Loving Our Neighbors: Responsibility in the Created World

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> *"The creation waits in eager expectation for the sons of God to be revealed. For the creation was subjected to frustration not by its own choice, but by the will of the one who subjected it, in hope that the creation itself will be liberated from its bondage to decay and brought into the glorious freedom of the children of God. We know that the whole creation has been groaning as in the pains of childbirth right up to the present time." (Romans 8:19-22, NIV)*

Creation is suffering. Patterns of human land-use and resource consumption result in fragmented ecosystems, pollution, climate change, loss of biodiversity, and ultimately emerging diseases. The link between ecology and human health is widely recognized among scientists. Conservation medicine is a relatively new discipline that has emerged to provide a scientific framework for the study of the relationship between environmental degradation and animal and human health (Ostfeld et al. 2002). Unfortunately this link often is overlooked by those outside ecological or scientific circles. Many people living in affluent societies do not realize how their behavior and patterns of consumption affect the environment, and subsequently human health. The United States has a long history of protecting ecosystems within National Parks and Forests, and proportionally more land is protected in the USA (15.8%) than the rest of the world (10.8%; Earth Trends 2003). Media attention that is given to large restoration projects resulting in the reforestation or the restoration of habitats might cause us to believe that our conservation efforts are sufficient. We do not realize; however, that restoration of a vegetative (plant) community does not necessarily restore the animal community. As you will learn in this paper, even slight changes in species composition can result in changes in disease transmission. For example, the emergence of Lyme disease in North America is a direct result of changes in species composition associated with the deforestation and subsequent reforestation of the eastern forests (Ostfeld 1997). The belief that protecting some lands and restoring others is sufficient conservation results in complacency and a weak response to the environmental crisis. In addition to believing that we are currently doing enough, we also do not recognize how our actions affect others outside our borders. Many of the resources consumed by affluent societies are obtained from developing countries. These countries often lack the environmental regulations that guide resource acquisition in more affluent nations. Therefore, our demand for resources, such as tropical wood or precious gems, results in environmental degradation that can promote the transmission of disease. Christians should recognize the biblical basis for environmental stewardship, and understand that creation care is a direct response to the second greatest commandment to “love your neighbor as yourself” (Matthew 22:39).

Who are our neighbors? When asked this question, Jesus told the parable of the Good Samaritan. We learn from this and other of Christ’s teachings that the concept of neighbor is to extend beyond those living in close proximity. We understand that a neighbor is one “who has mercy” on others, and we are challenged to “go and do likewise” (Luke 10:37). How can our understanding of neighbor inform the biblical mandate to care for creation (“*The Lord God took the man and put him in the Garden of Eden to work it and take care of it.*” Genesis 2:15)? Parham (1991) suggests that creation care requires us to extend our concept of neighbor beyond immediate acts of mercy to one that extends across time and space. Environmental degradation ultimately results in the suffering of our neighbors in future generations. As we consume resources and accumulate waste/pollutants, we reduce the quality of the environment and the ability of future generations to acquire basic necessary resources. In fact, our current patterns of consumption and land-use will have significant effects on the transmission of diseases, increasing the suffering of present and future neighbors. Therefore, in order to truly love our neighbors and have mercy on them, we need to consider the effects of our behavior on all of creation, human and non-human.

The link between human behavior toward non-human creation and the current environmental crisis has long been recognized. Rachel Carson (1962), in her book *Silent Spring*, warns of a future time where the culmination of our destructive behavior will lead to the elimination of species and negative consequences for human health:

> *"Then a strange blight crept over the area and everything began to change. Some evil spell had settled on the community: mysterious maladies swept the flocks of chickens; the cattle and the sheep sickened and died. Everywhere there was a shadow of death. The farmers spoke of much illness. … There was a strange stillness. The birds, for example – where had they gone?" (p. 2)*

While this "Fable for Tomorrow" describes a world damaged by the overuse of synthetic chemicals like DDT, the symptoms described could also result from other forms of environmental degradation, such as deforestation, over-grazing, and production of greenhouse gasses. Carson and many of her contemporaries used their writings to help the average person connect their behavior to observable ecological patterns, and thus ushered in the environmental movement. In his famous essay, "The Historical Roots of Our Environmental Crisis", Lynn White, Jr. (1967) asserts that human attitudes toward non-human creation result in environmental degradation. Additionally, he argues that the Christian understanding of man as distinct from nature and man's role as ruler over nature has perpetuated degradation and distanced us even further from an understanding of how our actions and attitudes affect ecosystem health (White 1967). White's thesis is still controversial; however, the result has been the development of an increasingly large body of literature establishing a biblical foundation for creation care (see Van Dyke et al. 1996, Bouma-Prediger 2001). While there is a growing Christian Environmental Movement, many Christians resist action for various reasons including a fear of pantheism, an apocalyptic world-view (the earth will be destroyed regardless), and an emphasis on caring for people rather than non-human creation (DeWitt 1994). These attitudes among Christians perpetuate complacency towards non-human creation, facilitate over-consumption of natural resources, and ultimately result in environmental degradation that perpetuates human suffering. We have fallen short of our God-given responsibilities to be caretakers of God's creation. In this paper I will demonstrate how creation-care and love for neighbor are intertwined. Human health and suffering are not separate from creation suffering. The actions that result in the groaning of creation also result in the suffering and death of people. It is our responsibility as Christians to love our neighbor, and one very good place to start is by changing our attitudes and working as Christ's representatives toward reconciliation of "all things, whether things on earth or things in heaven" (Colossians 1:20).

I. Land-Use and the Ecology of Disease

> *God blessed them and said to them, "Be fruitful and increase in number; fill the earth and subdue it. Rule over the fish of the sea and the birds of the air and over every living creature that moves on the ground."* Genesis 1:28

Human population growth, expansion and the global development of agriculture have resulted in the modification of natural vegetation on every continent except Antarctica (Saunders et al. 1991). In fact, it is estimated that currently 83% of the land surface has been altered by humans (Sanderson et al. 2002). The development of agriculture has historically precipitated the greatest changes in predominant vegetative communities (Saunders et al. 1991); however, the current landscape is influenced by a variety of land-use types including road-building, urbanization, dam-building, irrigation, mining, farm abandonment, and reforestation (Foster et al. 2002, Patz et al. 2004). Where humans are present, landscapes transition in predictable cycles from wilderness with low human population densities to clearings accommodating subsistence agriculture to large-scale changes in landscapes associated with intensive agriculture and urbanization (DesFries 2004). Cycles of changing land-use result in loss of habitat (fragmentation) for non-human organisms, pollution, migrations of wildlife and people, and ultimately outbreaks and the emergence of infectious diseases (Epstein, 1995, Foster et al. 2002, Patz et al. 2004).

