



Causes and consequences of extreme disruptions in wheat supply

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Wheat production disruptions events that gained media attention

AgriBusiness GLOBAL Empowering Agriculture To Feed The World

Brazil Wheat Hits Five-Year Low

The projected Brazilian wheat area of 1.93 million hectares (Ha) would be the lowest since 2002.



Wheat production failure in Brazil in 2006

FROM POLITICO PRO

France's farmers on suicide watch as wheat crop fails

Agriculture ministry predicts the worst harvest in 30 years.

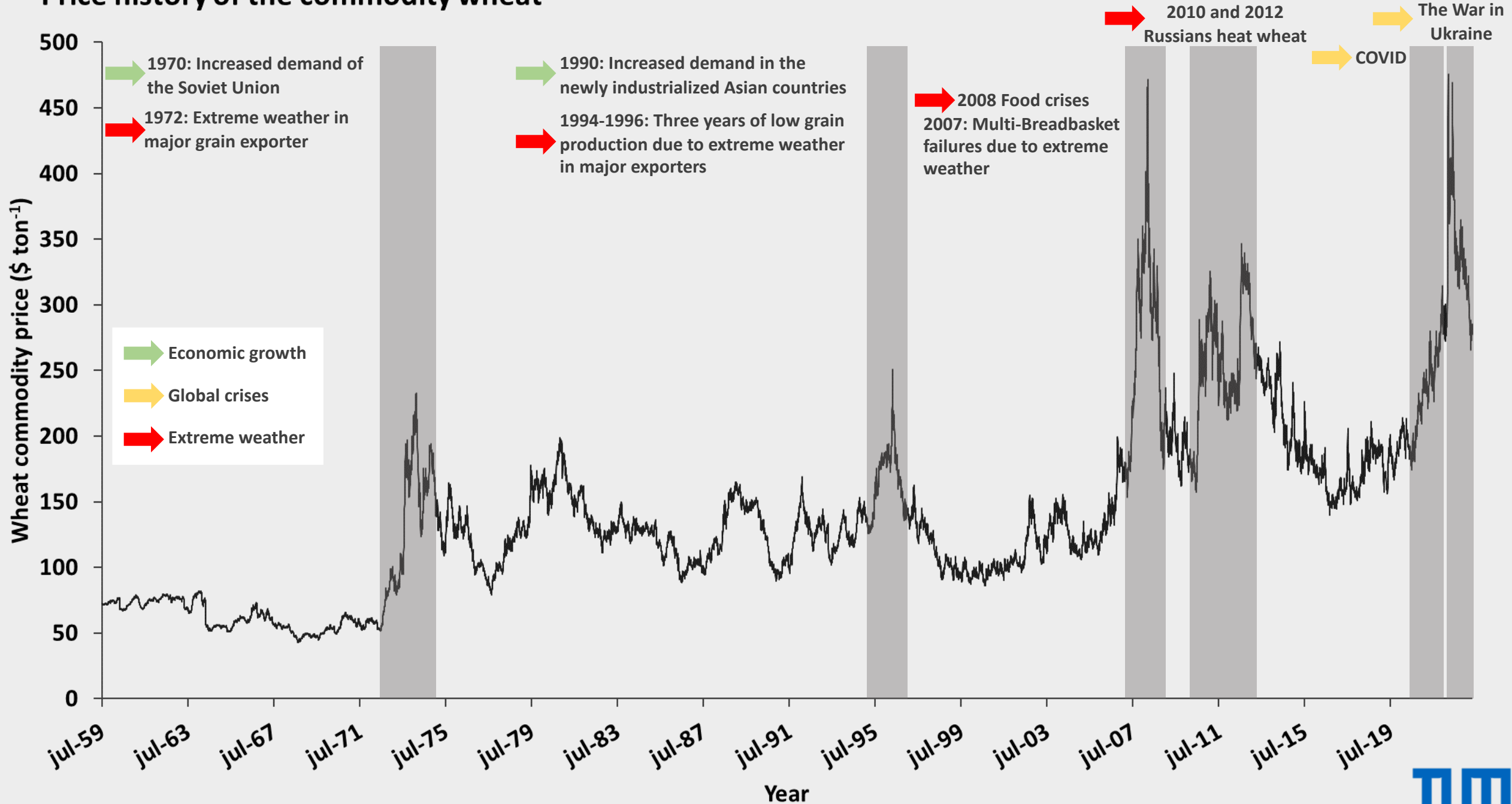


Wheat yield failure in France in 2016

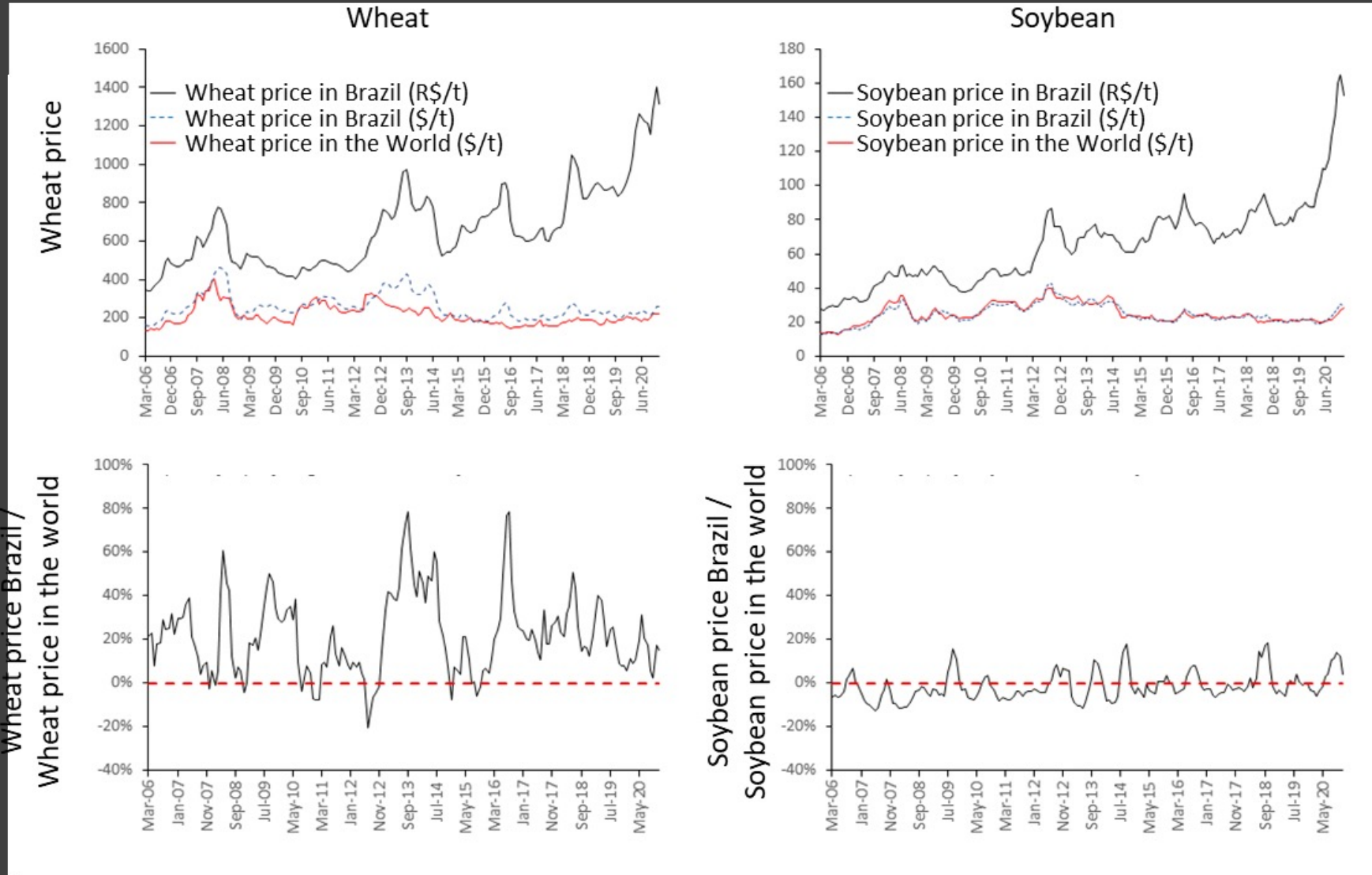


The 2022-2023 food crises due to the war in Ukraine

Price history of the commodity wheat



Wheat price in Brazil



Disruptions in the production and supply of wheat cause food crises, inflation and impoverishment of the population.

Our work is:

ENVIRONMENTAL RESEARCH LETTERS

LETTER

Extreme lows of wheat production in Brazil

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Keywords: climate change, extreme weather, food price and food security
Supplementary material for this article is available [online](#)

Abstract

Wheat production in Brazil is insufficient to meet domestic demand and falls drastically in response to adverse climate events. Multiple, agro-climate-specific regression models, quantifying regional production variability, were combined to estimate national production based on past climate, cropping area, trend-corrected yield, and