The Changing Role of Agriculture in the Global Climate Policy Regime

GOUTHAM R

The UNFCCC treaty of 1992 conceived of the agriculture sector primarily as a site of adaptation. However, there has been increasing pressure in the global climate regime to reconfigure agriculture into a site of deep emission cuts to meet the Paris temperature targets. Land-based mitigation measures—as opposed to adaptation measures—are prioritised and promoted by influential sections, including developed countries and international development and climate organisations. The emphasis on mitigation is an extension of the strategy of developed countries to transfer the responsibility of deep emission reductions to developing countries in the context of the failure of the former to undertake deep emission reductions in the decades following the establishment of the UNFCCC.

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Goutham R (*goutham.radhakrishnan@gmail.com*) works with the Climate Change Programme, M S Swaminathan Research Foundation, Chennai and is a PhD student at the School of Habitat Studies, Tata Institute of Social Sciences, Mumbai.

Agricultural emissions constituted only 12.42% of the total global greenhouse gas (GHG) emissions in 2021. In contrast, emissions from the energy sector were significantly higher at 73.31% of the global GHG emissions. If the livestock sector was excluded, the share of agricultural emissions would drop to 6.1%. If one considered only the least developed countries (LDCs), their share of agricultural emissions in global emissions was less than 2% (Table 1). In other words, the usually cited figures (Crippa et al 2021; Vermeulen et al 2012) on the contribution of agricultural emissions to global emissions are misleading. These figures include both input and output supply chain emissions, which are not included when emissions from industrial sources are estimated and cited.

Yet, climate change is a threat multiplier that amplifies the existing abiotic and biotic stressors and structural challenges faced by agriculture and allied activities. In developing countries, where small and marginal farmers dominate the rural areas, climate shocks are likely to have a direct negative impact on food and nutrition security, poverty eradication, and rural development. While the impacts of climate change are likely to be large in the developing world, their emissions are best termed "survival emissions." In contrast, emissions from the economically advanced countries are "luxury emissions" arising from profligate resource consumption (Climate Equity Monitor 2023).

The documented and realised impacts of climate change on agriculture—varying across regions and in intensity—are lower crop yields and livestock yields due to extreme weather events like droughts, floods, and heatwaves, changes in the timing and duration of seasons, water shortages and increased soil erosion and degradation. The impacts are harsher on regions with development deficits and dependence on climate-sensitive livelihoods, such as South Asia, West, Central and East Africa (IPCC 2022a). Given the correlations between climate risks and vulnerabilities and the prevailing developmental patterns—rather than differences between emission scenarios—the Working Group II (WG II) of the IPCC Sixth Assessment Report (AR6) noted the urgency to pursue socio-economic

Table 1: Emissions from Agriculture as a Share of Annual Global GHG Emissions, 2021 (in %)

Region	Share of Emissions from (%)	
	Agriculture Including Livestock	Agriculture Excluding Livestock
World	12.42	6.10
Non-annex-I countries	9.32	4.56
Least developed countries	1.91	0.96
Annex-I countries	3.04	1.52

Source: Author's calculations based on PRIMAP V2.4.2 database (Gütschow and Pflüger, 2023).

development and enhancement of adaptative capacity in these regions (IPCC 2022a). For example, there is an urgent need to implement robust science-based adaptation measures in the agricultural sector that are aligned to the needs of raising productivity and farmers' incomes and bolstering food security.[1]

However, land-based mitigation measures in agriculture—as opposed to adaptation measures—have been prioritised by international development and non-profit organisations, a section of climate scientists, global civil society and media, and in some recent IPCC reports. This paper would argue that an emphasis on mitigation is an extension of the strategy of developed countries to transfer the responsibility of deep emission reductions to the developing countries, particularly in the context of historical inactions by the former. Thus, a package of policy shifts has been advocated, parts of which contradict erstwhile priorities for agriculture in the global climate policy regime.

We begin with an overview of the history of agriculture within the global climate regime. Subsequently, the characteristics of the recent policy shifts in agriculture vis-à-vis climate change are traced. Further, the possible motivations for this policy shift are described. Finally, the potential implications of these policy shifts on the global South are discussed.

