Cocoa crisis: How chocolate is feeling the bite of climate change

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christian aid

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Contents

Cover: Children in Guatemala hold cocoa pods. Credit: Amy Sheppey/Christian Aid

Executive summary

The impact of climate change is being felt on chocolate this Valentine's Day. Cocoa prices are spiking to record levels as extreme weather causes failed harvests in Ghana and Côte d'Ivoire, where more than 50% of global cocoa is grown. This year's shortage follows a similar crash in production last year which saw cocoa prices rise 400% to $12,218 a ton after droughts, floods and climate-related diseases hit cocoa farmers last year. On 18 December 2024 a new record was set at $12,605 per ton and prices have remained stubbornly high ever since.

The cocoa shortage started in 2023, however, after unexpectedly heavy rainfall during Ghana's dry season. Total precipitation in West Africa was more than double the 30-year average for the time of year and the wet conditions caused plants to rot with black pod disease. This was followed by severe drought in 2024. The UN said that Ghana's 2024 drought affected more than 1 million people, resulting in terrible crop losses and record-high food prices.[1] According to a study by World Weather Attribution, climate change made the heatwave in West Africa 10 times more likely.[2]

Chocolate and the livelihoods that depend on it are at risk from this changeable, extreme weather caused by rising greenhouse gas emissions. Ultimately, we need to see emissions reduced to halt the impact of climate change and in the meantime financial support should be provided for cocoa farmers to help them adapt and diversify their incomes.

Introduction

"At no other time has Nature concentrated such a wealth of valuable nourishment into such a small space as in the cocoa bean."

Quote source. Alexander von Humboldt (1769–1859), natural scientist.

February 14th: a day to celebrate romantic love, with affectionate gifts of roses and chocolates. But what is the outlook for the US$109 billion market for chocolate in a world of a changing climate?

Chocolate comes from cacao, a tree-grown pod, grown in the tropics. Around two thirds come from the West African countries of Côte d'Ivoire and Ghana, a spatially concentrated area that increases the vulnerability of cacao production to climate related factors.

Chocolate has made its own historical contribution to climate change and biodiversity loss through deforestation and forest degradation to grow the trees. Transportation of the pods and the processed products also have their climate footprints.

But cacao trees are themselves vulnerable to climate change: changing weather patterns in growing areas bring greater temperatures and more irregular rainfall, both of which can make the growing conditions less than ideal from the trees' needs, and so reducing their pod production. Changing climatic conditions may adversely affect the tiny midge pollinators which the trees rely on to fertilize their flowers. Poor genetic diversity of commercial plantations increased industry risks to climate-exacerbated microbial diseases, further risking the income of already grossly unpaid farmers.

Chocolate can be even more complex and vulnerable due to its exposure to climate change: our favourite bars, boxes and truffles are often also manufactured using other tropically-produced commodities, such as sugar, soy and sometimes palm oil, each of which has its own climate-related supply chain vulnerabilities and wider environmental impacts.

Social problems, particularly undervaluing and disempowering of women, as well as child trafficking and slavery are social issues associated with cacao growing, and thus chocolate production, in some parts of the world.

However, to minimize the impacts of climate change on cacao growers and their workers, and to improve the social sustainability of an industry where this is not always a given, it is imperative that the global community treat the climate crisis as a crisis. There is no excuse for putting off policies for rapid and radical action, as it is the total cumulative emissions that will determine whether the internationally-agreed, and scientifically-imperative, goal of limiting global average temperature increases to 1.5°C will be achieved. This will require a rapid transformation of the energy sector from fossil fuels to renewable energy and conserving and restoring lost and degraded ecosystems.

Chocolate

Chocolate is the food of the gods. Literally: the Greek-derived name for the tree on which cocoa pods grow is *Theobroma cacao,* and it was Linnaeus who gave the tree this name in his 1753 work "Species

Plantarum"[3]. 'Theo' means 'god' while 'broma' means 'food'[4]. The word 'cacao' is thought to be a Spanish derivation from the Aztec word 'chcahuatl', which is what they called the beans[5]. The origin of the word 'chocolate' may derive from the Aztec word for their drink 'xocolatl', while another hypothesis suggests the Aztec word 'choqui', meaning 'warmth'[6].

Chocolate is generally thought to have been domesticated first in Mesoamerica, by the Olmec people[7], who flourished between 1200-400 BC[8]. However, genomic research has shown that the greatest genetic diversity of *T. cacao* is in the upper Amazonian region in NW South America, indicating that this is its origin. Theobromine and DNA residues found from archaeological research in SW Ecuador date from approximately 5300 years ago[9].

It was not for another 6800, or so, years until Europe got its first taste of the magic beans: Cortés introduced chocolate to the Spanish court after his 1519 travels to Mesoamerica and there sweeteners like honey and sugar began to be added. In 1585 Spain received its first known shipment of cacao[10]. A Dutch chemist, Coenraad van Houten, opened the modern era of chocolate making in 1828 when he patented his innovative process of using a hydraulic press to remove most of the cocoa butter from processed cacao to give cocoa. He added alkaline salts to allow the cocoa to mix more readily with water: the so-called 'Dutch process'[11].

The baton then passed to the Brits, and JS Fry's contribution was to remix the cocoa butter and liquor and to add sugar and to set the resulting mixture in molds: the first chocolate bars. The Swiss then got into the game with chocolatier Daniel Peter adding milk powder to create milk chocolate[12]. Chocolate is thought to have been associated with Valentine's Day since 1868, when Richard Cadbury produced, but did not patent, a heart shaped box containing chocolates[13].

There are different schools of thought on the nomenclature around chocolate.

Here, we use 'cacao' to describe the unrefined bean and the tree on which it grows. Cacao trees produce pods which contain ~20-60 seeds, known as cocoa beans. Cacao is minimally processed and comes in the form of nibs, powder and paste.

Cocoa is produced by opening the cacao pods, fermenting the beans for between 2 days and a week, drying the beans to reduce moisture content from 55% to 7.5%, roasting the beans (an individualized process depending on the desired output), removal of the bean's shell to leave the cacao nib, which can then be ground into a paste called cocoa mass, which is roughly half and half cocoa solids and cocoa butter[14]

Q: What is the difference between cocoa powder, baking chocolate, dark, milk, and white chocolate?

A: It all boils down to how chocolate is made. Cocoa beans are roasted, graded, and ground to make a chocolate liquor, which also contains cocoa butter.

