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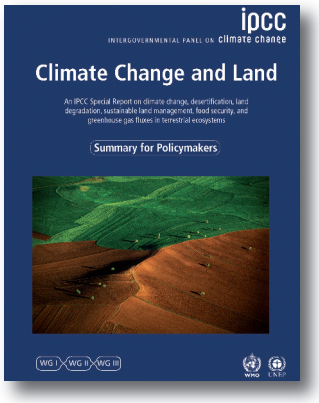
The contribution of the IPCC to a change of paradigm in agriculture and food systems

In 2019, the IPCC published a Special Report on Climate Change an Land[1], which for the first time has applied a system's approach in the assessment of food in the context of climate change. This report follows a holistic view, analysing land from a food security perspective and potential adaptation and mitigation options. The report concludes that deep changes in governance are needed to address the land, food and climate change challenges.

Agri-food systems have multiple interactions with global environmental change. For instance, five of the nine planetary boundaries are directly linked to agri-food systems as well as thirteen out of the seventeen sustainable development goals (SDGs). However, in their current form, agri-food systems do not fulfil their main objective of providing sufficient healthy and nutritious food to people without harnessing the environment. The most important challenges agri-food systems are facing include mitigation and adaptation to climate change, food security, social justice, public health and environmental sustainability. Given these multiple dimensions, assessing agri-food systems linkages with climate change requires understanding of the complex problems where conflicting interests, cultures, and worldviews exist (Thompson and Scoones 2009; Rivera-Ferre et al., 2013). This complexity is the point of departure of the IPCC "Special Report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems", shortly known as the Report on Climate Change and Land (SRCCL).



Using land as the central focus, the SRCCL recognises that land plays a central role in people's wellbeing, and particularly in the provision of food. Land is analysed from a broad perspective, integrating the human and nature dimensions of land, as well as the impacts of climate change on land systems and the potential adaptation and mitigation options, including synergies and trade-offs. This integrated analysis embraced the

multiple direct and indirect drivers of natural resource management (related to food, water and energy securities). Indeed, roughly 49% of ice-free land is directly used to produce the food we eat and agriculture uses about 70% of global fresh water use. But about a quarter of ice-free land is subject to human-induced degradation endangering the livelihoods and food security of billions of people, and climate change can exacerbate these degradation processes. Thus, following a holistic view, the report looked at land from a food security perspective (including all four dimensions of food security), also referring to the strong correlations between land degradation and poverty. Under the message that land is under growing human pressure, the SRRCL suggested that land is also part of the solution to climate change. From 2007-2016, land has acted as a carbon sink removing about one third of total CO2 emissions and one fifth of total greenhouse gas (GHG) emissions (IPCC, 2019). But for land being able to be part of the solution, substantial changes regarding how we manage land and how we produce and eat food are required. In other words, the report calls for a transformation of the system.

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To properly explore how we can transform agriculture and food systems, a systemic approach to food is required. This allows understanding the close relationship between the different components of the system (from production to consumption), develop supply-side (e.g. livestock and crop production) and demand-side (e.g. dietary change) options and analyse how they behave both in terms of adaptation and mitigation, including the role that different actors play in the system. Otherwise, fragmented and sectorial analyses, studying only one part of the reality deliver wrong and too generic conclusions. One example of this was the highly-repeated message that due to the expected growing population we needed to produce 50% more food by 2050 (FAO 2017). Despite the fact that we clearly need to increase the production of food in some parts of the world, this message, based on demographic and consumption trends, did not consider what happens along the food chain in terms of food loss and waste, nor the current overconsumption trends in many parts of the world. Thus, this number has now been contested (HLPE, 2019).

