week of addresses and discussions resulted in the Oxford Declaration on Global Warming. This Declaration brings together the science of global climate change, how it touches on foundational orthodox Christian worldview beliefs, and the needed action by people of Christian belief (Appendix D). The next step is to take this model of learning into another setting – the K-12 classroom.

Nooney et al. (2003) noted that environmental education can no longer be

content with the basic themes it has taught for the past 30 years. They recommend that to create more effective environmental education curriculum "a closer consideration of deterrents to and facilitators of performing environmental behaviors" (p. 778) is needed. Considering that the foundational worldview of a student may be one of the main deterrents to students, environmental education curricula need to focus more on the beneficial interactions of worldviews, such as the orthodox Christian worldview, if the goals of a scientific and environmentally literate citizenry who are willing to act on the basis of their knowledge and beliefs is to be achieved.

Limitations

A number of limitations constrain the conclusions of this study. First, the population of this study is from a region of the United States which historically has been associated with strong orthodox Christian beliefs. This culturally unique area may not adequately represent the diversity of orthodox Christian worldview beliefs.

Second, the population for the survey and, more specifically, for the interview, represent a student population that, while diverse in their knowledge base, tends to be predominately female. The selection for the interviews did not consider the gender of the student, only their placement in a specific quadrant. As such, only one male student was interviewed in this research. While this study represents a female population well, it has been reported that women tend to be more environmentally aware than men (Scott & Willits, 1994). Further research would seek to add more male students to this mix in order to better understand how male worldview interacts with environmental beliefs and attitudes.

Third, due to the nature of the region where the research was conducted, very few students were found who held a NEP<+/OC<+ perspective. Of the 281 students, only six initially met this criteria and one was disqualified during the interview. This left

only two students from which to glean a perspective of the NEP<+/OC<+ worldviews. While the purpose of this study did mainly focus on students holding a positive orthodox Christian worldview, the comparison between the NEP<+/OC+ and NEP<+/OC<+ students was impeded because of the limitations imposed by this quadrant's small number of interviews.

Finally, the survey tool used to divide students into the four quadrants does itself have limitations. Students taking the survey may reverse their Likert scoring accidentally, as occurred with one student interviewed for this research. These reversals of Likert items may influence the interpretation of NEP or OC scores. Also, the variability of the answers from interviewed students shows that placing a student at a specific point on the NEP or OC continuum based on their mean score can only act as a reference point at best. This mean score should not be used as a full measure of a student's belief given that the student may have both positive and neutral-negative beliefs dependent on the particular issue at hand, and as Nooney et al. (2003) showed, the reading of an NEP survey question may influence a student in a particular direction given their foundational worldview beliefs.

Appendices

Appendix A

New Ecological Paradigm Scale: Research Survey

New Ecological Paradigm Scale

1 - STRONGLY DISAGREE 2 - MILDLY DISAGREE 3 – UNSURE
4 - MILDLY AGREE 5 - STRONGLY AGREE

Do you agree or disagree that:

1. We are approaching the limit of the number of people the earth can support.
2. Humans have the right to modify the natural environment to suit their needs.
3. When humans interfere with nature it often produced disastrous consequences.
4. Human ingenuity will insure that we do not make the earth unlivable.
5. Humans are severely abusing the environment.
6. The earth has plenty of natural resources if we just learn how to develop them.
7. Plants and animals have as much right as humans to exist.
8. The balance of nature is strong enough to cope with the impacts of modern industrial nations.
9. Despite our special abilities humans are still subject to the laws of nature.
10. The so-called “ecological crisis” facing humankind has been greatly exaggerated.
11. The earth is like a spaceship with very limited room and resources.
12. Humans were meant to rule over the rest of nature.
13. The balance of nature is very delicate and easily upset.
14. Humans will eventually learn enough about how nature works to control it.
15. If things continue on their present course, we will soon experience a major ecological catastrophe.

Appendix B

Orthodox Christian Scale: Research Survey

Orthodox Christianity Short Scale

Mark a 1 if you ***strongly disagree*** with the statement,
2 if you ***moderately disagree*** with the statement,
3 if you ***slightly disagree*** with the statement.
4 if you feel ***exactly and precisely neutral*** about the statement.
Mark a 5 if you ***slightly agree*** with the statement,
6 if you ***moderately agree*** with the statement,
7 if you ***strongly agree*** with the statement.

16. Jesus Christ was the divine Son of God.
17. The Bible may be an important book of moral teachings, but it was no more inspired by God than were many other such books in the history of Man.
18. The concept of God is an old superstition that is no longer needed to explain things in the modern era.
19. Through the life, death, and resurrection of Jesus, God provided a way for the forgiveness of man's sins.
20. Despite what many people believe, there is no such thing as a God who is aware of Man's actions.
21. Jesus was crucified, died, and was buried but on the third day He arose from the dead.

Appendix C

Student Interview Questions

Relationship between Ecological Worldview and Orthodox Religious Beliefs Interview Script

Good (morning/afternoon/evening) _____(first name). Thanks for agreeing to participate in this follow-up interview to the survey that you completed recently. I am going to be asking you a series of questions which deal with some of your responses to the ecological worldview portion of the survey. Please feel free to be frank and honest with your responses and not just tell me what you think I would want to hear. The more you can tell me, the better opportunity we have for helping students learn about environmental topics in future classes.

Before we begin, you should be aware that I will be audio and video taping this interview (show subject audio recording device and video camera). The purpose of this is so that I can later transcribe our interview such that I can think more clearly about your responses. Both the audio and video tapes will be kept secure and confidential. Only your first name will be used in the interview and these will not be heard or seen by anyone other than those directly involved in this research project. Also, remember that nothing you say today will have any affect on your grade in the class you are presently taking.

Do you have any questions before we begin?

Grand Tour Question:

Eco-Crisis	Many people and scientists say our world is in trouble environmentally. I would like to hear your thoughts on this statement and why you think it is or is not.

