North Dakota Conviction

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Michael Foster (see How Does It Feel) was convicted on 6 October on three of four counts, two felonies and one misdemeanor. He will be sentenced in January. Judge Fontaine ruled earlier that the "necessity" defense was not allowed. We hoped I would still be able to testify about the threat of climate change and urgency of fossil fuel phaseout, to make the jury aware of factors affecting Foster's state of mind and his action. However, this too was not allowed.

I prefer taking the offensive, lawsuits against the real criminals, but let's consider the necessity defense and Foster's specific situation. The necessity defense requires showing that:

(1) there is no legal alternative to violating the law,

(2) the harm to be prevented is imminent, and

(3) a direct, causal relationship exists between defendant's action and the avoidance of harm.[1]

Michael Foster. I can't imagine a more sympathetic figure than Foster. He reached the point of committing a supposed felony, turning off a tar sands pipeline, after decades of growing concern and increasing efforts to take helpful actions. He walked the naturist talk, minimized his and his family's carbon footprint, became a vegetarian, even raising backyard chickens, showed that it was possible to live an American life while treading lightly on the planet.

As governments failed to take action on climate change, his concerns grew and his efforts to do something became almost superhuman. He started the website ClimateChangeforFamilies.com, founded Plant-for-the-Planet NorthWest, and co-founded 350 Seattle. He became a speaker for the Climate Reality Project, giving a slideshow to more than 13,000 people, but rather than just the standard slideshow, he included a pathway to a solution, as specified in our 2013 Plos One paper (emission reduction of several percent per year and 100 PgC carbon drawdown via improved agricultural and forestry practices). He became a parent coordinator for the Our Children's Trust (OCT) lawsuit against Washington State, to name just some of his activities.

These were the actions of a feeling adult with a masters of education in counseling psychology. In counseling adolescents and families he observed the increased anxiety and stress that today's youth face, a fact partially attributable to realization that young people face lesser prospects and difficult times because of climate change. As a practicing professional in the mental health area, he saw continuing governmental failure to address climate change as tantamount to child abuse.

The historic "victory" in the OCT lawsuit against Washington State added to Foster's frustration. Washington supposedly must reduce emissions on a pathway that, if adopted globally, would return atmospheric CO_2 to 350 ppm by 2100. In reality Washington's minimalist actions have little effect. Foster relates a "celebration" of Governor Inslee on stage with the kids, while his reality is "half-measures" and "soothing and baffling expedients" that promise young people only a "period of consequences," tantamount, indeed, to child abuse.

[1] *United States v. DeChristopher*, 695 F.3d 1082, 1096 (10th Circuit 2012).

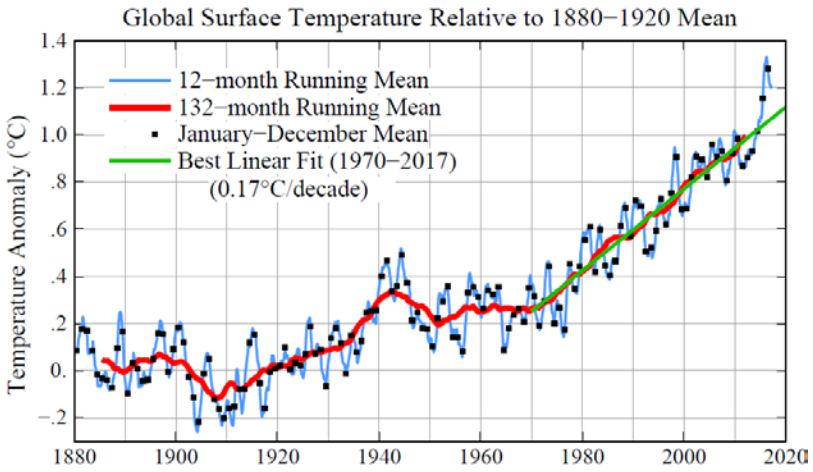

Fig. 1. Global surface temperature relative to 1880-1920 based on GISTEMP analysis. Data extend through August 2017. Update of Fig. 2 of Young people's burden, *Earth Syst. Dynam*. 8, 1-40, 2017.

Imminent Danger and Urgency of Action. One cannot recognize the imminent danger without understanding the science. It is not difficult science. The urgency of action arises from the slow response of the climate system to changes of atmospheric composition. This slow response means that there is more global warming "in the pipeline" without further increase of greenhouse gases (GHGs). Delayed warming is due mainly to the large thermal inertia of the ocean.

Delayed response of the ice sheets, and thus sea level rise, is due to both the thermal inertia of the ocean and dynamic inertia of the ice sheets. A warming ocean melts the ice shelves around Antarctica and Greenland, tongues of ice reaching into the ocean that buttress the ice sheet, which allows more rapid discharge of land ice to the ocean, speeding ice sheet disintegration.

