

Reading the tea leaves

Climate change and the British cuppa

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Cover: A tea picker with her child in the Tana River Basin, Kenya Photo: CIAT/GeorginaSmith

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Introduction

Tea is the most consumed drink in the world after water and it's the most popular hot beverage in the UK with three-quarters of the population drinking at least one cup a day.¹

Black tea makes up 85% of sales in the UK and globally demand is expected to increase as the growing global middle class seek out its refreshing taste and multiple health benefits.

However climate change is threatening the future of the British cuppa. Rising temperatures, drought, erratic rainfall and flash floods are taking their toll on the key tea growing regions of the world, damaging the delicate leaves that go into our teabags and ruining the livelihoods of the people who grow and pick those leaves.

This report highlights the impact of climate change on the world's four biggest tea growing nations: China, India, Sri Lanka and Kenya and will also examine how a changing climate is threatening the taste and nutrition of tea.



Kenya



A farmer picks tea near Mount Kenya. CIAT/NeilPalmer

Half the tea drunk in the UK is grown in the East African country. Not only is Kenya the biggest source of our tea, we import more from Kenya than the next nine countries combined.

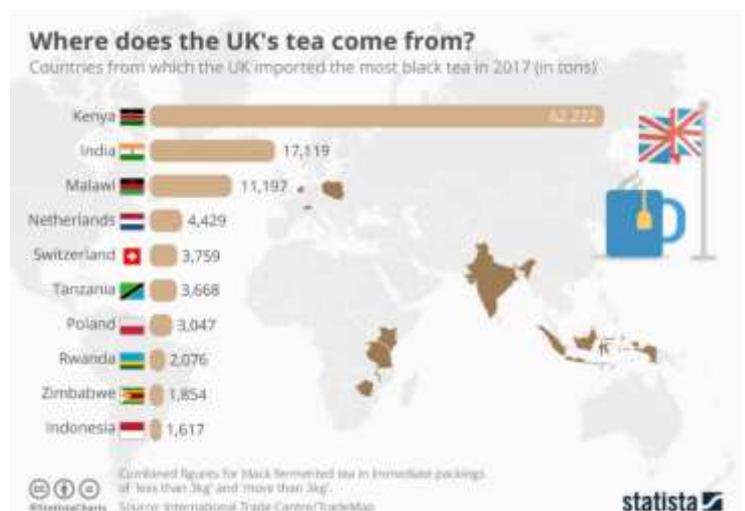
However, this may be set to change and the livelihoods of many Kenyan tea producers could be in danger due to climate change. Kenya is the biggest exporter of black tea in the world so any drop off in production will have global consequences.²

The origins of the British cuppa are riddled with injustices. During the colonial era, many Kenyans were forcibly evicted from their lands to make way for British tea plantations, now mainly owned by multinational tea companies.

For many years Kenya had the perfect climate for tea growing. Tropical, red volcanic soils and long, sunny days. The bushes grow best in mountainous regions, above 2000m, at temperatures of 16C to 29C and with stable rainfall.

Climate change is bringing erratic rainfall making floods and droughts more common and temperatures are rising, posing a threat to tea plantations carefully cultivated over many years.

A study by Sadeeka Layomi Jayasinghe and Lalit Kumar for the journal *Agronomy* found that climate



change is going to slash optimal conditions for tea production in Kenya by a quarter (26.2%) by 2050.³

In particular, the optimal growing areas around Mt Elgon and Mbeere will be totally absent under all climate projections by 2050.

And while the optimal tea growing regions will see production cut by over a quarter, the outlook is even bleaker in areas which currently have merely average tea growing conditions. The study found that in these areas tea production will fall by 39% by 2050.

The researchers concluded that it will be very hard for tea growers to move to new, previously uncultivated regions. "Tea is unlikely to be established in the areas of Kenya where it had not previously existed," they said.

As well as uneven rainfall and prolonged droughts, the main culprit is volatile temperatures. These are expected to rise above 23.5C which is the optimal average temperature for shoot growth and development.

This decline in production is already being felt by Kenyan tea growers. In a survey of 700 farmers in all seven of Kenya's tea growing regions the UN's Food and Agriculture Agency found farmers had observed that changes in rainfall patterns, distribution, and reduced yield of tea were tied to climate change. 43% of respondents had noticed changes in rainy and dry seasons which led to shifts in planting season and 35% cited drought.⁴

To compound this between October and mid-November 2019, Kenya saw rainfall up to 400% higher than average leading to floods. The change in climate made it perfect for plagues of locusts which consumed every morsel of vegetation in their path⁵.



Kenyan tea plantation. Arfan Abdulazeez

India



India tea pickers

India's tea estates also have a dark past. They were first formed in the 1830s, at the same time slavery was banned in the British Empire. Without slaves to do the labour-intensive work, the East India Company used indentured labourers, free men and women who signed contracts binding them to work for a certain period. But conditions for these workers weren't much better than for slaves.

