Christian perspectives on sustainability: The need for numerical answers to philosophical questions.

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Abstract

This paper presents a survey of Christian perspectives, from ancient to modern, on a variety of sustainability-related topics such as stewardship of the natural world, economic growth and technological change, energy, and human population. The emphasis is on the development of thought and the lineage of ideas, with application to modern viewpoints on current issues such as climate change, sustainable development, and human migration. We review four modern strands (eco-justice, stewardship, "ecological spiritualities", and consumptive economic prosperity) arising from four Christian traditions (Roman Catholicism, reformed Christianity, Eastern Orthodoxy, and conservative evangelicalism, respectively), leveraging a topology developed by Willis Jenkins (Jenkins).

The paper will cover a broad range of Christian thought and teaching in a digestible and coherent format. It will serve as a supplement to a future engineering textbook on sustainability challenges. Textbook chapters will provide a platform of background knowledge to facilitate one-hour in-class discussions of several sustainability topics or challenges. The conference presentation will highlight one area of Christian thought (stewardship) and focus on piloting classroom discussion questions related to the theology of sustainability.

1 Introduction

We want to discuss eschatology somewhere.

We want to introduce engineering earlier in the paper.

We need to signal early that we're not having the debate about whether GW is happening or whether humans can cause large-scale environmental degradation.

The topic of sustainability is often organized into three categories: environmental, economic, and social. Environmental sustainability involves preservation of the nonhuman creation. Economic

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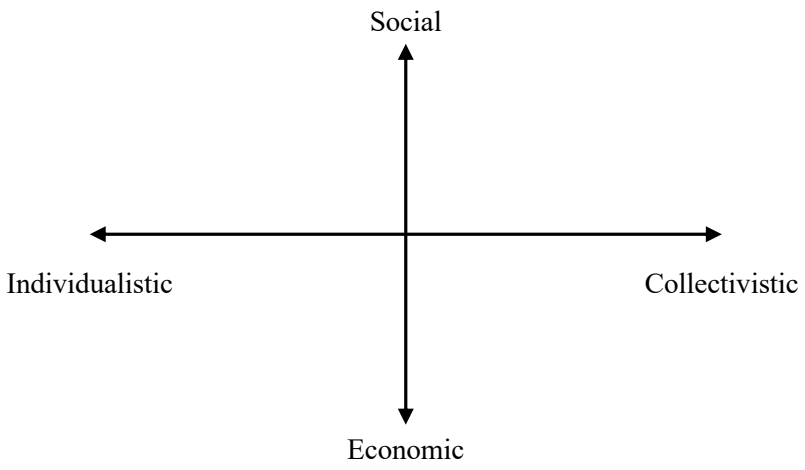

Figure 1: Axes for individualistic and collectivistic views on economic and social issues.

sustainability refers to the preservation and increase in value of human activities. In other words, not everything we do can lose money. Social sustainability refers to relationships among humans: there should be justice, peace, order, and flourishing in human society. For Christians, the root of social aspects of sustainability is the command to "love your neighbor as yourself." Overarching these three areas of sustainability are concerns for human shalom and wellbeing.

Different Christian traditions understand the relationship between humans and the nonhuman creation differently, and each tradition is informed by worldviews that are at times compatible and at other times discordant. Different Christian traditions have differing views on the economic and social themes of sustainability, too. This paper explores the questions "How do Christians think about sustainability topics?" and "Where do their views come from?" The paper is organized as follows: We briefly review Christian thought on the three areas of sustainability in Sections 2 and 3. In Section 4, we explore how Christian worldviews matter when sustainability issues are at stake by evaluating, by example, a proposal to ban personal transportation vehicles to improve the environment. Section 5 concludes, and and the appendix lists additional questions/issues that need to be evaluated from a Christian perspective to achieve a sustainable future.

