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Open Season on Chickadees: A Field Guide to the Anthropocene

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Preface

This paper was adapted from the 2015 Geddes W. Simpson Memorial Lecture, presented at The University of Maine, October 5, 2015.

In 2001, Professor Geddes Simpson's family established the Geddes W. Simpson Lecture Fund at the University of Maine Foundation. The lecture honors Simpson, a highly-respected faculty member with a 55-year career in the College of Life Sciences and Agriculture and the Maine Agricultural Experiment Station began in 1931. He chaired the Entomology Department from 1954 until his retirement in 1974. Professor Simpson was the first recipient of UMaine's Presidential Research and Creative Achievement Award. The Simpson Memorial Lecture was established to support an annual lecture that highlights speakers who have provided significant insight into intersection of science and history.

This paper presents the same material of my 2015 Simpson Lecture. I have only added citations of source material, details that are not appropriate in a lecture format.

I owe intellectual and professional debts to many people who shaped my world view reflected in this paper. In particular I want to thank Roger Howell, David Vail, and Matilda White Riley from my time at Bowdoin College; Frank C. Spooner of Durham University; Wayne I Boucher of the Futures Group; and Johannes Delphendahl, Steve Reiling, Wally Dunham, David Smith, Kevin Boyle, Kathleen Bell, Mario Teisl, and Caroline Noblet of the University of Maine.

A Proposition

Imagine for a moment that the State of Maine changed its hunting laws and adopted an open season on Chickadees. After all, the Black-capped Chickadee (Poecile atricapillus) is the official State Bird of Maine. An open firearms season, like the season on coyotes (Canis latrans) in Maine, would allow any licensed hunter to shoot as many Chickadees he or she wished throughout the year. Citizens could honor their state heritage by placing the stuffed birds on their mantle above a crackling winter fire in the hearth. These trophies would demonstrate the hunting prowess of the state's citizens -- it is not easy to shoot a Chickadee and leave enough of the bird for the taxidermist to work with. And anyone can tell you, there is an abundance of the bird in Maine throughout the year. It is hard to imagine that hunting could diminish the numbers of Chickadees significantly by year-round hunting.

When I presented this proposition in classes or public lectures, most people found it unacceptable. They questioned the point of shooting Chickadees, understood that there is likely little of nutritional value in eating such a small song bird, and did not view shooting Chickadees as sport. Yet reality is, we effectively have an open season on Chickadees in Maine in the form of free-ranging house cats (Felis catis). Recent analysis of metadata suggests that feral cats and owned cats that are allowed outside of houses together kill between 1.4 and 3.7 billion birds a year in the United States (Loss et al., 2013). While we now understand the magnitude of cat-caused bird mortality better than ever, the nature of the problem has long been recognized. Pioneering Maine entomologist Edith Patch described the problem of bird mortality at the paws of cats nearly a century ago (Gibbs, 2014).

Effectively we do have an open season on Chickadees and all the other song birds in Maine. Yet there is no broad social objection to keeping cats that range outside and kill birds as there would be to a firearms season on Chickadees. Many people see cats hunting birds as "natural" behavior that we could not or should not interfere with, even though cats have been domesticated for centuries. (Some might argue it was cats that domesticated us centuries ago.)

This is what the phenomenon called the Anthropocene looks like. Cats are favored by humans over wild species (song birds) and so human preferences dictate the number of birds and the mix of bird species. Many people accept what would be otherwise unacceptable, the mortality of billions of birds, because of the human bias for cats.

The same phenomenon is seen in more than just the impact of cats on wild birds. Communications towers, largely those for cellular phone transmission, kill more than 20 million migratory birds a year (Longcore, et al. 2013). This too is indicative of the Anthropocene, the idea that human behaviors have become significant in shaping the outcomes of nature. Steffen et al. (2007) explained that, "Human activities have become so pervasive and profound that they rival the great forces of nature." Our desire for easy and pervasive access to mobile communication and for the companionship of cats justifies the loss of millions of wild creatures.

Text a friend, kill a bird. Welcome to the Anthropocene.

