Scarcity is Coming - Will We Survive?

Dana E Robinson

Department of Political Science, Diablo Valley College

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Adjunct Professor: John Kropf

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Abstract

Climate change and population pressure will result in global resource scarcity unseen in modern history. In this coming resource-deprived environment, tension between human selfishness and altruism will determine our trajectory. Extrapolating from modern resource conflicts, our future will almost certainly include increased conflict over these scarce resources. We can avoid the worst outcomes if we work together to mitigate the effects of climate change, but this seems unlikely given our increased global balkanization and lack of progress so far.

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We live in a changing world, where political and economic systems set up at the end of World War 2 are breaking down and new ones are being formed. In these uncertain times, the world is re-evaluating our present situation and asking whether humanity in the coming years?

There are many lenses we can use to view these changes and likely future trajectories and there is no shortage of punditry to speculate on this. Religious leaders might say that we have strayed from the path that God has laid out for us and ask that we return to the fold or risk damnation. Philosophers and scholars will justify the present situation using their favorite theory and extrapolate from that. Scientists will explain our behavior using evolution and neuroscience, though most stop at prescribing scientific cures for society's ills (eugenics having gone out of favor in polite circles).

What we do know is that, while all of these people will have useful and interesting things to say about our present chaos, none of these people can accurately predict the future or describe the "true nature" of humanity. At best, we can make some bounded guesses about our likely near-term future based on an analysis of our present situation and some guiding principles based on the social, biological, and physical sciences.

The argument presented here is straightforward:

1) The world's population is straining global resources, and climate change will make this worse
2) Humanity tends towards selfishness in times of scarcity
3) Society will be changed for the worse by this

There is no wishful thinking or wild extrapolation in this essay. Everything presented here is an obvious extrapolation from our present situation. It could be argued that this is a bit of a cop-

out and that we should think further down the road than just the next few decades, but I disagree. Speculation even a few years into the future is challenging enough. Any essay that purports to guess what life on planet Earth will be like in a thousand or even a hundred years from now is just fiction. Instead, by limiting ourselves to a reasonable extrapolation from present events, we can use our educated guesses as the basis for an action plan that we can implement to stave off the worst of what is likely to come our way.

Coming Resource Shortages

There have been many claims about future resource shortages that were never realized. At the turn of the 18th century, Thomas Robert Malthus claimed that population growth would eventually outgrow the food supply if steps were not taken to control the birth rate. He did not anticipate mechanized agriculture and dramatic improvements in agricultural biotechnology, however. Because of these advances we have never seen a global Malthusian population collapse, even as billions of new humans have been born and raised out of poverty (modern day famine is usually local and often more due to political conditions than insufficient carrying capacity of the land). We have also seen claims of hitting "peak oil" for decades, after which oil production will decrease, but these have also not been borne out and global oil production is approximately twice what it was in the 1970s and 1980s, again due to unanticipated technological advances and discoveries of new resources. Should we believe current claims about future resource depletion?

Yes.

The primary reason why "this time it's different" is the sheer magnitude of the problem, both in magnitude and scope. Even small shocks to the global temperature can significantly decrease food production. The Little Ice Age, a period of increased cold weather that lasted from the 1600s to the 1800s, is associated with decreased food production, settlement abandonment,

and increased drought throughout the world (Wanner et al., 2022). The global average temperature shift during this period was only a few tenths of a degree Celsius. A nearby period in time, the Medieval Warm Period, which lasted from roughly AD 950 to AD 1250, is associated with increases in flooding and drought, though it did expand the growing season in some regions and allowed people to live at higher latitudes. This too, was a temperature shift of a few tenths of a degree Celsius. The current shift in the global average temperature is over one degree Celsius compared to the mid-1800s and we are on track to exceed three and possibly even hit four degrees Celsius of warming by 2100 (Intergovernmental Panel on Climate Change [IPCC], 2023). This is more akin to the magnitude of the temperature shift during the last ice age, which is estimated to have been about six degrees Celsius, albeit in the opposite direction. We should also consider that a large change in the atmospheric CO_2 level is also a suspected major cause of the end-Permian extinction that took place about 250 million years ago, which acidified the ocean and resulted in about 90% of the global species loss (Benton et al., 2003).

Not only will climate change be dramatic, but the scope will also be widespread, both in the number of planetary systems that will be affected and their geographic range. Climate change is predicted to increase the frequency and severity of both floods and wildfires, acidify and raise the level of the oceans, and change rainfall patterns. These shifts in the climate will vary regionally, but the net effect will be global disruption. There will be no planetary "safe spaces" that will be unaffected. How bad are future shortages likely to be? It is difficult to predict, but it is unlikely to be good. If we continue on our present path, climate change will reverse many of the gains we have made in lifting people out of food insecurity and increase the frequency and severity of food crises like the one that hit Ethiopia and Somalia in the 1980s-1990s (Mirzabaev et al., 2023)(Food and Agricultural Organization of the United Nations, 2018).

