Agricultural Policy Research in Africa

APRA Brief

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Agricultural Commercialisation Pathways:

Climate Change and Agriculture

Key messages

- Climate change will alter the environmental parameters which affect where agricultural commercialisation activity can occur in sub-Saharan Africa.
- With climate change, temperature will rise, precipitation patterns will change, and cereal crop productivity is expected to decrease. However, uncertainty levels in current projections make them insufficient for decision-making in the short-to-medium term.
- Climate change will impact on all types of agricultural commercialisation but will likely differentially affect alternative pathways.
- Women and men are affected both differently and relationally by climate impacts; it is key to account for the interactions of these different vulnerability profiles at various levels.
- Agricultural practices exist, which offer the prospect of increasing resilience to climate impacts and productivity. More could be done to adapt these to the requirements of African farmers looking to commercialise.

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Introduction

Given the highly climate-sensitive character of agricultural production, climate change has obvious and important ramifications for agricultural commercialisation, which in turn has a bearing on poverty, gender empowerment, and food and nutrition security. The nature and extent of climate change implications for agricultural commercialisation will depend on a) the magnitude of the climate impacts that farmers have to deal with; and b) the extent to which sustainable intensification processes can be pursued in ways which strengthen, rather than weaken, adaptive capacity and resilience in the face of climate change.

From the perspective of commentators concerned with climate change, agricultural commercialisation is a conundrum. It is implicated at a fundamental causal level in generating anthropogenic climate change and – at the same time – agricultural commercialisation is one of the modes of economic activity most sensitive to climate impacts.

Broadly speaking, the more commercial the agriculture, the more industrial and intensive agricultural production tends to be and the greater its contribution to the greenhouse gases driving climate change. At the same time, the fragility of agriculture and food systems has increased. This dynamic is fundamental to any discussion of commercialisation pathways, in sub-Saharan Africa or elsewhere.

However, it also needs to be recognised that not all forms of commercialisation have contributed equally to climate change: Africa's contribution to agriculture-related emissions – or indeed to greenhouse gas emissions more broadly – remains minimal. If the future is not to repeat the past, then debates around transformative climate adaptation may yield insights into the directions and forms that commercialisation activities might seek to take.

This brief provides a summary of a longer working paper (Newsham, Kohnstamm and Naess, 2018), which offers a review of recent literature on the implications of climate change for agricultural commercialisation and APRA's research in this area.

Implications of climate change on agricultural commercialisation

For the purpose of analysis, these can be grouped into two related sets:

1. **Agro-biophysical:**
   Higher temperatures, in combination with changes in rainfall quantities and patterns across Africa, may have profound effects on what can grow, and where, with potentially fundamental consequences for the types, distributions and viability of cultivation and livestock farming. The prospects for commercialisation are, therefore, highly contingent upon the prospects for substantial global greenhouse gas emissions reduction.

   However, predicting how climate change will unfold, and how it might impact on agricultural activities is uncertain. Current projections are not sufficient to form the basis of decision-making in response to climate change impacts, at least in the short-to-medium term, even though they do give us an alarming sense of what might happen if we do not act. Yet, commercialisation hinges on the most marketable crops, and it is necessary to consider how climate change might impact on these. The focus should be on planning for robustness in the face of a range of possible future climates, and gaining a clear sense of existing adaptive capacity and vulnerability in the face of climate variability.

2. **Societal** - incorporating social, political and economic dimensions:
   The consequences of climate change are necessarily gendered, because women are involved in, or excluded from, commercialisation activities in different ways. Yet, vulnerability and resilience also need to be understood relationally, both between women and men, and between different social groups.

Case study: relational vulnerability

Against a background of liberalisation policies from the 1990s onwards, farmers in Andhra Pradesh responded by planting commercial and non-food grain crops such as paddy, groundnut, oil seeds, vegetables and cotton. This resulted in a much greater use of high-yield variety seed in combination with irrigation and inputs such as pesticides and fertilisers, with farmers spending up to 35% of income on such inputs. In addition, interest rates on loans for inputs often exceeded farmers' sales profits.

This dependency was compounded by severe drought in Andhra Pradesh in 2012-13, which brought about water shortages that meant insufficient water being available for irrigation purposes, but also for livestock. In some cases, this led to distress sales of cattle at very low prices, which Hyderabad merchants subsequently profited from substantially. This was a case of relational vulnerability, in which the profits that merchants made came at the expense of farmers' resilience to climate impacts. The cycle of poverty for the farmers would be renewed with the loss of their assets (Taylor, 2013, 2014).

Implications of climate change on African agriculture

In the absence of appropriate adaptation, **crop yields** in some African countries could decline by as much as 50% by 2020. Yield declines of this magnitude would put greater pressure on food availability due to increases in prices of major food crops such as wheat, rice and maize.