2 Economic and Social

Economics and politics (or "the social" aspects of sustainability) are inextricably linked. Biblical teaching on money and justice are often recognized as two sides of the same coin, for instance in Micah 2:1-2, where the unjust deeds that are denounced are economic in nature. Biblical teaching on economics and justice tends not to be in terms of a systematic, over-arching theory, but rather in terms of individual interactions. One exception to this pattern is the Old Testament sabbatical/jubilee system of canceling debt and returning property. In modern economic terms, canceling debts and returning property would serve to minimize *income inequality* and ensure that there was uniform access to the *means of production*.

From the first chapter of Genesis, the call to stewardship of all creation has been understood by Christians to include money. The power of earthly resources to accomplish "heavenly things" is

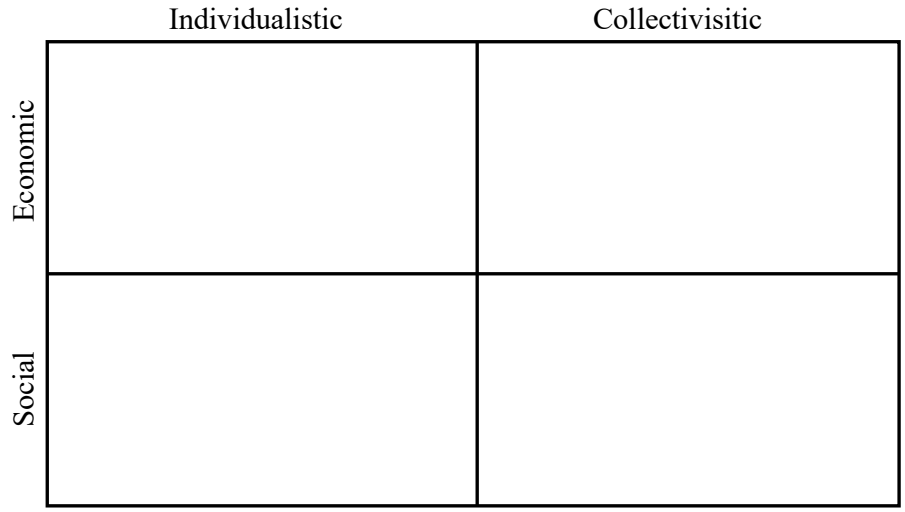

Figure 2: Table for individualistic and collectivistic views on economic and social issues.

made explicit in the parable of the shrewd (or dishonest) manager in Luke 16. To this end, the great majority of the Bible's teaching on money relates to generosity to the poor. Numerous Old and New Testament passages instruct God's faithful to give generously to the poor, the disadvantaged, and the marginalized, where "giving" is some combination of money (traditionally called "alms"), material goods (such as food or clothing), and justice or fairness.

One branch of Christian thought views wealth itself as a root of evil. This view goes beyond merely *love* money being the root of evil (I Tim 6:10). Proponents of the view that money itself is a source of evil would point to Jesus telling the rich young man to sell all his possessions and give to the poor and Jesus' further comment that it is easier for a camel to go through the eye of a needle than for a rich man to enter the kingdom of God (Mt 19:16-30, Mk 10:17-31, Luke 18:18-30). At the other end of the spectrum of Christian thought, worldly wealth is seen as God's blessing, even an indication of his favor (in a more extreme version of this view).

In terms of modern economic views, Christians hold a wide range of positions. Many Christian traditions advocate a communal economic arrangement, in imitation of the early church (Acts 2:42-46). Examples range monastic orders such as might be found in Roman Catholic or Eastern Orthodox traditions to the Hutterite and Bruderhof communities, which come from an Anabaptist tradition. At the other end of the economic spectrum, many Christians advocate for an economic system based on individual ownership and freedom of enterprise. Some key verses that support a more individual view include the comments "Didn't it belong to you before it was sold? And after it was sold, wasn't the money at your disposal?" (Acts 5:4) and Paul's instruction that we should work to eat (2 Thes 3:10) and to share with those in need (Eph 4:28). Thus, Christians hold a range of views from economic thought from communalistic to individualistic.