These coming shocks are not theoretical. They are happening now.

We have experienced the collapse of several fisheries during living memory. The Atlantic cod fishery located off the coast of Newfoundland was once one of the world's largest commercial fisheries, producing 800,000 tons of fish annually in the 1960s. Overexploitation due to improved fishing technology and mismanagement led to its collapse by the early 90s, when it had collapsed so completely that fishing was banned in 1992 in an effort to save it (Rice, 2018). In more recent years, we've seen the Pacific sardine fishery collapse, starting in the mid-2000s, where output dropped from 1.8 million tons to 27,000 tons over a decade, a drop of over 95% (Checkley et al., 2017). As an even more recent example, in the late 2010s we saw a collapse of the commercially important Alaskan snow crab fishery in the eastern Bering Sea, with a population decline of over 90%, which National Oceanic and Atmospheric Administration scientists attribute to the effects of a warming ocean (Szuwalski et al., 2023).

Water stress is also a growing problem that will worsen under climate change. Current estimates are that roughly half of the world population (~4 billion people) experience severe water scarcity for at least one month out of the year (United Nations Educational, Scientific and Cultural Organization [UNESCO], 2026). The worst-hit parts of the world include the Middle East and North Africa (MENA) region, southern Africa, and India. Even in our own backyard, the Colorado River Basin has been experiencing a drought for over 20 years. This is the dryest that river system has been in over a thousand years. Much of this is due to an increase in desertification and changes in precipitation levels. There are even future challenges to the water under our feet. Rising seas lead to saltwater intrusion in aquifers, and increased population, intensive agriculture, and datacenter cooling needs put extreme stress on a resource that cannot be quickly replenished.

At the same time that we are setting ourselves up for a future with fewer resources than we enjoy today, we are also increasing the number of humans. The current population of the planet is just over eight billion, which is high enough to strain our existing water and food resources. Current population projections predict that the global population will peak at a little more than ten billion, shortly after 2050, after which the population will slowly decline (United Nations Department of Economic and Social Affairs [UNDESA], 2024). Paradoxically, this will cause additional problems of its own, where degrowth and an elderly population will strain the social safety net, as we are currently witnessing in nations like Italy and South Korea.

This all adds up to a much more resource-poor world than we live in now, particularly when it comes to the existential resources of food and water. How will humanity respond to this new reality?

Human Behavior

Human beings are clearly capable of both selfish and altruistic behavior. The questions before us is which of these will dominate in a resource constrained environment? Under stress, will people unite and work together for the common good? Or will they instead turn inward and splinter into smaller groups that erect boundaries and feud among themselves?

The first thing we need to get out of the way is that the biological sciences cannot offer us much guidance. Most of what exists in the literature is speculative and unconvincing. As for altruism, we do know that helping others produces pleasurable sensations, primarily due to the release of the neurohormone oxytocin and that there are obvious social and genetic benefits to helping kin survive, but it's unclear what drives humans to help unrelated people (either in the genetic or social senses) even at personal risk to themselves and with no expectation of reward (Marsh, 2015). Even if we could describe lower-level genetic and neurological aspects of altruism

at some level, it would be difficult to extrapolate from the reductive parts of the system to something as complicated as the human brain. Selfishness and kin altruism are easier to explain, since surviving to reproduce is a winning evolutionary strategy, but we still lack a genetic or neurophysiological explanation of what drives them. So it seems that the best we are going to be able to do is to describe observed behavior when people are put into situations when they are low on resources and/or stressed and extrapolate from there.

Social science researchers have pointed out that humans seem to use two complementary systems for reasoning; system 1, which is a faster, more intuitive and emotional scheme, and system 2, which is slower and more logical (Kahneman, 2011). Research suggests that stressed people lean towards system 1, potentially making them more susceptible to tribalism, self-interest, and propaganda (Yu, 2016). Research into war refugees also suggests that people's altruistic/selfish response to similar stressors can be complicated and context dependent. For example, in some cases, altruism can increase, though this is typically either in in-groups ("parochial altruism") or after exposure to a similar stressor. In most cases, though, existing in a resource-deprived environment decreases altruism and increases selfishness, especially towards out-groups and rivals (Döring et al., 2023; Bauer et al., 2016).

