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The role of nationally determined contributions in transitions toward sustainable food systems

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Introduction

In December 2023, the 28th Conference of the Parties (COP 28) of the United Nations Framework Convention on Climate Change assembled in Dubai for its annual summit around meeting the 2015 Paris Accord climate goals of limiting average global temperature increases to 1.5–2.0 °C by 2050. This COP featured a first-ever Global Stock Take summarizing the state of global climate actions taken so far; the report showed that Parties to the Convention are collectively far off track in meeting most climate mitigation targets[1]. Greenhouse gas emissions continue to rise[2], and maintaining a 50% chance of keeping within the 1.5 °C Paris Accords target likely requires a 43% reduction in total emissions by 2030[3]. However, given countries' current mitigation commitments, reductions would have to be on par with Covid-19 economic lockdown emission rates every year from 2024 through 2030 to reach this goal.

Yet despite these challenging circumstances, some advances were made at COP 28. The meetings' summary statement acknowledged the need for a transition away from fossil fuels; increased targets for renewable energy and energy efficiency; pledged substantial reductions in methane emissions; and called for all Parties to revise their Nationally Determined Contributions plans (NDCs) to align with the Paris Accords 1.5 °C target. For the first time at any COP, climate impacts from global food systems were featured in a consensus declaration signed by 159 Parties[4].

It has been clear for some time that, without transforming food systems, it is likely impossible to meet the Paris goals[5,6]. Defined by the UN Food and Agricultural Organization (FAO) as 'the range of actors and interlinked activities related to the production, aggregation, processing, distribution, consumption, and disposal of food and non-food products that originate from agriculture, forestry, or fisheries'[7], food systems contribute about one-third of global greenhouse gas emissions[8]. Food systems also are primary drivers of global biodiversity loss, water usage, and significant terrestrial and aquatic pollution. In addition, abundant inequities throughout food systems present profound social and political challenges[9].

Bringing food systems into COP 28 certainly represents progress. However, COP 28 contained little in terms of food systems substance beyond aspirational messaging. No general framework with specific goals, quantitative targets, or timelines for collective action was offered. During COP 28, the only official group engaged in climate, agriculture, and food security, in existence since 2022, could not reach an agreement on how to structure its work. Parallel to formal negotiations, the United Nations Food and Agricultural Organization (FAO) released a roadmap that captures much of what must be done to transform food systems[10]. Yet several more detailed food system analyses and action plans already exist[11]. These reports identify food system sectors that require action: constructing a holistic food systems framework; incorporating more sustainable agriculture practices into croplands; mitigating emissions from land use and land use change; establishing national nutrition and dietary standards; reducing food loss and waste; reforming agricultural supply chains; supporting equity and just transitions; and finding funding to pay for it all.

In this policy perspective, we spotlight the critical role of Parties' new NDC revisions in jumpstarting transformations in food systems. We briefly comment on several aspects of accomplishing this work: (1) building a holistic social-ecological food systems framework; (2) acting to curb emissions from two food systems sectors that yield large supply-side greenhouse gas footprints—sustainable agriculture production practices up to the farmgate, and land-use changes; (3) reducing demand-side emissions through nutrition/dietary guidelines; and (4) funding for change in food systems. For each of these, we summarize general issues, offer potential solutions, and provide examples of NDCs that are already moving in the right direction. We conclude with general comments on negotiating transformative change throughout food systems. We do not cover important equity and just transition concerns in this brief perspective.

NDCs for food systems transformation

We suggest that the call for Parties to align their 2025 NDC revisions with the 1.5 °C Paris target is the single most important food systems outcome from COP 28. NDCs are iterative blueprints detailing how each Party plans to reduce emissions and respond to climate change across all segments of society. Currently, there are large gaps in ambition and content between Parties' NDCs; none are aligned with the Paris 1.5 °C target. However, there exist several tools to guide Parties toward strengthening their NDC revisions for 2025[12], and the UN is sponsoring a series of capacity-building NDC workshops before COP 29 and beyond.

Of course, constructing and implementing NDCs will not be sufficient to transform food systems. For example, there will likely be significant 'residual emissions' from agriculture even after the Paris goals are met[13]. NDCs are however critical stepping stones on the road to change since they are the primary channel for national-level planning to mainstream food systems reforms at scale, serve as a lever for ratcheting up ambition in response to new knowledge around food systems and climate, and can provide specific signals to potential private sector donors about where monies may be strategically invested. Parties are already acting right now on revisions due in 2025.

