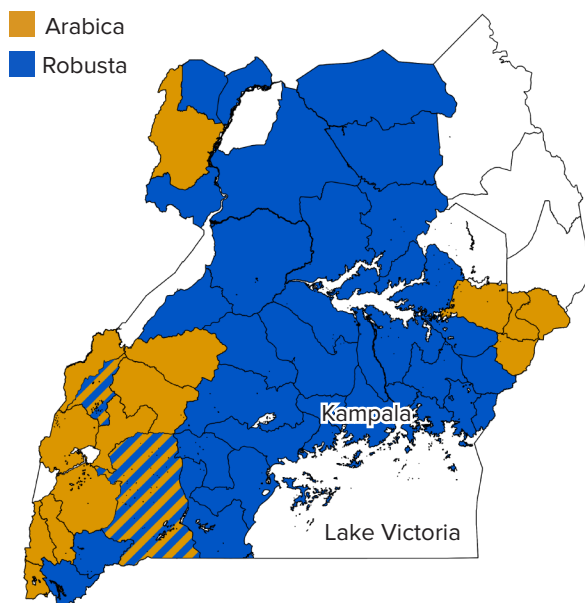


COFFEE PRODUCTION IN THE FACE OF CLIMATE CHANGE: UGANDA

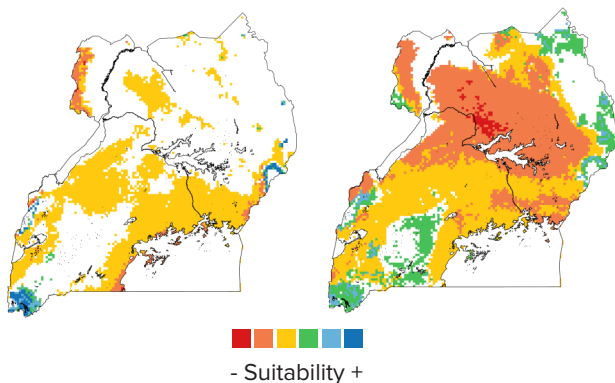
KEY PRODUCTION AREAS IN UGANDA



Coffee is produced across Uganda. Most of the Robusta coffee is produced in a wide belt around Lake Victoria. Arabica coffee is restricted to the mountainous regions in the east and west of the country.⁽⁶⁾

Arabica

Robusta



Changes in suitability between today and 2050⁽¹⁸⁾

OBSERVED AND PREDICTED EFFECTS OF CLIMATE CHANGE IN COFFEE PRODUCING AREAS^(9,10,11,13)



Rising Temperatures

- Average annual temperature is expected to increase by 1.5°C.
- Increase in hot days and nights.*
- Cold days and nights decreasing to zero.*



Changing Rainfall

- Rainfall amount and seasonality are strongly influenced by El Niño Southern Oscillation, making rainfall projections uncertain.
- Observed decreasing rainfall.
- Predicted slight increase in rainfall.



Changing Seasonality

- Delayed onset of the first rainy season in areas with bimodal rainfall, leading to a shorter season.



Extreme Weather Events

- Increase in the frequency of both high and low rainfall days causing floods and droughts.

LIKELY IMPACTS OF CLIMATE CHANGE ON COFFEE PRODUCTION

Predicted changes in coffee producing areas

- Loss of about 25% of land currently suitable for Arabica and limited potential for altitudinal migration⁽¹²⁾
- Net-loss of land suitable for Robusta and potential shift to higher altitudes and from the interior towards Lake Victoria⁽¹³⁾
- Coffee production is expected to reduce by 50%-75% due to loss of suitable land and decreasing yields⁽⁹⁾

*"Hot" or "cold" day/night is defined by the temperature above/below which 10% of days or nights are recorded in current climate.

