

CHAPTER 1.
**VISUALIZATION INSTRUMENTS OF CLIMATE CHANGE, CLIMATE
COMMUNICATION, AND HUMAN SECURITY, WITH AN EMPHASIS ON AFRICA,
SOUTH ASIA, THE CARIBBEAN, AND THE PACIFIC ISLANDS**

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Abstract. This study seeks to contribute to evidence-based approaches in responding to the climate change crisis and climate policies, focusing on the role of visualization instruments of climate change, climate communication, and the human security framework. The regions of interest are Africa, South Asia, the Caribbean, and the Pacific Islands. Climate change is a global factor in current and future security issues that has yet to penetrate broader security or resilience discourse, particularly in these fragile regions. International cooperation around disaster response and risk reduction is critical. However, adaptation and resilience planning must be active across these most fragile trans-continental regions. It could provide a sound basis for a thorough cross-continental and multilayered understanding of the future threat to improve government will and support risk management planning. The solution lies in climate-resilient development and social and political awareness to adapt to climate change and effectively tackle climate transition. It involves integrating measures to adapt to climate change with actions to reduce or avoid greenhouse gas emissions in ways that provide more comprehensive benefits. Demanding to fight against misconceptions and denial of the climate crisis and environmental fragility is essential because global warming will be consistent globally in these observed fragile Regions and the Global North. That is why visualization instruments (cartography, maps, satellite images, photographs, interactive atlases, and video sequences) can be invaluable for climate change and all misunderstandings within action research and collective activism. It is crucial to provide access to a broad audience, both to knowledge and through interactive participation, through zooming the data itself. However, capturing complexity for a specialized audience, scientists and experts, and keeping simplicity for a global audience takes work. Visual Climate impacts are emotionally powerful, and when adequately presented and elaborated, they become effective ways of communicating to an audience. Cartographic visualizations of different features of climate change and the power of climate photography and its narratives are significant for public perception. Satellite images and their models can display how regions will look if global warming and rising sea levels continue. Computer simulations can demonstrate circumstances and future scenarios; numerous areas could lose their centers, and flooding would occur in many populated areas. It would affect the displacement of people, migrations, food security, and crime level and jeopardize human safety. Specular attention should be devoted to using various visual instruments and images to show the increasing fragility caused by the climate crisis. Climate change narratives through images are a vital part of climate change communication, but while there is a decent amount of research, the "power of images" needs to be studied more. Climate change and environmental security can be studied, predicted, and captured

using photography. Increasingly, photography can help research the causes and effects of climate change. Likewise, various climate-engaged photographers can assist science in tackling climate change with solutions regarding climate resilience. Climate change visualization and communication are critical and should be examined and comprehended more profoundly. In the near and distant future, the multidisciplinary and trans-disciplinary association between entirely different fields of science will bring more epistemological familiarity that will prevent complex challenges in the future. The effort that invests in mitigating climate change must be more remarkable, especially the general social and psychological awareness of citizens. The reason is that, in addition to the consequences on the economy, society, and the environment, other inevitable consequences of climate change will appear (floods, droughts, heat waves, changes in the amount of rainfall, lack of natural resources, loss of biodiversity, migrations, wars and conflicts, terrorism, etc.). Climate change will even more negatively and strongly affect Africa, the Caribbean, South Asia, and the Pacific Islands, starting with potentially more harmful impacts on human health and already terrible conditions (especially for those who work in an increasingly hot environment), even greater migrations, and other related disorders. As with mitigation, crucial is action- research satisfactory politics. The new focus must be on the technological, social, psychological, and cultural aspects to ensure adequate climate change programs, commissions, governments, and various international expert institutions dealing with the adjustment. During the approaching "climate change transition," in a socio-political sense, it is essential that everyone is more actively involved in the policy-making process. The key is to ensure an appropriate geopolitical and financial focus, a Global South/Global North honest association, and a transformation of the Global North policies during the transition. It aims to assist the fragile regions of Africa, the Caribbean, South Asia, and the Pacific Islands. Climate change action, environmental security, and human security are critical, especially regarding observed regions and sectors that will be most affected - countries with fragile human security. We need technology, scientific, and educational focus to fight climate change. However, this is not only a technological and scientific issue but a social problem. Along with the social aspect, there is the problem of inequality, i.e., social justice - climate justice. Those who contributed the most to the climate crisis contribute the least to its solution. The government, practitioners, and policymakers must better understand human security's value and have a better climate security approach in addressing climate challenges in these regions. The climate policies should integrate and acknowledge the importance of visualizing instruments and climate communication into the resiliency approach. It must also include other workstreams related to environmental and human security. Climate change is a complex challenge that policymakers and practitioners must clearly understand and contextualize in the observed regions to help address the everyday challenges communities across these countries face.

Keywords: Climate Change, Visualizing Instruments, Climate Communication, South Asia, Caribbean, Africa, Pacific Islands, Climate Visuals, Climate Security, Human Security.

Introduction.

Climate change is not only a scientific phenomenon but also a cultural one. Individuals' opinions on climate change are often based on emotion (often by images) rather than scientific evidence. Therefore, research into the emotional characteristics of the imagery that the non-expert public finds relevant to climate change is essential to build a database of compelling climate change imagery, which can then be used by scientists, policymakers, and practitioners in mobilizing climate adaptation and resilience efforts. To this end, Lehman et al. (2019) collected ratings of relevance to climate change as well as emotional arousal and valence on 320 images to assess the relationship between relevance to climate change and the emotional qualities of the image. In addition, participants' environmental beliefs were measured to investigate the relationship between beliefs and image ratings. The results suggest that images rated highly relevant to climate change are higher in negative emotional valence and emotional arousal. Participants with higher pro-environmental disposition rated images as more relevant to climate change. (Lehman et. al, 2019)

Human activities have already transformed the planet at a pace and scale unmatched in recorded history, causing irreversible damage to communities and ecosystems. Yet global emissions continue rising, and current carbon-cutting efforts are insufficient to combat climate catastrophe. With few nations on track to fulfill their climate commitments and the developing world already suffering disproportionately from climate disasters, he said, rich countries are responsible for acting faster than their low-income counterparts. Beyond that threshold, scientists have found, climate disasters will become so extreme that people will not be able to adapt. Essential components of the Earth system will be fundamentally, irrevocably altered. Heat waves, famines, and infectious diseases could claim millions of additional lives by century's end. The latest report shows the world is running out of options to hit climate goals. With the world on track to blaze past its climate goals, only immediate, sweeping societal transformation can stave off catastrophic warming. (*Kaplan & Dennis, 2022*) Recently, heat waves have raged in Europe, Asia, and North America, and temperatures have exceeded 40 degrees Celsius, sometimes even 50 degrees Celsius.

According to the last report of the Intergovernmental Panel on Climate Change (IPCC), scientists have established serious and long-term changes in the Earth's climate in every region and the entire climate system. Many changes have yet to be seen for hundreds, and some for thousands of years, such as the steady rise in sea level. The report shows that greenhouse gas emissions from human activities are responsible for warming the planet by approximately 1.1 °C from 1850 to 1900 and reveals that, on average, over the next 20 years, global temperatures will reach or exceed 1.5 °C of warming. UN Secretary-General António Guterres said the report was nothing more than "a code red for humanity. The alarm bells are ringing, and the evidence is irrefutable." According to this report, reporting climate crises should become a daily routine. Focusing on narratives about global warming, environmental disasters such as drought or floods, and the impact on life on planet Earth should become a more critical part of social sciences and mainstream journalism. The presentation of the climate crisis problem and the impact of reporting on the audience will largely depend on how these topics are approached and what resources are used to bring the issue closer to the audience and make it as straightforward as possible. The role of the media in this fight and reducing people's behavior will be one of the keys to change. It is a fact that when we represent visually, it is more apparent. (*Intergovernmental Panel on Climate Change, 2021*)

In its special 2018 report, the IPCC warned that preventing irreversible climate change, which threatens the sustainability of civilization on Earth, requires a 45 percent reduction in carbon dioxide (CO₂) emissions by 2030 and their complete abolition by 2050. Climate change, which, without exaggeration, is a more precise albeit non-technical term, is the reality of today's world, and it is the most severe and complex crisis that humanity has ever been exposed to. Faced with the already galloping climate crisis and its consequences, it seems justified to call for a state of emergency declaration. During the last few decades, year after year, we have been noticing the consequences of climate change across the Earth, which we highlight here (from IPCC reports 2013 and on): record-breaking average global temperature, more frequent and intense occurrences of heat waves during the summer and cold precipitation extremes during winter, destabilization of permafrost, loss of glaciers as essential sources of drinking water, global sea level rise, coral bleaching, large forest fires, longer dry periods, large-scale floods and increasingly frequent and intense droughts. As a result, we are witnessing significant changes in the environment, which causes increasing problems in food production, forced migration, and degradation of biodiversity, manifested in galloping extinction and migration of species, among which the most visible occurrences of tropical species in the temperate zone. (*Intergovernmental Panel on Climate Change, 2018; Intergovernmental Panel on Climate Change, 2013*)

Four of the ten countries most affected by climate change in the past twenty years are in Southeast Asia (SEA). As such, climate change profoundly threatens Southeast Asian populations, spanning traditional security dimensions and non-traditional aspects such as food, water, and health security. Moreover, climate change amplifies existing inequalities within and between populations and their access to security and justice. This broadside attack on human security poses many challenges for security sector actors, who are asked to respond to an invisible threat everywhere and

nowhere. Security sectors across Southeast Asia are grappling with the changes required to deliver good security. There are links between SSG/R and climate security in Southeast Asia. The consequences of climate change on human security in SEA are already dire. The consensus among the scientific community indicates they are likely to only worsen in the coming years. An increase in the severity and frequency of natural disasters and associated problems such as food scarcity will push more people towards mobility and migration as strategies for safeguarding their livelihoods. (Socquet-Clerc et. al, 2022) Security Sector Reform (SSR) is the political and technical process of improving state and human security by making security provision, management, and oversight more effective and more accountable within a framework of democratic civilian control, rule of law, and respect for human rights. SSR's goal is to apply sound governance principles to the security sector.

Climate change is an underlying security issue and the driver of citizen insecurity and fragility in the Caribbean. A region long-tested by extreme weather events and illicit economic activity, the Caribbean has abundant climate science and resilience expertise but many underlying governance and security challenges that may amplify each other as climate impacts intensify. (Fetzek, 2019) Thus, the Caribbean islands are particularly susceptible to rising sea levels, hurricanes, and volcanic eruptions and face extreme vulnerability.