Agriculture in the Global Climate Policy Regime

The United Nations Framework Convention on Climate Change (UNFCCC), which came into effect in 1992, calls for climate action based on equity and in accordance with countries' common but differentiated responsibilities and respective capabilities (CBDR&RC). The UNFCCC considered the vulnerabilities and developmental needs of developing countries and accorded them flexibility in carrying out emission cuts. It mandated developed countries to undertake emissions cuts and provide new and additional financial resources to meet the needs of climate action in developing countries. This was a critical foundation on which the global climate governance regime was established and evolved.

Reflecting the spirit of equity and differentiation in the UNFCCC, "Agriculture, Forestry and Other Land Use" (AFOLU) was envisaged as a site of adaptation and not a carbon sink. As per Article 2 of UNFCCC, its ultimate objective was the stabilisation of GHG concentrations at a level that would prevent dangerous anthropogenic interference in the climate system. This stabilisation was to be achieved within a time frame to "allow ecosystems to *adapt* naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner" (UNFCCC 1992: 9).

Since the establishment of the UNFCCC, developed countries have attempted to extend the burden of deep emission cuts to the global South. This trend began during the negotiations towards the Kyoto Protocol, where many developed countries proposed, relatively successfully, to incorporate land-based carbon sinks and negative emissions into international climate policy discussions. The aim was to provide flexibility and cheaper alternatives for the deep decarbonisation of the economies of the global North (Carton et al 2020). Jung (2004) showed that countries that were the most opposed to strong international climate action, such as the United States, were also the staunchest advocates of land-based carbon sinks in the Kyoto Protocol negotiations. But although land-based sinks were discussed, emissions from agricultural production were not under focus in the global climate policy and negotiations in the two decades after 1992.

The focus on agriculture in the UNFCCC began to gain traction at the 17th Conference of Parties to the UNFCCC (COP-17) held in 2011 in Durban. For the first time, parties allowed the Subsidiary Body for Scientific and Technological Advice (SBSTA) to consider agriculture as an agenda item at its 36th session (SBSTA 36).[2] Agriculture has since then been a part of SBSTA agenda items. From SBSTA 36 in 2011 till SBSTA 46 in 2017, discussions on agriculture were framed in terms of themes like enhancing adaptation, increasing productivity, rural development, food security, finance, technology transfer and a recognition of the diversity of agricultural production systems. SBSTA 47 continued the exchange of views on issues relating to agriculture, considering the outcomes of the past in-session workshops and parties' deliberations and the progress made at SBSTA 46. At the end of SBSTA 47, a draft decision titled "Koronivia Joint Work on Agriculture" (KJWA) was recommended to COP-23 and adopted as a decision (UNFCCC 2017).

The COP-23 decision establishing the KJWA requested countries to submit their views on climate action in agriculture through six "Koronivia workshops." It, however, made no reference to the question of differentiation across countries despite demands from the developing countries. Subsequent negotiations witnessed the deepening of fault lines between developed and developing countries. Developed countries began to prioritise reductions in agricultural emissions in addition to their earlier focus on forest carbon stocks and other land-based negative emissions in the AFOLU sector. Additionally, they refused to acknowledge the vastly different circumstances under which agriculture, as a productive economic activity, is undertaken in the global South as compared to the global North.

In response, developing countries were resolute that discussions must focus only on adaptation if differentiation was not explicitly addressed in climate action in agriculture (Urrutia and Siemons 2020). During their Koronivia negotiations and submissions made to the UNFCCC, developing countries from Asia and Africa highlighted the challenges faced by agriculture in the global South, including low yields and low use of external inputs, prevalence of subsistence modes of production, underdeveloped infrastructure, high vulnerability to climate extremes, relatively high contribution of agriculture to GDP and employment, and the need to increase productivity. They also demanded vastly enhanced international cooperation and support with respect to financial resources and capacity building, technology transfer, enhancing adaptive capacities, and securing food security (UNFCCC 2023).

While these fault lines were deepening, during the COP-27 held at Sharm el-Sheikh in 2022, developed countries once again pushed for targeted action to reduce agricultural emissions. It even appeared in the final decision text as a key area of focus. However, the persistent opposition from developing

countries resulted in the addition of a caveat that solutions were "context-specific" and regional, local, and national circumstances were to be taken into consideration while addressing issues in agriculture.