Likewise, Christian social perspectives can stress individual freedom, which we'll call "liberal'," or collective behavior, which we'll call "collective." A liberal approach to providing for poor widows would be represented by the instruction that widows should be provided for, first of all, from their own families (1 Tim 5:4). The collective approach is represented by the group effort of

caring for widows at the beginning of Acts chapter 6. How Christian church denominations are organized is another example of this liberal-to-collective spectrum. At the liberal end of the spectrum are "independent" bible churches. In the middle are denominations that follow a presbyterian form of church government. The local church in the presbyterian system has some autonomy but within the constraints of the broader denominational structure. The local churches also have a voice in the operation of the collective. At the collective end of the spectrum are denominations that use an episcopal form of church government. For example, the Roman Catholic church is very "top down" in how it operates.

We next show how the individualistic/communalistic economic perspective and the liberal/collective social (political) perspective apply to a solving sustainability problems.

add 4-quadrant diagram?

2.1 Christian solutions to the tragedy of the commons

The term "tragedy of the commons" was popularized in (Hardin) and is used as a shorthand way of referring to situations where there is equal and open access to a resource or pool of resources and it is in the rational self-interest of every individual to maximize their use of the resource, even if this results in the net effect of destroying the resource itself through over exploitation. This class of problems is recognized as "having no technical solution." Instead, sustainable solutions are the result of social and/or economic policies. This section will examine several Christian responses to the tragedy of the commons.

As originally stated, each herdsman had incentive to add more animals to his flocks grazing on the common land, since the benefits (the extra animals) would accrue solely to him but the cost (degradation of the land) would be split between all herders using the land for grazing. Moreover, since he knew that every other herder faced the same set of incentives, it is rational to predict that the land will be ruined and that he should "get while the getting is good." The "tragedy" lies in the "remorseless working out of things."

One communalistic solution to the tragedy of the commons is for all of the animals grazing on the commons to be common property. Every member of the community would receive an equal share of the common herd (for example, cash value of the meat raised at the end of the year). It would thus be in every individual's self-interest to maximize the *total* output, not just their own output. An individualistic solution is to charge each herder an increasing amount of rent for each additional animal placed on the common land, which would create a financial incentive for each herdsman to keep only a reasonable number of animals on the common land. A liberal social solution would be for each herder to be allowed only a limited number of animals on the common land. A collective solution would be where an authoritative governing board is set up to administer the common land. The board decides how many animals total are allowed and what proportion of that total is allocated to each individual herdsman.

As we'll see below, many sustainability challenges are wholly or partly "without technical solution" and we need Christian approaches to solving these problems.

3 Environmental

Add first action for sustainability? The weakness or pitfall of each approach. (for instance, lack of information?) Need to add in for each worldview, discussion question 13, what is the purpose of the natural world?

Willis Jenkins' book *Ecologies of Grace* (Jenkins) provides a topology of Christian thought regarding the nonhuman creation and the environmental aspect of sustainability. He identifies three schools of thought: stewardship, eco-justice, and ecological spirituality, which loosely correspond to Reformed (or evangelical protestant), Roman Catholic, and Eastern Orthodox traditions. To Jenkins' three, we add a fourth: consumptive economic prosperity and the conservative evangelical tradition. These four schools of thought span a wide range of Christian stances toward the nonhuman creation and consequently outline a range of possibilities for Christian responses to environmental issues and environmental sustainability concerns more broadly. One way to begin unpacking the four schools of thought is to identify a keyword for each: *redemption* for stewardship, *sanctification* for eco-justice, *deification* for ecological spirituality, and *resilience* for consumptive economic prosperity.

Redemption The stewardship school of thought in the Reformed tradition emphasizes that all of human existence is a response to God's redemptive acts and God's providence to humans. Knowing God leads to vocational responsibility to care for nonhuman creation, which is the means by which God provides for humankind (Jenkins 19). Thus, all human work to care for the creation is seen as service to the Creator out of gratitude for redemption (Jenkins 77). *Earthkeeping* (Wilkenson) provides a cogent summary of the importance of redemption for Reformed Christians doing creation care.