The delayed response is dangerous in one sense, because it allows greater climate change and consequences to build up before effects become large enough to awaken the public to danger. On the other hand, the delayed response allows global warming to be kept less than 1.5°C relative to the 1880-1920 mean (Fig. 2a), assuming that emission reductions begin soon.

Earth begins to cool after fossil fuel emissions are eliminated, but the rate of cooling is very slow (Fig. 2a). Therefore, if it is desired to return global temperature close to Holocene levels within a century, it is necessary to somehow extract a large amount of CO_2 from the air (Fig. 2b). The largest carbon extraction that can be achieved by natural processes such as reforestation and improved agricultural and forestry practices is not more than[2] about 100 PgC.

The target to keep global warming below 1.5°C is included in the 2015 Paris climate agreement as an ambitious goal, but without scientific justification. In fact 1.5°C is 1°C warmer than the maximum temperature in the Holocene, the past 10 thousand years in which civilization developed and most of the world's large cities were established on coastlines. Indeed, 1.5°C is at least as warm as, but probably warmer than, the Eemian period, about 120,000 years ago[2], when sea level reached 6-9 meters (20-30 feet) higher than today. Earth's paleoclimate history shows

[2] Hansen, J., M. Sato, P. Kharecha, K. von Schuckmann, D.J. Beerling, J. Cao, S. Marcott, V. Masson-Delmotte, M.J. Prather, E.J. Rohling, J. Shakun, P. Smith, A. Lacis, G. Russell, and R. Ruedy, 2017: Young people's burden: Requirement of negative CO_2 emissions. *Earth Syst. Dynam.*, **8**, 577-616, doi:10.5194/esd-8-577-2017.

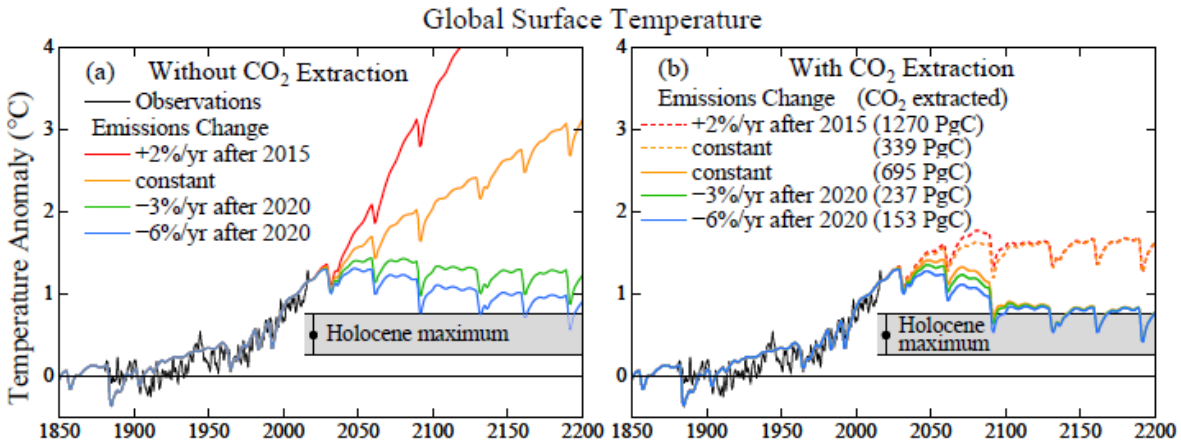

Fig. 2. Simulated global temperature for alternative emission growth rates. Observations as in Fig. 1. Gray area is 2σ (95% confidence) range for centennially-smoothed Holocene maximum temperature. Fig. 12 of Young people's burden, *Earth Syst. Dynam.* 8, 1-40, 2017.

that sea level responds to global temperature change with a lag of 1-4 centuries[3], but the paleoclimate forcings were much weaker and slower than the present human-made increases of atmospheric GHGs. Therefore it would be dangerous to leave global temperature at a level that is expected to eventually yield sea level rise of several meters.

If emissions reduction of 6%/year had begun in 2013, and if 100 PgC (1 PgC = 1 GtC = one billion tons of carbon) were removed from the air via reforestation and carbon storage in the soil and biosphere via improved agricultural and forestry practices, atmospheric CO_2 would have declined to 350 ppm by 2100 and temperature returned close to the Holocene range.[4] The simulations for Fig. 2 have reductions beginning in 2021 relative to 2020, based on the fact that it will take at least a few years to achieve global policies, such as a carbon fee or tax that would be essential to achieve rapid sustained emission reductions. The delay from 2013 to 2021 increases the requirement for carbon extraction from the air by 53 PgC, if emission reductions of 6%/year are possible, or 137 PgC, if reductions are at the easier rate of 3%/year.

