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# EL NIÑO: THE IMPACT ON AGRICULTURAL COMMODITIES

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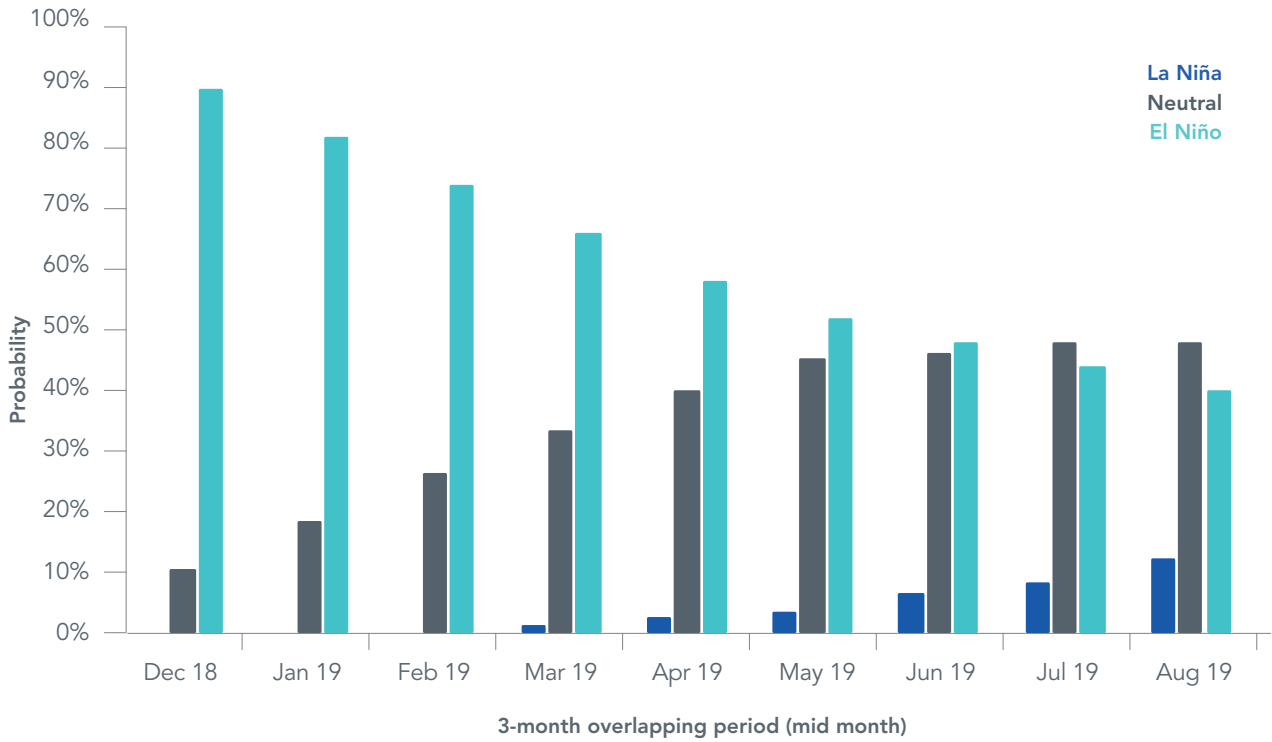
El Niño refers to a climate cycle in the Pacific Ocean that has a global impact on weather patterns. The name, which loosely translates to 'Christ child', traces its origin back to Peruvian fishermen in the 1600s, who observed that fish yields would often decline around Christmas time as sea water temperatures rose. The effects of El Niño include specific wind patterns across the Pacific Ocean, heavy rain in South America, and drought in Australia and parts of Asia, and as such, it can have a significant impact on the fortunes of the agricultural industry, which are tied to weather conditions.

With the National Oceanic and Atmospheric Administration (NOAA) forecasting an 82%<sup>1</sup> probability of an El Niño weather event during the current Northern Hemisphere winter, there is a chance that we could see some weather abnormalities in the months ahead.

<sup>1</sup> See Appendix 1: El Niño: What, Why, When and How?

<sup>1</sup> La Niña is the opposite of El Niño, i.e. a cooling of the surface water around the equatorial zone of the central and eastern Pacific Ocean.