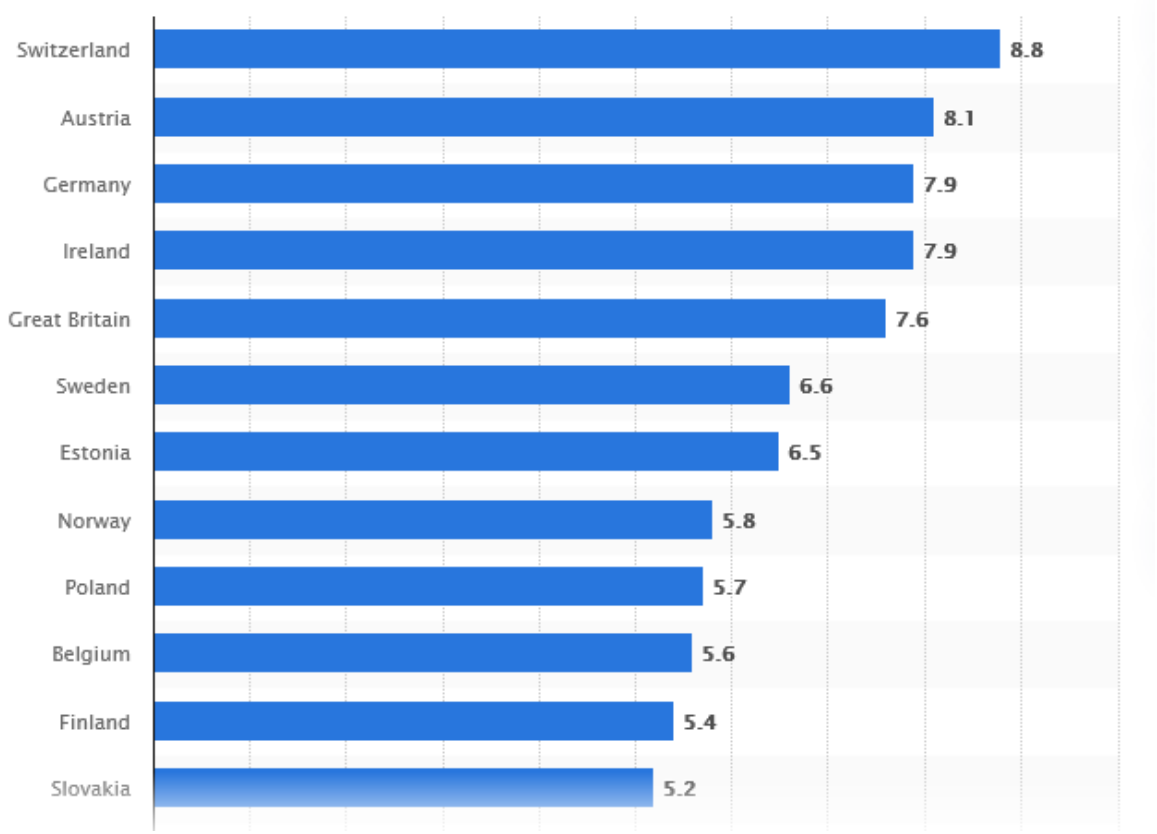
- Unsweetened baking chocolate is chocolate liquor that's been solidified and pressed.
- Cocoa powder is when cocoa butter removed from chocolate liquor and the remainder dried into cocoa powder.
- Dark chocolate is a blend of sugar, cocoa butter, chocolate liquor, and sometimes vanilla.
- Milk chocolate is made by adding milk or milk powder to the dark chocolate formula.
- White chocolate contains sugar, cocoa butter, milk or milk powder, and vanilla. It has no chocolate liquor.[15]

This report first describes the global chocolate market, before exploring in more depth ways in which climate change and cacao production interface. Social and other environmental impacts are raised, with deeper exploration of the particular circumstances of some of the most important cacao producing countries. Finally , the report explores whether something as divine as chocolate can actually be good for you? It does contain some minerals and flavanols that seem to have a variety of helpful health benefits. This comes with some caveats, however. Chocolate can contain a lot of fat and sugar. In general, the darker and more bitter the chocolate, the better it is for you.

Global market – supply and demand

In 2024, the global chocolate market is expected to have been worth US$109 billion, and has been estimated to grow to US$145 billion by the end of this decade, assuming a compound annual growth rate of 4.9%, faster than the 3.8% growth seen between 2018 and 2023. Milk and white chocolate dominate the confectionary market share, accounting for 64% of value share, while dark chocolate is expected to be the fastest growing part of the market, because of consumer interest in its health benefits[16]. Other drivers that are growing market shares include demand for dietary specialist products, such as vegan, organic, gluten-free, and sugar-free chocolates[17].

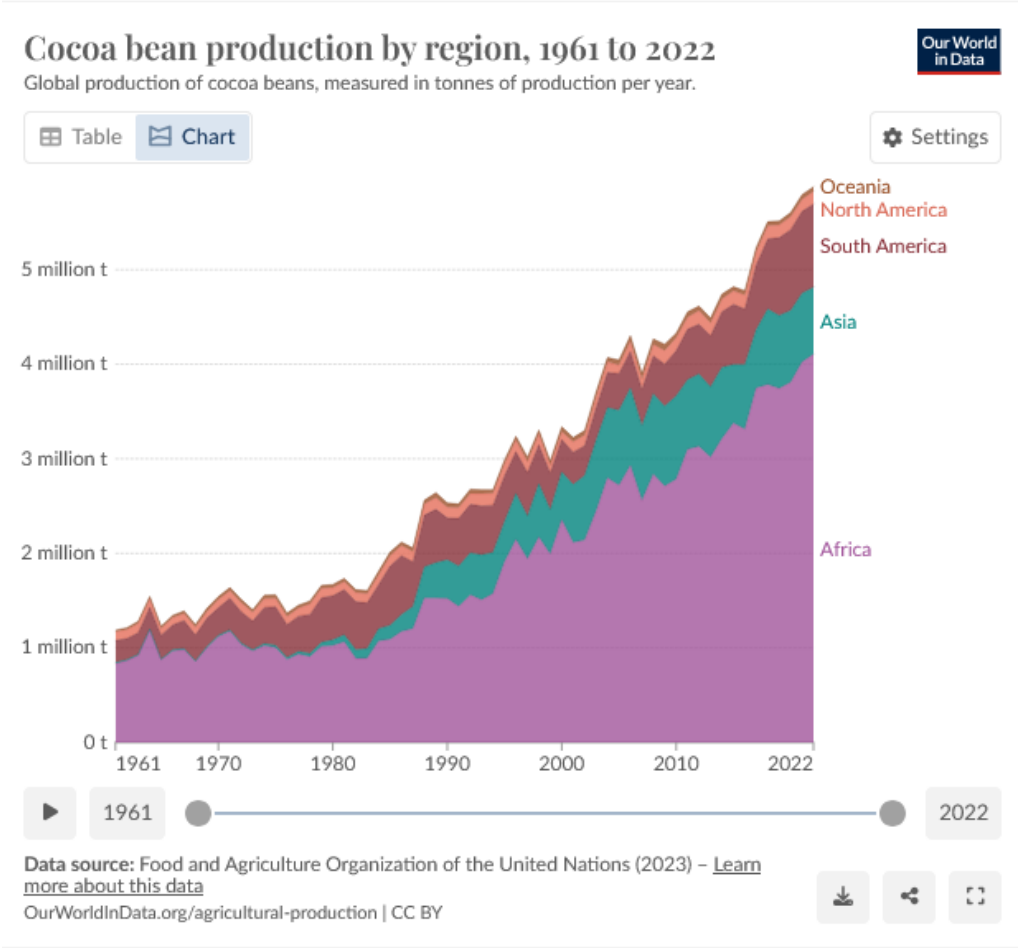
Europe is the largest regional consumer of chocolates, with the UK in fifth place on a *per capita* basis, with 7.6kg consumed per person in 2017. Switzerland manages to put away 8.8kg of chocolate per person per year, with Austria not far behind with 8.1kg.