THE IMPORTANCE OF COFFEE IN THE UGANDAN AGRICULTURAL SECTOR^(1,2,3,4,5)

Coffee production and export in 2017/2018

- Arabica: ~ 70,000 tons
- Robusta: ~ 230,000 tons
- Almost all coffee exported as green beans
- Domestic consumption: 4%

Area under coffee production

- Estimated 350,000 ha, of which circa 30% is Arabica and 70% Robusta

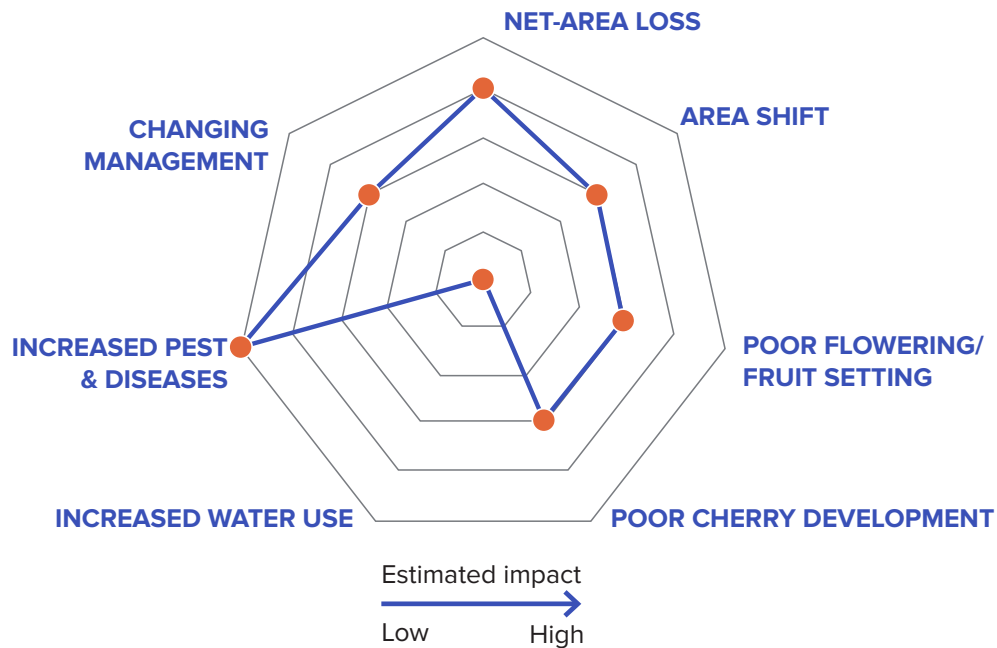
Farms

- 1.7 million smallholders with farms of 0.5-3 ha produce 85% of coffee

Importance in the national economy

- Coffee Generates:
- 25% of export revenues
 - 2% of gross domestic product
 - Most important agricultural commodity by value

LIKELY IMPACTS OF CLIMATE CHANGE ON COFFEE PRODUCTION



- Increased occurrence and damage from leaf miners, mealy bugs, Coffee Leaf Rust, Coffee Berry Borer and Coffee Bacterial Wilt are observed and are likely related to climate change.^(8,14)
- The Coffee Berry Borer is expected to complete up to 10 life cycles per year by 2050 versus the 1-5 cycles currently.⁽¹⁵⁾
- In particular at lower altitudes ($\leq 1,300\text{m}$) abortion of flowers and poor filling of cherries is expected.

PRODUCTION STANDARDS AND PRACTICES



CERTIFIED PRODUCTION

- Approximately 20% of coffee produced is certified according to sustainability standards.
- Only 3% of coffee is exported as certified coffee.