Figure 1: The probability of El Niño occurring this year<sup>1</sup>

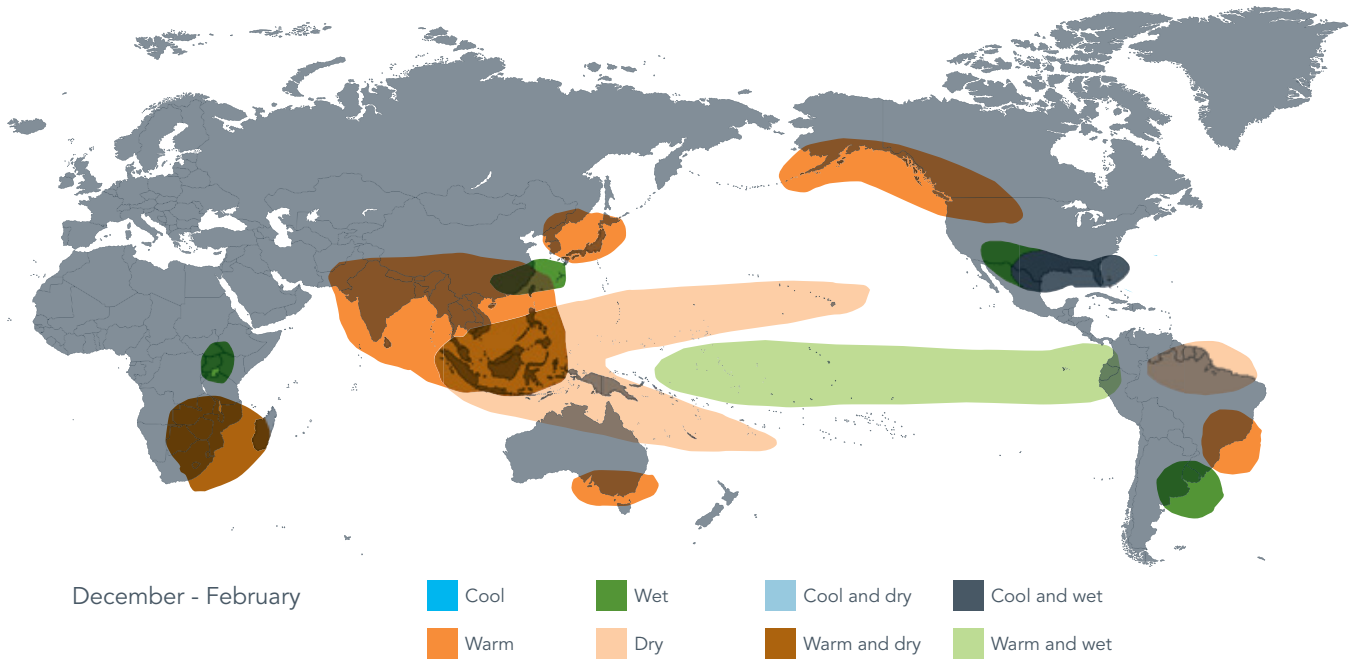


Source: NOAA'S Climate Prediction Center and Columbia University's International Research Institute for Climate and Society, WisdomTree, data available as of close 21 January 2019.

**Forecasts are not an indicator of future performance and any investments are subject to risks and uncertainties.**

The weather impacts from El Niño vary depending on the time of the year that it materialises. The chart below describes the effects during the winter period (when the expected El Niño is likely to be most intense).

Figure 2: The weather impact of El Niño



Source: NOAA

**ANALYSING THE IMPACT ON AGRICULTURAL COMMODITY PRICES**

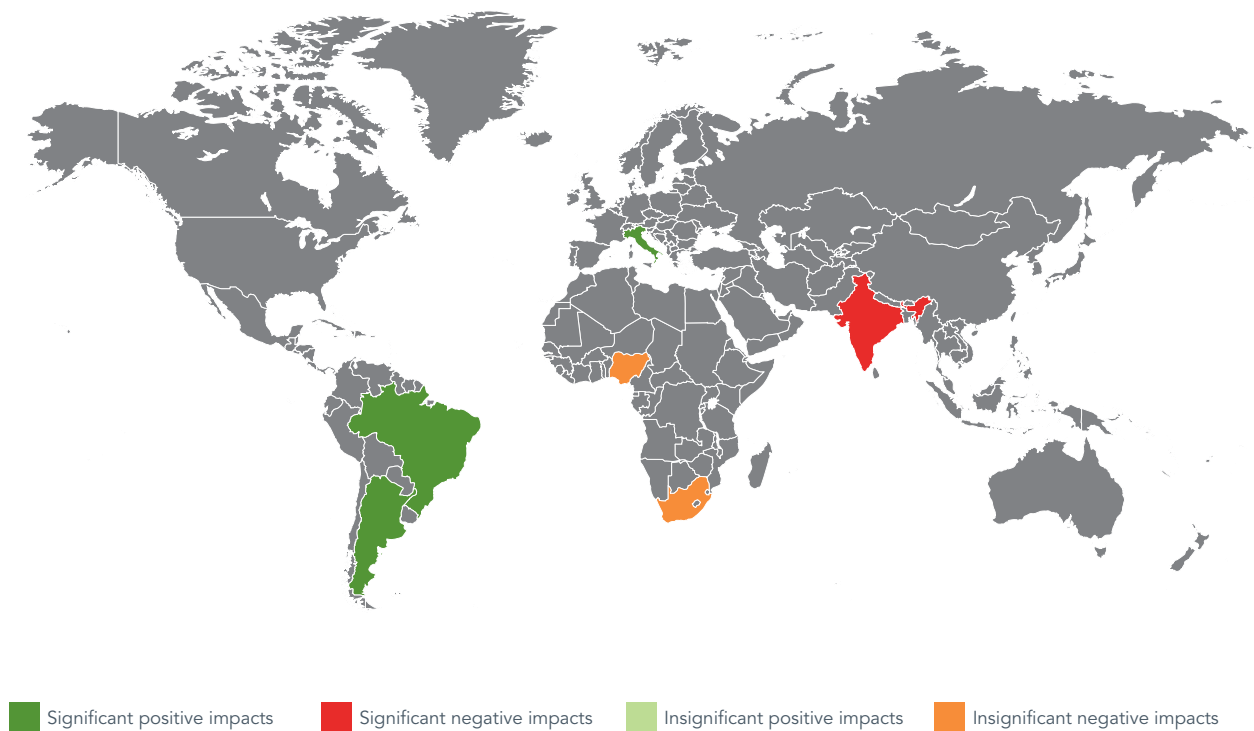
When assessing likely El Niño effects, the first step is to consider the time of the year that El Niño is likely to begin. According to the NOAA, the event is likely to occur in the Northern Hemisphere in the current winter, but there is a good chance that it will linger into the Spring with a lower intensity (>50% chance of it staying until May 2019). The next step is to assess which part of the crop cycle it will affect. We summarise crop calendars in Appendix 2. According to research by Iizumi et al., a weather disturbance during the 'reproductive' growth period tends to have the largest impact (positive or negative) on crop yields.