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With regard to the GHG emissions related to the production and consumption of food, the SRCCL estimates a significant contribution of 21-37% of total anthropogenic emissions, of which 14-28% correspond to agriculture and land use and 5-10% correspond to emissions outside the farm gate (Table 1). Considering that approximately one third of the produced food is never consumed, it is estimated that food losses and waste along the food chain constitute 8-10% of total GHG emissions. But emissions and land uses are not isolated from consumption patterns, they reinforce each other. In the last decades, global

Food system component	Emissions (Gt CO_2eq yr^{-1})	Share in mean total emissions (%)
Agriculture	6.2 ± 1.9	9-14%
Land use change (e.g. deforestation)	4.9 ± 2.5	5-14%
Beyond farm gate	2.6 – 5.2	5-10%
Food system (Total)	10.8 – 19.1	21-37%

Table 1. GHG emissions (Gt CO_2eq yr^{-1}) from the food system and their contribution (%) to total anthropogenic emissions. Mean of 2007-2016 period.

diets have transitioned towards ultra-processed food and increasing animal food products that we can source from different parts of the world.

Thus, from the SRCCL we understand how food systems contribute to climate change, but we also need to assess the potential mitigation and adaptation (M&A) options to climate change both from the demand and supply sides. The SRCCL puts special efforts in assessing the synergies, trade-offs and co-benefits between M&A of the different options analysed, that is, which of these options allow to reduce GHG emissions, adapt to climate change, and ideally, contribute to carbon sequestration. In the executive summary of chapter 5 of the SRCCL we can read: *"Supply-side options include increased soil organic matter and erosion control, improved cropland, livestock, grazing land management, and genetic improvements for tolerance to heat and drought. Diversification in the food system (…) is a key strategy to reduce risks (medium confidence). Demand-side adaptation, such as adoption of healthy and sustainable diets, in conjunction with reduction in food loss and waste, can contribute to adaptation through reduction in additional land area needed for food production and associated food system vulnerabilities. ILK can contribute to enhancing food system resilience"* (Mbow et al., 2019).

As an example on the supply-side, increasing soil organic matter and erosion control contribute to mitigation through carbon sequestration and reduced GHG fluxes in terrestrial ecosystems and to adaptation through increases in fertility rates, reduction of evapotranspiration, making soil less vulnerable to drought; and reduction of soil erosion, making the soil less vulnerable to flooding. On the demand side, by reducing the demand to produce resource intensive food, emissions are proportionally reduced. Adding to this, pressure on land is also reduced so more land is available to other uses, including afforestation and

reforestation, contributing also to carbon sequestration or to reduce land conflicts. It is estimated that by 2050, dietary changes could free several million km2 of land and provide a technical mitigation potential of 0.7 to 8.0 $GtCO_2e\ yr^{-1}$, relative to business as usual projections (Mbow et al., 2019).

And, what is the relationship with the IAASTD (2009)? First, both reports conclude that *"business as usual is not an option"*. Further, some of the SRCCL messages are very close to those delivered by the IAASTD ten years earlier. Of those, I highlight: i) the relevance of indigenous knowledge and local knowledge (ILK) in achieving sustainable food systems and just development; ii) the need of biodiversity enhancement in the food chain and the importance of agroecological practices; and iii) the need to empower women as main actors in provisioning food for their families.

The relevance of indigenous and local knowledge in achieving sustainable food systems

ILK has been proposed as one type of strategy capable to foster transformational adaptation (IPCC, 2014). It refers to the know-how accumulated across generations, however, it is rarely considered in the design and implementation of modern M&A strategies since it has been considered a rudimentary form of thinking. The last decade, however, showed an increased interest in ILK as a source of information for sustainable development policies. ILK is strongly associated with sustainable management of natural resources (including land), and with autonomous adaptation to climate variability and change (Morton et al., 2019). Across diverse agroecological systems, ILK is the basis for traditional practices to manage the landscape and sustain food production, while delivering co-benefits in the form of biodiversity and ecosystem and food systems resilience (Mbow et al, 2019; Morton et al., 2019). In the SRCCL, ILK plays a central role (see chapters 5 and 7). Particularly, agriculture based on ILK that focuses on diversification, soil management, intercropping and rotational cropping, sustainable water harvesting and local irrigation systems holds promise for long-term resilience and rehabilitation of degraded land. ILK can also play an important role in ecological restoration, including for carbon sinks, through knowledge surrounding species selection and understanding of ecosystem processes (Morton et al., 2019).