[The following are potential follow-up questions to the Grand Tour question. Each question will be followed up by asking the student questions about their basis for believing this way, how they came to hold those concepts and finally, how strongly they believe they hold to those concepts]

Dimension	Question
Population	1. Some scientists say we are approaching the limit of the number of people the earth can support. How would you respond to such a statement?
Limits	2. Some people have compared the earth to a spaceship with very limited room and resources. How would you describe the earth?
Anthropocentrism	3. What rights do you think humans have to modify the natural environment to suit their needs?
Endangered Species	4. There are often stories in the newspaper about conflicts between human activity and endangered species. What rights do you think plants and animals have to exist?

Anthropocentrism	5. Some people would say that humans were meant to rule over nature, what do you think?
Balance	6. What effect would you say humans are having on the environment?
Eco-Crisis	7. Do you believe that the so-called "ecological crisis" facing humankind has been greatly exaggerated?
Global Climate Change	Follow-up: What about the issue of global climate change?
Eco-Crisis	8. How would you respond to someone who says that if we continue on our present course we will soon experience a major ecological catastrophe?
Balance	9. How resilient do you believe nature to be?

[Concluding Remarks]

"That's it for what I have to ask you _____. Is there anything else you would like to add before I turn off the tape? [turn off tape] Thanks again for helping me with this research project. If you have any further questions, you can contact me through the Institute for Science Education on the third floor of Wood Hall."

Coding Definitions

Appendix D

Oxford Declaration on Global Warming – 2002

OXFORD DECLARATION ON GLOBAL WARMING
Climate scientists and Christian leaders call for action
July 14–17, 2002

More than 70 leading climate scientists, policy-makers and Christian leaders from across 6 continents gathered for 'Climate Forum 2002' in Oxford, England to address the growing crisis of human-induced climate change. The Forum recognizes the reality and the urgency of the problem, which particularly affects the world's poorest peoples and the very fabric of the biosphere. The Forum also recognizes that the Christian community has a special obligation to provide moral leadership and an example of caring service to people and to all God's creation. To that end, the Forum offers the following statement to church, business and governmental leaders.

I.

II. Human-induced climate change is a moral, ethical and religious issue

- God created the Earth, and continues to sustain it. Made in God's image, human beings are to care for people and all creation as God cares for them. The call to 'love the Lord your God and love your neighbour' (Matthew 22:37–39) takes on new implications in the face of present and projected climate change. God has demonstrated his commitment to creation in the incarnation and resurrection of Jesus Christ. Christ who 'reconciles all things' (Colossians 1:20) calls his followers to the 'ministry of reconciliation' (2 Corinthians 5:18,19).
- Human induced climate change poses a great threat to the common good, especially to the poor, the vulnerable and future generations.
- By reducing the Earth's biological diversity, human induced climate change diminishes God's creation.

Human induced climate change, therefore, is a matter of urgent and profound concern.

III. The Earth's climate is changing, with adverse effects on people, communities and ecosystems

- There is now high confidence in the scientific evidence of human influence on climate as detailed by the Intergovernmental Panel on Climate Change (IPCC) and endorsed by 18 of the world's leading Academies of Science.
- Human activities, especially the burning of coal, oil and natural gas (fossil fuels) are rapidly increasing the concentrations of greenhouse gases (especially carbon dioxide) in the global atmosphere. As a result the global climate is warming, with rising sea levels, changes in rainfall patterns, more floods and droughts, and more intense storms. These have serious social, economic and ecological consequences.
- The harmful effects of climate change far outweigh the beneficial ones:
  - In many arid and semi-arid areas, the quantity and the quality of fresh water will continue to decrease.

1. Although agricultural productivity may increase in temperate northern latitudes, it will decrease throughout the tropics and sub-tropics.
2. A greater incidence of diseases, such as malaria, dengue fever and cholera, is expected.
3. Sea-level rise and increased flooding is already displacing people and will eventually affect tens of millions especially in low income countries. Some island states are likely to disappear altogether.
4. Important ecosystems, such as coral reefs and forests, will be destroyed or drastically altered, undermining the very foundation of a sustainable world.

A. Action is needed now, both to arrest climate change and to adapt to its effects

- We must take immediate steps to stabilize the climate. This means reducing global emissions of carbon dioxide (the most important greenhouse gas) to below 1990 levels well before the middle of the 21st century.
- While industrialized nations have largely caused the problem, its most severe effects fall upon the peoples of developing countries. Industrialized countries need therefore to make much greater reductions in emissions in order to allow for economic growth in developing countries.

5. We urge industrialized nations to take the lead in reducing their emissions. They have the technical, financial and institutional ability to do so now.
6. We urge industrialised countries to assist developing countries in gaining access to cleaner and renewable forms of energy
   - We urge that actions be taken to increase energy efficiency, in transportation, buildings and industry. Many actions can produce savings or be taken at little or no net cost.. Examples were presented to the Forum of such actions by 38 major multinational companies.
   - We urge greater use and development of renewable sources of energy.
   - We urge increased financial investment and that banking initiatives be grasped to enable the necessary changes.

- The cost of inaction will be greater than the cost of appropriate action.
- Adapting to the impacts of climate change (e.g. droughts and flooding) is not an alternative to mitigation, but is essential given that the climate is already changing and further change is inevitable.

Christian denominations, churches and organizations need to take action to:

- increase awareness of the facts of global climate change and its moral implications;
- set an example through individual and collective actions that reduce greenhouse gas emissions;
- increase demand for technologies and products that produce less emissions of carbon dioxide;
- urge immediate and responsible action by national governments, in cooperation with other governments under the Framework Convention on Climate Change. This should be, first, to ensure the successful operation of the Kyoto Protocol (which some countries, including the United States, Canada and Australia, have not yet ratified) and, second, to establish an effective programme of emissions reductions in the period immediately following that covered by that Protocol.

