

# Climate Change and the Future of Taste

*Gonzalo: Had I plantation of this isle, my lord...*

*Antonio: He'd sow it with nettle seed.*

—Shakespeare, *The Tempest*

LET'S NOT TALK ABOUT whether climate change might happen, or how soon it will occur, or whose fault it will be. Even if the situation is mitigated slightly by following particular streams of environmental advice, nothing will happen quickly enough to save all the tastes, textures, and varieties of foods that we enjoy today. I make this assertion from a broadly Western perspective. Although current research on the subject of climate change is invariably earnest, it remains patchwork. It does, however, carry a note of desperation. If I err in what I write here, as I well might do, it is likely in making projections that are too optimistic for European “realists” and environmentalists.

I begin with an analysis from the *Proceedings of the National Academy of Sciences in the United States of America* (PNAS), which late last year published a crop breakdown of American winners and losers as the climate pattern changes. In the medium-long term, the big losers will be cold-weather crops like strawberries, wheat, apples, and oats. The winners (though only with small gains) will be sunflowers, chickpeas, and soybeans; mushrooms will also thrive as soil temperatures rise. Another winner will be the millets, both the pearl and common varieties, which are still enjoyed by small economies, even though this grain has fallen out of favor in the developed West. (In the United States, for example, millet is more likely to be sold as bird seed than for human consumption, except at natural-foods stores.) How quickly might Western cultures relearn to enjoy starches like millet? Would you be able to adapt a wheat recipe to millet tomorrow?

This discussion logically proceeds from the seemingly glib question of how flexible we are as diners and recipe-writers to the nearly unanswerable question of how flexible livestock will be to a change in the grains they are fed.

People may understand the nature of duress and the need to adapt, but can dairy cows? The more fixed a bird or animal is in its diet (i.e., the more dependent it is on any one species for its survival), the more likely we are to lose that bird or animal as a food source.

Adding to the precariousness of species and of the tastes to which we have grown accustomed is the issue of how plants and animals will react to the stresses of climate change. We might brace ourselves with arguments that climates always evolve, but this planet has never experienced a physical breakdown, or even a nervous breakdown, in which one part of the body cripples all other parts of the body. The issue of stress is important. There is already good research into how, for example, both the color and taste of langoustines change according to the way these crustaceans are netted and treated on boats.

Some optimists argue that within, say, one hundred years, some crops and animals will be able to find analogous climates—the French wine industry will move to England, for example. But the PNAS study belies this. Using a five-hundred-kilometer radius (roughly 250 miles from where the crops or animals under discussion are now comfortable), the researchers came up with a “no analogy” result across the board, and, at any rate, this area is much too large for farmed species to migrate naturally into. (Only truffles seem to be migrating spontaneously; they now grow as far north as Paris.) Sustaining some of our agriculture and food culture might, therefore, depend on large agricultural corporations repositioning some of the world's natural crops in new latitudes, which would entail a high cost. In short, although climate is the main determinant for what is eaten and where, there are many other factors that can't be neutralized by crop relocations. For one thing, soils, built up by different types of vegetation over time, change in different latitudes. The current viruses and pests will likely move with a crop, but in new environments established pests will eagerly develop new appetites, too. As a result, the use of both pesticides and fertilizers will necessarily increase.

England's great food historian Tom Jaine, editor of the second edition of the *Oxford Companion to Food* and publisher of *Petits Propos Culinaires*, has reminded me that there have always been taste extinctions, such as the wiping out of silphium in North Africa. "While we all yearn to know what it would have tasted like, we can't say that its vanishing changed the world," he says, adding, philosophically, that although climate-change problems are gripping because they threaten our ability to feed ourselves, "I am not sure that we should care if they change what is available in the shops. It will simply mean alteration. Take vanilla. No one had vanilla in the fourteenth century. Were they unhappy in consequence? So we lose vanilla. We'll surely find something else."