Source: https://www.statista.com/statistics/819288/worldwide-chocolate-consumption-by-country/ [18]

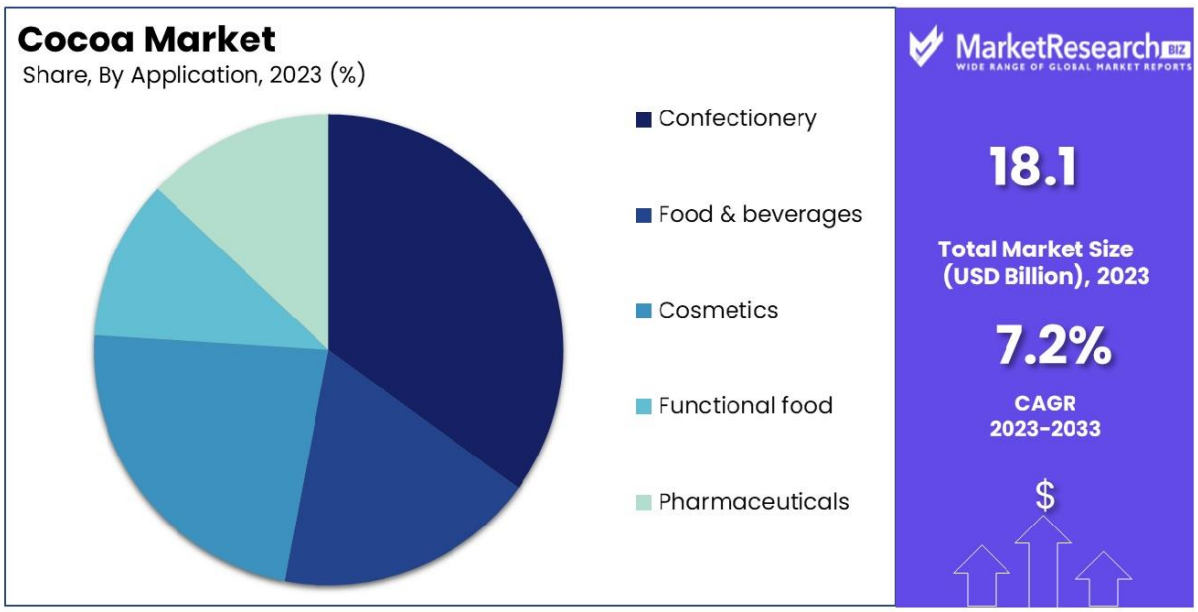
The largest absolute importer in 2023 was the US, with US$4 billion worth of imports, or 10.9% of the total imported chocolate. The UK came second with US$3.1 billion (8.3%) followed by Germany US$3 billion (8.1%), France US$2.7 (7.3%), the Netherlands US$1.8 billion (4.8%) and Belgium in sixth with US$1.4 billion (3.7%). Overall, the US and Europe account for over 80% of market share, although the Middle East is the most rapidly growing market for chocolate[19]. International purchases of imported chocolate totalled US$37 billion in 2023[20].

Cocoa bean production is dominated by the West African countries of Côte d'Ivoire (~2.2M tonnes in 2022) and Ghana (1.1M tonnes), with Indonesia in third place (~667k tonnes). Ecuador takes fourth place (337k tonnes) with Cameroon in fifth (300k tonnes) and Nigeria sixth (280k)[21]. Production has increased around five-fold since 1961 with massive growth in African production, Asia entering the market and South America maintaining a presence.



Source: https://ourworldindata.org/grapher/cocoa-bean-production , using FAO data

Demand for cacao products is not limited to chocolate (although that is the focus of this report): cosmetics and pharmaceuticals also account for a significant share of the market[22]. If you use a cocoa butter-containing moisturizer, it will be subject to the same climate-related impacts on cacao production as your favourite bar of chocolate.



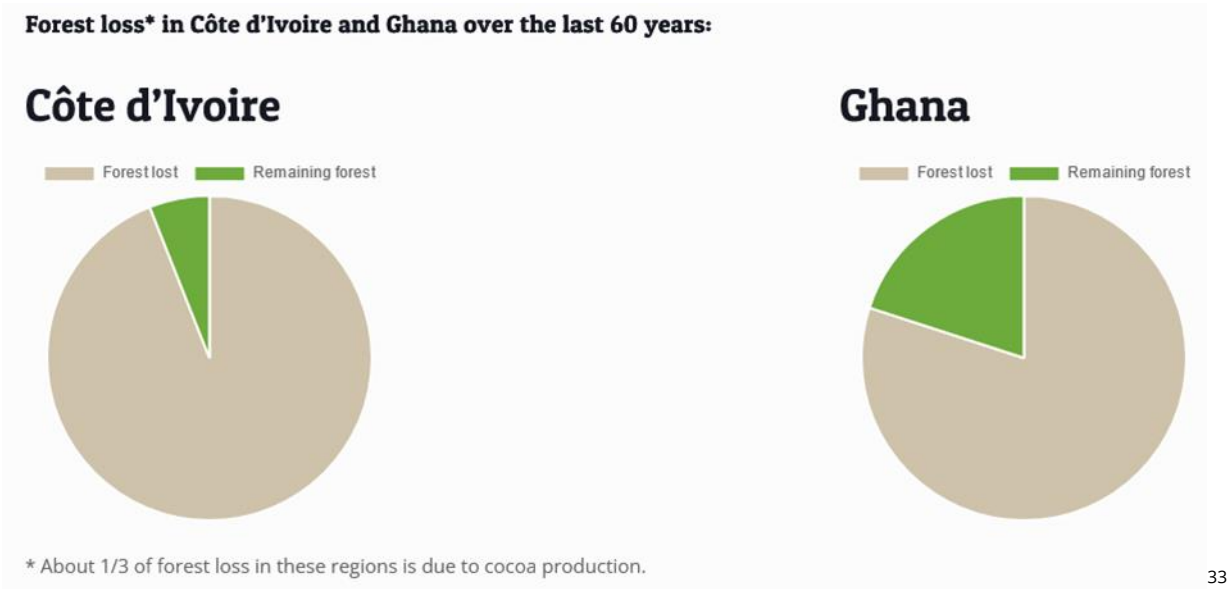
Source: https://marketresearch.biz/report/cocoa-market/