The Turn to Mitigation

Following COP-23 in 2017, climate policy discussions led by the developed nations and organisations based in the global North shifted markedly. There was a definitive shift towards using agriculture as a key means of reducing global emissions to meet temperature targets. This was in sharp contrast to the earlier view of crop production as primarily a site of adaptation.

In an important review of the reports of the High-Level Panel of Experts (HLPE) on Food Security and Nutrition, Jayaraman (2021) outlined the defining features of the policy shift in agriculture (FAO 2019, 2020). The first related to how agriculture was conceived in the discussions led by developed countries. With mitigation as the focus, agriculture came to be conceptualised in terms of ecological conservation rather than as a productive activity. For example, the COP-27 decision text described farmers, including smallholders and pastoralists, as "stewards of the land" who were "inclined to apply sustainable land management approaches" and vulnerability to climate change as "a challenge in fulfilling this important goal" (UNFCCC 2022b). Theories on natural resource conservation were privileged over agricultural science in directing policy.

Second, the aim of productivity growth was dismissed or relegated as a lower policy priority. Policy recommendations favoured low-input, low-productivity and low-profitability agriculture using languages appropriated from mainstream agricultural sciences. For example, irrigation was denounced as detrimental for environment and climate adaptation; the use of chemical fertilisers was decried; food supply was to focus on "local" production; livestock production was disapproved of; and the replacement of rice and wheat by millets was advocated without acknowledging the technical and socio-economic barriers to increasing millet production and consumption.

Third, certain points of view that were historically marginal in their policy impact began to attain a mainstream status. For example, there has been increasing importance accorded to degrowth and associated concepts as a theoretically reasonable response to the complex challenge of improving human welfare in the era of global warming (Gerber 2020; Guerrero Lara et al 2023; Hickel 2020; Kallis 2011).

Fourth, prominent multilateral institutions, such as the FAO (nd, 2019, 2022a, 2022b) but also others, began to advocate for the conservation agenda in policy discussions. Previously, the FAO was an important source of information and technological knowhow on the need for increasing productivity in agriculture even if they overlooked the social, political, and institutional barriers to agricultural production. But more recently, the FAO and other international organisations have begun to share a deep scepticism towards modern agricultural practices on grounds falsely attributed to the green revolution and not validated by agricultural science (see papers by Ramakumar and Sandipan Baksi in this issue). As a result, many smaller developing nations were deprived of the right kind of technical advice, information, and inputs to participate effectively in negotiations and framing appropriate domestic policies in agriculture.

In another curious development in emissions accounting, emissions from crop production were sought to be labelled under "food systems." The Special Report on Climate Change and Land (SRCCL) of the IPSS defined food systems as "all the activities and actors involved in the production, transport, manufacturing, retailing, consumption, and waste of food, including production, transport, processing, packaging, storage, retail, consumption, loss, and waste" (Mbow et al 2019). Instead of accounting for emissions from different sectors on a direct basis, as in the standard IPCC emissions accounting procedure, emission accounting in agriculture was modified to also include indirect emissions from all sectors and activities indirectly associated with it. Consequently, emissions from activities like fertiliser production or transportation, which were previously accounted for under industry and transportation sectors, were now included under agrcultural emissions.

Having inflated agricultural emissions with such a methodological change, "food systems" were then identified as one of the crucial sites of mitigation to achieve emission reduction targets in the global South. Similar inclusion of indirect emissions was not undertaken for other sectors that contributed a larger share of global emissions. For instance, emissions accounting in the energy sector, the most important source of GHG emissions globally, does not include emissions associated with the manufacturing of power production machinery like turbines or generators.

It must be mentioned that the pressure to shift policies as described earlier had begun much before 2017 from various quarters of the scientific and policy community. But it was after 2017 that they came together into a unified mass of policy appeals with considerable political, financial and institutional backing, culminating in the KJWA at COP-23. One of the products of this convergence of views was the emergence of new concepts, such as Nature-based Solutions (NbS) and agroecology, which have currently become pervasive in the academic and policy circles.

