A. Introduction

Progress on hotly contested issues usually starts with finding common ground, an endeavor that favors truth over ideology. It seems this isn't happening in America, based on a recent Pew Research Center poll. 40% of us don't believe the earth is getting warmer, and another 20% don't believe the warming is caused by humans. More disturbing than the percentages is the near-perfect correlation the pollsters found between popular beliefs and political orientation. These are questions of fact, not value. Either the planet is warming or it's not. Either humans are the main contributors or they're not. That so many Americans align their view of objective reality with their world view tells me we have snubbed scientific inquiry. We've surrendered critical thinking to the bloggers, politicians and mass media desperate to win our loyalty by reinforcing our biases – whether right or left leaning.

So while most of the world moves on to tackle climate change, Americans remain locked in fruitless debate. Maybe the two sides are not as far apart as they appear. Deniers pretend there is no problem, but insist that the proposed solution would ruin the economy. Believers acknowledge the problem, but pretend the solution could be painless. I will offer evidence to dispel both delusions, mindful that either extreme is born of moral necessity. To either knowingly place our own welfare ahead of our grandchildren's, or to declare all remedies utterly futile is unthinkable. But instead of dodging left or right, I suggest we can face the challenge head-on, guided by reason and driven by what theologian Reinhold Niebuhr called "the ultra-rational hopes and passions of religion."

B. Delusions of the Right

Denial of climate change is enabled, not so much by evidence as by the lack of incontrovertible evidence. Atmospheric concentrations of carbon dioxide (CO_2) have risen almost 50% from pre-industrial levels. The concentration of methane, less abundant than CO_2 but far more efficient at trapping heat, is up 150%. No informed person disputes this. The disagreement hinges on the following questions, presented in order of increasing controversy:

1. Can the increase in greenhouse gases during the industrial era be attributed to human activity?
2. Has there been a significant increase in global temperatures during this period?
3. If the earth is getting warmer, can the increasing temperatures be attributed to the rise in greenhouse gases?
4. Do rising temperatures threaten the earth's climate and human welfare?
5. If the threat is real, what can and should be done about it?

Like the receding glaciers of Alaska, prominent skeptics have grudgingly yielded on the first three questions. No reputable scientist any longer denies that the buildup of CO_2 is anthropogenic; it is fairly easy to prove just by balancing the carbon. The two greatest sources

of manmade CO_2 are fossil fuel combustion and deforestation. Roughly half the CO_2 emitted by these sources is absorbed by water bodies and terrestrial sinks like plants and soil. The other half stays in the air and fully accounts for the measured increase. The rise in methane is likewise traceable to human activity.

The second question seems simple, but has aroused suspicions about the reliability of global temperature data. One of the most outspoken skeptics was U.C. Berkeley Professor of physics, Richard Muller. Funded in part by fossil fuel interests, his team scrutinized historical data sets from 39,000 weather stations around the world. Their work refuted the accusation that earlier studies had used biased data. Muller also proved that urban heat island effects were negligible. He summed it up in the Wall Street Journal, "When we began our study, we felt that skeptics had raised legitimate issues... Our results turned out to be close to those published by prior groups… Global warming is real." Given his prior skepticism and his funding sources, I find this conclusion particularly convincing. To add an exclamation point, 9 of the 10 warmest years on record occurred in the 21st century. Ocean heat content in 2014 was the highest ever recorded, having risen in each of the last 7 years. This is telling because the oceans store over 90% of the additional energy trapped by rising greenhouse gases.

Muller addressed the third question in a follow-up study. In the New York Times he stated, "It appears likely that essentially all of this [temperature] increase results from the human emission of greenhouse gases." Muller's approach did not rely on atmospheric physics, complex computer models, or questionable assumptions that cloud other studies. He simply performed a 250-year regression analysis between global temperatures and potential causal factors. He cited a "clear fingerprint" of volcanoes (with short-term cooling) and carbon dioxide (with long-term heating).* Concluding that no other explanation comes close to matching the data, he wrote, "I hope [this] analysis will help settle the scientific debate regarding global warming and its human causes."