I take heart from Jaine's optimism, as I did in London not long ago, when I heard this mock-revolutionary street chant in a pub:

Leader's shout: "What do we want?"

Reply: "Just a small salad and some iced water. Really!"

Leader: "When do we want it?"

Reply: "About once a week?"

But climate change is not a situation where the right-minded will make it and the reprobates won't. The coming changes will envelop everyone. In view of that reality, the approach I take here is one that is familiar to environmentalists. I offer some snapshots, from which you can make your own montage by pasting them together however you wish. If you are dubious about one snapshot, discard it, and simply arrange the others, just as you would do when reviewing a restaurant on the second visit—by honing in on whichever choices would make sense of your initially muddled view. On our Menu for the Future, we need to understand our options.

## Meat

We all know that beef production and methane gas from the digestive systems of cows are twin demons in the food industry. In fact, methane emissions are as bad from rabbits, sheep, and many other grass-eating creatures. Carbon pollution from cattle is heavy; if the same cows that produce our dairy protein were also to provide our meat, it might prove to be methane-economical, as has recently been demonstrated by the use of dairy cattle in the fast-food hamburger industry (the methane cost of meat is often cited but is rarely mentioned in the context of milk and cheese). Because cattle breeds were diversified for their strongest

traits not all that long ago, the current system could perhaps be reorganized, although that would probably mean new tastes for both beef and dairy products.

A recent American study concluded that, yes, a vegetarian diet is better for the environment, except that a lot of non-arable land can support sheep, goats, and sometimes cattle when it can't grow anything a vegetarian would eat. To ignore this land and its protein contribution to our plates would be foolish. As the space suitable for cultivation decreases with climate change, the acreage available for animals who are unfussy eaters will increase. Some years



ago, an article in the *New York Times* came out in support of yak meat, because yaks are foragers and eat ice instead of clean drinking water. Well before that, in 1994, Elizabeth Carey Mungal and William J. Sheffield, authors of *Exotics on the Range: The Texas Example*, looked at wild game meat. The authors did not foresee that the animals then being raised for the pleasure of gourmets are the ones most likely to handle climate change well. Texan game is mostly African imports and may be genetically suitable to erratic climates, both dry and wet. At the nature reserve Oostvaardersplassen in the Netherlands, nearly extinct species like aurochs (wild cattle), wisent (European bison), and red deer are being bred. Perhaps alternative meats for people with high standards of taste will be discovered there, too.

And then there is chicken. Roughly forty percent of the meat now eaten in the United Kingdom is chicken, according to recent crusades undertaken by the real-food

campaigner Hugh Fearnley-Whittingstall. The economy—both for the environment and for the cost to the cook—comes from the fowl’s short life cycle, and although a farmyard chicken lives twice as long as a housed one, both birds are efficient consumers of grain. In addition, their waste is enriching in ways that much other animal waste is not, or at least not yet. If environmentalists were to stick to criteria regarding the efficient use of energy and materials, they would call for chicken on all of our plates, since they see chickens as a food product with relatively little unrecyclable waste. However, we are in a good position to encourage rethinking here. For instance, geese have become expensive because they can’t be housed, but we have lost sight of the fact that, like rabbits, they can roam productively on land that won’t sustain crops. Thus, geese might survive on the new menu.

The animals we should farm are those most resilient to stress. Earlier this year, when the temperature in caves inhabited by Australian flying foxes rose to 42 degrees centigrade (107.6 degrees Fahrenheit), the animals left their caves to perch in the shade of trees, panting and fanning themselves with their wings, until, after several hours, they gradually dropped from those trees—dead. The flying fox is a mammal, and all mammals will overheat in the range of mid-forties centigrade. To call this “stress” makes it sound psychological, but the problem was simple heat stress—overheating. Although plants are more adaptable to temperatures than they are to drought, almost all birds and mammals are not.