Nature-based solutions and agroecology: NbS, which was first mentioned by the World Bank (2008), has had no single definition or standards (Sowińska-Świerkosz and García 2022). To date, scholarly research on NbS has remained largely conceptual, either offering principles and frameworks for implementation and/or assessment or reviewing the concept's origins and use. Despite the concept's policy relevance and ramifications for people and the environment, little empirical research is currently available. Even the limited empirical studies, available mostly from the developed countries, focus narrowly on the environmental benefits of NbS, and no study has comprehensively evaluated its social, economic, and environmental benefits (Hanson et al 2020).

Closely related to NbS, and often presented as a part of NbS, is the concept of agroecology. According to FAO, agroecology is a "holistic and integrated" approach that simultaneously applies "ecological and social concepts and principles to the design and management of sustainable agriculture and food systems."

Adherents assert that agroecology is concurrently a science, a set of practices, and a social movement. It is argued to be optimising the interactions between plants, animals, humans, and the environment while also addressing the need for socially equitable food systems within which people can exercise choice over what they eat and how and where it is produced (FAO 2019, nd). It claims to endorse diversification, mixed cultivation, intercropping, cultivar mixtures, habitat management techniques, biological pest control, improvement of soil structure and health, biological nitrogen fixation, and recycling of nutrients, energy and waste.

These are indeed desirable outcomes but, as Jayaraman (2021) points out, each of the practices mentioned lacks a distinctive characteristic that sets it apart as "agroecological" compared to other approaches. Additionally, each practice seems to have originated independently of this seemingly novel concept. Agroecological approaches strive to eliminate all external inputs using closed local resource loops, endorsing local knowledge and direct exchange between farmers, promoting labour intensification, and relying on local markets (FAO 2019). They challenge the notion of economies of scale and advocate farm-level self-sufficiency employing labour-intensive techniques. While it does not prioritise science to boost productivity and output, it may utilise scientific advancements to bolster sustainable and low-input practices at the local level. Like for NbS, empirical studies examining the agronomic and socio-economic performance of agroecology practices are not yet available.

Despite the lack of conceptual clarity around the terms, what is common to almost all framings of NbS and agroecology is that they are presented as "cost-effective" measures that deliver a "triple win" for climate, biodiversity, and society (Jaiswal et al 2023). This framing appears to address multiple objectives, including cheap mitigation (since these "solutions" require far fewer financial resources compared to similar efforts in industry, energy, and transportation sectors in the global North), slows down the pace of industrial and infrastructure growth, and successfully draws developing countries into adopting mitigation policies on par with developed countries. It also leverages the general reverence for nature in developing societies to actively promote the idea.

In the Indian context too, the promotion of agroecological techniques like no-till and regenerative agriculture, and a broader policy shift towards emphasising conservation and mitigation in agriculture, can be observed. This includes the endorsement, under the garb of agroecology, of not-validated concepts like zero budget natural farming (ZBNF), which sideline or ignore established agricultural science. The currently popular version of ZBNF, or natural farming, has no significant benefit over conventional agriculture (Ramakumar and Arjun 2019; NAAS 2019), except in situations where smallholders apply no inputs at all, and hence any extension advice provides opportunities for some improvement.

Leveraging Modelling Studies and Climate Finance

Modelling studies: Different modelling exercises are used to lend a semblance of scientific validity and justify the advocacy of mitigation in the AFOLU sector, especially in the global South. The first are a set of modelling studies, almost all conducted in the global North, that estimate the mitigation potential of land-based mitigation measures (Roe et al 2019, 2021). These models, driven purely by the cost-minimisation logic, declare that more than 80% of the cost-effective mitigation potential is in developing and LDCs (Nabuurs et al 2022; Roe et al 2021). By their own admission, these modelled mitigation pathways do not make "assumptions about global equity, environmental justice or intra-regional income distribution" (IPCC 2022b), but rather explore cost-effective pathways to limit temperature rise, thereby allocating emission reductions wherever it is cheaper. To be more specific, cheap mitigation measures in developing countries translate to protecting, restoring, and managing forests, carbon sequestration and reduction in emissions from agriculture (IPCC 2022b).