The Idea of the Anthropocene

Paul Crutzen (2002) proposed the idea of the Anthropocene, asserting that the planet Earth has entered a new Epoch succeeding the Holocene, the name geologists gave to the relatively warm period in Earth history of the last 10-12 thousand years. The concept of the Anthropocene is that industrialization of human society starting in the late 18th Century fundamentally changed the relationship between humanity and the planet. With industrialization came increasing movements of matter and energy from one part of the planet to another (Landes, 1969; McNeill and McNeill, 2003). The impact of this industrialization is seen in multiple phenomena that collectively constitute a "great acceleration" (Steffen et al. 2007) and can be observed stratigraphically (Waters et al. 2016). This increasingly rapid change is visible in multiple social, economic, and biophysical parameters such as, but certainly not limited to:

- Human population numbers

- Real gross domestic product
- Fertilizer use
- Water extractions for human use
- Paper consumption
- Numbers of McDonald's restaurants

McNeill (2000) described the environmental change wrought by humans in the 20th Century as "something new under the sun," expressing the fundamental nature of that change.

The reality of the great acceleration and its novelty compared to that of society before the 18th Century led to the proposal that we have entered this new epoch, the Anthropocene. Steffen et al. (2007, p. 842) explain the justification thus: "The human imprint on the global environment has now become so large and active that it rivals some of the great forces of Nature in its impact on the functioning of the Earth system."

For modern humans though, the whole of our lives has been lived in the midst of this great acceleration. This very unusual time in human history appears normal to most people because it is all that we have known. Rapid technological change and access to relatively inexpensive, high quality energy have been the essence of our lives, particularly in the developed economies of the West (York and Clark, 2010). Given the pervasiveness of the great acceleration in our lives, it is difficult for us to appreciate how unusual this is in human history. Therefore, it is difficult to understand intuitively the idea of the Anthropocene. If this is what our lives have been like, how can we sense that it is something fundamentally new, marking a new Epoch?

Need for a Field Guide

Crutzen (2002) acknowledged the roots of the Anthropocene idea in the work of American polymath George Perkins March (1800-1882), Russian

geochemist Valdimir Vernadsky (1863 – 1945), and French paleontologist Theildhard de Chardin (1881-1955). The new Epoch is understandable in terms of measurements from the sciences devoted to study of Earth and human phenomena, sciences pioneered by these three. Current work on such measurement is done under the broad umbrella of global change, including disciplines such as ecology, biogeochemistry, atmospheric science, geography, geology, and economics.

Much of the research in these disciplines supporting the idea of humans becoming the great force of change in nature is abstract, aimed at academic audiences, and not intuitive to the general public. For example, Rockstrom et al. (2011) identified twelve planetary boundaries that "must not be transgressed." Collectively these boundaries define "a safe operating space for humanity" in the midst of rapid global change. They argued that the boundaries in three systems – rate of biodiversity loss, climate change, and the global nitrogen cycle – have already been exceeded. Nevertheless, it is hard for us in our daily lives to experience what exceeding these boundaries means. For example, what is the human experience when a species goes extinct somewhere on the planet, particularly if we did not personally know the species existed in the first place?

