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## Growing food has a massive impact on the climate



### Richard, what do you think of the Trump administration's withdrawal from the Paris climate agreement?

It's disappointing. We, along with many other businesses, advocated that the White House stay in the agreement but we weren't successful. The Paris agreement already falls short of what is needed to keep global warming no more than 2°C above pre-industrial levels. Since the United States is the world's second biggest emitter of greenhouse gases, its withdrawal will make a 2°C limit an even bigger challenge.

Although the US federal government is out, we are still in. Mars is one of 2,000 companies and investors, states, cities, counties, universities and foundations across the whole of the US who have decided to stand firm with the rest of the world. We will take action on climate so that the country can, at the very least, meet the commitments it promised

in the Paris agreement. Mars generates about 26 million tonnes of carbon dioxide equivalent per year. That is roughly the same as Panama. If we pull our weight by making our business more sustainable, the impact will be significant.

We will be joining other businesses at COP23 in Bonn in November to discuss our plans to bring about the change needed to accelerate global progress.

### So what are you doing in the fight against climate change?

We recently announced a series of new commitments in our sustainability strategy — we call it the Sustainable in a Generation Plan. We're really upping our game when it comes to climate action, both in our own factories and offices and also across our entire supply chain. Our headline goal is to reduce the total greenhouse gas emissions from our entire value chain

Richard Ware, Vice President of Supply, Research & Development and Procurement at Mars, Incorporated (pictured, left) shares his thoughts on climate change. Mars is a privately-held company and one of the largest food businesses globally. While the Mars name may evoke images of M&M's, Snickers or the Mars bar, it's also one of the world's leading pet care providers.

by a massive 67% by 2050 (from 2015 levels). We've used the best available climate science to set this target and it's also a larger reduction than almost any other company has committed to. To achieve it, we are transitioning to 100% renewable energy in our own operations, sending zero waste to landfill and cutting the energy required to manufacture our products. Growing food has a massive impact on the climate. It's responsible for up to a third of anthropogenic greenhouse gas emissions. So we're focusing especially on our supply chains — for example ending deforestation and stopping land use change by helping farmers of our raw materials improve their yield per hectare. We are also working to better understand and advance reforestation and carbon sequestration. And that is just the start.

### What's in it for Mars?

There's a lot in it for us. Consumers are obviously very aware of the importance of tackling climate change and are prepared to vote with their feet when they feel a business is not doing enough. We want our customers and our consumers to know we are doing the right thing by them and for the planet we share.

We also want to make sure our Associates (our employees) are proud to work with us. It's heartening that more and more current and future Associates are actively seeking to work with companies that are committed to growth that is sustainable.

Increasingly, emitting carbon will also come with a price tag. When this happens, we obviously want to be ready so that we can stay competitive. It takes time to cut carbon at the levels that are necessary so it makes sense for us to be tackling this sooner rather than later.

But, this is fundamentally about principles for Mars. When we talk about principles at Mars we mean something quite specific — our Five Principles of Quality, Responsibility, Mutuality, Efficiency and Freedom. The Five Principles began with Mutuality in the 1940s when Forrest Mars, Sr. dreamed of creating a mutuality of benefits for all of Mars' stakeholders. All Five Principles are just as important now. We have a responsibility to think beyond the short-term bottom line and run our business in a way that is good for Mars, the planet and people. Addressing climate change is central to that. ■

# The threat to cocoa

Climate change is an undeniable fact. The science is clear. The world is coming together to reduce global greenhouse gas emissions to prevent raising Earth's temperature by more than 2°C. Because, if this doesn't happen, our supply of resources is in jeopardy.

If temperatures and rainfall change significantly, then the yield of crops we rely upon, like cocoa, mint and peanuts, will be massively affected.

Cocoa, for example, is a fragile crop that only grows in specific climates in a narrow band 18 degrees

north and south of the equator. It requires average temperatures between 18°C and 32°C, high humidity and high rainfall well distributed throughout the year<sup>1</sup>. If temperatures and rainfall change due to global warming, then masses of land will suddenly

become unsuitable for cocoa production. In West Africa, for example, where roughly 70% of the world's cocoa is produced, climate models<sup>2</sup> suggest that the area of land suitable for cocoa production will seriously decrease by 2050 (Fig. 1).

Moreover, 95% of cocoa is produced on smallholder farms in the developing world<sup>3</sup>. If harvests fail to materialise due to climatic conditions, the livelihoods of smallholder farmers are at stake. By extension, small-scale local distributors and retailers would also suffer. Globally, approximately 50 million people depend economically on cocoa production<sup>4</sup>.