Chocolate and Climate Change

Like any other plant, *T Cacao* has preferred growing conditions. It grows in tropical countries, mainly between 20ºN and 20ºS[23]. It likes elevations of 30-300m above sea level, temperatures in the range 20-28ºC, and at least 100cm of annual rainfall, reasonably evenly distributed, with 150-200cm optimal. The tree needs well-drained soil that is humus-rich and, because of its shallow root system, it needs protection against strong winds[24]. *T Cacao* appreciates shade, and so is often grown under other larger trees, such as mango[25], rubber or banana[26].

It can take five years from seed to bearing fruit and an average mature tree can produce 30-40 pods per year. Commercial cocoa bean crop yields may vary from less than 100 to over 3,000kg per hectare, with 340-450kg per hectare average across the world. Because of the tree's susceptibility to disease, it is usually grown in small, labour-intensive, farms of less than two hectares, rather than in large plantations[27], although high intensity systems are also used and there may be conversion of the former to the latter to avoid resource competition, notably in SE Asia[28].

The changing climate is already impacting cacao growers because of changing weather patterns and pest problems[29]. In West Africa, climate change, combined with deforestation (some of which has been done to create space to grow the cacao trees), see below, have changed rainfall patterns[30]. Forests emit hydrocarbons that act as nucleation centres for raindrops, that on a large enough spatial scale can create rainclouds: their loss leads to drying. The 2023-24 El Niño weather phenomenon was a strong one[31], and some recent research suggests that climate change may be exacerbating the phenomenon, so that the two climate effects can act additively[32].



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Longer term, research has predicted that Côte d'Ivoire and Ghana, which together produce over half of the world's chocolate, could experience average temperature increases of 2.1ºC by 2050[34]. While higher temperatures are not necessarily a direct barrier to cacao growing – *T. Broma* trees in Malaysia experience higher temperatures than their African counterparts – the increased heat will lead to increased evapotranspiration from the trees' leaves, and since this is not predicted to be accompanied by overall increased rainfall in West Africa, this net moisture loss is likely to put stress on the trees[35]. A 2013 study of

Côte d'Ivoire and Ghana found that, of the 294 locations examined, 89.5% were deemed likely to become less suitable for cacao production by 2050[36].

As well as changing weather and climatic patterns, chocolate production is vulnerable to the changing climate because of the lack of genetic diversity of the commercially grown trees. Since the 1940s, chocolate trees have been bred from a fairly small genetic pool, and while there have been improvements in disease resistance and adaptability, little new variation has been introduced that might help commercial *T. cacao* growing more sustainable in the changing climate. On-farm genetic diversity on SE Asia and West Africa is low and therefore not resilient to changes caused by climate change[37].

Climate change also affects the wider ecosystems in which cacao is grown, including prevalence of microbes and insects. If the weather is too dry, the trees may abort their pods, if it is too wet and there is not enough sun, they become more susceptible to disease. The fungal disease black pod (Phytophthora) is the main problem in this regard[38]. Witches' broom (caused by *Moniliophthora perniciosa*) and frosty pod rot (caused by *M. roreri*) are additional fungal threats affecting the Americas' and West Indies' production. Asian trees are not immune from fungal attack either: *Oncobasidium Theobroma* attacks the branch tips first before working down the tree.

Insects are another threat to production. In West Africa, mealybugs can spread viral disease, while other insects can affect the tree's vegetation, weakening it, or can attack the pods directly, lowering yields[39].

Climate change may also impact the cacao trees' pollinators[40]. The flowers, which grow out of the trunk of *T. cacao* and branches, are pollinated by tiny midges[41,42.], which themselves may not weather the climatic changes well. This is serious, as the trees have a specialized dependence on *Forcipomyia* midges, who prefer shaded damp environments. From this factor alone, a 2023 study on the loss of insect pollinator abundances as a proportion of all production in a given location, found that "among crops, cocoa is estimated to be at highest risk, by a large margin, especially in Africa"[43].