The requirement of extracting CO_2 from the atmosphere will fall upon today's young people and their children, as today's adults have yet to develop and seriously consider, no less commit to, any serious program to extract massive amounts of CO_2 from the air. This "young people's burden," the need to somehow achieve negative CO_2 emissions in the middle and latter part of this century, has been quietly inserted into all studies of the United Nations modeling group (IPCC) in their scenarios that attempt to stabilize climate. But it simply will not happen absent a conscious, concerted international effort, and its costs seem likely to be unbearable.

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[3] Grant, K. M., Rohling, E. J., Bar-Matthews, M., Ayalon, A., Medina-Elizalde, M., Ramsey, C. B., Satow, C., and Roberts, A. P.: Rapid coupling between ice volume and polar temperature over the past 150,000 years, Nature, 491, 744-747, 2012.

[4] Hansen, J., P. Kharecha, M. Sato, V. Masson-Delmotte, F. Ackerman, D. Beerling, P.J. Hearty, O. Hoegh-Guldberg, S.-L. Hsu, C. Parmesan, J. Rockstrom, E.J. Rohling, J. Sachs, P. Smith, K. Steffen, L. Van Susteren, K. von Schuckmann, and J.C. Zachos: Assessing "dangerous climate change": Required reduction of carbon emissions to protect young people, future generations and nature. *PLOS ONE*, **8**, e81648, doi:10.1371/journal.pone, 2013.

Let us first note the estimated cost of negative emissions. Smith et al. (2016)[5] review estimated costs for a wide range of proposed methods of extracting CO_2, concluding that costs are at least \$150-350/tC, where tC is a ton of carbon. Thus the cost of extracting 100 PgC is \$15-35 trillion. Let's assume the emitting nations agree to cover this cost, spread over the last 75 years of this century. The bill would be \$200-467 billion/year. The United States is responsible for 25% of the excess CO_2 in the air from fossil fuel use, so the proportionate U.S. annual bill is \$50-117 billion/year for each 100 PgC of extraction.

However, carbon extraction needed to stabilize climate is likely to be much more than 100 PgC. If fossil fuel emissions remain constant, the extraction requirement is 695 PgC (Fig. 2). Thus the cost of removing the CO_2 from the air would be about a factor of seven larger than for 100 PgC. I am not saying that young people will actually be able to come up with the resources to clean up this mess. Our "Young People's Burden" paper[2] concluded that "Continued high fossil fuel emissions unarguably sentences young people to either a massive, implausible cleanup or growing deleterious climate impacts or both."

The tragedy of this situation is that there is little if any net cost of rapidly reducing fossil fuel emissions – and thus to reduce the burden for young people to a still-huge but potentially manageable level -- if emissions reductions are secured via a gradually increasing across-the-board (oil, gas, coal) carbon fee collected from fossil fuel companies at domestic mines and ports of entry with the funds distributed uniformly to the public (see references in the Burden paper).

Foster's Defense. Michael Foster is a mental health professional deeply concerned about the well-being of young people and the global mess that we are leaving them. Michael Foster is not a scientist, but when I met him in North Dakota I was shocked at his quantitative knowledge of information in our papers such as Young People's Burden, and he quoted several lines from my TED talk, including: "What would you do if you knew what I know?" We know what Foster did: he turned off a damned tar sands pipeline. It is a travesty that Foster should go to prison, while those guilty of child neglect and abuse sit lavishly in Washington and corporate headquarters.

As for the necessity defense, the evidence is overwhelming, it seems to me, that the second and third requirements are satisfied, i.e., the harm to be prevented is imminent and there is a causal relation of the defendant's actions with avoidance of harm. The first requirement, proving that there is no legal alternative to violating the law, is harder to meet. That is the reason I prefer to go on the offense, use the legal system to go after the real criminals.

Michael Foster could have made an argument that the exceedingly slow pace of alternative approaches is inconsistent with the urgency of addressing the present climate emergency. Understanding the urgency of CO_2 emission phasedown requires understanding the slow response of the climate system, the role of amplifying climate feedbacks, and the danger of passing a point of no return. Regrettably, these points are not yet matters of widespread knowledge – and I was not allowed to inform the jury about them.

Accordingly, I think the judge made an egregious error in prohibiting expert testimony relevant to Foster's state of mind – in particular, the basis for Michael's understanding of the urgency of emission phasedown and government's failure to take meaningful action – as I discussed in "How Does It Feel?" The jury should have heard about factors that affected Foster's state of mind before it determined his guilt as to charges carrying the potential for long prison time.

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[5] Smith, P., Davis, S. J., Creutzig, F., Fuss, S., Minx, J., Gavrielle, B., Kato, E., Jackson, R. B., Cowie, A., Kriegler, E., van Vuuren, D. P., Rogelj, J., Ciais, P., Milne, J., Canadell, J. G., McCollum, D., Peters, G., Andrew, R., Krey, V., et al.: Biophysical and economic limits to negative CO_2 emissions, Nature Clim. Change, 6, 42-50, 2016.