Food system frames

As recognition of the interconnections between biophysical and social/economic conditions across food systems has grown,

understanding has become more grounded in a social-ecological systems view[14]. A food systems framework allows for identifying links within and between food sectors; construction of integrated plans within NDCs allows for the integration of multiple actions and co-benefits across both supply and demand. But 10 years on from committing to specific Paris Accords goals, COP Parties have yet to begin negotiating a food systems framework with uniform goals and definitions, quantitative targets, and measurable indicators to monitor results. (In this regard, COP 28 is 14 years behind the UN biodiversity COP where standards, targets, and indicators have been deployed since 2010[15]). Despite this, several Parties' NDCs show progress; the Costa Rican and French NDCs incorporate a holistic view of food systems, Colombia has a monitoring, review, and verification platform in place, and Madagascar has such a system in development[11]. A set of globally relevant indicators for quantitatively tracking food systems is now available[16]. In the future, the new FAO roadmap may provide the best blueprint upon which to build a global food systems framework to guide NDCs – but only if the roadmaps' shortcomings are addressed[17], and incipient COP negotiations bear fruit by 2025 or soon thereafter.

Sustainable agricultural practices

About 40% of greenhouse gas emissions from food systems come from agricultural production up to the farmgate[8]. These emissions are the largest of any food system sector, with over half resulting from the production of animal-based meat and dairy products. Global food systems already face declines in productivity from climate impacts and these are set to increase toward 2050 and beyond[18]. The risk of spatially compounding extreme events occurring in global breadbasket regions is also increasing[19]. Yet few current NDCs address agroecology, regenerative, organic, climate-smart, circular agriculture, or other specific sustainable practices on agricultural lands[11], and there remains a dearth of natural ecosystem habitat in and around farm fields[20]. Targets for sustainable intensification, above and below-ground protection and restoration of biodiversity and ecosystem functions, livestock manure, feed and methane management, and reducing fertilizer and pesticide use should be included in NDCs now undergoing revision[21]. Several Parties' NDCs do show progress here: Madagascar has plans for increasing crop diversity while reducing emissions from livestock; Cote d' Ivoire is already implementing a part of its' current NDC that supports 500,000 farmers to reduce croplands emissions while increasing incomes and health co-benefits; Sweden plans for 30% organic agriculture in all farming by 2030; and Vietnam is providing climate information services to thousands of smallholder farmers in eight provinces[11,12]. However, navigating changes in food systems practices on farms is complex with multiple tradeoffs that will require levels of local, national, regional, and international cooperation that have yet to be negotiated or employed at scale[22].

Land-use and land-use change

Land-use and land-use change account for 32% of all food system emissions, mostly through deforestation that drives natural ecosystem conversion to croplands. To address (some of) these emissions, Parties adopted the Declaration on Forests and Land Use in 2021 at COP 26. But progress on meeting targets remains far off track[23]. Only eight of 20 countries with the highest rates of tropical deforestation have quantitative reduction targets in their current NDCs[24]. At COP 28, there was little sign of a collective forward movement to address deforestation, though small groups of countries and funders did announce new programs and Brazil proposed the establishment of a large-scale Tropical Forests Forever initiative. Several current NDCs address emissions from land-use changes; Ethiopia and Kenya plan for reductions in this sector of 85% and 50%, respectively, by 2030[11]. And, though it does not represent a single NDC, the 28-member nation European Union's efforts to address unsustainable land use through certifying supply chain products as 'deforestation-free' represent a forerunner for changes that should be addressed by COP Parties[25]. All told ambition must greatly increase across all NDCs for 2025 revisions to meet the COP 28 'align with 1.5 °C' mandate.

Nutrition guidelines and dietary change

Establishing national food-based dietary guidelines and reducing animal-based foods in diets could lead to large demand-side reductions in greenhouse gas emissions, with multiple human health co-benefits as well as reduced land-use change pressures[26,27]. However, no COP 28 document nor the FAO Roadmap substantively deal with dietary change, and few current NDCs specifically address this issue. Transforming this food system sector presents particular challenges due to the great variety of social and cultural values that are embedded in individual eating behaviors, and decision makers' lack of leadership on this issue which comes with multiple political and environmental tradeoffs. The most comprehensive framework for building nutrition guidance into NDCs that we have seen calls for: health and emissions labeling of foods; inserting low emission foods into public procurement for schools and government workplaces; and more[28]. Reducing meat consumption is particularly challenging. This is due in part to disparities in animal-based foods consumption between countries with differing food security and dietary traditions and needs, as well as the political power of entrenched agri-food actors that benefit from maintenance of the status quo. Achieving healthier diets will also involve altering crop and production practices that will likely lead to workforce shifts and food price/affordability concerns[22]. There are ways forward—global dietary guidelines designed to maximize health benefits while reducing environmental impacts were published in 2019[29]. Several low- and middle-income countries appear set to draft NDCs with stronger nutrition/diet content[30]. The German and Dutch NDCs already feature specific actions toward reducing animal-based foods, and those from Burundi, Dominica, and Venezuela all accent the human health and emissions co-benefits derived from sustainable agricultural practices[11,12]. These last three NDCs also include estimated costs for nutrition and dietary change.