Some scientists like Muller remain ambivalent about question four, the risks posed to the earth's climate and biosphere. Sophisticated models disagree on specifics like how much the temperature, sea level, and storm severity will increase. Skeptics have exploited this to discredit global warming theories and predictions. If science can't forecast the weather more than a few days ahead, how can it possibly predict atmospheric conditions decades in advance? Climatologists would reply that predicting what will happen on average is far easier than forecasting events for a specific time and place. But the real fallacy in betting on uncertainty is that the modeling details matter less in the presence of large driving forces and long time frames. The 30 most widely accepted computer models may differ on the details, but all of them predict dramatic long-term climate impacts if carbon emissions continue on their current trajectory.*

C. Delusions of the Left

Question five, how to combat climate change, has meaning only for those who perceive a threat. Their answers often sound too good to be true. Paul Krugman recently wrote in the New York Times, "If we ever get past the special interests and ideology that have blocked action to save the planet, we'll find that it's cheaper and easier than almost anyone imagines." Pretending that progressive policies and greener technologies could spare us from sacrifice forestalls the real solution, which Kenneth Brower said "will be in the hard, nontechnical work of changing human behavior."

Mark Jacobson of Stanford University published an outwardly promising study laying out a roadmap to 100% renewable energy by 2050 (right now wind and solar make up about 1% of both U.S. and global energy production). I found his plan for insuring electric grid reliability to be superficial, and his economic analysis ignored massive demand-side infrastructure requirements. Correcting for these deficiencies, the capital expenditure in the U.S. alone could be $25 trillion – equivalent in real dollars to the amount our country spent on World War II. Jacobson played down the cost impacts, concluding that the impediments to switching to all clean energy are not technical, but social and political. Well, technically we could suspend human reproduction too, and it might work wonders for the planet. But we cannot overstate the social and political barriers. James Hansen, the NASA scientist who helped legitimize early warnings of climate change, says the "merchants of doubt play a role," but the main obstacle to solving climate change is that people who accept its reality "are not proposing actions that would work."

The great philosopher and psychologist William James once proclaimed, "Our science is a drop, our ignorance a sea." Optimists expect technology to rescue the climate system, forgetting that technology also endangers it. Hydraulic fracturing of shale rock has returned America to the days of cheap oil and natural gas, reinvigorating fossil fuel consumption and suppressing investment in clean energy. Oil extracted from tar sands has left an ecological disaster in Canada, while each barrel consumed doubles the carbon emissions of conventional oil. Every time human ingenuity removes one environmental constraint, our footprint swells until it bumps into a more daunting constraint.* Ever since the oil embargo 42 years ago we've known that a transition to sustainable energy is inevitable. Yet each generation says, "We can't afford it right now." So we add to the cost and pass the bill on to the next generation, when more people and fewer options will only exacerbate the crisis. The stakes get higher each time humans postpone self-regulation. Naomi Klein says our culture's intoxicating narrative is that some future technology will save us.

Let's look at the facts. Global carbon emissions have nearly doubled in the 23 years since the world got serious about curtailing them. Even in Germany, the poster child for renewable

energy, carbon emissions rose in 2012 and 2013. Let's face it; modern civilization is both indebted and addicted to fossil fuels. The key contributors to this addiction are population, appetite, and carbon-intensity. Over the past few decades, the dialog has emphasized the third contributor, mostly at the neglect of the other two. During that time, laudable improvements in renewable energy and end-use efficiency have been overwhelmed by a steady increase in world population and rapid growth in per-capita consumption.*

Consider China, now the world's largest contributor to carbon emissions. Having worked there recently, I can attest that the impediments to phasing out fossil fuels are not ideological. Unlike the U.S., Chinese leaders unanimously acknowledge the reality of human-caused climate change. Their incentive to stop global warming is only intensified by accompanying near-term dangers. A senior Communist Party official said air pollution is now the single greatest cause of social unrest in the country. It is also the number four killer. No wonder China spends more to advance renewable energy than any other nation. But the mandate for economic growth and higher living standards has quickly swallowed any gains from this investment.* And lest we point a finger, much of China's fossil fuel consumption powers the manufacture of products bound for America. Some of their emissions rightfully belong to us. The U.S. has 3.1% of the world's children, yet we buy 40% of the world's toys. If the rest of the world consumed like Americans, global carbon emissions would triple.

