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Climate Change, Resource Scarcity and Conflict

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ABSTRACT

Natural resource scarcity and global climate change may alter the risk of violent conflict in the future. Resource scarcity to meet basic needs such as food and land and water can be worsened by governmental ineffectiveness, and vulnerability of populations, ecosystems, economies, and institutions can outweigh the magnitude of climate or scarcity impacts themselves. Resource availability must be seen not as a stand-alone issue, but rather in the context of the overall political economy landscape. Policymakers can benefit from the use of surveillance, early warning systems, and risk anticipation to plan for coming natural disasters and associated scarcity. Development of resilience can offer valuable adaptation and risk reduction methodologies while international action needs to focus on improving cooperation and resilience of international markets through multilateral trade rules or stockpiling of key commodities. Too often, the natural environment is directly attacked or damaged by warfare. Attacks can lead to water, soil and land contamination, or release pollutants into the air. Explosive remnants of war can contaminate soil and water sources, and harm wildlife. Such environmental degradation** reduces people's resilience and ability to adapt to climate change. The indirect effects of conflict can also result in further environmental degradation, for example: authorities are less able to manage and protect the environment; large-scale displacement places strain on resources; natural resources can be exploited to sustain war economies. In Fao, south of Basra, Iraq, people blame their water and farming problems on the felling of date palms for military purposes during the Iran-Iraq war. Conflict can also contribute to climate change. For example, the destruction of large areas of forest, or damage to infrastructure such as oil installations or big industrial facilities, can have detrimental climate consequences, including the release of large volumes of greenhouse gases into the air.

KEYWORDS: *climate, conflict, resource, change, scarcity, reduction, pollutants, greenhouse, oil*

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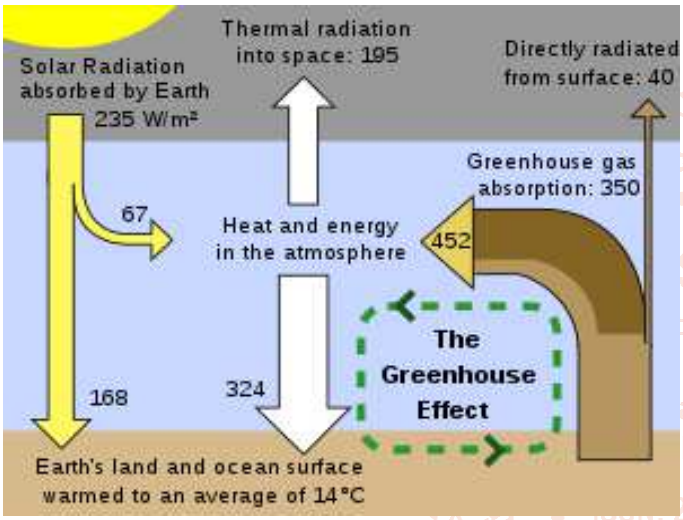
INTRODUCTION

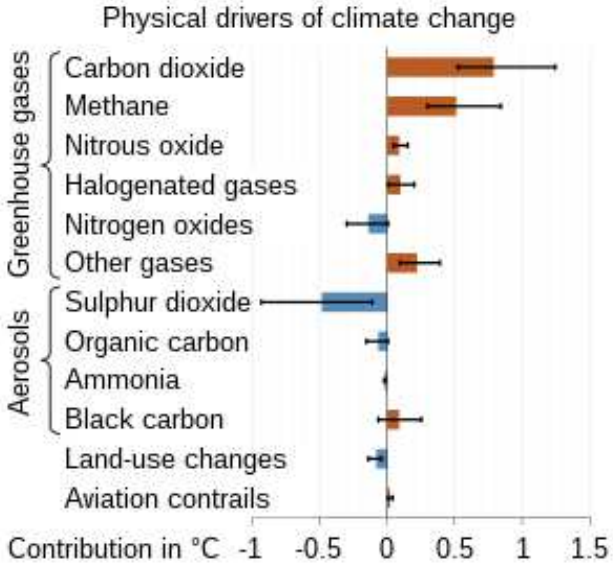
Climate change can drive water scarcity and reduce the availability of arable land. By prohibiting attacks on objects indispensable to the survival of the civilian population, such as agricultural areas and drinking water, IHL protects these resources from additional conflict-related violence. The climate crisis is altering the nature and severity of humanitarian crises. Humanitarian organizations are already struggling to respond and will not be able to meet exponentially growing needs resulting from unmitigated climate change. Limits to the availability of key natural resources (such as land, food, water and oil) and climate change have been linked to social unrest and violent conflict. Analysis that ignores the reliance of society and the economy on natural resources underestimates the exposure to systemic risks. Conflict over natural resources can occur both over the fair distribution of an abundant high value resource, or access to a scarce resource. This focuses only on the latter i.e. where local demand for a resource is greater than available supply, either due to access, distribution or affordability. The security