Using insights from Iizumi et al. we have assessed the possible impact from El Niño on crops that are in a reproductive phase of growth. We summarise our key thoughts below:

**Bearish on soybean**

Brazil and Argentina, who together are responsible for almost half of the world’s soybean supply, are likely to experience favourable growing conditions in the event of an El Niño, while India, which only produces around 4% of global soybean supply, is likely to experience negative growing conditions. On balance, an El Niño will likely prove to be price negative for soybean prices.

Figure 3: The effect of El Niño on soybean growing during the December to March reproductive growth phase



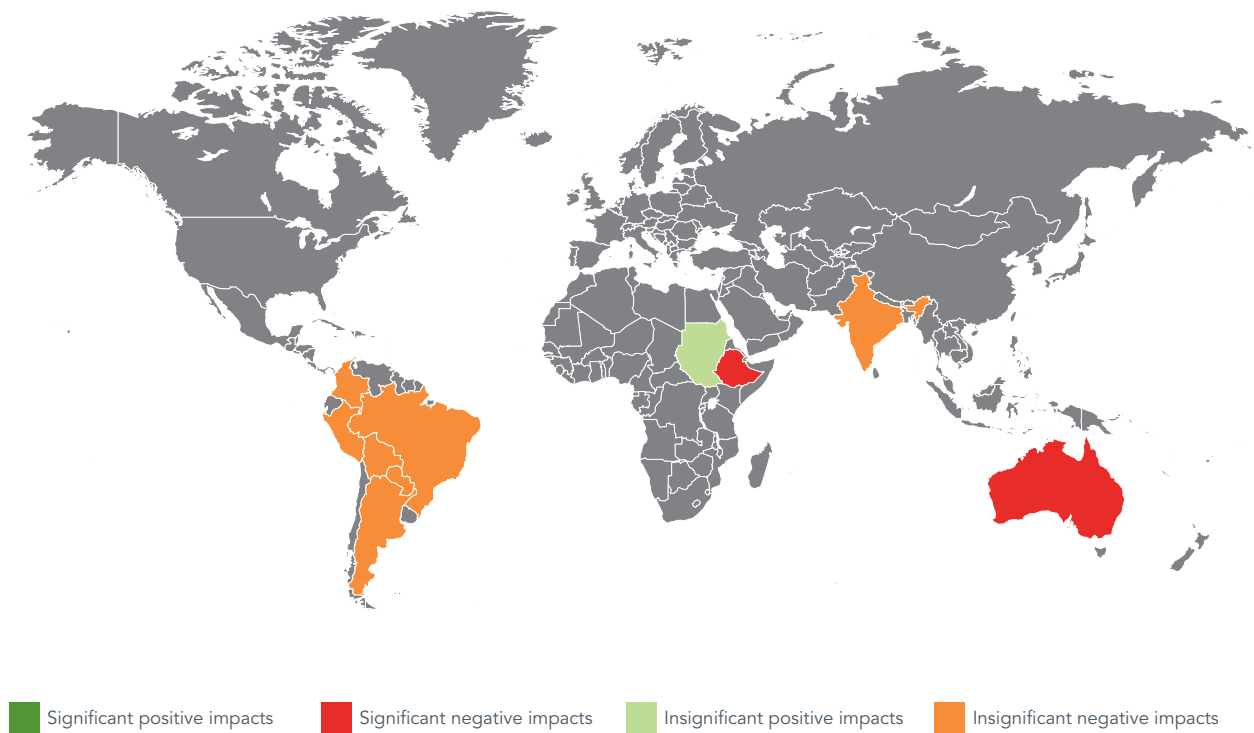
Source: Adapted by WisdomTree from “Impacts of Southern Oscillation on the global yields of major crops” by Iizumi et al, May 2014.

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**Mildly bullish on wheat**

Australia, which produces 4% of global wheat supply, could face dry weather if El Niño emerges. However, much of the wheat harvest will be complete by mid-January, limiting its impact. The effects of El Niño are less significant in South America.

Figure 4. The effect of El Niño on wheat growing during the December to March reproductive growth phase