Sanctification The eco-justice school of thought in the Roman Catholic tradition emphasizes that God's grace reveals the creation's inherent integrity (Jenkins 19), giving it natural value and inherent moral standing (Joldersma). Thus, Christians must respect creation's inherent value and respond to its moral standing in all activities. If the nonhuman creation can't speak for itself, we must speak for it and defend it when necessary. The *Laudato Si* encyclical (Pope Francis) is a clear enunciation of Roman Catholic thought on environmental sustainability issues.

Deification The deification school of thought in the Eastern Orthodox tradition highlights the union between all of creation and God. This view holds that there is a radical, integral relationship between humans and the nonhuman creation (Jenkins 93). The speech "To Commit a Crime Against the Natural World Is a Sin" (Bartholomew I of Constantinople 133-136) provides an excellent summary of the Eastern Orthodox view on the nonhuman creation.

Resilience The resilience school of thought in the conservative evangelical tradition holds that the nonhuman creation is resilient, robust, and self-correcting. Furthermore, its well-being is assured by God. In addition, human well-being is paramount. Thus, humans are to be consumers of the nonhuman creation to provide economic prosperity and lift people out of poverty. Documents from the Cornwall Alliance provide a summary of conservative evangelical thinking on creation care issues (Cornwall Alliance).

4 Application: personal transportation

Far from being esoteric or merely philosophical, the impact of worldview on sustainability issues and behavioral choices is both crucially important and entirely practical. Thus, it is *essential* that engineers consider worldviews when examining choices and tradeoffs related to sustainability. This section considers, as a practical example, the effects of different Christian approaches to the economy and societal structures (Section 2) and to the nonhuman creation (Section 3) on a sustainability-related policy question, namely whether to ban vehicles for personal transportation.

In 2017, the United States emitted 5.14 billion metric tons equivalent of greenhouse gases, of which, about 1.8 billion tons (35%) were from petroleum used for transportation. Consider a proposed ban on personal transportation vehicles. Commercial vehicles are not addressed by the proposed ban.

The alternative to the proposed ban is to do nothing. Under this "null hypothesis," significant amounts of greenhouse gasses would be added to the atmosphere at ever-increasing rates. Do we need to explain ever-increasing rates? Enacting the proposed ban would eliminate a (major) category of greenhouse gas emissions and would be a step on the road toward sustainability and would, presumably, avoid future costs for climate change adaptation. However, the proposed ban would involve massive monetary costs in the near-term. Billions of dollars per year would be required. One estimate citation needed is that it would require between 7 and 14% of GDP annually over 20 years to achieve a fully-renewable transportation infrastructure.

Emplacing a fully-renewable transportation infrastructure would displace or require thorough transformation of many existing industries, including the automobile industry, the liquid petroleum distribution industry, and the electricity generation and distribution industries, to name a few. Disruptions in those industries would cause massive social disruptions as jobs are lost. Therefore, a large-scale job retraining effort would be necessary.

The proposed ban would have massive implications for real estate values and patterns of land use. Presumably, rural living would be much more difficult if the proposal were enacted, whereas urban dwellers could avail themselves of extensive public transit networks.

Questions about the legality of a ban on personal transport vehicles would surely arise. Even for the benefit of the long-term survival of life on planet Earth, would we make such a draconian decree? Is it even ethical to do so?

4.1 Evaluating tradeoffs

Implementing the proposed ban on personal transport vehicles will involve tradeoffs among the dimensions of sustainability, environmental, economic, and social factors. Decisions on tradeoffs are necessarily informed by worldviews, many of which are briefly described in Sections 2 and 3. In this subsection, we use the proposed ban to explore how Christian worldviews matter for tradeoffs when sustainability issues are at stake. That is, how do each of the Christian traditions (Is Christian traditions the right way to discuss these ideas?) discussed in this paper evaluate tradeoffs among environmental, social, and economic factors? We briefly summarize each tra-

dition below. again, maybe want to merge with sections above to avoid repetition. What are the weaknesses of each approach?

