

Spatial Hierarchy of Climate Injustice

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ABSTRACT

Background: Climate justice has emerged as an organising frame in the attempt at addressing the challenge of climate change. The principle that there should be no disproportionality in the burden of climate change, which underlies climate justice, is widely accepted. Be that as it may, climate justice analysis is usually based on an assumption that the global climate system is the norm. This article, based on facts and figures, makes the case for a spatial hierarchical organization of climate justice analysis. **Methods:** Data from four sources are used. These are published researches, position papers by climate change related organizations, statistical bulletins/abstracts of relevant organizations, and field observations/field records. A descriptive approach is the basic information/data analysis method from which conclusions are derived. **Results and Discussion:** Three spatial tiers of climate change and associated climate injustice (global, regional, and local) are identified, characterized and analyzed. The global one, which is the usual one discussed by extant works, though couched in terms of anthropogenic climate change, has a natural dimension. In contradistinction, the regional and the local ones are purely anthropogenic. The regional component examined is regional transborder pollution and the associated challenge of acid precipitation. Gas flaring in the Niger Delta region of Nigeria and the associated challenges form the basis of the local dimension. **Conclusion:** Climate (in)justice cannot be analyzed simply from the perspective of the global climate system. A spatial hierarchical organization is possible. Such a framework could be employed in other cases beyond the examples used here.

Key Words: Climate Injustice, Spatial Climate Injustice Hierarchy, Global Climate Injustice Hierarchy, Regional Climate Injustice Hierarchy, Local Climate Injustice Hierarchy.

INTRODUCTION

Climate justice, an aspect of environmental justice, has its basis in the perspective that there should be no disproportionality the impact of climate change. It is guided by the need to ensure an equitable and fair distribution of the burdens and the benefits, if any, of climate change [1-5]. Its formal origin is the Climate Justice Summit during the COP 6 meeting of 2000 in The Hague, Netherlands; although, the concept was first used in a 1999 report by Corp Watch, an American watchdog of multinational corporations. The subsequent Bali Declaration of 2002 [6, 7] and the 12 December 2009 demonstrations for climate justice by groups from all over the world during COP 15 in Copenhagen, Denmark [7], fundamentally catalyzed the acceptability and popularity of climate justice as a paradigm of the struggle against climate change. The several declarations on climate justice that have emerged are clear indications of its significance. The most significant of these are those of Durban, 2004 [8], Mary Robinson Foundation, 2013 [9], St. Julian, 2015 [10], Volmoed, 2015 [11], Suva, 2017 [12], and Girdwood, 2018 [13]. These declarations, in varying degrees, decried the impact of climate change and advocated determined efforts to address the challenges, taking into consideration the leading role the developed countries must play, being the main contributors to the challenge. It is significant that there have emerged several international and national networks pursuing the goods of climate justice.

The Paris Agreement on climate change [14-17] not only fundamentally promoted the international prominence of climate justice but also provided a meaningful framework. The preamble emphasized “the importance ... of the concept of climate justice when taking action to address climate change”. It recognized the fact that while “the principle of equity was fundamental, there was the need for “common but differentiated responsibilities ... in the light of different national circumstances”. It urged that

... Parties should, when taking action to address climate change, respect, promote and consider their respective obligations on human rights, the right to health, the rights of indigenous peoples, local communities, migrants, children, persons with disabilities and people in vulnerable situations and the right to development, as well as gender equality, empowerment of women and intergenerational equity.

The issue of climate justice was addressed in COP 27 of 2022 in Sharm El-Sheikh, Egypt, in its loss and damage provisions.

Apart from conceptualisations, the ever-increasing literature on climate justice reflects the issues raised in the preamble of the Paris Agreement. These issues may be divided into three broad groups. These are:

- (i) Climate injustice across geographical areas;
- (ii) Climate injustice among socio-economic groups; and
- (iii) Intergeneration climate injustice.