Human alteration of ecosystems and changes in interactions between humans and the environment are the most commonly recognized factors contributing to the emergence of disease (Morse, 1995). Activities such as deforestation, irrigation, dam-building, wetland modification, and agriculture can result in very specific ecological changes that enhance the transmission of diseases (Anonymous 1996, Patz et al. 2004, Slingenbergh et al. 2004). Habitat alteration can facilitate the expansion and subsequent establishment of disease vectors and/or reservoirs (Epstein 1995, Ostfeld and Keesing 2000). For example, changes in hydrology associated with logging frequently result in increased mosquito populations and a subsequent increase in the transmission of malaria (Croll 1983). In addition to immediate changes in population sizes of vectors (carry diseases from host to host) or reservoir hosts (source of pathogen), conditions associated with shifts in predominant land-use also result in related factors that can exacerbate disease transmission or even promote disease emergence (Patz et al. 2004). These related factors include pollution, erosion, introductions of exotic and/or pathogenic species, and the marginalization of people resulting in human migration and poverty (Farmer 1996, Kidder 2003, Patz et al. 2004).

The emergence of infectious diseases among human populations has occurred throughout history, and such infections have had significant impacts on human culture and civilizations (Satcher 1995, Barrett et al. 1998). An emerging infectious disease can be defined as a new infectious disease that appears in a population, or a previously rare disease that has increased in incidence (Morse and Schluederberg 1990, Morse 1995). Many of the diseases that plagued early civilizations are still common among current human populations (Morse 1995). For example, Schistosomiasis (caused by infection with the human blood fluke) was described in several of the Egyptian papyri, including the Ebers Papyrus (Kolata 1985), and still affects 200 million people throughout the world today (World Health Organization 1996). Infectious diseases such as HIV, West Nile virus, influenza, Lyme disease, Hanta viruses, and cholera all have emerged recently due to the introduction of an infectious agent (virus/bacteria/parasite) into a new host population, and the facilitation of transfer between hosts (Morse 1995). Shifts in human land-use are directly responsible for the introduction of new pathogens into human populations, and altered transmission dynamics from host-to-host. As humans transform untouched habitats, they create conditions that cause shifts in population sizes of other species that are potential reservoirs of disease. For example, many rodent populations increase in size when forests are converted to agricultural fields. Because rodents are common hosts of pathogens such as Hanta Virus, emergence of this disease among humans is common in areas where agriculture is the predominant land-use.

Pathogens have an uneven dispersion throughout the individuals of a population and throughout the environment. Unequal distribution due to differences in susceptibility of humans and other hosts, patchy distributions of vectors, and variability of the environment result in complex patterns of disease emergence that ultimately depend on human population densities and behavior (Croll 1983). Therefore, as humans transitioned from a primarily nomadic lifestyle to an agrarian and ultimately sedentary lifestyle, the patterns of disease and disease emergence changed (Barrett et al. 1998, Satcher 1995). Nomadic peoples lived in small groups widely dispersed throughout the landscape. Certainly these people were exposed to diseases, especially helminth parasites (worms) transmitted via consumption of wild game (Kliks 1983). However, low-density human populations were somewhat protected from diseases requiring frequent human contact for transmission. Such diseases might severely impact one small family group; however, transmission of the pathogen to other people would not be likely due to lack of contact (Barrett et al. 1998). The hunting and gathering lifestyle also meant that people moved as availability of resources changed; therefore, they avoided diseases associated with accumulating human waste (Barrett et al. 1998).

A. Human Population Growth and Epidemics

The development of tools allowed people to exploit and settle in new environments and resulted in the introduction of new pathogens to human populations (Kliks, 1983). Agricultural techniques improved as well, resulting in more resources to support a growing human population. The combined effect of increased human population densities, accumulated human waste, and surplus crops (food for pests) set the stage for the emergence of the most recognized example of emerging infectious disease, plague (Dols 1977, Lappé 1994, Diamond 1997). Ibn Khatimah from Andalusia, wrote in 1349:

> *This is an example of the wonderful deeds and power of God, because never before has a catastrophe of such extent and duration occurred. No satisfactory reports have been given about it, because the disease is new…God only knows when it will leave the earth* (quoted in Watts 1997, p.1).

Bubonic plague was new to Europe, but it was not a new disease. There are earlier references to illness characterized by the development of tumors (buboes) in the armpits or groin area; however, the frequency of occurrence increased as people established trade routes (Ziegler 1969, Shrewsbury 1970). Movement of goods from Asia to Rome resulted in the accidental introduction of a rodent species, *Rattus rattus*, the common house or field rat, throughout the Middle East (Shrewsbury 1970). Rodent populations became established due to agricultural practices and grain storage, and continued to disperse north as trade moved into Europe (Shrewsbury 1970). Coinciding with the expansion of rats, local occurrences of plague emerged throughout history (Shrewsbury 1970, Watts 1997, Kruse et al. 2004). The plague of Justinian (A.D. 540) was the first recorded large-scale pandemic of bubonic plague; however, scholars speculate that plague could have been common much earlier (Shrewsbury 1970, Watts 1997). Some scholars believe that the plague of the Philistines in I Samuel 5:6-6:18 was the bubonic plague (McNeill 1976, Kruse at al. 2004).

By the fourteenth century, the conditions for a pandemic disease emergence were in place. Efficient farming practices and surplus grain allowed people to abandon rural lifestyles and move into urban centers. The increased densities of people created unsanitary conditions as waste accumulated (Garrett 1995). Well-established rodent populations grew as a result of human behavior and accumulation of waste, and contact rates between humans and the rat reservoir of plague increased (Lappé 1994, Diamond 1997, Kruse et al. 2004). The Black Death of the fourteenth century began in Asia killing hundreds of thousands, and moved swiftly with trade across the Mediterranean and into Northern Europe (Ziegler 1969, Shrewsbury 1970, Garrett 1995, Watts 1997). The bacterium responsible for the black death, *Yersina pestis*, naturally cycled between fleas and rodents; however, it can infect other mammals including humans (Garrett 1995). Fleas feeding on rats acquire the bacteria and transmit the infection to the next host as it takes its next blood meal. In fourteenth century Europe, bathing was considered dangerous (Garrett 1995). The unhygienic practices and high human densities resulted in ideal conditions for the transfer of *Y. pestis* from rats to humans (Garrett 1995). As the pandemic swept across the Mediterranean and Europe, the bacteria no longer required the flea for transmission, and a new form of plague developed (Garrett 1995). Bubonic plague is typically transmitted via the bite of fleas. The bacterium establishes in the blood stream and results in painfully swollen lymph nodes (buboes or tumors). The second form of plague, pneumonic, results when the infection establishes in the lungs.