Figure 1. Climate change danger effects in the Caribbean (Cuba)



Source: Repeating Islands, 2017

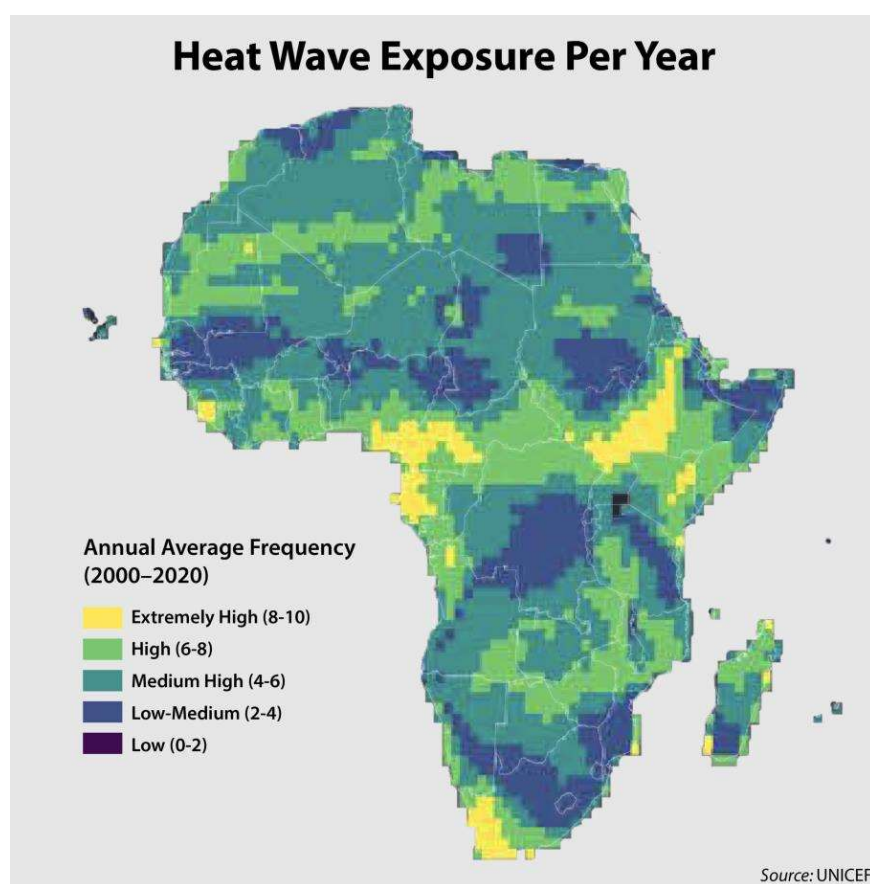
Climate change undermines human security in the Pacific and will inevitably worsen based on the current global trajectory. The implications of climate change for human mobility have become a clear and widely cited example of the impacts of climate change on the security of Pacific communities. The Boe Declaration Action Plan, adopted by the leaders of the Pacific Islands Forum in 2019, recognizes the need to anticipate better, understand, and contextualize the impact of climate change on security in the region, including its interactions with human security and conflict. Pervasive security threats like climate change require commitment and responses at multiple scales. It is, therefore, essential to examine the relationship between human security and climate-related mobility in the Pacific in the overall context of climate security. (Westbury et al., 2022)

Global warming is contributing to more extended heat waves, a tripling of droughts, a quadrupling of storms, and a tenfold increase in flooding in Africa since the 1970s—exacerbating security threats on the continent. African countries *within 15 degrees of the equator* are projected to experience an increase in the frequency of heat waves. In Central Africa, Cameroon, Equatorial Guinea, Gabon, the Republic of the Congo, and the coastal areas of northern Angola and DR Congo, we already see an average of 8-10 heat waves yearly. In East Africa, Uganda, Ethiopia, and Kenya—and the Atlantic coast of South Africa—are also experiencing an increasing frequency of heat waves. A 0.5°C increase in temperatures can lead to a 150 percent increase in heat waves that kill 100 people or more. **Priority Actions are needed in Africa.** There is *insufficient climate data* collected from Africa.

Generating more comprehensive and accurate data will lead to more informed and better-tailored approaches to adapting to global warming impacts. Agriculture employs a majority of Africans and can absorb large numbers of relatively unskilled workers. The agricultural sector, therefore, is a critical link between climate change and security. In addition to adapting more drought-tolerant seed varieties and practices, greening the productivity of small-holder farming and strengthening property rights and land access rights are vital. With intra-African migration expected to continue increasing, efforts to create more and safer migration opportunities are needed for those looking for alternative livelihoods. To defuse potential increases in inter-communal conflict related to growing land pressure caused by climate change, governments, and intermediary reconciliation committees should proactively encourage dialogue between farmers and herding communities to enhance mechanisms to handle disagreements and mitigate conflict escalation. Governments will also need to review *grazing and land rights*—and take an even-handed approach to enforcement.

Regarding conflicts, of the 20 countries deemed most vulnerable to climate change according to the *ND-GAIN Country Index*, 17 are African. Nine of those African countries are experiencing conflict. While most analysts agree that global warming does not cause conflict, many have stressed that it acts as a “*crisis amplifier and multiplier*,” which can increase tensions around access to resources, food, and ancestral lands. These tensions can lead to conflict in places with sociopolitical disparities, weak rule of law, and frayed social cohesion. (Africa Center for Strategic Studies, 2021)

Figure 2. Infographic - heat wave exposure per year in Africa



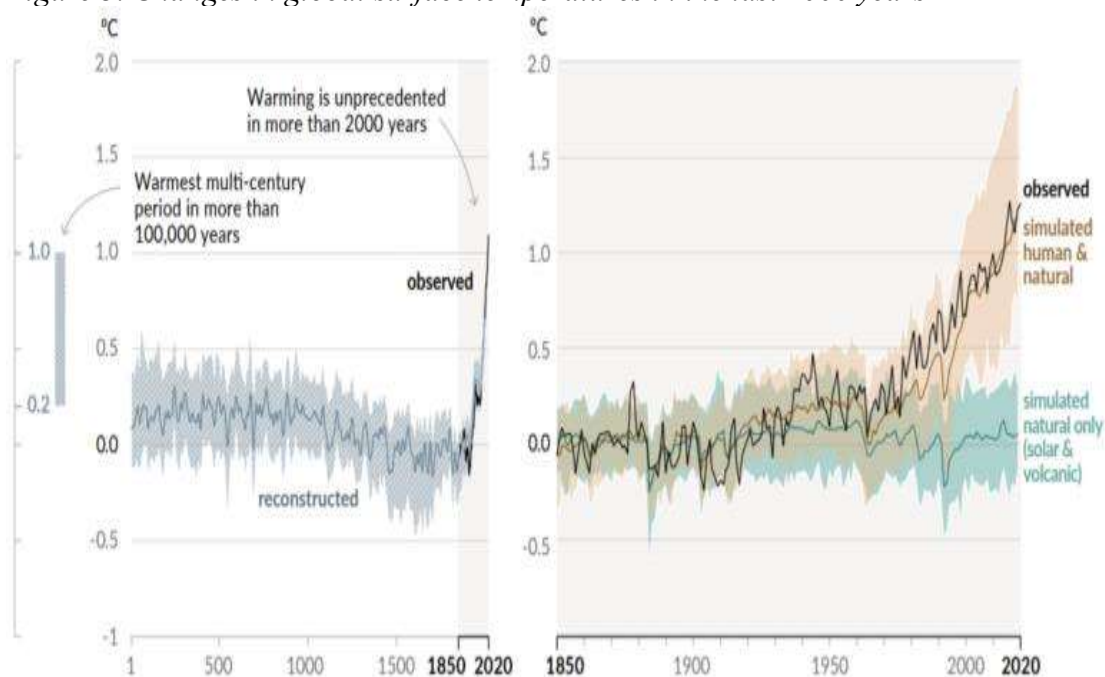
Source: Unicef and Africa Center for Strategic Studies, 2021

The conformist refusal to accept the reality of the climate crisis has lost all rational basis. At the same time, we are witnessing action movements that we can consider as the beginning of a global ecological revolution, a new historical moment that humanity has not yet experienced. One of the main demands of those movements is a call to institutions to listen to scientists. True, scientists are often very modest in publicly communicating their results and implications, which can be attributed to strict adherence to the rules of the scientific method.

As climatologist James Hansen pointed out: "Caution is a laudable virtue, but today, perhaps we should still control our restraint because it is leading us into a cataclysmic future." One of the

common refrains from decisive systemic action until now has been the position that climate change is a problem but not a crisis. The challenges are evident when we communicate about the climate crisis, i.e., a change in communication approach is needed to be more effective. One of the tools that should be emphasized is the power of narrative through various tools and actors – how to spread the climate message through stories, which people digest much more efficiently and can lead to broader awareness and action. Thus, Visualization of reported information has always been an excellent tool to present any topic more clearly. When we talk about climate crises and ecological fragility, environmental security, and human security framework, it is undoubtedly one of the most effective methods of presenting what is happening more clearly. Since 1970, the rate of global temperature increase has changed by an unprecedented 1.7 degrees Celsius per century; it does not sound like much change. Not even with the phrase "unseen." What does that represent to a general audience with insufficient knowledge that even half a degree means a massive change for all of humanity? The visual presentation of content and data is essential for the broad audience's understanding of this data. When we visually represent the changes that have occurred, then this data becomes a significant change. (Huremovic, 2021)

Figure 3. Changes in global surface temperatures in the last 2000 years

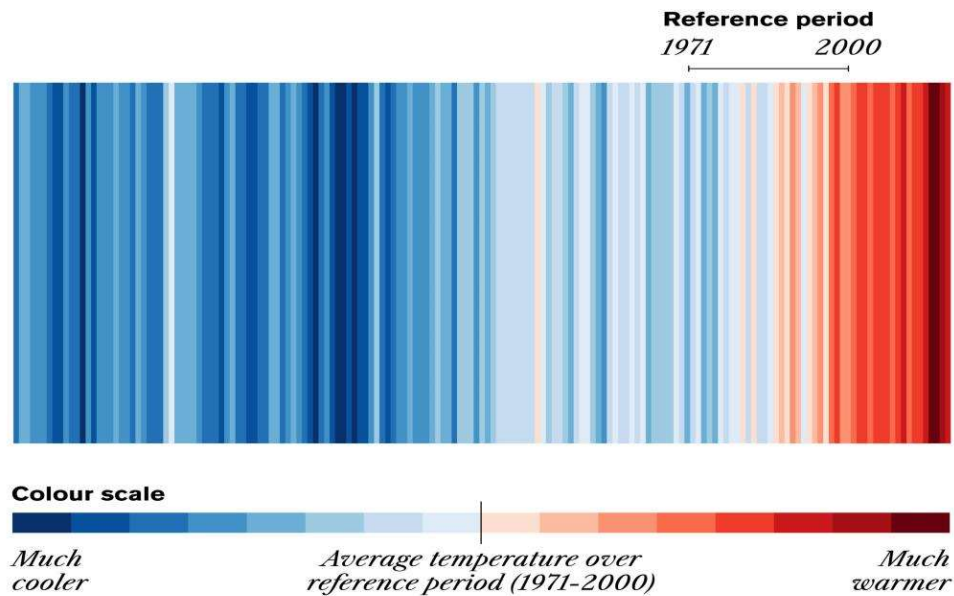


Source: Balkansmedia, 2021.