national commodity prices. Projections with five CMIP6 climate change models suggest extremes of low wheat production historically occurring once every 20 years would become up to 90% frequent by the end of this century, depending on representative concentration pathway, magnified by wheat and in some cases by maize price fluctuations. Similar impacts can be expected for other crops and in other countries. This drastic increase in frequency in extreme low crop production with climate change will threaten Brazil's and many other countries progress toward food security and abolishing hunger.

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RESEARCH ARTICLE

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The extreme 2016 wheat yield failure in France

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Abstract

France suffered, in 2016, the most extreme wheat yield decline in recent history, with some districts losing 55% yield. To attribute causes, we combined the largest coherent detailed wheat field experimental dataset with statistical and crop model techniques, climate information, and yield physiology. The 2016 yield was composed of up to 40% fewer grains that were up to 30% lighter than expected across eight research stations in France. The flowering stage was affected by prolonged cloud cover and heavy rainfall when 31% of the loss in grain yield was incurred from reduced solar radiation and 19% from floret damage. Grain filling was also affected as 26% of grain yield loss was caused by soil anoxia, 11% by fungal foliar diseases, and 10% by ear blight. Compounding climate effects caused the extreme yield decline. The likelihood of these compound factors recurring under future climate change is estimated to change with a higher frequency of extremely low wheat yields.

KEYWORDS

compounding factors, extreme weather, food security, grain number, grain size, temporally and multivariate events

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Needed global wheat stock and crop management in response to the war in Ukraine

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ABSTRACT

The war in Ukraine threatened to block 9% of global wheat exports, driving wheat prices to unprecedented heights. We advocate, that in the short term, compensating for such an export shortage will require a coordinated release of wheat stocks, while if the export block persists, other export countries will need to fill the gap by increasing wheat yields or by expanding wheat cropping areas by 9% in aggregate. We estimate that a production increase would require an extra half a million tons of nitrogen fertilizer, yet fertilizer prices are at record levels, driven by rising energy prices. Year-to-year variability plus more frequent climate change-induced crop failures could additionally reduce exports by another 5 to 7 million tons in any given year, further stressing global markets. Without stabilizing wheat supplies through judicious management of stocks and continuing yield improvements, food and national security are at risk across many nations in the world.