This form of plague is transmitted in the sputum and by coughing individuals. The pneumonic plague spreads very rapidly in dense human populations. The pandemic known as the Black Death began as bubonic plague, and spread rapidly as pneumonic plague. As the plague spread, the European population was reduced by at least 25% (Ziegler 1969, Shrewsbury 1970, McNeill 1976, Garrett 1995), and the population structure also was altered in such a way as future population growth would be reduced (Watts 1997). Women and children were more susceptible to plague, thus reducing the next reproductive generation and slowing population growth in Europe for hundreds of years (Watts 1997).

High human densities certainly facilitate the rapid transmission of communicable diseases; however, the environmental impacts of increasing populations also contribute to the emergence of diseases with other modes of transmission. Human populations have been growing exponentially (unchecked) since the dawn of agriculture (Population Reference Bureau 2005). Prior to agriculture, approximately 10 million people lived a nomadic lifestyle. By A.D. 1, the population size had reached 300 million and, by the start of the Industrial Revolution in 1750, numbers reached 760 million. Technology allows us to live beyond the immediate capabilities of the land. For example, deserts are farmed because of technological advances in irrigation. Therefore, mankind entered the 20th century with 1.6 billion individuals, and, remarkably, entered the 21st century with 6.1 billion people (PRB 2005). A necessary result of population growth is the transformation of ecosystems and environmental degradation (Ehrlich and Holdren 1971). Because humans are not dispersed evenly across all landscapes, their disproportionate environmental impact results in unequal patterns of disease transmission and emergence (Farmer et al. 2000, Clark 2001). Erlich and Holdren (1971) demonstrated that human impact on the environment is directly related to consumption, affluence, and technology. These factors have driven the land-use history of much of the developed world and currently are shaping the landscapes of the developing world (Pimm 2001).

B. Transformation of Landscapes and Transmission of Disease

Landscapes are transformed as a direct result of human resource consumption. The modification of landscapes via fire, deforestation, cultivation, and irrigation has ancient roots (Kates et al. 1990) and contemporary consequences (Anonymous 1996). As many as 37 million acres of forest are lost worldwide each year (Perlin 1989), an astonishing figure considering most of the forests were cleared in Europe and China prior to the industrial revolution (Pimm 2001). Deforestation results in the reduction of necessary resources (e.g. a majority of the world's population depends on firewood for energy), as well as increased frequency of flooding, erosion, desertification, salinization of soils, and loss of soil productivity (Allen and Barnes 1985, Newson and Calder 1989, Perlin 1989). Each of the physical changes associated with deforestation also are contributing factors in the emergence and transmission of infectious disease.

A major contributor to landscape transformation is habitat fragmentation, or the breaking-up of continuous habitat types into smaller patches (Forman 1997). Natural processes such as fire or herbivore activity can result in habitat fragmentation; however, anthropomorphic processes such as logging and agriculture also play an important role in transforming landscapes (Forman 1977, Kates et al. 1990). As habitat is fragmented, native patches of habitat are reduced in size, isolated, and the proportion of edge-to-interior is increased (Rolstad 1991, Saunders et al. 1991). Increased edge-to-interior ratios may negatively affect species dependent on interior habitats resulting in decreased biodiversity (Yahner 1988). The ultimate reduction of habitat patches results in further declines in biodiversity as species requiring larger ranges are lost (Fahrig 2002). Isolation of these patches may further impact diversity through the loss of species with limited dispersal ability and/or high site fidelity (dependence on the particular location) (Sjoren 1991, Verboom et al. 1991, Robinson et al. 1992). The loss of species in highly fragmented landscapes has been documented in many ecosystems. For example, declines in songbird and mammalian species richness have been documented in landscapes dominated by agriculture (Rolstad 1991, Yahner 1988), and populations of large mobile predators, such as wolves, also have demonstrated declines in highly fragmented ecosystems (Beier 1993). Maintaining high levels of biodiversity is an important goal of conservation biology and conservation medicine (Ostfeld et al. 2002). Transmission of pathogens to humans is typically slower when there is a high diversity of potential natural hosts (Ostfeld and Keesing 2000, Schmidt and Ostfeld 2001). Therefore, maintaining high biodiversity creates a dilution effect for disease transmission, and results in reduced human-pathogen contact (Ostfeld and Keesing 2000, Schmidt and Ostfeld 2001).

Not all species exhibit declines in highly fragmented habitats. In fact, species characterized by the ability to exploit several different habitat types, species with affinities for edge or ecotonal habitats, species with high levels of mobility, and species that are tolerant and/or dependent on human activity generally demonstrate population increases in fragmented landscapes (Meffe and Carroll 1994). When these species are reservoirs or vectors of pathogens, transmission increases as a direct response to the transformation of landscapes.

Raccoons are opportunistic omnivores and can exploit resources in a variety of habitat types (Gehrt 2003). They are a common mammal in the Midwestern United States where landscapes have been transformed via fragmentation from nearly contiguous forest to nearly homogeneous agricultural fields (Spetich et al. 1997). In such human-dominated landscapes raccoon population densities increase, and often range from 40-120 individuals/km^2 (Riley et al. 1998, Gehrt 2003). The population response of raccoons to transformed landscapes has implications for human health because they are potential hosts of many diseases that affect other wildlife (Roscoe 1993, Gehrt 2003), domestic animals (Mitchell et al. 1999, Kazacos 2000), and humans (de Almeida 1987, Kazacos 2000, 2002, Sorvillo et al. 2002).