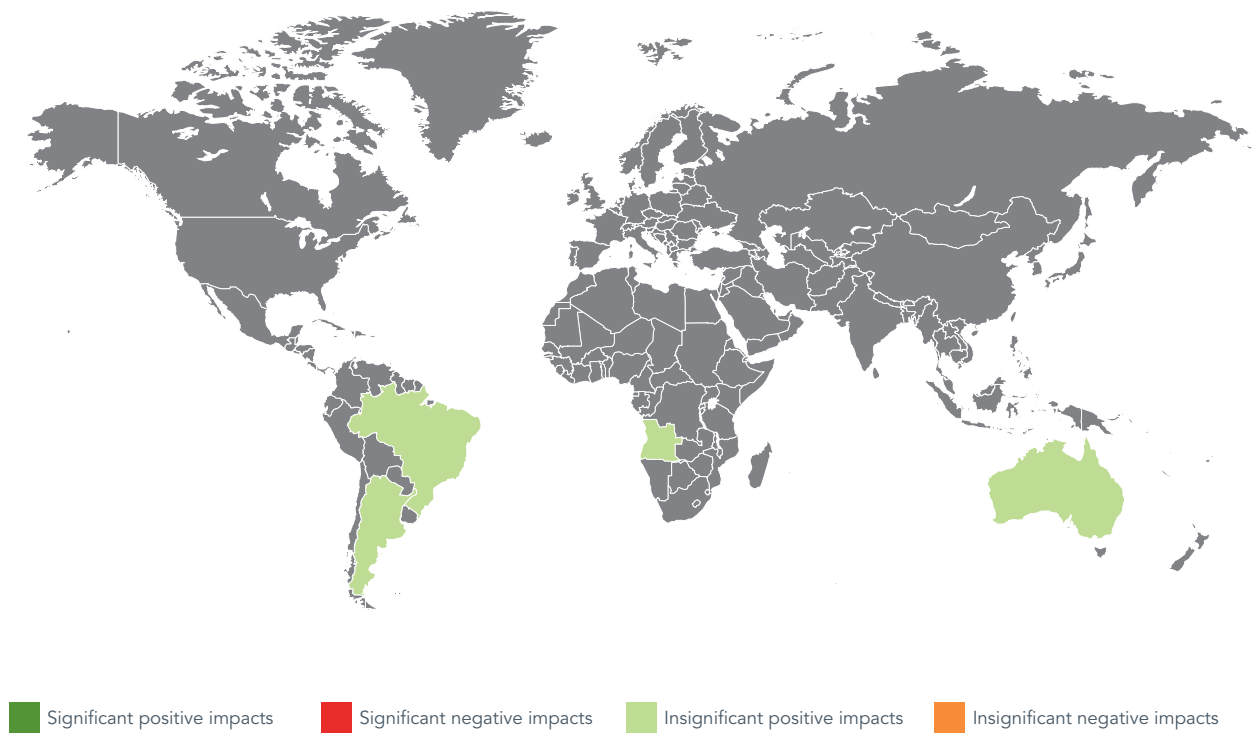
Source: Adapted by WisdomTree from "Impacts of Southern Oscillation on the global yields of major crops" by Iizumi et al, May 2014.

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**Mildly bearish on corn**

The effects of El Niño on corn are less significant but could be mildly positive for growing conditions in South America and parts of Australia, and hence slightly price bearish.

Figure 5. The effect of El Niño on corn growing during the December to March reproductive growth phase



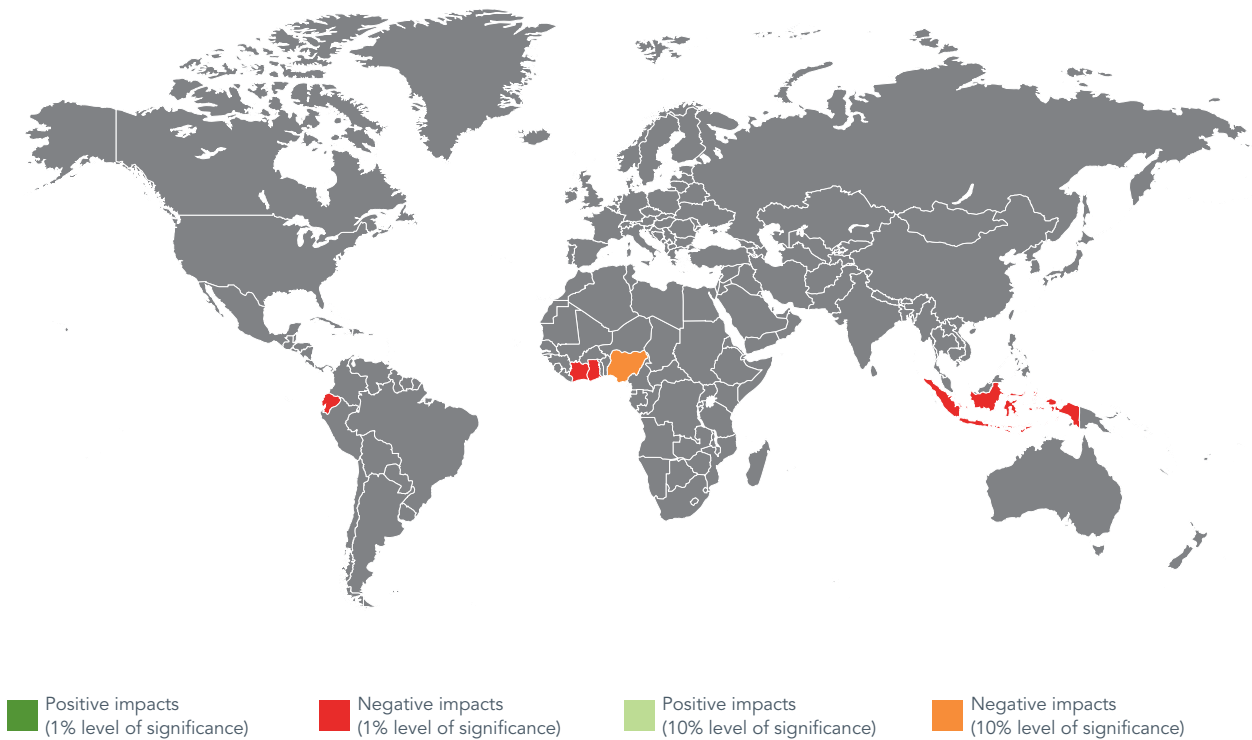
Source: Adapted by WisdomTree from "Impacts of Southern Oscillation on the global yields of major crops" by Iizumi et al, May 2014.

