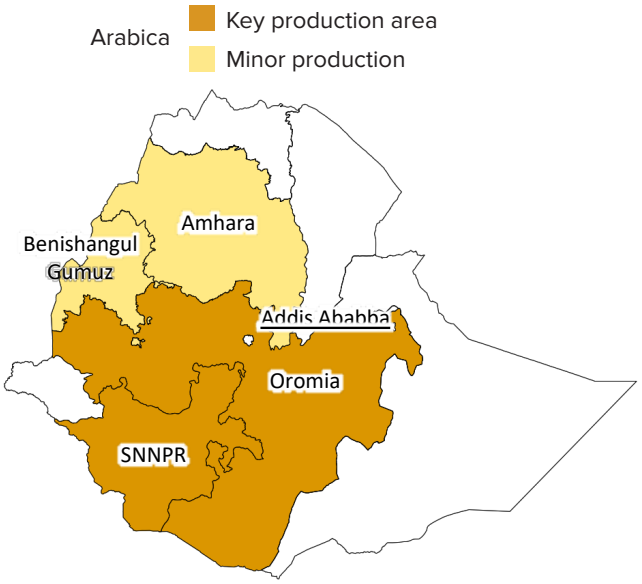
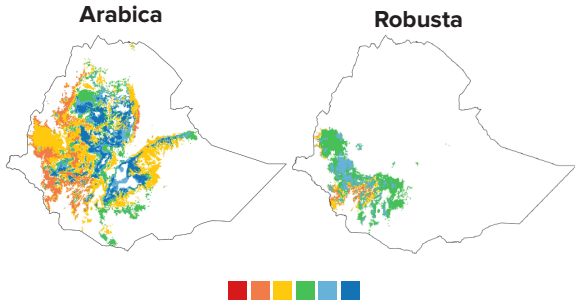
COFFEE PRODUCTION IN THE FACE OF CLIMATE CHANGE: **ETHIOPIA**

KEY PRODUCTION AREAS IN ETHIOPIA



The majority of coffee is produced in the southwest, in the Oromia Region, and Southern Nations, Nationalities, and Peoples' Region (SNNPR). Coffee production in Amhara is growing.



- Suitability +

Changes in suitability between today and 2050 [17]

OBSERVED AND PREDICTED EFFECTS OF CLIMATE CHANGE IN COFFEE PRODUCING AREAS [1,7]

Rising Temperatures

- From 1960-2006 mean annual temperature increased by 1.3˚C.
- Mean annual temperature is predicted to increase 1.1-3.1˚C by 2060, with hot days and nights expected to become more frequent.

Changing Seasonality

- Farmers report increasing uncertainty regarding the onset of the wet season, as well as a prolonged dry season.

Changing Rainfall

- Rainfall is very variable. General circulation models do not agree on future projections of precipitation change.
- Rainfall has declined by about 10% across Ethiopia (1948-2006). The decline is greater for spring/summer rains.

Extreme Weather Events

- Warming is projected for all four seasons, which can cause more frequent heatwaves.
- Drought is the most significant climate hazard.

LIKELY IMPACTS OF CLIMATE CHANGE ON COFFEE PRODUCTION

Predicted changes in coffee producing areas:

- Forecasts by experts[8] predict an 85% reduction of localities where indigenous coffee Arabica is growing naturally by 2080.
- Forecasts for 2050 by CIAT (below) show shifts in areas suitable for coffee growing to higher altitudes. The reduced suitability of current production areas can likely be offset by increasing suitability in other regions.
- Areas becoming suitable for Arabica coffee production are located at higher elevations, previously too cool for Arabica. Cultivation of coffee is starting in some of these areas.[2]
- Robusta, currently not produced in Ethiopia, could be an alternative crop for areas where Arabica coffee will be most affected by climate change.