The research on the geographical dimensions of climate justice focuses on the disproportionate harm suffered by three key areas. These are the global south [18, 19], small islands [20-22] and coastal areas [23-25]. The socio-economic literature discusses the disproportionate impact of climate change on women [27-30], some races [31-34], and the poor [35-37]. Indeed, some researchers conceptualize the disproportionate burden on these disadvantaged groups as an

issue of human rights [38-40]. The research on intergenerational climate justice focuses on the disadvantaged position of future generations compared to the present one [41-43].

The extant literature on climate justice is based on the disproportionate burden consequent on the global climate system. There is little or no appreciation that lower levels of climate (Meso climate and Microclimate), different from the global macro climate, could generate their own disproportionate burdens. It is this realisation that is explored in this paper. The paper analyses the injustice that the different levels of climate throw up. Three levels and scales are identified and examined. These are the global (macro), the regional (meso) and local (micro). The global, (macro), is the one typically analysed in the literature. It is included for completeness.

METHODS: SOURCES OF DATA/INFORMATION

Four basic sources of data were useful. These included: (i) published researches; (ii) position papers by relevant organizations; (iii) statistical bulletins/abstracts of relevant organizations; and (iv) field observation/field records. The published researches provided information on the status of climate change and climate justice, and impact of climate change at different spatial scales. These scales included the macro (global), meso (regional) and micro (local). The relevant data at the macro level involved the global climate system while those of the meso scale included mainly the climatic implications of transborder pollution in regions of Asia, Europe and North America. The micro level data pertained the microclimate of gas flare sites in the Niger Delta region of Nigeria and related implications. The position papers/publications of organisations also provided information on the status and impact of climate change. The publications of the Intergovernmental Panel on Climate Change (IPCC) were particularly useful.

The statistical bulletins/handbooks of Nigeria's national oil company, Nigerian National Petroleum Corporation (NNPC) and the associated Department of Petroleum Resources (DPR), were the sources of data on the quantity of gas flared in the country, the pattern of gas flaring and the utilization of gas in the country. Publications of the Nigerian Electricity Regulatory Commission and NNPC were the sources of information on the location and operation of gas-powered electricity generating plants in the country.

In addition to the various secondary sources of data, field observation was carried out in a sample of gas flare sites. This facilitated the choice of communities close to gas flare stacks. Various characteristics of these communities, such as availability of electricity, supply and other infrastructural facilities, were also recorded through this approach.

THE GLOBAL (MACRO) SCENE

The global climate justice scenario, as indicated earlier, is currently the norm [e.g. 1-43]. This perspective is apparently based on the fact that the atmosphere, within which climate processes manifest, is monolithic and hence climate change processes also operate within a single sphere. Given this, the need for climate justice is generated within a single sphere. Thus, even where climate justice at a regional or local level is discussed, the climate reference is usually the impact of the global on the regional or local.

The manifestations and consequences that are disproportionately distributed globally include extreme climatic conditions, extreme weather conditions and sea level rise, with their

accompanying effects [44, 45]. Extreme climatic conditions have resulted in drought and desertification [46-48]. The fact that a predominant percentage of the people and areas affected are in the developing countries underlines the significance of climate justice. The Sahelian region of Africa is a typical example. These phenomena not only result in the deterioration of ecosystems, thereby negatively impacting their ability to provide ecosystem services [49, 50] but also particularly affect the agricultural productivity of these areas [51-53].

Extreme weather, particularly hurricanes/typhoons and heatwaves, has also emerged as a major component of the disproportionate burden consequent on climate change [54-57]. There is no doubt that hurricanes/typhoons and heatwaves are characteristic of both less developed and developed countries. For instance, China, U.S.A. and Cuba are the countries most affected by hurricanes/typhoons. The first two are developed and are leading contributors to the climate change challenge while Cuba, a less developed, contributes minimally to climate change. The issue is that countries such as Cuba, and the small island nations of the Pacific and the Indian Oceans, contributing little to anthropogenic climate change and with low resilience, are disproportionately impacted by extreme weather events.