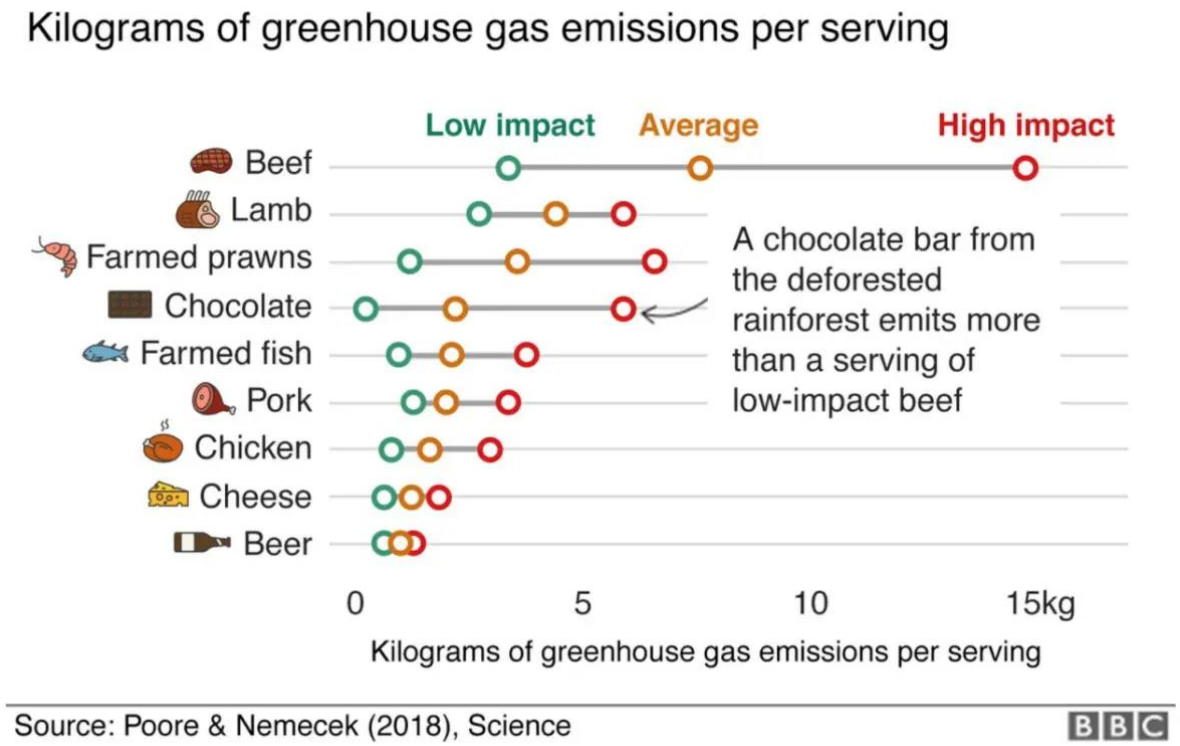
Cacao pods

Cacao pods can be red, orange, yellow or green, depending on the tree variety. There are three general divisions of types[44]. Forastero pods are most used in commercial production, not least as criollo is very prone to disease and so is not widely grown. Trinitario is a hybrid of these varieties and is used in high quality dark chocolate[45]: the pool of varieties grown commercially is small.

Source: https://www.lakechamplainchocolates.com/where-do-cocoa-beans-grow/

Chocolate consumption itself contributes to climate change. Deforestation is a major impact, and use of fossil-fuel based agrochemicals continues reliance on the very things (fossil fuels) that have done most to cause climate change. As well as environmental impacts of producing the core commodities that go into chocolate, there are further environmental impacts in transporting and processing the ingredients for

chocolate, including greenhouse gas emissions from transportation. Overall, chocolate grown in deforested rainforest can have a higher climate impact per serving than some low and medium impact animal-based foods.



Source: https://cocoarunners.com/chocopedia/water-and-chocolate/

Social impacts:

Chocolate growers typically do not make enough money from their production to cover their basic needs. Most earn less than a dollar a day[46]. Market prices vary, and while the governments of Ghana and Côte d'Ivoire set prices paid to farmers which protects them from volatility, since prices are set at the start of each cocoa campaign, farmers are unable to capitalize on higher revenue when global market prices do rise. In contrast, Latin American growers lack the baseline protection in bad years, but their exposure to markets means that they can benefit in times of high prices[47]. Farmers also are disadvantaged by an unfair supply chain: on average, cocoa farmers earn just 6% of the final value of a bar of chocolate[48] and most are not organized into cooperatives that could enable them to better collectively bargain and benefit[49]. The current cash crop-driven economies of West Africa should also be seen in the wider context of their colonial histories and latter-day extensive interventions by the World Bank and IMF[50]: without these drivers, perhaps more sustainable and fair economies may have emerged.

Women:

As bad as things can be for male farmers, women have an even tougher time. A 2020 Fairtrade report found that in West Africa, the average woman cocoa farmer earns as little as 23p per day[51], compared with the (still unliveable) 75p daily income that men earn[52]. The report found that, as well as earning significantly less, women have fewer rights than men and do not have the enhanced security of owning land. Their work on the cocoa farms is on top of their domestic labours.

Deforestation:

For both men and women, the low incomes mean there is no spare cash that they can use to develop more robust agroforestry systems to make their farms more productive and means they may be driven into collusions with illegal loggers or poachers for food or money[53]. These actors degrade the local environment and its biodiversity, which can make it less resilient to climate impacts. This poverty trap also has carbon implications: a study of Indonesian cacao stands found that above- and below-ground carbon stocks were fives times higher in multishade agroforestry stands than in monoculture plantations (57, compared with 11 MgC ha^{-1} yr^{-1}) and the additional sequestration was achieved without losses in yield[54].

Chocolate can act as a driver for deforestation, with concomitant losses in biodiversity and stored carbon. Forest clearance for cacao production has been implicated in 70% of illegal deforestation in Cote D'Ivoire[55]. It is not just the cacao however that is a driver for forest loss:

Palm oil can be an ingredient in chocolate to give a smooth texture and has directly caused an estimated 50% of deforestation in Malaysian Borneo and 3% in West Africa, as well as causing drainage of high-carbon storing peatlands[56].

Soy lecithin is also widely used in chocolate production to aid moulding. Soy is seen as an indirect driver for deforestation, as soybean farms are typically planted in old cattle pastures, but which push new ranches into virgin forests[57].

The EU has recently leveraged its market power to try and address deforestation in supply chains importing into the EU. Regulation (EU) 2023/1115 on deforestation-free products aims to reduce the EU's external carbon footprint, as well as reducing biodiversity loss, and is part of a wider range of measures the Union is implementing as part of its efforts to help Protect and Restore the World's Forests[58]. The Regulation requires anyone placing commodities, such as cacao or chocolate, on the EU market to be able to prove that the products have not originated from recently cleared land or contributed to forest degradation[59].

Child labour:

The poverty plight of the parents also falls on their children. As of 2018/19, an estimated 1.56 million children are involved in child labour in Ghana and Cote d'Ivoire alone[60]. Some have been trafficked away from their homes and parents and lost opportunities they may have had for education[61]. Despite the efforts of many companies to avoid the use of child labour in their products, including putting in supply chain monitoring measures, more needs to be done, including tackling the poverty that is often a root cause of child labour.

The Fairtrade Foundation has been active in trying to improve the situation of cocoa farmers. It offers farmers a minimum price, which sets a floor and not a ceiling on earnings for their products. Additionally, the Foundation provides a Fairtrade premium which goes into a community fund for workers and farmers, who have joined together to form a cooperative, to improve their environmental, social and economic conditions. Decision making is made by the farmers' democratically elected representatives. These schemes, paid for by socially-conscious consumers, help pay for things like improved access to education[62] for tens of thousands of cocoa farmers and their families. Under their Shared Impact initiative, Fairtrade are enabling retailers to pool resources through pre-competitive collaboration to support farmers to meet their environmental, economic and personal needs.