The chart on the left shows changes in global surface temperatures over the last 2000 years, and the chart on the right focuses on changes since 1850, overlaid with simulations of natural and artificial factors.

In 2018, Ed Hawkins created a simple graph with shades of blue and red to show global warming, a graph that has gone viral in the last couple of years and effectively talks about the problem of climate crises. Hawkins emphasizes the need for different types of visuals to speak to other audience groups. Audience prioritization makes these tracks an engaging and visually stunning example of communication with the general public.

Figure 4. Color scale chart, average temperature (1971-2000)



Source: Balkansmedia, 2021.

Photography can help raise awareness about Climate Change. Global climate change is evident and has noticeable effects on the environment. It affects all regions of the world. The polar ice caps are melting, and the ocean levels are rising. In some regions, extreme weather events and precipitation are becoming more frequent, while others face extreme heat waves and droughts. Many plants and animal species are endangered. Some terrestrial, freshwater, and marine species have already moved to new territories. Plants and animals will be in grave danger of extinction if the planet's average temperature rises uncontrollably. These effects are expected to intensify in the coming decades. Scientists agree that global temperatures will continue to grow for decades, mainly due to greenhouse gases produced by human activities. *The Intergovernmental Panel on Climate Change (IPCC)*, which includes more than 1,300 scientists, forecasts a temperature rise of 2.5 to 10 degrees Fahrenheit over the next century. According to the IPCC, the extent of climate change effects on individual regions will vary over time and with the ability of different societal and environmental systems to mitigate or adapt to change. With these facts in mind, *All About Photo* has selected photographers documenting the consequences of climate change on our beautiful planet and its inhabitants. Thanks to their dedication and courage, we can observe the effects of climate change on all four corners of the world. (Hermand-Grisel, 2020)

Satellite images have proven to be one of the most influential and straightforward ways of enriching the written content of the story and data visualization and as irrefutable proof of the claims made. One of the most common uses of satellite images is undoubtedly presenting the traces of climate change on our planet. One of the most common uses of satellite images is undoubtedly giving traces of climate change on our planet. Satellite images can detect environmental changes that are often invisible from the ground. In addition, satellite data is helpful in natural disaster research, as it provides quick information on the extent of damage and the need for assistance in the affected area. They also monitor environmental and social problems, such as pollution or human rights violations. Although there are challenges in accessing and interpreting the data, satellite imagery provides researchers with a better understanding of the world. It allows them to report with greater accuracy and depth. (Tinjak, 2023)

Climate Visuals' practice, insights, and potential climate change image libraries should be based on global research and evidence to catalyze imagery that is not just illustrative but genuinely impactful. All forms of Visual media are essential to connect with audiences, but environmental and climate change imagery often needs improvement and broader availability. We communicate on climate change and environmental issues using familiar metaphors, poorly representing people's

experiences and connecting with a minimal sector of the world's population - missing a vital opportunity for proper and lasting public attention. "Visualization tells you exactly what it wants you to think and feel. It takes a stand but does not mislead regarding urgency or seriousness. There is no need to read a more detailed chart or judge the severity of the situation based on the numbers. It represents a chart that relies on the trust and prior knowledge of its audience because it leaves no room for different research or interpretation of the data. The message is clear, and we can take it or leave it," writes Erica Buden. The power of maps is critical. One misconception about the climate crisis is that global warming will be uniform. Because of this, maps can be an invaluable tool against this misunderstanding. For the first time, the IPCC has released an "interactive atlas" that captures the data from their latest report, allowing the public to participate interactively by panning and zooming the data. However, if we try the IPCC atlas, we can see how difficult it is to capture complexity for a specialized audience while maintaining simplicity for a global audience. As James Cheshire points out in an article on the importance of using visualizations to cover the topic of climate crises, most audiences will not engage closely with high-level data sets called "CMIP5" or "Aphrodite" or with the mass of code that makes up the IPCC-WG1 repository on GitHub. He states that this kind of presentation of data is a good start but that more universally accessible visualizations are needed to clearly show where we are going. The power of maps lies in their ability to simultaneously show us that as global average temperatures rise, local conditions threaten to become more extreme. (Huremovic, 2021)

Climate communication or climate change communication is a field of environmental communication and science communication focused on the causes, nature, and effects of anthropogenic climate change. Thus, Climate change communication is a topical and relevant issue, and it is widely acknowledged that public communication about causes, impacts, and action alternatives is integral to addressing the challenges of the changing climate. Conversely, Climate visualization concerns communicating climate information and data through different information technologies and modes of visual representation. In climate change communication, climate visualization is highlighted as a potential way of increasing public engagement with climate change. In particular, developments within information technology have provided significant advancements that are claimed to be transformative in engaging lay audiences with climate change mitigation and adaptation issues. Nevertheless, there needs to be more research exploring climate visualization from an audience perspective. As there is a gap, the overarching aim is thus to examine the role of climate visualization in climate change communication from an audience perspective, focusing specifically on how lay audiences make meaning of climate change as represented in two examples of climate visualization.

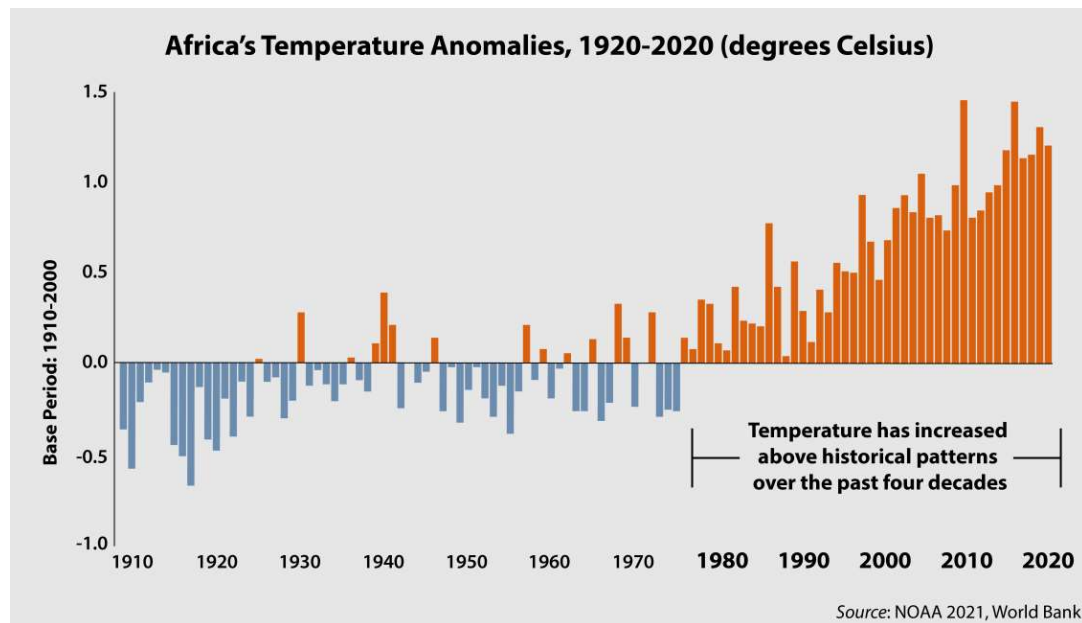
Ballantyne's 2018 study discussed climate visualization's potential contributions and limitations from a communication perspective. Based on a social semiotic theoretical framework, the paper employed focus group interviews to study participants' meaning-making related to two cases of climate visualization: a dome theatre movie developed for Swedish high school students to encourage reflection on climate change causes, impacts, and mitigation alternatives, and a web-based tool for climate change adaptation developed to assist Nordic homeowners in adapting to the local impacts of climate change. The results of this study show that climate visualization can help audiences concretize otherwise abstract aspects of climate change and that the localized focus can make climate change appear more personally relevant and compelling for targeted audiences. Nevertheless, despite these communicative qualities, the analyses also show that participants' interpretations are shaped by their preconceptions of climate change as a global and distant issue to be solved by other actors, such as national governments, or through international policy negotiations. (Ballantyne, 2018)

At their core, climate negotiations continue to be shaped by equity concerns between postindustrial countries in the Global North and emerging economies in the Global South. Of course, these include the study's focus on climate change-fragile regions: the African continent, the Caribbean, South Asia, and the Pacific Islands. The debate is mainly over which countries have contributed most to greenhouse gas (GHG) emissions and how the costs of mitigating and adapting to climate change should be shared. How effectively the principle of equity will be embodied in global

efforts to combat climate change will help determine the scope and ambition of these efforts. Industrialized and post-industrialized nations are responsible for a significant share of the historical carbon dioxide (CO₂) emissions in the atmosphere today. The United States has emitted more carbon than any other country and is responsible for 25 percent of historical emissions. Next in line are the twenty-seven countries of the EU (plus the UK), which are responsible for 22 percent of global CO₂ emissions. Meanwhile, China's historical contributions are estimated to be around 12.7 percent. By contrast, India (3 percent) and Brazil (0.9 percent) have historically not significantly contributed to global emissions.

Similarly, the contributions of African countries (3 percent combined), relative to the continent's population size, have also been minimal. In addition, the Global North continues to have much higher per capita emissions than much of the world even today. The United States ranked high among post-industrialized countries in 2019, with 16 tonnes of CO₂ emissions per capita, just behind Australia (16.3 tonnes per capita) and ahead of Canada (15.4 tonnes per capita). The figures for Europe generally fall between 5 and 10 tonnes per capita, depending on the country. Hydrocarbon-based economies like Russia and members of the Gulf Cooperation Council in the Persian Gulf like Kuwait, Qatar, Saudi Arabia, and the United Arab Emirates also rank pretty high, some even higher than countries in the Global North. (Ulgen 2021)

Figure 5. Infographic - temperature anomalies in Africa (1920-2020)