THE IMPORTANCE OF COFFEE IN THE ETHIOPIAN AGRICULTURAL SECTOR [1,2,3,4,5,6]

Coffee production and export in 2017/2018

- Arabica: 450,000 tons
- 240,000 tons or ca. 53% were exported

Area under coffee production

Arabica

Approx. 525,000 ha

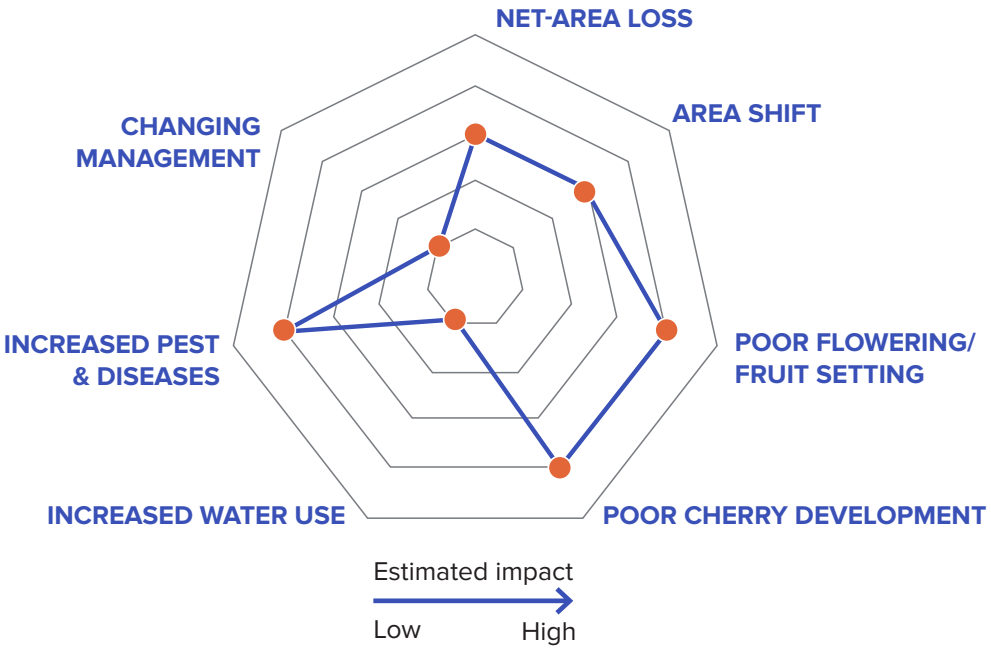
Farms

- 90% of coffee is produced by 2 million smallholders with an average farm size between 0.5-2 ha
- Only about 200 larger farms and estates (> 10ha) exist

Importance in the national economy Coffee generates:

- 25% of export revenues
- 1.1% of gross domestic product
- Coffee is key livelihood source for 15 million Ethiopians (16% of the population)

LIKELY IMPACTS OF CLIMATE CHANGE ON COFFEE PRODUCTION



- Reliance on rain-fed production systems makes coffee vulnerable to shifting rainfall patterns and drought.
- Erratic rainfall at the beginning of the rainy season can cause abortion of flowers.
- High temperatures (> 28-30˚C) have been observed to reduce flower bud formation and cherry production.[8]
- The increasing temperatures create a more favorable environment for the Coffee Berry Borer. Losses caused by the insect are expected to increase.
- Droughts are expected to cause production losses and, in extreme cases, death of coffee trees.[1]

PRODUCTION STANDARDS AND PRACTICES

CERTIFIED PRODUCTION

- In 2013, 3% of exports were certified or verified by sustainability standards.
- Good agricultural practices are practiced on about 6% of farms.

FARM PRACTICES

- Coffee grown under full shade is common in the southwest. Elsewhere, coffee is grown in agroforestry with variable shade.
- Smallholder farms typically use family labor and often practice mixed-cropping techniques.
- Nearly all coffee production is rain-fed. Some irrigated production systems exist in Amhara, Benishangul Gumuz, and in the northeast of Oromia.
- Most smallholders do not use agro-chemicals, making about 95% of coffee organic-quality.[6]

FARM ECONOMY

- Yield is low, with about 0.5 tons/ha produced on average.[4]
- Due to the low input use, production costs are relatively low with about 190 USD/ha.[5] However, costs can be very high for farms relying on hired labor.
- Farmers receive approximately 60% of export price.[5]

CLIMATE CHANGE ADAPTATION:

STRENGTHS

Technical aspects

Ethiopia has two authorities protecting which preserve the genetic diversity of landraces and wild coffee: the Ethiopian Biodiversity Institute and the Jimma Agricultural Research Center. Over time, farmers have contributed to the genetic diversity of coffee by "developing" wild coffee into special "landrace" varieties.[9,10]

The Jimma Agricultural Research Center can rely on Ethiopia's coffee genetic diversity to develop improved varieties resistant to pests and diseases which are expected to increase with climate change.