Other environmental impacts of cacao:

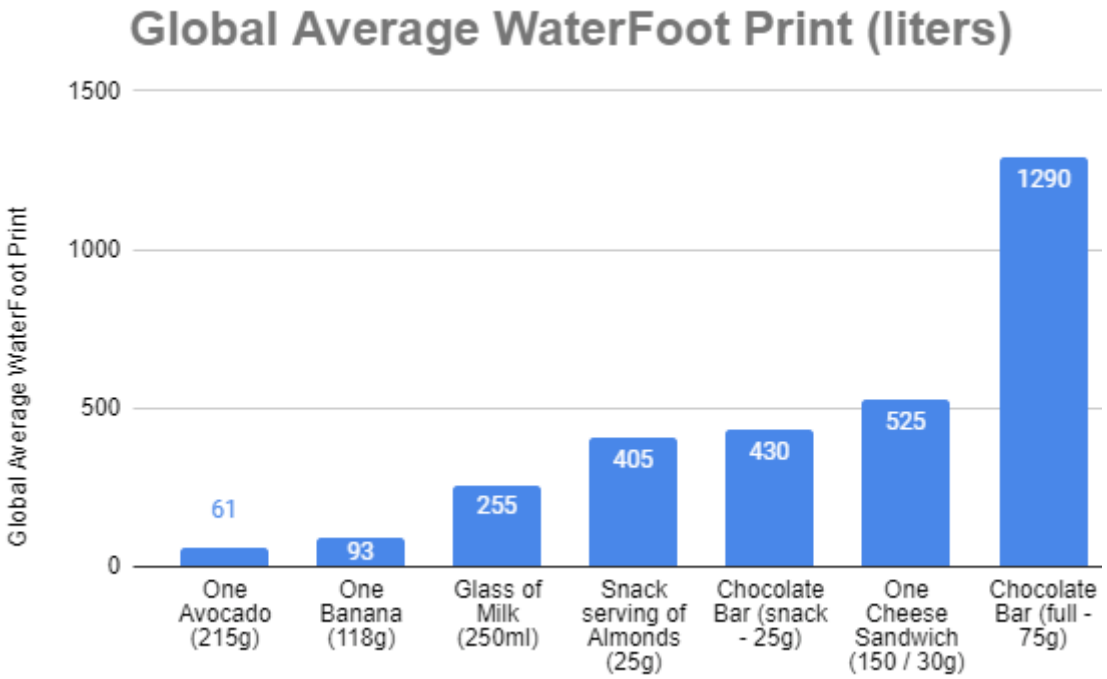
Cacao can be grown intensively, requiring inputs of pesticides and other agrochemicals, which has harmful effects on growers and the local environment. Every year 44% of farmers are poisoned by pesticides[63], with chocolate consumers also at risk.[64] In 2005, the EU used its power as a large market to regulate against the use of most dangerous pesticides, including cyclodienes (high toxicity, high persistence), mercurial fungicides

and many highly hazardous organophosphorus and carbamate insecticides[65]. While this is seen as having created positive change for the health of cacao growers, and the International Cocoa Organization (ICCO) provides updated advice on pesticide use in cocoa[66], research indicates that the on-going use of pesticides threatens pollinators that the cacao trees rely on to grow their fruits[67,68].

Sugar is a crucial ingredient in chocolate, but runoff of agrochemicals and silt can pollute freshwater and coastal ecosystems. It is also water-thirsty, taking an estimated 40 litres of water per teaspoon[69].

Another ingredient in milk chocolate - milk - is a source of methane emissions from the burping of cows: methane is a greenhouse gas with more than 80 times of the global heating effect than carbon dioxide, molecule for molecule over a 20-year time period[70].

Chocolate production also has an impact in terms of the thirstiness the *Theobroma cacao* trees: a 100g mass-produced chocolate bar can have required the input of 1500-2000 litres of water, making chocolate a commodity with one of the highest water footprints per unit of production[71].



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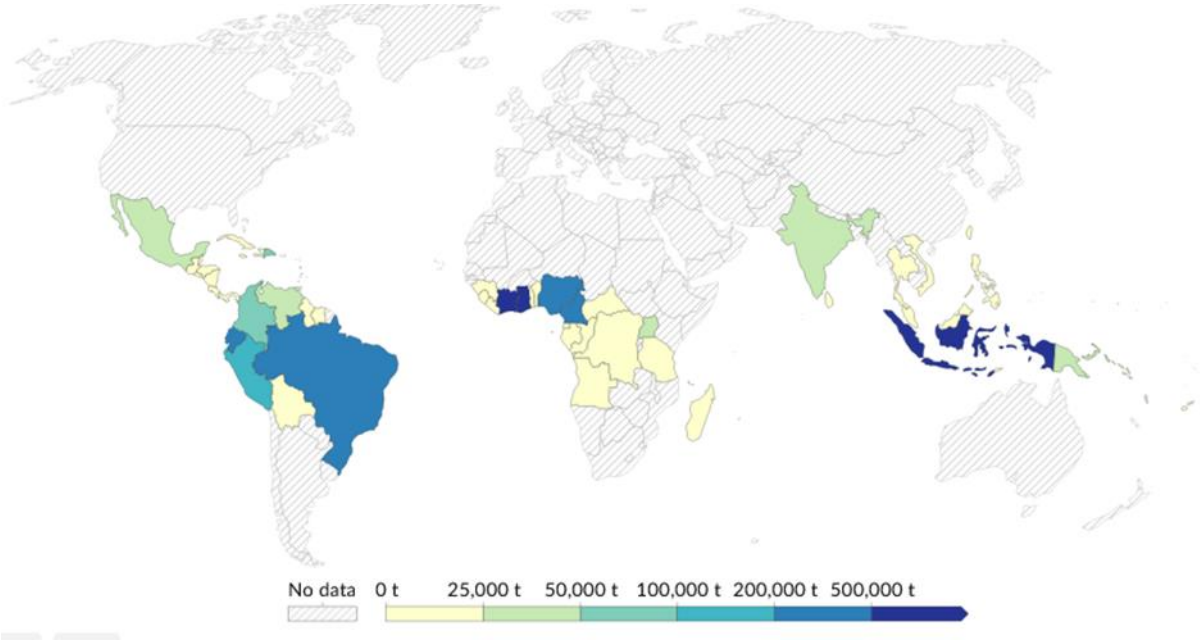
Country Case Studies

Cacao production is limited to the tropics and, even then, a few countries dominate commercial production. Côte d'Ivoire alone in 2022 accounted for around 37% of production, and together with other West African producer countries – Ghana, Nigeria and Cameroon – accounted for two thirds of global production that year. Indonesia is another big player with 11.4% of 2022's production. Ecuador and Brazil are the biggest producers in Latin America, together accounting for about a tenth of global production that year.