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**Mildly bullish on cocoa**

Although El Niño does not directly impact the weather in major cocoa growing regions in Africa (which produces 70% of global supply), the change in weather patterns elsewhere can transmit to Africa via so-called ‘teleconnection’ patterns, according to the International Research Institute for Climate and Society. Indonesia, which produces 10% of global cocoa supply, will be more directly affected. Dry warm weather in Indonesia could drive prices higher.

Figure 6. The effect of El Niño on cocoa growing during the December to March reproductive growth phase



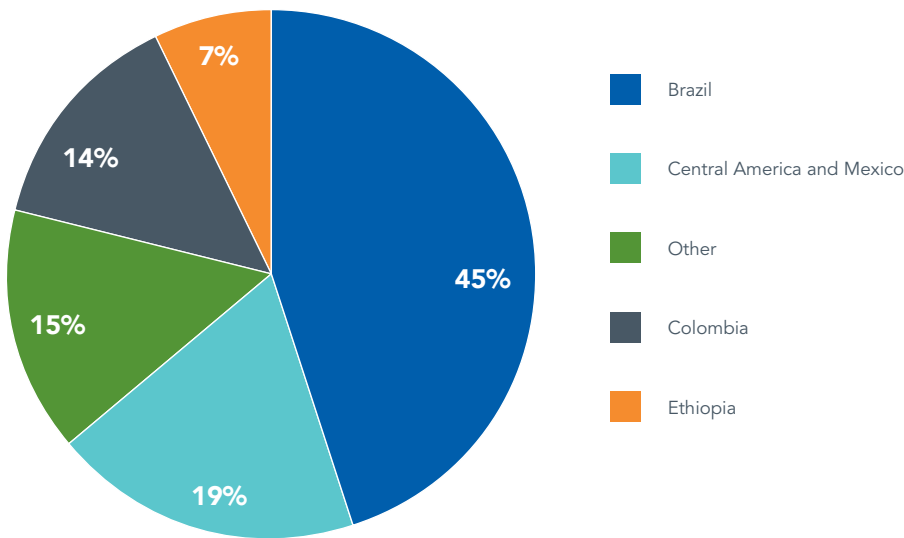
WisdomTree, Executive Committee of International Cocoa Organization report “Impact of El Niño/La Niña Weather Events on The World Economy”

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**Bearish on Arabica coffee**

Arabica coffee production is highly concentrated in Brazil – particularly in the Minas Gerais region – and Central America, Mexico and Colombia. Most of the coffee in these regions will be in a reproductive growth phase. Therefore, we could see a positive supply shock to Arabica coffee<sup>2</sup>, after record production levels in 2018. While Brazilian coffee production will enter the low part of its biennial cycle<sup>3</sup>, we note that Brazil has historically managed to defy the biennial cycle to produce more in consecutive years when provided with a positive supply shock. We will continue to monitor the situation, as favourable weather can easily turn into excess, which could damage the crop.

Figure 7. Global Arabica coffee production



USDA, WisdomTree, data as of December 2018

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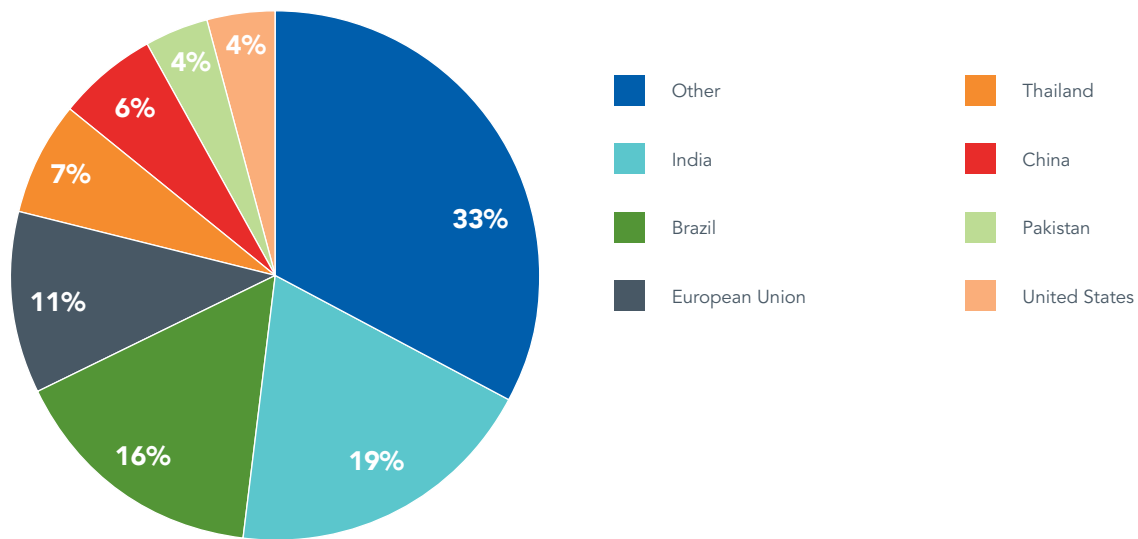
<sup>2</sup>According to El Niño, La Niña and World Coffee Price Dynamics, Ubilava, 2012 the effects of El Niño tend assist growing of Arabica and reduce the growing of Robusta.

