

## **Article Title:** The Bryson Synthesis: The Forging of Climatic Change as a Political Tool during the World Food Crisis

### **Author:**

Robert L. Naylor  
0000-0002-9585-9939  
Centre for the History of Science, Technology and Medicine: The University of Manchester  
Robert.Naylor-4@postgrad.manchester.ac.uk  
No conflicts of interest

### **Argument**

During the first half of the 1970s, climatic research gained a new significance and began to be perceived within political and academic circles as being worthy of public support. Conventional explanations for this increased status include a series of climate anomalies that generated awareness and heightened concern over the potentially devastating effects of climatic change. This paper argues that controversial climatologist Reid Bryson was one of the first to publicly promote what he saw as a definitive link between these climate anomalies and unidirectional climatic change in the fall of 1973, and that rising food prices in the same year gave him a platform to air his views to receptive senior members of the US Congress. Through his testimony, we gain a unique perspective on how Bryson was able to successfully resonate his agenda with that of senior politicians in a time of crisis, as well as the immediate responses of those senior US politicians upon first hearing climatic change arguments. Bryson was also one of the first in the US climatological community to decisively break a taboo against making bold climatological predictions and de-facto policy recommendations in public. As a result, although Bryson was shunned by many in the meteorological community, he instigated other scientists to enter the public arena, leading to an important elevation in US public climate discourse.

Keywords: Reid Bryson, Climatic Change, World Food Crisis, 1970s Climate Anomalies, The Sahelian Effect, Sahel Drought, Great Grain Robbery, Hubert Humphrey, History of Science, History of Meteorology, History of Climatology, Climate Discourse

### **1. INTRODUCTION**

During the 1970s, 'climatic change' - here defined as changes to the atmosphere which are unintentional, unprecedented, global in reach, and unidirectional - transitioned from a niche pursuit within the physical science community to a subject of policy discourse which coalesced into the first World Climate Conference in 1979. A conventional explanation for this change in status, exemplified by historian of physics Spencer Weart, sees a convergence of four factors. First, the emergence of environmentalism as a respectable political force prompted a cultural shift amongst scientists towards a more environmentalist perspective (Weart 2008, 66–67). Second, concerns over climate-induced famine were accentuated by the influential neo-Malthusian arguments put forward in The Club of Rome's 1972 publication *Limits to Growth* (Weart 2020, 14). Third, interest in energy policy alternatives increased with oil price during the 1973–79 OPEC crisis; those who advocated nuclear

power found that climate-based arguments could provide another string to their bow (Weart 2008, 102–103). Finally, a series of climate anomalies occurring in the first half of the decade generated awareness and heightened concern over climatic change and its devastating effects, increasing the political weight of the issue (Weart 2008, 68; Hechler 1980, 972; Hart & Victor 1993, 665; Edwards 2013, 372; Howe 2014, 103–104; Janković 2015, 104–106). The most prominent of these anomalies, at least from an American perspective, included the 1972 poor harvest in the Soviet Union that instigated controversial grain purchases from grain-producing nations, a ‘wet fall’ in the same year in the United States which prevented crops being harvested, and successive drought years in the Sahel region of West Africa that caused widespread starvation and death, especially amongst populations reliant on pastoralism. This coincided with the first substantial drop in cereals production in over a decade, declining by 2.2% in 1972 compared to 1971 (FAO 1974).

However, Weart and others are yet to explore the mechanisms by which these climate events came to be associated with the then-obscure idea of climatic change within public, political, and academic circles. Despite being occasionally mentioned in government documents in the 60s, climatic change can hardly be described as a stand-out political issue at the beginning of the 1970s. Scientific meetings were extremely conservative in their claims and even more conservative in their recommendations, not advocating anything more than further research (National Research Council 1973; Pecan & Woodwell 1973; SMIC 1971). This was reflected by the attitude shown by National Oceanic and Atmospheric Administration officials during oversight hearings in November 1972, where the occasional mention of ‘inadvertent weather modification’ failed to garner any attention during questions from members of congress (U.S. Congress 1973a). The climate anomalies did not emerge onto a political scene which was pre-equipped with a significant history of climate discussion. Instead, as I will argue, the politico-economic context of the climate anomalies played an important role in increasing the receptibility and prominence of climate-based narratives.

Firstly, this paper will outline the climate anomalies, paying special attention to how these events were lent prominence in the minds of the public and politicians, arguing that none of these events initially became prominent due to climatic change concerns. I will next examine the politico-economic environment surrounding the climate anomalies, including the Nixon administration’s response to the strained Bretton Woods economic system and the rises in food price which hallmarked the so-called ‘World Food Crisis’ (Gerlach 2005). This paper will then explore how Bryson linked these climate anomalies to climatic change and world food supply during the autumn of 1973, and how this resonated with pessimistic discourse surrounding the World Food Crisis. Reid Bryson’s testimony to a US Senate subcommittee in October 1973 provides a uniquely well recorded snapshot of this amorphous discussion, where Bryson synthesised these climate anomalies, which had been previously been given prominence for different reasons and in different institutional areas, and presented them as an argument which suited his personal, academic and institutional interests. Importantly, the testimony also provides the viewpoint of former Vice-President Hubert Humphrey upon hearing these climatic change arguments for the first time, suggesting in what way climatic change arguments were attractive to senior politicians. Finally, this paper will explore the reactions to Bryson’s narrative. Despite condemnation of Bryson’s ideas and methods by the meteorological community, his rhetoric linking climatic change and food supply was embraced by agents of securitisation, including in a publicly released CIA report which references Bryson explicitly. This linkage was also tentatively taken up by the meteorological community in requests for public funds,

as well as the administration as a convenient framing which de-emphasised its own role in exacerbating the World Food Crisis. In addition, Bryson decisively broke a taboo within the meteorological community against engagement with policy issues in the public sphere, helping to precipitate unprecedented (albeit still not headline-dominating) public climate discussion in the US during the 1970s.

## 2. OVERVIEW OF KEY CLIMATE ANOMALIES

Of the climate anomalies, Bryson most strongly associated the Sahel Drought of 1968–73 with climatic change in the public domain. There are still no reliable statistics regarding the magnitude of the tragedy surrounding the drought (Garcia 1981, 101–110). Reasonable human death toll estimates vary from 18,000 to 500,000. The most sensational then-contemporary newspaper headlines put the number of people who died at 1,000,000 (Schusky et al. 1986, 159). This ambiguity has had a knock-on effect on academic discussion about the crisis. Writing in 1977, Jonathan Derrick, a scholar of African Studies at London's School of Oriental and African Sciences, chose to forego specific numerical estimates altogether, using phraseology such as 'Livestock deaths in Nigeria probably ran into hundreds of thousands' (Derrick 1977). The data was indeed poor – academic conferences and legislative hearings often relied on the reports of newspaper journalists for the latest information (Morley 1973; U.S. Congress 1973c). What is certain, however, is that failing rains caused a mass displacement of people as desperate nomads and their remaining livestock crowded onto irrigated farms and into towns and cities. In March 1973, six Sahelian governments declared a regional disaster, which in turn licenced a substantial aid response led by the UN's Food and Agriculture Organisation (FAO) and the United States Agency for International Development (USAID) (Sheets & Morris 1974). Evocative photographs of the disaster became some of the most tragically iconic images of the decade and provided a strong motivator for aid giving throughout the world (Rogers and Sood 1980; Walker 1973). The quotes emerging from UN officials were chilling. In June, Newsweek quoted a regional director of the Economic Commission for Africa as saying 'if the problem is not solved in two months, nearly six million people may die' (Newsweek 1973, 44). The Sahel drought was big news.