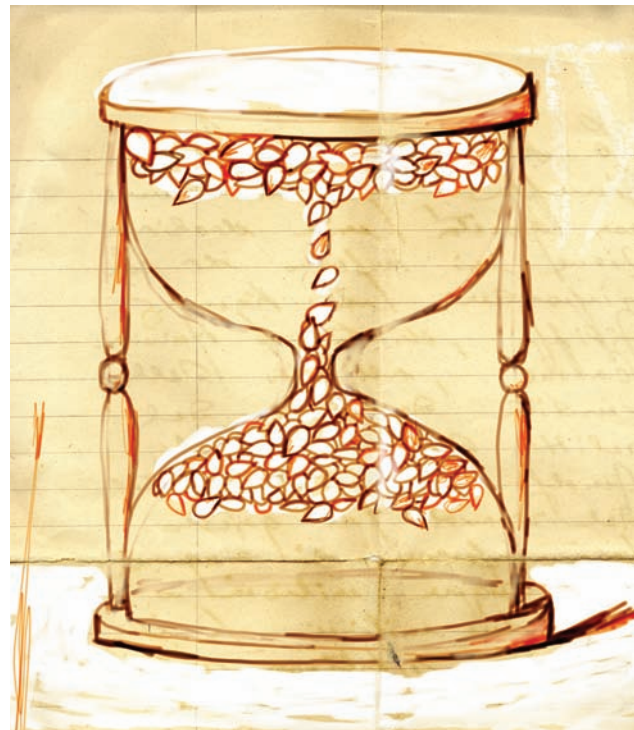
### “Authenticity”

This word has become important to taste-keen foodies. We keep reaching for a palate validation in a past that is about to disappear. My comforting metaphor is the thaumatrope, a toy that philosophers once used, which consists of a card with pictures on each side that is attached to a piece of string. As the string is spun, the viewer sees opposite sides of the card as one picture—that is, bird, cage, then caged bird. Part of the success of the trick is that the thaumatrope does not aim for combinations that the mind will not accept. Considering foods as they adapt to new climates, I think we will need to do something similar.

Although most readers would probably not expect me to say this, there are two compatible views regarding how best to accommodate the changing world. One relies on helping animals and plants to withstand greater extremes of wet and drought, heat and cold, through genetic manipulation. The second desires the same results but hopes to

achieve them by reconfiguring species to what they were “originally”—that is, within recorded memory (I use quotes here and above because it is wrong to assume that one’s own conception of “original” or “authentic” coincides with someone else’s). The research on both levels is being done by the same companies. I have developed a relationship with one of them, Syngenta, because they have been so generous with information.

Syngenta genetically breeds back those crops that they also breed forward. The older species have virtues that have been sacrificed to agriculture—usually to higher yields, deeper color, and so on. Among varieties of maize, for instance, the genetic differences are wider than the genetic



differences between people and chimpanzees. It may be that the fibrous beet, which grows once discarded for its inconvenience in processing, has other virtues. Food writers might suggest that a potato species be preserved for its taste and cooking qualities, but we are a long way from advocating for most crops on this basis. Yet sorghum can get by on much less rainfall than wheat, and, if cooks would try harder, it might be as edible as wheat. Farro, or emmer, thrives in extraordinarily difficult circumstances. Although no new cereals have been domesticated in more than three thousand years, that’s not to say that they can’t be domesticated now. At the moment, wheat provides about 20 percent of the food calories for the world, so as climate change affects this crop alternatives must be

developed. Over the past two years, wheat prices worldwide have almost tripled. Peruvians now find *papapan*, potato bread made with one-third mashed potatoes and two-thirds wheat flour, an acceptable substitute for bread as they once knew it.

## Rice

I am incredulous at how little attention the food press gave to the 2007 Intergovernmental Panel on Climate Change (IPCC)'s report on climate change, which cited Asian rice as responsible for emitting a volume of methane nearly equal to that produced by all the cows in the world, a result of the rice being grown in paddy fields, which, on the plus side, are also rich in small fish. The Asians want to continue to eat their native rices (not American, dry-land rice), and most cooks know that rice varieties are distinctive. However, environmentalists would argue that you can't try to mitigate the risks that methane emissions pose to the climate unless you tackle Asian rice (currently sustaining about a third of the world's population) along with those four-legged farm animals whom we forgive for being fartars.