We, the forum participants, recognize the urgency for addressing human induced climate change, repent of our inaction and commit ourselves to work diligently and creatively to adopt solutions in our own lives and in the communities we influence. We call upon leaders in churches, business and government to join us in recognizing human induced climate change as a moral and religious issue and to take necessary action to maintain the climate system as a remarkable provision in creation for sustaining all life on Earth.

IV. For more information:

http://www.climateforum2002.org (Climate Forum 2002)
http://www.ipcc.ch (Intergovernmental Panel on Climate Change)
http://www.jri.org.uk (John Ray Initiative)
http://www.ausable.org (Au Sable)

V.

VI. Chairmen and Key Speakers

Dr John Biggs, Environmental Issues Network of Churches Together in Britain and Ireland; Steering Committee, Eco-Congregation, UK

Dr James Bruce, former Head of Atmospheric Environment Service, Canada; former Co-chair of IPCC Working Group 3

Prof. R J (Sam) Berry, Professor of Genetics, University College London, UK

Rev. Richard Cizik, Vice President for Government Affairs, National Association of Evangelicals, USA

Mr Henry Derwent, Department of Environment, Food and Rural Affairs, UK Government

Prof. Calvin DeWitt, Au Sable Institute, USA

Prof. James Drummond, Department of Physics, University of Toronto, Canada

Ms Nafia D'Souza, Director, Laya, India

Dr Job Ebenezer, Visiting Professor, Messiah College, USA

Dr Jae Edmonds, Chief Scientist, Pacific Northwest National Laboratories, Joint Global Research Institute, USA

Rt Hon John Gummer MP, former Secretary of State for the Environment, UK

Prof. Michael Grubb, Professor of Climate Change and Energy Policy, Imperial College, London, UK

Prof. Michael Hulme, Head of Tyndall Centre, UK

Sir John Houghton, former Co-chairman of Scientific Assessment Working Group, IPCC; Chairman of The John Ray Initiative, UK

Rt Rev. James Jones, Bishop of Liverpool, UK

Rev. Dr Ernest Lucas, Vice-Principal and Tutor in Biblical Studies, Bristol Baptist College, UK

Dr Mack McFarland, Principal Scientist, Environmental Program, DuPont, USA
Prof. Jesse N K Mugambi, University of Nairobi, Kenya
Dr John Mitchell, Meteorological Office, Hadley Centre for Climate Prediction and Research, UK
Rev. John Paarlberg, Minister for Social Witness and Worship, Reformed Church in America, USA
Dr Rafe Pomerance, Chairman, Board of Directors, Americans for Equitable Climate Solutions, USA
Dr Robert Watson, Director Environment, World Bank, Washigton DC, USA, and former Chairman of IPCC

VII. Other Forum speakers and participants:

Myles Allen, Clarendon Laboratory, University of Oxford, UK
Claire Ashton, Research Engineer, Thames Water, UK; Director, John Ray Initiative
Graham Ashworth, Chairman, EnCams (Environmental Campaigns), UK; former President of the Baptist Union, UK
Peter Bakken, Coordinator of Outreach and Research Fellow, Au Sable Institute, USA
James Ball, Director, Evangelical Environmental Network, USA
Kara Unger Ball, Member, Board of Trustees, Au Sable Institute, USA
Rachel Bardsley, University of Gloucestershire, UK
Jerry Beilby, Chair, Department of Science and Mathematics, Northwestern College, USA
Pam Berry, Terrestrial Ecology and Biodiversity Group, Environmental Change Institute, University of Oxford, UK
Paul Bodenham, Energy and Climate Change Campaign Co-ordinator, Nottingham, UK
Peter Bright, Director, John Ray Initiative, UK; Former External Affairs, Shell International
Ann Brown, Jubilee Centre, Cambridge UK
Edward Brown, Chief Operating Officer, Au Sable Institute, USA
Donald Bruce, Director, Society, Religion and Technology Project, Church of Scotland
Roger N. Brummel, Member of the Board of Trustees, Au Sable Institute, USA
Bruce Buursma, Corporate Communications, Herman Miller Inc., MI, USA
David Byers, Executive Director, Committee on Science and Human Values, US Conference of Catholic Bishops, USA
Bob Carling, Freelance Science Editor, Southampton, UK; Adviser to The John Ray Initiative
Peter Carruthers, Executive Director, The John Ray Initiative, UK
J Stafford Carson, Vice President for Academic Affairs, Westminster Theological Seminary, Philadelphia, USA
Professor James Clark, Geology and Environmental Science, Wheaton College, USA
Richard Davis, Communications Advisor, Presbyterian Church of Aotearoa New Zealand
Jae A. Edmonds, Chief Scientist, Pacific Northwest National Laboratory, Joint Global Change Research Institute at the University of Maryland, USA
Glen Fell, Professor of Agriculture, MidAmerica Nazarene University, USA
Doreen J. Ferko, California State University at Fullerton, USA
Thomas E. Ferko, Assistant Professor of Physical Science, California Baptist University, USA
David Foster, Director, Oakes Museum, Messiah College, USA
Douglas Grace, Director, Interfaith Climate and Energy Campaign, National Religious Partnership for the Environment, Washington, USA
Herbert Grover, Associate Professor of Biology, Hardin-Simmons University, USA
Keith Hitchman, Chaplain University of Gloucestershire, UK
Diana Hoare, Green Apostle, Diocese of Hereford, UK
Martin Hodson, Principal Lecturer in Environmental Biology, Oxford Moore's University, UK
Margot Hodson, Curate, St John's Church, Grove, Oxfordshire, UK