Raccoons are the host of a common roundworm parasite, *Baylisascaris procyonis*, that has recently been recognized as the cause of an emerging zoonosis (a disease transmitted from animals to humans; Kazacos 2000, 2002, Sorvillo et al. 2002). The transmission of this parasite changes as a function of human land use, increasing in highly fragmented habitats (Page et al. 2001a). As many as 80% of adult raccoons and 90% juvenile raccoons can be infected (Kazacos and Boyce 1995, Kazacos 2001). Transmission of *B. procyonis* requires that intermediate or accidental human hosts contact raccoon feces (Kazacos 2001, Page et al. 2001b). Raccoons habitually defecate at preferred locations or latrines (Giles 1939, Stains 1956, Yeager and Rennels 1943, Page et al. 1999). Latrines are characterized by large accumulations of feces on horizontal substrates ranging from fallen logs and stumps in more natural settings (Page et al. 1998) to rooftops, woodpiles, and decks in urban settings (Roussere et al. 2003). A single raccoon can deposit millions of resistant (they may survive as long as 10 years) eggs with its feces daily. Eggs accumulate with feces at latrines; therefore, transmission occurs at latrines (Page et al. 1998, 1999, 2001b, Kazacos 2001). Young children are at the greatest risk for zoonotic infection because of the fecal-oral transmission route and the tendency to put objects into their mouths (Kazacos 2000, 2002). Human infections with *B. procyonis* can result in fatal or severe Central Nervous System (CNS) disease (Kazacos and Boyce 1995, Park et al. 2000, Rowley et al. 2000). In the United States, 15 cases have been documented (Huff et al. 1984, Fox et al. 1985, Cunningham *et al*., 1994, Moertel *et al*. 2001, Kazacos 2000, 2001, Center for Disease Control 2002), 5 of which were fatal (Huff *et al*. 1984, Fox *et al*. 1985, Kazacos 2001). In many of these cases, transmission occurred in environments where latrine densities were high and in close proximity to play areas of children (Kazacos 2001). Although the incidence of this disease is currently low (Kazacos 2001), the devastating neurological damage it causes when children acquire the infection warrants an understanding of how transmission dynamics change as the landscape is transformed.

Deforestation and Zoonoses

As landscapes are deforested for development, people come in closer contact with wildlife (free-ranging animals) and the diseases they carry (Gibbons 1993, Morse 1995). Many infectious diseases of humans originated in wildlife reservoirs (Kruse et al. 2004), and 62% of 1,415 known human pathogens are zoonotic (Taylor et al. 2001). Perhaps some of the most devastating pathogens, including Ebola, Hanta viruses, and HIV, entered the human population as a result of human manipulation of the environment and therefore the inevitable contact with wildlife (Lappé 1994, Garrett 1995, Kruse et al. 2004, Slingenbergh et al. 2004). When a pathogen enters a new host for the first time, the resulting infection often is highly virulent and spreads quickly through the new host population (Lappé 1994), as was the case of the Ebola emergence in the early 1970s (Garrett 1995), the HIV emergence of the early 1980s, and the Hanta Virus (Hemorrhagic fever) emergence in 1993 (Epstein 1995).

In Central Africa, the logging industry is characterized by selective cutting (for specific species) rather than clear-cutting (Wolfe et al. 2000). This approach results in highly fragmented forests with decreased biomass and biodiversity (Wolfe et al. 2000). Road-building accompanies forestry practices and, as a result, interior forest becomes accessible to people (Wolfe et al 2000, Laurent et al. 2004). Decreased biodiversity results in fewer potential hosts for microbes, and increased fragmentation and accessibility of interior forests result in the introduction of humans as a potential host for pathogens (Ostfeld and Keesing 2000, Wolfe et al. 2000). When people begin hunting along newly accessible roads, the probability of cross-species infections with potentially devastating microbes, such as Ebola and HIV, increases.

In the summer of 1976, two separate but concurrent outbreaks of a horrifying new disease ravaged villages in the Democratic Republic of Congo and Sudan (Garrett 1995, McCormick 2004). A severe hemorrhagic fever was taking hundreds of lives, especially those of doctors and nurses working in the rural hospitals associated with communities where people depended on resources from previously untouched tropical forests (Garrett 1995). A new filovirus, Ebola, had emerged. Since the initial outbreak, several other outbreaks have occurred, and 4 species of Ebola have been identified (Allela et al. 2005) with mortality rates ranging from 50-89% (Nichol et al. 2000, Rouquet et al. 2005). The animal reservoir of the virus has not been identified; however, human outbreaks were thought to occur after hunters contacted sick or dead gorillas, chimpanzees, or duikers (antelope) and subsequently infected their families and others at hospitals (Wolfe et al. 2000, Allela et al. 2005, Rouquet et al. 2005). Every outbreak of Ebola has been associated with villages on the edge of lowland tropical forests with increased fragmentation due to agriculture and logging roads (Morvan et al. 2000).

As technology improved and the ability to move goods worldwide resulted in an increased demand for natural resources such as tropical wood, mass deforestation of tropical forests in equatorial Africa brought people in close proximity to new wildlife reservoirs and new pathogens. Human Immunodeficiency Virus (HIV), the cause of Acquired Immunodeficiency Syndrome (AIDS), emerged in the 20th Century as one of the deadliest microbes in the history of humankind (Marx et al. 2004, World Health Organization 2005a). Nearly 30 million people have died since the beginning of the AIDS pandemic, and more than 14 million children have lost one or both parents (WHO 2005a). At the end of 2004 more than 40 million people were estimated to have HIV, and it was estimated that more than 8,000 people died every day during 2004 from AIDS (WHO 2005a). Acquired Immunodeficiency Syndrome (AIDS) is the ultimate manifestation of an infection with one of two lentiviruses, HIV-1 or HIV-2 (Peeters et al. 2002, Weiss 2003a, b, WHO 2005a). Since the initial emergence, HIV-1 (type 1) has spread throughout the world; however, HIV-2 (type 2) is restricted primarily to West Africa (Peeters et al. 2002). It is believed by many scientists that these viruses have zoonotic (wildlife reservoir) origins because of the similarity to Simian

Immunodeficiency Viruses (SIV) identified in chimpanzees (*Pan troglodytes troglodytes*) and sooty mangabeys (*Cercocebus atys*) (Peeters et al. 2002, Weiss 2003a, b).

The conditions allowing for the emergence and pandemic of HIV are numerous and include both environmental and sociological factors (Peeters et al. 2002, Weiss 2003a, b, Laurent et al. 2004). Environmental changes linked to the deforestation occurring as a result of commercial logging are implicated in increased contact rates between humans and non-human primates (Laurent et al. 2004). Phylogenetic studies of HIV and SIV demonstrate a close relationship and support the hypothesis of cross-species transfer (Peeters et al. 2002, Weiss 2003a), and the increase in bush-meat consumption that corresponds to commercial logging explains the mechanism of this transfer (Peeters et al. 2002, Walters 2003). Scientists believe that SIV viruses have been transmitted from non-human primates to humans on at least 8 separate occasions (Peeters et al. 2002, Weiss 2003a). This frequency of exchange corresponds to the increase in commercial logging. Preceding and concurrent with the timing of the AIDS pandemic, over 300 million hectares of tropical forest have been cut and converted to agriculture or large-scale plantations (Hennig 2005). Bush-meat consumption also increased in frequency due to increased access to wildlife and the need of food resources by those engaged in logging in such remote locations (Walters 2003, Laurent et al. 2004). It is believed that SIV was acquired by humans through cuts acquired while butchering non-human primates for consumption, rather than via consumption of undercooked meat (Dixon 1999, Peeters et al. 2002).