There needs to be a good deal more nonlinear thinking when we look for solutions. The Australians have discovered that kangaroos don't emit methane from the gut, and so there may be a meat solution in transferring kangaroo genes to, say, sheep. Of course, the more we tinker with the genes of sheep and rice (to name but two), the more the taste of the food will, likewise, be altered.

The GM technology company Monsanto recently surveyed leading scientists and academics about what farming requires in the face of climate change. The conclusion, perhaps predictably, was that more adaptable plants must be created. Drought already costs maize growers worldwide about eight billion dollars a year, so most research is beginning with maize and grains that will accept a wider water tolerance. As sea levels rise, salt tolerance also becomes important, the salinity of soil being a special problem in crops that depend on groundwater instead of rainwater. A gene for thale cress, combined with alfalfa, is the first seed of this type to go on sale, but tomatoes tolerant of salty soil are not far from the market. Such tinkering turns the gastronomic idea of *terroir* on its head, if tomatoes, grown on otherwise unusable saline land, might actually arrive in grocery stores pre-salted.

I have also been following the unraveling story of "scented" rice versus "Basmati" in India, a controversy that touches on *terroir* because Basmati is a geographical

indication. The Indian government wants to improve farm yields, which entails changing the genes in this rice (a man-made variety called Pusa Basmati can mingle with non-Basmati strains). This is precisely the type of action that future food writers will debate. Although the desire here is to create better yields, as the climate shifts, all the *terroir* arguments will shift, too. The concern about Basmati's low yield will soon move to whether it is environmentally sustainable, compared to those Basmati hybrids, which in a changed climate can still promise a good yield.

As for taste, one problem is how to determine where we are now versus what we will lose or have already lost. The extinction of the chicken toad now draws public sympathy (and take my word for it, the toad was tasty). But these end-of-this-or-that-taste laments do not always conform to the gradable scales of other aesthetic appreciations. It is hard to articulate what would be lost if genuine Basmati no longer existed. Is it more analogous to the loss of ten of the piano's eighty-eight keys or to the end of a great ballerina's career? Either way, it is not hard to anticipate that genuine Basmati may one day disappear.

## Herbs and Natural Flavors

Not that life itself is going to disappear, no matter what carbon does. In the short term, it is probably best to expect that we won't lose the flavors that have been flourishing for thousands of years, particularly those of certain nuts and robust herbs like thyme that, unlike basil, need no farm management. However, black pepper export prices in India soared last year because of weather problems. Crops like bananas, which have no seeds and so must be propagated by cuttings, do not have natural genetic variations from one generation to the next. As a result, they are not as adaptable to changes as seed-plants. Other big flavors at risk are those that involve crops that are very sensitive to pests. So, yes, vanilla will be vulnerable, since some vanilla vines are one hundred years old and are still protected by human hands picking off bugs. Vanilla would not have reached the price that it now commands if it were adaptable to new climates and soils; in fact, a commodity's current cost is one indicator to consider when trying to figure out how jeopardized its flavor might be.

A world without vanilla would also mean one without our familiar chocolate flavor, as practically all the chocolate we now enjoy is enhanced with vanilla. Chocolate itself comes from a crop as sensitive as vanilla, though cacao trees may be able to move to other latitudes more easily. But the question is not whether your grandchildren will ever

understand your enthusiasm for these flavors; it is whether food science should try now to rescue genetically some of the natural flavors that we consider to be essential. Seaweed flavor will survive; so will mint, because the plant is a great adaptor. But I hope that in the future more agricultural research will be devoted to flavor rather than to yields, as virtually all of it is now.