<sup>3</sup>Arabica coffee in Brazil goes through a cycle of one year with high yields than the next

**Bullish on sugar**

Sugar production is highly concentrated in India and the Sao Paulo and Centre South regions of Brazil. Both countries could see below-normal rainfall during an El Niño event, and therefore, drier conditions could drive prices higher.

Figure 8. Global sugar production



USDA, WisdomTree, data as of December 2018

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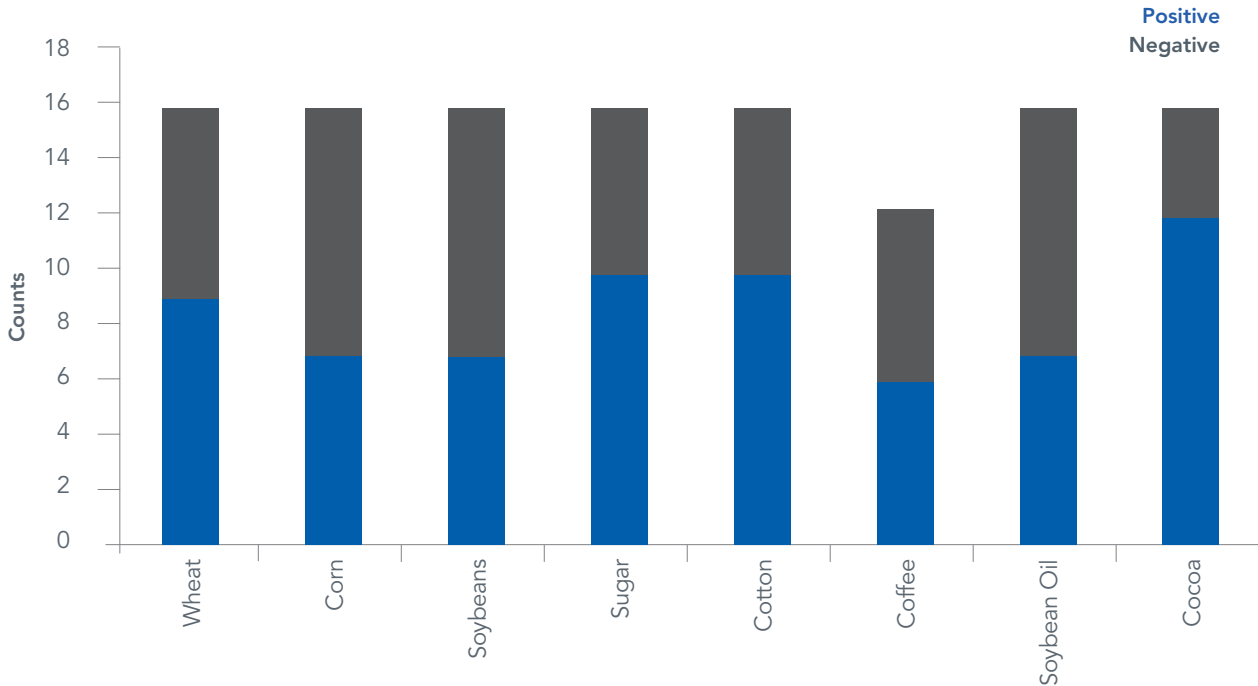
**A note on our predictions**

We caution that the analysis above is based on the pure effect of an El Niño, without consideration of the many other factors that can affect crop yields. Agricultural commodity production is hard to predict over long-time horizons. For example, at this stage, we don't even know what crops are in the ground. Even in the case of soft commodities – such as coffee, cocoa, and sugar – which are only partially replanted each year, there can be other factors that affect yield and production including disease, maintenance decisions, and exchange rates. There are also many other weather events in addition to El Niño that can affect crop production.

Looking back at past El Niño events, we see that the price behaviour of agricultural commodities (six months after the event started) has not been consistent.

Figure 9. El Niño price behaviour

Price positive vs price negative El Niño events



Source: Bloomberg, WisdomTree, data available as of close of 20 December 2018.