threat from global warming is inextricably linked to development.[1,2] Resource scarcity and environmental change increase the risk of conflict, and institutional capacity is key to minimising this effect. Food insecurity, lack of water and the impact of natural disasters, combined with high population growth, are stoking conflict and displacing people in vulnerable areas. In light of recent events, such as the mass kidnapping of the 343 schoolboys in Nigeria, the war in Tigray in the northernmost region of Ethiopia, as well as decades-long issues such as the Darfur war, the accumulating news headlines seems unequivocal: there is a growing link between climate change and conflict, and that link is seen right across the African continent. Climate change is widely recognised as a "threat multiplier" due to its role of exacerbating the traditional cause of conflict. [3,4]



Climate change is driven by rising greenhouse gas levels in the atmosphere. This strengthens the greenhouse effect which traps heat in Earth's climate system

The most egregious form is the way changes in climate alter competition over increasingly scarce resources. Research on the so-called 'heat--aggression relationship' suggests there is a 10- 20% increase in the risk of armed conflict associated with each 0.5°C increase in local temperatures. This hypothesis has been recently expanded upon, with research indicating that -- from 1970 to 2015 -- local temperature increase in 159 countries also saw an increased number of terrorist attacks and subsequent deaths.[5,6]The report concluded that: "When temperature increases, the number of terrorist attacks and deaths due to terrorist attacks tend to increase. Our results are consistent with a large body of research on the effect of climate on conflict and are of practical concern given increasing average global temperatures."Such research has paved the way, today, for reduction in the growth of climate change being recognised as an essential prerequisite to achieving peace in many parts of the world. Alongside the cultivation of economic and political stability, increased peace as a product of addressing climate change efforts at that heart of much environmental protection and restoration work. The Sahel\ Across the Sahel, stretching from Senegal in the West to Sudan in the East, prolonged periods of drought, intense desertification and soil erosion persist, resulting in depleted productivity of land, changes of grazing patterns, all because of climate change. In Sudan this has led to civil war lasting from the 1980s.Between 1983-84, famine alone killed nearly 100,000 of those living in its Darfur region. Desperation triggered mass ecological migration, mainly towards Southern Darfur, disrupting harmony between inhabitants. In particular the pastoralists, the Arab nomads, in the search for survival, moved into more fertile lands inhabited by settled farmers, the fur tribes. Thus, this conflict, largely driven by resource scarcity, became enmeshed with ethnic polarisation. Weapons smuggling and continual underdevelopment and marginalisation have ensured that fighting has continued well into the 2000s. [7,8]

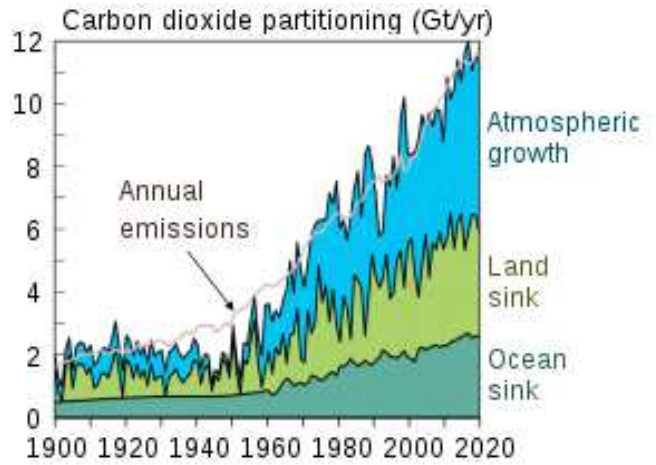


Drivers of climate change from 1850–1900 to 2010–2019. There was no significant contribution from internal variability or solar and volcanic drivers.