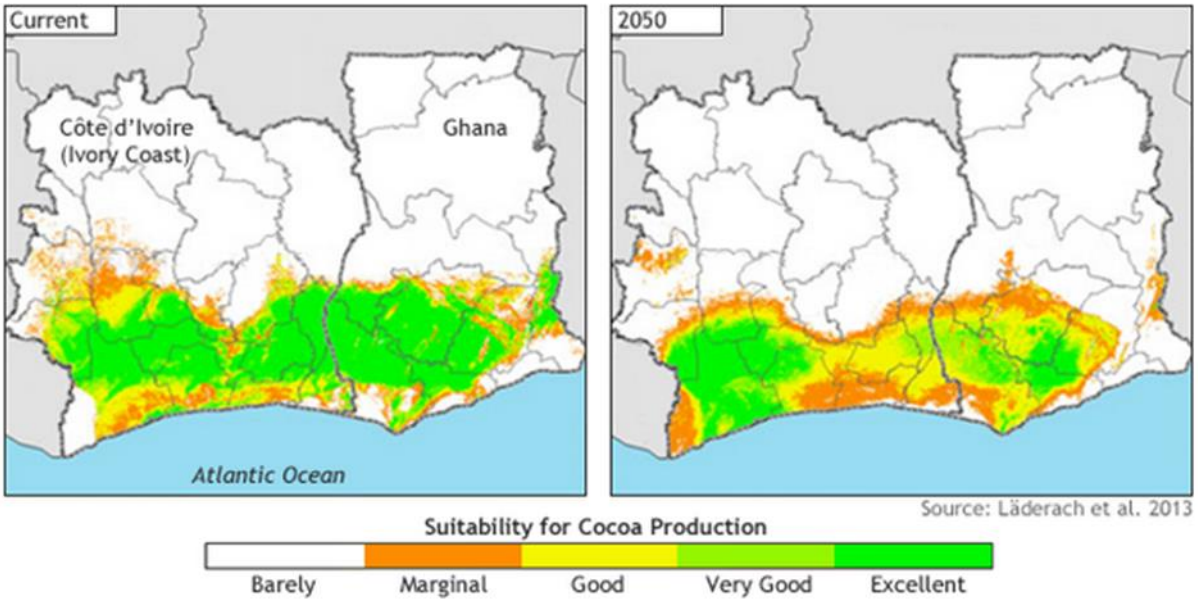


Source: Cocoa bean production in 2022, in tonnes https://ourworldindata.org/grapher/cocoa-bean-production

West Africa: Côte d'Ivoire and Ghana:

West Africa has grown *T. cacao* for a considerable time. Trees from Brazil were first brought over in 1874 in Nigeria and Ghana in 1879, following previously unsuccessful attempts by the Dutch (1815) and Swiss (1843) to grow cacao in Ghana. Cameroon's introduction to cacao production was another European project, in the colonial period between 1925 and 1939[73]. The area remains the mainstay of global cacao production.

But that it will remain so is not a given. The challenge of climate change and the resulting regional temperature increases has already been noted and can be seen below. In addition, other climatic systems pose a threat to the conditions required by *T. cacao.* El Niño can bring wet conditions and flooding, which do not give the trees the evenly distributed rainfall they favour and the flooding in contrary to the well-drained soil the trees need. The 2023-24 El Niño was a strong one and brought rot and swollen shoot disease to the trees. The fall in production meant both reduced incomes for West African farmers, and elevated cocoa prices on the global markets[74], increasing the prices of chocolates to far-away consumers.



These maps show suitability for cacao cultivation at present (left) and projected for 2050 (right). Image adapted from Läderach et al. 2013.

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Another challenge for the region is that the trees are ageing and so less productive than they were in their prime. An estimated third of Côte d'Ivoire's orchards will need to be replaced because of age and disease in the near future[76]. In Ghana, around 23% of the orchards will need to be replaced because of age, with 17% of the total cacao trees[77], or 590,000 hectares, affected by the fatal swollen shoot disease. Ghana's Cocobod, a regulatory and promotional body, had plans to support replacing ageing trees, but has run into financial difficulties that have impacted the farmers. Only 67,000 hectares have been rehabilitated by the body, nowhere enough to keep pace with the spread of the swollen shoot disease.[78]

As well as falling yields of pods, West Africa does not have high capacity for processing of the cacao, and so the added value goes elsewhere, often to Europe[79]. Fairtrade Africa is working to establish projects to address this to better allow locals, formed into cooperatives, to gain more financially from the product they work to produce by adding their value to the supply chain by producing products such as chocolate tablet, cocoa butter and cocoa powder[80].

As well as illegal mining, child slavery, trafficking and smuggling of cacao pods are other areas of criminality in the region connected to the cacao industry. This is at a time when the EU is requiring supply chain clarity and consumers also seek sustainable chocolate that does not involve child slave labour or deforestation. These social and environmental factors together create massive challenges for these West African countries.

Indonesia:

T. cacao trees were first introduced to Indonesia by the Spanish, during the 16th century, but Asia did not become a significant producing region until the 1970s, with Malaysia and Papua New Guinea among the other bigger regional producers[81].

Although world production of cacao has been generally increasing for several decades, Indonesia's production peaked in 2010, in part due to falling areas of land under cacao cultivation. Falling production has also been influenced by farmers' lack of skilled knowledge, including on pruning and pest control, as well as them having limited access to finance to replace older trees.[82] This is particularly an issue for smallholder farmers which make up >95% of Indonesian cacao plantations[83].

While production has been in decline, there have been efforts to reengage Indonesia's cacao industry. The Sustainable Cocoa Production Programme (SCPP), a public-private partnership involving a range of actors, is an initiative that reaches 165,000 farmers, with stated aims including "productivity increase, poverty reduction and reductions in greenhouse gas emissions" across the sector, including through training in improved practices and diversification[84].

Cacao farmers in Indonesia do not generally benefit from operating through the supply chain, instead selling their unfermented beans to processors. In Sulawesi in 2019, more than 50% of farmers did not ferment their own beans, seeing a negligible price premium for their efforts[85]. The Government has set quality standards for beans and chocolate makers' training for cacao farmers are additional efforts to improve the value of cacao production for farmers[86]. Since a growth area in the chocolate markets is for certified and traceable products, these initiatives may represent useful opportunities for Indonesia's growers.

Although Indonesia's cacao production has been in decline, the Asia region, with Indonesia as a significant player, is a significant global cocoa processor, accountable for 23.4% of global grinding in 2020-1. Since the region's production of cacao beans is insufficient to meet its processing capacity, it is an important importer of raw beans from West African producers and from Ecuador[87].

While the cacao producers' vulnerabilities include those directly related to climate change, Indonesia's processors are exposed economically to freight costs and the pricing vagaries of the cacao markets, which mean they are indirectly exposed to the price implications of climate-related poor harvests.

Ecuador:

The cocoa industry is an important one for Ecuador's economy, bringing in over US$700 million annually from the 98% of production that is exported, and employing 15% of the country's rural population[88], or 140,000 producers[89]. The 591,557ha land area used is significant, amounting to 41.3% of the total agricultural area[90] or 2.4% of the country's total land area[1]. Much of the added value of the cocoa beans is gained elsewhere, however, as only 10-12% of total production has been processed to semi-finished cocoa products domestically[91]. Most production is in monocrop plantations, but 13% are in mixed systems, mostly with food crops and 2-3% within agroforestry systems[92].