Geoff Hogan, Research Physicist, Clarendon Laboratory, Oxford
Alycia Ashburn Holtebeck, Institute for Environmental Studies, University of Wisconsin, USA
Juliana Horne, Environmentalist, Colombia, South America
Paul Houghton, Treasurer, John Ray Initiative, UK; Further Education Tutor in Science
John G. Kelly, Lecturer in Systematic Theology, St John's College, Nottingham, UK
Robert S. Keys, Assistant Professor of Science, Cornerstone University, USA
Sarah La Trobe, Public Policy Officer for Environment and Disasters, Tearfund, UK
Phil Leigh, Diocese of Liverpool, UK
John Mead, Member of UNED Stakeholder Forum Climate Change and Energy Panel; Member of ITDG
Mike Morecroft, Ecologist, NERC Centre for Ecology & Hydrology & Oxford University, UK; Director, John Ray Initiative
Shirley Morrison, InterVarsity Christian Fellowship, USA
Terence Morrison, Director, InterVarsity Christian Fellowship, USA
Benito Mueller, Oxford Institute for Energy Studies, UK
Harrison Murbi, AISRED, University of Nairobi, Kenya
David Pickering, Eco-Congregation Co-ordinator, UK
William Randolph, Dean, Division of Natural and Social Sciences, Northwest College, USA
A. Relton, Heber Au Sable Institute of Environmental Studies, Bishop Heber College, India
Colin Russell, Emeritus Professor in History of Science, The Open University and the University of Cambridge, UK; Director, John Ray Initiative
Zachary Sheely, Westmont College, USA
Amanda Sparkman, Westmont College, USA
Eric Steinkamp, Northwest College, USA
Fred Taylor, Professor of Atmospheric Physics, and Fellow of Jesus College, University of Oxford, UK
David Thistlethwaite, Administrator, John Ray Initiative, UK
Janet Trotter, Principal, University of Gloucestershire, UK
John Twidell, Director, AMSET Centre for Renewable Energy, UK; Visiting Professor in Renewable Energy Engineering, University of Reading, UK
Melissa Van Ee, Au Sable Institute, USA

Appendix E

Human Subjects Institutional Review Board Approval

WESTERN MICHIGAN UNIVERSITY

Human Subjects Institutional Review Board

Centennial 1903-2003 Celebration

Date: March 22, 2002

To: William Cobern, Principal Investigator
Robert Keys, Student Investigator for dissertation
Eric Howe, Student Investigator

From: Mary Lagerwey, Chair

Re: HSIRB Project Number: 02-03-09

This letter will serve as confirmation that your research project entitled "Relationship between Ecological Worldview and Orthodox Religious Beliefs" has been **approved** under the **expedited** category of review by the Human Subjects Institutional Review Board. The conditions and duration of this approval are specified in the Policies of Western Michigan University. You may now begin to implement the research as described in the application.

Please note that you may **only** conduct this research exactly in the form it was approved. You must seek specific board approval for any changes in this project. You must also seek reapproval if the project extends beyond the termination date noted below. In addition if there are any unanticipated adverse reactions or unanticipated events associated with the conduct of this research, you should immediately suspend the project and contact the Chair of the HSIRB for consultation.

The Board wishes you success in the pursuit of your research goals.

Approval Termination: March 22, 2003

Walwood Hall, Kalamazoo MI 49008-5456
PHONE: (616) 387-8293 FAX: (616) 387-8276

TITLE: Relationship between Ecological Worldview and Orthodox Religious Belief

Project Description

The purpose of this study is to investigate the source of student beliefs about the environment, and in particular the role that Christian religious beliefs affect student beliefs about the environment. These results will be used in future research to develop teaching methodologies which will be more effective in the instruction of environmental science classes.

The procedures and research design are as follows: The research will proceed in two steps. The first group of students (pilot subjects) involved in the research will be used to help develop interview protocols which will help refine the interview questions and develop a coding scheme for the second set of students (research subjects). Both sets of students will be administered a survey tool (see instrumentation) which makes use of two well developed and validated survey instruments, the New Ecological Paradigm scale (NEP) and the Christian Orthodoxy scale (CO). The instrument will require approximately 20 - 30 minutes to complete. The purpose of the survey tool is to provide a base student score from which students can be divided into interview groupings. The student investigator or an independent agent (neither are associated with the class) will administer the survey tool to the students (sees the attached recruitment/consent script which outlines the initial contact). The results of the survey instrument will be analyzed by the student investigator (Robert Keys) to categorize the students into four sub-classification based on the totals of all items on the NEP scale and the totals of all items on the CO scale. The four sub-classifications will be as follows: High NEP score/High CO score; High NEP score/Low CO score; Low NEP score/High CO score; Low NEP score/Low CO score.

A percentage of the students who complete the survey will additionally be selected to participate in a semi-structured interview (in both the initial set of students and secondary set). Four interviewees will be randomly selected from each of the above mentioned sub-classifications. Each selected student will be contacted via telephone or e-mail by the student researcher (the telephone number and e-mail address will be asked for on the student consent form). A script of this "interview contact" is attached. If a student wishes not to participate in the interview, the researcher will randomly draw another name from the respective sub-category to fill the quota. General note: Students will not know before, during or after the interview how their survey was "scored". Also, recall that the students are informed prior to the administration of the survey that there is a possibility that they will be contacted and requested to participate in an interview.

The interview will consist of questions which are related to the survey and the student's responses to those survey questions. An initial script of the interview is attached. The purpose of the interview is two-fold. The first purpose is to allow the researcher to determine the student's reasoning for their particular set of beliefs about the environment and secondly to determine how the student came to hold those particular beliefs (source), especially beliefs containing an orthodox religious connection. The pilot study group of interviewees will be used to help refine the interview questions and to develop an initial coding protocol. The results of these surveys and interviews will not be used in the final research. The research study subjects will be asked the refined set of interview questions. The interviews will be coded using a coding scheme which will focus on the conceptions which shape the students ecological worldview and the source

of student beliefs about the environment. All interviews will be audio and video taped for research purposes.