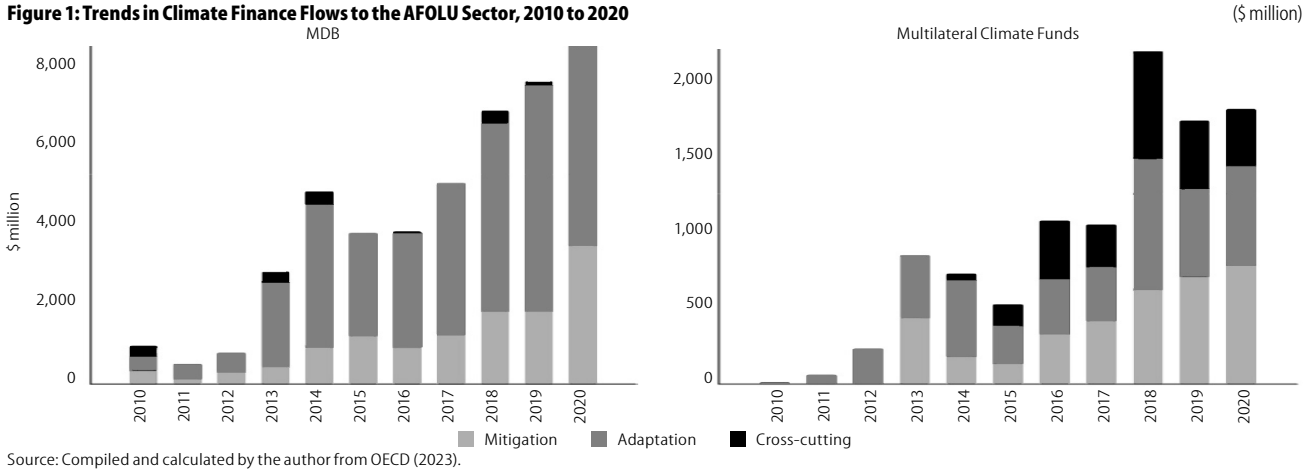
Despite the highly iniquitous nature of prevailing modelling studies, it is possible to develop alternative models that allow different sectors and regions to share the mitigation burden based on fairness and equity (Kanitkar et al 2013; Baer et al 2012; Holz et al 2019). Therefore, statements about the unavailability of rapid mitigation led by the AFOLU sector in meeting 1.5°C or 2°C temperature targets (CCAFS-CGIAR 2016; Hole et al 2022; Lynch 2020) are an outcome of inequitable assumptions and normative choices made by the modelling studies.

Climate finance: Another avenue to force the hand of developing countries in climate policy is the emerging international climate finance regime. Developing countries are facing mounting pressure from the climate finance institutions to prioritise land-based mitigation efforts. Based on the modelling studies discussed earlier, there has been a surge in global finance flows towards mitigation in the agriculture and forestry sector (Jaiswal et al 2023). According to OECD (2022) estimates, mitigation finance from developed to developing countries targeting the energy sector decreased between 2016 and 2020, both in relative terms (51% to 44%) and in absolute terms (by $0.8 billion). In contrast, mitigation finance steadily increased in agriculture, forestry, and fisheries, marking a shift away from adaptation finance (Jaiswal et al 2023).

Data in OECD (2023) details the shift in global climate finance flows towards mitigation in the AFOLU sector (Figure 1, p 68). Between 2010 and 2020, the AFOLU sector received $39.5 billion in climate finance from multilateral development banks (MDB), of which 69.4% went towards adaptation, 27.8% went toward mitigation, and 2.8% went towards cross-cutting goals (both mitigation and adaptation). Out of the $10 billion finance from multilateral climate funds, 41.8%, 35.2% and 23%, respectively, went to adaptation, mitigation and cross-cutting. While adaptation still dominates climate finance provided by MDBs to the AFOLU sector, the share of mitigation finance rose to 41% in 2020 from 15% to 32% between 2013 and 2019. There is a clear trend in finance from multilateral climate funds shifting towards cross-cutting and mitigation financing at the expense of adaptation.

