Beer supply threatened by future weather extremes

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Severe climate events could cause shortages in the global beer supply, according to new research involving the University of East Anglia (UEA).

The study warns that increasingly widespread and severe drought and

heat may cause substantial decreases in barley yields worldwide, affecting the supply used to make beer, and ultimately resulting in "dramatic" falls in beer consumption and rises in beer prices.

Beer is the most popular alcoholic drink in the world by volume consumed. Although the frequency and severity of drought and heat extremes increase substantially in a range of future climate scenarios, the vulnerability of beer supply to such extremes has never been assessed.

In recent years, the beer sector has consumed around 17% of global barley production, but this share varies drastically across major beer-producing countries, for example from 83% in Brazil to 9% in Australia. Results from the new study reveal potential average yield losses ranging from 3% to 17%, depending on the severity of the conditions. Decreases in the global supply of barley lead to proportionally larger decreases in barley used to make beer.

During the most severe climate events, the results indicate that global beer consumption would decline by 16%, or 29 billion litres—roughly equal to the total annual beer consumption in the US—and that beer prices would on average double. Even in less severe extreme events, beer consumption drops by 4% and prices rise by 15%.

The findings, published today in *Nature Plants*, suggest that total beer consumption decreases most under climate change in the countries that consumed the most beer by volume in recent years. For example, the volume consumed in China—today the largest consuming country—falls by more than any other country as the severity of extreme events increases, and by 4.34 billion litres in the most severe.

In the UK, beer consumption could fall by between 0.37 billion and 1.33 billion litres, while the price could as much as double. Consumption in the US could decrease by between 1.08 billion and 3.48 billion litres.

Co-ordinator of the research and lead UK author Dabo Guan, professor of climate change economics at UEA's School of International Development, said: "Increasingly research has begun to project the impacts of climate change on world food production, focusing on staple crops such as wheat, maize, soybean, and rice.

"However, if adaptation efforts prioritise necessities, climate change may undermine the availability, stability and access to 'luxury' goods to a greater extent than staple foods. People's diet security is equally important to food security in many aspects of society.

"Although some attention has been paid to the potential impacts of climate change on luxury crops such as wine and coffee, the impacts on beer have not been carefully evaluated. A sufficient beer supply may help with the stability of entertainment and communication in society."

Prof Guan added: "While the effects on beer may seem modest in comparison to many of the other—some life-threatening—impacts of climate change, there is nonetheless something fundamental in the cross-cultural appreciation of beer.

"It may be argued that consuming less beer isn't itself disastrous, and may even have health benefits. Nevertheless, there is little doubt that for millions of people around the world, the climate impacts on beer availability and price will add insult to injury."

The international study involved researchers from the UK, China, Mexico, and the US, who identified extreme climate events and modelled the impacts of these on barley yields in 34 world regions. They then examined the effects of the resulting barley supply shock on the supply and price of beer in each region under a range of future climate scenarios.

Some countries with smaller total beer consumption face huge reductions in their beer consumption: the volume of beer consumed in Argentina falls by 0.53 billion litres, equivalent to a 32% reduction, during more severe climate events. Even in the least severe climate events, total beer consumption in Argentina and Canada decreases by 0.27 billion litres (16%) and 0.22 billion litres (11%) respectively.

Countries where beer is currently most expensive, for example Australia and Japan, are not necessarily where future price shocks will be the greatest. Changes in the price of beer in a country relates to consumers' ability and willingness to pay more for beer rather than consume less, such that the largest price increases are concentrated in relatively affluent and historically beer-loving countries.

The researchers suggest that changes in barley supply due to extreme events will affect the barley available for making beer differently in each region, as the allocation of barley among livestock feed, beer brewing, and other uses will depend on region-specific prices and demand flexibilities as different industries seek to maximize profits.

Their findings show that global and country-level barley supply declines progressively in more severe extreme event years, with the largest mean supply decreasing by 27-38% in some European countries, such as Belgium, the Czech Republic and Germany.

More information: Decreases in global beer supply due to extreme drought and heat, *Nature Plants* (2018). DOI: 10.1038/s41477-018-0263-1 , www.nature.com/articles/s41477-018-0263-1

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