For Mars, efforts to combat climate change will ultimately secure the supply of our raw materials and also the livelihoods of those who grow these crops around the world. ■

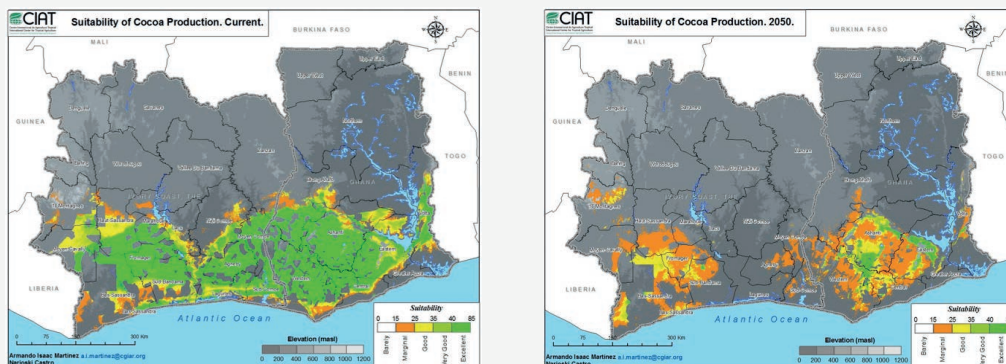


Figure 1 | Relative climatic suitability for cocoa in the West African cocoa belt will be lower under projected 2050s climate conditions than under current conditions. Estimated using MaxEnt statistical model of crop suitability – in which the main driver for changes in cocoa production is maximum temperature. Optimum altitude changes from 100-250 m to 450-500 m – so higher regions remain suitable.

## Sustainable in a generation

In September, Mars launched its new **Sustainable in a Generation** plan. We have been transforming our direct operations to make them more sustainable for the last decade. Now, we're taking the experience we gained and are applying it to our whole value chain.

Our Sustainable in a Generation Plan consists of three ambitions which we see as interconnected and essential drivers of sustainable growth: a healthy planet, thriving people and nourishing wellbeing. These ambitions will change the way we use natural resources, empower the people across our whole value chain to help them thrive, and advance science and innovation in ways that help billions of people lead healthier, happier lives.

### Taking action on energy

As part of our healthy planet ambition, we're reducing our greenhouse gas emissions throughout our entire value chain by 67% by 2050 compared to 2015 levels. One of the first ways for us to do that is to use 100% renewable energy for our direct operations. We were one of the first three companies to sign up to the

RE100 renewable electricity commitment and, today, more than 100 companies have followed that lead.

To bring our renewable energy commitment to life, Mars opened a wind farm in Moy, Scotland, through a partnership with energy company Eneco (Fig. 2). The wind farm generates enough electricity to cover all 12 Mars UK sites. Mars UK will buy all of its electricity through Eneco for 10 years, making this one of the biggest long-term commitments to renewable energy use of any business in the UK.

As well as the UK, we are purchasing renewable electricity to cover 100% of our operations in Belgium, Brazil, Lithuania and the US. In 2018, we'll add Austria, the Czech Republic, Mexico, France, Spain and Poland to the list. Eventually, we want to be using renewable energy in all 80 countries in which we operate.

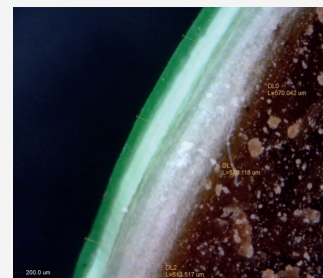


Figure 3 | The sugar shell on M&M's and Skittles is only 500 μm thick but creating it is one of the most energy intensive processes inside a Mars factory.

### Using energy efficiently

An important strategy in reducing greenhouse gas emissions is reducing the amount of energy we use in the first place. And we are taking a scientific approach to this.

Surprisingly, the process to create the sugar shell (Fig. 3) on our M&M's and Skittles is one of the most energy intensive processes in our factories. These candies are



Figure 2 | Mars opened the Moy wind farm in the Highlands of Scotland to cover the energy needs of its entire UK operations, part of our move towards reducing greenhouse gas emissions.