Similarly, although sea level rise impacts all islands and all coastal areas [58-62], there is disproportionality in the impact on areas of the less developed countries. As in the case of extreme weather events, small island nations particularly in the Pacific, contributing little to climate change, are the most impacted and most vulnerable [63-68]. The burden in the small island States of the Pacific, which are low lying, such as Fiji, Marshall Islands, Solomon Islands, Micronesia, Tonga, Samoa, Tuvalu, and Kiribati, is characterized by inundation, flooding, coastal erosion, salt water intrusion and diminishing fresh water supply. Indeed, some of the islands in the Solomon Islands and Micronesia groups have already been submerged.

The various manifestations of climate change have also resulted in disproportionate health challenges in some impacted areas, particularly in the less developed countries [69-73]. Extreme climatic conditions, such as drought and desertification, usually result in famine and malnutrition, as was evident in the Sahel zone of Africa in the early 1970s. The scarcity of fresh water consequent on both extreme climate and extreme weather conditions promotes water-borne diseases, such as cholera and diarrhoea, as unsafe sources of water become the norm. Increased temperature results in changes in the ecology of vectors; thus promoting infections and increase in such vector-based diseases as malaria. Extreme weather events, such as heatwaves, increase heat-related morbidity and mortality particularly of vulnerable groups such as the elderly and children. Sea-level rise may result in anxiety and mental health challenges.

The global climate justice challenge is the most widespread and best appreciated. Be this as it may, there are lower levels of climate and climate change which could be meaningful bases for analyzing lower-strata climate justice. The next two sections examine these.

THE REGIONAL (MESO) SCENE

The anthropogenic climate conditions created at the regional level and the disproportionate distribution of the negative impact are the bases of this level of climate justice. The challenge of acid rain precipitation is a good case in point. The phenomenon has attracted a lot of research attention [74].

The conditions resulting in acid rain, acid snow, acid sleet and acid fog are the result of sulfur dioxide and nitrate oxides emission from mainly fossil fuel-based electricity plants and industrial processes. The emissions rising high into the atmosphere mix with water, oxygen and other chemicals and become sulfuric acid, sulfurous acid and nitric acid. It is these acidic substances formed through this chemical reaction that fall back to earth as acid rain and related precipitation. Given the constituents of acid rain, it has several environmental detrimental effects [75-79] that are spread over hundreds and even thousands of kilometres from the origin of the emission; thus becoming a regional challenge.

The fact that toxic emissions in a given location creates an unfavourable climatic condition underlines the climate justice challenge consequent on acid rain. Although, acid rain affects both the emission locations and others, the transborder dimension is particularly critical [80, 81] and raises more issues of climate justice than the within border. Typical climate justice settings at the regional level include:

- (i) Acid rain in the Scandinavian countries, (Norway and Sweden) resulting from emission mainly in Britain and Germany [82-84];
- (ii) Acid rain in the “Black Triangle” of Europe (a triangular area including Southwest Poland, Northwest Czech Republic and Southwest Germany) from emissions within and parts of Central European Countries [85, 86];
- (iii) Acid rain in Southeast Canada from emissions largely in U.S.A. [87-90]; and
- (iv) Acid rain in Japan and South Korea from emission largely from China [91-93].

Acid rain, consequent on toxic emissions from industries in Britain and Germany, has led to the acidification of lakes, in Norway and Sweden resulting in a reduction in their productivity. For instance, the availability of food for fish is adversely affected; so is the reproductive ability of fish. The result has been a drastic fall in the fish population of lakes and, in some cases, becoming devoid of fish. There is also decline in soil fertility, reduction in forest productivity and the phenomenon of dying forests [82-85]. The “Black Triangle” of Central Europe is a good example of a climate justice setting within a country. The acid rain challenge here, apart from the influence of emission from other areas, developed largely from the several coal-based power plants. These are plants that benefit, not only this area but also others in each of the three countries, Czech Republic, Germany and Poland; although, imposing environmental challenges in one region. The impact of acid rain here is mainly on forest resources, particularly the spruce trees, that have suffered considerable damage. The environmental challenge here has been such that the area was declared an “ecological disaster zone” by the United Nations Environment Programme [85, 86].