Early responders to the Sahel crisis did not have long-term shifts in climate at the forefront of their minds. According to interviews conducted with USAID officials in 1974, the organisation struggled to respond to the crisis in the period 1968–73 partially because of a prevailing belief that the drought was a 'temporary climatic aberration', and that 'each year would be the last' (Sheets & Morris 1974, 29). The language used in FAO yearly state of agriculture reports was that the Sahel region suffered from 'bad weather' in 1968 from which it then made a 'satisfactory recovery' in 1969. A reduction in groundnut production in the region in 1971 was indeed attributed to drought, but was also attributed to lower producer prices due to the loss of preferential access to French markets (FAO 1969, 78; FAO 1970, 117; FAO 1971, 109). In the first academic reports regarding the crisis, climate was a nebulous and debated factor discussed alongside a plethora of sociological causes to the crisis, including overpopulation, overgrazing, and overexploitation of underground water supplies. These sociological causes were partially attributed to aid organisations drilling wells and improving health outcomes for both people and livestock. In addition, the climate change mechanisms proposed were cyclical in character or localised – hardly the basis of global climate disaster narratives (Dalby & Church 1973; USAID Office of Science and Technology 1972). More explicitly, an early report in the

*Washington Post* concerning the Sahel Drought and other disasters contained soothing advice from 'weather experts' in the US Department of Agriculture (USDA) that 'despite appearances there is no worldwide drought' (Ottaway 1973). Due to the lack of predisposition within government and academia towards the association of climatic change with the Sahel crisis, it is clear that a specific mechanism was responsible for forging this association.

Another climate event that Bryson associated with long-term climatic change was the 1971–72 agricultural season in the Soviet Union. In the Ukrainian SSR, a lack of winter snow cover adversely affected crops. This was followed by a period of hot and dry summer weather that mostly affected the region around Moscow (Roberts & Lansford 1979, 12). However, these events were partially offset by a good crop in the east of the country in Siberia, Kazakhstan, and the Urals. This resulted in a harvest of 168 million tonnes, compared to 181 million tonnes the year before (FAO 1973, 66–67). What made this drought unusual, and most notable in the eyes of the American press, was the perceived policy response of the Brezhnev regime, which decided to expand its wheat purchase on the international markets, following a pattern of increasing imports which in fact began during a record high Soviet harvest in 1970 (FAO 1973, 69). In July and August 1972, the US sold 440 million bushels of wheat to the Soviet Union on US credit, which was the equivalent of 30% of average US annual production the few years previously (Luttrell 1973, 1).

This sale, which reached deep into US government-held grain reserves and was considered part of US national economic strategy by those who organised it at the USDA, became a national scandal with many aspects. One aspect, explored in legislative hearings, was that the grain deals were negotiated in utmost secrecy, meaning that many US farmers, whose contracts were based on the price of wheat prior to the announcement of the sale, failed to capitalise on the rise in wheat price that was attributed to the purchase. In addition, domestic grain purchasers such as bakers were prevented from planning for the price increase (Kenworthy 1972; U.S. Congress 1972). Another aspect was the perceived intimate relationship between grain-exporting companies and employees of the USDA, with some former employees of the latter being hired by the former to negotiate the sale (Kotz 1972). Finally, the subsidies placed on the purchase by the US government were seen as inappropriate in the context of the world food crisis, with observers drawing a causal link between domestic food prices and the Soviet purchases (Luttrell 1973). The vividness of the 'Great Grain Robbery' went well beyond economic implications. Newspaper reports of alleged collusion between the USDA and grain-exporting companies had a glamorous appeal, reporting on Democratic allegations of a 'cozy clubby atmosphere' and accusations made by an American Bakers Association representative of a 'vest-pocket operation'. The story made the front page of the *Washington Post*, with an article that portrayed photographs of former USDA employees alongside their protestations of innocence (Kotz 1972). For reasons largely independent of scientific explanations, the Great Grain Robbery became a sensational event.

The climate anomalies that Bryson associated with the food crisis and climatic change did not only occur in countries far from US shores. In January 1973, National Oceanic and Atmospheric Administration (NOAA) meteorologists reported that precipitation for October 1972 was up to eight times the normal in the Southwest and more than twice the normal in portions of the Southern Plains and the lower Mississippi Valley (Taubensee 1973). It took until November for the *Washington Post* and *New York Times* to stop reporting on a 'bumper crop' (King 1972) and start reporting on a

quagmire that resisted the heavy machinery required for planting and harvest (Associated Press 1972). Further reporting for the next few months focused on the spectre of food inflation, as crops (primarily soybean and corn) were left to rot in their fields (J. Egan 1973a, 1973b). Supposedly in response, the USDA relaxed restrictions on wheat acreage in January 1973, although this came too late to increase the planting of winter wheat, which traditionally accounted for three quarters of US production. The net result was that the grain harvest in the US reduced by approximately 4% (FAO 1973, 73). These three climate anomalies became prominent in the US for different reasons. The Sahel drought became prominent because of the sheer scale of human suffering, the poor Soviet harvest became prominent largely because of political intrigue, and the wet fall became prominent because of the proximity of the event and the link drawn with rising prices of food. None of these events were initially made prominent because of the implications regarding climatic change. Drawing this link required the economic context of 1973, and the intervention of Reid Bryson.

### **3. THE NIXON ADMINISTRATION AND THE WORLD FOOD CRISIS**

When Nixon came into office in January 1969, he inherited decades-old economic problems that were being compounded by current events. His response would ensure that the climate events of 1972–73 happened in unprecedented economic circumstances. Through a series of post-war agreements, the US dollar had been pegged to the price of gold and was used as the worldwide reserve currency, with other major currencies being pegged to the US dollar in turn through the Bretton Woods System. Another aspect of this system was that the US would freely convert foreign US dollars into gold. Under Bretton Woods, the world experienced a period of economic stability and growth unprecedented in the preceding century. However, with inflationary policies being pursued by the US government in the 1960s threatening a run on the dollar, Nixon apparently attempted to protect the currency by removing the convertibility between dollars and gold. Simultaneously, he imposed emergency price controls and import surcharges over the US economy to offset the expected fluctuations in exchange rate (Bordo 2017). These actions were designed to induce a de-facto devaluation of the US dollar, which would assist US exporters but would also make imports more expensive. These measures were popular with the US public, contributing to Nixon's 1972 electoral success (Yergin and Stanislaw 1998, 63). The economic consequences are still debated. On the one hand, Nixon eliminated a major threat to the value of the US dollar by stopping free convertibility. On the other hand, devaluation of a currency traditionally contributes to inflationary pressures. The remaining part of the system, the pegging of currencies to the US dollar, was watered down in December 1971 before being disbanded completely in March 1973. The dollar devalued substantially, dropping by 26% against the Japanese yen by October 1973 (U.S. Congress 1974, 39). The Nixon administration's apparent attempts to control inflation, arguably rushed through to support Nixon's re-election bid in 1972, may have contributed to an eventual inflation crisis (Yergin and Stanislaw 1998, 60–64; Zoeller and Bandelj 2019). There is some evidence that Nixon was aware of this, telling one of his advisors in July 1971 'I've never seen anybody beaten [in elections] on inflation in the United States. I've seen many people beaten on unemployment' (Zoeller and Bandelj 2019, 6).