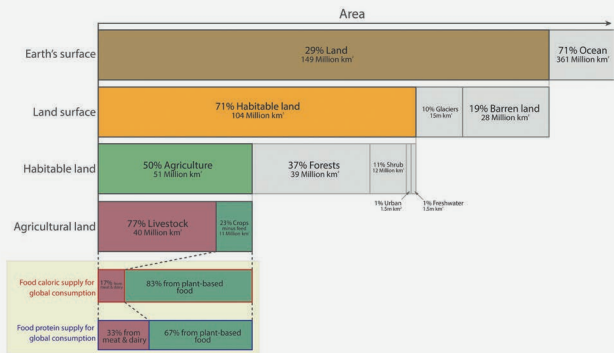


Figure 4 | Land use in agriculture. A breakdown of the surface area of the Earth by functional and allocated uses. Area allocated to livestock includes grazing land as well as arable land that is used to grow animal feed. Ref. 5.

two of the most difficult to make for Mars — it takes hours to build up the layers in a drum, then the sweets need to be dried and polished.

Recently, we teamed up with the Los Alamos National Laboratory in the USA to drastically cut the amount of energy we need to coat M&M's and Skittles. Los Alamos have some of the most sophisticated computer modelling capabilities in the world. We are working with them to create computer models of the coating process. These models allow us to experiment with changes to the design of our processes and machinery in a matter of hours rather than months. The modelling will show us what the perfect process and machine design is. Once we have the perfect design, we think we could reduce the energy needed to coat M&M's and Skittles by 10%, a significant amount.

### Limiting land use

According to data from the WWF, humans use half of the planet's habitable area for agricultural production. Of the remainder, 37% is forested, 11% is scrubland and only 1% is urban area<sup>5</sup>. The world population is predicted to rise to 9.6 billion by the year 2050, which has caused the United Nations Food and Agriculture Organization to warn that we will need to produce 70% more food to guarantee universal food security<sup>6</sup>. However, we cannot afford to clear more forested land to make way for agriculture. The impact on the concentration

of carbon in the atmosphere is not justifiable. To protect our forests and natural resources, we need to be able to grow more food on the same area of land. Mars' goal is therefore to hold flat the total land area associated with our value chain despite business growth.

For cocoa, we have a way to do this. We want to increase the yield of the trees that produce cocoa pods, cacao trees (*Theobroma cacao*). The yield of commodity crops like corn and wheat has increased by a factor of five or six since the 1930s thanks to improved agricultural practices<sup>5</sup>. The yield of cocoa, on the other hand, has not changed much.

To improve cocoa yield, Mars, IBM and the US Department of Agriculture sequenced, assembled and annotated the genome of *Theobroma cacao*. The genomic data was released into the public domain in 2010 so that plant breeders everywhere could begin the process of identifying and breeding trees with enhanced yield, climate change adaptability and water efficiency. The first trees with improved traits are now in field trials and are expected to reach farmers within the next few years.

Higher yields mean that we need less land to meet current demand for cocoa. Land that is currently being used for cultivating *Theobroma cacao* can be turned over for other uses, such as growing other food crops or for reforestation.



Figure 5 | Improving cocoa yields through genomics-led plant breeding will reduce the land area needed to meet cocoa demand and will create an opportunity for reforestation in cocoa-growing countries.

### Improving nutrition security

Building on the cocoa genome project, Mars partnered with several international organisations to create the African Orphan Crop Consortium. The consortium is sequencing, assembling and annotating the genomes of 101 African “orphan crops” — food crops previously overlooked and untouched by international scientific researchers (Fig. 5). Ultimately, our goal is to end chronic hunger and malnutrition and provide nutritional security for the 600 million people who live in rural Africa<sup>7</sup>, many of whom depend on these crops for sustenance<sup>8</sup>.

The 101 African orphan crops include crops like baobab and Bambara groundnut (Fig. 6). Plant breeders from all over Africa trained by the consortium will use the genomic data to breed cultivars of these crops that have higher yields, higher nutritional content, better



Figure 6 | The Bambara groundnut is one of the 101 traditional African food crops whose genomes are being sequenced by the African Orphan Crops Consortium in order to, ultimately, improve food security for the 600 million people that grow and eat them in rural Africa.

climatic adaptability and better disease resistance.

Mars and the consortium of international partners, an uncommon collaboration that includes the University of California, Davis, The New Partnership for Africa's Development, the Beijing Genomics Institute, the International Centre for Research in Agroforestry, Illumina, the UN Food and Agriculture Organization, Google and the African Plant Breeding Academy lab, believe that this project will be a boost to the food and agriculture sectors in Africa and improve food security for millions. To learn more, visit [www.africanorphancrops.org](http://www.africanorphancrops.org).

To grow in a way we can be proud of, Mars must become Sustainable in a Generation. We are working in many ways to make this happen. ■

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