FARM PRACTICES

- Smallholders usually intercrop coffee with food crops.
- Coffee is frequently cultivated under shade from banana or trees.
- Low input use: farmers use insufficient fertilizer due to high cost and limited availability.
- About 70% of coffee trees are more than 40 years old.⁽²⁾
- About 50% of coffee Arabica is washed⁽³⁾



FARM ECONOMY

- Low cost production using family labor. The biggest cost items are fertilizer (46%) and harvest (22%).
- Low yields with an average of 0.6 tons/ha.⁽⁷⁾
- Farmers receive an estimated 75% of the export price.⁽²⁾ However, many farmers sell coffee before it is harvested at prices well below regular market price.⁽⁷⁾
- On average, coffee is grown on 20% of farm but generates > 50% of income.⁽³⁾

CLIMATE CHANGE ADAPTATION:

STRENGTHS

Technical aspects

In Uganda, many farmers traditionally cultivate coffee in combination with banana. Research shows the beneficial aspects of the coffee-banana agroforestry-system with regard to climate change adaptation and resilience of farming households. Details on the coffee-banana system are provided below.

A detailed [training manual](#) for coffee farming is available from the Uganda Coffee Development Authority. The manual was developed and tested together with Ugandan research institutions, NGOs, and private sector.

Organizational aspects

The coffee sector is fully liberalized, making the supply chain efficient and allowing direct interaction between producers and exporters. However, trade is dominated by agents and brokers at aggregator level.

Uganda has sub-sector specific government bodies, the [Uganda Coffee Development Authority](#) and the [National Coffee Research Institute](#), working closely with other researchers, the private sector, development partners, and NGOs to develop the coffee sector in Uganda.

Supported by the private sector, development partners and NGOs, producer organizations for about 250,000 coffee farming households were established to date. The producer organizations and the related national apex organizations: the [National Union of Coffee Agribusinesses and Farm Enterprises](#) and the [Uganda Coffee Farmers Alliance](#) provide marketing and other support services. Producer organizations help to close the gaps left by the national extension system.

Political aspects

Coffee is a very important agricultural sub-sector in the Ugandan economy. This is reflected in the existence of dedicated government institutions and a regularly updated coffee policy. The target of the Coffee Road Map, developed in 2017, is to quadruple coffee production by 2030. The planned measures are geared towards increasing productivity and area under coffee cultivation amongst others.

OPPORTUNITIES

Technical aspects

Robusta coffee is native to Uganda, giving researchers an advantage in breeding new varieties with high productivity suited to the changing climatic conditions and with higher resistance to pests and diseases.

Disease resistant varieties (e.g. Coffee Wilt Disease) and technologies to control pests (e.g. Black Coffee Twig Borer) are available. However, their multiplication and uptake requires concerted effort by all stakeholders. A positive example is the multiplication of new varieties by private sector nurseries.

Economic Aspects

Uganda is Africa's biggest producer and exporter of Robusta coffee. The potential to sustainably increase production of Robusta is significant despite the anticipated climatic changes if producers invest into better management practices that increase productivity and resilience to climate change.

Management measures with adaptive benefits (rejuvenation with new varieties, soil nutrient management and planting of shade trees) could double the net-income of farmers by increasing productivity.

Organizational aspects

Less than one fifth of coffee farmers are affiliated to producer organizations. For more farmers to benefit from services provided by producer organizations, investments into organizational development are needed. In the long run, services provided by producer organizations will reduce the burden on government extension services.

WEAKNESSES

Technical aspects

The uncertainty of climate models for Uganda is high. As a result, planning for climate change adaptation is difficult. Options range from no/limited need for interventions over targeted investments into climate-smart coffee production to a shift to other, more suitable crops in current coffee growing areas.

The accessibility of quality agro-inputs, including improved coffee varieties, is low for smallholder farmers.

Little basic research on the genetic diversity of Robusta coffee in Uganda is available, limiting the potential for the development of new varieties.

Economic aspects

Many farm households rely on pre-selling their coffee crop to cater for urgent financial needs such as school fees or hospital bills. Coffee pre-sold to agents and brokers is commonly sold well below market value, reducing the financial appeal of coffee farming and the likelihood of investments into better management.

Due to the small quantities produced per farm and low penetration of farmer organizations, certification in Uganda is expensive. Furthermore, only a fraction of the certified coffee is exported as certified coffee, implying low demand for certified [Robusta] coffee. Premiums paid for certified coffee, especially Robusta, are too low to be an incentive for additional investments. Hence, certification is an unlikely tool for scaling of sustainable production methods.