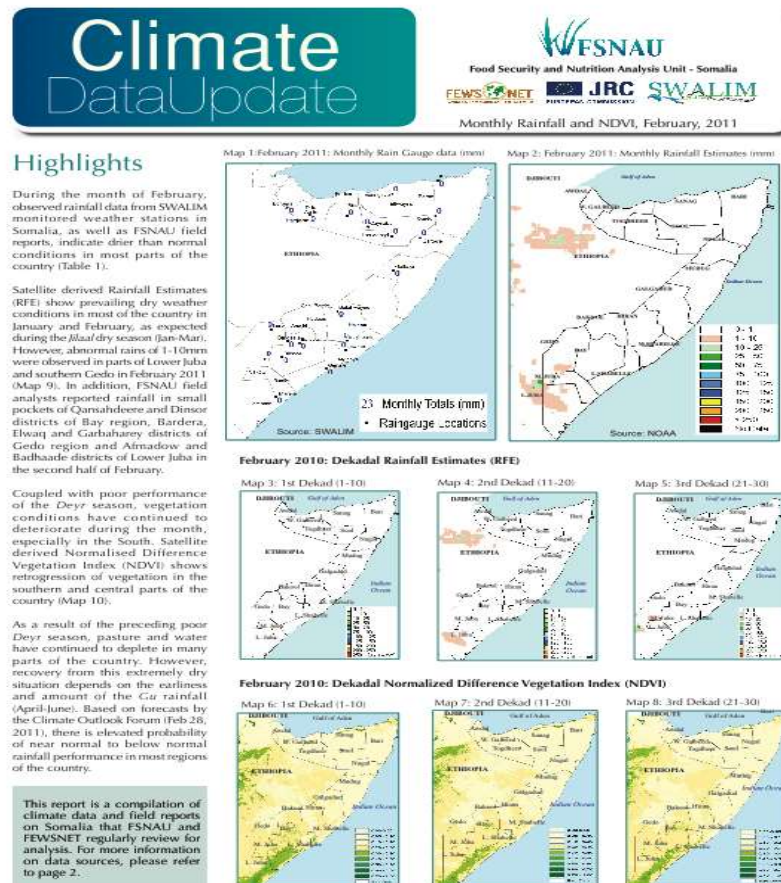
Source: NOAA 2021. World Bank & Africa Center for Strategic Studies 2021

A crucial and practical tool is opening Climate Data for the general public, which is increasingly critical, as has yet to happen in recent years. In the past, a wealth of raw data on climate has been under-used, often ending up as static PDFs or on specialists' hard drives. For example, The New Climate Portal aims to make it easier to access and use climate information from various sources, including the Bank's open data catalog. Reliefweb published parts of a study by the World Bank in 2011. "Opening climate data will encourage experts and innovators, wherever they may be, to develop new tools for analyzing and managing the effects of climate change," says Shaida Badiie, director of the Bank's Development Data Group. "The combination of open data and innovative tools will be an excellent resource for countries as they develop plans for adapting to climate change." (Reliefweb, 2011) The portal allows users to query, map, compare, chart, and summarize climate and climate-related information, as well as to visualize the effects of changing patterns of rainfall and

temperature. It aids government ministries and World Bank teams in 130 countries where adapting to climate change is a development priority.

For example, illustration of the climate data for Somalia: Climate Data Update - Monthly Rainfall and NDVI, February 2011

Figure 6. Infographic – monthly rainfall and NDV, 2011.



Source: Reliefweb, 2011

Another example I can illustrate is Modeling Risk in Mozambique. The Global Facility for Disaster Reduction and Recovery (GFDRR), a partner of the Climate Portal, is supporting this effort through its Open Data for Resilience Initiative in 31 countries. GFDRR and government ministries are conducting disaster risk analyses, creating climate data websites, and developing applications to model risk. "Making data available is one of the crucial steps toward building resilience to climate change," says GFDRR Manager Saroj Jha. "Open data enables countries to develop the kinds of countermeasures needed to deal with extreme events and which must be at the core of every country's policy and planning." GFDRR expected 15 countries will have climate open data websites by May, and possibly 31 will have them by the end of 2012. Mozambique was likely to be first. The country already suffers from droughts, cyclones, and coastal flooding and is worried about projections that rainfall will decrease during the primary growing season. Mozambique is one of many countries in the world facing such challenges. Mozambique's disaster management agency and GFDRR are building "climate decision" tools targeted to Mozambique's needs, which could be made freely available to other countries once they are developed, says Robert Soden of GFDRR's technical Labs group. (Reliefweb, 2011)

The ecological crisis brings global inequalities to the surface. Events over the years have made it clear that no one can escape the impacts of climate change. However, at the worldwide level, climate effects are not uniform. The Global Climate Risk Index 2021 indicates that while registering the lowest industrial pollution levels, the world's poorest countries are most susceptible to the

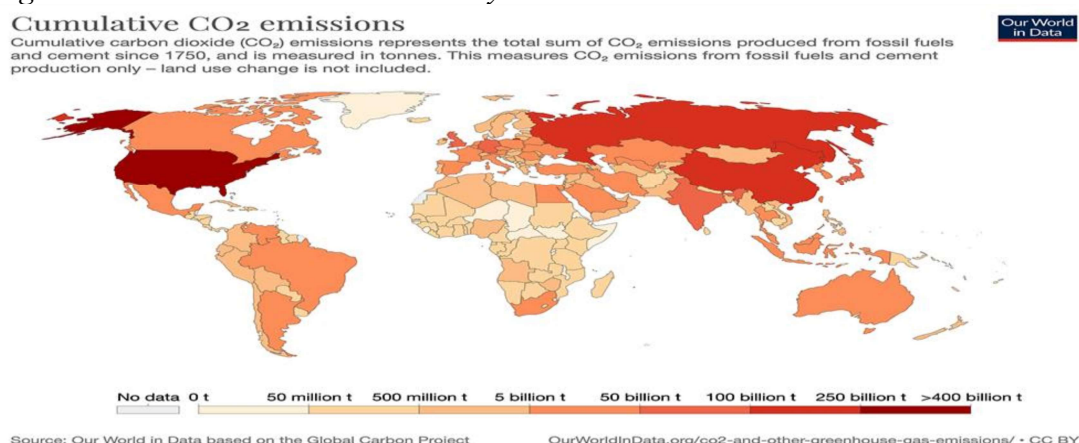
damage produced by climate change. Evidence suggests that the initial inequality experienced by nations of the Global South puts them at a disadvantage, where they are particularly vulnerable to the impacts of climate change.

Consequently, climate change widens existing global inequalities, undermining efforts for poverty reduction. A report from the World Bank estimates that the ecological crisis might drive up to 135 million people into poverty by 2030. Looking at the national level, climate change further deepens within-country inequalities by hitting the poorest communities, including Black, Indigenous, and People of Colour communities (BIPOC), as well as women and children, hardest. These most vulnerable groups face the effects of global warming daily. Although smallholder farmers in rural areas provide up to 75 percent of the food supply in many developing countries, they are undermined by floods, droughts, and other natural disasters.

Notwithstanding, vulnerable groups are often the ones who are actively involved in the protection and conservation of natural habitats, as in the case of indigenous environmental defenders. In addition to being exposed to the most direct adverse effects of climate change and global warming, these groups are facing extreme violent attacks for defending their home and the planet. As reported by Global Witness, 227 environmental and land defenders were killed in 2020 in the Global South. (Strazzante et. al, 2021)

Africa, South Asia, Africa, the Caribbean, and the Pacific Islands are the least responsible for greenhouse gas emissions but are currently the hardest hit by climate change. The Global South is a part of the world that abounds with tragedies. In that part of the world, we are witnessing the disappearance of the conditions on which people's lives and the normal functioning of society depend. Moreover, developing countries in the South and industrialized countries in the North have had a complicated relationship since World War II. On the other hand, modernization theorists claim that globalization and liberalization create new prospects for the South. Developing countries benefit from drawing in foreign investment, technology, and foreign knowledge. It is essential to make fundamental adjustments to reverse this tendency resulting from globalization. Since the Cold War ended, for example, South America's strategic relevance has been further weakened by competition for finance and investment and foreign aid from Eastern Europe and the former Soviet Union. (Mujrai & Rao, 2022)

Figure 7. Cumulative CO2 emissions by all world countries



Source: Carnegie Europe, 2021

The concept of "just transition" has been around since the 1980s, when it was used in a movement by US trade unions to protect workers affected by new water and air pollution regulations. In recent years, the concept has gained traction concerning meeting climate goals by ensuring the whole of society – all communities, all workers, all social groups – are brought along in the pivot to a net-zero future. The International Labour Organization (ILO) defines it this way: "Greening the economy in a way that is as fair and inclusive as possible to everyone concerned, creating decent work opportunities and leaving no one behind." While this provides a sound basis, perception does vary between countries and regions. What is essential, though, is that each country fosters ongoing

dialogue to develop a shared vision for what a just transition means for their impacted workers, communities, and businesses. When discussing Climate transition, risks, and opportunities, the summer of 2022 saw record-breaking heatwaves and forest fires across Europe. Climate change makes such extreme weather events more likely and increases the hot and dry conditions that fuel wildfires.

In national and international arenas, climate change and its impact are often framed as a grave global security threat, causing chaos, conflict, and destabilizing countries. This framing still needs to result in exceptional measures to tame the purported threat. In the Global North, “climate security” has become a dominant frame for thinking—and not thinking—about the climate crisis. The framing assumes that climate change will disrupt weather and environmental systems, putting pressure on economic and social systems as well as natural resources, leading to large-scale displacement; all of this is expected to create instability, worsen tensions and create new ones, and increase the threat of violent conflicts. Though views within this framing rarely claim that climate change is the sole cause of conflict, they often see climate change as ushering in an era of persistent conflict, a security environment much more ambiguous and unpredictable than that faced during the Cold War.” Climate change is framed as a “threat multiplier,” driving insecurity and violence, particularly across the Global South. While this body of research points to very real and worsening problems, it also pulls attention and resources from addressing the causes of the climate crisis and the necessary solutions. (Cohn & Duncanson, 2022)

Critical security studies are crucial scholarship to respond to the climate crisis. Critical security studies should not establish "objective truth" but enable a broader understanding of Security based on respect for specific theoretical and political starting points in its conceptualization. Environmental Security and environmental protection are issues of overall Security because they directly cause open conflicts, have the potential to destabilize the regime, and can lead to the displacement of the population and the disintegration of the states. Regarding the geopolitical consequences of climate change (particularly in observed Regions), climate change consequences, such as global warming, rising sea levels, droughts, melting glaciers, and many others, significantly impact world geopolitics. The level of conflict between states depends on how strong the ties and common interests of the entire region states and globally. Some states rely on what the atmosphere will be like in their environment. They will affect neighboring countries if they are stable and economically prosperous. When climate change has reduced living resources, the economic framework played a much more critical role than religion in joining terrorist organizations. There is a need for research initiatives on how modern technologies, on the one hand, and the involvement of the younger generations and minorities, on the other, can be used and increased as ways to strengthen communities' resilience to disasters and ensure an effective, comprehensive, and sustainable approach. Quality governance and leadership in climate change are crucial for environmental safety. (Hadzic, 2020)

This study seeks to contribute to evidence-based approaches in responding to the climate change crisis and climate policies, focusing on the role of visualization instruments of climate change, climate communication, and the human security framework. The regions of interest are Africa, South Asia, the Caribbean, and the Pacific Islands.

Methodology

This research review incorporated a meta-analysis and included content analysis, a descriptive method, an in-depth literature review, and an examination of various visual data. The study aims to analyze concepts and notions of these highly actual scientific frameworks/areas, expanding social, political, and educational cognition. This study seeks to contribute to evidence-based approaches to the climate change crisis and climate policies, focusing on the role of visualization instruments of climate change, climate communication, and the human security framework. The regions of interest are Africa, South Asia, the Caribbean, and the Pacific Islands.