1. Main

Ukraine contributes to 9% of the world's wheat exports (in 2020). In 2020, the country produced 26 million tons (Mt) of which they exported 72%, which was valued at more than 3.5 billion dollars (FAO [stat](#), 2022). The war in Ukraine threatened to block most of Ukrainian wheat exports (FAO [stat](#), 2022). Even if part of this wheat would be exported (FAO, 2022), the areas in Ukraine sown with crops are estimated to be significantly lower than those in recent years (W [et al.](#), 2022). It is a crisis for the Ukrainian national economy and a threat to global food security. Several African and Asian countries depend on Ukrainian wheat to provide staple foodstuffs for their population. Indonesia and Egypt consume together more than 5 Mt of Ukrainian wheat per year,

Brazil and Algeria, and particularly those in sub-Saharan Africa will also feel the impact from the wheat price hike caused by the export block. Wheat was priced at US\$281 per ton in the beginning of February 2022 and reached US\$490 per ton early March 2022 (Supplementary Fig. S3), a week after the Russian Federation invaded the Ukraine. The wheat price has remained high for several weeks and recently decreased again, but it remains exceptionally high compared to the last five years (Supplementary Fig. S3), threatening food insecurity in many importing countries.

Ninety percent of wheat exports in 2020 (the most recent year for which reliable data are available from FAO) are supplied by the world's 13 largest wheat exporting countries (Fig. 1). Across exporting countries, wheat areas have remained steady over the last two decades at

Wheat production failure in Brazil in 2006

Wheat yield failure in France in 2016

The 2022-2023 food crises due to the war in Ukraine

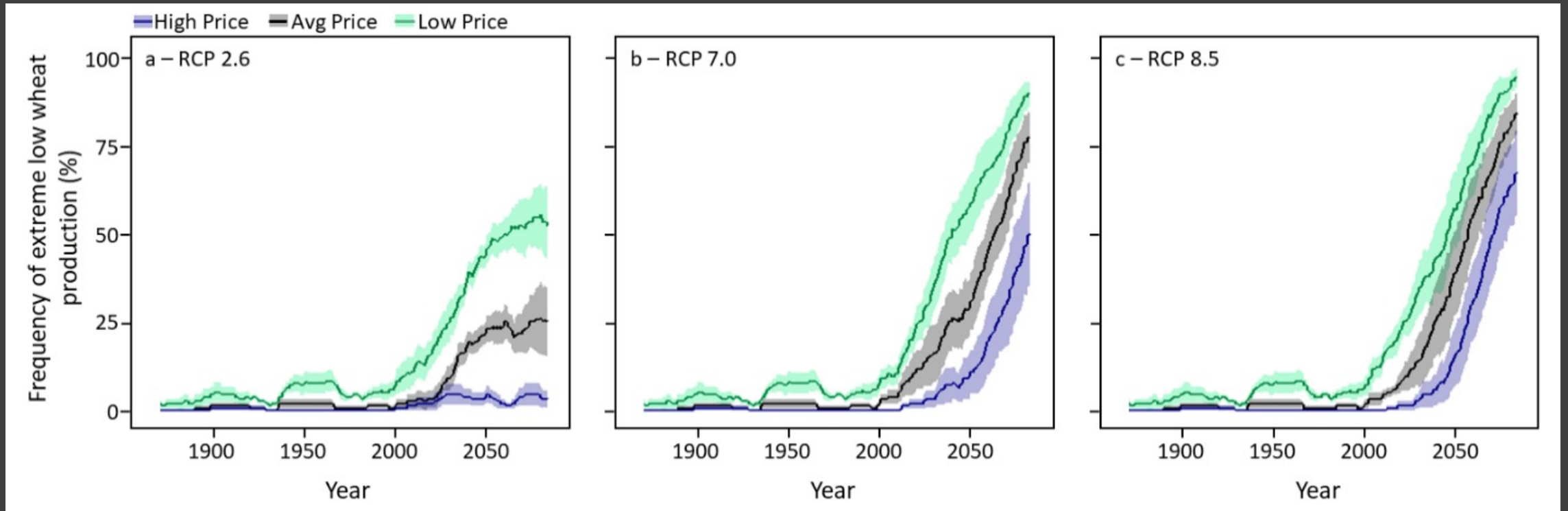
Our work is:

1 - Understand the causes of production failure

2 - Quantify the future frequency of these extreme events with climate change

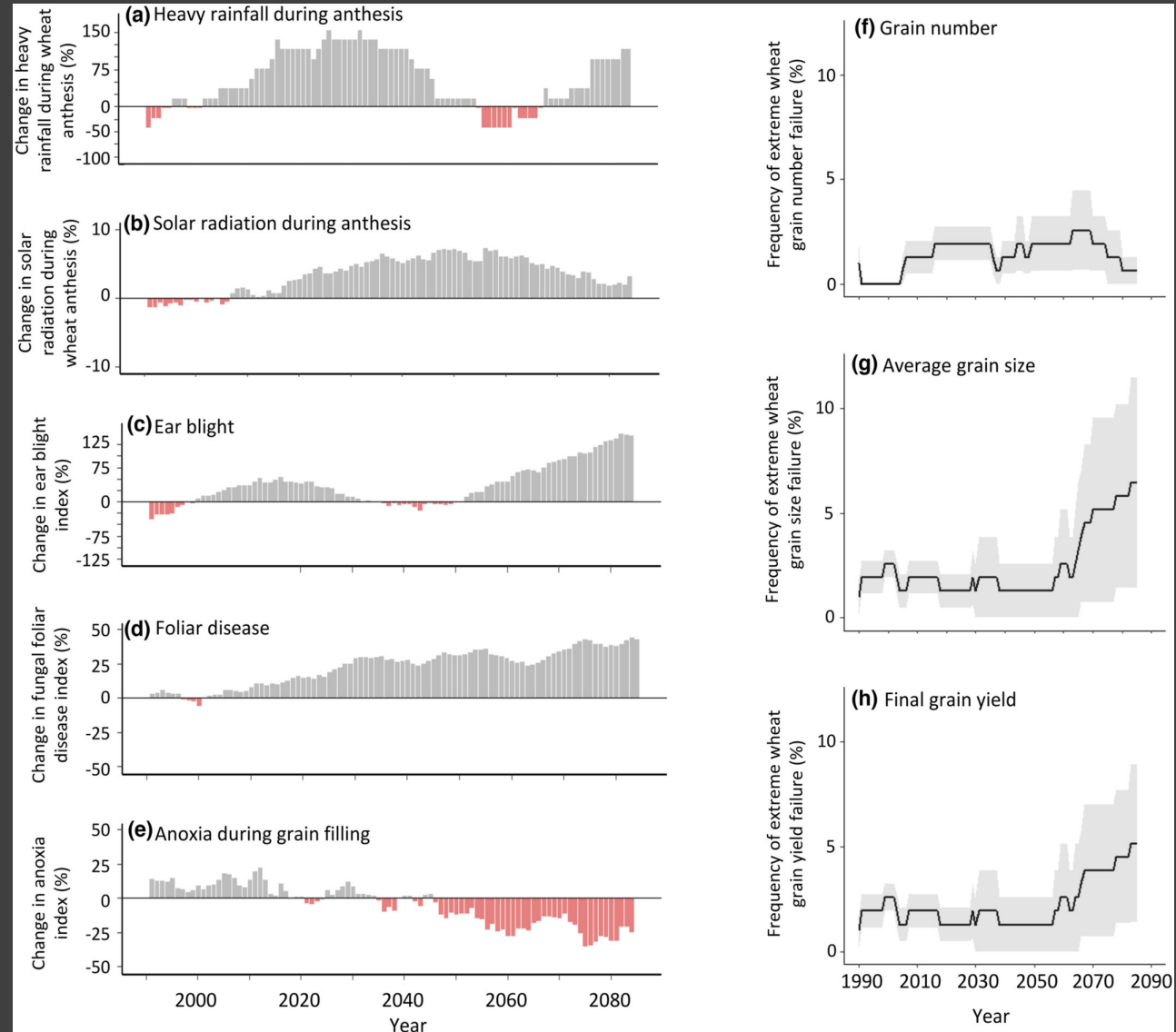
3 - Indicate ways to compensate for production failures

Our work is:



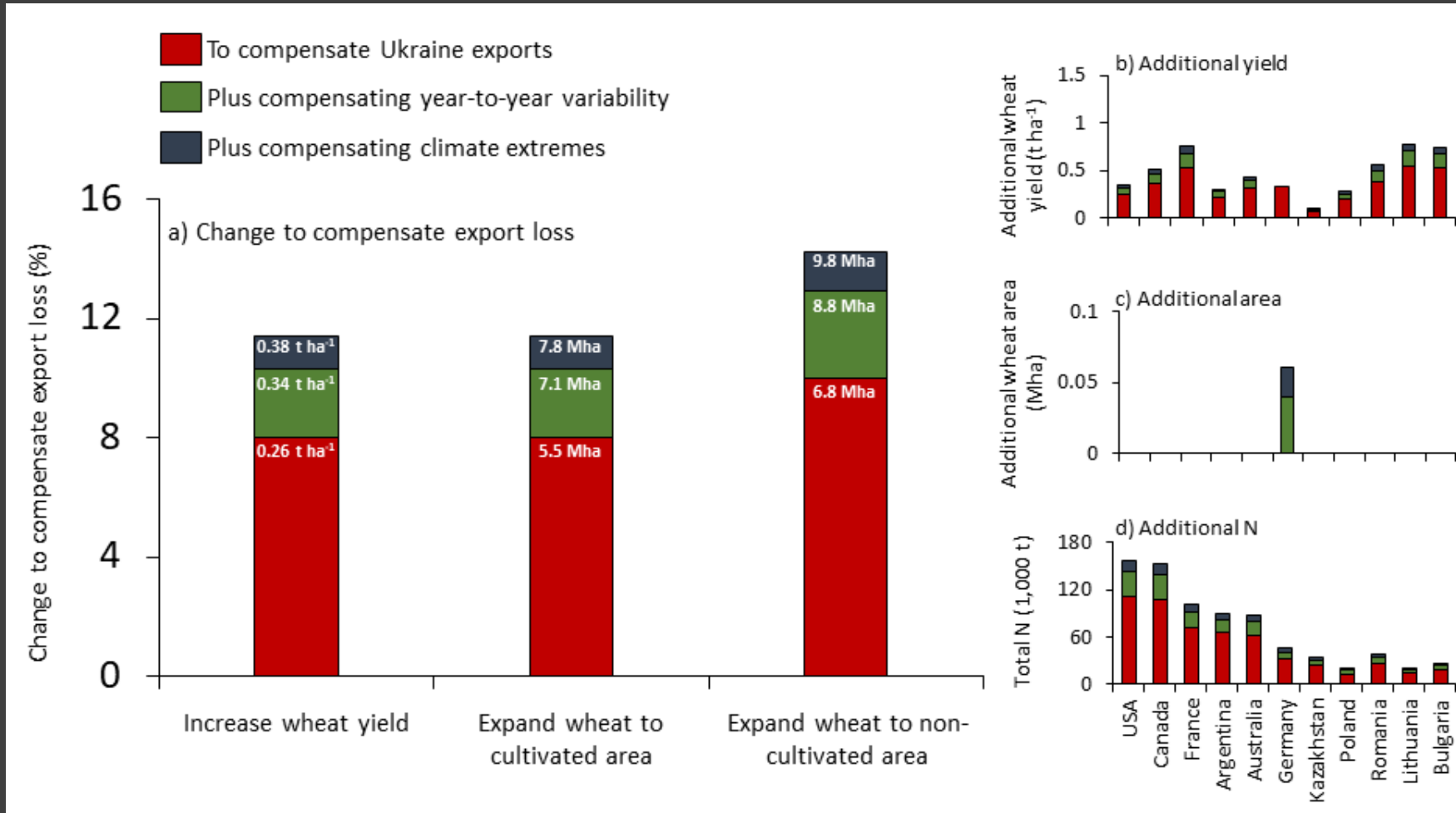
Nóia Júnior et al. (2021), Extremes low of wheat production in Brazil, *Environmental Research Letters*.

Our work is:



Nóia Júnior et al. (2021), The extreme 2016 wheat yield failure in France, **Global Change Biology**.

Our work is:



Thank you

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