India is the second largest tea producer in the world. More than half of it is produced in the north east region of Assam, the largest single tea growing region in the world. North Bengal in the Darjeeling district is another major tea growing area.⁶ However climate change is threatening these very regions which will have an impact on the growing of tea in India and those working in the sector.

In a survey of producers in Assam, 88% of plantation managers and 97% of smallholders stated that the challenging climate conditions were a definite threat to growing and production of tea.⁷ Furthermore, climate change has caused erratic rainfall which has led to both droughts and heavy rain in Assam.

The changes in average temperature and rainfall patterns could lead to some traditional tea-growing regions of Assam in India becoming obsolete for tea cultivation. A report by the Ethical Tea Partnership showed that tea regions of Assam could significantly reduce by 2050.⁸

Climate change particularly affects the tea plants' yield, as intense rainfall can cause erosion and waterlogging of soil, which damages the root development.⁹ Although one study in India has shown that while climate change will damage many traditional tea growing regions it may lead to others becoming more suitable. However this is of little help to families who have cultivated their farms over many years and which produce unique tea varieties like Darjeeling.

According to a long-term study by Darjeeling Tea Research and Development Centre (DTR&DC) in Kurseong, Darjeeling district, West Bengal, a temperature rise and decline in annual rainfall and relative humidity has contributed to overall production declines.¹⁰ The production of Darjeeling tea that stood at 11.29 million kg in 1994, dropped to around 8-8.5 million kg in 2018.¹¹

Darjeeling has not just faced production problems due to climate change but it is also causing a drop in quality and a loss of the tea's famous light taste and aroma. More extreme bouts of heavy rainfall in Darjeeling and rising temperatures have also led to new and increased pests and insects, yet another challenge that tea farmers need to respond to.¹²

China



Woman harvesting tea in China

China is the world's largest tea producer, supplying the world with over 300 thousand metric tons of tea annually. Tea in China is regularly produced in the provinces towards the south and east of the country where the weather is humid and changes from tropical to subtropical. Green tea in particular, is the most produced and consumed Chinese tea and is growing in popularity in the UK thanks to its antioxidant health benefits.

However climate change is reducing tea yields in China, with changes to weather patterns over the past 50 years affecting crop growth, quality and chemical composition of tea leaves, according to researchers in the US and China. A study led by Tufts University in Massachusetts has found that longer monsoon seasons with heavier daily rainfall can be linked to crop losses.¹³

Another Tufts University survey of Chinese tea growers found the majority of farmers interviewed had observed shifts in the occurrence of seasons, the length of seasons, increased temperatures, and changes in rainfall.¹⁴

Many farmers in China's tea-growing provinces have noticed that extreme rain or droughts can distort the taste and aroma of tea (see section below on taste for more information). Furthermore, warmer weather and changes in the rainfall patterns also lead to pests and weeds in tea plants which can dry them out. These changes impact

the livelihoods of tea farmers with many saying that climate change has contributed to a reduction in their income.¹⁵

Farmers in Yunnan Province have reported that drought has cut production by half with provincial officials blaming climate change for the greater frequency of drought in recent years, while warning that rising temperatures threaten losses in crop production.¹⁶

The Yunnan government has warned that mean annual temperatures will keep rising over the next 10 to 30 years, adding that rain patterns disrupted by climate change will threaten the output of crops such as tea, tobacco and rubber. “The entire precipitation pattern has changed due to global warming,” said Xiao Chan, head of weather services at Beijing’s National Climate Center.¹⁷

Sri Lanka

Sri Lanka is the fourth-largest producer of tea globally, generating more than 18% of global tea exports. It is the sole producer of Ceylon tea, which has been described as “the highest-quality tea in the world” for its unique aroma and taste characteristics. A crucial plank of the country’s economy, the industry employs a tenth of the Sri Lankan population.

This industry has developed thanks to Sri Lanka’s excellent tea growing climate of predictable rainfall and suitable temperatures. However the World Bank warns that average temperatures in Sri Lanka could rise by up to 2C by 2050 if action to cut emissions is not forthcoming which would spell disaster for the country’s tea producers.¹⁸

According to a study specifically looking at the impact of climate change on Sri Lankan tea production in the journal *Agricultural and Forest Meteorology*, Sadeeka Layomi Jayasinghe and Lalit Kumar found that optimal tea growing areas would be reduced by 10.5% by 2050. Medium quality areas would suffer even more, down by 17%.¹⁹



A woman working in a tea plantation in central Sri Lanka.
Christophe Meneboeuf

Climate impact on taste

What gives tea its flavour is known as 'secondary metabolites'. These aromatic compounds are what allows people to differentiate one tea from another as well as giving tea its antioxidant qualities and caffeine.

However when tea plants get really wet they suffer a double whammy because the plants stop having the ecological cues to make these metabolites and the few that are there get diluted as the plant gets waterlogged.