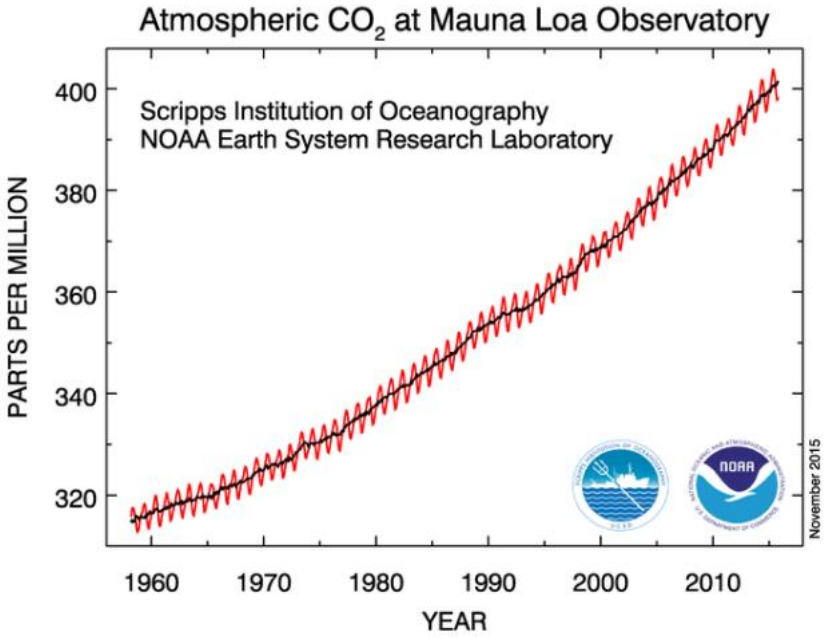
Wackernagle et al. (2002) suggested a more intuitive approach with the idea of ecological footprinting. We all understand the idea of the print left behind by our boots in muddy ground. In this approach, individual societies and the whole planet are evaluated in terms of biological capacity to produce goods and services for human and to process the waste products of the consumption of those goods and services. The impacts of the overall human footprint are measured in terms of the fractional portions of the "Earth" used to provide this biological capacity. One estimate is that the human footprint is now nearly two Earths of biological capacity (Global Footprint Network).

The obvious question here is how could the human footprint now be two Earths (what the authors term ecological overshoot) when there is only one Earth we live on. One way to think about this is to imagine you are traveling on an Interstate Highway at the posted speed limit and realize that you have one gallon of gasoline left in the car's tank, forty miles to travel to the next gasoline station, and a car that gets 30 miles to the gallon at best. Running out of fuel is inevitable;

none the less you can still accelerate the car. It will not help, you are still going to run out of gas on the highway, but you can drive faster if you want to. So we can use more biological capacity of the Earth only because some of that capacity is in a form that is stored, just the way energy is stored in fossil fuels (Dukes, 2003).

While the idea of a human footprint might be intuitively understandable, the measurement of such footprints is still abstract and indirect. It does not yet yield a compelling individual understanding of humans as great agents of change on Earth.

Perhaps the most powerful and often-cited indicator of the Anthropocene is the concentration of CO_2 in the atmosphere (U.S. NOAA, 2015).



This is the most obvious indicator of the fossil-fuel based economy that characterizes the Anthropocene. Starting with industrialization, humans have harnessed huge quantities of coal, oil, and natural gas to fuel unprecedented growth in human numbers and in consumption of goods and services (Crosby, 2006). The combined effect of this growth has been to make humans the great force for change on the planet.

While carbon dioxide levels, ecological footprints, and planetary boundaries all provide measurement of the coming of the Anthropocene, they all are abstract concepts and not intuitive for most people. The consensus among climate scientists notwithstanding (IPCC, 2013), it is hard for many people to accept that a change in carbon dioxide concentrations in the atmosphere from 300 to 400 parts per million can affect the global climate. The numbers feel so small and, after all, carbon dioxide in the atmosphere is invisible to human senses. We need more tangible and concrete phenomena that show those who have grown up in the Anthropocene a sense of the dramatic changes this term describes.

Making the Anthropocene More Concrete

I would propose four ways to sense the Anthropocene in our lives. Two of these are awareness exercises that we can all do on a daily basis and witness the extent to which our culture is responsible for moving large quantities of matter and energy in ways that change the planet. Humans are great forces for change. Two other ways reflect the human tendency to see the challenges posed by the Anthropocene as a largely, if not exclusively, human problem. After all, the root of the word Anthropocene is anthro – of humanity. The Anthropocene is characterized by a growing anthropocentric world view.

First, think about the automobile. Cars are a central part of American lifestyles and are a great way to make the Anthropocene idea more tangible. In model year 2013, the U.S. Environmental Protection Agency estimates that the average weight for light duty vehicles in the U.S. was just over 4000 pounds. (U.S. EPA, 2015). There are currently about 17 million new light duty vehicle sales in the United States each year (Federal Reserve Bank of St. Louis, 2015).