The interviews will occur separately from the administration of the survey. Ideally, the student investigator will score/interpret the survey results within one week of their administration. Those students selected for interviews will be contacted and interviewed in the same location that the survey was administered or in a room nearby if the classroom is unavailable.

It should be noted that the survey and interviews are in no way tied to the students' course grades. The results from the surveys and interviews will be used by the student investigator for dissertation purposes that will be related to the improvement of science teaching.

Location: The administration of the surveys and interviews will occur in the same classroom in which the students normally attends their class if possible. If this is not convenient due to conflicts with other classes using these rooms, a conference room or another classroom site close to the survey classroom will be chosen.

Duration: The students involved in the research will be surveyed and interviewed during the Winter and Spring semesters of 2002. If insufficient subjects are available for the interview stage, the surveys and interviews may also be administered during the Fall semester of 2002.

Benefits of Research

While participants of this research will not benefit from this research per se, the information gained through their participation will be used to help in the future development and modification of teaching strategies for courses taken by later students. It is also the desire of the researchers to improve the quality and presentation of science and environmental education using the results of this research.

Recruitment

The recruitment of students involved in the pilot study will be from three sections of SCI100: Principles of Scientific Inquiry course at Cornerstone University, Grand Rapids, MI. These students will be used to help develop the interview questioning protocol and some of the initial coding protocols. All students in the three sections of the class will be potential subjects for the study. In the same way, all students enrolled in all sections of Western Michigan University's ED401: Teaching Elementary School Science, Cornerstone University's EDU450: Elementary Science Methods, and Calvin College's IDIS213: Teaching Science in Elementary School will be potential subjects for the research study. All students will be given the option of whether or not to participate in the research. Should students excuse themselves from participating, they will be given a 30-minute recess from the class while the remainder of the class completes the survey. Those students who elect not to participate in the survey may spend the time at the café, doing course homework, checking e-mail, etc.

At this time there is no plan to offer extra credit or other compensation for participation in the research. The participants will be informed that the research results will be used to better the classroom teaching of science education, in general.

Those students who elect not to participate will in no way compromise their performance in the class.

Risks to the Subjects

Risks to the subjects include: perceived discomfort in having to participate in "extra work"; the psychological discomfort of having to disclose personal religious beliefs; the potential sensitivity to the disclosure of the assessment results (although it is the intent of the researcher to maintain both privacy and confidentiality); and the inconvenience of having to fill time if the student declines participation in the survey. The risk of discomfort is small given the nature of the interview material. No sensitive questions will be asked of the students during the interview process and the entire process is voluntary by nature. Students may opt to quit at any time during the process.

Protection of Subjects

The researcher will maintain the confidentiality of the results in a secured location. The results will be secured in a stored and locked cabinet in the principle investigator's office for at least three (3) years and then destroyed. Copies of the results maintained by the student investigator will also be secured in a stored and locked cabinet in his office* for at least three (3) years and destroyed when the data is no longer needed for research purposes.

A Master list which links students to a designated identifier used on collected data (see confidentiality section) will be destroyed upon completion of data coding.

*The student researcher is a faculty member at Cornerstone University in Grand Rapids, MI.

Confidentiality

The results of the survey or the interviews are not anticipated to be sensitive in nature. However, the researchers will maintain strict adherence to confidential protocol. The first sheet of the survey will include an instruction/information sheet which will ask the student for the last six digits of their student identification number, e-mail address and telephone number. The scantron survey form will again ask the student to input the their last name and the last six digits of their student identification number. When the student is finished with the survey the cover sheet will be separated from the survey. After the completion of the survey each subject will be assigned a designated identifier based on school, semester, last name and the last six digits of the student's school identification number. For example, a student "Jane Doe" at Cornerstone University enrolled in the spring science methods class would receive the designator CUSD336937. The master list of students, with designated identifiers, e-mail addresses and telephone numbers will be inputted into a database program and stored on disk and paper copy in the office of the principle investigator in a locked cabinet until the completion of the data coding. The master list will be kept separate from all other data collected in this study. The researcher will only access this list to contact students for interview purposes. After the

coding of the data, the master list and any software files associated with such list with any identification relating to the student will be destroyed. Audio and video materials created during of the course of the research will also receive the student-designated identifier and only first names will be used during the interviews. All original copies of videotapes and audiotapes will be stored in the principle investigator's office in a locked cabinet for a period of at least three (3) years after which period they will be destroyed.

In the write-ups of the data subjects will be given a fictitious first name (both in transcripts and papers written which use the data) which will only be related to the gender of the subject. When a name is used it will also include a code designation which will refer back to coded data stored in the files of the principle investigator.

VIII. Instrumentation

The survey is attached. This survey is a compilation of two instruments which have been widely used to assess ecological worldview and Christian religious orthodoxy. The survey consists of an instruction sheet and scantron response form.

A script of the initial interview to be used in the pilot study is also attached. Questions listed represent the starting Grand Tour question and follow-up questions which will likely result in reply to student responses to the initial question, as is the nature with the semi-structured interview format.

As the topic has very little in the way of a research base on which to base a coding structure, the coding sheets will be developed in conjunction with the pilot study.

Environmental and Religious Worldview Survey
Instruction Sheet

Thank you for taking the time to assist me in my research into student conceptions of worldview. Please read the directions carefully for each of the following scantron sections and answer each question in a way which reflects your view of the world.

General Information

Last name: Please fill in your last name in the upper left hand boxes of the scantron form. This is for reference and contact purposes only and will be kept secure in the office of the principal investigator.

Last six digits of student number: Please indicate the last six (6) digits of your student number in the boxes in the upper right hand area of the scantron form and on this sheet. Again, this is for reference purposes only and will be kept secure.

Phone Number/e-mail: This is to contact you if you are selected for the follow-up interview. This will not appear in any other area except on this sheet, which will be kept secure in the office of the principal investigator.