If you attend food-industry trade fairs you will have noticed an adjustment in the way flavor ingredients are priced. Where the market once touted natural flavors, now “natural” is two or three times more expensive than so-called “nature-identical” flavors. These days, poorer economies like Poland generally have access only to what is “nature-identical,” and soft-drink manufacturers everywhere use “nature-identical” alternatives. As climate imposes new crises, the truly natural options will disappear as chemistry increasingly steps into the breach.

## Fish and Shellfish

The IPCC report on climate warming provides a good explanation of the acidification of the oceans, which presents a problem for the future of taste. Mussels, scallops, and oysters will probably die out before other marine life, due to a gradual erosion of their shells that will affect their ability to breed. Fish that have an appetite for shellfish will be disappointed, too. Carol Turley, of Britain’s Plymouth Marine Laboratory, has done research to show that the more carbon dioxide in the oceans, the less carbonate is usable by shellfish. Around the poles the effect is worse, and no one foresees how shellfish stocks will be able to adjust.

The acidification of seawater is also likely to affect the ability of ocean fish to fertilize their eggs. As populations of ocean fish fall, our tastes must turn to freshwater fish. Most people do not think that fish from lakes and rivers have the panache of saltwater fish, and yet freshwater fish are the ones that the world must soon accept. Does a solution lie in more freshwater fisheries? The numbers are not on my radar yet. For saltwater fish, pilot farms stocked with delicious cobia are being tested at the University of Maryland, but the challenge is to teach these carnivorous fish to adapt to an algae-based diet.

The demise of ocean fish is occurring even more rapidly with the warming of seawater, which reduces the water’s ability to carry dissolved oxygen and results in marine dead zones. One hundred and fifty areas around the world already suffer such low oxygen levels that they no longer support fish or shellfish. This depletion can happen quite

suddenly. Active fish like salmon and tuna have greater oxygen demands than lazy fish, so the last fish you eat will probably come from the slowest species. On the other hand, certain species of jellyfish flourish in these dead zones, and in Asia the one-hundred-and-twenty-million-dollar-a-year jellyfish industry takes advantage of this phenomenon.

## “Wet” and “Dry” Crops

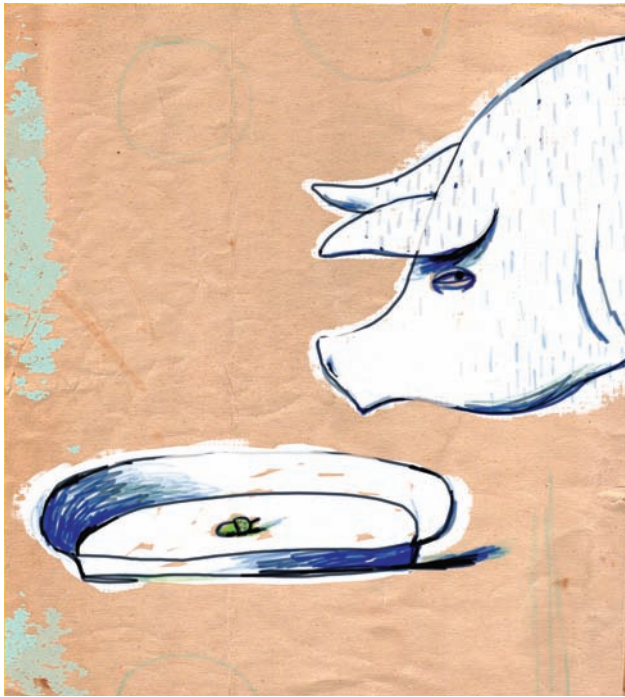
Most discussion of climate change leaps to the erroneous assumption that we are expecting a warmer and drier world. There is, in fact, only one foretelling, and it is that climates will become more and more erratic compared to whatever baseline farmers anywhere are using now. Rainfall, in particular, will be irregular, and many places will become wetter, because the storms will carry more precipitation. The increase of fresh water falling during very heavy storms in the far North will run off into the oceans and significantly disrupt the so-called thermohaline circulation, which now keeps European waters warm and maintains Europe’s fishing grounds. Places at the latitude of the United States will get more rainwater, too, but it will arrive as storms rather than as regular rainfall.