Individualistic Stuff here about the individualistic approach to economic and social aspects of sustainability.

Collective Stuff here about the collective approach to economic and social aspects of sustainability.

Reformed (stewardship) The stewardship approach emphasizes the human responsibility to care for the nonhuman creation as a response to God's redemptive actions. It acknowledges that tradeoffs are present in every policy and in every decision. So, in an engineering sense, Christian environmental stewardship could be considered an optimization problem in which policies that bring about the most good are to be preferred. Who decides what goods matter most is important, and all voices should be heard on this matter. Ignoring or disregarding voices is dangerous, since injustices could result. Humans will be persuaded on the right course of action for sustainability policies by weighing the tradeoffs among environmental, economic, and social factors. Here is an example of where imperfect information, in both an engineering sense and an economic sense, would bite you big time.

Roman Catholic (eco-justice) The eco-justice approach is based upon the moral standing of the nonhuman creation, meaning that the nonhuman creation itself must be given a voice. To properly evaluate sustainability tradeoffs, someone must be empowered to speak for the nonhuman creation and give voice to unjust and unfair aspects of policies and decisions that have implications for sustainability and the nonhuman creation. Humans will pursue the right course of action on sustainability issues when someone speaks eloquently and forcefully for the those who can't speak for themselves, including the nonhuman creation.

Eastern Orthodox (ecological spirituality) The primary departure point for ecological spirituality is the radical connection between the creator and the creation. Consequently, and by virtue of both owing their existence to the creator, there is a radical connectedness among all human and nonhuman creatures in the creation. Because of this radical connection between humans and the nonhuman creation, any good done to the environment is a good done to humans, and praiseworthy. Conversely, any environmental harm is a harm to humans and sinful. We should always be doing right by ourselves and the environment to please the God of us all. In ecological spirituality, tradeoffs between the environmental and social realms of sustainability fade into the background. And because the economy is a way of organizing social relationships and structures, tradeoffs between the environmental and economic are minimized, too.

Conservative Evangelical (consumptive economic prosperity) In this worldview, any environmental degradation caused by humans will be fixable, given sufficient economic resources and the guidance of the free market's invisible hand. People with the consumptive economic prosperity worldview will note that a ban on all personal transport vehicles will likely lead to decreased economic prosperity, as some people will no longer be able to work, commute times will increase

for others, and commerce will slow. A reduction in economic prosperity will, ultimately, be bad for the environment, because we will have fewer economic resources with which to address environmental damage. Thus, those whose focus is consumptive economic prosperity will be unlikely to support the proposed ban on personal transportation vehicles.

4.2 A conundrum

The proposed ban on personal transportation vehicles implicitly accepts a conundrum: you can't have personal transport vehicles and a flourishing environment. In this subsection, we consider several questions about the conundrum and explore ways out of the conundrum, guided by the worldviews discussed above. Need a transition here. Maybe another way to say it: we don't actually do what the leading paragraph promises. The worldviews are not applied consistently.

What assumptions are behind the conundrum? The proposed solution assumes that all personal transport vehicles degrade the nonhuman creation. The proposed solution does not allow for variation in environmental damage from different modes of transport or different types of vehicles.

Can you think of alternative policies that break free from the conundrum and solve the dilemma? It may be possible to incentivize any number of low-impact vehicles, including bicycles and renewable energy vehicles. Policies to incentivize adoption of mass-transit (subways and busses) or shared transit (Lyft and Uber) could allow societies to meet transport needs with significantly less environmental impact per person-km.

But tradeoffs exist. There are financial costs to changing the transportation infrastructure to low-impact vehicle technologies or away from personal to mass-transit solutions. There will be social costs to changing the transportation infrastructure as well. Relationships and employment may be disrupted by changes in the availability of personal transport vehicles, especially if substitutes are of lesser quality or availability. Converting to a renewable-energy personal transportation infrastructure might imply land-use changes, requiring significant amounts of space for solar and wind renewable electricity production, not to mention storage needs. Will land-use changes impinge on the "freedom" or rural life or increase the density of urban living?