Economic aspects

Ethiopian coffee varieties are already well-known, and in high demand by the global market. The organic-quality of Ethiopian coffees contributes to the high demand. There is growing potential development of specialty coffee.[1,10]

Organizational aspects

The Jimma Agricultural Research Center has a long track record of developing improved coffee varieties.

Political aspects

The Growth and Transformation Plan II aims to double coffee production by 2020 and reform the Ethiopian Commodity Exchange to boost export of specialty coffee.

OPPORTUNITIES

Technical aspects

There is significant potential for increasing yields from the current 0.5 to over 1 ton per ha by implementing good agricultural practices and rejuvenation.[4]

Economic aspects

By improving productivity, coffee has significant potential for increasing farmer incomes and boosting the national economy. The net-income of farmers could more than double with good agricultural practices and rejuvenation.[5] Income could be increased further by switching from sun-dried to washed coffee.[6]

The total national supply of coffee could be increased by roughly 20-80% if coffee farms are rejuvenated and good agricultural practices (GAP) are implemented.[4] An estimate of the potential value added for country is 573m USD.[5]

The Coffee and Tea Development and Marketing Authority intends to offer farmers greater access to credit and a better extension packages (e.g. coffee management, distribution of new varieties).

Political aspects

Ethiopia is a signatory to the Convention on Biological Diversity and the World Heritage Convention. The country's engagement in forest conservation through biodiversity protection regulations and actions is key to preserving wild coffee and the diversity of the Arabica gene pool and adaptation to climate change.

WEAKNESSES

Technical aspects

The adoption rate of good agricultural practices and the use of agro-chemicals is very low. About 80% of coffee is well beyond peak production. Together, these factors contribute to the low productivity.[12]

Robusta, a potential alternative to Arabica in the future, is not cultivated in Ethiopia.

Economic aspects

Due to the low productivity of and income from coffee, other crops – in particular, Khat – are favored in some regions, with Khat gradually replacing coffee farms.

Rejuvenation of coffee farms is investment intensive. Smallholders have limited financial resources for the investment.

Smallholders are highly credit constrained. Roughly 70% complain about inability to access credit, and 14% complain about the high cost of credit. [4] The limited access to finance limits the ability of farmers to purchase inputs and rejuvenate their farms.

Organizational aspects

The distribution of improved coffee seed from research stations and by extensions services is limited, reducing the potential to rejuvenate coffee farms with high yielding, and pest and disease resistant varieties.

Few smallholders have adequate access to public extensions services.

The majority of smallholders growing coffee are either in loose or weakly connected value chains. The resulting low prices for producers are a disincentive for investments into better management.

Only about 10% of coffee growers are members of cooperatives. Cooperatives usually don't have the financial & technical capacity for extension services but improve market access and in some cases access to inputs.

Political aspects

Ethiopia's second Growth & Transformation Plan includes increasing coffee production. However, the set production goals were not achieved so far, pointing to inadequate instruments and/or funding for implementation of the plan. Key constraint to reaching these targets are management practices and old coffee trees (see above).[2]

The best quality coffee is reserved for export, i.e. should not be traded domestically. However, farmers could achieve higher prices for high quality coffee on local and national markets, thereby providing an incentive to invest in sustainable production of high quality coffees.

THREATS

Technical aspects

The improved varieties (incl. clones) of coffee are not very accepted by the growing specialty market, which is, however, still very small.

Political and organizational aspects

Some farmers have started to plant coffee at higher elevations which were previously unsuitable for coffee cultivation.[2] Uncontrolled expansion of coffee will contribute to land degradation and deforestation.