Most of us can’t cite any food crops that thrive under erratic, blasts-of-water conditions. As carbon dioxide in the atmosphere increases, plants will generally grow faster, but their leaves will have less protein, and they will be more vulnerable to insects. At the other end of the scale, drought conditions are sure to complicate the food grown in southern latitudes. I am impressed by a new study from the University of Leeds that looked at the DNA of a moss called *Physcomitrella patens*, the first lower-order plant to be sequenced at the Genome Institute in Berkeley, California. This moss, like several others, carries a genome that can suffer dehydration to the point where we would call it “dead” rather than merely dormant, but with water, it can revive. The ambition is to transfer genetically this plant’s survival talent to other plants.

The impact of drought will be felt especially keenly on grapes grown for wine. Already, the rise in alcohol levels in wine appears to be due to climate change. The grapes’ fermentable sugar levels no longer coincide with features like tannin, flavor, and color that must guide wine-making expertise. In the future, the shortage of water in traditional wine-growing regions (or rainwater at the wrong times and levels) will be devastating. We can’t simply “migrate” a classic vineyard within the space of time that the climate scientists are allowing for. Even if it could be done quickly, deciding where to replant would only be guesswork.

## Seeds in the New Situation

I find that most people who concentrate on food are rather cavalier in their attitude towards seeds. After all, seeds seem numerically sustainable. Up to this point in history, we have trained crops to be efficient, which means heavy-bearing (usually top-heavy, on short stalks), retaining their seed tightly so it doesn't blow away, and so on. But the



more we have bred these tightly disciplined performers of the vegetable world, the more anxious we should be about their resilience. It is no good saying that organic farming or farming on family plots will change the temperament of seeds. Seed stock is mostly the same, and a big share of it is becoming unviable. Soon the plant may produce its seed unseasonably early, or the new climate may introduce new predators, or new weeds to compete with. The complications are endless.

It is generally not appreciated that, whether it is a grain or an acorn, we are feeding poultry and animals these seeds. Therefore, problems with seed supply also involve problems with meat quality. The *jamón Ibérico puro* from Spain faced a crisis last year when the acorns on which the pigs grow fat were hit by a drought, and then a fungus hit the oak trees in their weakened state. Ten percent of the trees (and of the pigs' diet) was lost in a short space of time—and of course new trees take generations to reproduce.

## Nettles, Mugwort, and More

So perhaps we should rethink our relationship to weeds, as the Shakespeare quote at the beginning of this essay implies. Almost everywhere in food writing we find the fanciful idea that the weeds we now occasionally forage might be a sustainable food source in the future. The reason that this idea has not hit the supermarkets is purportedly because customers resist the earthy and the bitter. I imagine that the research is lacking, both on wide-scale crop growing and on how to make most of these plants palatable to people and to livestock. Nettles and dandelions work for me. Borage, which I grow on my windowsill, is cited in *Traditional Foods of Britain*, since its seeds can provide processors with a good oil. The leaves have a mild cucumber flavor, but most British borage is grown only as a crop for honeybees. Almost all the weedy plants that encyclopedias describe as “self-seeding” and that have historically met the demands of many latitudes are good tastes to integrate into our new, climate-evolved menu. However, too many have been sold on us for nutritional reasons alone. The cookbooks that future readers will turn to include Patience Gray's *Honey from a Weed* and, optimistically, Paula Wolfert's *Mediterranean Grains and Greens* (for readers well beyond the Mediterranean).