Whatever the causes, in March 1973 the rising cost of living attracted attention from the Subcommittee of Consumer Economics in the US Senate, chaired by former Vice President and 1972 Democratic presidential candidate Hubert Humphrey. In introductory remarks, Humphrey declared

that the greatest concern of American consumers was the high prices they were paying for ‘food, fuel, gasoline, medical services, household services, rent, consumer credit, and many other items’, and that the hearing was the start of a long-term investigation into the nature and causes of the commodity boom as well as the administration’s policy response. The prominence of the chairman, as well as polling cited in the opening statement, indicate the level of public concern and political capital attached to the issue (U.S. Congress 1973b, 1–3). The first day of the hearing received testimony from two members of the president’s economic inner circle who provide a representation of the administration’s public response to the crisis. These White House officials were Herbert Stein, chairman of the Council of Economic Advisers, and John Dunlop, director of the Cost of Living Council. Both men separated out food inflation, which Humphrey had explicitly referenced as the cause of most concern, from the other commodities when offering explanation of price rises. Stein claimed that food prices had followed a course ‘independent of’ the prices of other commodities and that this had ‘significantly influenced’ the total price indexes (U.S. Congress 1973b, 4). Furthermore, he claimed that food prices were being driven by a combination of rising incomes and poor weather,<sup>1</sup> and that they would soon stabilise as supply naturally increased to satisfy demand. Stein emphasised the government had been tackling the problem through ‘a number of strong moves designed to increase food supply’. These included relaxing restrictions on land production, selling reserves, and increasing imports (U.S. Congress 1973b, 3–6). It should be pointed out that these measures were already in place as part of Nixon’s economic strategy to re-orientate the US economy towards exports and that selling reserves eliminated an important price regulation tool (Garcia 1981, 28–29, 62–69). These hearings provide a snapshot of Nixon administration officials shifting the language from a crisis concerning the general cost of living towards a crisis more focused around food specifically, which, as pointed out in the hearings, is a sector which is more prone to temporary fluctuations outside of the administration’s control such those induced by weather. However, climatic change, as opposed to weather, was not mentioned in the March hearings. The World Food Crisis was caused by a combination of factors both exogenous and endogenous to the administration (Gerlach 2005; Schnittker 1973). However, administration officials emphasised exogenous factors, including the effects of weather. Both the nature of the crisis and the political framing used by the administration provided fertile ground for climate-based narratives to thrive.

#### **4. THE DEVELOPMENT OF REID BRYSON’S CLIMATIC CHANGE NARRATIVE**

After the March 1973 hearings the price of food continued to rise exponentially, intensifying the World Food Crisis. In August, another actor emerged in the shape of Reid Bryson whose intervention might be seen as intensifying Stein’s emphasis on exogenous factors. Bryson served as a forecaster in the US Air Force during the Second World War, before becoming the founder of the University of Wisconsin’s meteorology department and Center for Climatic Research, advocating and practicing a highly interdisciplinary method of study which sometimes drew conflict with colleagues at Wisconsin. He was known by colleagues to focus on new ideas rather than detail, looking for completely new mechanisms and theories for phenomena rather than advancing data collection methods (Broad 1989; Devitt 2008). By the early 1970s, Bryson had been promoting the idea of human-induced local climatic change for years, identifying what he saw as a positive feedback loop

---

<sup>1</sup> It is important to note that ‘weather’ (i.e. short-term fluctuations in the atmosphere) does not come under this paper’s definition of climatic change stated in the opening sentence

between dust release and desert expansion in the Thar desert of Northwest India (evidenced partially by archaeological sources), and using this mechanism to advocate soil surface stabilisation as a way to alter the regional climate. His interdisciplinary nature is reflected by the fact that, unlike most of his atmospheric science contemporaries, his papers often ended by exploring social consequences and making de-facto policy recommendations, for example by explicitly recommending a desert reclamation project in the case of the Thar (Bryson & Baerreis 1967).

However, Bryson's ideas sometimes struggled to gain traction amongst his colleagues. This can be seen directly in a 1972 report concerning the Sahel zone written by USAID officials with a panel of academic advisors of which Bryson was a member, where 'several reviewers noted that this [dust–desert] relationship has not yet been satisfactorily proved', this being the only such footnote in the chapter (USAID Office of Science and Technology 1972, 5). In August 1973, Bryson published a report, hereafter known as *The Sahelian Effect*, which intimately linked the Sahel drought with a new climatic change mechanism, now relating to the general circulation of the atmosphere (Bryson 1973). The report is written in an idiosyncratic manner, beginning with a series of quotes and facts to emphasise the seriousness and the magnitude of the ongoing catastrophe in the Sahel, not all of which are referenced. Bryson does not write like a traditional physical scientist, but for effect, reflecting the literary prize he would jointly win five years later for *Climates of Hunger* (Bryson and Murray 1977; *Wisconsin Library Bulletin* 1979, 7).

Bryson's hypothesis in *The Sahelian Effect* relied upon the laboratory experiments of David Fultz, where a pan of water with induced temperature gradients was used to simulate the atmospheric circulation of one of the Earth's hemispheres, distinguishing between the circumpolar Rossby regime and the equatorial Hadley regime (Fultz 1961). In summary, Bryson claimed that when the equator–pole and altitudinal temperature gradients were greater by a tiny increment, the monsoon rains in the Sahel region would be substantially displaced south, causing the observed drought. He identified two influencing factors on these temperature gradients – atmospheric carbon dioxide, referencing the now famous calculations by Syukuro Manabe and Richard Wetherald, (Manabe & Wetherald 1967) and turbidity (suspended particulate matter that blocks sunlight), claiming that both factors may act in tandem to push the Sahel monsoon south. Strikingly, he claimed that this cut through arguments about whether the greenhouse effect or turbidity would win out in determining world temperature. Through this claim, Bryson 'resolved' a complex scientific debate and utilised both sides as reinforcement for his argument. As will be seen, this was a common rhetorical feature of Bryson, synthesising seemingly discordant discourses into a revelation that allows the uninitiated reader or listener to pierce through a fog of technical complication. When it comes to attributing blame for increases in carbon dioxide and turbidity, Bryson attributed a large portion of the blame to human activity, although he claimed, citing a previous study of his, that most of the increase in turbidity originated from resurgent volcanism (Bryson 1972). He then reeled off some staccato single-sentences paragraphs of abject pessimism:

Will mankind give up burning fossil fuels to aid the people of the monsoon lands? No way!

Will the volcanoes please settle down? Probably not, since they were unusually quiet from 1922–1955.

Will mankind go easy on particulate air pollution by careful pollution controls on factories, slow careful construction, dust-free agriculture (including no slash-and-burn)? Even the monsoon nations resist this strongly.

Will the monsoons return? Probably not regularly this century. (Bryson 1973a, 9–11)

In the closing passages of *the Sahelian Effect*, Bryson examined a graph of Icelandic temperature since the year 950 (Fig. 2), reconstructed by Páll Bergþórsson through historical documents (Bergþórsson 1969). Independent of carbon dioxide and turbidity, Bryson drew attention to the idea that what was then defined as ‘normal climate’ between the years 1930–60 was in fact exceptional on the scale of the millennium, and that dramatic changes should be expected. He drew his arguments to a close by referring to the last major change in world climate as the world entered the Little Ice Age: ‘the Mali Empire collapsed and the magnificent Indian city at Fatehpur Sikri was abandoned as its water supply failed. Do such events lie ahead?’ (Bryson 1973a, 11).

## 5. U.S. AND WORLD FOOD SITUATION HEARINGS

Bryson became much more active in the political arena when, on October 18, 1973, he provided testimony before the US Senate’s Subcommittee on Agricultural Production, Marketing, and Stabilization of Prices and Subcommittee on Foreign Agricultural Policy of the Committee on Agriculture and Forestry (U.S. Congress 1974). The session was again chaired by Hubert Humphrey and the hearings were largely a continuation of those concerning consumer price rises in March. However, since the session in March, domestic food inflation had increased from 9.1% to 17.2% (U.S. Bureau of Labor Statistics 2019), and this was reflected by a much more pessimistic tone taken by Humphrey in his introduction on October 17: ‘We just never dreamed, for a moment, that our food surpluses would become shortages. Well, all of that, as we know, has changed and things will never be the same’ (U.S. Congress 1974, 3).<sup>2</sup> The language had changed from concern to abject pessimism, although it should be noted that the introduction made no reference to climatic change. The objective of the hearings was similar to those held earlier in the year, aiming to identify the causes of US and worldwide agriculture being ‘out of kilter’ and attempting to predict where the crisis was likely to lead over the coming months (ibid, 5). To this aim, the subcommittee members invited agricultural experts, including representatives of the USDA, as well as Reid Bryson. Bryson was unlikely to have been invited without consideration of *The Sahelian Effect*, which had received moderate attention in *The New York Times* and had been republished in the October edition of the environmentalist magazine *The Ecologist* (*New York Times* 1973; Bryson 1973b). In addition, the fact that *The Sahelian Effect* was funded under the Research Applied to National Needs Program meant it would have more direct access to policy circles (National Academy of Engineering 1973, 14).<sup>3</sup> The aforementioned USAID report to which Bryson was a contributor was also inserted into the congressional record in July, meaning Bryson’s name was not a newcomer to the congressional scene (U.S. Congress 1973c, 159–220).