For **non-cereal crops,** climate change projections indicate variable impacts. For example, cassava yields could increase in eastern and central Africa, while banana and plantain production may decline in West and lowland East Africa but increase in the East Africa highlands.

Perennial crops may face serious challenges, with projected high losses in the production of high-value crops including tea, coffee, and cocoa. The areas that are currently suitable for these crops are projected to decrease. Yield reduction or failure is potentially a serious problem for producers in particular areas because these crops take years to come into full production, require resource investment up front, and are often grown under contract farming arrangements. Conversely, these crops may provide a potential opportunity for producers in other areas.

Suitable growing areas will shift and the winners and losers will change. But, in order for anyone to benefit from these shifts, farmers will need to anticipate the changes and adapt to grow the right crops in the right areas at the right time, whilst trying to anticipate and adapt to climatic changes that may differ from one season to the next.

Likewise, **incentives** are likely to change. For example, the private sector may invest in contract farming schemes for coffee or cocoa in new or potentially suitable areas, or increasing risks and uncertainty may discourage companies from investing. Smallholders, medium-sized farmers and estate farmers are likely to face different opportunities and risks depending on the changes in the natural environment, as well as the policy environment as governments, the private sector and citizens navigate the changing suitability of areas for major crops.

Gendered impacts of climate change and barriers to commercialisation

Gender roles, gendered access to resources, and gender-constricted access to power may contribute to climate vulnerability in specific contexts. However, reappraisals of gender and vulnerability to climate impacts argue that they may not be generalised.

Women also face climate change impacts in the context of barriers to commercialisation. These include: lagging land ownership; less decision-making power within and outside the household; lower levels of access to and control over key agricultural resources (namely finance and credit); and less access to agricultural inputs as well as to extension services, technology, training and information (including climate information).

Case study: gendered climate programme

Arora-Jonsson (2014) provides an example of a government climate programme in Andhra Pradesh that intended to influence gender norms by granting land tenure to women, but did so without accounting for the women's preference or intention:

In some districts women were 'encouraged' to grow biodiesel plants (*Pongamia pinnata)* as part of climate programs that would enable them to earn carbon credits. The degraded forests, which they would have regenerated with indigenous species, and agriculture lands that supported food crops, were replaced with mono-plantations as they were assured a regular income from the sale of seeds. After one payment from the World Bank for neutralizing carbon emissions, a few years down the line, 80% of the trees perished, most families were forced to sell their cattle, were subject to an increased dependence on chemicals and ruined their land in the process. What also emerged was that the women were completely unaware of the reason they had received the money and had no idea about the ramifications of carbon trade and the relationship of their self-help group activities to climate change.

According to Jost, et al. (2015): 'A main challenge for the climate change research community is to move beyond the current simplistic understanding of smallholder women as a homogenous group that is inherently nature-protecting, but unable to adapt to climate change because of their overwhelming vulnerability'. Indeed, narratives that cast women and girls in the light of victimhood and vulnerability may have adverse implications for female access to opportunities for commercialisation, and for the kinds of adaptation policies that are aimed at them.

Specific commercialisation pathways

This brief considers context-specific evidence on the implications of climate change for four different commercial agriculture pathways in specific places and times. However, given the paucity of the evidence base, our consideration of these implications is necessarily speculative, and we call for more research in this area.

1. **Smallholder farms and commercialisation**
   Smallholder farmers are highly vulnerable to climate change because landholdings are small and, in most cases, rely on rain-fed farming. Although farmers will likely need to adapt what, how and when they grow, smallholders – particularly female farmers – often have less capital and connectivity to information to adapt effectively. When smallholders move from subsistence to commercial agriculture, there is often a transition from food crop to cash crop production, which has consequences for intra-household relations, food security and the gendered division of resources, including land and labour.

2. **Medium-scale commercial farming**
   For medium- and large-scale farmers, literature shows that their climate vulnerability increases because they tend to plant a single crop to respond to market opportunities, which can render no returns at all in unfavourable climate conditions. However, when there are good returns, they may be able to increase their income base and, thus, their resilience. Those living in areas in which conditions will become more favourable for cultivation of crops with greater commercial potential may be presented with greater opportunities. However, much may hinge on the ability of farmers, in combination with the presence of enabling conditions, to switch to a different commercially viable crop, which does better under changing environmental conditions.