Ecuador's cacao production seems to be developing in two very different ways, one for the mass market and one for chocolate connoisseurs.

Ecuador has a millennial-long tradition of chocolate production: there is evidence that *T. cacao* was produced and domesticated in the country around 5,300 years ago by the Mayo Chinchipe culture[93]. The premium Nacional variety grown for the specialist market is thought to belong to the same strain[94]. Up until around 1920, all Ecuadorian production was of the Nacional variety, but trees were devastated by two diseases - frosty pod and witches' broom - which led to the variety's near extinction until rediscoveries in the early 2000s, and concerted efforts to propagate the variety, have led to its re-entry into a niche premium market. Industrial chocolate makers are not willing to pay a price premium for Nacional's floral, fruity and herby notes (like wines, chocolate flavour profiles depend on the *terroir*). However, there are specialist chocolate makers, such as To'ak, which was involved in efforts to restore Nacional propagation[95], and Pacari, which partners directly with 4000 Ecuadorian farmers and families to make sustainable chocolate[96] that seek to capitalise on the growing market for premium and origin-defined chocolates[97].

This small scale, high quality, cocoa production contrasts with the industrial scale ambitions of another part of Ecuador's production. The government is seeking to expand production, involving the planting of a high-yielding clone, known as CCN-51(Colección Castro Naranjal). A 2020 interview with the head of its cocoa

producer association indicated ambitions to double cacao production in the seven years to 2027, through the use of this new variety and through technology transfer to the country's 140,000 cacao producers, supporting them to group into associations[98].

Christian Aid case study – Guatemala

Amelia, 24

"In the past three years, we have been experiencing high heat and a lack of rain. It is very worrying. With high heat there is very little we can do except to adapt. One of the biggest issues is the lack of water and thus the death of plants which provide us with food. We expect this to get worse.

"This is my land. My plantations have been dying due to the lack of water, and in terms of how its affecting me, there is no food for my family. The cocoa trees are dying, which are usually very resilient. I'm actually not worried that it 'may' happen (climate related crop loss) it's happening already."

Aurelia, 53

Climate change has been killing our crops. This means there is no income because we cannot sell anything.

What is happening is that my planation has been dying. So what has been happening, is death. Death to my crops. The few cocoa trees I had, didn't develop enough, so we couldn't use them. The same thing happened to the banana crops, they are dying off. The trees are folding down and dying. The crops have been dying. In the past there was a prediction that this would happen in the future, but it has come earlier and this is because we are not taking care of our motherland, our ecosystems, and this is very worrying for our kids and especially for our grandkids.

What is uncertain, is perhaps this situation is going to worsen in the future and we lose this whole plantation. This is going to be a huge issue for me.

Aurelia holding a dead cacao pod
Photos: Amy Sheppey/Christian Aid

Nutrition and health benefits

Chocolate's impacts on health can be both positive and negative and depend on the cocoa content (the higher the better: dark chocolate can contain 50-90% cocoa solids and milk chocolate 10-50%[99]) and the quantity consumed. Dark chocolate is healthier than milk chocolate, both because of its greater chocolatiness and lower sugar content.

The minerals in chocolate are useful for health. Iron is important in the red blood cells that carry oxygen around the body, magnesium can help improve sleep quality, while zinc is important for immune function[100]. There are also useful amounts of protein and dietary fibre, although the high sugar levels are less than healthy.

There is a significant body of evidence that limited dark chocolate or cocoa consumption can have significant health benefits, something that is helping to drive the global demand for chocolate[101]. *Caveat emptor*, however: the content of the beneficial antioxidant flavanols it contains can vary considerably even between dark chocolates, and this is not typically part of the labelling. So-called "Dutch" processing with alkali improves the taste, but the health-aware shopper would do better to seek out 'natural cocoa' and failing that, a high cocoa-content dark chocolate[102].

While sugary chocolate may not be good for diabetics, the flavanols "may positively affect the pathophysiological mechanisms involved in insulin resistance", that is, may give some protection against developing diabetes[103]. Epidemiological evidence from the Kuna Indian people of Panama's islands, who drink 10 times more cocoa-containing drinks than their urban counterparts, provides additional support for this[104].

For migraine sufferers, there was some potentially positive news from a literature review that concluded "there is insufficient evidence that chocolate is a migraine trigger; thus, doctors should not make implicit recommendations to migraine patients to avoid it."[105]

All in all, high cocoa chocolate seems like it can indeed offer useful protections to improve health, but flavanols can also be found in many other fruits and vegetables, including apples, red grapes, broccoli, cherry tomatoes, beans, kale, and onions[106].

Recommendations

Cut emissions

To limit the damage climate change Is already wreaking on the cacao-growing habitats, and the people whose livelihoods depend on this crop, it is imperative that rich countries set ambitious climate mitigation targets in line with the Paris Agreement to limit global warming to 1.5C above pre-industrial times. Countries are due to submit their updated 'Nationally Determined Contributions' in early 2025, representing a great opportunity to demonstrate how they intend to cut emissions fairly.

New "polluter pays" sources of climate finance

Rich countries, which are responsible for the vast majority of historic emissions, need to commit to paying their fair share of climate finance to 'developing countries'. Whilst the outlines of a new climate finance target were agreed at COP29 in Baku, rich country governments have so far failed to outline how they will pay their fair share of climate finance. The much greater sums involved necessitate new taxes based on the polluter pays principle, particularly on high polluting industries and high net worth individuals, given the link between wealth and emissions.

Targeted adaptation measures for cocoa farmers

Cacao famers are facing additional challenges from climate change beyond their low pay and dangers of exploitation. Greater diversification of farming and increased capacity by cacao farmers to produce more of the final products will help them have more sustainable livelihoods. As the land for growing cacao reduces, it is even more important farmers are supported to be resilient, adapting their crops and approaches.

Encourage more profitable organic growing methods to boost resilience and sustainability

With 90% of cacao grown by small scale farmers, a livelihood depended upon by 70% of the world's poorest and most vulnerable, enhancing the climate resilience and environmental sustainability of cacao represents an opportunity to reduce poverty. Growing evidence shows that the best way to achieve this is by supporting cacao farmers to transition to organic and agroecological growing systems that increase profitability and food security, reduce land degradation, enhance gender equity, protect the vital pollinating midges that cacao relies on and promote improvements in long-term sustainable productivity. By enhancing soil and tree carbon, they also mitigate climate change more effectively than conventional, chemical growing systems.

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