While human transformations of the landscape via deforestation played a critical role in the acquisition of HIV, it also played a critical role in the dissemination of the disease (Laurent et al. 2004). Roads associated with logging facilitated migrations of people (especially men) and ultimately resulted in changes in social and economic patterns, especially increases in commercial sex (Laurent et al. 2004). Therefore, while ecological factors allowed HIV to emerge, social conditions resulting from development associated with land-use facilitated the epidemic (Weiss 2003a).

Agriculture, reservoirs, and vectors

Human health is dependent on healthy ecosystems (Meade 1976); however, as humans expand and attempt to develop stable economies, ecosystems are degraded (Cook et al. 2004). A lack of sustainable approaches to development and agriculture has resulted in permanently damaged soils, changes in hydrological (water) systems, and ultimately insufficient food supplies and poor health for the growing human population in the developing world (Waltner-Toews and Lang 2000). These changes in land-use are the most common factors associated with disease emergence (Morse 2004). Transformations of the landscape often result in the increase of populations of reservoir hosts and/or vectors of microbes, changes in water regimes and altered soil quality. Environmental degradation caused by land-conversion related to agriculture has resulted in the emergence of hemorrhagic fevers, increased incidence and distributions of malaria, and the spread of parasitic infections such as schistosomiasis.

Cultivation and storage of grain supports the population growth of rodents, that often are reservoirs of infectious microbes implicated in hemorrhagic fevers (Mills and Childs 1998). These microbes are present in rodent urine and feces, and humans can become infected by breathing in aerosolized rodent excreta. The 1993 outbreak of the Sin Nombre virus in the four corners area (New Mexico, Arizona, Utah, and Colorado) of the United States might be the most familiar emergence of a hemorrhagic fever; however, such viruses exist worldwide and have emerged with the conversion of land to agriculture (Mills and Childs 1998, Yates et al. 2002). For example, as the cultivation of maize spread through northern Argentina in the 1930s and 1940s, a new illness emerged (Lappé 1994). The corn mouse (*Calomys musculinus*) is the reservoir of the Junin virus, the cause of Argentine hemorrhagic fever. In the presence of agriculture, this rodent out-competes other native rodent species that are not suitable hosts for the virus (Lappé 1994, Morse 2004). The resulting increased population density of corn mice resulted in hundreds of human cases per year until the implementation of an effective vaccine in 1992 (Lappé 1994, Mills and Childs 1998). Like Argentine hemorrhagic fever, Korean hemorrhagic fever is caused by a virus hosted by a rodent, the field mouse (*Apodemus agrarius*), that responds positively to agriculture by increasing in numbers (Morse 2004). The Hantaan virus causes hemorrhagic fever with renal syndrome and is responsible for at least 100,000 human cases per year in landscapes dominated by agriculture in the People's Republic of China (Morse 2004). Factors that contribute to the population growth of rodent reservoirs (e.g. grain production and storage), may also contribute to the persistence and transmission of hantaviruses (Abbott et al. 1999). Therefore, the land-use changes associated with agriculture increase the likelihood of hemorrhagic fever emergence among people living within that landscape.

Changes in hydrologic regimes play a significant role in disease emergence, as it often results in increased habitat for disease vectors and reservoirs (Meade 1976, Garrett 1995, Martens and Hall 2000, Cook et al. 2004). Significant outbreaks of vector-borne disease have been attributed to human manipulation of the hydrologic cycle. During the construction of the Panama Canal, more than 5000 people died from yellow fever, a mosquito-vectored pathogen (Cook et al. 2004). Following the construction of the Aswan Dam in Egypt, an outbreak of Rift Valley fever affected 200,000 people and claimed 600 lives (Haggett 1994). The dam stabilized the water table and resulted in an 800,000-hectare body of water, increasing breeding habitat for the mosquito vectors of Rift Valley Fever. Two of the most important causes of human disease, malaria and schistosomiasis, have transmission ecologies significantly impacted by changes in hydrological regimes (Packard 1984, Martens and Hall 2000, Saker et al. 2004). Together the parasites that cause these diseases affect more than 700 million people (World Health Organization 1996, Centers for Disease Control 2005).

Conversion of forest to agricultural fields and irrigation practices result in environmental conditions where water pools and accumulates, creating the perfect conditions for mosquitoes to lay their eggs. Therefore, altered water regimes in agricultural areas promote the increase and expansion of mosquito populations (Ghebreyesus et al. 1999, Confalonieri 2000). Mosquitoes are distributed world-wide, and nearly all of the 3,500 species have a life-cycle in which the female requires a blood-meal prior to depositing eggs in a moist environment (Reiter 2001). Because of this blood meal, mosquitoes are efficient vectors of disease, and they are responsible for the transmission of numerous pathogens and parasites (Kidwell and Wattam 1998, Reiter 2001). Malaria is caused by a parasite, *Plasmodium spp.*, that is transmitted between humans via the *Anopheles* mosquito vector (Centers for Disease Control 2005). Incidence of malaria is highest in Sub-Saharan Africa, where >90% of global cases occur each year (Martens and Hall 2000, Centers for Disease Control 2005). As landscapes are transformed via irrigation and deforestation, incidence and geographic distribution of malaria increase (Packard 1984, Martens and Hall 2000). Further increases in incidence are predicted as *Plasmodium* spp. and *Anopheles* spp. develop resistance to drugs and pesticides (Denholm and Rowland 1992, Bloland et al. 1993) and, ultimately, as mosquito populations increase and spread with global climate change (Haggett 1994, Pimental et al. 1998).

Schistosomiasis is an ancient disease that has long been associated with changing hydrological regimes. Caused by several species of parasites in the genus *Schistosoma*, this parasitic infection is second only to malaria in contributing to human suffering (Weil and Kvale 1985). Each of the schistosome species has a life-cycle that requires a snail intermediate host (Weil and Kvale 1985, Bogitsh et al. 2005). Infected snails shed an infective larval stage of the schistosome that is capable of penetration through the skin of a human (Weil and Kvale 1985, Bogitsh et al. 2005). Therefore, casual contact with snail-infested waters can result in schistosome infections (Kloos et al. 2001, Bogitsh et al. 2005). Adult schistosomes reside and reproduce in the blood vessels of the human host (Bogitsh et al. 2005). Infections with the parasite result in damage to the bladder (*S. haematobium*), the liver (*S. mansoni*), or the colon (*S. japonicum*) of the human host (Weil and Kvale 1985). Symptoms vary, but infected individuals suffer with chronic illness that reduces productivity and their ability to contribute to society. Incidence of schistosomiasis has increased worldwide as a direct result of development and urbanization (Pimental et al. 1998, Ernould et al. 2000, Saker et al. 2004). Construction of irrigation systems and dams creates suitable habitat for snails (Weil and Kvale 1985, Inhorn and Brown 1990, Saker et al. 2004), and urbanization results in increased contamination of water sources (Ernould et al. 2000). Without appropriate strategies to limit snail populations and manage human waste, Schistosomiasis will continue to spread as hydrological regimes are altered.