3. **Outgrowing/contract farming**
   Contract farming is especially relevant in sub-Saharan Africa for fruits and vegetables and such arrangements have facilitated smallholder farmer linkage to high-value European markets to use improved inputs, access financial services, and pursue commercial farming. However, given the likelihood that pests and diseases will increase with climate change, as well as growing conditions and suitability, much depends on the inclusivity of the contracting arrangement. Criticisms of contract farming cite the unequal power relationship between a company and farmers; as climate change will increase risk, this is a critical factor in the vulnerability of women, men, boys and girls involved in contract farming.

4. **Estate/plantation/large-scale commercial farming**
   Estate farms are likely to have greater capital to anticipate and respond to climate change and shocks, and are therefore more resilient to climate change. However, their tendency to focus on one crop increases vulnerability. There is a gap in the literature on what the expected implications of climate change for large-scale commercial farming – including potential adaptation measures – will mean for the men, women, boys and girls who may work on these farms. A shift in types of crops grown may have implications on labour demands, quality and benefits.

How resilient to climate change is modern agriculture?

Farmers pursuing any of the four pathways to commercialisation (see above) may employ 'modern' techniques, such as using improved seed varieties, non-organic fertilisers, and mechanised farming methods. Alternatively, farmers may intensify production for surplus sale using traditional seed varieties, conservation agriculture techniques, and other sustainable intensification methods. Techniques that improve water retention and reduce run-off, such as integrated soil fertility management practices or soil and water conservation, can stabilise yields whether inputs are organic or modern.

However, a divide seems to exist in the literature. On the one hand are those who argue or assume that pursuing modern techniques is better for farmers; on the other are those who argue that modern techniques are more climate-sensitive and require optimum conditions.

Particularly in Africa, the assumption often leans toward pro-modernisation, in part because yield levels are much lower than the rest of the world, so food production can grow to a higher potential before reaching biophysical limits. However, much of climate change literature argues that, while heavy input use may help farmers to offset some climate change effects in the near term through higher incomes, in the medium-to-long term, it is an unsustainable approach to climate adaptation. More diverse farms, which intercrop, manage soils with organic inputs, maintain seed diversity and keep indigenous livestock breeds, may be more drought-, flood- and pest-resilient in the longer term.

Nevertheless, commercialisation pathways that do not sufficiently take into account the agro-environmental conditions in which they are being applied may end up contributing to heightened vulnerability to climate impacts, and/or commercialisation activities may simultaneously strengthen the resilience of some directly at the expense of others.

Sustainable agri-food systems

It is perhaps important to note that, whilst there is a long list of diverse and often overlapping concepts which – to differing extents – offer visions of alternative agriculture, they frequently package and recommend the same agricultural practices, namely that they all attempt to reconcile the need to:

a. Continue producing enough food to feed populations which both in Africa and globally are projected to grow until 2050;

b. Maintain the commercial viability of agricultural production;

c. Minimise environmental impacts, especially those which adversely affect yield levels, so that agricultural production remains ecologically viable over the long term.

Perhaps the two most pertinent approaches for the purposes of sub-Saharan African agricultural commercialisation are sustainable intensification and climate-smart agriculture. Both of these terms are contested and are used by many different actors to mean different things. However, by using an approach such as the 'sustainable agri-food system productivity' (SAP) framework proposed by Sitko and Jayne (2017), it may be possible to identify techniques and technologies, which are locally appropriate, well-conceived in terms of their likelihood of being effective in that context or region, and which may serve commercialisation, livelihood and climate resilience objectives.

The SAP framework is premised on the need to look beyond farm-level dynamics and techniques to phenomena occurring at 'higher' levels within a social-ecological system. The framework therefore seeks to integrate sustainable intensification, climate-smart and market-smart approaches to agricultural production, with a view to situating them more insightfully within a context of rapid change within African agri-food systems.

In order to gauge the prospects for farming techniques deemed climate-smart, market-smart or sustainably intensified, and their geographic/temporal suitability, Sitko and Jayne argue that they must be:

- Contextualised against a background of broader, exogenous factors operating on the agri-food system – such as population growth, urbanisation, climate change, the implications of a demographic skewed towards a young population, etc.