The very industrialised parts of North America and Asia have also faced the challenge of acid rain. The Canada-U.S.A. case is one of the oldest and best-known examples of transborder pollution. As revealed by the Trail Smelter pollution case [80], transborder pollution in Canada and U.S.A. is mutual; although, the predominant trend is U.S.A. to Canada. The southeastern parts of Canada, particularly Ontario and Quebec, are the most impacted. The water resources, particularly the lakes are the most affected environments [87-90]. Indeed, about 95,000 lakes in Canada have been adversely affected and there have been large losses of fish and other aquatic communities in more than 30,000 sensitive lakes in the provinces of Ontario and Quebec [89]. In many areas, particularly in the Sudberg region of Ontario, many fish species have become extinct. The soils and the forests have also been adversely affected [87-90]. The

contribution of China, being the largest economy and the most rapidly industrializing country, depending largely on fossil fuels, to the emission and acid rain challenge in Asia is overwhelming. All the countries bordering or relatively near China are adversely affected; Japan and South Korea being typical examples. Only about 30% of the acid rain generating emissions in each of Japan and South Korea is from internal sources. About 70% is from external sources overwhelmingly from China [91-93]. Thus, whereas the economic development generating the emission and acid rain benefits Chinese, the environmental detrimental prize is shared by other countries. Here lies the climate justice challenge.

The economic loss consequent on acid rain could be enormous. A study in China [94] indicated that the loss of construction materials as a result of acid precipitation was as much as 32.165 billion yuan in 2013. This was 0.057% of the gross national product and 3.4% of total expenditure on environmental pollution control that year. The amount involved would be extraordinarily large if other losses were added. The implication is that areas that bear a disproportionate burden of climate change suffer enormous losses. Given the various diseconomies from acid rain, attempts have been made at different levels of decision-making, subnational, national, regional and global, to address it [95-101]. For instance, at the international level, there have been several conventions and protocols addressing the challenge.

THE LOCAL (MICRO CLIMATE) SCENE

A number of microclimatic settings may be identified. The urban heat island and the issues of justice it throws up are a good example [102-103]. Be this as it may, the microclimatic conditions consequent on gas flaring in Nigeria and the associated issues of justice provide ideal settings for examining microclimatic justice. The Niger Delta region is the natural gas province of Nigeria, apart from being the center of the oil industry in the country. A significant proportion of gas found in association with crude oil is flared. Nigeria is one of the leaders in the flaring of natural gas. For instance, in 1991, the country flared 76% of the gas produced while the next in rank, Libya, flared 21%. The world average then was 4.8% and the OPEC average was 18% [104]. As Table 1 shows, although the percentage flared has decreased over the years, the proportion flared is still significant.

According to the American Association for the Advancement of Science, there were 96 gas flare sites, 74 on land and 22 offshore, in the Niger Delta region in 2010. Of these, 48 were located in close proximity of less than 100 metres to about 2 km. of inhabited locations. Typically, there were several gas flare stacks in each site [105]. The country's Department of Petroleum Resources identified 45 active sites in 2020 given the fact that the "gas flare out" policy and the initiation of the National Gas Flare Commercialization Programme has resulted, as shown in Table 1, in the reduction of gas flaring in the country.

The flaring of gas in the country has two major microclimatic consequences. These are the elevated temperature around the flare sites and the acid rain resulting from sulfur and nitrate emissions from the burning gas. Studies [106-110] have conclusively established that gas flaring results in the creation of arid conditions around the flare stacks. As is to be expected, temperatures increased with increasing proximity to the flare stacks. For instance, one study [104] reported that the air temperature was elevated by 4.3°C two km. from the flare stack, 9.2°C at a distance of one km. and 11.6°C 500m away. Acid rain, consequent on emissions from

the flaring is a major challenge. Field studies, particularly those based on rain water samples [111-117] in various parts of the Niger Delta region, indicate that it affects all parts of the region.