II. Creation Suffering leads to human suffering

> *Woe to you who add house to house*
> *and join field to field*
> *till no space is left*
> *and you alone live in the land.*
> *The Lord Almighty has declared in my hearing:*
> *"Surely the great houses will become desolate,*
> *the fine mansions left without occupants.*
> *A ten-acre vineyard will produce only a bath of wine,*
> *a homer of seed only an ephah of grain." Isaiah 5:8-10*

Ecosystem health is influenced by human manipulation, and human health is dictated by ecosystem health (Cook et al. 2004); therefore, much of the suffering in the world is perpetuated by complacency and a lack of response to environmental degradation. Creation suffers because of our sin (Romans 8:22), and our indifference to this groaning perpetuates the suffering of our neighbors, present and future. Isaiah warns of a time when Israel's actions toward creation would leave them alone in the land (Isaiah 5:8), and suggests that, despite effort, the land will no longer produce enough to sustain them (Isaiah 5:9-10). I would argue that our current reality, while outside the context of the Mosaic covenant and its blessings and curses, parallels that which threatened the Israelites. Currently 2 billion people worldwide suffer from malnutrition (Nierenberg and Halweil 2005) while more than 30% of Americans are obese (Brown 2005). We are seeing decreases in soil productivity and food production such that grain yields in Asia are predicted to decrease 30% while the population will increase 44% (Nierenberg and Halweil 2005). Poverty, malnutrition, and environmental degradation are intimately connected, and it is not coincidence that most of the diseases discussed in this paper disproportionately affect the poor. As Christians we are called to meet the needs of our poor neighbors. When we realize the connection between our consumption, behaviors, environmental degradation, and human disease and suffering, we should be convicted to live lives serving the poor. This includes environmental stewardship.

Emergence of disease occurs in every ecosystem despite the socioeconomic status of the associated people. Diseases emerge in affluent societies; however, many people do not realize the link to environmental change. For example, Lyme disease has emerged in the United States in direct response to the deforestation and reforestation of the eastern forests (Ostfeld 1997). This disease is caused by a bacterium, *Borrelia burgdorferi*, which is vectored by ticks as they acquire blood meals. The emergence of Lyme disease has been perpetuated by a series of complex ecological factors associated with land-use changes (Ostfeld 1997, Van Buskirk and Ostfeld 1998). When the eastern forests were cut during early European settlement, populations of predators declined and/or disappeared. As a result the white-tail deer (*Odocoileus virginiana*) populations increased. Deer are important hosts for ticks and the bacterium; however, white-footed mice (*Peromyscus leucopus*) are very important reservoir hosts (allowing the bacteria to reach very high levels in tick populations). White-footed mouse populations also increased when other larger rodents (squirrels, chipmunks) declined as forests were cleared. During the mid-20th century, the eastern forests were allowed to regenerate. The resulting reforestation of the eastern United States did not restore the original species assemblages, nor did it reduce the population sizes of deer and mice. Concurrent with reforestation were changes in human behavior that resulted in a desire to live closer to nature. As a result humans were living in close contact to large numbers of infected deer and mice, and their beautiful lawns at the edge of the forest created prime habitat for the tick vector of Lyme disease (Van Buskirk and Ostfeld 1995, Ostfeld 1997).

Disease emergence in affluent nations receives significant media attention (e.g. Lyme Disease, SARS, West Nile Virus) and technological advances allow for rapid response, decreased duration, and reduced human suffering (Farmer 1996, Farmer 1999). This is not the case in developing countries. Impoverished people often are more dependent on natural resources for their livelihoods, and as a result, are more directly impacted by the effects of environmental degradation (Dasgupta et al. 2003) and resulting emergence of disease. The poor, in desperation, may utilize resources beyond the possibility of renewal, perpetuating hunger and conditions that facilitate the emergence of disease. In many cases malnutrition complicates diseases associated with pathogens, and reduces the likelihood of restored health. For example, hookworms (*Ancylostoma duodenale, Necator americanus)* cause common parasitic diseases associated with degraded soils and hydrologic regimes (Lilley et al. 1997). This parasite is transmitted easily when erosion results in silty soils that are contaminated by human waste (Lilley et al. 1997). The consumption of resources obtained locally contributes to the emergence of this pathogen, but poverty and malnutrition exacerbate the results (Stephenson 1994). Hookworm infection is most common among already malnourished people, and results in subsequent malnutrition, decreased ability to work (productivity), increased maternal and fetal morbidity, decreased birth weights, and decreased cognitive development of children (Stephenson 1994). The social and economic implications of this single pathogen are enormous, and could be prevented with a more sustainable approach to resource consumption. For example, sustainable agroforestry (combining tree and crop farming) stabilizes soils, planting appropriate crops for a given soil type decreases erosion, and the development of ecotourism in areas not suitable for forestry or agriculture provides income while putting less pressure on fragile natural resources. Consumption of local resources by the world's poor certainly contributes to the overall degradation of creation; however, it is the over-consumption by the wealthy of the world that significantly alters ecosystems, resource availability, and ultimately the transmission of infectious disease (Farmer 1996, Morse 2004).

In our affluence, we might not recognize our dependence on creation or the ramifications of our consumption, but all human beings depend on natural resources. From the beginning, "*Every seed-bearing plant on the face of the earth and every tree that has fruit with seed in it*" were given to man for food (Genesis 1:29). God also provides for non-human creation! "*To all the beasts of the earth and all the birds of the air and all the creatures that move on the ground – everything that has the breath of life in it – I give every green plant for food*" (Genesis 1:30). This provision for all of creation suggests a balance in creation. Scientists might define this balance by describing ecosystem function and trophic (feeding) relationships. A biblical understanding of this balance might best be understood by examining relationships: between man and God, man and man, and man and creation (see Boff 1997, Stephenson 2005). When sin entered the world these relationships were broken. Christians recognize that our relationship with God and other humans suffer as a result of our sin; however, we frequently dismiss the broken relationship with non-human creation: "…*cursed is the ground because of you; through painful toil you will eat of it all the days of your life*"

(Genesis 3:17). Environmental stewardship requires an understanding of these broken relationships. We must acknowledge that our sins of over-consumption and indifference toward non-human creation prevent us from loving our neighbors and ultimately loving God with all of our heart, soul, and mind (Matt 22:37-39).