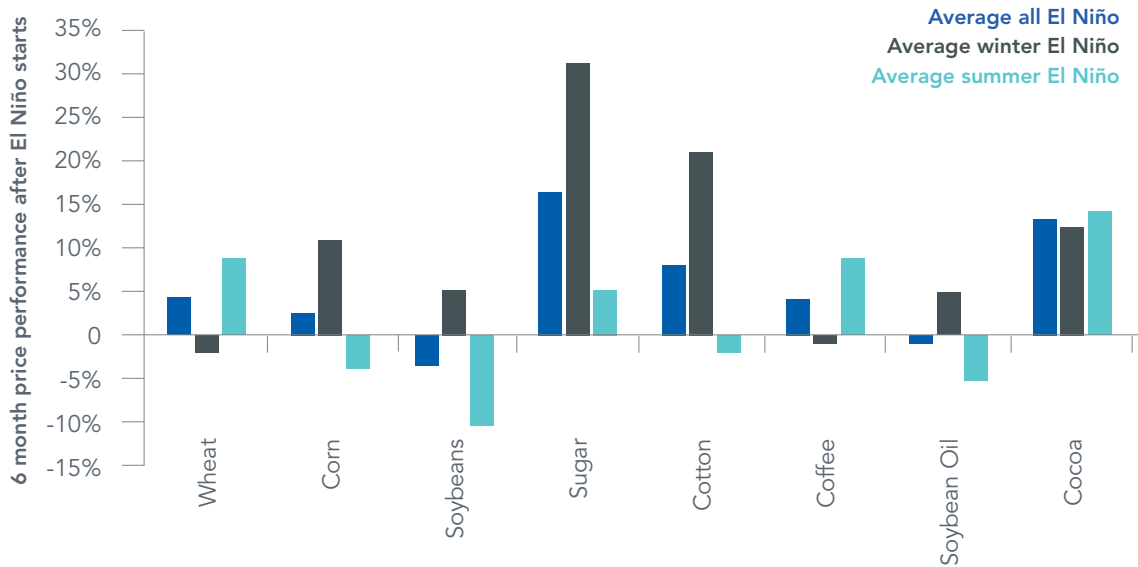
The analysis draws on 16 El Niño events since 1950 (12 in the case of coffee, as we only have price data from 1972). We look at the price behaviour six months from the start of the weather event. We treat the start of an El Niño event as when the Oceanic Niño Index (ONI) is above 0.5 (standard definition by NOAA).

**Historical performance is not an indication of future performance and any investments may go down in value**

Furthermore, the price effect can vary according to whether the event starts in the Northern Hemisphere summer or Northern Hemisphere winter, as shown in Figure 10. The analysis does not control for amplitude or length of the event (some events will last through both summer and winter). With such a small sample, dissecting into every sub-category will simply leave individual case-studies per category.

Figure 10. Summer versus winter El Niño effects

Summer and winter El Niño often have different impacts



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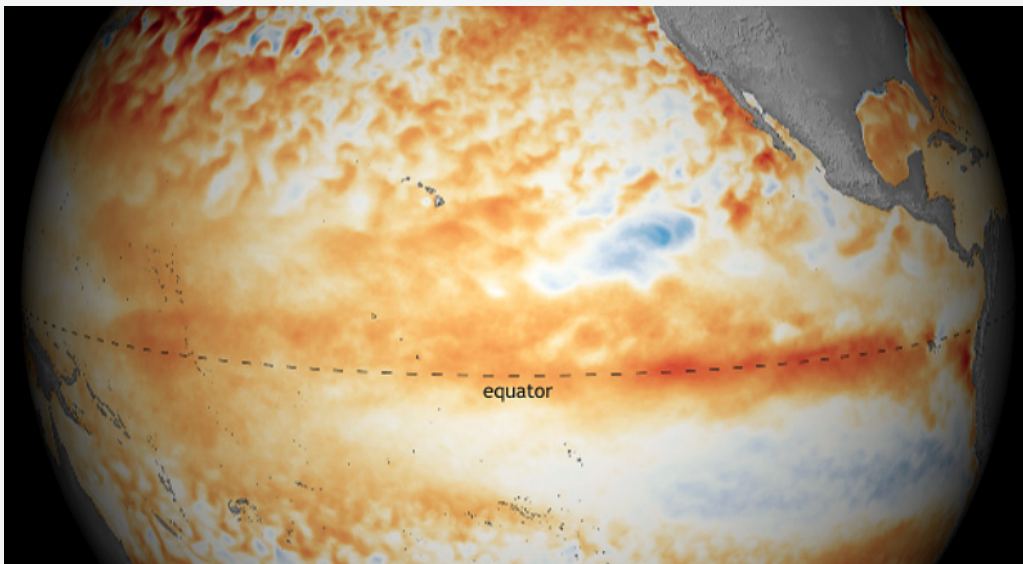
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We will continue to update our thoughts on agricultural crop developments in our regular research pieces. As we gain more information on planting decisions, exchange-rate movements, and trade policies, as well as the development and intensity of the El Niño event, we will be able to provide a more accurate guide for commodity prices. However, the analysis above should provide guide-posts for the effects of an El Niño weather pattern in isolation.

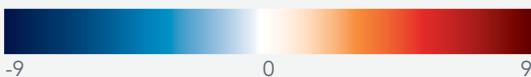
**APPENDIX 1: EL NIÑO: WHAT, WHY, WHEN AND HOW?**

**What is an El Niño?**

An El Niño is the local warming of surface water around the equatorial zone of the central and eastern Pacific Ocean off the Peruvian coast. While the warming of surface water is described as local, an El Niño affects atmospheric circulation world-wide (what meteorologists call a ‘teleconnection’). El Niño has a reputation for being a powerful catalyst to driving weather extremes. An El Niño typically creates droughts in Australia and parts of Asia including India and Indonesia, while bringing unusually wet weather to parts of the US. However, the characteristics of the El Niño vary according to its timing and amplitude. For example, in the northern hemisphere summer, an El Niño is associated with wetter-than-usual weather on the West coast of the US, whereas in the winter there is no significant change in precipitation levels in that region associated with an El Niño.