The most violent actions have been taken by the government in support of the Arab nomadic militias. Civilian areas in West Darfur, south of North Darfur around Kabkabia and Jebel Marra have been heavily bombed. Boxes filled with metal shrapnel were dropped from the back of Antonov planes and helicopter gunships were flown at low altitude to clear villages. In 2014, bombing renewed its intensity February-March with the aim of clearing out the settled farming communities. Seen from the camps in Chad, the terror of these bombing campaigns deters the thousands of refugees from returning back to their country. [9,10]From 2003, the conflict has left

300,000 dead and 2.5 million displaced. Violence has since flared up this January 2021, leaving at least 83 people dead. The Lake Chad Basin\ Moving West, the next hotspot is the Lake Chad Basin. Around 30 million people in Nigeria, Chad, Niger and Cameroon are competing over this dramatically shrinking water source, which from 1960, has lost 90% of its surface water. Displacement, hunger and malnutrition are rife. This has contributed to increasing abductions, killings and rights violations and to the growth of terrorist organisations, causing 10 million people to need humanitarian assistance. In addressing the rise of terrorist groups in the region, the 2017 Security Council Resolution 2349, recognised "the adverse effects of climate change and ecological changes among other factors on the stability of the Region, including through water scarcity, drought, desertification, land degradation, and food insecurity". Plainly put, at the UN, President Buhari of Chad proclaimed that the "The 'oasis in the desert' is just a desert now... Farmers and herdsmen struggle over the little water left; Herdsmen migrate in search of greener pastures resulting in conflicts; Our youths are joining terrorist groups because of lack of jobs and difficult economic conditions.[11,12]

"In North East Nigeria, where more than 50% of the population make their living from farming, fishing and livestock production, increased aridity has eradicated many livelihoods making them vulnerable to recruitment by Boko Haram. Its attacks have grown in brutality and consistency in 2020, with early December's attack leaving 110 rice farmers dead. Since Boko Haram's formation in 2009 it has caused nearly 40,000 casualties and has contributed to the displacement of 2.4 million people around the Lake Chad Basin. However, Boko Haram is only one of the many violent actors in the country. In the light of recent kidnaping of 344 boys in Nigeria, banditry has also grown rapidly in areas deeply affected by climate change. [13,14]



Most CO2 emissions have been absorbed by carbon sinks, including plant growth, soil uptake, and ocean uptake (2020 Global Carbon Budget).

Among the kidnapper's complaints were objections over how their cattle are being killed and how various vigilante units disturb them. Recent large-scale armed attacks are suspected to have been carried out by the semi-nomadic Fulani community. This is part of a wider trend of growing organised violence between pastoralists and settled farmers, representing a similar dynamic to the Darfur war. This has caused 300,000 people to flee their homes, and mass insecurity in parts of Adamawa, Benue, Nasarawa, Plateau and Taraba states since 2018. The roots of the conflict lie in climate-induced degradation of pasture and increasing violence in the country's far north, owing to the rapid growth of ethnic militias, which have forced herders south. According to Amnesty International, 1,126 people were killed by bandits in Nigeria between January and June in 2020 alone.The Horn of Africa\ The horn of Africa, encompassing Eritrea, Ethiopia, Somalia and Kenya is also affected by climate driven conflict. Drought impacts over 13 million people, encouraging induced migration and ultimately ethnic tensions and terrorism.[15,16]

Discussion

In the arid region of Tigray, years of drought contributed to its different patterns of settlement, social formation and economic production to the rest of Ethiopia. In 1973, drought caused chaos to the social and environmental systems allowing the Tigrayan People's Liberation Front (TPLF), set up in 1975, to thrive. The TPLF to this day has maintained its popularity amongst the peasantry. With war beginning in November 2020 in Tigray, a region already hosting 100,000 Eritrean refugees and suffering from drought, the position of its communities has become extremely volatile. The violence from the conflict has transnational reverberations affecting Eritrea, Sudan and Somalia. Peacekeeping troops were pulled out of Somalia, crucial for halting the advances of Al Shabaab. Their absence has also accentuated the existing conflicts between the clans and warlords that battle over the monopolisation of water and other valuable resources. Ownership over water sources and access acts as a significant source of power. According to the U.N., more than 2.5 million people in Somalia have been forced from their homes by drought and insecurity in recent years; many are now at risk of starvation."These camps have become hotspots for criminal activities such as human trafficking and child exploitation, and a recruitment ground for Al Shabaab."[17,18] Across Africa, the effects of climate change are shaping these conflict patterns, in