On October 17 the hearings were dominated by agricultural experts that appeared to confuse and frustrate Humphrey in equal measure. Most experts advocated a less pessimistic view than Humphrey, leading Humphrey to interrogate them to extract worst case scenarios (U.S. Congress

---

<sup>2</sup> For context, the average inflation rate for the years 1950–70 was 2.4% (U.S. Bureau of Labor Statistics 2019)

<sup>3</sup> RANN was explicitly interdisciplinary, resonating well with Bryson’s style of research.

1974, 8–61). Humphrey’s only relief came from the testimony of Lester Brown, who offered a stark and simple neo-Malthusian perspective that coincided much better with Humphrey’s introduction (ibid, 61–105). On October 18 Bryson’s testimony was preceded by that of Gale Johnson, professor of economics at the University of Chicago. Humphrey was on somewhat uncertain ground with much of the testimony, regularly requesting repetitions or clarifications (ibid, 105–112). Johnson claimed that the events of 1973, including the Soviet purchases, an international economic boom, and poor harvests, were a ‘once in a hundred year flood’, and that policymakers may be reluctant to mitigate against such circumstances for the future. Humphrey’s co-chair, Senator Walter Huddleston, expressed concern over the effects of such a system in the event of overproduction. In reply, Johnson used the term ‘cycle of good weather’. This intrigued Huddleston, who enquired as to whether one could identify the cycles over long periods of time to prepare for such situations, to which Johnson replied that he did not know, although he believed teams were working on it (ibid, 112). This short exchange is interesting in demonstrating the level of climate knowledge in the room. In closing, Humphrey began a cynical interrogation of Johnson. Upon learning that Johnson believed the tight supply situation would ease quickly over the next one or two years, Humphrey explicitly asked what Johnson thought about the neo-Malthusianism perspectives put forward the day before, picking at Johnson’s rather positive replies (ibid, 117). Overall, Johnson’s analysis of the situation was that the exceptional nature of food prices in 1973 was largely dictated by economic, rather than geophysical, factors. Throughout the hearing, Humphrey had been presented with a picture that did not resonate with his pessimistic outlook and was difficult to decipher. With the statement of Bryson, Humphrey received a simpler narrative that resonated much better with his outlook.

In introducing Bryson, Humphrey reveals a little about his current mindset with regard to climate. He tells of how he occasionally had ‘been bringing up the whole subject of meteorology and the relationship of weather patterns, cyclical patterns, and all of it is just one man’s interest without scientific information. Now maybe we are going to get some real information.’ The explicit mention of ‘cyclical’ patterns demonstrates that it is unlikely that Humphrey had read *The Sahelian Effect* in advance. The testimony began with Bryson relaying the ‘impressive list’ of climatic events, including the three discussed earlier. Bryson was in the unfortunate position of having to contradict the testimony of the speaker before him. He tackled the problem directly and forcefully, specifically referencing Johnson and ridiculing his ‘once in a hundred years’ comment, saying ‘Well, last spring we had two 100-year floods in the same month in St. Louis, and this September we had two 100-year floods in the same week in Kansas. So the question that really need to be addressed is “Is this really just a bad year or is this really the shape of the future?”’. Clearly this resonates with Humphrey’s ‘things will never be the same’ introduction, and Humphrey responded by fretting about whether the press table had copies of a written statement that Bryson began referencing (ibid, 119). Immediately striking is the fact that Bryson was dynamic and responsive in his use of language, subtly incorporating quotes from Humphrey and Johnson; he was charismatic and in-tune with Humphrey.

Bryson presented the same arguments as made in *The Sahelian Effect*. However, he turned the order of his argument around, beginning with the closing passage of *The Sahelian Effect*: the Icelandic temperature graph indicating the warmth of 1930–60 (ibid, 119–120). Instead of having to explain a

complex physical theory first, Bryson was able to make an immediate, comprehensible, and visual impact on his non-specialist audience (Fig. 1).<sup>4</sup>

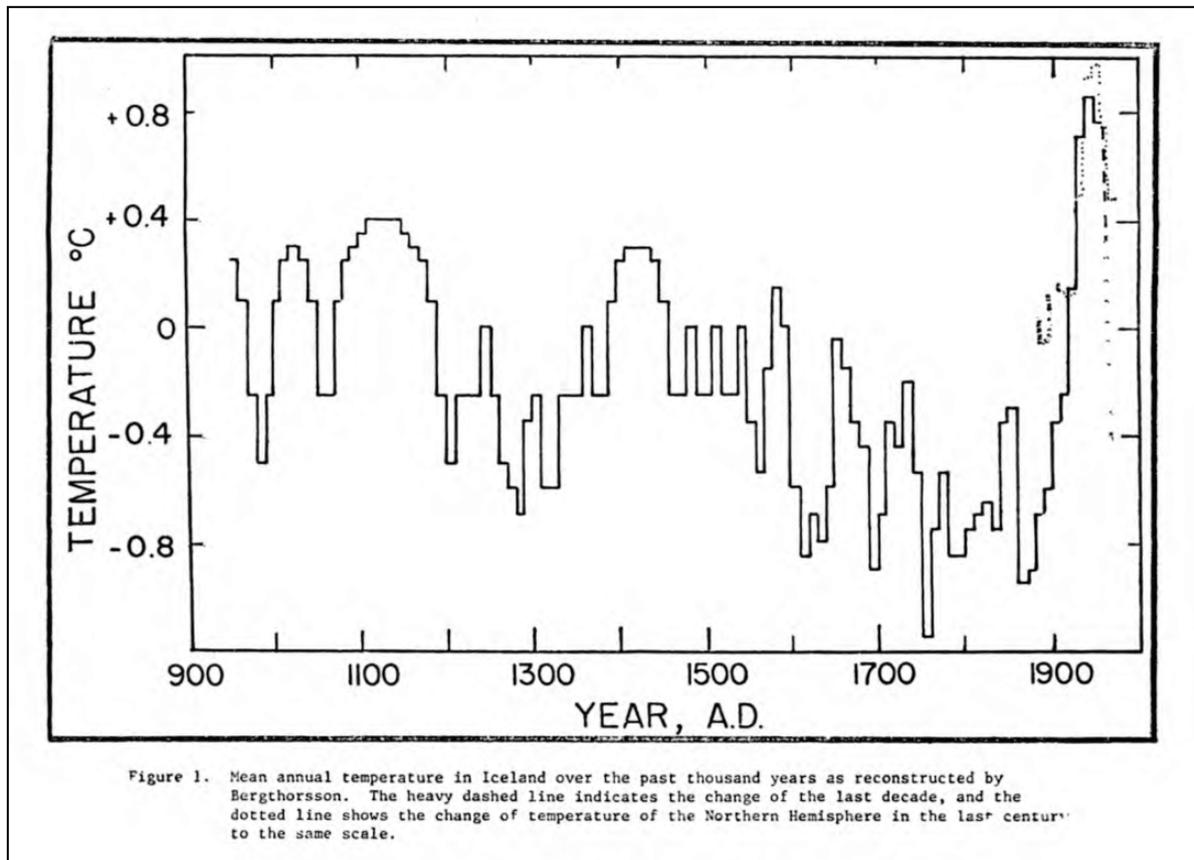


Figure 1. Graph of Icelandic temperature measurements presented by Reid Bryson to the US Senate in October 1973 (U.S. Congress 1974, 134)

Very early in his testimony, Bryson was already implying climatological predictions, claiming that temperature had started to go down in the Northern Hemisphere in 1940 and was likely, via historical precedent, to continue going down for at least four decades. Bryson then gently began to build up the complexity, bringing in the quasi-dynamical pollution-driven arguments made in *The Sahelian Effect* (ibid, 120). Bryson made the transition between the graph and the Sahelian effect theory appear seamless and mutually reinforcing. However, it was contradictory for Bryson to claim to know where climate was going due to historical precedent, and then to propose a mechanism that was partially driven by unprecedented levels of pollution. This self-contradiction was overlooked by Humphrey.