Organizational aspects

The government extension system and advisory services are inadequate. Despite past and ongoing efforts, the government is not able to ensure the quality of agro-inputs available in the market.

Only about 15% of coffee farmers are members of producer organizations ⁽²⁾

Political aspects

The target to quadruple coffee production by 2030 set by political leaders is not realistic, and may, in fact undermine the sustainable development of the sector as decisions are taken and investments made without adequate consideration of the technical and financial feasibility. The necessary instruments, like incentives or subsidies for the adoption of new technologies, are not in place.

THREATS

Technical aspects

The upwards shift of land suitable for Arabica coffee may lead to increased pressure on the forests and protected areas located in these areas.

Economic aspects

Coffee farming is dominated by the oldest household members. Agriculture is often not perceived as an attractive livelihood by younger family members. Household heads are reluctant to share responsibility for and benefits of the cash crop with other household members. This often results in income loss at the household level, and lower ability and willingness to invest into quality and productivity.

Political aspects

Forests in Uganda are poorly protected, a fact illustrated by the high deforestation rate of 2% per year for the period 2000-2015. Agriculture is one of the key drivers of deforestation. The genetic biodiversity of Robusta coffee is under threat from deforestation and forest degradation.



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Coffee-banana intercropping systems are traditional farm management systems in south-western and eastern Uganda. Here, an estimated 75% of farmers intercrop coffee and banana on at least part of their coffee farm.⁽¹⁶⁾ But a large share of coffee farmers in central and western Uganda do not intercrop their coffee with banana and do not have adequate shade trees on their coffee farms.

Correctly established and managed, coffee-banana intercropping systems can deliver an increase in food security and income, improve climate resilience, and provide climate change mitigation benefits.⁽⁸⁾

Intercropping coffee with banana has some straightforward benefits:

- The in-situ mulch from the banana improves soil fertility and structure and suppresses weeds.
- The mulch and banana canopy help to reduce soil erosion.
- Banana (bearing fruit after 1 to 1.5 years) planted together with coffee can offset cash flow constraints in the first few years, i.e. before coffee starts yielding.
- Once established, banana provides regular income throughout the year, while coffee results in larger cash amounts once or twice per year.

Specific adaptation and mitigation benefits of integrating banana into coffee gardens are:

- Regulation of micro-climate by providing shade for coffee trees within one year after planting
- Improved water retention capacity of soil
- Increased ability to withstand drought
- Additional carbon sequestration in the above and below ground biomass and as soil carbon.

Furthermore, the combined system contributes to household resilience by diversifying income and leveling out irregular cash flows in comparison to coffee mono-cropping. Household food security benefits directly (consumption of bananas), as well as indirectly from increased purchasing power.

Research of the coffee-banana intercropping system shows that:⁽⁸⁾

- Intercropping with banana has no significant negative impact on coffee yield in comparison to coffee as a mono-crop. On the contrary, total income can be 50% higher in comparison to banana or coffee monocrops, while having a positive effect on coffee quality.
- While bananas are quite sensitive to drought, they are also more efficient at regulating than many shade trees. This allows banana to remain hydrated under drought stress and compete less for water with the coffee plants than some other shade trees.
- Some agroforestry tree species are known to be secondary host to coffee pests and diseases such as Coffee Leaf Rust and Black Coffee Twig Borer. In banana shaded coffee plots, incidences of these were found to be 50% less compared to tree-shaded systems.

The coffee-banana intercropping system is especially viable for small farms in densely populated areas, i.e. where land is limited but labor readily available.