Phone Number **e-mail address**

(__ __ __) __ __ __ - __ __ __ __ _____

Sex: **F** **M** (circle here) **First Name** _____

Survey Part One – Front side

This portion of the survey includes a number of statements related to ecological worldviews. On the scantron sheet, please read the statements carefully and then fill in the appropriate circle, according to the amount of your agreement or disagreement, by using the following scale:

Shade a
1 if you **STRONGLY DISAGREE** with the statement
2 if you **MILDLY DISAGREE** with the statement
3 if you are **UNSURE** with the statement
4 if you **MILDLY AGREE** with the statement
5 if you **STRONGLY AGREE** with the statement

Survey Part Two – Back side

This portion of the survey includes a number of statements related to specific orthodox religious beliefs. You will probably find that you *agree* with some of the statements and *disagree* with others, to varying extents. On the scantron sheet,

please read the statements carefully and then fill in the appropriate circle, according to the amount of your agreement or disagreement, by using the following scale:

Shade a **1** if you **STRONGLY DISAGREE** with the statement,
2 if you **MODERATELY DISAGREE** with the statement,
3 if you **SLIGHTLY DISAGREE** with the statement.
4 if you feel exactly and precisely **NEUTRAL** about the statement
Shade a **5** if you **SLIGHTLY AGREE** with the statement,
6 if you **MODERATELY AGREE** with the statement,
7 if you **STRONGLY AGREE** with the statement.

Relationship between Ecological Worldview and Orthodox Religious Beliefs Recruitment/Consent Script

Good (Morning/Afternoon/Evening). My name is _____, and I am here to facilitate a research project for the next 20 minutes.

You are being asked to participate in research from which the results will be used to help improve the teaching and learning in science classes. We hope that you will elect to participate.

First, you need to understand that participation is entirely voluntary and will have no effect on your grade in this class. All of your surveys will be coded so that your information will remain confidential.

Secondly, if you elect to participate, I have a brief consent form that you will be asked to sign and which I will pass out now. I will be passing out two forms, one for you to keep and one which I will need returned. If you choose not to participate, you are free to work on your homework or other projects at your desk for the next few minutes. If you do not wish to participate, please indicate so with a shake of your head when I bring around the consent forms. Again, you will be penalized in no way for not participating in this survey.

[Pass out consent form and ask students to read along with you as it is read aloud]

[Collect signed consent forms]

I will now pass out the survey questionaire to you. There is a cover sheet which will be separated from the survey and used for contact purposes if you are chosen to participate in a follow-up interview. Again, please remember that you are not required to participate in the follow-up interview, which will take place in this classroom or close by.

There are 21 statements we are asking you to respond to. Please take your time and read directions carefully for each of the two parts. When you are finished you can bring the completed survey to me.

[Pass out surveys to each student]

[recollect finished surveys as the students complete them. Check to make sure the student identifier on the cover sheet matches the identifier on the survey and separate the two pieces.]

Thank you again for participating. Again, some of you may be randomly selected for a follow-up interview. While this will not require much of your time, you participation is voluntary. If you are selected, you will be contacted by phone or e-mail to set up a time for the interview.

Relationship between Ecological Worldview and Orthodox Religious Beliefs Interview Recruitment Script

Note: Contact will be made via telephone. If telephone contact is not possible, e-mail will be used.

"Good (morning/afternoon/evening) _____. My name is Rob Keys, and I am a PhD. student in the Institute for Science Education. Not long ago you completed a survey during your _____ class. Is this correct? You may recall that I mentioned that some of you may be randomly contacted to participate in a follow-up interview.

My call is to inform you that you were one of the students selected for this follow-up interview. My hope is that you will be able to meet with me to talk briefly about some of your responses to the ecological worldview portion of the survey. Again, as with the survey, you are not required to participate, it is entirely voluntary. If you decide you do not want to participate, it will in no way affect your grade in your class.

Would you still be willing to talk with me?"

[If agreeable, set up a date and time in the classroom or other closeby location (when it will be private) for the follow-up interview]

[If not agreeable, thank them for their initial participation and confirm that their responses will continue to remain confidential]

Relationship between Ecological Worldview and Orthodox Religious Beliefs Interview Script

Good (morning/afternoon/evening) _____(first name). Thanks for agreeing to participate in this follow-up interview to the survey that you completed recently. I am going to be asking you a series of questions which deal with some of your responses to the ecological worldview portion of the survey. Please feel free to be frank and honest with your responses and not just tell me what you think I would want to hear. The more you can tell me, the better opportunity we have for helping students learn about environmental topics in future classes.

Before we begin, you should be aware that I will be audio and video taping this interview (show subject audio recording device and video camera). The purpose of this is so that I can later transcribe our interview such that I can think more clearly about your responses. Both the audio and video tapes will be kept secure and confidential. Only your first name will be used in the interview and these will not be heard or seen by anyone other than those directly involved in this research project. Also, remember that nothing you say today will have any affect on your grade in the class you are presently taking.

Do you have any questions before we begin?

Grand Tour Question:

Many people and scientists say our world is in trouble environmentally. I would like to hear your thoughts on this statement and why you think it is or is not.

[The following are potential follow-up questions to the Grand Tour question. Each question will be followed up by asking the student questions about their basis for believing this way, how they came to hold those concepts and finally, how strongly they believe they hold to those concepts]

Western Michigan University
Institute for Science Education

Principle Investigator: William Cobern
Student Investigator: Robert Keys

I have been invited to participate in a research project entitled The Relationship between Ecological Worldview and Orthodox Religious Beliefs. This research is intended to study how students perceive environmental issues and how that may relate to Christian beliefs. This project is a part of Robert Keys' (an Institute for Science Education Ph.D. student) dissertation research.