How might Christian worldviews shape perceptions of these tradeoffs? Perceptions of the desirability and advisability of choices implied by these tradeoffs will be shaped by the Christian worldviews discussed above.

Add something from collective approach here.

Add something from individualistic approach here.

For example, stewardship concerns may indicate deep study of alternatives, weighing weigh costs and benefits in the environmental, economic, and social realms to discover the best way to manage the human and nonhuman elements of creation. Study and deliberation will be in order as debates over the numeraire for comparisons arise. Those informed by an eco-justice worldview may want to evaluate differential benefits and costs of a transportation system overhaul. To whom

will benefits and costs accrue? Which people groups will benefit most and least? Which portions of the nonhuman creation will benefit or be harmed? Those in the deification school of thought might be concerned about loss of quality of personal connections among people due to transportation system disruption and advocate for policies that ensure transportation system changes are coupled with ways to increase the connectedness that people feel toward the nonhuman creation. Those with a resilience mindset may be likely to disfavor large-scale changes to the transportation infrastructure on the grounds that the financial cost of a transportation system overhaul would be burdensome, without much regard for any environmental benefits, because the Earth system is resilient anyway.

5 Conclusions

The purpose of this paper is to explore how Christian worldviews matter when sustainability issues are at stake. The example discussed in Section 4 shows that Christian worldviews can and do both inform responses to sustainability issues and affect assessments of policy tradeoffs.

In reviewing Sections 3–4, it becomes clear that there is an urgent need for a theology that addresses human effects on the nonhuman creation. This theology should provide guidance for daily life and for corporate decision- and policy-making on several axes: economic gain vs. environmental harm, individual harm vs. corporate good, benefits to the current generation vs. future generations, environmentally harmful but convenient solutions vs. environmentally benign but inconvenient solutions, dollar-quantifiable goods and harms vs. non-quantifiable goods and harms, costs and benefits that accrue to an individual vs. a group or a group vs. an individual, etc.

Indeed, there is much work to be done.

A Discussion questions

Section 4 demonstrated application of the Christian worldviews discussed in Sections 2 and 3 to an environmental sustainability issue and a hypothetical policy prescription. In this appendix, we provide several additional issues and policy prescriptions to which Christian worldviews could be applied. The issues and policy prescriptions are presented in the form of discussion questions for use in classrooms or with small groups. I suggest we merge this list into the Appendix

- What are the economic sustainability issues we want to address? How do we want to address them?
- Global poverty and other ills associated with it like lack of access to clean water and food insecurity.
- The concept of continual economic growth based on extractive consumption.
- Carbon tax

1. In Section 4, a proposed solution to address environmental degradation caused by personal tranport vehicles is banning all personal transport vehicles.

- The proposed solution might solve an environmental problem. But it may cause social and economic problems. What are they?

- Suppose reducing the number of personal transport vehicles results in job losses for auto industry employees. How should Christians respond to unemployment that results from something "good," like saving the environment?

- Should there be a "social safety net?" If so, how big should it be?

- Are your responses informed by your Christian worldview or your political orientation?

- Does your answer depend on whether the job losses are the result of technical innovation ("progress") or new regulations that prohibit something or reduce "freedom?"

2. An alternative to banning all personal transportation vehicles would be banning fossil fuel (FF) personal transportation vehicles. An alternative to FF personal transportation vehicles is electric personal transportation vehicles that are manufactured, operated, and disposed using renewable electricity.

    - How equivalent do FF and electric vehicles need to be before banning FF personal transportation vehicles would be acceptable?

    - Would there be value to maintaining some FF personal transportation vehicles as a historical artefact?

3. Banning all personal transport vehicles might be considered a "clean" or "ideal" policy option. Other policy options could be classified as pragmatic, e.g. improving efficiency of personal transport vehicles. How should Christians navigate the space between ideal and pragmatic policy proposals? Give examples.