Paying for food system transformations in NDCs

Food systems currently receive about 4.3% of global climate finance, some 13 times less than estimated needs[31]. Developed world countries get 84% of climate financing; smallholder farmers, who grow 35% of the world's food, only receive 19% of global agricultural funds. The reality is stark: without more financing, little climate action progress on NDCs (or any other front) will be made. Steps to address food system financing in the 2025 NDC revisions begin with individual Parties identifying key gaps and then assessing costs in all sectors. Kenya has already accomplished this in its current NDC and Colombia has identified potential pathways to obtain financing for all climate sectors[11]. Germany's NDC is one of the first to outline specific steps to reduce harmful agricultural subsidies. Constructing cost assessments along with building monitoring, review, and evaluation platforms in NDCs are essential for tracking progress and also are key to better positioning Parties to attract private sector investment. Money does exist for financing climate action; the UN estimates that global agriculture gets about USD $350 billion per year in nature-negative public subsidies and private sector financing with negative impacts on nature amounts to at least USD $5 trillion per year[32]. But redirecting food systems

subsidies and investments is unlikely to happen until links between profit-making and unsustainable and inequitable behaviors are challenged and changed. We are also concerned that global conflicts will direct monies away from climate action (including food systems change); for example, if NATO defense spending continues to increase at its current rate, it could equal the projected expense of all climate adaptation actions in low- and middle-income countries over the next seven years[33].

Transformative change in food systems

Despite the COP 28 calls for 'urgent' action, to us the pace of food system changes on the ground looks more like 'transition' than 'transformation'. The process of revising NDCs is illustrative here. Revisions are due in 2025 and yet major tools to assist Parties to accomplish this work – completion of the FAO Roadmap and results from the existing COP agriculture working group – will not be ready to use until *after* the revised NDCs are submitted. Parties will then have only five years to push NDC implementation to meet Paris Accord outcomes due in 2030. These timelines do not match with research showing that it may take a generation (20–30 years) or more for changes in food systems to gain traction[34].

In academic literature and policy documents, there is broad agreement on how to support change in food systems: constructing and implementing a food systems framework[35]; advancing integrated decision making at all scales[36]; supporting broadly inclusive public participation[3]; addressing Global South/North power imbalances[37]; and racking up actions that result in just transitions for food systems workers and other disenfranchised groups[38]. The work of two global coalitions of food systems researchers and change-makers, the Food, Agriculture, Biodiversity, Land-use, and Energy Consortium (FABLE)[39] and the Food and Land Use Coalition (FOLU)[40], is exemplary here.

Given the gaps between where we are today and where we need to go, we advocate for increased attention to the details on how to accelerate the pace of change[41]. Transformative change occurs as complex systems evolve into something new; these changes are dynamic, nonlinear, often disruptive, and always political. The extensive literature on this topic highlights several key ingredients to speed change: (1) reframe problems using a holistic view (accomplished at COP 28); (2) invest in planning to reduce long-term costs (NDC revisions); (3) work with cross-disciplinary partners to identify pilot projects that can stimulate innovation (beginning to occur as NDCs are mainstreamed into Parties' policy and political systems); (4) prioritize projects when funding is limited (becoming more frequent through NDC cost accounting); (5) use mixes of economic incentives and social nudges to advance change; (6) explore trade-offs and be ready to compensate 'losers'; and (7) share lessons learned, scale up successes, and adapt[42].

History shows that large social-ecological perturbations create 'windows of opportunity' for new values, behaviors, and institutions to emerge[43]. Ongoing gaps between current NDC climate actions and the Paris targets show that even transformative change is to some degree incremental. Nevertheless, today's 'transitional' NDCs have no replacement as the main drivers of national-scale climate actions focused on food systems. If NDCs are increasingly used by Parties as instruments for new learning and action, they may evolve to become 'transformative' in the not-too-distant future.

Author contributions

The authors confirm contribution to the paper as follows: study conception and design: Grumbine RE, Xu J; data collection: Grumbine RE; analysis and interpretation of results: Grumbine RE, Xu J; draft manuscript preparation: Grumbine RE. Both authors reviewed the results and approved the final version of the manuscript.

Data availability

Data sharing not applicable to this article as no datasets were generated or analyzed during the current study.

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Conflict of interest

The authors declare that they have no conflict of interest.

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