Gas flaring, particularly the consequent elevation of temperatures and acid rain, has adversely impacted ecosystems/ecosystem services, agricultural production and human health. One of the most critically impacted ecosystems, mainly from thermal effect of gas flaring, is the vegetation [118-120]. The result usually is the withering and death of plants in the immediate vicinity of flare stacks. Trees and plants in other surrounding areas that are not heat-resistant are destroyed. Consequently, fewer species survive while the vegetation becomes less dense. Thus, the ability of the vegetation to provide ecosystem services is adversely affected. This is particularly impactful because in the rural areas of the Niger Delta, people depend so much on the natural environment in the satisfaction of many basic needs. For instance, building materials such as wood, ropes and thatch become scarce. This is also true of medicinal plants which are an important component of the traditional health care system. Wildlife, locally referred to as "bushmeat" and wild fruits which are significant components of the diet of many, are also adversely affected. The acidity of the rains also means that an important source of drinking water is adversely affected.

The agricultural economy of the impacted areas suffers not only due to the elevated temperatures in the flare sites but also because of the impact on the productivity of the soils [121-124]. Studies [e.g. 106, 121] have shown that the ideal climatic conditions necessary for the cultivation of the staple food crops, cassava, yam, cocoyam, maize and plantain, are adversely affected, with a consequent threat to food security. This is complicated by the fact that the soil conditions around flare stacks are also unfavourable.

An additional burden gas flaring imposes on the people is the health implication. Gas flaring has resulted in several health risks in several parts of the Niger Delta region [125-131]. Prolonged exposure to gas flaring and the associated atmospheric pollution have resulted in the prevalence of pulmonary diseases in many of the communities. As studies [126, 130, 131] have indicated, there have also been the challenge of hormonal dysfunction and haematological diseases. Heart-related diseases, such as hypertension, have also been reported to be more prevalent in gas flare communities compared to non-gas flare ones.

Climate injustice, more appropriately microclimate injustice, is apparent in the gas flare communities; for, in spite of the burden, the benefits from the utilisation of gas are hardly ever enjoyed by the people. One typical case in point is electricity power supply. Natural gas, accounting for about 76% of electricity supply in Nigeria, is the main source; the other being hydropower. Table 2 indicates many of the gas-powered electricity generating plants are near the centres of gas production/flaring. However, because of government policy on the supply and distribution of power, the gas flare communities, being rural ones, typically do not have electricity supply (Table 3). The centralisation of electricity distribution complicates the issue. All power generated in the country is fed into a national transmission grid operated by a federal agency. Given the urban-biased development process in the country, most rural areas, including the gas flare communities, are not linked to the national grid. The gas flare communities suffer permanent glow of the gas flare stacks but only see the glow of electricity at night in nearby cities in the distance.

The gas flare communities are doubly disadvantaged. This is because crude oil production which necessitates gas flaring also hardly benefits the communities. This is a wider issue of environmental injustice in the Niger Delta region [132-135]. Although, there is a lot of environmental damage consequent on oil and gas production, other parts of the country benefit more from the resource. The gas-flare communities do not also benefit from the fines imposed on the companies flaring gas. This is because the amount realised from the fines (3 cents per 1,000 cubic feet in 1984 but from 2018, 2 dollars per 1,000 cubic feet for companies producing 10,000 or more barrels of crude oil and 0.5 dollar for those producing less), is paid into a federation account and distributed among the States.

CONCLUSION

The environmental justice movement has made a remarkable impact on the environment management process. The climate justice component of this movement has had some impact. The fundamental driver of the climate justice movement has been the concern about climate change. The various climate change conventions, particularly the Paris Agreement, and the work of the Intergovernmental Panel on Climate Change (IPCC) have brought out in clear relief the challenge of climate change.

The fact that the burden of climate change is not equally incident on all regions and people is usually explicit or implicit in the various conventions and work of IPCC. Understandably, given the fact that such conventions and works are global in outlook, the climate change challenge and the associated issues of climate justice are framed within a global perspective. The disproportionate burden of sea level rise in small islands and coastal regions, of extreme weather such as hurricanes/tropical cyclones in coastal areas, and of extreme climatic conditions in such regions as the Sahel of Africa typically dominate the discourse.

The burden of climate change and the associated issue of climate justice could be meaningfully analysed at scales smaller than the global. This is the thesis of this article. In addition to the global scale, smaller scales of the regional/meso and the local/micro are therefore identified and analysed.