Some constraints to a wider adoption of the system exist:^(8,16)

- Diseases like Coffee Wilt Disease or Banana Bacterial Wilt have wiped out one of the two crops completely in some cases. Reestablishing the system requires access to disease-resistant varieties and the ability to invest.
- To sustain high productivity, a combination of mineral fertilizer, manure, and compost is needed.
- To yield optimal results, coffee-banana intercropping systems must be adjusted to the specific sites, i.e. recommendations must be flexible.
- The management requires knowledge on how to regulate competition for water, nutrients, and light between the two crops, application of fertilizers and organic nutrient inputs, and practicing soil and water conservation.

A detailed manual for trainers/extension officers is available [Banana-coffee system cropping guide](#).⁽¹⁷⁾

REFERENCES

1. ICO, 2018: Trade Statistics Tables. International Coffee Organization. http://www.ico.org/trade_statistics.asp, accessed 20.07.2018.
2. UCDA, 2015: Uganda National Coffee Strategy 2040. Plan for 2015/16 - 2019/20. Uganda Coffee Development Authority.
3. UCDA, 2018: Export statistics. Uganda Coffee Development Authority. <https://ugandacoffee.go.ug/>, accessed 23.10.2018.
4. USDA, 2018: Uganda Coffee Annual 2018. USDA Foreign Agricultural Service. <https://www.fas.usda.gov/>, accessed 25.09.2018.
5. USAID, 2017: Country Data Sheets for Coffee Renovation and Rehabilitation. Report by Dalberg Advisors for USAID Bureau for Food Security.
6. UCDA, 2014: Uganda Training Materials for Coffee Production. Uganda Coffee Development Authority.
7. Technoserve, 2018: Uganda: A Quick Scan on Improving the Economic Viability of Coffee Farming. Report for the Global Coffee Platform
8. Van Asten P, Ochola D, Wairegi L, Nibasumba A, Jassogne L, Mukasa D, 2015: Coffee-Banana Intercropping: Implementation guidance for policymakers and investors. Practise brief for Climate-smart agriculture. International Institute for Tropical Agriculture.
9. MWE, 2015: Economic Assessment of the Impacts of Climate Change in Uganda. Report prepared by the Baastel consortium for the Ministry of Water and Environment, Uganda.
10. Jassogne L, Läderach P, van Asten P, 2013: The Impact of Climate Change on Coffee in Uganda: Lessons from a case study in the Rwenzori Mountains. Oxfam research report.
11. McSweeney C, New M, Lizcano G, 2012: UNDP Climate Change Country Profiles: Uganda
12. Ovalle-Rivera O, Läderach P, Bunn C, Obersteiner M, Schroth G, 2015: Projected Shifts in Coffea Arabica Suitability Among Major Global Producing Regions Due to Climate Change. PLoS ONE 10(4).
13. Bunn C, 2015: Modeling the climate change impacts on global coffee production. Dissertation at the Faculty of Life Sciences, Humboldt-University, Berlin.
14. Ekong J, 2015: Putting banana-coffee intercropping research into action. CCAFS Outcome Study no. 2. CGIAR Research Program on Climate Change, Agriculture and Food Security.
15. Jaramillo J, Muchugu E, Vega F, Davis A, Borgemeister C, Chabi-Olaye A, 2011: Some Like It Hot: The Influence and Implications of Climate Change on Coffee Berry Borer (*Hypothenemus hampei*) and Coffee Production in East Africa. PLoS ONE 6 (9)
16. Bongers G, Jassogne L, Wanyama I, Nibasumba A, Mukasa D, van Asten P, 2012: Understanding and exploring the evolution of coffee-banana farming systems in Uganda.
17. Wairegi L, van Asten P, Giller K, Fairhurst T, 2016: Banana-coffee system cropping guide. Africa Soil Health Consortium, Nairobi. <http://africasoilhealth.cabi.org/wp-content/uploads/2014/10/390-Banana-coffee-English-low-res.pdf>
18. Bunn C, Läderach P, Ovalle-Rivera O, Kirschke D, 2015: A bitter cup: climate change profile of global production of Arabica and Robusta coffee. *Climatic Change* (2015) 129:89–101

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