Our faith in technological miracles is fueled by past breakthroughs like splitting the atom or landing on the moon. But these narrow goals are easier to manage than the international resolve needed to alleviate climate change. Ed Ayres wrote, "Building a livable world isn't rocket science; it's much more complex." An article in Scientific American supports his claim, "If we are to cope with climate change in any fundamental way, radical solutions on the social side are where we must focus…The relative efficiency of the next generation of solar cells is trivial by comparison."

D. Hope in the Middle

Between the fantasies of an indestructible environment on one hand and an infallible technology on the other, there are some encouraging signs. The rate of global warming has slowed the last 15 years. Global carbon emissions per dollar of economic output dropped considerably over the last decade. China produced less power from fossil fuels in 2014 than in 2013 – a symbolic milestone – while its renewable sources increased 20%. Proposed rules in the U.S. will cut carbon emissions from power plants (if they survive political and legal opposition). Canada will phase out all conventional coal fired power plants within 15 years. European Union leaders struck a deal last year to lower greenhouse gas emissions 40% from 1990 levels by the year 2030. Surely, these partial solutions are preferable to inaction.

No one really knows the consequences of climate change. The Intergovernmental Panel on Climate Change, which drives the scientific and diplomatic effort on global warming, attaches probabilities to its predictions. Climatologists tend to believe global warming is dangerous, but hurricane scientists disagree on whether it has affected the number and intensity of hurricanes. It seems unlikely that anyone can accurately predict the tipping point beyond which life on earth is doomed. This uncertainty can serve either as a motivator or an excuse. To the visionary the problem might still be fixable; to the reactionary it might not need fixing. At the very least humans should limit the rate of greenhouse gas buildup and adapt to the probable impacts. So while we "rage against the dying of the light," we must devise ways to make the light last longer and (just in case) prepare to navigate in the darkness.

Mitigation and adaptation will take vision, but we need practical strategies that won't blind that vision. The National Renewable Energy Laboratory (NREL) released a futuristic study that I found less ambitious but more thorough and credible than the Stanford study. NREL concludes that by 2050 we could get half our electricity from solar and wind, and more if we add other renewables like hydropower, geothermal, and biomass. For grid stability their plan includes some nuclear, coal and gas-fired generation. They factor in more electric vehicles but do not eliminate gasoline, diesel and jet fuels. Their plan is limited to commercially proven technologies. The authors do not pretend it will be easy, suggesting major infrastructure investment, institutional overhaul, and a potential 50% increase in electricity prices.

History affords another kind of inspiration. The abolition of slavery in America overcame tremendous social barriers and economic hardship (the slave trade has been valued at $10 trillion in today's currency). Of course, the fight for civil rights hasn't ended. Any struggle for universal justice is doomed in the strictest sense. But how much more injustice might there be if no one resisted? The victims of war and oppression over the course of human history probably outnumber the potential casualties of a warmer planet. We don't surrender to these social ills, so why should we give up on a healthy environment?

E. The Power of Place

The science of climate change and the task of remediation are sobering. But contemplating the environment also stirs memories and feelings that have nothing to do with science. Josephine Hart wrote, "There is an eternal landscape, a geography of the soul; we search for its outlines all our lives." I believe this eternal landscape is all around us. Our relationship to the land is vital to meeting any environmental crisis – not merely because it nourishes the body, but because it sustains the soul.

With fewer people deriving their livelihood from the land, with the insulation from natural forces that affluence has bought, and with the increasingly seductive but artificial world of electronic media, our culture suffers from environmental amnesia. This alienation from nature,

comparable to an infant being separated from its mother at birth, potentially threatens human wellbeing more than climate change. The evolutionary response to our natural surroundings is woven into our identity. For the lucky ones still attached to a place, seeing it compromised brings a deep sense of grief.