Discussions and Results

1.) Human security and global climate change policies with emphasis on South Asia, Africa, the Caribbean, and the Pacific Islands

Scientists have warned us for three decades that this is happening much more intensively and faster than expected. Although one should be optimistic that, as a civilization, we can fix things, weeks and months like this, in which temperature records are broken daily worldwide, call into question how much room there is for optimism. The current temperature increase is 1.2 degrees compared to the pre-industrial period. Heat waves and weather extremes are the climate system's response to this increase. The current climate policies of the countries that joined the Paris Agreement lead us to an increase of at least 2.7 degrees. If this is the case with an increase of 1.2 degrees, we can only imagine what the world will look like with an increase of 2.7 or even three degrees when talking about a largely uninhabitable planet. The latest research also shows that climate change threatens the collapse of the entire global food system. When discussing climate change, the focus often remains on energy and the fossil industry. However, agriculture is essential for its share in carbon dioxide and methane emissions. Large-scale industrial agriculture is not sustainable if we want to return to a stable frontier and feed the world.

In Southeast Asia (SEA), the armed forces have been at the forefront of responses to natural disasters, while other security sector actors have played supporting roles. Moving beyond traditional emergency responses, security sector actors must significantly mitigate the effects of climate-induced security threats on populations region-wide. Security institutions must help local communities prepare for such threats and ensure this collaboration is done inclusively. Local security sector actors, ranging from traditional and religious leaders to non-state armed groups, must be consulted and included in the design of responses and mitigating measures. At the same time, oversight bodies and mechanisms will need to be able to carry out their duties to ensure transparency effectively. To achieve this, their governments must support security institutions by allocating necessary budgets, sharing essential scientific knowledge, and providing essential technical training and support. Moving beyond the government level, as climate insecurity transcends national borders, so should response strategies. (*Socquet-Clerc et. al, 2022*). Climate change has a direct bearing on the two essential components of human security: „freedom from fear“ and „freedom from want.“ Natural disasters occurring from extreme weather lead to both „fear“ and „want.“ In South Asian countries, at least two components of human security are likely to be affected severely by climate change: food security and health security. By using the panel data of the four South Asian countries for the period 1973-2009, one study demonstrated that health is negatively affected by an increase in temperature and precipitation. Similarly, an increase in temperature tends to reduce food availability; however, an increase in precipitation tends to increase food availability. Moreover, inflation has a negative relationship with the availability of food and health, revealing that due to the average low income of people in South Asia, inflation tends to affect the affordability of health and food items. It was also found that Per Capita GDP and openness positively impact health and food security indicators. (*Akram & Hamid, 2014*)

In the fragile Caribbean, key regional security risks driven by climate change include economic contraction, violence, and criminal activity; disaster impacts and political repercussions; food and water insecurity, damage to livelihoods, and social unrest; and Latin American security deterioration impacting the Caribbean. These risks provide an opportunity for better regional and international security cooperation in disaster response scenarios, and such collaboration could provide a strong foundation for better resilience, long-term preparedness, and resilience. The Caribbean is already highly exposed to various climate hazards amplified by climate change. The area can expect more intense tropical storms, changing precipitation patterns (more intense rainfalls and drought), rising sea levels, and ocean acidification in future years. The region also has a 400-year history of coping with illicit maritime smuggling and challenges to the rule of law, and serious organized crime activities, including gangs and cartels, continue to challenge states' authority and create security threats in some Caribbean states and territories. Climate change impacts and security threats in the

region are likely to interact and amplify each other. This interaction will occur under underlying structural challenges, including high unemployment, undiversified economies, livelihoods dependent on climate-sensitive natural resources, and governance gaps that inhibit the effective rule of law. (Fetzek, 2019)

Cuba sounded a warning in 2017 about the dangers of extreme commercial protectionism, the threat of climate change, and building walls that will not solve the problems of poverty in the region during the inauguration of the 5th Ministerial Meeting of Countries of the Caribbean Community (Caricom) in Havana. “We face the danger that extreme commercial protectionism is taking root, the Paris Agreement on climate change is threatened, the criminalization and deportation of our citizens are being promoted, and their human rights are frequently violated. The religious and racial persecution is on the rise, as are plans “to build walls” that will not, however, solve the problems of “poverty, the effects of climate-caused natural disasters, nor the unjust international order, all of which and more are reasons why today’s migrations happen, Cuban Foreign Minister Bruno Rodriguez stated. (*Repeating Islands*, 2017)

The Pacific Islands are especially vulnerable to the impacts of climate change. Direct security impacts may include diminished access to fresh water, local food supply, and coastal infrastructure damage. For atoll island nations, climate-related sea level rise is an existential threat. Areas for cooperation to manage the threat are mitigation, adaptation and response, and knowledge creation and dissemination supporting those initiatives. The Pacific Islands should promote and exploit opportunities for regional collaboration to better manage mitigation, adaptation, and response to climate change and to develop and disseminate better knowledge supporting those activities. Pacific Island countries and territories should invest in maintaining and expanding institutions and programs for knowledge creation and dissemination regarding the impacts of climate change and their potential for mitigation, adaptation, and response. There is a continuing need for education at all levels — from public education for an informed citizenry to higher education to provide the skills necessary to participate fully in global scientific and policy communities. Pacific Islanders should also pursue a higher level of participation in climate-related research and policy; for example, as authors and editors in any subsequent round of IPCC assessment reporting and as participants in growing observation networks to collect and analyze data on climate-related events, environmental change, and social impacts of these phenomena. (Hauger, 2015).

The Pacific is the Commonwealth region most vulnerable to climate change. It faces intense temperature variations, extreme storms, and rising sea levels and is also highly vulnerable to earthquakes, floods, tidal surges, landslides, droughts, forest fires, tsunamis, and volcanic eruptions. It is indisputable that Pacific islanders face an existential threat from climate change. To a far more immediate degree than people living in most other parts of the world, inhabitants of low-lying atolls and archipelagos in the Pacific have to worry about losing their security and livelihoods, and even the very existence of the place they call home. Some Pacific nations have seen sea-level rise four times above the global average. It is estimated rising sea levels could by 2100 engulf thousands of islands in the region, meaning they will become uninhabitable due to salinization of water, recurrent flooding, and infrastructural destruction. Without a focus on concerted international efforts, millions of people in this region could be forced to leave the homes of their ancestors to seek safer lives elsewhere. (*The Commonwealth*, 2019)

Figure 8. Climate vulnerability and insecurity of Pacific islanders



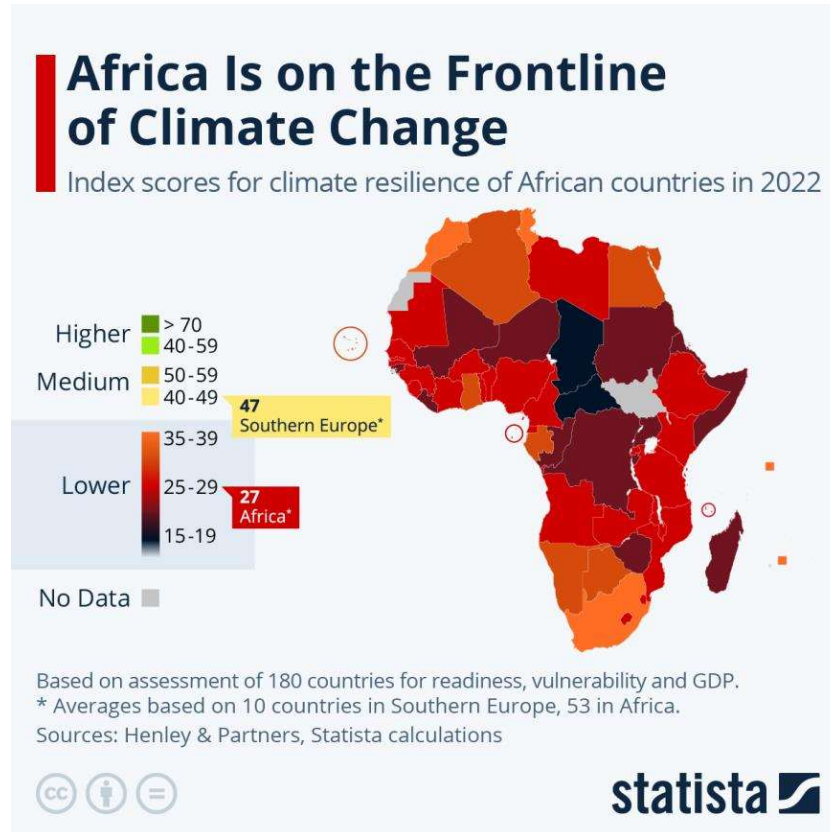
Source: *The Commonwealth*, 2019

Africa's only three mountains with glaciers in East Africa will likely see "total deglaciation" by the 2040s. Kenya, perhaps a decade earlier. At a two degrees increase, southern Africa is set to become 5 to 10 percent drier as increasing drought frequency and number of heat waves cause reductions in the volume of the Zambezi Basin. According to François Engelbrecht, one of Africa's leading climatologists, "Multi-year droughts are the number-one climate change risk South Africa faces in a changing climate." At a 3 degrees increase, the western Sahel region is expected to experience the strongest drying, with a significant increase in the maximum length of dry spells. Central Africa would see a decrease in the length of wet periods and an increase in heavy rainfall. Global warming is expected to amplify Multiple security risks in Africa, including reduced food production.

A 1°C increase in temperature is associated with a decline in agricultural output of 2.7 percentage points. The impact will be especially severe in Africa, where many households depend on weather-sensitive activities, such as rain-fed agriculture, herding, and fishing, for their livelihoods. Biodiversity losses and ecosystem degradation due to drought and unpredictable rainfall will affect the soil and vegetation quality. Increased incidents of floods will continue to negatively affect agricultural livelihoods (e.g., through seed loss, crop damage, and livestock morbidity and mortality), leaving communities more vulnerable. Under a warming of 2°C, the World Bank forecasts a 10 percent decrease in crop yields across Sub-Saharan Africa by the 2050s. Likewise, there will be land pressure and displacement. Intensification of production on existing agricultural lands to fill "yield gaps" threatens the environment through the potential overuse of regional water resources and ecosystems. Likewise, expanding agriculture into "new" lands often threatens local and regional ecosystems. Growing land pressure can lead to displacement and escalating existing tensions between communities. Lake Chad—which is a lifeline for some 30 million people in Chad, Niger, Nigeria, and Cameroon - has shrunk by over 90 percent since the 1960s due to climate change, a growing population, and unmanaged irrigation. Evaporation of the lake has only accelerated as it gets shallower. Losing livelihoods has coincided with increased criminality and migration to urban centers. An estimated 18 million seasonal migrant workers in Africa, of which 80 percent work in agriculture, mining, and fishing. Deteriorating climate conditions have turned seasonal migration into an ineffective strategy for many, however, and is one of the contributing factors to more permanent

migration and displacement. In the worst-case global warming scenario, Sub-Saharan Africa would see up to 86 million people moving within national borders. North Africa would make up the most significant proportion of those climate migrants, with 19.3 million people moving, equivalent to roughly 9 percent of its population, due mainly to increased water scarcity. As a result of lower crop yields, reduced agricultural and labor productivity, and declining human health, climate change is projected to have a compounding negative impact on Africa's economic well-being over time. (Africa Center for Strategic Studies, 2021)

Figure 7. The index score for climate resilience of African countries in 2022.