We should also not ignore social conditioning, which can have a huge effect in our media-driven world. On one hand, many groups in the US tend to promote heroism and self-sacrifice, which is positive. Religions, the education system, film and television, and even the military, to a certain extent, all extol those virtues. On the other hand, many institutions emphasize our differences and portray out-groups in a negative light. The US, in particular, is rife with left vs. right political conflict that occasionally escalates to violence. On the positive side, a recent survey

suggested that the United States has become more, not less altruistic regarding strangers since the 1950s, so perhaps we are not as divided as the politicians would have us think (Yuan et al., 2022).

Additionally, we should not forget that self-interest is the driving force of our global economic system, so many people, particularly in the developed nations, have been socialized to accumulate resources and take advantage of situations since they were very young. Not only does this behavior exacerbate resource shortages (and hasten their onset), but it can also lead to hording behavior when resources are scarce, as we saw during the COVID pandemic, when enterprising individuals bought up all the toilet paper in the hopes of setting up price gouging shops. "Every person for themselves" behavior can also lead to other negative outcomes, like tragedies of the commons.

However, it is also true that there is evidence that suggests that humans are inherently cooperative and social. Toddlers cooperate. Humans are cooperative breeders. People often exhibit true altruism, even at risk of life, without any prospect of repayment. Most religions are also based on cooperation and community and there certainly are a great many religious adherents in the world, suggesting broad approval for altruism. Nation-state citizenship can also drive communal altruistic behavior, though recent events in the US and abroad suggest that those ties may not be as binding as was once thought.

But in a resource-constrained world, which will dominate? Altruism or selfishness? It is reasonable to predict that survival is a powerful driver of behavior, and that people will choose survival of themselves and close group members over the survival of out-groups, where attachments are much weaker. Research that claims to demonstrate altruism research is usually conducted on people in relatively resource-rich environments, and it seems unlikely that this will extrapolate to resource-poor environments. Even in times of war and severe deprivation, people

will sometimes help each other out, but it seems far less likely that someone who needed $5 to feed their kids that day would give that away than a college student research subject for whom $5 is a beer.

It's also worth considering whether altruism at the individual level extrapolates to altruism at the broader economic and political level. e.g., will an "altruistic" person who is willing to share their sandwich with a hungry person, even if it means that they will go hungry, also vote for economic policies that would share scarce resources with less fortunate neighbors? We frequently do this in times of plenty, but normally at very low levels that don't materially affect our well-being. Would we do this when we are struggling ourselves? Sadly, the answer to this question appears to be "no" given our behavior concerning medical resources during the COVID pandemic (McMahon et al., 2020).

Conflict

Many of the world's conflicts have been over resources and it would be surprising if this were also not a factor during a global food or water crisis. One thing that hampers analysis is that we do not have any recent examples of large, powerful nations engaging in a shooting war over resources necessary for their survival, like food and water, which limits our analysis. In Europe, for example, there really aren't any existential resource wars between major powers in modern history.

What we do have plenty of examples of is more powerful nations taking things from smaller nations by force. Despite the presence of the United Nations, this is a tradition that continues to this day and which many "developed" nations like the United States enthusiastically participate in. Leaving aside historical examples, like the scramble for Africa, we have plenty of recent examples of this, such as our endless military adventurism in the Middle East, some of

which is taking place in the Persian Gulf at the time of writing. It seems likely that powerful nations will engage in similar behavior if there were a food or water crisis that affected their population.

Aside from neo-colonialism or neighborly feuds on the part of the major powers, we are also likely to see increased conflict among the developing nations. Due to their lack of resources, there are more likely to be conflicts over food and water. An example here is the Lake Chad conflicts circa 2020, which are multifaceted, but have at their core a conflict over water access. These conflicts have, at times, created millions of refugees and are likely to spread as the region becomes increasingly water challenged.

Even developed nations with otherwise interlinked, modern economies can come to blows over resources. A good example of this is the "Cod Wars" between Iceland and the UK, where Iceland expanded its exclusive economic zones over the protests of UK fishermen. These lasted from the 1950s to the 1970s and although it did not result in actual armed conflict, shots were fired and there were ship collisions.

Can We Fix This?

This essay paints a rather bleak near-term outlook for humanity, but will it come to pass? Can we do anything about it? To answer the first question, nobody truly knows, but humanity seems unlikely to come together to offset the worst effects of climate change. Consider the global carbon budget: Decades ago, climate scientists warned that it was unwise to go past 350 ppm CO_2, but today we are at 430 and the year-over-year increases are going up (IPCC, 2023). Although some countries have made remarkable progress in reducing their CO_2 emissions, our addiction to energy means that those efforts are not enough to offset the worst effects of climate change.

