Emergency Appeal to Policy Makers to Save Arctic Sea-Ice and Reverse Climate Change

Dear Policy Makers,

Put simply, there are two ways of crossing into (accelerated) catastrophic climate change in the next decade or two. One is through failing to reduce and remove Green House Gas (GHG) emissions at a fast-enough pace, that is, as it should be, the most important focus of efforts at climate solutions. The second is through failing to slow or prevent complete Arctic summer sea-ice melt, the first climate tipping point that based on current trends could begin to occur as early as 2025 (Baiman 2021, p.7). For example, an article in today's (3/2/2021) New York Times, (Velasquez-Manoff and White 2021), notes that some scientists fear 'monstrous change' from a weakening Atlantic Gulf Stream (linked to Arctic sea-ice melt – see (Baiman, 2021)),and highlights the extreme danger that we face. As far as I can tell, the proposal offered by Graciela Chichilnisky offers the best plan for rapidly reducing and reversing GHG emissions and urge that it, or something like it, be implemented at the Glasgow COP26 in November 2021 (Chichilnisky and Bal 2019, Chap. 9). But so far, no official government body is investigating emergency climate triage to slow or prevent the Arctic summer sea-ice from completely melting.

It appears that this is not receiving the attention and necessary urgent action that it merits, in large part because of disciplinary siloization. Climate scientists have been documenting this looming first climate tipping point and its abrupt and potentially catastrophic impact on the global climate for years but do not see themselves as responsible for proposing solutions. On the other hand, social scientists, who are focused on trying to develop plans and estimates for solutions, are focused on politics, economics, and technological change, that are rightly viewed as the fundamental locus and source of the problem and of potential remedies. Arctic summer sea-ice melt is a natural science phenomenon that is too far along at this point to be impacted by political, economic, or technological efforts to reduce and remove GHG emissions from the atmosphere and ocean. It therefore falls outside the traditional scopes of both climate scientists who are focused on documenting and understanding climate change, and social scientists and engineers focused on GHGs emissions. Thus, in spite of its well documented potentially abrupt calamitous impact on the global climate, that in the short term is likely to be more immediately harmful than increased GHG emissions, the possibility and urgency of trying to do something to slow or reverse this first climate point is not being addressed by any government or international body that I know of though several nonprofits are working on and proposing methods (that may or may not be feasible or realistic). This lack of action persists, despite relatively modest cost estimates of $ 1-10 B for the various proposals (Baiman 2021, Table 1, p. 8).

Estimates included in (Pistone et al 2019), and corroborated by multiple other studies using different data and methodologies cited in this paper, suggest that crossing this tipping point would have a radiative forcing impact equivalent to that of 25 years of GHG emissions at current rates. This would be in addition to projected increases in global warming based on current emission trends. Resetting this estimate to a 2016 baseline reduces this to 17.3 years of GHG emissions (Baiman 2020, p. 2 footnote 1, and acknowledged in communications with Kristina Pistone), and additional recalibration that assumes that the first "blue ocean" complete Arctic summer sea-ice melt occurs in 2025 reduces this to about 14.5 years (link to spreadsheet here). These are GHG equivalent estimates of the (added) increase to global warming exclusively because of the loss of albedo (or ability to reflect sunlight) from complete summer sea ice melt (for a summary of possible other adverse effects see (Baiman, 2021 p. 5-6). However, no matter the specific estimate, in all cases there is little doubt that crossing this tipping point

alone, regardless of how successful we are in reducing and removing GHG, will lead to greater than 2.0 Celsius warming, as the impact of these 14.5 years of GHG would be added to the impact of GHG emissions that do not take into account the accelerated impact of polar ice melt.

Understandably there is skepticism regarding the feasibility and advisability of proactive climate triage methods, and I as an economist am surely not qualified to be the final judge of these matters. But given that one volcanic eruption (Mt. Pinatubo in 1991) cooled the planet by 0.6 Celsius for 15 months, I think we can agree that these methods could potentially afford triage (suggesting feasibility). And given that another of these proposed methods, adding iron salt aerosol (ISA) to 100 large coal burning power stations to cool the planet, could be quickly terminated in the event of unforeseen consequences (suggesting advisability) (Oeste et al 2017, p. 34), I see no reason for not immediately convening an international committee of experts to review these methods and recommend (or not) an emergency international climate triage plan.

With regards to longer term GHG removal, I urge that COP26 delegates and other policy makers consider the Chichilnisky proposal (Chichilnisky and Bal 2019, Chap. 9). Economist Graciela Chichilnisky was lead US author of the 1997 IPCC report; designer and key negotiator of the very successful 1997 Kyoto global "cap and trade" Emissions Trading System (ETS) (Kramer 2019) (Bayer and Aklin 2020); co-inventor (with Peter Eisenberger) of a low cost and profitable "Direct Air Capture" (DAC), net carbon negative, electric power generation technology that can (in the short-term) build on our current fossil fuel infrastructure; and co-founder (with Eisenberger) and CEO of Global Thermostat, that is successfully operating carbon negative natural gas electric power generation plants in the US that use this technology. She has proposed the following for the 2021 COP26 in Glasgow:

a) With the US now (thankfully!) again fully engaged, it is time to adopt revised "conditionally mandatory", global cap and trade ETS and Clean Development Mechanism (CDM), protocols, as these appear to be the only realistic methods to rapidly generate and transfer the large scale level of funding and technology to developing countries that is necessary to avoid the onset of accelerated climate catastrophe from GHG emissions in the next decade.

b) More specifically, the conditionally mandatory emissions caps in a) would be: (i) binding for poor countries only if funding and technologies are provided by rich countries through a revised CDM that finances GHG reduction technologies that *increase* electric power generation, supporting rapid and equitable economic development, and (ii) binding for rich countries only if these emissions caps can be achieved through DAC and other GHG reduction and removal methods that promote profitable and beneficial economic growth.

c) These, and other national and regional carbon negative content regulations, would have the goal of bringing about a long term transition to a fully Renewable Energy and Materials Economy (REME), through a "Human Designed Carbon Cycle Run by Renewable Energy" (HDCCRRE) (Eisenberger 2020), powered by renewable energy and carbon capture and use technologies, that would lead to a more prosperous and equitable future for humankind as carbon in the air (unlike carbon in the ground) is distributed uniformly, and solar radiation or wind are available almost everywhere.

The future can be hopeful, but we need to move at lightning speed to make it so!

To human and species survival, Ron Baiman (4/13/2021)