Continuing to draw from *The Sahelian Effect*, Bryson then supposedly resolved the conflict between those advocating global cooling and warming, saying that the debate ‘misses the main point’. He brought Humphrey into the discussion, saying ‘Being from an agricultural state and remembering, I am sure, the 1930’s, I am sure you appreciate as well as anybody that what counts is where the rains

<sup>4</sup> The ability to visualise climate change forms an important part of modern climate change literature (Ungar 2000; Mahony and Hulme 2012). Bryson’s testimony shows us the power of visualisation was utilised very early on in climatic change discourse.

fall, the pattern.’ Bryson then outlined the Sahelian effect, saying that the last time the monsoons shifted around the year 1490 the Mali empire collapsed due to, as his ‘historian friends’ informed him, the region becoming a desert. He then disregarded the economics of world food trade as a primary concern, diminishing the importance of almost every other testimony, saying ‘the problem is not that it [failing rains] will impact our food trade particularly, because they [Sahelians] cannot afford to buy our grain, but the political instability that is likely to result from such a calamitous series of drought in that region [of the Sahel] will impact the United States.’ (ibid, 120–121). This emphasis on political instability as opposed to price stabilisation pushes the narrative towards securitisation by portraying climatic change as an existential threat not only to the Sahelian region, but the United States itself.

Having established his climatic change narrative of the crisis, Bryson emphasised vulnerability by bewailing the loss of world food reserves, saying that the world retained less than one month’s rate of consumption, which is when Humphrey interrupted: ‘You know, that statement has got to be driven home to people in high positions of leadership and responsibility.’ (ibid, 121). Bryson underlined the impact of climatic changes on developing nations by emphasising that mechanised pumps were reducing the water table, utilising a sociological argument that could have been used against his climate attribution thesis. He parried the suggestions, made by Huddleston and Humphrey, of weather modification and water desalination as possible solutions. To this, the transcript records Humphrey laughing, saying ‘Have you any good news?’ (ibid, 124).

Humphrey then explained why he was so appreciative of Bryson’s testimony: ‘I really looked forward to your testimony today because almost by intuition and scattered reading, and listening to a number of people in scattered parts of the country, what you are saying to us today, in a very learned manner, is what I have sensed from the kind of tidbits of information you get in this kind of hurley-burley life as generalists in the Congress of the United States...’ In reply, Bryson leapfrogged Humphrey’s pessimism: ‘...I keep smiling to keep from crying because literally, it is that kind of situation, as I see it.’ (ibid, 124). From the start of the testimony, Humphrey had wanted to believe Bryson’s argument due to his intuition that the real situation was far worse than the economists such as Johnson suspected. Humphrey’s comment also shows the sense in which the pessimism of Humphrey and Bryson were reflected by the country at large. American pessimism and declinism were on the rise during the 1970s, reflected by the loss of utopian visions and the perception that the US was falling behind emerging economies such as Japan (Bailey 1988; Rosecrance 1976). Historian Michael Egan writes that the 1970s ‘mark a decade in which imminent - immanent - catastrophe lurked behind shock and crisis. Optimism was replaced with pessimism; progress with decline.’ (M. Egan 2017, 26).

Clearly confident of a downbeat answer, Humphrey asked Bryson whether his views were reflected by the wider academic community (U.S. Congress 1974, 125). This presented another problem to Bryson, whose ideas were indeed often controversial both within the meteorological and wider academic community (Anderson 1974; Dickinson & Bryson 1974; Roberts & Lansford 1979, 130; Schneider & Mesirov 1976, 139–141). He decided to circumvent the question altogether, making another reference to Johnson: ‘There was a comment made earlier by Dr. Johnson that I must disagree with when he says there are substantial groups working on this question of whether the weather is cyclical and whether there might be a period of unusually good crop weather, and so on.

There are not substantial groups in this country working on it.' He then went on to claim that there were at most only three small groups working on the problem of 'how climate will change and how that will impact on world agriculture', one being started by a couple of people at the National Center for Atmospheric Research (NCAR), one possibly existing in NOAA, and finally his group at Wisconsin of 15 individuals. Of course, this did not answer Humphrey's question, but Humphrey nevertheless replied with 'Are you funded in any way by governmental research funds?'. What followed ends with Humphrey guaranteeing to 'look into' Bryson's funding troubles (U.S. Congress, 1974, 125). Bryson did not outright lie – he hedged by naming groups working on climate *and* agriculture within the United States. However, he gave the impression that he almost had a monopoly on meteorological discourse with regard to the crises, which was blatantly false.

Three days later, *The Washington Post* reported that Humphrey was 'visibly stirred' at the hearing by Bryson's arguments (The Washington Post 1973). It is clear that the complex situation in 1973 gave Bryson a raised platform from which he could air his views with receptive senior members of Congress, and that he made full use of the opportunity to legitimise himself, his institution and his ideas. This testimony provides a snapshot of climate discussion at a nascent, protean stage, where advocates were able to use rising domestic food prices to push a new agenda. A discussion held between Bryson and fellow atmospheric scientist and friend Stephen Schneider, reported by both men in separate publications, suggests that Bryson's rationale in promoting highly uncertain climatological forecasts was deeply intertwined with his wartime experience. He describes in detail a situation where an Admiral of the US Pacific Fleet ignored his forecast of Typhoon Cobra, leading to the loss of 790 lives (Bryson 2000). The early advocacy of climatic change is complex on the scale of global economics and national institutions, but is also complex on the individual level. Bryson believed in his ideas, and also truly believed that he was saving lives by promoting his views with all his considerable rhetorical might against what he saw as an inherently sceptical establishment.

## 6. REACTIONS TO BRYSON'S NARRATIVE

Bryson caused controversy amongst his colleagues in academia. The consensus amongst leading atmospheric scientists at the time was that climate was a hugely complicated system which was not yet understood well enough to forecast in the long term, and this largely remained the case throughout the decade (Anderson 1974; Garcia 1981, 241–296). By promoting uncertain climatological forecasts, Bryson was advocating a new status for climatic change research as a 'crisis discipline', which are characterised by acting before knowing all the facts (M. Egan 2017).<sup>5</sup> This push did not go down well in the wider meteorological community. It seems that some of the most personal attacks were not written down. Stephen Schneider describes how Bryson received abuse: '...to listen to some of the vicious remarks about Bryson's *motives* made by some members of the discipline makes me wonder just who in the profession is being most unethical' (Schneider & Mesriow 1976, 139–141). In addition, the climatic change narrative caused frustration amongst some social scientists responding to the Sahel crisis, who claimed that the social sciences had largely been relegated to investigating the reactions to the crisis rather than root causes, which had been,

---

<sup>5</sup> In addition, Egan's crisis disciplines are reactionary, mission-orientated and adisciplinary – all features of Bryson's climatic change research.

as said by political scientist Michael Lofchie, ‘left almost entirely to climatologists, physical geographers, water experts, and agronomists’ (Lofchie 1975, 551; Glantz 1977; Schusky et al. 1986).



