

Earth & Space

Environmental change and fruits, vegetables, nuts, and seeds: what is the gap to bridge?

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ABSTRACT

Environmental change will -in absence of adaptation strategies- have a substantial negative impact on production and availability of fruits, vegetables, legumes, nuts and seeds - all highly important components of a healthy diet. This study gives an overview of the "gap to bridge" to make sure our food system will provide us with healthy foods in the future - despite higher environmental pressure.



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There is now much scientific evidence to suggest that our planet's environment is changing rapidly and that this poses an ever-increasing risk to human health and our food systems. Changes such as agricultural land degradation, water shortages, rising temperatures and changing rainfall patterns can affect yields and nutrient levels of crops used for human food and animal feed, threatening food security and nutrition.

Vegetables, fruits, legumes, nuts, and seeds are nutritionally important for human health; they provide valuable nutrients that prevent [micronutrient deficiencies](#) and [noncommunicable diseases](#) such as cardiovascular disease. Both micronutrient deficiencies and noncommunicable

diseases are major global public health concerns at this present time, and fruit and vegetables, in particular, have an important role in their prevention. In fact, research has suggested that a climate-induced decrease in fruit and vegetable consumption would be one of the largest contributors to climate-related deaths in the future.

Therefore, we set out to further understand this relationship between environmental changes and the availability (yield) and nutritional quality of vegetables, fruits, legumes, nuts, and seeds by reviewing the currently available evidence published on this topic, in order to provide an overview of what the combination of evidence is showing. We did this by performing three separate systematic reviews of

previously published studies; one focussing on vegetables and legumes, another on fruits, and a final one on nuts and seeds. These reviews were a synthesis of the available information we could find from studies that had examined the effect of a change in one or more environmental stressors (for example, water availability, carbon dioxide concentration, tropospheric ozone, water salinity, and ambient temperature) on yield or nutritional quality of crops contained within these food groups. As these studies were all experiments, they represent the hypothetical situation where there is a certain level of environmental change, but no new (agricultural) techniques that help adapt to these new environmental circumstances, such as drought- or heat-resistant varieties. As there is a lot of research ongoing in the agricultural field, this is obviously not very realistic, but our estimates show “the gap to bridge” with adaptation techniques in case we will not succeed in attenuating current trends in environmental change.

Our reviews found that – in the absence of any adaptation strategies – a decrease in water availability would reduce vegetable and legume yields by approximately 35%. Increasing ambient temperatures would – in sub-tropical & tropical areas – reduce yields by 31%. Increasing tropospheric ozone and water salinity showed to also result in yield reductions, though smaller than reduced availability and increased temperatures. Reduction in water availability and ambient temperature also reduced fruit, nut and seed yields substantially.

Interestingly, increasing carbon dioxide concentrations actually showed a positive impact on

all crop yields, but when combined with other stressors such as increased tropospheric ozone or ambient temperature, this positive effect was lost.

Although the evidence base for the effect of environmental changes on nutritional quality of fruit was modest, it did suggest there would be some negative impact. This suggests that in the future eating the same amount of fruit could provide you with fewer nutrients than it does currently.

In summary, our review of the available evidence suggests that in the absence of appropriate adaptation strategies, changes to the environment are likely to have a substantial negative effect on yields of vegetables, legumes, fruits, nuts, and seeds. This will have far-reaching implications not only for food security due to decreased availability but also for noncommunicable disease risk and suboptimal intake of essential nutrients.

There are obviously limitations and gaps in our research; for example, more can be done to clarify the impact of environmental change on nutrient quality of foods essential for health. However, our research serves to reinforce the need for adaptation and mitigation strategies, which will depend on an integrated strategy effort across multiple sectors including agriculture, trade and public health.

Hopefully, with successful adaptive strategies, and all efforts to keep the environmental change as low as possible, our food systems will be able to deliver diverse and healthy diets for many generations to come.