As the affluent continue to increase their use of natural resources and concurrently increase their contributions to global waste, the poor continue to struggle. Approximately 79% of the world's population lives in the global south - more than 1 billion in abject poverty (Boff 1997). Reviews of disease on a global scale demonstrate that the poor of the developing world are sicker than the affluent of the industrialized world (Farmer 2003). Social inequalities result in more frequent exposures of impoverished people to disease, yet they have little or no access to medical services (Farmer 1999, 2003). The combination of the two results in millions of suffering neighbors, but we are slow to respond. The HIV epidemic emerged nearly 3 decades ago, and has claimed nearly 30 million people (WHO 2005a). Antiretroviral therapies have existed since the late 1980s (e.g. Meruelo et al. 1988), and are successful at increasing quality of life and lengthening survival of those with HIV (WHO 2005b). In Europe and North America, death rates due to HIV/AIDS have decreased 80% in response to antiretroviral therapy (WHO 2004), but unequal access to this treatment in other parts of the world has resulted in the suffering and premature death of millions (Garrett 2003). As of 2004, 6 million people were in need of antiretroviral therapy, but only 400,000 people received this treatment (WHO 2004). While the initial emergence of HIV is related to environmental degradation associated with deforestation and road-building (Peeters et al. 2002, Weiss 2003a, b), the factors that have perpetuated the epidemic are more complex. HIV/AIDS represents how indifference can result in extreme suffering. At the beginning of the AIDS epidemic in the United States there was a very slow response to the suffering because it seemed to only affect homosexuals or drug users (Shilts 1987). Millions of people (representing every demographic) were suffering with AIDS before any real response was mounted. Presently the church is still slow to respond to our suffering neighbors in Africa, China, Haiti, and India. HIV/AIDS started with our broken relationship to non-human creation and resulted in broken relationships with our suffering brothers and sisters.

III. Love Your Neighbor: how we should respond

Christ's life was a ministry to those in need. As his image-bearers (Genesis 1:26-27) and those renewed into Christ's image (Romans 8:29, Colossians 3:10), our ministry should be likewise – acting in love as Christ's representatives. Being created in the image of God requires that we act with dignity towards creation (Walton 2001). Because we are created with the capacity to reflect our creator (Walton 2001), we have the responsibility to act with care and compassion and to respond to the cries of the suffering (Bouma-Prediger 2001). "*The human calling is to enable the whole of creation to praise its creator by particular acts of faithful action towards both other people and the world by proper relationality and by loving dominion*" (Gunton 1996, p 41). Our call to have dominion over creation (Genesis 1:28) requires that we act in a way that allows all of creation, human and non-human, to flourish (Bryant 2000).

God created man in His image (Genesis 1:26-27), and to be in relationship (Phillips and Okholm 1996, Bryant 2000, Bouma-Prediger 2001, see Genesis 2:18, 21-24). Many Christians have a dualistic (physical vs. spiritual) understanding of *imago Dei* which results in a false understanding of dominion because it overlooks the relational aspect of God's image. As a result, many Christians overlook the importance of relationality among God, humans and non-human creation (Stephenson 2005). This misunderstanding results in the over-consumption and misuse of natural resources. Phillips and Okholm (1996) argue that the greatest commandment to *"Love the Lord your God with all of your heart and with all your soul and with all your mind* (Matthew 22:37)*"* reflects that we were created to be in relationship with God. To "*Love our neighbor as (our) self*" (Matthew 22:39) is an extension of this relationality. Because love for our neighbor should include care for the environment in which our neighbors live, the renewed image of God in our lives should prompt us to act as stewards of creation (Walsh and Keesmaat 2004).

The biblical foundation for creation care is well-established (Van Dyke et al. 1996, Bouma-Prediger 2001); however, Christians are slow to respond. Many believe that our responsibility to care for non-human creation should not jeopardize caring for other people (DeWitt 1994). Without caring for their environment, however, we can not care for others. The needs of our poorest brothers and sisters – food, shelter, medicine – can all be provided by a healthy ecosystem (Cook et al. 2004). Intact forests protect hydrologic regimes and fertile soils for subsistence agriculture. Healthy ecosystems are characterized by high biodiversity, thus providing food from many plant and animal sources. Healthy ecosystems provide plants with medicinal properties, such as chichona, tree bark from which the anti-malarial drug Quinine is extracted. Care for creation should always consider people (Bouma-Prediger 2001). Certainly Christians should meet the immediate needs of the suffering, but our efforts will be in vain if we do not address the long-term effects of our actions on the global environment. We need to recognize and respond to the fact that human manipulation of the environment is directly or indirectly responsible for nearly every emergence of infectious disease (Garrett 2003).

The Israelites understood that the effects of their sin would be manifest in their relationship with the land. They understood that God, the creator, saw all of creation as good. They were promised a land "flowing in milk and honey", but were left to wander in the wilderness because of disobedience. The Old Testament prophets' warnings link sin with broken relationships to the land:

> *"The earth dries up and withers, the world languishes and withers, the exalted of the earth languish. The earth is defiled by its people; they have disobeyed laws, violated the statutes and broken the everlasting covenant. Therefore the curse consumes the earth; its people must bear their guilt. Therefore the earth's inhabitants are burned up, and very few are left."* (Isaiah 24:4-6)

The proper response was to return to covenant-life or life in community with God, other humans, and non-human creation (DeWitt 1994).