particular the pattern of violence arising from forced migration into contested space. Finally, the insecurity has been exacerbated during the last few years, by another confluence of climate change and violence as locust outbreaks have swarmed across the horn of Africa. Unusual weather patterns amplified by climate change in the Arabian Peninsula enabled conditions for mass locust breeding. In particular, Yemen's response system has been unable to inhibit its growth. Five years of civil war and bombing campaigns led by Saudi Arabia, assisted by Britain, have destroyed much of the vital infrastructure that deals with locusts. One thing seems to be clear -- Africa, a continent that contributes merely 2% of the earth's growing carbon emissions, bares the full force of the consequences of global warming, none more so than in climate-fuelled armed violence.[19,20]

In a report for the Pentagon, speculate about the consequences of a worst-case climate change scenario and its implications for US national security. They argue that 'as abrupt climate change lowers the world's carrying capacity aggressive wars are likely to be fought over food, water and energy' and further that a collapse in carrying capacity could make humanity revert to its ancient norm of constant battles for diminishing resources (p. 16). Although warning against overstating the relationship between climate change and armed conflict, both accept that the depletion and altered distribution of natural resources likely to result from climate change could under certain circumstances increase the risk of some forms of violent conflict. It is not likely to be a major or sufficient cause of conflict, but may contribute to a mounting environmental challenge. Based on the 2007 impact assessments of climate change from the United Nations Intergovernmental Panel on Climate Change (IPCC), we identify three major processes expected to follow from climate change that according to the environmental security literature is likely to have security implications: degradation of cropland, increasing freshwater scarcity and population displacement.[21,22]

Results

In this study we try to reconcile these diverse findings by moving below national aggregates to see if local resource scarcity offers a better prediction of conflict behavior. While rarely stated explicitly in the resource scarcity literature, the link between resources and conflict may not be properly studied by regressing cross-national aggregate data. Environmental problems may arise and persist locally, and armed conflicts rarely affect whole countries equally. A recent study of India (Urdal, 2006) suggests that sub-national disaggregated studies may provide more support for the resource-conflict nexus, and many case studies in the field look at local pressures and responses. This study addresses the relationship between local resource scarcity and conflict for a global sample. The main focus is on areas that experience multiple stressors in the form of scarcity and population dynamics, as well as on important contextual factors, captured in the following set of hypotheses:

H1: In areas of greater population growth, areas with high levels of land degradation are more likely to experience armed conflict.

H2: Areas with high freshwater scarcity are more likely to experience armed conflict the greater the population growth.

H3: Areas with high population density are more likely to experience armed conflict the greater the population growth.

H4: The effect of demographic and environmental factors is stronger in areas in poor countries than in areas in rich countries.

H5: Areas with demographic and environmental pressures are more likely to experience armed conflict during periods of regime collapse and transitions. [23,24]

Our assumption is that demographic and environmental pressures are primarily associated with internal armed conflict in very poor settings and in periods of regime collapse and transitions, empirical support for this assumption supports the state failure hypothesis. On the other hand, if income level and regime interruption does not account for a lot of the variation in the relationship between DES and armed conflict, this could be consistent with the state exploitation hypothesis.

The measure of soil degradation throughout the world was commissioned by The International Soil Reference and Information Centre (ISRIC) for the United Nations Environment Programme in 1990. The information of soil degradation is based on questionnaire answers from numerous soil experts throughout the world. Each measure combines type, degree, extent, cause and rate of soil degradation. Based on such measures, each kilometer of land was classified by the level of degradation ranging from 1 (no or very low degradation) to 4 (very high). Areas of greatest soil degradation include the tip of South Africa, swaths of the northern Sahel belt, Central America, sections of East and Central Europe and large portions of East and South East Asia. For the purposes of this statistical analysis, we constructed a set of four dummy variables where land which is categorized as having no or very low levels of

degradation is the reference category with 4644 observations, squares with low level degradation account for 2190 observations, medium to high levels of land degradation are 5560 observations and very high levels of degradation are a separate category containing 805 observations. Areas with no information on degradation were factored out. Interaction terms between medium and high levels of degradation and population growth were created to determine the influence that higher than average population growth in higher than average areas of degradation have on conflict. In additional, interactions between medium and higher levels of degradation and political instability are added to establish whether, in times of political upset, rebels may seize the opportunity to redress land degradation grievances against the government.[25]