4. The transportation system (all modes, not just personal transportation vehicles) provides economic value and connects people. But it also causes CO_2 to be emitted in the manufacture, use, and disposal of all vehicles (planes, trains, and automobiles). We must reduce the CO_2 intensity of transport to move toward a sustainable future. Air travel is more CO_2-intensive than automobile transport (per-person-km). Thus, it is proposed that all air travel be banned.

    - Should we ban air travel? Why or why not? Are there ethical aspects to this question or only technical/practical aspects?

    - In developing policies regarding air travel, whose opinion should we respect? Experts? Novices? Technologists? Generalists? Corporate executives? Blue collar workers?

    - This policy question gets at several "axes" of tradeoffs and policy-making: economic gain vs. environmental harm, individual harm vs. corporate good, benefits to current

generation vs. future generations, and environmentally harmful but convenient (e.g., jet airliners) vs. environmentally benign but inconvenient (e.g., blimps). How would each of the Christian worldviews discussed in Sections 3 and 2 assess tradeoffs on these axes?

5. How would Christians holding the worldviews discussed in Sections 3 and 2 respond to the following policy proposals for addressing climate change?

    - Taxation of fossil fuel *production*. using the proceeds to convert all energy infrastructure to renewables

    - Taxation of fossil fuel *consumption*, using the proceeds to convert all energy infrastructure to renewables

    - Stimulation of economic growth to create excess wealth to be applied in some proportion to environmental restoration, poverty alleviation, or society-wide relationship counseling

6. "Environmental" is only one dimension of sustainability. Tradeoffs often exist among "environmental," "social," and "economic" aspects of sustainability. How would each Christian worldview discussed in the paper respond to the following tradeoffs?

    - Long-term employment losses due to climate-change-caused flooding vs. short-term employment retention for coal miners

    - **** More here? ****

7. Any policy-driven change, such as reducing carbon emissions by banning personal transport vehicles, results in consequences that have *direct* dollar-measurable impacts (such as increased personal cost per mile traveled), *indirect* but still dollar-measurable consequences (such as reduced CO_2 output), and consequences that *aren't* measurable in dollars (such as an aesthetic impact on the landscape). Economic cost-benefit analysis converts all social and environmental costs to dollars, thereby providing a consistent numeraire and allowing direct comparisons among environmental, economic, and social effects.

    - How should Christians evaluate choices among policy solutions whose impacts are dollar-quantifiable policy solutions whose impacts are *not* dollar-quantifiable?

    - Similarly, Pareto optimality is used to conceptualize choices in a multiobjective environment. How do Christians think about tradeoffs under Pareto optimality?

    - Should we be so mathematical in our decision making?

    - How do/should Christian assessments of tradeoffs change

        – when cost and benefits fall to different (groups of) people?

    - when many benefit at the expense of a few?
    - when few benefit at the expense of the many?
    - when benefits and costs accrue to different generations?
  - Does the size of the benefit/cost matter?
  - Does the number of people in the group matter?
  - Are there guidelines on what's a "big enough" difference to matter?
  - Possible frameworks within which to consider these questions include eminent domain, corporate profit vs. air pollution, aquifer depletion, species extinction, and climate change.

8. What is the Christian solution to the tragedy of the commons (Section 2)?
9. Both the Old and New Testaments teach that Christians should work to eliminate poverty. How do we respond to the observation that alleviating poverty increases economic consumption, which has negative environmental consequences?
10. A Brazilian farmer argues that he/she needs to make a living. Can he/she create another subsistence farm in the Amazon rainforest? What is the value of "wilderness?"
11. Which Christian tradition discussed in Sections 3 and 2 resonates with you personally? Why? Which aspects of other Christian traditions do you embrace? Why?
12. What is the purpose of the Creation? The natural world?
13. What is aspects of economic sustainability are most important to a Christian?
14. Why are disruptions from technological innovations seen as positive changes while disruptions from regulations seen as negative? How does your view of justice influence your view of regulations?

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