In my youth I spent long hours on a tractor cultivating row crops. It required concentration to keep the cultivator blades between the rows and avoid severing the plants. I was prone to daydreaming, especially when the west face of the Bighorn Mountains came into view. On one occasion I recall taking out four rows of corn over a 70-yard swath before coming to my senses. I found myself hoping the corn field would grow quickly to hide the destruction from my father's watchful eye. But he confronted me that very evening, and was quite blunt about my future as a farmer. I dared not admit that while my body was stuck to the tractor seat my mind was drinking from the springs, roaming the canyons and scaling the cliffs of the Bighorns. I was worshiping the landscape. John Adams might have appreciated the spectacle more than my father did. He said something like, "I am a soldier, that my son may become a farmer that his son may become a poet."

I tell this story to illustrate the intense bond one may form with his or her surroundings. We are fortunate to live in a pleasing environment, but the fact that it is home – that we have communed with it and know it deeply – overshadows any aesthetic appeal. A mother's face draws her child's love by its familiarity, not its beauty. On a journey to retrace the migration paths of early humans, Paul Salopek wrote of the arid region in the Middle East, "I have entered a corrugated maze, where landscape is read like sacrament." Place conveys a sacred sense of permanence in an otherwise perplexing world.

Wordsworth mourned the gradual morphing of the child, fresh from the source of life and entranced by nature, into an adult preoccupied with commerce and public image. His pessimism shows in these lines:

> Heaven lies about us in our infancy!
> Shades of the prison-house begin to close
> Upon the growing Boy
> The Youth, who daily farther from the east
> Must travel, still is Nature's priest,
> And by the vision splendid
> Is on his way attended;
> At length the Man perceives it die away,
> And fade into the light of common day.

This poem might serve as an allegory to human civilization, which has prospered by forfeiting an identity rooted in the land and celebrated by primitive cultures. To Emerson the loss was tragic, but not inescapable. He wrote, “The lover of nature…has retained the spirit of infancy into the era of [adulthood].” Just as every raging river begins with a raindrop or a snowflake, we must trust that our primal love for the land, deeply felt and freely expressed, will combine with others and gather momentum towards a cultural renewal. In the words of Wendell Berry, “Conservation turns on affection.”

F. The Religious Response

There is a cartoon in which a man stands up at a climate summit and asks, “What if it’s a big hoax and we create a better world for nothing?” Even if we need not, or cannot stop global warming, think about the co-benefits of slowing it down: less toxic air pollution, fewer wars over oil, smaller scars from fossil fuel extraction, and the spiritual lift from trying to live sustainably.

A recent presidential candidate, with noticeable contempt, referred to the anxiety over global warming as a “pseudo religion.” If there is truth to his accusation, it applies to deniers no less than to believers. Roy Spencer, one of the few qualified climate scientists who remains a skeptic, signed An Evangelical Declaration on Global Warming. It states that "Earth and its ecosystems – created by God's intelligent design and infinite power and sustained by His faithful providence – are robust, resilient, self-regulating, and self-correcting." Climate change merits an equally evangelical response from those of us not reassured by this declaration. It calls for a faith (missing from the man in the cartoon) to act in the absence of certainty.

The foundation of this faith is compassion. Hatred, whether for corporations, politicians, or overindulgent consumers, will not save the climate. Compassion means accepting our own limitations, too. How can I enjoy even a moment of abundance while others starve? Nature limits the burdens each of us can bear in the name of humankind. We could not survive otherwise. Emerson rationalized, “I have a work of my own which I know I can do with some success.” So do all of us. Constant shame or outrage leaves the spirit paralyzed and the work unfinished.

Sometimes I worry about the ticking clock of climate change. But I worry more about the steady drip that drains human hope as the evidence mounts. Niebuhr sensed this predicament in the struggle for social justice. He said to redeem the human enterprise of its excesses we must substitute new illusions for abandoned ones. To confront climate change, I suggest we replace the tired illusions that excuse complacency with the motivating vision of a sacred landscape. Niebuhr portrayed this kind of vision as “a sublime madness of the soul, brought under the control of reason.” He warned, “I only hope that reason will not destroy [the madness] before its work is done.”