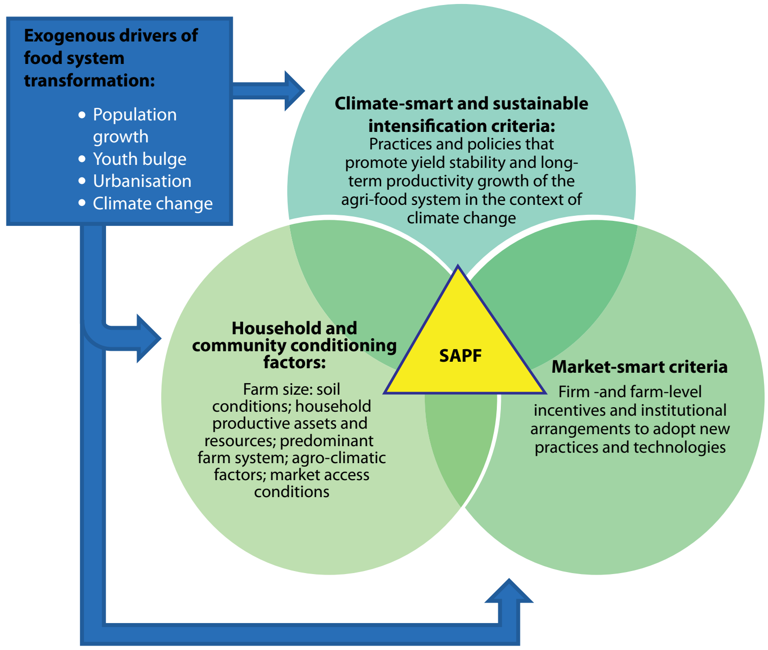
- Situated within authority understanding of the local dynamics – such as agro-ecological characteristics, farm size, soil conditions, household productive assets, etc. – which pertain at the farm level.

Alternative techniques and methods for sustainability in agricultural commercialisation

1. **Conservation agriculture (CA)**
   CA is underpinned by three core principles and related practices: the minimum possible level of disturbance to the soil; the retention of crop residue; and crop diversification either through crop rotation or intercropping. Although they are often used separately, the consensus is that using them in combination gives much better results. In the context of East and Southern Africa, Wall et al., (2013) report that where there is uptake of CA methods, most of it (99 percent) is accounted for by commercial rather than smallholder farming. This suggests already that although CA has commercial viability credentials, it is not being used by farmers who represent one of the key commercialisation pathways APRA is seeking to explore.

2. **Cover crops**
   This technique entails planting leguminous crops, grasses or other crops at times when cash crops are not being cultivated,

Sustainable agri-food system productivity framework



Source: Sitko and Jayne (2017)

with a view to managing soil erosion, fertility and quality, water, pests and weeds.

Substantial benefits from cover crops have been found in studies in sub-Saharan African contexts. However, despite suggesting the potential for climate resilience, Sitko and Jayne (2017) do not find cover crops a very likely candidate for the achievement of the SAP framework objectives. Principally, they argue that this is because many farmers would struggle to devote scarce land to the purposes of non-food crop production, which is what primarily explains low adoption rates. Nevertheless, they suggest that, in areas where there is increased cost of on-farm labour – owing to lower availability or higher returns to farm labour – the greatly reduced weeding that cover crops require can offer incentives for its uptake.

3. **Agroforestry**
Agroforestry involves land-use systems and technologies where woody perennials (trees, shrubs, palms, bamboos, etc.) are used on the same land as agricultural crops and/or animals. Agroforestry techniques help to provide an improved microclimate, more efficient water use, better soil quality, options for pest control and off-farm sources of revenue. Evidence suggests that, in a number of sub-Saharan African countries, agroforestry systems have contributed substantially to yield increases and stability.

However, as with CA, potential benefits from agroforestry are realised over the medium-to-long term, which means that, effectively, only better-off farms with more land and income tend to adopt these practices. Sitko and Jayne argue that, in areas with quite high population growth, greater land fragmentation and rising land prices, agroforestry is unlikely to be adopted in ways capable of meeting the SAP framework criteria.

4. **Soil conservation and erosion management**
Practices such as tied ridge systems, bunds, contour farming and terracing tend to be used with a view to managing water and increasing its availability to plant roots during growth. When effective, such practices can aid biomass production, returning more biomass to the soil, thereby improving soil organic carbon composition. Evidence suggests substantial yield increases are being achieved, especially in cropping systems in which moisture is a substantial constraint to production.

However, these practices are often land and labour intensive, which can constrain their adoption. Sitko and Jayne observe that adoption is likely to be higher where there is greater knowledge of the adverse implications of soil erosion and, thereby, greater demand for techniques that address it, in combination with the presence of service markets which provide such techniques.

5. **Irrigation**
Access to irrigation technologies is believed by many to be key to assisting smallholder farmers in overcoming the constraints to crop productivity growth and stability in sub-Saharan Africa, imposed by erratic and insufficient water supplies. However, much evidence shows limited success in irrigation use relative to its potential, with farmer abandonment of techniques (e.g. drip irrigation and treadle pumps) intended to be appropriate to specific contexts. Moreover, the economic returns from irrigation when used with low value crops can be very low, suggesting the expediency of using irrigation with higher-value crops. Sitko and Jayne suggest that irrigation would be most effectively applied to areas in which land prices were rising as a result of population growth and urban expansion, giving rise to greater incentives for land intensification.

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