The gene pool of Arabica coffee is threatened by deforestation and forest degradation. The threat is compounded by the incomplete mapping of Ethiopian wild coffee diversity and limited ex-situ conservation.[10]

PRESERVING THE GENETIC DIVERSITY OF ARABICA COFFEE IN ETHIOPIA

Arabica coffee is native to the Boma plateau in South Sudan, and along the west and east sides of the Rift Valley in southern Ethiopia.[13] Ethiopia, often called the birthplace of Arabica coffee, retains much of the genetic diversity of coffee. This diversity is reflected in the various, globally known coffee provenances such as Limu, Jimma, Ghimbi, Lekempti, Sidamo, Yirgachefe, Illubabor, Harar, Tep and Bebeka. It is argued that comprehensive research on the genetic diversity of Arabica coffee in Ethiopia is a prerequisite for implementing long-lasting conservation efforts.[10,13] Without this knowledge, the value and opportunity for maintaining the coffee sector climate resilient will not be captured.

The global industry relies on varieties which are descended from a small collection of individual plants with little genetic variation – just 10% of the diversity found in the wild. Wild coffee possesses genetic variation which is needed to breed varieties adapted to climate change and resistant to pests and diseases. Without this diversity, the sustainability of the coffee industry may be under threat.[14]

Within Ethiopia, farmers cultivate local "landraces" and the "improved" coffee varieties. The local landraces were derived from wild coffee, by farmers collecting and cultivating coffee from the forest evolving them into specific varieties. The improved coffee includes around 40 varieties which have been bred by the Ethiopian Coffee Research Institute based in Jimma to be disease resistant, high yielding, and high quality. The increasing shift from cultivation of local landraces to improved varieties in combination with deforestation (incl. loss wild coffee populations) may have an impact on coffee diversity within Ethiopia over time.

Arabica coffee is part of Ethiopia's high biodiversity preserved in the remnant Afromontane forests located in the highlands of southwest and southeast Ethiopia.[15] However, deforestation is a major threat to these key habitats and thus, the genetic diversity of coffee. Within the last 40 years, Ethiopia has lost one third of its forest cover in the southwest.(14) According to the Ethiopian Biodiversity Institute, the Arabica gene pool is "highly endangered" due to increasing settlements and land pressure on the montane forests.[9]

Researchers at the Kew Royal Botanic Gardens in London have modelled how climate change will impact regions where indigenous coffee Arabica occurs in Ethiopia. They forecast an 85% reduction of localities with wild coffee in these regions by 2080.[8]

Ethiopia is signatory to various international biodiversity policies including the Convention on Biological Diversity and the World Heritage Convention.[9] Coffee conservation efforts within Ethiopia include gene banks and research centers. The two institutes working on conservation are the Ethiopian Biodiversity Institute and the Jimma Agricultural Research Center. The Ethiopian Biodiversity Institute is responsible for implementing the Convention on Biological Diversity and the National Biodiversity Strategy & Action Plan (2015-2020) for national conservation research.[16] To conserve coffee and other crop varieties, the Institute has established field gene banks throughout the country. Over 6,200 varieties of coffee, spices, root and tuber crops were catalogued.[9] Three of its field gene banks (Choche, Bedesa & Yayo) protect coffee species.[9] The Jimma Agricultural Research Center has the mandate to coordinate national coffee research and breeding. Conservation is carried out by cultivating varieties in Jimma and nine sub-centers or testing sites in the main coffee producing zones. In December 2006, the center included 4,780 samples.[11]

Different land management models are being implemented in Ethiopia to address deforestation and thus protect Arabica coffee and its genetic diversity within its natural habitat. These models include strictly protected areas, community managed forests and small church or sacred forests. UNESCO Biosphere Reserves have been established in the forests of Yayu, Kafa, and Sheka. The Ethiopian Biodiversity Institute has established 15 conservation sites in the Benshangul Gumuz, Oromia and Southern Nations, Nationalities and Peoples regions. However, many forests re-main without strong legal protection making them prone to degradation and deforestation.[9]

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