So the production new passenger vehicles in the United States every year requires the procurement of about 34 million additional tons of steel, aluminum, glass, and plastic. All of these materials needed to be mined or recycled, transported, processed, and combined into new machines. Each of these processes requires energy to do that work, most of which comes from fossil fuels, which in turn are required to energize the use of these vehicles after their sale. 34 million

tons of material and the energy to move and shape them is a staggering sum, but still a little hard to intuit.

To make this more concrete, go stand on a street corner in Maine, which is not very crowded by global standards. With each passing car, pickup truck, or SUV just assume that it is of average weight, 4000 pounds. Count the thousands of pounds that go past you …4…8…12…16…20…24… Soon the numbers are staggering. When you tire of this exercise, just divide the number you have gotten by 2000 to calculate the tons of matter moving at human behest. You are witness to the Anthropocene.

For a second exercise to intuit the Anthropocene, think of lawns, turf grass. According to NASA estimates (2015) managed turf grass now constitutes the largest irrigated "crop" in the U.S. Lawn is estimated to take up three times the land area of irrigated corn in this country. And every acre of that grass, largely grown as a monoculture, not only requires irrigation water, but also fertilizer, herbicides, and maintenance mowing. All of these activities in turn represent the movement of matter and energy around the planet at the hands of humans. Fossil fuels are central to all of these lawn-based activities. Here is yet another sign of the Anthropocene. To make is real to you, do the same thing that I suggested for automobiles. As you drive around, witness the areas of lawn maintained to satisfy purely human aesthetic needs. You are seeing the Anthropocene.

There are two less concrete ways that we can see the Anthropocene, particularly in terms of issues of environmental quality. Even environmentalists are part and parcel of this new Epoch.

First, note the widespread embrace of benefit cost analysis (BCA) to address questions of environmental policy (U.S. EPA, 2015). Good environmental policy is supposed to come from a careful toting of the benefits and costs to humans, giving extra weight to some people and lower weight to others. This happens, despite widespread critique of the underlying assumptions of BCA from economics, the discipline where it originates (Anderson, et al., 2015). Defining environmental quality and sustainability in purely human terms is reflective of the underlying ethics that have led to the great acceleration at the heart of the

Anthropocene concept. All that matters are those human interests that we can measure in dollar terms.

A second and similar approach from the environmental community can be seen in recent writings from the chief scientist of the Nature Conservancy and his colleagues (Kareiva, et al., 2007). They argued that nature should now be seen as "domesticated" and we should thus accept domesticated nature as a given about which we can do nothing other than manage it for human ends. Calls for the simple acceptance of the Anthropocene are a clear sign that it is the Epoch we are now in. In this ethic, humans need only worry about managing nature such that we address human wants and needs – minimize the cost and maximize the benefits of environmental change on humans and their economic activity.

The reality is that we need to go beyond acceptance. The fundamentally new nature of this Epoch demands that humans will need to think differently. As Steffen et al. (2011) say, "Many characteristics of the Anthropocene are largely outside the range of past experience from an environmental governance perspective." To deal with this novel reality, we will need first to develop a new moral code of this new Epoch and then to learn how to apply that code to navigate in the Anthropocene.

Environmental ethicist Bryan Norton (2005) said, "What has changed in recent history, long after our moral codes were developed, is the human ability to employ pervasive and powerful technologies, as humans exert more and more dominance over natural systems. The effect of these changes on human morality is that we live in a hugely expanded moral universe of human responsibility."

A Moral Code for the Anthropocene

In order to develop this new way of thinking about human relations with the natural world there are two laws and one principle from the sciences developed in the second half of the 20th Century that we can draw upon.

First is the so-called first law of ecology: everything is connected to everything else. It is sometimes also stated as: we can never do just one thing. This is particularly important to remember when humans try to fix environmental problems we have caused moving ever more matter and energy around the planet. A good example of the risks here is seen in policies designed to address the contribution of fossil fuel use to global climate change.