Figure 2. Image on the front page of Rockefeller Foundation publication *RF Illustrated* from August 1974 (Rockefeller Foundation 1974)

However, Walter Orr Roberts, the founder of NCAR, pointed out that although many atmospheric scientists thought that Bryson’s climate theories were conjecture, ‘some of them also feel that Bryson has done society a useful service by making the public aware that such a climatic development is at least in the realms of possibility’ (Roberts & Lansford 1979, 106–107). Interestingly, Roberts put climate strongly on the agenda during a conference of the Aspen Institute for Humanistic Studies in August 1973 – the month that *The Sahelian Effect* was released. He was also instrumental in ensuring that climate was inserted onto the research agenda of the Rockefeller Foundation (Hare 1981, 374). Indeed, Bryson himself played an important role at a 1974 meeting of the Rockefeller Foundation where, in contrast to scientific meetings pre-crisis, attendees made the explicit policy recommendation of ‘food reservoirs’ (Fig. 2). It seems that some atmospheric scientists, although they disagreed vehemently with Bryson’s ideas and methods, began to recognise the power of relating climate to food supply. For example, there were several mentions of food supply in a proposal for a Global Atmospheric Research Programme (GARP) extension in 1975 (United States Committee for the Global Atmospheric Research Program 1975). The world food crisis led to a change of culture within parts of the meteorological community, breaking a long-held taboo against climatologists actively and publicly engaging with issues within the political sphere. Bryson spearheaded this charge; as said by Spencer Weart ‘Scarcely any popular article on climate in the 1970s lacked a Bryson quote or at least a mention of his ideas’ (Weart 2020, 18). This discussion culminated in several high-impact popular books written by climatologist-journalist teams outlining

various climatic change prognoses, including the prominent *Climates of Hunger* co-authored by Bryson himself (Bryson and Murray 1977; Schneider and Mesirov 1976; Roberts and Lansford 1979).

Discourse in the 1970s reverberated with claims of imminent societal and ecological collapse, and Lester Brown was considered one of the foremost figures in promoting various disaster narratives (Holden 1974). The day before Bryson gave testimony to Humphrey, Brown gave his own testimony to the same committee in which he relayed a rather traditional neo-Malthusianism analysis of the world situation with no mention of climatic change (U.S. Congress 1974, 61–105). However, Brown soon after began to publicly embrace, promote, and embellish the climate disaster narrative, using much of the same language as Bryson. For example, Brown also enjoyed dismissing the debate between those who advocated global warming and cooling as irrelevant (Brown & Eckholm 1974; Brown 1975, 1977). In addition, Bryson was extensively referenced in an August 1974 report written by the CIA, which assessed climatic change to present a serious security threat to the United States (United States Central Intelligence Agency Office of Research and Development 1974). Bryson's narrative was received negatively amongst many atmospheric scientists, but it was received positively and utilised amongst some influential neo-Malthusians and practitioners of securitisation. This complicates a hypothesis put forward in climate securitisation literature that posits that the securitisation narrative shifted from discussions surrounding nuclear weapons towards the climate change debate as the Cold War thawed in the 1990s, almost as if securitisation was a conserved quantity (Diez et al. 2016, 39–40; Buzan et al. 1998, 75–76).

There is some evidence of an increase in interest amongst US agencies regarding climate issues coinciding with the publicization of Bryson's narrative in the fall of 1973, although it is important to note that any causality in the relationship is impossible to substantiate without further research. Before the time in question, there is little evidence to suggest that the climate question was a priority for any government department. International projects such as GARP, although they incorporated a climatological component, were mostly focused on improving short-term weather forecasts (Weart 2008, 207). On 19 September 1973, a joint academic-NOAA group met at the Environmental Data Service headquarters in Washington to discuss the problems of drought in the US, leading to a report that emphasised climatic change as a potential threat to food supply (McQuigg et al. 1973, 1). For the administration, climate provided another arrow in the quiver, along with neo-Malthusianism, for placing the blame for the world food crisis on factors other than US policy. This was evident at the first World Food Conference of April 1974, where Kissinger had to balance the commercial interests of American agricultural exports against demands to increase food aid (Gerlach 2015; Kissinger 1974, 580–581). Climate research was also used by the administration in an attempt to assuage Sahelian governments, some of which were pressing for a more active American intervention in the crisis (U.S. Department of State 1974). A tacit acknowledgement of Bryson's perspective is shown by the fact that he was invited to informal discussions with administration policymakers and agency officials on matters pertaining to climate and food security in June 1974. However, Bryson was frustrated by the attitude shown by the USDA, the representatives of which used phrases like 'we have an agricultural policy – a policy of plenty' (Schneider & Mesirov 1976, 31–32; Roberts & Lansford 1979, 131–132). This attitude was taken due to the fact that agriculture formed an important part of Nixon's strategy to re-orientate the US economy towards exports (see section 3 of this paper), and since the end of the First World War the USDA's existence was dominated by the need to manage overproduction (Garcia 1981, 62–69;

Roberts & Lansford 1979, 109–144). There is no evidence that the Nixon administration or the USDA changed any economic policy in response to arguments regarding climate. In fact, the USDA played down the prospect of climatic change in public briefings in December 1974, just as they had in January 1973 as news of the Sahel drought broke (Ottaway 1973; US Department of Agriculture Economic Research Service 1974).

## Conclusion

This paper presents a picture of an unprecedented politico-economic situation in the fall of 1973 which made US policymakers particularly susceptible to climate-based narratives. This susceptibility can be split into three factors. Firstly, politicians outside of the administration were under pressure to provide explanations for an economic situation that they often could not understand, and climatic change provided a superficially convincing argument for the rising price of food. Secondly, the Nixon administration was able to use weather and climatic change as a convenient political framing to cover its own domestic and foreign policy failings, especially with regard to its handling of the World Food Crisis. Thirdly, an environment of pessimism, partially attributable to poor economic performance, made pessimistic disaster narratives more attractive to certain politicians, as exemplified by the response of Humphrey during testimonials in October 1973. The World Food Crisis represented a window of opportunity that Reid Bryson was able to exploit. In doing so, he controversially pushed the image of climatic change research as a crisis discipline.

In Bryson politicians were presented by a charismatic orator who zealously believed that he was saving lives by making his arguments as convincing as possible. In *The Sahelian Effect*, he did this by employing grandiose historical narratives about the falls of previous civilisations, exploiting the visual impact of his own version of the ‘hockey-stick’ graph, and liberally quoting newspapers to emphasise the human impact of the Sahel Drought. In testimony Bryson took his argument to a new level, pointedly rebutting almost every testimonial before his own, resonating his tone and language with those of Humphrey, and suggesting himself as representative of meteorological discourse. Most importantly, Bryson was able to synthesise disparate events, which had been made prominent for different reasons in different institutional areas, into a narrative that hijacked existing sources of concern. In response, Bryson was largely ostracised from the mainstream meteorological community. However, within a year his narrative linking climatic change with food and societal collapse was tentatively taken up within academic, political and media discourse (Shmeck 1974; Sullivan 1974). This was at the expense of competing narratives of societal causes of 1970s events, which are sometimes still dismissed out of hand (Nicholson 2018). In addition, Bryson decisively broke a taboo within the meteorological community against public engagement with issues of policy, helping instigate unprecedented public climate discussion during the 1970s.

The fall of 1973 represents an important elevation in the political status of climatic change. In March 1973 the rising cost of food was blamed on weather and trade unions by Nixon Officials, with no mention of climatic change. By the first World Food Conference in April 1974, US Secretary of State Henry Kissinger told the world that the possibility of worldwide climatic changes had ‘ominous’ implications for food and population policy (Kissinger 1974, 580–581). Barely an hour before Bryson’s speech in Congress, Senators Huddleston and Humphrey demonstrated that they knew very little about changes to the climate, which at most was an occasional interest. By the end of Bryson’s

testimony, the former US Vice-President was visibly moved, advocating increased public funds for an until-then minor area of research. Due at least partially to the World Food Crisis, climatic change gained a cognitive foothold in the fall of 1973 from which it could develop into one of the defining issues of our time.