I am being asked to respond to a survey that will require me to provide answers to various questions. I may also be asked to participate in a follow-up interview so that the researcher can gain additional information about my responses. The results from this research will in no way be used in the evaluation of my performance as a student of this class.

As in all research there may be unforeseen risks to the participant. If an accidental injury occurs, appropriate emergency measures will be taken; however, no compensation or additional treatment will be made available to the subject except as otherwise stated in this consent form.

One way in which I may indirectly benefit from this activity is in knowing that the answers I provide may be used to better the teaching and learning approaches in science education. The research tool may also benefit my understanding of the nature of environmental topics – topics deemed worthy by the National Science Standards.

All of the information collected from me is confidential. That means that my name will not appear on any papers on which this information is recorded. The forms will all be coded, and Robert Keys will keep a separate master list with the names of participants and the corresponding code numbers separate from these research tools. Once the data are collected and analyzed, the master list will be destroyed. All other forms will be retained for three years in a secure location in the principle investigator's office.

I may refuse to participate or quit at any time during the study without prejudice or penalty to my grade in this course. If I have any questions or concerns about the study, I may contact either Robert Keys at 616.949.5300 or William Cobern at 387-2971 or the vice president for research at 387-8298 with any concerns that I have.

This consent document has been approved for use for one year by the Human Subject Institutional Review Board as indicated by the stamped date and signature of the board chair in the upper right corner. Subjects should not sign this document if the corner does not have a stamped date and signature.

My signature below indicates that I have read and/or had explained to me the purpose and requirements of the study and that I agree to participate.

_____ _____
Signature Date

Consent obtained by: _____ _____
Initials of researcher Date

Appendix F

Coding Numbers and Pseudonyms for Interviews

Coding Numbers and Pseudonyms for Interviews

NEP+/OC+

WFA861	Anne
WFL066	Laura
WFR045	Randy
WFW028	Wendy
WSB900	Beth
WSL867	Lisa

NEP+/OC<+

WFB473	Barb
WFH967	Holly
WFB749	Becca
WFM029	Mary

NEP<+/OC+

WFD047	Diane
WFL024	Linda
WFS115	Sara
WSP022	Penni

NEP<+/OC<+

WFI989	Sue
WFK965	Kelly

Numbers following the coding in the text refer to transcript line numbers in the qualitative analysis software, Ethnograph (Qualis Research, 1998).

APPENDIX G

Coding Definitions

Robert Keys Ecological Worldview Coding Matrix

Code	Parent Code	Secondary Code	Description
ECOLOGICAL CRISIS			
CRISIS1.0	Ecological Crisis	No Crisis	There is no real ecological crisis – student indicates that there is no ecological crisis, or chooses a specific issue which they belief is not in crisis – "no problem, fallacy, scare tactics…"
CRISIS1.1	Ecological Crisis	Crisis	There is a real ecological crisis – student believes there is a real ecological crisis and uses language and examples to illustrate "crisis, trouble…
CRISIS1.2	Ecological Crisis	No but coming - concern	Student believes there is not a crisis right now, but it is coming in the future, so we should be concerned – "future, coming, concerned"
CRISIS1.3	Ecological Crisis	No but coming – no concern	Student believes there is not a crisis right now, but it may come in the future, but we don't have to be concerned – "not our problem, God in control, technology will fix…"
ECOLOGICAL LIMITS			
NATRES1.0	Natural Resources	No Limits	There are no limits to what humans can do with the resources of earth – "will not run out of resources, earth replenishes itself, takes care of itself…"
NATRES1.1	Natural Resources	Some Limits	There are some limits to our natural resources. Student describes resources which they believe are limited, but also indicates that there are resources which are not limited
NATRES1.2	Natural Resources	Limited	We are limited by natural resources. Student indicates that there are limits. "limited, run out, conserve…"
ANTHROPOCENTRISM			
DOM1.0	Dominion	Human Right	Humans have the right to modify natural world to suit needs. "Humans have the power, humans are over…, humans can do what they want, human use of land, resources, etc is more important than the things that live there…"
DOM1.1	Dominion	Humans No Right	Humans do not have the right to modify the environment to suit their needs. "The living thing is as important as the

			human, have just as much right…"
DOM1.2	Dominion	Human balance	Humans must balance rights to modify with rights of animals. "balance, equal rights, though humans in control, respect…"
ECOLOGICAL BALANCE			
RESIL1.0	Resilience of Nature	Very resilient	Nature is very resilient to human impact. "Nature bounces back, fights back, will come back, takes care of itself…"
RESIL1.1	Resilience of Nature	Not resilient	Nature is not very resilient to human impact. "Does not bounce back, does not recover from human impact…"
HUMAN POPULATION			
POP1.0	Population	Too high	Population of earth is too high. "Problem now, need to control, indicates place with high population…"
POP1.0.1	Population	Future Problem	Population is growing and will be a problem in the future. "future, for my children's children, coming…"
POP1.1	Population	No problem	Population of earth is not a problem. "will not be a problem, not in my life, God will come before problem…"
	SECONDARY CODING RELATING TO PRIMARY POPULATION CODE		
POP2.0	Population	Limit Number	The number of children born should be limited to control population. "abortion, China policy okay, control, limit…"
POP2.1	Population	No Limits	The number of children born should not be controlled in any way. "no abortion, China's policy wrong, have as many children as wanted…"
ENDANGERED SPECIES			
RIGHT1.0	Endangered Species (ES)	Human over nature	Humans have rights over ES. "move them, people have power over, human activities take precedence…"
RIGHT1.1	Endangered Species (ES)	Nature over human	Nature has rights over humans. "animal/plant there first, have as much right, should let them live…"
RIGHT1.2	Endangered Species (ES)	Balance	Must balance the rights of humans with the rights of nature. "need to evaluate, not harm but live with, balance…"
GLOBAL CLIMATE CHANGE			
GLOBE1.0	Global Climate Change	Happening	Global Climate Change is a problem. "problem, happening, issue…"
GLOBE1.1	Global Climate	Not Happening	Global Climate Change is not a problem.