The Federal Renewable Fuel Standard was established under the Energy Policy Act of 2005 and expanded by the Energy Security and Independence Act of 2007. Today the standard requires that gasoline sold for motor fuel be at least 10% Ethanol, most of which is made from corn in the U.S. (An import tariff on Brazilian sugar cane Ethanol effectively keeps this out of the U.S. market.) The logic is that since Ethanol is "renewable" it will reduce the greenhouse gas emissions from internal combustion engines. But you can never do just one thing.

There is a spirited debate in the scientific literature over the environmental benefits of corn-based ethanol production (Pimentel, 2003; Farrell et al., 2006). Proponents focus on the renewability of the fuel while detractors cite the corn production for contributing to hypoxia in the Gulf of Mexico, increased global food prices, and decline in monarch butterfly populations in North America. There is even debate in this literature over whether the amount of energy it takes to grow and process corn ethanol is greater than the energy content in the fuel – whether its net energy production is positive or not. If not, Ethanol production is actually contributing to climate change, not reducing it.

So it is not as simple as advocating for renewable fuels. In the Anthropocene everything is connected to everything else. When we adopt environmental policies, awareness of second order effects is essential.

The second law for developing our new moral foundation for the Anthropocene is the first law of economics: there is no such thing as a free lunch. This is important to pay attention to because of the common graphic used in

talking about sustainability, an idea that is supposed to help us deal with this expanded moral universe required by the Anthropocene.

The diagram shows three sets: the states of the world that are socially sustainability, those that are environmentally sustainable, and those that are economically sustainable. There are a number of problems with the simplicity of this diagram, not the least of which is whether we can define sustainability in each of these three domains. But most significantly is the idea that the intersection of these sets defines sustainable development.

The problem with this is that it suggests we know that there are states that fall in this intersection, often lulling people into complacency about the challenges of sustainable development. The first law of economics suggests that there are going to be tradeoffs here that will demand difficult choices (another reason why economics might be seen as the dismal science).

The third idea that will help us develop a new moral code for the Anthropocene comes from Hardin's (1968) famous article, *The Tragedy of the*

Commons. This is arguably the most important scientific article of the 20th Century dealing with human/nature relations. While usually understood to be important for its contributions to discussions of population growth or its focus on the challenges of resource management under common property regimes, there is a third reason to respect the seminal importance of this article. Hardin argued that there is a category of problems facing human society that he calls "…no technical solutions problems" and that solving them requires a "…change in human values or idea of morality."

The initial human response to the challenges of the Anthropocene is that we can harness human ingenuity to develop new technologies or to manipulate nature and fix the problems. Hardin questioned the wisdom of this approach well before the idea of the Anthropocene was proposed. Seeing problems as largely technical in nature is another indication of the Anthropocene.

Navigating the Anthropocene

These two laws and one principle fall short of providing us with a fully developed moral code for the Anthropocene, which is a work in progress. They do suggest four ideas for navigating the uncharted waters of this new epoch.

First, the economic tools that served us over the last century or more and contributed to the great acceleration are no longer sufficient for the challenges that lie ahead. Neoclassical economics was good for a time when growth was necessary to improve human wellbeing. But growth has gone from being part of the solution for human society to being part of the problem. With a global population of almost 7.3 billion people we are stretching the capacity of the biosphere to satisfy human needs.

Increasingly the most challenging economic problem is distribution rather than growth (Saez, 2015). Nowhere is this clearer than in the area of global climate change, where the wealthiest people on the planet must reduce their emissions of greenhouse gases considerably if we are to tackle the problem