Source: Statista, 2022

Although Africa is responsible for only about 4 percent of global greenhouse gas emissions, it is on the front line of the consequences of global warming. Based on an assessment of local impacts and countries' adaptive capacities, the Henley & Partners index gives the continent an average climate resilience score of 27 - a shallow level compared to the rest of the world. As our map shows, the Sahel countries are the most vulnerable. While Africa is among the regions most at risk from climate change, it has vast renewable energy potential - particularly in solar, wind, hydro, and geothermal power generation, but also in green hydrogen. The ability to harness these sustainable resources and efforts to restore ecosystems are solutions that will enable African countries to meet the climate challenges of this century. (Amstrong, 2022)

Climate change demands a whole-of-government response, with environmental change and degradation considered in an integrated effort from the Ministries of Environment, Defence, Energy, Development, Finance, Health, and Foreign Affairs. It needs to amount to more than a 'greenwash,' characterized instead by bold and visible steps towards an economy not based on carbon (for example, through a massive scale-up of funding for research and development into renewable energy sources), which recognizes the joined-up nature of security threats, examining key determinants, e.g., water, land, agriculture, health, energy, disaster risk management and early warning systems. Simultaneously, the climate change terminology consists of various terms that could be more familiar to the general public. In the climate change discourse, we often hear about greenhouse gas emissions, carbon dioxide, net zero, and other terms. In the most basic explanations, Greenhouse gas emissions

represent the release of gases that cause climate change - through the greenhouse effect that traps the sun's heat in the atmosphere, which warms the atmosphere. Carbon dioxide (CO₂), released by burning fossil fuels, is the most important greenhouse gas. Methane is another natural gas released using fertilizers; it is released in smaller quantities but has a more substantial warming effect. Net Zero is achieving zero, getting to the point where you are not adding to the amount of greenhouse gases in the atmosphere. It can be achieved by reducing greenhouse gas emissions as much as possible and balancing any remaining by removing an equivalent amount – either naturally, such as trees, which absorb CO₂, or using technology. Many Western countries have set targets to reach net zero by 2050. However, greenhouse gas emissions and global temperatures continue to rise, and our planet is approaching a tipping point that will make climate chaos irreversible.

The fight against climate change will be win or lose in the next ten years unless we start with an action plan. The COP27 summit was held in Egypt for the first time, and Sharm el-Sheik was the first Egyptian city to undergo the beginnings of the Green Revolution. Namely, one of the topics that appeared in the speeches of world leaders at 2022 COP is the problem of the consequences suffered by developing countries, which are not even close to being responsible for the climate changes that are happening. The "Poor South" bears the responsibilities of the prosperous North and pays a high price, mainly in the great natural disasters that have occurred over the years. (NI, 2022)

While the Global North continues to emit greenhouse gases with undiminished intensity and enjoys the prosperity made possible by extravagance, the Global South suffers the consequences of such an unsustainable way of life. It reveals the fundamental injustice at the very core of climate change. The book "Petroleum Papers - Inside the Far-Right Conspiracy to Cover Up Climate Change" by the Canadian-American journalist and publicist Geoff Dembicki is not the story of Joanna Sustento. However, the story of her tragedy was taken as the narrative backbone for a highly detailed analysis of the origin and development of climate change denial by the fossil fuel industry and the closely related conservative right. The book "Petroleum Papers" is about how the tragedy of Joanna Sustento could have been avoided if the fossil industry had not chosen the path of actively creating and feeding lies on which the denial of climate change is based. (Biliskov, 2023)

Climate change threatens the future of human rights to undo development, health, and the fight against poverty and marginalization. As global warming, excessive rainfall, and severe droughts affect agriculture, food supplies will fall, increasing food prices and poverty. It leads to unmanageable economic, social, and political conditions, and the opportunities for stable international and domestic policies will be significantly damaged. It impacts armed conflicts and mass migration. Critical security theory should be both a theoretical commitment and a political orientation, as a set of ideas that critically and continuously explore communities and emancipation. Addressing socioeconomic and other disparities within minorities, indigenous and non-indigenous populations, global impoverished, and community empowerment is crucial to increasing climate change resilience. Tackle persistent poverty, inequalities, natural disasters, depletion of natural resources, environmental destruction, and climate change requires joint action. The existence of a quality state apparatus, an efficient rule of law, and a welfare state can alleviate inequality. Migrations will require elaborate state tactics and a peaceful solution; otherwise, the catastrophe's scale is questionable. (Hadzic, 2021)

Geoff Dembicki chronologically followed and abundantly documented knowledge about the danger of climate change, which the fossil industry has been aware of for a long time. Namely, as early as the end of the fifties of the last century, scientists were warning about the ecological crisis that intensive use of fossil fuels could lead to. An ample space is devoted to the argumentation of the facts about the exhaustive climatological knowledge in the fossil industry's possession. Nevertheless, there are also the financial interests and greed of a small "elite" and the paranoid fear of the spread of communism by the conservative right and other influences. All this has led to the wealth of collected knowledge being kept in corporate drawers. Thus, reports from that time typically state that this report's central message is that there is still time to save the world's people from the catastrophic consequences of pollution, but time is running out. (Biliskov, 2023)

More active inclusion of Global South actors and voices is critical. Rather than suffering the most from climate change, communities at the forefront should be at the center of the world's fight against global warming and should be given more space to raise their voices. The Global South actors (South Asia, Africa, the Caribbean, and the Pacific Islands) must actively participate in worldwide action and partnerships to reduce global inequalities, especially on climate-related issues. This also means that people in the Global North must support the more active inclusion of Global South actors. Today, the voices of the Global South remain too often unheard. A recent study points out that climate change academics from some of the worst-hit regions struggle to be published – a challenge that is even harder for female authors. The lack of diverse voices means that critical views are missing. Moreover, BIPOC communities of the Global South possess unique practical and ancestral knowledge about nature and ways to live harmoniously. Their inclusion can widen the understanding of climate change and help shape policies. (*Strazzante et. al, 2021*)

In underdeveloped fragile societies (mainly South Asia, the Caribbean, the Pacific Islands, and Africa), the human security concept requires a comprehensive approach to diverse factors, such as the broader socioeconomic imbalances and external international synthesis contributing to health and socioeconomic insecurity. The critical human securitization approach should transform the inequitable realm. However, conforming to questionable ethical aspirations differs from how humans can develop potential, advance society, and live without fear, want, and indignity. Sociopolitical activities in underdeveloped societies should focus on challenges such as poverty, inequality, climate change, environmental degradation, peace, and justice. Sustainable development programs are valuable for addressing health inequalities and the broader socioeconomic inequalities that lie at their roots. The specific level of inequality should encourage investment in human capital, contribute to mobility, and encourage innovation. (*Hadzic, 2021*)

The Intergovernmental Panel on Climate Change (IPCC) findings are clear: to avoid the most catastrophic effects of climate change, global temperature rise must be limited to 1.5°C or below. To reach this goal, greenhouse gas (GHG) emissions must be reduced by 50 percent by 2030 and net zero by 2050. Climate Transition Action Plans (CTAPs), also known as transition plans, can address the need for clarity on how companies are moving from setting goals to taking near-term action to achieve those goals in line with a 1.5°C pathway. They have emerged as a framework to equip corporate planning and share critical details of those plans with companies' stakeholders: investors, NGOs, governments, and the public. (*We Mean Business Coalition, 2022*)

Nevertheless, equity concerns between Global North and Global South essentially stem from the asymmetry between countries' emissions and their respective burdens to respond to climate change (including the costs of emissions mitigation, adaptation, and other impacts and risks). Most human-driven GHG emissions in the atmosphere are from economic activities performed in or for affluent countries. Yet poorer nations weathering climate-induced environmental shocks carry a more significant burden of climate change impacts. A further dividing line in climate negotiations results from the contrast between past and future emissions. While industrialized and post-industrialized countries in the Global North are responsible for most past emissions, these countries led by the EU are implementing policies to reduce their GHG emissions. At the same time, the emissions of most developing nations (particularly China) remain on an upward trajectory. This second group of countries will not reach peak emissions for another decade at least. As a result, developing countries share the responsibility for reducing future emissions. Such juxtaposed trends also create issues of generational justice. These differences, coupled with the immediacy of the effects of climate change, also shape the diplomatic groups engaging in multilateral climate negotiations. Subgroups among countries in the Global South and issue-based coalitions of countries in the Global North and South have emerged based on common concerns. Less developed economies and small island nations, already facing the existential threat of climate change, are demanding immediate answers from post-industrialized and developing countries. The Organization of the Petroleum Exporting Countries members are urging post-industrialized economies to embrace policies that reduce welfare losses in nations that rely on petroleum exports. (*Ulgen, 2021*)

However, there might be only one efficient cooperation instrument between the Global North and the Global South: a Green Climate Fund (GCF). The Green Climate Fund (GCF) is a relatively new international organization established under the UNFCCC and is based in South Korea. Its purpose is to collect contributions from member countries and mobilize private capital to finance climate projects in the Global South (particularly in South Asia, Africa, the Caribbean, and the Pacific Islands).

The Green Climate Fund (GCF) boasts some important institutional innovations that distinguish it from other international financial institutions, such as the IMF and the World Bank. Most importantly, in GCF decision-making, there is parity between donor countries in the Global North and recipient countries in the Global South. Taking on the responsibility to respond rapidly to climate-related disasters could bring changes that would speed up processes across the Green Climate Fund (GCF). This may seem overly optimistic, given the problems the Green Climate Fund (GCF) faces. Still, as a laboratory for equitable North-South relations, the GCF is the best option. (*Kalinowski, 2022*)

It is critical to note, however, that the “security” that is of most concern in this framing is threats to the security of powerful states in the Global North, and “security” is taken to mean the ability to defend not only their state borders, but also their political, economic, and military dominance. The privileging of this narrative stems in part from the fact that Global North departments of defense typically have far more power and resources, particularly when it comes to international interventions, than those governing development or the environment. But it goes beyond institutional capacity and resources.