Several multilateral organisations have called for aligning the AFOLU sector finance to pursue the Paris Agreement's 1.5°C global warming limit (FAO 2022b; IFAD 2022). The sectoral

Figure 1: Trends in Climate Finance Flows to the AFOLU Sector, 2010 to 2020



Source: Compiled and calculated by the author from OECD (2023).

guidance and strategy documents of the multilateral climate funds and multilateral organisations are now framed around NbS, low-emission resilient agricultural systems, and ecosystem and forestry measures that integrate mitigation, adaptation, and biodiversity concerns (FAO 2022a, 2022b; GCF 2021, 2022a, 2022b; IFAD 2022).

The increasing efforts to redirect the flow of international climate finance towards mitigation need to be read alongside the observation by IPCC that the current global finance flows for adaptation are inadequate and hinder the implementation of adaptation options in developing countries (IPCC 2022a). Annual adaptation needs are projected to reach $160–$340 billion by 2030 and $315–$565 billion by 2050, with a significant portion in the AFOLU sector. Developing countries currently require five to 10 times more adaptation funding than they receive from international sources, and the gap has continued to grow (UNEP 2022). The UNFCCC Standing Committee on Finance estimated that the total adaptation finance in 2020 was only about 9% of the total global climate finance flows. Considering public finance flows from developed to developing countries, adaptation constituted only 23.3% of the total $72.7 billion mobilised (UNFCCC 2022a).

Therefore, the pressure from the global North to channel climate finance away from adaptation towards mitigation in agriculture, by altering the financing strategies of major multilateral donor organisations, would compel developing countries to undertake deeper emission reductions in agriculture, even at the cost of their food security and livelihoods.

Exploring the Motivations

There is irrefutable scientific evidence that the increase in global average temperatures over the pre-industrial levels is directly proportional to the cumulative emissions of carbon dioxide, primarily from the use of fossil fuels, for economic activities (IPCC 2021). Therefore, to limit the temperature increase to 1.5°C or 2°C, over pre-industrial levels, there is a limit to the cumulative emissions from all countries that can be emitted. This limit on the cumulative emissions is the global carbon budget. As per the latest estimates, the bulk of the global carbon budget has already been exhausted, primarily on account of the historical emissions by developed countries categorised as Annex-1 countries.

However, three decades since the Rio Conference, the developed countries have failed to undertake any meaningful emission reduction at a scale and pace commensurate with their historical responsibility, capabilities, or what is scientifically required to avoid overshooting the temperature targets. On the other hand, they continue to appropriate far more than their fair share of the remaining global carbon budget (Kanitkar and Jayaraman 2019). Annex-I countries, despite being home to less than one-fifth of the global population, contributed more than four-fifth of the cumulative emissions between 1850 to 1990 (Table 2).

The Table from the Summary for Policy Makers (SPM) of the IPCC's Sixth Assessment Report (AR6) (IPCC 2021), presented in a modified form in Table 3, gives the estimate of historical CO2 emissions (1850–2019) and remaining carbon budgets (2020 onwards), for different temperature limits and different probability levels. Two of them correspond to the Paris Agreement temperature goal of limiting global warming to well below 2°C and preferably to 1.5°C, compared to pre-industrial levels, and the third to an intermediate value of the temperature.

In short, only a small proportion of the global carbon budget is remaining for the world to stay below the temperature targets set by the Paris Agreement. The remaining carbon budget is particularly small for a 50% probability of staying below 1.5°C; at current rates, this is expected to be exhausted within a few years. Despite this scientifically established fact, developed countries have done little to ratchet up their mitigation actions. The

Table 2: Share of Cumulative Emissions between 1850–1990 and 1990–2019 by Major Annex-I and Non-annex-I Countries (%)

Regions	Share of Global Population 2019	Share in Global Cumulative Emissions, 1850–1990	Share in Global Cumulative Emissions, 1991–2019
Annex-I countries	18	81	49
US	4	29	31
Canada	0.50	2	2
Australia	0.33	1	1
Japan	2	4	4
Germany	1	8	3
UK	1	7	2
EU (27)	6	23	12
Russia	2	9	6
Non-annex-I countries	82	19	51
China	18	5	22
Brazil	3	1	1
South Africa	1	1	1
India	18	2	5

Source: Climate Equity Monitor (www.climateequitymonitor.in).

net-zero targets announced by all the major developing countries also fall short of the year required to stay within their fair share of the remaining carbon budget (Table 4).