	Change		"not happening, scare tactics, not an issue, not enough evidence…"
GLOBE1.2	Global Climate Change	Unsure	Not sure if global climate change is happening. "not sure, mixed evidence, want more information…"
	EVIDENCE USED TO SUPPORT GCC BELIEFS		
	WEATHER		
GCC1.0	Global Climate Change	Weather – 2-4 months	Relates climate change to weather in past 2-4 months
GCC1.1	Global Climate Change	Weather – 1-3 years	Relates climate change to weather in past 1-3 years
GCC1.2	Global Climate Change	Weather – in lifetime	Relates climate change to weather in lifetime
GCC1.3	Global Climate Change	Weather – past history	Relates climate change to weather changes in past history
	OZONE		
GCC2.0	Global Climate Change	Ozone – hole	Relates climate change to hole in ozone layer
GCC2.1	Global Climate Change	Ozone – destruction	Relates climate change to destruction of ozone layer
GCC2.2	Global Climate Change	Ozone – effects on ozone	Relates climate change to the use of materials which affect ozone
GCC2.3	Global Climate Change	Ozone – skin cancer, etc.	Relates climate change to effects of loss of ozone, like skin cancer
GCC2.4	Global Climate Change	Ozone – other	Relates climate change to actions of people (Ozone action day, burning, etc)
	FOSSIL FUELS		
GCC3.0	Global Climate Change	Fossil Fuels – cars	Relates climate change to use of cars or car emissions
GCC3.1	Global Climate Change	Fossil Fuels – Burning	Relates climate change to burning of fossil fuels
	OTHER FACTORS		
GCC4.0	Global Climate Change	Other Factors – health	Relates climate change to other factors such as health, asthma
GCC4.1	Global Climate Change	Other Factors – Oceans	Relates climate change to ocean level change
GCC4.2	Global Climate Change	Other Factors – misc	Relates climate change to other factors (ex. Nuclear power)
	UNDERSTANDING OF ISSUE		
GCC5.0	Global Climate Change	Good Understanding	Feels they have a good understanding of issue
GCC5.1	Global Climate Change	Inadequate	Do not feel like they have a good understanding of the issue

		Understanding	
	HUMAN INVOLVEMENT		
GCC6.0	Global Climate Change	Human Change – no hope	Cannot stop it, only slow it down
GCC6.1	Global Climate Change	Human Change – technology	Technology is the only way we have a chance of changing future
GCC6.2	Global Climate Change	Human Change – People	People will not change their way of living
SOCIOECONOMICS			
	NEIGHBORHOOD SETTING		
SOCECO1.0	SocioEconomic	Urban	Grew up in an urban type setting
SOCECO1.1	SocioEconomic	Suburban	Grew up in a suburban type setting
SOCECO1.2	SocioEconomic	Rural	Grew up in a rural type setting
	MARITAL STATUS OF PARENTS		
SOCECO2.0	SocioEconomics	Family – 2 p	Grew up in two parent home
SOCECO2.1	SocioEconomics	Family – 1 p	Grew up in one parent home
	MARITAL STATUS OF STUDENT		
SOCECO3.0	SocioEconomics	Single	Currently single
SOCECO3.1	SocioEconomics	Married - nc	Currently married – no children
SOCECO3.2	SocioEconomics	Married – c	Currently married – with children
SOCECO3.3	SocioEconomics	Widowed – c	Currently widowed – with children
SOCECO3.4	SocioEconomics	Unknown	Unknown status
	SOURCE OF ENVIRONMENTAL VIEWS		
SOURCE1.0	Worldview Source	Parent	References parent(s) as source of understanding
SOURCE1.1	Worldview Source	Grandparent	References grandparent(s) as source of understanding
SOURCE1.2	Worldview Source	Modeling	References someone as a model which they wanted to follow
	OUTDOOR ACTIVITIES		
SOURCE2.0	Worldview Source	Outdoor Activity – fishing	References time spent outdoors fishing as reasoning for view on environment
SOURCE2.1	Worldview Source	Outdoor Activity – hunting	References time spent outdoors hunting as reasoning for view on environment
SOURCE2.2	Worldview Source	Outdoor Activity – Hiking	References time spent outdoors hiking as reasoning for view on environment
SOURCE2.3	Worldview Source	Outdoor Activity – sport	References time spent outdoors involved in sports as reasoning for view on

			environment
SOURCE2.4	Worldview Source	Outdoor Activity	References time spent outdoors as reasoning for view on environment
	MEDIA SOURCES		
SOURCE3.0	Worldview Source	Media – news, newspaper, TV	References media news source as reasoning for view on environment
SOURCE3.1	Worldview Source	Media – books	References books read as source for view on environment
	SCHOOL AS SOURCE OF ENVIRONMENTAL INFORMATION		
SOURCE4.0	Worldview Source	School – Elem	References Elementary school learning as source for view on environment
SOURCE4.1	Worldview Source	School – Middle/High	References Middle/High School as source for view on environment
	HEALTH CONCERNS ARE SOURCE FOR STUDY OF ENVIRONMENT		
SOURCE5.0	Worldview Source	Health	References health problems as source of views on environmental problems
	PERSONAL RESEARCH ON ENVIRONMENT		
SOURCE6.0	Worldview Source	Research	References personal research done on issues as a source of views
	ORTHODOX CHRISTIANITY AS REFERENCE		
SOURCE7.0	Worldview Source	Religion: Christian view invoked	References traditional Christian views as source of understanding. “God, Bible, Jesus, book of Bible, other Christian reference…”
SOURCE7.1	Worldview Source	Religion: Other religion invoked	References other religious views in understanding (Native American, Tao, Eastern religions). “spiritual connection to earth, evolutionary reasoning, naturalism…”

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