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Biodiversity enhancement and the importance of agroecological practices

The SRCCL gives a prominent role to diversification along the food chain, including dietary enhancement in the consumption of foods to achieve healthy and sustainable diets, in contrast to the homogenization process experienced in the last decades (see chapters 5 and 6). Dietary diversity has also been correlated to agricultural diversity in small-holder and subsistence farms (Mbow et al., 2019). Diversification of many components of the food system is then a

key element for increasing performance and efficiency that may translate into increased resilience and reduced risks (Mbow et al., 2019). On-farm biodiversity conservation is considered as an M&A practice, particularly together with the use of agroecological practices, and with neglected and underutilised species playing a central role (Mbow et al., 2019). In the SRCCL, attention is paid to the need to favour seed sovereignty.

Smith et al. (2019) suggest that the promotion of local seed-saving initiatives, including seed networks, banks and exchanges, and non-commercial open source plant breeding, can help protect local agrobiodiversity and can often be more climate resilient than generic commercial varieties, although the impacts on food security and overall land degradation are inconclusive. They document the increased ability of farmers to revive and strengthen local food systems and that studies have reported more diverse and healthy food in areas with strong food sovereignty networks, with women, in particular, getting more benefits from seed banks for low-value but nutritious crops.

The need to empower women

With their central role in the households, women have been responsible for the food and nutritional needs of their families. They prepare, process and preserve food in the house and also work with men in the agricultural fields to produce and harvest food. They are responsible to store the seeds, to transplant the paddy, to grow vegetables for domestic consumption and commercial use and to root out the weeds in the fields. Also in livestock keeping women play a direct role in animal feeding, disease management, management of housing environment and milk processing (Habib 2011). Women are often more linked to small-scale, agroecological projects and subsistence agriculture where ILK and biodiversity play a central role.

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The SRCCL acknowledged that gender is a key axis of social inequality that intersects with other systems of power and marginalisation – including race, culture, class/socio-economic status, location, sexuality, and age – to cause unequal experiences of climate change vulnerability and adaptive capacity. For that reason, the report calls for using a framework of intersectionality to integrate gender into climate change research in order to recognise overlapping and interconnected systems of power (Hurlbert et al. 2019). Given women's strong presence in agriculture provides an opportunity to bring gender dimensions into climate change, particularly regarding food security, since impacts of climate change have strong gendered impacts in all four dimensions of food security. The point of departure is that marginalised social groups have their own capabilities to adapt to climate change but gender norms and power inequalities also shape the ability of men, women, boys, girls and the elderly to adapt to climate risks (Mbow et al. 2019). Women's adaptive capacity is also diminished

because their work often goes unrecognised (Rao 2005; Nelson and Stathers 2009).

Many of women's activities are not defined as 'economically active employment' in national accounts. This non-economic status of women's activities implies that they are not included in wider discussions of priorities or interventions for climate change. Their perspectives and needs are not met; and thus, interventions, information, technologies, and tools promoted are potentially not relevant, and can even increase discrimination (Mbow et al., 2019). Thus, an assessment of gender-differentiated needs and priorities and the selection of appropriate policy instruments to address barriers to women's sustainable land management are required. If women had the same access to productive resources as men, the number of hungry people in the world could be reduced by 12–17% (Hurlbert et al. 2019). Empowered women are crucial to creating effective synergies among M&A and food security but this may include targeting men in integrated agriculture programmes to change gender norms and improve nutrition (Mbow et al., 2019).

Enabling conditions: changing governance

The SRCCL concluded that deep changes in governance are needed to address land, food and climate change challenges. In this regard, it is stated that "weak grassroots institutions characterised by low capacity, failure to exploit collective capital and poor knowledge sharing and access to information, are common barriers to sustainable land management and improved food security" (Smith et al., 2019). The UN Committee on World Food Security is seen as an opportunity to address food systems governance challenges, where diverse actors, voices and narratives are integrated in the global food security governance.

Endnote

1 See https://www.ipcc.ch/report/srccl/

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