## Acknowledgments

I would like to thank Vladimir Janković for his help in preparing this manuscript. I would also like to thank Catherine Whatley, David Schultz, Mickey Glantz, Eleanor Rose Shaw, and the two anonymous reviewers for their kind and helpful comments. Funded by an Economic and Social Research Council CASE fellowship partnered with the Royal Meteorological Society. NWSSDTP Grant Number ES/P000665/1.

## References

- Anderson, Alan. 1974. "Weather Forecast for the Future?" *Lakeland Ledger*, December 29, 1974, sec. Views.
- Associated Press. 1972. "Weeks of Rain, Snow Peril Midwest Crops." *The Washington Post*, November 25, 1972.
- Bailey, Joe. 1988. *Pessimism*. 1st ed. Abingdon-on-Thames: Routledge.
- Bergþórsson, Páll. 1969. "An Estimate of Drift Ice and Temperature in Iceland in 1000 Years." *Jokull* 19: 94–101.
- Bordo, Michael D. 2017. "The Operation and Demise of the Bretton Woods System; 1958 to 1971." Working Paper 23189. NBER Working Papers Series. Cambridge, MA: National Bureau of Economic Research.
- Bryson, Reid. 1972. "Climatic Modification by Air Pollution." In *The Environmental Future: Proceedings of the First International Conference on Environmental Future, Held in Finland from 27 June to 3 July 1971*, edited by Nicholas Polunin, 134–74. London: Palgrave Macmillan UK.
- . 1973a. "The Sahelian Effect." Institute for Environmental Studies Report 2. Climatic Modification by Air Pollution. Madison, Wis: Madison Institute for Environmental Studies, University of Wisconsin.
- . 1973b. "Drought in Sahelia: Who or What Is to Blame." *Ecologist*, October 1973.
- . 2000. "Typhoon Forecasting, 1944, or, The Making of a Cynic." *Bulletin of the American Meteorological Society* 81 (10): 2393–98.
- Bryson, Reid, and David Baerreis. 1967. "Possibilities of Major Climatic Modification and Their Implications: Northwest India, a Case for Study." *Bulletin of the American Meteorological Society* 48 (3): 136–142.
- Bryson, Reid, and Thomas Murray. 1977. *Climates of Hunger: Mankind and the World's Changing Weather*. Madison, Wis: Univ of Wisconsin Press.
- Buzan, Barry, Ole Waever, and Jaap de Wilde. 1998. *Security: A New Framework for Analysis*. 1st ed. Boulder, Colo: Lynne Rienner Publishers.
- Dalby, David, and Ronald James Harrison Church, eds. 1973. *Drought in Africa: Report of the 1973 Symposium*. 1st edition. London: University of London, School of Oriental and African Studies, Centre for African Studies.
- Derrick, Jonathan. 1977. "The Great West African Drought, 1972-1974." *African Affairs* 76 (305): 537–86.
- Dickinson, Oliver, and Reid Bryson. 1974. "Drought and the Decline of Mycenae: Some Comments." *Antiquity* 48 (191): 228–230.

- Diez, Thomas, Franziskus von Lucke, and Zehra Wellmann. 2016. *The Securitisation of Climate Change: Actors, Processes and Consequences*. Routledge.
- Edwards, Paul N. 2013. *A Vast Machine: Computer Models, Climate Data, and the Politics of Global Warming*. Cambridge, Massachusetts; London, England: MIT Press.
- Egan, Jack. 1973a. "Floods Dampen U.S. Hopes of Leveling Food Price Rise." *The Washington Post*, April 29, 1973.
- . 1973b. "'73 Projection of Food Prices Rises Sharply." *The Washington Post*, May 8, 1973.
- Egan, Michael. 2017. "Survival Science: Crisis Disciplines and the Shock of the Environment in the 1970s." *Centaurus* 59 (1–2): 26–39.
- FAO. 1969. "The State of Food and Agriculture 1969." Rome: FAO.
- . 1970. "The State of Food and Agriculture 1970." Rome: FAO.
- . 1971. "The State of Food and Agriculture 1971." Rome: FAO.
- . 1973. "The State of Food and Agriculture 1973." Rome: FAO.
- . 1974. "The State of Food and Agriculture 1974." Rome: FAO.
- Fultz, Dave. 1961. "Developments in Controlled Experiments on Larger Scale Geophysical Problems." *Advances in Geophysics* 7: 1.
- Garcia, Rolando V. 1981. *Nature Pleads Not Guilty: The 1972 Case History*. 1st ed. Oxford: Pergamon Press.
- Gerlach, Christian. 2005. "Die Welternährungskrise 1972-1975." *Geschichte Und Gesellschaft* 31 (4): 546–85.
- . 2015. "Famine Responses in the World Food Crisis 1972–5 and the World Food Conference of 1974." *European Review of History: Revue Européenne d'histoire* 22 (6): 929–39.
- Glantz, Michael. 1977. "The Value of a Long-Range Weather Forecast for the West African Sahel." *Bulletin of the American Meteorological Society* 58 (2): 150–58.
- Hare, Fredrick Kenneth. 1981. "Climate: The Neglected Factor?" *International Journal* 36 (2): 371–87.
- Hart, David M., and David G. Victor. 1993. "Scientific Elites and the Making of US Policy for Climate Change Research, 1957-74." *Social Studies of Science* 23 (4): 643–80.
- Hechler, Ken. 1980. *Toward the Endless Frontier: History of the Committee on Science and Technology, 1959-79*. 1st ed. Washington D.C.: U.S. Govt. Print. Off.
- Holden, Constance. 1974. "Lester Brown: Tireless Sounder of the World Alert." *Science* 185 (4152): 680–82.
- Howe, Joshua P. 2014. *Behind the Curve: Science and the Politics of Global Warming*. 1st ed. Weyerhaeuser Environmental Classics. Seattle; London: University of Washington Press.
- Janković, Vladimir. 2015. "Working with Weather: Atmospheric Resources, Climate Variability and the Rise of Industrial Meteorology, 1950–2010." *History of Meteorology* 7: 98–111.
- Kenworthy, Edwin Wentworth. 1972. "Farmers Critical of U.S. Grain Deal: Democrats on House Panel Also Score Agriculture Unit on Data Release Farmers Critical of Agricultural Department's Handling of Big Grain Deal with Russians." *New York Times*, September 19, 1972.
- King, Seth. 1972. "Midwest Farmers' Minds on Big Crops and Not Politics." *New York Times*, October 15, 1972.
- Kissinger, Henry A. 1974. "Address to the Sixth Special Session of the United Nations General Assembly." *International Organization* 28 (3): 573–83.
- Kotz, Nick. 1972. "'Coziness' Charged in Soviet Grain Deal: 'Cozy Clubby Atmosphere' Hit in Soviet Grain Deal." *The Washington Post*, August 27, 1972.
- Lofchie, Michael F. 1975. "Political and Economic Origins of African Hunger." *The Journal of Modern African Studies* 13 (4): 551–67.
- Luttrell, Clifton B. 1973. "The Russian Wheat Deal—Hindsight vs. Foresight." *Review* 55 (Oct): 2–9.
- Mahony, Marinela, and Mark Hulme. 2012. "The Colour of Risk: An Exploration of the IPCC's 'Burning Embers' Diagram." *Spontaneous Generations: A Journal for the History and Philosophy of Science* 6 (1): 75–89.