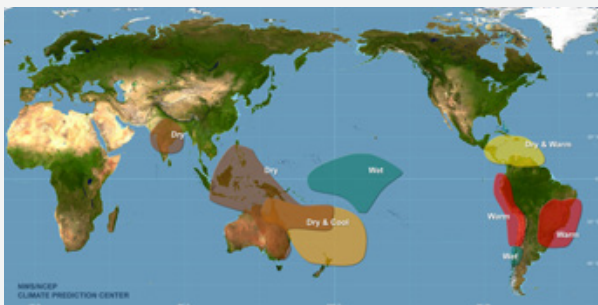


Difference from average temperature (°F)

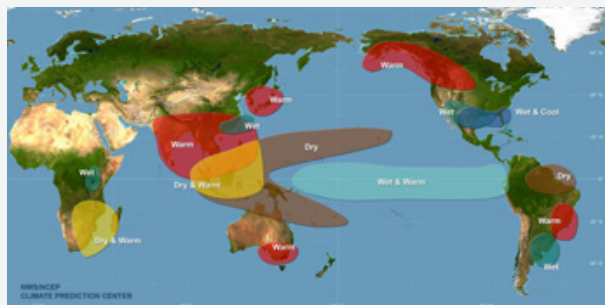


November 2018 compared to 1981 - 2010  
Climate.gov/NVL  
Data: Geo-Polar SST

**Warm Episode Relationships: June-August**



**Warm Episode Relationships: December - February**



## APPENDIX 1: EL NIÑO: WHAT, WHY, WHEN AND HOW?

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### Why does an El Niño matter for agricultural futures prices?

The growing of agricultural products is very sensitive to weather patterns. The right amount of sun and rain at the right time is important to produce the yield expected. At the extremes, droughts can ruin a crop because of insufficient water, or floods could wash away plants or delay the process of harvesting a good crop from the ground, causing it to spoil. El Niños have historically had significant impacts on agricultural commodity prices<sup>4</sup> but the specific impact on the price of any individual commodity will depend on the El Niño's amplitude, timing, and locational factors such as where the crop is grown and how prepared the farmers are for extreme conditions. Most agricultural commodities are traded globally and have close substitutes. So even though a futures market contract could be very specific in terms of what is deliverable, the supply and demand dynamics of close substitutes can impact its price e.g. a supply deficit in Chinese wheat could drive demand for US wheat. A disruption during a crop's reproductive growth phase causes the most damage. However, a perfectly developed crop could face damage if there are excessive rain delays during harvesting.

### How intense will this year's El Niño event be?

If the weather event materialises (it has not begun yet, but there is an 82% chance of it occurring according to the NOAA), it is likely to be weak according to the latest guidance from NOAA. However, the probability of the event and assessment of its strength does change frequently.

<sup>4</sup>For example, see 'Does El Niño Affect Business Cycles' by Laosuthi and Selover for a causality test analysis of the correlation between commodity price inflation and El Niños between 1950 and 2000

APPENDIX 2: CROP CALENDAR SUMMARY

  Probability of El Niño greater than 60%

	% of global production	% of global exports	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Brazil coffee	45 (Arabica)	27 (of both arabica & robusta)	Bud					Harvest			Bloom		Bud	
Central America and Mexico Coffee	19	More than 10% (of both arabica & robusta)	Harvest		Bloom							Harvest		
Colombia Coffee (2 seasons)	14	11 (of both arabica & robusta)			Flower 1		Harvest 2				Flower 2		Harvest 1	
Brazil Center South Sugar	16	34					Plant & Harvest							
India Sugar	19	7	Plant	Harvest									Plant	Harvest
EU Winter Wheat	20	20							Harvest			Plant		
China Winter Wheat	17	Net Importer				Head	Harvest				Plant			
China Spring Wheat					Plant				Harvest					
India Wheat	13	Often net Importer				Harvest						Plant		
US Winter Wheat	8	16				Head	Harvest				Plant			
US Spring Wheat					Plant			Head	Harvest					
Australia Winter Wheat	4	11					Plant				Head	Harvest		
Russia Winter Wheat	8	15					Head	Harvest			Plant			
Russia Spring Wheat					Plant			Head	Harvest					
Ukraine Winter Wheat	4	8					Head	Harvest			Plant			
Ukraine Spring Wheat					Plant			Head	Harvest					

APPENDIX 2: CROP CALENDAR SUMMARY

Probability of El Niño greater than 60%

	% of global production	% of global exports	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
US corn	36	35				Plant				Silk		Harvest		
North China Corn	22	Net Importer		Plant						Harvest				
Center South Brazil (First Crop) Corn	8	17			Harvest								Plant	
Center South Brazil (Second Crop) Corn			Plant							Harvest				
Ukraine Corn	3	13				Plant			Silk		Harvest			
Center South Brazil Soybean	31	43	Flower	Fill	Harvest								Plant	
US Soybean	32	37					Plant		Flower			Harvest		
Argentina Soybean	32	37	Plant		Flower	Fill	Harvest							Plant
China Cotton	24	Net Importer					Plant					Harvest		
India Cotton	26	15	Harvest				Plant						Harvest	
US Cotton	11	29				Plant		Square				Harvest		
Cote d’Ivoire Cocoa	42%	42%	.....					Mid crop harvest				Mid crop harvest...		
Ghana Cocoa	20%	20%	.....					Mid crop harvest				Mid crop harvest...		
Indonesia Cocoa	7%	15%			Mid crop harvest						Mid crop harvest			

Source: WisdomTree, USDA, ICO, ICCO, NOAA

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