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Pests versus Crops in the Context of Climate Change

Fuzhou Wang^{*,Δ}

The pace of climate change is matched the science development. We are paying for the climate change when we are enjoying the benefits of science. The impact of the changing climate on the surrounding environments is unequal: some benefit from it, but some suffer from it. Agriculture is the very example for this. In the field of agriculture, weeds and pests are the winners of the increasing carbon dioxide, whereas the food crops failed in this competition. How to deal with these thorny problems rose from the development of science? In fact, agriculture itself also is developing, modified crops against various pests, and increased production of staple food crops. However, the advanced growing of agriculture cannot reverse the decline of nutrients of crops resulted from the climate change. What would be the solution for this problem?■

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Extreme climate changes, polar glacier melting, and abnormal record-breaking temperatures have been becoming the hot topics that were discussed worldwide and concerns about the future derived from them. It seems difficult to slow down the pace of climate change. One big reason is that we human beings need development. What is the underlying determinant for this unstoppable process?

Maybe you would say it was from the human activities, or maybe you would like to say it was due to the

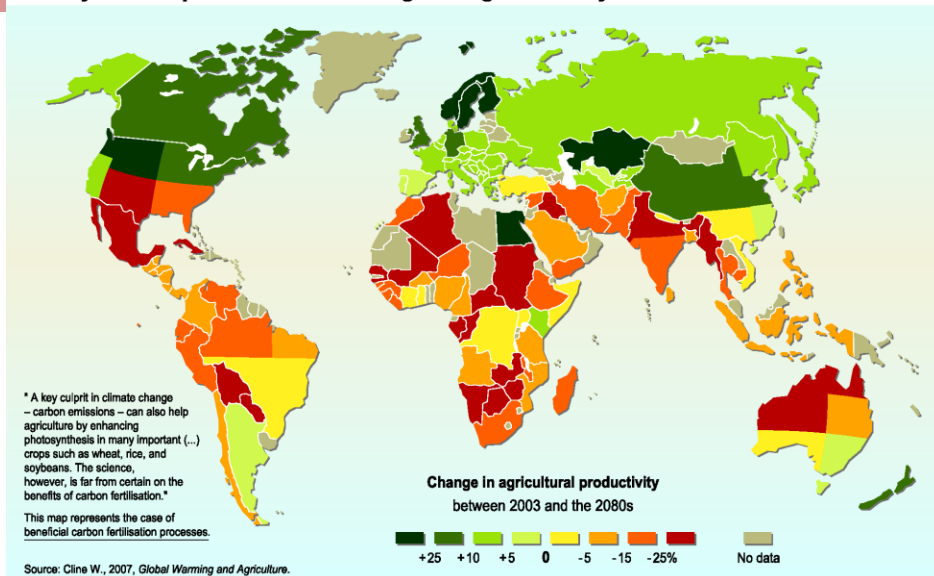
indifferent attitudes. Yes, all these reasons are reasonable, whereas they are not the original contributors to the climate changes. So, what is the fundamental reason? It is science. That is to say science should pay for it. When our human being is complacent the progress and advancement of science and technology, we ignore their potential effects on our surrounding environments. That science makes our life better, but also science changes the climate.

One more intriguing thing is the beneficiaries of climate change in

agriculture: weed and insect pests, or the nutrients the crops have? In the context of climate change, who benefits more?

A new federal climate report released by the National Climate Assessment and Harvard University said that the weeds and crop-devouring insects are going to be winners under any climate change scenario, and the biggest losers are us. From the report, the scientists declared that rising carbon dioxide levels, warming temperatures and more frequent extreme weather events did not treat all plants,

Projected impact of climate change on agricultural yields



insects and soil nutrients equally, the final effects are skewed.

This April (2014) was the first month in human history when carbon dioxide levels averaged greater than 400 parts per million in the atmosphere. It is an arbitrary but ominous milestone. How does this change alter the crops, weeds, and pests?

Although carbon dioxide is the core ingredient of photosynthesis from which a plant (food crops and their weedy nemeses) converts energy from the sun into sugar to thrive, some plants turn the gas into a competitive edge more efficiently than others. A lot of worst weeds benefit the most from high carbon dioxide. What's more, many weeds are incredibly adaptive to environmental changes, including warmer temperatures, or extreme events such as droughts or floods, which may help them further choke out critical crops. Insect pests, even more than weeds, thrive in warmer temperatures, which can increase the speed at which the menaces grow and reproduce, and the chances that their progeny will survive to continue feeding on and infecting crops with harmful bacteria, viruses and fungi. More seriously, some of the pests began to expand and migrate to new territories where once too cold for them to host.

Dealing with these weeds and bugs creates a two-fold threat to public health: The increased use of herbicides and insecticides. More chemical dousing means higher costs to

farmers and greater contamination of soil, food, and water. The most widely used herbicide in the United States, glyphosate (also known as Roundup), loses its efficacy on weeds grown at the levels of carbon dioxide projected to occur in the coming decades. Much of the increase has been linked to evolving resistance among weeds to the widely used chemicals. Many farmers are then driven to apply greater quantities of glyphosate, or supplement with other more toxic herbicides such as 2,4-D (2,4-Dichlorophenoxyacetic acid), a common systemic pesticide or herbicide used in the control of broadleaf weeds. It is one of the most widely used herbicides in the world.

One big concern is the nutrients of food crops, including wheat, rice and soybeans, has been affected by the changing climate. The nutritional impacts of these large environmental perturbations are one of the biggest public health challenges. Nearly two billion of the world's people receive the majority of their zinc and iron from food crops. The minerals are critical for a healthy, functioning body, i.e. everything from the immune system to the brain. A lack of protein

is also dangerous, and can lead to stunted growth and losses in muscle mass, including a weakened heart. Although we can now produce more calories than we need to feed every person on the planet, what we really have a problem with is malnutrition. A higher carbon dioxide world is going to work against us. Carbon dioxide may help a plant produce more sugars, starches and other high-energy carbohydrates. A resulting low-level swap of protein for carbohydrates may increase risks of obesity, diabetes, heart disease and other chronic diseases in both the developed and developing worlds, declared by Dr. Samuel Myers, an environmental health expert at the Harvard School of Public Health.

A host of climate changes impact on the food system, including high temperatures during the transportation of goods and potential effects on valuable insects such as bees and other pollinators. It is necessary for agriculture to adapt to the changing environment, whether that is diversifying the types of crops that fill farmers' fields or employing technological tools. One major reason is the poorer, the more vulnerable, because the higher prices for food preclude the poor from obtaining expensive meat and seafood that could supplement the lower nutrient content found in staple foods, as emphasized by professor Diana Liverman from the University of Arizona.

All agricultural practices (from GMO to organic to conventional) have roles to play. We are completely transforming the environmental con-



ditions under which humanity has lived throughout its evolution. We need face the changing climate, but more importantly, we need face the reality of the changes in weeds



and pests resisting to herbicides or/and pesticides, and especially the changes in nutrients in food crops. Who will be the final winner in this complicated race? Is it science?■