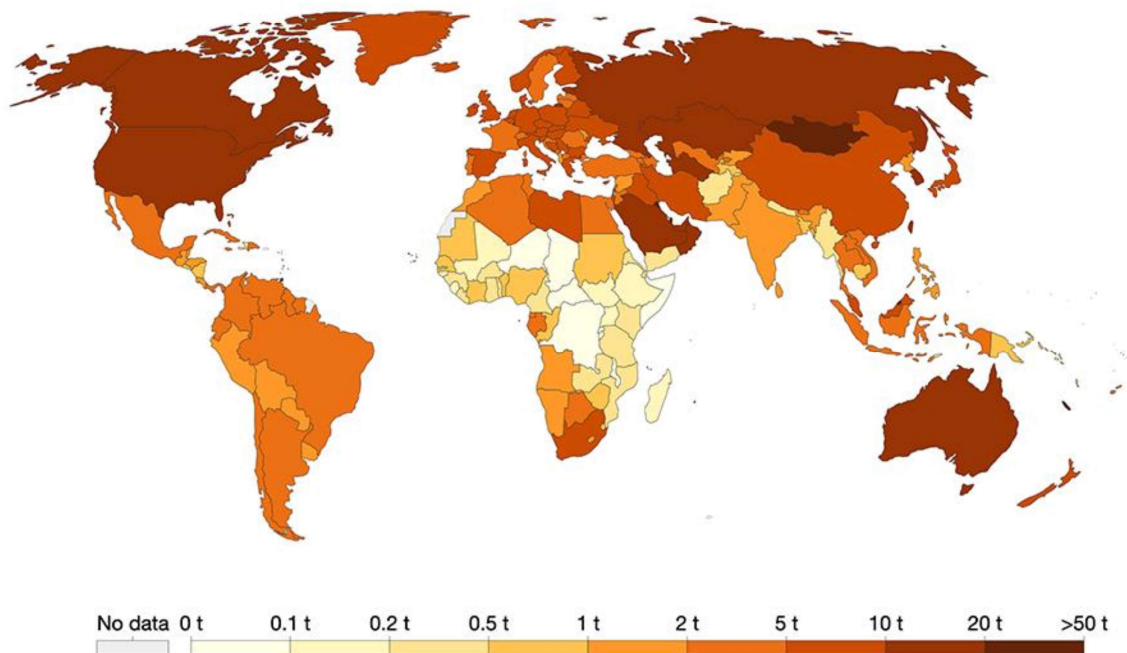
We can only fully explain the privileging of security institutions and framings (especially their influence on the climate crisis) and their grip on the popular imagination by paying attention to gender. What we need to do is transform the root causes of this catastrophe, which will take nothing short of a paradigm shift: from a model that conceives the purpose of economic activity as ever-increasing extraction, exploitation, and consumption of nature’s resources, and human labor, for profit, to one which focuses on meeting human needs and ensuring the sustainability of the resources and ecosystems on which life depends. In other words, we need a feminist green transformation: a restructuring of production, consumption, and political-economic relations along truly sustainable pathways. The first steps could include developing a feminist political-economic analysis of the transnational actors and processes that present the most significant threats to sustainable life on Earth, mapping routes to intervene in those processes, and articulating policy alternatives that transform our understanding of the purposes of economic activity and humans’ relation to the planet. We call this a “Feminist Roadmap for Sustainable Peace and Planet.” As we have argued elsewhere, we need to unapologetically claim the mantle of “realism” for an economic system based on an ethics of care—for people and planet—over the short-sighted, destructive ethic of unlimited individualistic acquisition and corporate consolidation of wealth; a system that recognizes interdependence—among people and nations—as the basis for mutual collaborative action, rather than mutual armament. One that acknowledges that the goal of sufficiency, of ensuring livelihoods and lives of dignity, will never be achieved in a system that deepens, rather than transforms, inequalities. (*Cohn & Duncanson, 2022*)

Figure 7. CO₂ emissions per capita by all world countries

Per capita CO₂ emissions

Carbon dioxide (CO₂) emissions from the burning of fossil fuels for energy and cement production. Land use change is not included.

Our World
in Data



Source: Our World in Data based on the Global Carbon Project

OurWorldInData.org/co2-and-other-greenhouse-gas-emissions/ • CC BY

Note: CO₂ emissions are measured on a production basis, meaning they do not correct for emissions embedded in traded goods.

Source: Carnegie Europe, 2021.

2.) Visualization of climate change and climate communication

Visualization and communication of climate change, the simplification of maps, and the creation of visually more precise and transparent representations of profound historical changes should be a significant focus of media coverage to use the power of Visualization and encourage the audience to take action. However, the term itself - climate change, often sounds relatively passive and gentle. Science is speaking about a catastrophe for humanity.

Carbon dioxide and global climate change are largely invisible, and the prevailing imagery of climate change is often remote (such as ice floes melting) or abstract and scientific (charts and global temperature maps). Extensive color imagery demonstrates how climate change works where we live. It reveals how we often conceal, misinterpret, or overlook the evidence of its impacts and the role of our carbon usage in causing them. Using visual media to communicate climate change vividly illustrates the science and the practical solutions for climate change, such as local renewable energy and flood protection. It introduces powerful new visual tools (from outdoor signs to video games) for communities, action groups, planners, and other experts to use in engaging the public, building awareness, and accelerating action on the world's greatest crisis. (*Sheppard, 2012*)

Communicating the climate crisis is critical to moving policy solutions forward and gaining the collective buy-in necessary for creating a future that is not dependent on the heat-trapping gases that have resulted in this crisis. However, this is where many of us in the advocacy, policy, and education space continue to struggle. For a long time, climate communication has been highly scientific and has focused on an informational deficit approach that assumes relying on logic and facts-sharing was enough to move people toward action. However, we know that reason is not necessarily what drives human behavior. At first glance, communicating the climate crisis is about educating and informing people about the systems and behaviors that have led to the ecological and climatic issues we face

today and in the future. However, climate change communication is shaped by our different experiences, mental and cultural models, and underlying values and world views. (Olano, 2020).

Although climate visualization can enhance a sense of proximity to climate change, the localization of climate risk can also lead to participants downplaying the significance of climate impacts. In addition, despite the intentions of inducing a sense of agency in both cases of climate visualization, participants critically negotiated messages concerning their roles as individuals in mitigating or adapting to climate change and assigned this responsibility to other actors. The findings showed that although climate visualization presents certain communicative qualities, it is not a panacea for engaging lay audiences with climate change. It also underlines the importance of considering cultural and social aspects of the communicative event when studying and developing climate visualization tools as a means of communication. (Ballyntine, 2018)

Successful communication of the climate crisis in social life, the media, and educational settings is crucial. Thus, using basic communication techniques, local or regional examples. Therefore, it represents clear and straightforward communication of scientifically based facts about the climate crisis. All topics on climate crisis are transversal topics aiming at slowing down and adapting to climate change as an opportunity to build a fairer society (group work, intuitive learning). We should ask ourselves what to do about the climate crisis. Thus, we must identify meaningful individual and collective climate actions through visuals. Also, in what way do we perceive climate narratives? We need to build a positive narrative in approaching the topic of the climate crisis and connecting it with everyday life (e.g., Greenwashing). Media needs to achieve readership without sensationalism and false reporting. Thus, there are evident positive and negative examples of reporting. In a positive and rational approach, readers will recognize the relevance of climate topics for their local reality. In that way, climate discourse will achieve penetration. Likewise, the role of education in climate change is critical.

One beneficiary of Climate change institutional awareness (mainly by the Global North) could be the Horn of Africa, where the World Bank has committed \$1.88 billion to help the region cope with severe drought and build resilience. With GFDRR and other partners in the effort, including Google, the World Food Program, and the National Aeronautics and Space Administration (NASA), the Bank met earlier this month to discuss sharing data. A new Horn of Africa data website will be accessible through the Climate Change Knowledge Portal and the Open Data site. "Because there is so much unknown and so much data out there, it is going to be important that the data is accessible," said Jason Kessler of NASA. "To be able to study and understand what is going on meaningfully, it will require as much information as people can get their hands on." (Reliefweb, 2011) Thus, the Climate Change Portal helps visualize world climate and expand access to data.

Regarding visualizing climate change, Toby Smith, Visuals and Media Program Lead at Climate Outreach in the UK, discussed how Climate Visuals, a program of Climate Outreach, translated research insights into seven accessible Core Principles and created a reference library of hundreds of photographs for public use. Climate Visuals focuses on how images can motivate action – emphasizing digital media. His talk proved very popular, with over 350 people attending the virtual event worldwide, demonstrating the widespread need in the climate community for best practices on selecting and distributing visual content to motivate action. He has a strategic goal of expanding the Climate Visuals program's presence, influence, and impact in the media and photographic sectors. The Yale Center for Environmental Communication and the Yale Program on Climate Change Communication hosted the second talk in the 2021 mini-series on the power of visual communication in the climate sector.

Below are four high-level takeaways from Smith's insightful presentation:

1. Nothing apart from a shutter sound happens when you press that button on the top of a camera: The life of a photo is defined by the way it is used, whether it be by NGOs, campaigns, social media, or the editorial world. The placement and distribution of the image are what determine its impact. Photographers sit at the bottom of the media food chain.

2. Two sides to environmental photography: Environmental photography is an art like any other – there are techniques and aesthetics to consider. On the other hand, there is so much to learn empirically from message testing about how images factor into communications and what makes them land. Smith reflected that his career is trying to balance the two.

3. Ineffective imagery: Type "global warming" into Google, and you get a clipart of the Earth on fire. While it may be illustrative, it could be more practical. What is compelling is people-centered narratives and positive solutions. "Imagery must resonate with the identity and values of all viewers, not just... those already in the green bubble." The illustration is not an impact; the stereotypical images of climate change only prompt a vast amount of cynicism and fatigue.

4. Seven Climate Visual Principles:

a. *Show real people*: Staged or over-composed photographs often appear gimmicky, even manipulative, to most audiences.

b. *Show climate change causes at scale*: Images that focus on individual actions, such as driving SUVs or eating meat, often prompt a reactionary backlash from viewers. Large photographs contextualizing climate change's broad scale and impacts on everyday life are better.

c. *Understand your audience*: Levels of skepticism, political orientation, and many other factors change how different people see the same images.

d. *Tell new stories*: The old stories are cliché: the polar bears, the smokestacks, and the clear-cut forests. Image testing reveals that these have become ineffective at generating engagement.

e. *Show emotionally powerful impacts*: Message testing shows that destruction brought by extreme weather events is impactful and causes a broad desire to change behavior.

f. *Show local (but severe) impacts*: You must balance making it clear how impactful climate change is local while not trivializing and minimizing its global impact.

g. *Be careful with protest imagery*: The most significant level of cynicism, polarization, and alienating photos are those of climate protests. The average person does not identify with them. (Smith, 2021; Yale Program on Climate Change Communication, 2021).

Satellite images can complement investigative stories and provide evidence. However, to take full advantage of the wealth of information that satellite imagery offers, the following should be observed:

Determine the scale of the image to help you determine the size of the area you are analyzing;

Look for patterns, shapes, and geographic textures, including natural and man-made landmarks.

Detailed analysis of geographic features, including rivers, lakes, mountains, forest cover, or coastlines, and observing changes in these features can indicate climate change and its environmental impact.