Conclusions

It appears from this disaggregated analysis that demographic and environmental variables only have a very moderate effect on the risk of civil conflict. The analysis is unique in that both the dependent variable and the main independent variables are disaggregated, allowing for direct testing of hypotheses regarding population pressure, land degradation and water availability. Although this analysis is a beginning attempt at using these data, the information from geospatial data at local levels can consistently sharpen our understanding of how local processes and national characteristics shape the context of conflict. In the global model, we find that overall, medium to high levels of land degradation are related to increased conflict, as are very high levels of water scarcity. However, the relative increases in risks are quite small. Increasing levels of land degradation increases the risk of conflict from a baseline of 1% to between 2-4%. Freshwater scarcity appears to exert a somewhat stronger effect, increasing the risk of conflict to 6% for areas with very high levels of scarcity. The coefficients for land degradation and water scarcity have to be interpreted as the effect when population growth in a square is zero. High population density, measured locally, is a consistently strong predictor of armed conflict. Population density and conflict is presumably correlated because densely populated areas and large cities are attractive conflict locations both because they provide better opportunities for organizing and financing conflict, and because they represent strategic targets. [20,21]

From the resource scarcity literature, we hypothesized that interactions between 'demandinduced' scarcity, measured by population growth, and 'supply-induced' scarcity represented by land degradation, water scarcity and population density, were likely to produce multiple stressors that could act as triggers of resource scarcity conflicts. In the global model, only the interaction between population growth and water scarcity, as well as that between population growth and density, were statistically significant. It has been argued that the role played by demographic and environmental variables within conflict scenarios is contingent upon economic and political aspects of the state. In this paper, we merged specific environmental data, collected at a local level, with state-level GDP estimates and political attributes. We further split the global sample into two subsets based on income. The analysis reinforced the well established importance of these variables in civil war studies. Lower levels of GDP are the most important predictor of armed conflict, with the exception of wealthier states where it exhibits an insignificant effect. This may speak to a threshold effect of GDP in mitigating the risk of conflict across and within states. We considered that states with low GDPs will depend more on their environment for individual and state income than states with higher GDPs. In addition, a poor state's inability, due to lower capacity as a result of lower national income, to attenuate tensions over degradation may quickly lead to violent conflict. However, resource scarcity actually seems to matter less for conflict in low-income states than for wealthier states. And while political instability is a strong driver of internal conflict in poor states, it does not seem to interact with demographic and environmental factors to increase the risk of conflict. Such results and assumptions suggest that environmental and demographic factors may be second to other drivers of armed conflict. While the resource scarcity literature posits that state capacity, or state weakness, is an important intermediate factor in the resource scarcity-conflict nexus, the rather crude, economic and political variables used in this study to proxy state capacity do not capture any of the variance explained by demographic and environmental factors. [24,25]

References

[1] IPCC AR6 WG1 2021, SPM-7

[2] IPCC SR15 Ch1 2018, p. 54: These global-level rates of human-driven change far exceed the rates of change driven by geophysical or biosphere forces that have altered the Earth System trajectory in the past…

[3] IPCC AR6 WG1 Technical Summary 2021, p. 59: The combined effect of all climate feedback processes is to amplify the climate response to forcing...

[4] IPCC SRCCL 2019, p. 7: Since the pre-industrial period, the land surface air

temperature has risen nearly twice as much as the global average temperature (high confidence). Climate change... contributed to desertification and land degradation in many regions (high confidence).; IPCC SRCCL 2019, p. 45: Climate change is playing an increasing role in determining wildfire regimes alongside human activity (medium confidence), with future climate variability expected to enhance the risk and severity of wildfires in many biomes such as tropical rainforests (high confidence).