- Manabe, Syukuro, and Richard T. Wetherald. 1967. "Thermal Equilibrium of the Atmosphere with a Given Distribution of Relative Humidity." *Journal of the Atmospheric Sciences* 24 (3): 241–59.
- McQuigg, James, Louis Thompson, Sharon LeDuc, Marla Lockard, and Grady McKay. 1973. "The Influence of Weather and Climate on US Grain Yields: Bumper Crops or Drought." Report to Administrator NOAA. Washington D.C.
- Morley, J. W. 1973. "Report on the Present Drought Situation in Upper Volta." In *Drought in Africa Symposium*. Centre for African Studies, School of Oriental and African Studies, University of London.
- National Academy of Engineering Committee on Public Engineering Policy Ad Hoc Steering Committee for the Study of Research Applied to National Needs. 1973. *Priorities for Research Applicable to National Needs*. Washington D.C.: National Academy of Engineering.
- National Research Council, ed. 1973. *Weather & Climate Modification: Problems and Progress*. Washington D.C.: National Academy of Sciences.
- New York Times*. 1973. "Weather Enigma," August 26, 1973, sec. SM.
- Newsweek*. 1973. "The Year of Famine," June 4, 1973.
- Nicholson, Sharon. 2018. "The Myth of the ITCZ over Equatorial Africa and Other Myths Concerning African Climate." Colloquium presented at the KlimaCampus Kolloquium (SoSe 18), Universität Hamburg, April 26. <https://lecture2go.uni-hamburg.de/l2go/-/get/v/22930> (last accessed January 16, 2020).
- Ottaway, David B. 1973. "Drought Threatens Famine in Wide Areas of Africa." *The Washington Post*, January 20, 1973.
- Pecan, Erene V., and G. M. Woodwell, eds. 1973. *Carbon and the Biosphere; Proceedings of the 24th Brookhaven Symposium in Biology, Upton, N.Y., May 16-18, 1972*. AEC Symposium Series, 30. Washington: Technical Information Center, U.S. Atomic Energy Commission; [available from National Technical Information Service, Springfield, Va.].
- Roberts, Walter Orr, and Henry Lansford. 1979. *The Climate Mandate*. 1st ed. San Francisco, Cal: W. H. Freeman.
- Rockefeller Foundation. 1974. "Climate Change Threat to the World?" *RF Illustrated*, August 1974.
- Rogers, Everett M., and Rahul Sood. 1980. "Mass Media Communication and Disasters: A Content Analysis of Media Coverage of the Andhra Pradesh Cyclone and the Sahel Drought." *Disasters and the Mass Media*, 139–57.
- Rosecrance, Richard N., ed. 1976. *America as an Ordinary Country: U.S. Foreign Policy and the Future*. Ithaca, N.Y: Cornell University Press.
- Schneider, Stephen, and Lynne E. Mesriow. 1976. *The Genesis Strategy: Climate and Global Survival*. Springer US.
- Schnittker, John A. 1973. "The 1972-73 Food Price Spiral." *Brookings Papers on Economic Activity* 1973 (2): 498–507.
- Schusky, Ernest, Peter Heinricher, David Brokensha, Barbara Chasin, Don Hadwiger, Robert Launay, Philip Leis, Phillip Leis, Robert Netting, and George Sherman. 1986. "Technology and Politics in the Ecology of the Sahel [with Commentaries]." *Politics and the Life Sciences* 4 (2): 155–79.
- Sheets, Hal, and Roger Morris. 1974. "Disaster in the Desert." *Issue: A Journal of Opinion* 4 (1): 24–43.
- Shmeck, Harold. 1974. "Climate Changes Endanger World's Food Output: Scientists View Global Climate Changes as Threat to World's Food Output Soviet Estimate Rises New Pattern Emerging 7th Year of Draught Problems in Iowa Benefits of Technology." *New York Times*, August 8, 1974.
- SMIC. 1971. *Inadvertent Climate Modification*. Cambridge, Mass: MIT Press.
- Sullivan, Walter. 1974. "Parley Says Oil Cut Reduces Fertilizer: Monsoon Shift Held Threat to World Food Supply Drought Has Wide Impact." *New York Times*, January 26, 1974.

- Taubensee, Robert E. 1973. "Weather and Circulation of October 1972." *Monthly Weather Review* 101 (1): 85–90.
- The Washington Post. 1973. "Mass Starvation Threat Is Seen for Africa, Asia." *The Washington Post*, October 21, 1973, sec. General News.
- Ungar, Sheldon. 2000. "Knowledge, Ignorance and the Popular Culture: Climate Change versus the Ozone Hole." *Public Understanding of Science* 9 (3): 297–312.
- United States Central Intelligence Agency Office of Research and Development. 1974. "A Study of Climatological Research as It Pertains to Intelligence Problems." Internal Report. Central Intelligence Agency. Document Expediting (DOCEX) Project, Exchange and Gifts Division, Library of Congress.
- United States Committee for the Global Atmospheric Research Program. 1975. *Understanding Climatic Change: A Program for Action*. 1st ed. Washington, D.C.: National Academy of Sciences.
- U.S. Bureau of Labor Statistics. 2019. "Consumer Price Index (CPI) Databases."
- U.S. Congress. 1972. *Sale of Wheat to Russia: Hearings before the Subcommittee on Livestock and Grains of the Committee on Agriculture House of Representatives, Ninety-Second Congress, Second Session. September 14, 18, and 19, 1972*. Washington: U.S. Govt. Print. Off.
- . 1973a. *Hearings before the Subcommittee on Oceanography of the Committee on Merchant Marine and Fisheries, House of Representatives, Ninety-Second Congress, Second Session, on NACOA Oversight, November 28, 1972, on NOAA Oversight, November 29, 1972*. U.S. Government Printing Office.
- . 1973b. *The Cost of Living: Hearings before the Committee on Consumer Economics of the Joint Economic Committee, Congress of the United States, Ninety-Third Congress, First Session. March 21; April 4; May 8, 22 and 23 1973*. Washington, D.C.: U.S. Govt. Print. Off.
- . 1973c. *The Drought Crisis in the African Sahel: Hearings before the Subcommittee on Africa of the Committee on Foreign Affairs, House of Representatives, Ninety-Third Congress, First Session. July 16, 1973*. Washington, D.C.: U.S. Govt. Print. Off.
- . 1974. *U.S. and World Food Situation: Hearings before the Subcommittee on Agricultural Production, Marketing, and Stabilization of Prices and Subcommittee on Foreign Agricultural Policy of the Committee on Agriculture and Forestry, United States Senate, Ninety-Third Congress, First Session. October 17 and 18, 1973*. Washington: U.S. Govt. Print. Off.
- US Department of Agriculture Economic Research Service. 1974. "The World Food Situation and Prospects to 1985." Washington, D.C.: US Department of Agriculture.
- U.S. Department of State. Telegram to U.S. Embassy in Senegal. 1974. "Proposal for Conference on Application of Science and Technology to Sahel Drought," May 1, 1974. Public Library of US Diplomacy.
- USAID Office of Science and Technology. 1972. "Desert Encroachment on Arable Lands: Significance, Causes and Control." Washington, D.C.: US Agency for International Development.
- Walker, Martin. 1973. "The Lost Year: Martin Walker from Senegal, Monday, on the Fading Hope of a Starving People." *The Guardian (1959-2003); London (UK)*, July 24, 1973.
- Weart, Spencer R. [2003] 2008. *The Discovery of Global Warming: Revised and Expanded Edition*. 2nd ed. Cambridge, Mass: Harvard University Press.
- . 2020. "The Public and Climate." <https://history.aip.org/climate/pdf/Public.pdf> (last accessed March 6, 2020).
- Wisconsin Library Bulletin*. 1979. "Climates of Hunger - Reid A. Bryson and Thomas J. Murray," February 1979.
- Yergin, Daniel, and Joseph Stanislaw. 1998. *The Commanding Heights: The Battle for the World Economy*. 1st ed. New York: Simon & Schuster.
- Zoeller, Christoffer J. P., and Nina Bandelj. 2019. "Crisis as Opportunity: Nixon's Announcement to Close the Gold Window." *Socius* 5 (January).

Robert Naylor is a historian of science currently studying for a PhD at Manchester's Centre for the History of Science, Technology and Medicine. His research investigates how atmospheric knowledge transferred into public and private activity since the Second World War, and how public and private organisations recognised threats and opportunities presented by stochastic weather events.