Global warming has brought unseasonably high levels of rainfall in many parts of the world. Because the atmosphere's water-holding limit increases by about 4% for every 0.6C degree rise in temperature, extreme precipitation is more likely when a storm passes through a warmer atmosphere holding more water.²⁰ These places include major tea producing areas like China's Yunnan province, Assam and Darjeeling in India among others. Tea plants can only take a certain threshold of rain, and in all of these areas, plants are being pushed past their precipitation limits.

That means that a tea plant can actually grow in size because of the extra rain but the leaves be of inferior quality leaving the tea tasteless.

Climate impact on health benefits

Another reason for tea's popularity is its positive impact on human health. Studies have shown that tea can help boost the immune system, fight off inflammation and prevent cancer and heart disease, as well being a stimulant to help people be more alert throughout the day.²¹ However, researchers have found that climate change is expected to result in lower quality, less healthy tea in the future.

The key secondary metabolites that contains anti-inflammatory, cardioprotective and stimulant qualities are methylxanthine and polyphenolic compounds such as the antioxidant epigallocatechin gallate.

Dr Salena Ahmed of Montana State University lived in China's Yunnan province for eight years conducting research into the properties of tea and the impact of climate change. Her laboratory studies showed that tea's key health compounds were reduced by 50% when leaves are harvested after heavy rains.²²

Another study showed that rising temperatures may also strip tea of its health and medicinal qualities.²³ Researchers from Tufts University in Massachusetts, found that tea grown at a higher elevation, where the temperature is lower, contains compounds potentially beneficial to health that are missing from tea grown at a lower elevation at the same location. This implies that tea would lose some of its purported health benefits should temperatures climb.

Climate change in Kenya

Kenya is hugely vulnerable to climate change with projections suggesting that its temperature will rise up to 2.5°C between 2000 and 2050. Rainfall will become more intense and less predictable. Even the slightest increase in droughts will present major challenges for food security and water availability, especially in Kenya's arid and semi-arid area in the north and east.

Other parts of the country, most notably in the Rift Valley, are also vulnerable to climate change due to increasing extreme weather events especially droughts and floods while glacier melt will further reduce future water availability. Coastal areas suffer from rising sea levels and associated floods and saltwater intrusion.

Richard Koskei, 72, a tea farmer from Kericho in Kenya's western highlands, said: "Tea is our livelihood. Tea has been of assistance to us and has enabled me to support my family for decades. It's a vital part of life and without it whole communities here would struggle. For generations we have carefully cultivated our tea farms and we are proud that the tea that we grow here is the best in the world. But climate change poses a real threat to us. We cannot predict seasons anymore, temperatures are rising, rainfall is more erratic, more often accompanied by unusual hailstones and longer droughts which was not the case in the past. If this continues then it will make growing tea much harder and life for us extremely difficult. The conditions here used to be good and we had a great tea harvest. When the climate changed the production of tea in my farm dropped.

"We have nothing else to rely on here. People in my community will consider running away from tea farming, with jobs lost and consumers of tea might see the price rise. The low earnings have made the younger generations opt for other means of earning income. When you add Covid-19 then the situation becomes worse. It has resulted in even lower earnings from our tea because we had to scale down as we tried to take measures to prevent the further spread of the disease.

"We see the impact of climate change and we also know how it's caused. Carbon emissions need to be reduced urgently. Farmers like us are bearing the brunt of this crisis but we aren't the ones that have caused it. We small scale farmers cannot fix this problem ourselves. This needs a joint effort from developed countries who enjoy our tea abroad. Tea is an example of how we are all connected. We grow it here in Kenya and it's enjoyed by people around the world. But if we are to carry on growing it we need those other, richer countries, to cut their emissions and to think about how we are affected as tea farmers."



Richard Koskei on his tea farm in Kericho, Kenya.

Recommendations

In order to tackle the climate change which is making tea growing in Kenya and elsewhere so challenging there are three things we recommend. These will address the root cause of the problem, help countries adapt and give them support to aid tea growers whose livelihoods are under threat.

1. Cut emissions to prevent climate change from accelerating the harm caused to tea growing regions.

Recently we have seen countries like the US submitting new and improved climate plans under the Paris Agreement. These 'Nationally Determined Contributions' (NDCs) need to be ramped up ahead of COP26 in November 2021.

2. Boost climate finance to help countries help farmers adapt to the changing climate and assist in the diversification of livelihoods to climate resistant crops.

Rich countries promised to deliver \$100 billion a year in climate finance by 2020 to help poor nations leapfrog dirty energy and adapt to a changing climate. This has so far been lacking and needs to be mobilised ahead of COP26.

3. Debt cancellation to help poorer countries gain the fiscal space to better respond to the impacts of climate change.

Poor nations are currently facing acute financial pressures dealing with the Covid-19 pandemic with many economies stagnant after lockdown measures. Combined with other difficulties including poverty, conflict, poor health and climate change, budgets are stretched. Post-Covid debt cancellation at the G7 would give these nations financial breathing space to respond to these challenges.

End notes

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