[5] IPCC SROCC 2019, p. 16: Over the last decades, global warming has led to widespread shrinking of the cryosphere, with mass loss from ice sheets and glaciers (very high confidence), reductions in snow cover (high confidence) and Arctic sea ice extent and thickness (very high confidence), and increased permafrost temperature (very high confidence).

[6] EPA (19 January 2017). "Climate Impacts on Ecosystems". Archived from the original on 27 January 2018. Retrieved 5 February 2019. Mountain and arctic ecosystems and species are particularly sensitive to climate change... As ocean temperatures warm and the acidity of the ocean increases, bleaching and coral die-offs are likely to become more frequent.

[7] IPCC AR5 SYR 2014, pp. 13–16; WHO, Nov 2015: "Climate change is the greatest threat to global health in the 21st century. Health professionals have a duty of care to current and future generations. You are on the front line in protecting people from climate impacts – from more heat-waves and other extreme weather events; from outbreaks of infectious diseases such as malaria, dengue and cholera; from the effects of malnutrition; as well as treating people that are affected by cancer, respiratory, cardiovascular and other non-communicable diseases caused by environmental pollution."

[8] IPCC SR15 Ch1 2018, p. 64: Sustained net zero anthropogenic emissions of CO2 and declining net anthropogenic non-CO2 radiative forcing over a multi-decade period would halt anthropogenic global warming over that period, although it would not halt sea level rise or many other aspects of climate system adjustment.

[9] IPCC AR6 WG1 Technical Summary 2021, p. 71

[10] IPCC SR15 Ch2 2018, pp. 95–96: In model pathways with no or limited overshoot of 1.5 °C, global net anthropogenic CO2 emissions decline by about 45% from 2010 levels by 2030 (40–60% interquartile range), reaching net zero around 2050 (2045–2055 interquartile range); IPCC SR15 2018, p. 17, SPM C.3:All pathways that limit global warming to 1.5 °C with limited or no overshoot project the use of carbon dioxide removal (CDR) on the order of 100–1000 GtCO2 over the 21st century. CDR would be used to compensate for residual emissions and, in most cases, achieve net negative emissions to return global warming to 1.5 °C following a peak (high confidence). CDR deployment of several hundreds of GtCO2 is subject to multiple feasibility and sustainability constraints (high confidence).; Rogelj et al. 2015; Hilaire et al. 2019

[11] United Nations Environment Programme 2019, p. xxiii, Table ES.3; Teske, ed. 2019, p. xxvii, Fig.5.

[12] United Nations Environment Programme 2019, Table ES.3 & p. 49; NREL 2017, pp. vi, 12

[13] IPCC SRCCL Summary for Policymakers 2019, p. 18

[14] IPCC AR5 SYR 2014, p. 17, SPM 3.2

[15] Trenberth & Fasullo 2016

[16] NASA, 5 December 2008.

[17] Joo et al. 2015.

[18] NOAA, 17 June 2015: "when scientists or public leaders talk about global warming these days, they almost always mean human-caused warming"; IPCC AR5 SYR Glossary 2014, p. 120: "Climate change refers to a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcings such as modulations of the solar cycles, volcanic eruptions and persistent anthropogenic changes in the composition of the atmosphere or in land use."

[19] NASA, 7 July 2020; Shaftel 2016: " 'Climate change' and 'global warming' are often used interchangeably but have distinct meanings. ... Global warming refers to the upward temperature trend across the entire Earth since the early 20th century ... Climate change refers to a broad range of global phenomena...[which] include the increased temperature trends

described by global warming."; Associated Press, 22 September 2015: "The terms global warming and climate change can be used interchangeably. Climate change is more accurate scientifically to describe the various effects of greenhouse gases on the world because it includes extreme weather, storms and changes in rainfall patterns, ocean acidification and sea level.".

[20] Hodder & Martin 2009; BBC Science Focus Magazine, 3 February 2020

[21] The Guardian, 17 May 2019; BBC Science Focus Magazine, 3 February 2020

[22] USA Today, 21 November 2019.

[23] Oxford Languages 2019

[24] Neukom et al. 2019.

[25] "Global Annual Mean Surface Air Temperature Change". NASA. Retrieved 23 February 2020.