Determine where north is to help determine the direction of movement of the subject of interest and/or shadows;

Analyze the direction of the shadows and the color of the terrain to help determine the date and time of taking a particular image;

Consider prior location knowledge to determine if something stands out in the environment.

Analyzing satellite images for climate change reporting requires careful observation and focus on specific elements. When analyzing satellite images, special attention should be paid to several key steps and factors, such as:

Image Resolution: Resolution refers to the clarity and detail of the image provided by a satellite image. High resolution allows better discrimination of details, while low resolution can limit the precision of the analysis. When selecting images for analysis, choose high-resolution images to obtain the most detailed view of the area of interest. For the analysis of images and recordings to be effective, the recordings must have a resolution of at least 10 meters per pixel.

Time of acquisition: The image taken can be critical for climate change analysis. Consider when the image was taken and how relevant it is to your story.

Identification of crucial indicators: Focus on critical indicators relevant to climate change. These may include changes in temperature, sea level, ice sheet area, vegetation patterns, or

environmental pollution. Identify these indicators on the satellite image and compare them to historical data to provide context for the occurring changes.

If one has doubts about the correctness and validity of the satellite image, he/she can check it in the following way:

Confirm that the image matches the original source; Compare the satellite image with other sources; Try checking when the image was taken using tools like suncalc.org to analyze the position of the sun and shadows; Consult a remote sensing expert.

If one is not an expert (e.g., journalist) in satellite image analysis, he/she should work with geographic information specialists, climatologists, or climate change scientists. They can provide additional understanding and interpretation of the images and confirm your findings. (*Tinjak, 2023*)

One of the most significant causes of insufficient coverage of climate change and related environmental topics is the need for more journalists and special sections closely specialized in various eco-issues. In addition, media reports on climate change are often based only on superficial transmission and translation of international news sources. The in-depth investigative journalist approach is lacking.

If we examine Climate change discourse profoundly, skepticism is a significant barrier to public engagement when we should all act as one. What about the power of photography, videography, and climate change awareness? Can an image make a difference if facts and words don't curve their little trust in what they are told? "The power of still photography has diminished during the digital age, but make no mistake that images, particularly of climate change, can bring the issue to life in a way that can capture people's imaginations, present vital and often unknown facts and statistics, and particularly for younger generations, make a mighty impression. Photography can capture the unseen and, with factual captions and words to accompany such images, can give people pause, change their minds, and prompt them to get involved and engage with the issue. Any one of these impacts is vitally essential and serves the more significant cause of saving our planet while creating new jobs and improving Mother Earth and our economies at the same time. - Ed Kashi, VII Photo Agency." (*Hermand-Grisel, 2020*)

Images are important because they represent the issue in people's minds. Complex concepts like climate change are given power through imagery that creates a shared understanding of the images that define it. Just as journalists and communicators seek to communicate effectively in written stories, we should aim to do the same with visual stories about climate change. Scientific imagery is helpful and engaging, particularly from the point of view of building curiosity about many different sciences and broadening knowledge about environmental security and climate change. Thus, the basis for concern about climate change is scientific evidence, and images documenting this evidence can be particularly effective when they supplement more expansive human narratives about climate change.

However, communicators should be wary of assuming their audience has scientific knowledge – or interest. When non-experts interpret scientific charts, their understanding does not match well with that of the experts who designed them. Such images rarely emerge from free association (“What image comes to mind when you think of climate change?”), despite being considered distinctive images of climate change. This suggests that scientific charts, however familiar they are, may not linger in the audience's imaginations and are not the most powerful visual stories. In terms of engaging wider audiences, one problematic feature of climate imagery is the absence of human stories: on the whole, it needs to focus on ordinary people. Every day, thousands of photographs of climate change are shared. When humans are depicted in these, politicians dominate, followed by public figures such as celebrities, protesters, and scientists. Research shows that images of politicians are often disliked; skepticism can make people essential, and they can do little about it. Images of stereotypical protesters and publicity stunts can elicit similar responses and are disliked across the political spectrum. On a broader scale, such figureheads frame climate change as a political and ideological struggle, which can enhance polarisation along political lines and alienate those who do not identify with the groups. Showing identifiable and ‘real’ people – who are relatable, credible, and whose connections with climate change are perceived as authentic – is essential for fostering greater

engagement across a broader audience. Candid photos of ordinary people dealing with the impacts of climate change elicit stronger reactions than staged photos. If the person depicted makes direct eye contact with the camera, it can be a powerful way to connect to the audience. (Corner, 2018)

The reality is that the world is on fire, underwater, and in trouble. The recent Intergovernmental Panel on Climate Change (IPCC) report states that climate change is widespread, rapid, and intensifying, a fact that we have been witnessing these past few months of raging wildlife, massive floods, and intense heatwaves worldwide. Things could get much more destructive if we do not take urgent action immediately. In conjunction with World Photography Day, "Greenpeace" has an updated conversation with photographers and an editor about photography and its role in discussing the urgency of the climate crisis. How do we visually communicate the climate emergency? What makes an impact? Can photography help to raise awareness of the climate crisis? There is no denying that the power of photography as a universal communication medium transcends language and cultural barriers. The planet needs everyone on board in the fight against climate change. These dedicated photographers and editors share with us how, through images, we can see the planet's vulnerable beauty, the devastating impact of our actions, and what we could potentially lose without immediate, direct action. (Kuen, 2021)

There is a growing interest in narratives and images of the climate crisis related to endangered forests and Indigenous communities. However, inconsiderate media publications risk simplifying and sensationalizing a complex story narrative. They often isolate and burden these communities with a responsibility to protect primary forests. At the same time, according to most recent research, the traditional knowledge of the world's indigenous peoples can be a vital tool in the fight to mitigate the growing climate crisis. Indigenous and local knowledge had played an increasing role in historical climatology, especially in areas where instrumental observations were sparse. For example, Peruvian fishermen had first thought of the name "El Niño" for the now well-known climate phenomenon in the tropical eastern Pacific Ocean. Researchers later linked it to the Southern Oscillation, and both were now jointly known as ENSO (El Niño Southern Oscillation). (Ghai, 2021)

Figure 8. The Indigenous peoples and their climate knowledge



Source: Downtoearth, 2021.

Critically, the authors of one study have compiled the mean relevance, valence, and arousal ratings of each 320 images into a database that is posted online and freely available. Their goal was to gather objective, quantitative data on how individuals viewed the affective characteristics of climate-related imagery to create an accessible stimuli database for experimental research on climate imagery. They achieved this goal while also supporting the findings of previous, similar studies on this subject that common subjects and emotional aspects are most salient to people when visualizing climate change. They also found that an individual's interest in the environment affects how they rate images as relevant or irrelevant to climate change. Non-expert opinions were prioritized, and it was

carried out to generalize to non-expert audiences viewing and using these images in future studies. (Lechman et al., 2019)

Conclusion

Climate change is a global factor in current and future security issues that has yet to penetrate broader security or resilience discourse, particularly in these fragile regions. International cooperation around disaster response and risk reduction is critical. However, adaptation and resilience planning must be active across these most fragile trans-continental regions. It could provide a sound basis for a thorough cross-continental and multilayered understanding of the future threat to improve government will and support risk management planning. The solution lies in climate-resilient development and social and political awareness to adapt to climate change and effectively tackle climate transition. It involves integrating measures to adapt to climate change with actions to reduce or avoid greenhouse gas emissions in ways that provide more comprehensive benefits. Demanding to fight against misconceptions and denial of the climate crisis and environmental fragility is essential because global warming will be consistent globally in these observed fragile Regions and the Global North.

That is why visualization instruments (cartography, maps, satellite images, photographs, interactive atlases, and video sequences) can be invaluable for climate change and all misunderstandings within action research and collective activism. It is crucial to provide access to a broad audience, both to knowledge and through interactive participation, through zooming the data itself. However, capturing complexity for a specialized audience, scientists and experts, and keeping simplicity for a global audience takes work. Visual Climate impacts are emotionally powerful, and when adequately presented and elaborated, they become effective ways of communicating to an audience. Cartographic visualizations of different features of climate change and the power of climate photography and its narratives are significant for public perception. Satellite images and their models can display how regions will look if global warming and rising sea levels continue. Computer simulations can demonstrate circumstances and future scenarios; numerous areas could lose their centers, and flooding would occur in many populated areas. It would affect the displacement of people, migrations, food security, and crime level and jeopardize human safety. Specular attention should be devoted to using various visual instruments and images to show the increasing fragility caused by the climate crisis. Climate change narratives through images are a vital part of climate change communication, but while there is a decent amount of research, the "power of images" needs to be studied more. Climate change and environmental security can be studied, predicted, and captured using photography. Increasingly, photography can help research the causes and effects of climate change. Likewise, various climate-engaged photographers can assist science in tackling climate change with solutions regarding climate resilience.

Climate change visualization and communication are critical and should be examined and comprehended more profoundly. In the near and distant future, the multidisciplinary and trans-disciplinary association between entirely different fields of science will bring more epistemological familiarity that will prevent complex challenges in the future. The effort that invests in mitigating climate change must be more remarkable, especially the general social and psychological awareness of citizens. The reason is that, in addition to the consequences on the economy, society, and the environment, other inevitable consequences of climate change will appear (floods, droughts, heat waves, changes in the amount of rainfall, lack of natural resources, loss of biodiversity, migrations, wars and conflicts, terrorism, etc.). Climate change will even more negatively and strongly affect Africa, the Caribbean, South Asia, and the Pacific Islands, starting with potentially more harmful impacts on human health and already terrible conditions (especially for those who work in an increasingly hot environment), even greater migrations, and other related disorders.

As with mitigation, crucial is action- research satisfactory politics. The new focus must be on the technological, social, psychological, and cultural aspects to ensure adequate climate change programs, commissions, governments, and various international expert institutions dealing with the adjustment. During the approaching "climate change transition," in a socio-political sense, it is essential that everyone is more actively involved in the policy-making process. The key is to ensure

an appropriate geopolitical and financial focus, a Global South/Global North honest association, and a transformation of the Global North policies during the transition. It aims to assist the fragile regions of Africa, the Caribbean, South Asia, and the Pacific Islands. Climate change action, environmental security, and human security are critical, especially regarding observed regions and sectors that will be most affected - countries with fragile human security.

We need technology, scientific, and educational focus to fight climate change. However, this is not only a technological and scientific issue but a social problem. Along with the social aspect, there is the problem of inequality, i.e., social justice - climate justice. Those who contributed the most to the climate crisis contribute the least to its solution. The government, practitioners, and policymakers must better understand human security's value and have a better climate security approach in addressing climate challenges in these regions. The climate policies should integrate and acknowledge the importance of visualizing instruments and climate communication into the resiliency approach. It must also include other workstreams related to environmental and human security. Climate change is a complex challenge that policymakers and practitioners must clearly understand and contextualize in the observed regions to help address the everyday challenges faced by communities across these countries.

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