Various gardeners' groups in Britain have kept diaries to observe the changes in plants as the climate alters, and although effects range from increased spindliness to leaves and flowers of slightly weaker color, the larger effect is the plants' insistence on trying to flower and fruit out of season, or even a couple times a season. It may seem no hazard for fruit trees to produce new leaves and shoots earlier than usual—except when a cold snap occurs a few weeks later, causing these plants, which have learned to adapt to frost as something that comes gradually, to collapse. The plants' dead tissue in the autumn is useful to the plant, but nutrients from tissue killed by earlier, erratic weather are not remobilized. However, not all plants suffer to the same degree, and it is time we bred ones that can cope well.

## How to Choose?

The first thing to remember is that without the involvement of opinion-makers and food pundits, like those of you now reading this essay, the bottom line will remain at a consideration of what is most feasible and nutritional. Even though the researchers I have met consider climate change a “lifeboat” situation, most of them are involved in issues of food security, not taste. Nowhere have I found

any discussion about the choices we might make (“we” being people who care about food) within the options that are slowly being forced upon us. I recently reread Raymond Sokolov’s 1981 *Fading Feast* and marveled at how “fading” for him meant fading in fashionable taste—not the extinction of the food itself. People involved in food history need to be more outspoken when it comes to future food solutions.

Returning to the idea of “nature-identical,” I think aquatic food and the smell of the sea may be the first test. Britain’s University of East Anglia has come up with a formula that replicates this marine smell, which is associated not only with our liking of fish but also with aromas that ocean-feeding birds enjoy, too. This aroma is being tested in small coastal villages, both in labs and in situ, and it seems promising. I expect that in the face of climate change, it is the smells of the old ingredients and freshly harvested crops that we will recall with nostalgia. Like perfumes that are formulated to elicit a strong emotional response, these aromas from the past will be consoling. Since at least ancient Roman times cooks have passed off one taste as another. More recently scientists have become involved, and perhaps we are about to find new reasons for taste technology that can replicate not only caviar and crab (which is done ubiquitously now) but also celery and nutmeg.

There are questions about the speed of climate change, and the answers depend in some small part on the rate at which we are able to cut carbon emissions. Warming of only one degree centigrade will put into effect most of the food changes that I have mentioned here. There will be some benefits—across the northern United States and elsewhere, for instance, potato production will increase. In England, navy beans may become a major crop, and not only for baking in a brown-sugar syrup. By two degrees cen-

tigrade of warming, American soybean and sorghum crops will shrink, and although some of those crops might move to Canada, the Canadians will lose their maple syrup and salmon. One half-degree higher, and the market prices of food will become chaotic. Food deficits will lead to emigrations not only of people but also of wild animals and birds. By then, the subject of taste and climate change will have become almost irrelevant, as we will then be surviving on subsistence menus. Some climate conferences are using three degrees centigrade warming as the breaking point.

I have presented only a fraction of what I would like to say; there is a hundred times more. We are wading into such a morass of information that as we take the next step we are not always confident of finding solid ground. One thing is certain: nothing will remain as it is. If tastes are to be kept and enjoyed, even if only for old times’ sake, then those of us who care deeply about food must begin to discuss the options now. ☉

#### NOTES

The December 11, 2007, issue of *PNAS*, published online at [www.pnas.org/cgi/content/full/104/50/](http://www.pnas.org/cgi/content/full/104/50/), contains a number of useful articles about climate change and agricultural adaptations.

Melissa Clark wrote on yak meat in the May 21, 2003, edition of the *New York Times*.

The IPCC report from the United Nations (2007) speaks mostly of “mitigation” possibilities, but it also gives glimpses of the future that I am describing. The author and coordinator of the report’s chapter on agriculture is Pete Smith, professor of soils and global change at the University of Aberdeen’s Institute of Biological and Environmental Sciences. He has read the present essay and agrees that my thoughts are in line with wider thinking.

For an approachable book discussing how much the increases in degrees centigrade will reconfigure life, I recommend Mark Lynas’s *Six Degrees: Our Future on a Hotter Planet* (National Geographic Books, 2008).

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