Because Christ comes "*to reconcile to himself all things whether things on earth or things in heaven, by making peace through his blood shed on the cross*" (Colossians 1:20), a proper response to the suffering caused by environmental degradation is to act as Christ's agent (image bearer) of reconciliation. Paul outlines rules for holy living in Colossians 3, and urges us to "*put on the new self, which is being renewed in knowledge in the image of its Creator*" (Colossians 3:10). When we live with compassion, kindness, humility, gentleness, patience, and love, we image the love of our Creator and love our neighbors (Bouma-Prediger 1998). Walsh and Keesmaat (2004) describe how these attributes can be applied to our relationship towards non-human creation. We should respond with compassion to the groans of creation, working to preserve the diversity of creation. In kindness we will make thoughtful decisions about the resources we consume, and the way that we interact with non-human creation. We should humbly accept that our technology will eventually be limited by the capacity of ecosystems to repair, and work towards sustainable solutions to environmental needs (e.g. sustainable agriculture including agro-forestry). Our consumption of resources should be gentle, always considering the needs of our future neighbors. Therefore, we should not consume beyond our immediate need. Natural systems are resilient, and are created so that they can provide for our needs. However, God intended for his creation to rest as He did. Under the Mosaic covenant, the Israelites were to observe the Sabbath as a time of rejuvenation and worship. Likewise, God intended for them to allow the land a Sabbath rest (Leviticus 25:4). Land Sabbath would prevent damage to the land from overgrazing and it would allow for restoration of soil nutrients. While we are not necessarily called to follow this Mosaic Law, it does reflect God's care for His creation, and this care should be reflected in our interactions with creation (DeWitt 1994). This requires patience. Finally, we are to act in love because God is love. *"For word of the Lord is right and true; he is faithful in all he does. The Lord loves righteousness and justice, the earth is full of his unfailing love"* (Psalm 33:4-5). We should consider how our actions affect creation because creation reflects God's love (Walsh and Keesmaat 2004).

Caring for creation is love for our neighbors. How then should we live in order to diminish the suffering of creation and our brothers and sisters? As Christians we are called to be earthkeepers (DeWitt 1994, Phillips and Okholm 1996, Van Dyke et al.1996, Bouma-Prediger 1998). The development of an environmental ethic involves virtuous living (Bouma-Prediger 1998), awareness, appreciation or valuing, and stewardship (DeWitt 1994, Van Dyke et al. 1996). When we fail to acknowledge God's and our relationship with non-human creation, we ultimately fail to be appropriate caretakers. Because we are called by God to be stewards of His creation, failure to respond is direct disobedience, and therefore sin.

The Christian response to both environmental degradation and the suffering of the poor from disease has been slow (DeWitt 1994, Boff 1997, Campolo 2002), and frequently misinformed. For example, some highly influential leaders of the church in the United States prepared a document regarding ethics for the 2004 presidential election. In this document, they speak to natural resource use:

> *"**Natural resources:** God put human beings on the earth to 'subdue it' and to 'have dominion' over the animals (Gen. 1:28). We value the beauty of the natural world which God created, and we believe that we are called to be responsible stewards who protect God's creation while we use it wisely and also seek to safeguard its usefulness for future generations. The Bible does not view 'untouched nature' as the ideal state of the earth, but expects human beings to develop and use the earth's resources wisely for mankind's needs (Gen 1:28; 2:15; 9:3; 1Tim 4:4). In fact, we believe that public policy based on the idealism of 'untouched nature' hinders wise development of the earth's resources and thus contributes to famine, starvation, disease, and death among the poor. We believe the ethical choice is for candidates who will allow resources to be developed and used wisely, not for candidates indebted to environmental theories that oppose nearly all economic development in our nation and around the world."* (Anonymous 2004).

Wise use of resources is certainly mandated by the scriptures. In the context of this document, the authors continually refer to resource development and wise-use. Because they do not define wise use, and this document is designed to inform voters on an election framed by certain partisan policies, their use of the phrase “wise use” apparently is framed within the context of current use. The authors do not suggest that current patterns of consumption are unethical, only that to “protect untouched nature” is not biblical. Currently the United States consumes more natural resources than any other country, and is the leading contributor to global pollution (World Resource Institute 2004). In the United States we consume 1,942,807 thousand metric tons (oil equivalent) of fossil fuels and only 83,372 thousand metric tons (oil equivalent) of renewable forms of energy (World Resource Institute 2004). This pattern of consumption does not reflect wise use, and does in fact contribute to environmental degradation because the United States also contributes the highest per-capita carbon emissions in the world: >1,200,001 thousand tons of CO_2 per year (World Resource Institute 2004). Energy consumption is only part of the picture, but if patterns of energy consumption are reflective of other types of resource use (for example paper consumption – the average US citizen consumes nearly 350 kg of paper per year, while the average global citizen consumes less than 50kg/year), I would argue that our current patterns of consumption contribute to the global economic crisis, and are anything but wise. In fact, current development contributes to *“famine, starvation, disease, and death among the poor”* rather than preventing such suffering (Anonymous 2004).

Christians must respond to the current ecological crisis. The first step is to recognize that our complacency toward the environment results in the excessive consumption of resources and subsequently the degradation of ecosystems that provide those resources. We can respond as individuals; however, a corporate Christian response would be more effective. Van Dyke et al. (1996) remind us that while individual responses directed by our obedience to God may result in different choices, our corporate response must work toward a common goal. Christian leaders need to learn about environmental issues and present a biblical foundation for creation care to their congregations (Van Dyke et al. 1996, DeWitt 1998). There are numerous excellent resources to guide Christian's toward an appropriate response (see VanDyke 1996, DeWitt 1998, Bouma-Prediger 2001). The Evangelical Environmental Network maintains a web page (http://www.creationcare.org) and publishes a magazine (*Creation Care*) that are excellent sources of practical approaches to environmentally-friendly living. The purpose of this paper is not to re-state these excellent sources, rather, it is to urge Christians to refer to these or other sources as they intentionally live as stewards of God's creation. In our daily lives we need to recognize our patterns of resource consumption. We need to make efforts to use resources that are necessary, and limit excessive or frivolous use. We should spend a few extra minutes to research the source of the products we buy. For example, purchase products made from recycled materials or sustainable sources rather than products made from tropical woods that are not harvested with sustainable methods (you can obtain this information on product websites). We should take a few extra minutes to sort our trash and recycle what we can. Simple steps taken as individuals do make a difference.

Christians in the developed world must recognize how we contribute to the suffering of our neighbors. We should embrace the virtues of frugality, humility and wisdom, and develop a stewardship ethic that restores our broken relationship with non-human creation (Bouma-Prediger 2001). In this way we work to restore relationships with our neighbors and with God. Paul's teachings in Romans and Colossians help us understand how to live in Christian community and proclaim the gospel around the world. A proper understanding of these teachings (esp. Romans 8:19-22 and Colossians 1:15-23; 3:10-14) requires believers to respond as responsible stewards of God's creation (Moo 2000, Walsh and Keesmaat 2004).

We are called to image Christ, to live in family, and to respond in love to our neighbors. Care for creation is love for neighbor. Therefore, we are called to live with compassion, kindness, humility, gentleness, patience, and love (Colossians 3:10-14) toward our neighbors and toward non-human creation. By acting as agents of reconciliation for all things on earth and in heaven, we can truly love the Lord our God with all our heart, soul and mind, and love our neighbor as ourselves!

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