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Table 1: Trend of Gas Flaring in Nigeria, 2001-2018

Year	Gas Production (Mscf)	Percentage Flared
2001	1,000,748,082	64.48
2002	1,340,591,744	68.70
2003	1,387,104,460	57.78
2004	1,584,922,039	53.73
2005	1,626,444,779	49.53
2006	1,542,136,671	53.20
2007	1,599,190,078	51.07
2008	1,593,835,503	42.09
2009	1,582,137,295	33.90
2010	1,865,159,719	29.21
2011	1,839,230,068	27.40
2012	1,872,875,894	24.84
2013	1,786,603,702	23.95
2014	1,880,374,658	20.94
2015	1,740,550,000	19.01
2016	1,517,667,415	19.04
2017	1,700,929,721	19.06
2018	1,716,822,031	18.71

Source: DPR, 2018 Nigerian Oil and Gas Industry Annual Report, p.54.

Table 2: Gas-Based Power Stations of Nigeria

S/No.	Name	State Located	Capacity (MW)	Proximity to Gas Production/Flares Sites*
1	Aba	Abia	140	Near
2	Afam iv-v	Rivers	726	Very Near
3	Afam vi	Rivers	624	Very Near
4	Alaoji	Abia	1,074	Near
5	Azusa	Edo	450	Very Near
6	Calabar	Cross River	561	Near
7	Egbema	Imo	338	Very Far
8	Egbin	Lagos	1,000	Very Far
9	Egbin Barge	Lagos	270	Very Far
10	Geregu I	Kogi	414	Very Far
11	Geregu II	Kogi	434	Very Far
12	Ibom I	Akwa Ibom	191	Very Near
13	Ibom II	Akwa Ibom	190	Very Near
14	Ihovbor	Edo	450	Very Near
15	Okpal	Delta	480	Very Near
16	Olorunsogo I	Ogun	336	Very Far
17	Olorunsogo II	Ogun	675	Very Far
18	Omoku I	Rivers	150	Very Near
19	Omoku II	Rivers	225	Very Near
20	Omotosho I	Ondo	336	Far
21	Omotosho II	Ondo	450	Far
22	Sapele I	Delta	420	Very Near
23	Sapele II	Delta	450	Very Near
24	Ugheli/Delta	Delta	900	Very Near

***Very Near = less than 100 km.; Near = 100-200 km.; Far = 201-300 km.;
Very Far = more than 300 km.**

Source: Compiled by Authors from Publications of Nigerian National Petroleum Corporation and Nigerian Electricity Regulatory Commission.

Table 3: Electricity Supply in a Sample of Gas Flaring Communities

S/No.	Name of Settlement	State Located	Availability of National Grid Supply	Availability of Oil Company Supply
1	Anieze	Delta	No	No
2	Beneku	Bayelsa	No	Yes
3	Burukiri	Delta	No	No
4	Ebedei	Bayelsa	Yes	No
5	Ekperikiri	Delta	No	No
6	Erhoike	Delta	No	No
7	Gbatan	Rivers	No	Yes
8	Kula	Rivers	No	Yes
9	Mbodo-Aluu	Akwa-Ibom	No	No
10	Mkpanak	Rivers	No	Yes
11	Nedugo	Rivers	No	No
12	Obagi	Rivers	No	No
13	Obite	Rivers	No	Yes
14	Obrikom	Bayelsa	No	Yes
15	Obukiri	Bayelsa	No	Yes
16	Obunagha	Rivers	No	Yes
17	Obuocha	Bayelsa	No	Yes
18	Ogboinbiri	Delta	No	No
19	Okwuibome	Rivers	No	No
20	Oloma	Bayelsa	No	No
21	Olugbobiri	Rivers	No	Yes
22	Oton-Yasene	Rivers	No	No
23	Soku	Bayelsa	No	Yes
24	Tengi-Tereke	Delta	No	No
25	Youbebe-Ogulagha		No	Yes

Source: Authors' Fieldwork.