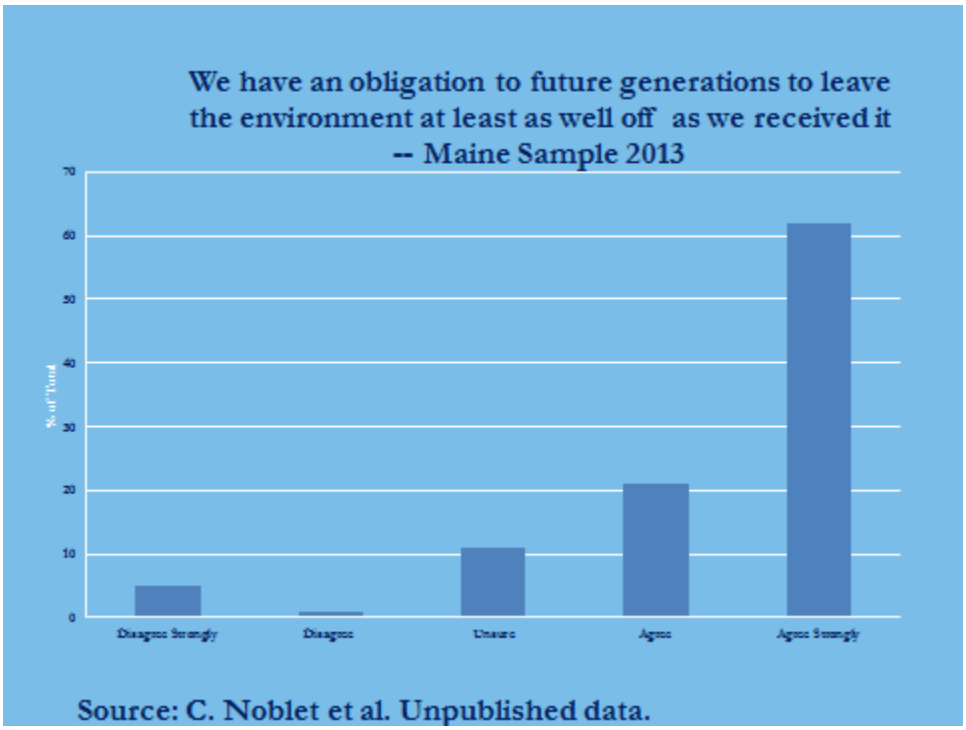
successfully and allow the poorest people on the planet the chance to achieve minimal human wellbeing (Charkravarty, et al., 2009).

No longer is it viable to think that continued growth will solve our social problems by invoking the time worn phrase, "a rising tide lifts all boats." Indeed, for many in the world degrowth will be necessary. Pimentel and colleagues (2010) argued that the planet can support less than a third of the current human population. If right, shrinking to this level to achieve sustainability will require new economic thinking in multiple dimensions (Kallis, 2011).

Second, in navigating the Anthropocene cultural change will be the necessary first choice in addressing problems. Technology will be a last resort rather than the primary response to environmental problems in the currently dominant world view. This is the lesson of Hardin and one that we have not learned well in the last 65 years.

Third, the complexity of global systems, human and natural, demands that we resist presentism (Norton, 2005). Norton (p. 321) argued that we need to ask, "How should an earlier generation balance the concern for future generations against its own moral and prudential concerns?" Answering this question will require that we pay more attention to both the past and the future. The lessons of the past need to be learned (Guldi and Armitage, 2014). Those lessons will not only help us avoid the mistakes of the past, but also better understand how the future will judge our actions of today (Anderson et al., 2012).

Central to this resistance to the dominance of presentism will be leaving a bequest for the future, a planet that is better than one we received from the past. Mainers, perhaps better than others, get this idea. We can see this from survey data of Maine citizens collected in 2013.



Finally, to help think about navigating the Anthropocene, return to where we started with chickadees and house cats. Cats are precious, as are song birds. When humans decide that cats trump song birds, we do so at great risk to ourselves and to the rest of our fellow travelers on the planet. Recognizing this risk should cause us to adopt greater intellectual humility and to become more cautious. What would it take for us to collectively adopt the simple behavior of keeping our house cats in the house for the sake of birds?

Conclusion

The arrival of the Anthropocene demands three things of us as we struggle to navigate this new terrain.

First, it demands our attention. We need to look for signs of it "in the field." Only by recognizing it can we appreciate how different human lives have become from the lives of our ancestors.

Second, it requires us to adopt a posture of intellectual humility. Reflection on the arrival of the Anthropocene and the challenges it presents us will show us that we are not as smart as we think.

Third, our humility needs to extend beyond just our intelligence, as vast as that is. We are also not as wise as we think.

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