In the past, however, humanity has been able to work together to solve global problems. One of the best and most well-known examples of this is the enaction of the Montreal Protocol in

1987, where the countries of the world banded together to ban the use of chlorofluorocarbons (CFCs) as refrigerants due to their deleterious effects on the ozone layer. The treaty was notable for the speed at which it went into force (the effects on the ozone layer were only discovered in 1974), its broad acceptance (all United Nations members ratified it), and fair implementation, where developed nations were required to phase out CFCs sooner than developing nations. This treaty is even more remarkable when you consider that it was negotiated against the backdrop of increased cold war tensions, when the US and USSR were squabbling over intermediate-range ballistic missiles in Europe and fighting proxy wars in Africa and Latin America (Gonzalez et al., 2015).

There are many other examples of countries working together to solve large-scale environmental problems. After the Northwest Atlantic cod fisheries collapsed in the early 90s and, despite severe economic pain in the fishing industries of several countries, a moratorium on cod fishing was successfully imposed in 1992. This led to a recovery of the cod population, which had collapsed to 1% of its historical levels) to recover to the degree that some commercial fishing is now allowed (Rice, 2018). Another example is the Aral Sea in central Asia, which had almost completely dried out by the mid-2000s due to unwise Soviet-era irrigation projects that significantly reduced inflow into the lake. Improved water usage in the region and a dam completed in 2005, coordinated by the International Fund for Saving the Aral Sea (IFAS), has restored enough of the water level of the North Aral Sea to allow some commercial fishing to resume (Micklin, 2016).

In *Collapse* (Diamond, 2011), Jared Diamond also provides several examples of societies that managed to adapt to environmental changes, and *Falter* (McKibben, 2019) ends with a discussion of potential paths towards averting the worst effects of climate change. It's unclear,

though, if the rosier endings to popular books and modest past successes at lower-stakes, often regional cooperation mean that we will come together as a global society to mitigate the negative effects of climate change. This is especially true given the immense power wielded by capitalist business interests, who would have their immediate business models threatened by extensive environmental legislation. As Naomi Klein points out in her 2014 book *This Changes Everything* (Klein, 2014), capitalism is fundamentally at odds with environmentalism and mitigating climate change.

The power of global capitalism and the wealth of the people who are enriched by it is, by far, the greatest threat to our current state of civilization. Breaking the power of the oligarchs that control the levers of power, and the means of production will be a critical step that MUST be taken if we are to save our society from the worst of the coming scarcity and all that entails. This would be easier if we only had to depose a handful of extremely wealthy people, however, it is not just the captains of industry who benefit from excessive capitalism. The entire global economy and thus the livelihoods of billions of people depend on the elaborate machinery creaking along. In the United States, with its meagre social safety net, this is especially true. If a crackdown on, say, the tech oligopolies were to tank the stock market, millions of retirees could see their 401k plan values decrease significantly. Throughout history, revolutions have involved strife as well as progress, and it's unclear if the global proletariat are willing to endure present pain in exchange for uncertain future benefits.

Conclusion

The near future of humanity will almost certainly bring severe resource shocks, which will lead to more selfish behavior in humans, and result in increased global conflict and a lower standard of living, even in developed nations. Unless humanity comes together to solve our

collective environmental problems, this is almost certainly our future. The only questions are to what degree and how quickly.

Although this does not bode well for the future, increased scarcity and the disruption it will wreak is not an existential threat for *Homo sapiens*. Humanity will survive this, as we have the last ice age (which humanity survived using stone age technology), the black death, hordes of Mongol invaders, World War II, and several global financial crises. Instead, we will simply face a new existence in a world with more resource constraints than during our golden age. How much will this future society resemble our present society? This is unclear.

It is difficult to say much about the long-term trajectory of humanity. This essay only touches on one factor: human selfishness in an environment of scarcity, primarily of food and water. No mention is given of other important considerations, like population migration, which can destabilize governments, the potential for lethal pandemics (natural or engineered), or the potential for resource conflicts to lead to the use of nuclear weapons. In these and many other areas, difficult-to-predict stochastic events could lead to major downstream effects. Consider that an offhand joke by then President Obama at the White House Correspondents' Dinner possibly led to the breakdown of the post-WWII economic order. Or that an errant bat in a market in Wuhan led to ten million COVID deaths and disrupted the global economy for years. These were probably not things that people would have predicted in 2010. Guessing what our society might look like in twenty-five, fifty, or a hundred years is a fool's errand.

One thing is for sure: the children of today are going to have to clean up the messes their parents made. Let's hope the kids are up to the challenge.

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