Developed countries, confronted with the rapidly depleting carbon budget to stay within temperature targets, are using their inordinate levels of influence within the global policy regime to transfer the burden of emissions reduction onto the developing countries. In this context, as a strategy to delay and substitute deep emission reductions in fossil fuels, agriculture and allied land-based sectors in the developing countries are being painted as sites of cheap emission reductions and carbon sinks (Anderson and Peters 2016; Carton et al 2020).

Table 3: Remaining Carbon Budget for Different Probabilities of Staying Below 1.5°C, 1.7°C and 2°C Temperature Limits

Approximate Global Warming Relative to 1850–1900 until Temperature Limit (°C)	Additional Global Warming Relative to 2010–2019 until Temperature Limit (°C)	Estimated Remaining Carbon Budgets from the Beginning of 2020 ($GtCO_2$) Based on the Likelihood of Limiting Global Warming to the Temperature Limit				
		17%	33%	50%	67%	83%
1.5°C	0.43°C	900	650	500	400	300
1.7°C	0.63°C	1,450	1,050	850	700	550
2°C	0.93°C	2,300	1,700	1,350	1,150	900

Source: Summary for Policy Makers (SPM) of the IPCC AR6 WG I, Table SPM.2 (IPCC 2021).

Table 4: Declared Net Zero Target versus Required Year of Reaching Net Zero to Stay within the Fair Share of Their Remaining Carbon Budgets, Selected Countries

Country	Declared Year of Reaching Net Zero	Required Year of Reaching Net Zero to Stay within Fair Share of Remaining Carbon Budget	
		1.5°C (50% Probability)	2°C (67% Probability)
US	2050	2025	2032
Canada	2050	2025	2033
Australia	None	2024	2031
Japan	2050	2031	2046
Germany	2045	2030	2045
UK	2050	2035	2057
EU (27)	2050	2031	2047
Russia	Not declared	2026	2036
China	2060	2031	2047
World	Second half of century	2037	2062

Source: Compiled and calculated by the author and Sreeja Jaiswal from OECD (2022).

In Conclusion

If agriculture was previously seen as a site of climate adaptation, the focus in the recent years has shifted to reducing emissions in agriculture, especially in the developing countries. The policy shifts that enable new focus are characterised by a new framing of agriculture: as a site of environmental conservation rather than of production. Most modelling studies used to advocate mitigation in the AFOLU sector in the developing world are based on cost minimisation assumptions that ignore inequalities across countries. New policy recommendations focus on low-input, low-productivity agriculture, and receive extensive climate finance and other economic supports from multilateral development and financial organisations.

The interface of agriculture and climate change needs to be studied in the context of the concerted attempts by the global North to shift the burden of global environmental conservation and climate action on to the global South. In this process, the productive capacities in the global South are being weakened. Prioritising mitigation measures in agriculture can also lead to a compounding of socio-economic vulnerabilities in the global South.

Developing countries, with their low historical contribution to cumulative emissions, must be able to independently determine the course of their low-carbon development pathways. These determinations must be based on their development priorities and capabilities, and their compatibility with critical goals related to food security and livelihoods. Fundamental principles of equity and differentiation, as explicated in the UNFCCC, entail that these countries should not be expected to take on heavy mitigation burdens in agriculture and allied sectors.

NOTES

1 Various studies have suggested that closing yield gaps by increasing productivity, rather than bringing more land under crop production, is the most sustainable path for achieving food security (Foley et al 2011; Godfray et al 2010; Mueller et al 2012; Phalan et al 2011). Yuan et al (2021) show that most paddy cropping systems have room for increasing yield, resource-use efficiency, or both with the potential for aggregate total rice production enhancement pegged at 32%. See also Isaac and Jayaraman (forthcoming).

2 The SBSTA is one of two permanent subsidiary bodies to the UNFCCC (along with Subsidiary Body for Implementation) which supports the work of the COP (Conference of Parties to the UNFCCC), the CMP (Conference of Parties to the Kyoto Protocol) and the CMA (Conference of Parties to the Paris Agreement) through the provision of timely information and advice on scientific and technological matters.

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